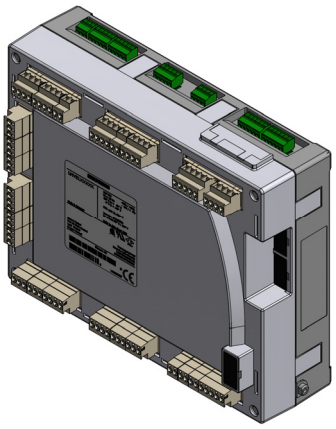
Appendix B: LMV5 Complimentary Products Guide



Description

The LMV5 Complimentary Products Guide combines the technical literature for all of the Siemens products that could be used in conjunction with the LMV5.

Table of Contents

LMV5 System Direct Accessories

7MF Pressure Sensor Technical Instructions (SEN-2000) 4
AGG16.U QRA75 Right Angle Adapter Installation Instructions 9
AGO20 Weldless Flue Gas Collector Installation Instructions 11
BR-AS Bracket Assembly Technical Instructions (CPBK-2000) 17
BR…CBAIR Cleaver Brooks Air Damper Retrofit Kit Installation Instructions (CPBK-4100) 32
BR…CBAIR Cleaver Brooks Air Damper Retrofit Kit Technical Instructions (CPBK-4000) 42
BR…CBOIL Cleaver Brooks Oil Valve Retrofit Kit Installation Instructions (CPBK-5100) 45
BR…CBOIL Cleaver Brooks Oil Valve Retrofit Kit Technical Instructions (CPBK-5000) 61
BR…LUC Lucoma Air Damper Bracket Kit Installation Instructions (CPBK-3100) 64
BR…LUC Lucoma Air Damper Bracket Kit Technical Instructions (CPBK-3000) 73
Cxx Coupling Technical Instructions (CPBK-1000) 75
QA Temperature Sensor Technical Instructions (SEN-1000) 83
QGO O_2 Sensor Technical Instructions (P7842) 93
QRA75 Ultraviolet Flame Scanner Technical Instructions (N7712) 120
QRI Infrared Flame Scanner Technical Instructions (N7719) 134
RWF50 Universal Controller Technical Instructions (U7866) 146
RWF55 Universal Controller Technical Instructions (U7867) 210
SQM4 Actuator Technical Instructions (N7814) 303
SQM9 Actuator Technical Instructions (N7818) 312
TS Local Touchscreen Kit O&M Manual (TS-1100) 322
TS Local Touchscreen Kit Technical Instructions (TS-1000) 374
TS Serial Communication Kit Technical Instructions (TS-1050) 386
TS-MS Master Panel Technical Instructions (TS-2000) 392

Table of Contents (continued)

Fuel Train Accessories

QP Pressure Switch Technical Instructions (155-292) 404

SKP15 Safety Shutoff Valve Actuator Technical Instructions (155-751) 406

SKP25 Pressure Regulating Valve Actuator Technical Instructions (155-752) 411

VA Valve Actuator Assemblies with Hauck Oil Valves (VA-4000) 418

VA…VKF Valve Actuator Assemblies with VKF Butterfly Valves (VA-3000) 424

VGG/D Gas Valve Technical Instructions (155-512P25) 433

VKF Butterfly Valve Technical Instructions (CVLV-1000) 445

VOG Oil Valve Technical Instructions (129-464) 455

Feedwater Accessories

599 Water Valve Technical Instructions (155-184P25) 462

SKB/C/D Water Valve Actuator Technical Instructions (155-717) 480

(Also see RWF50/RWF55 Technical Instructions)

Flow Meters

FLMTR Natural Gas Flow Meter Technical Instructions (LV5-4000) 496

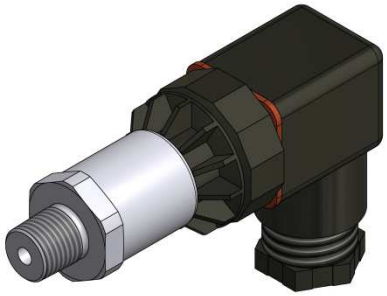
FLMTR-0.75-6.0KIT Natural Gas Flow Meter Kit Installation Instructions (LV5-4050) 503

KT-BMK-PLC… Natural Gas Flow Meter Kit Installation Instructions (LV5-4250) 516

KT-LMV52-PIK… Natural Gas Flow Meter Kit Installation Instructions (LV5-4150) 520

7MF Series

Sitrans Pressure Transducers



Description	7MF… series pressure transducers accurately measure the pressure of liquid, gas, or vapor.
Features	• Measuring accuracy of 0.25% of full scale • Temperature-compensated measuring cell • Suitable for aggressive and non-aggressive media • Stainless steel NEMA 4 housing • 1/2” NPT electrical connection • Compact design
Application	7MF… series transducers measure the pressure of liquid, gas, or vapor. A selection of transducers is available for measuring pressures up to 750 PSI. 7MF… series pressure transducers produce either a 4-20 mA or 0-10 Vdc output signal that is linearly proportional to the input pressure.

Product Part Numbers

Table 1: Available 7MF… Pressure Transducers

Pressure Range	Output Signal	
	4-20 mA	**0-10 Vdc**
0-15 PSI	7MF1565-4BB00-5EA1	7MF1565-4BB10-5EA1
0-30 PSI	7MF1565-4BE00-5EA1	7MF1565-4BE10-5EA1
0-60 PSI	7MF1565-4BF00-5EA1	7MF1565-4BF10-5EA1
0-100 PSI	7MF1565-4BG00-5EA1	N/A
0-150 PSI	7MF1565-4CA00-5EA1	7MF1565-4CA10-5EA1
0-200 PSI	7MF1565-4CB00-5EA1	7MF1565-4CB10-5EA1
0-300 PSI	7MF1565-4CD00-5EA1	7MF1565-4CD10-5EA1
0-500 PSI	7MF1565-4CE00-5EA1	7MF1565-4CE10-5EA1
0-750 PSI	7MF1565-4CF00-5EA1	7MF1565-4CF10-5EA1

Specifications

Physical characteristics

Materials	
-Housing	Stainless Steel
-Measuring cell	Ceramic
-Electronics module	Ceramic
-Gasket	Viton
-Process connection	Stainless steel
Media	Aggressive and non-aggressive liquid, gas, or vapor
Electrical connection	1/2” NPT
Process connection	1/4” NPT
NEMA rating	NEMA 4
Accuracy	0.25% of full scale
Process temperature	5 to 257 °F [-15 to 125 °C]
Ambient temperature	-13 to 185 °F [-25 to 85 °C]
Weight	0.55 lb [0.25 kg]

Installation

- The output signal is linearly proportional to the input pressure.

- A steam syphon loop (pig tail) should be installed between the steam source and the pressure transducer as shown in Figure 1. As condensate forms in the syphon loop, it creates a water barrier to protect the transducer from heat and chemicals. On new installations, it is recommended to add water to the syphon loop to protect the transducer when condensate has not yet formed.

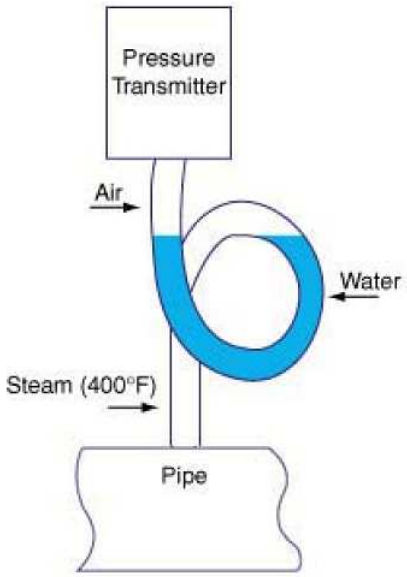
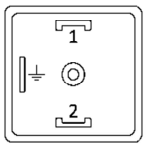
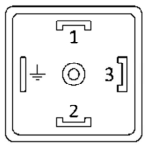
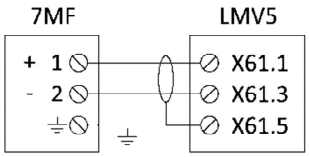
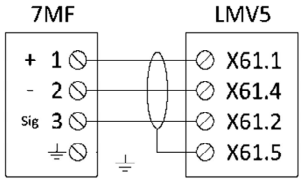
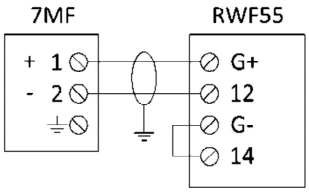
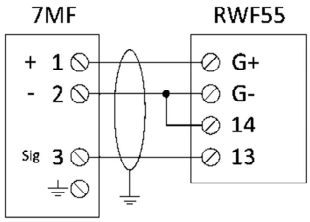
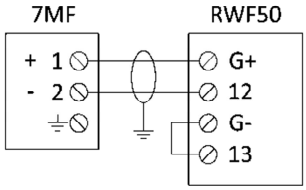
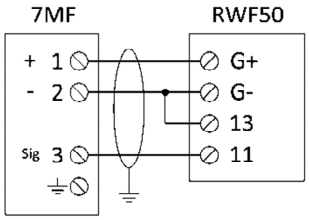
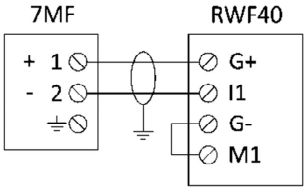
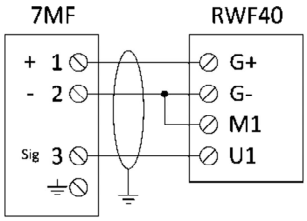
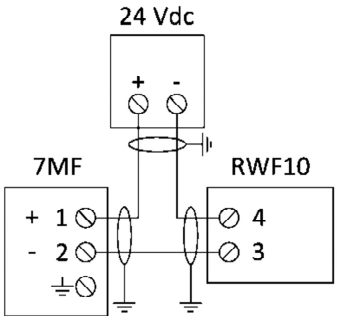
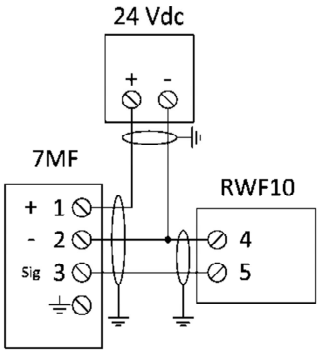


Figure 1: Example of a Syphon Loop

- A cord grip comes installed on the back of the transducer for the electrical connection. To use 1/2" conduit instead, remove the cord grip, washer, and packing.

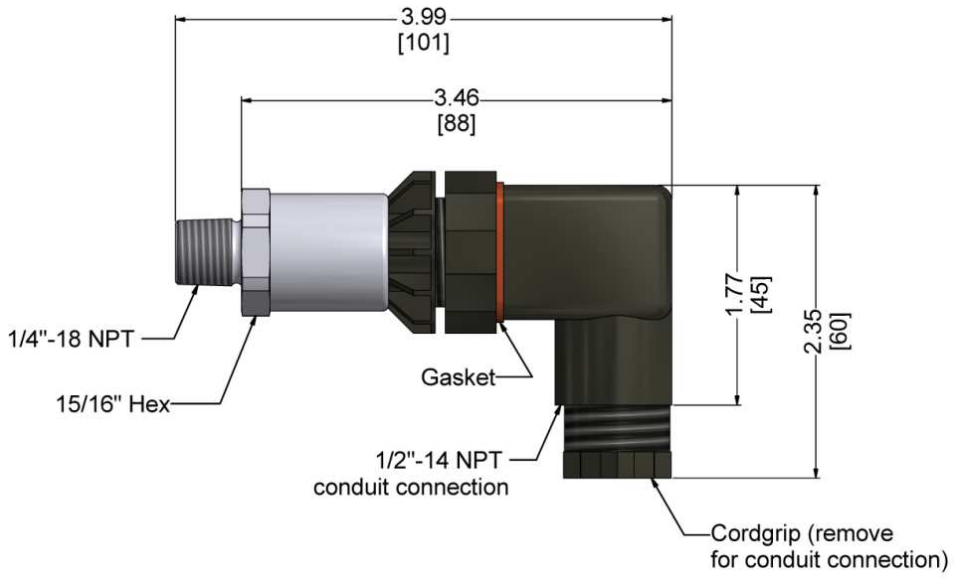
Wiring

Table 2: 7MF… Pressure Transducer Wiring

Controller Type	4-20 mA	0-10 Vdc
		
LMV5…		
RWF55…		
RWF50…		
RWF40…		
RWF10…		

Dimensions

Dimensions in inches; millimeters in brackets

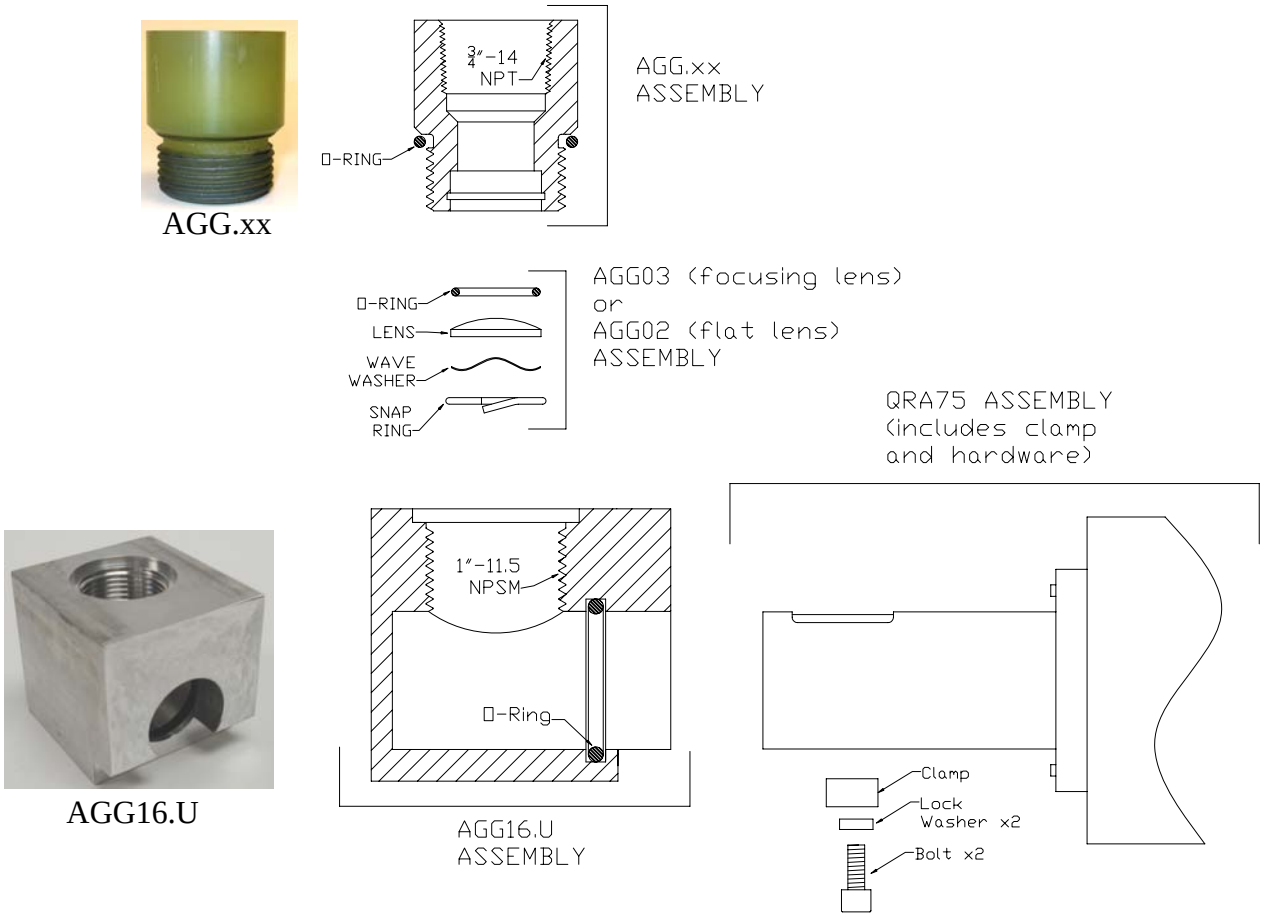


Information in this publication is based on current specifications. The company reserves the right to make changes in specifications and models as design improvements are introduced. Product or company names mentioned herein may be the trademarks of their respective owners. © 2009 SCC Inc.

Introduction

The AGG16.U is a right angle adapter for use with the QRA75 flame scanner. The AGG16.U is the only piece necessary to mount the QRA75 on most flame scanner tubes. If the application has high scanner tube temperatures (up to 280 °F) an AGG.xx thermal barrier can be used between the scanner tube and the AGG16.U. Additionally, the AGG03 focusing lens or the AGG02 flat lens can be installed into the AGG.xx thermal barrier for certain applications. Figure 1 identifies these pieces.

Figure 1. AGG16.U and accessories



Mounting and Installation

1. Mount the AGG16.U to the flame scanner tube.
    a. If lenses are not needed, go to step b. If lenses are needed, install the lens assembly (either AGG02 or AGG03) onto the AGG.xx thermal barrier. This is done by placing the AGG.xx assembly upside down so that end with external threads is pointing up, and then dropping in the o-ring, lens (if focusing, domed side to o-ring), wave washer, and finally the snap ring. The snap ring should snap into the annular groove of the AGG.xx

    b. If the thermal barrier is not needed, go to step c. If the thermal barrier is needed, screw the AGG.xx into the AGG16.U. Make sure that the o-ring fits into the counterbore on the AGG16.U. The thermal barrier fits onto a ¾" NPT scanner tube.

Mounting and Installation (continued)

c. If lenses and thermal barriers are not required, the AGG16.U can be directly screwed onto a 1" NPT or 1" NPSM male thread. Sealing tape is recommended for use with the 1" NPT threads. The AGG16.U can be used with smaller flame scanner tubes by using a pipe bushing having 1" NPT male threads and the appropriate size female threads.

NOTE : If the 1" NPT male thread (on the flame scanner tube) is over-threaded when the threads are cut, it is possible for the end of the tube or pipe to interfere with the QRA75 flame scanner.

2. To insert the QRA75 into the AGG16.U, push the barrel of the QRA75 into the bore that has a sealing o-ring. Use a "push while twisting back and forth" motion to slide the QRA75 through the o-ring seal. Slide in the QRA75 until it stops.

3. Install the clamp provided with the QRA75. This is done by placing the clamp in the square groove machined into the block and installing the two hex head screws. The clamp should be flush with the outer edge of the block. Maximum torque for the hex head screws is 25 in*lb. Use a 3mm Allen key. See Figure 2.

Figure 2. QRA75 correctly mounted in an AGG16.U

Front View



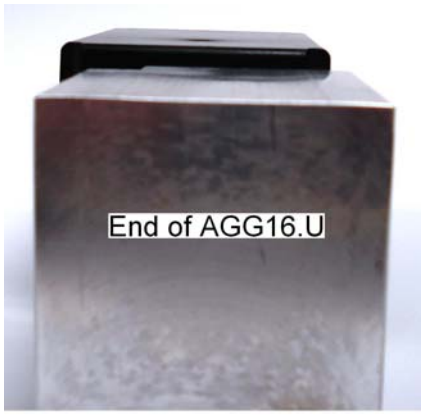
Back View



NOTE: Ensure that the UV bulb is in the center of the AGG16.U's threaded hole (see Figure 2 above). This will be the case when the QRA75 is inserted until it stops, and the QRA75 is square to the AGG16.U. The QRA75 is square when its sides are parallel with the AGG16.U's sides. See Figure 3.

Figure 3. QRA75 Orientation (must be square)

QRA75 square to AGG16.U
(correct)



QRA75 not square to AGG16.U
(incorrect)



Introduction

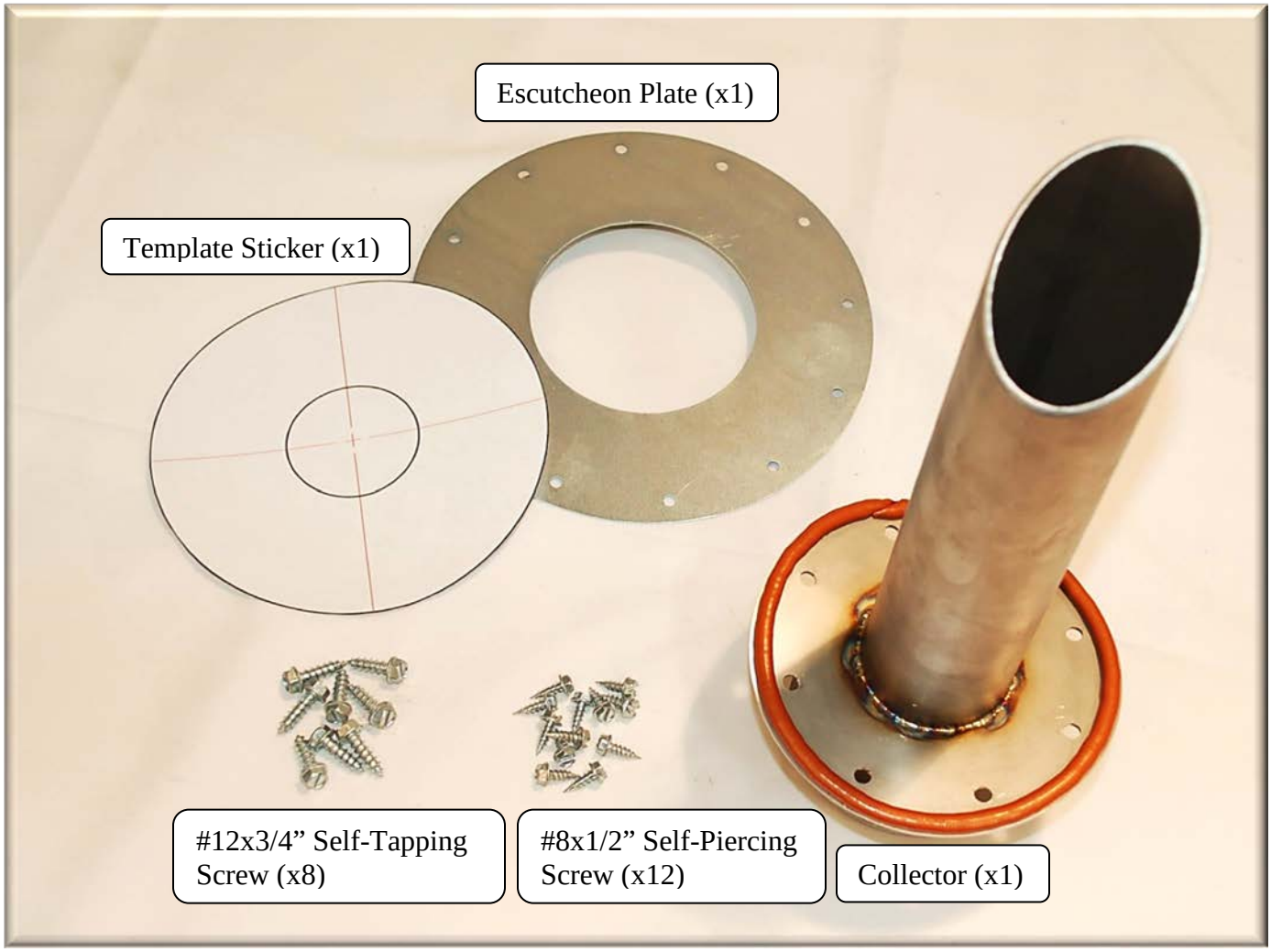
This mounting kit is designed for quick, simple weldless installation of the collector for the QGO20 O2 sensor into a double-wall stack using common tools. The following pages give a procedure for installing the kit in round double-wall stacks having an inner stack diameter from 12" to 36". Maximum flue gas temperature is 590 ºF.

SCC Part # AGO20.001SDS-KT → Inner Stack Diameter: 12"-16"
SCC Part # AGO20.002LDS-KT → Inner Stack Diameter: 18"-36"

Required Pieces

The mounting kit should contain the following assemblies / pieces:

Fig.1 Pieces Supplied in Kit



Recommended Tools / Supplies

1. Aviation Snips (green handle, right hand)
2. Cordless drill/driver
3. Spring loaded center punch
4. 1/8” Drill Bit for metal
5. 7/32” Drill Bit for metal
6. 2-1/8” Bimetal hole saw (new and sharp) with arbor and pilot bit
7. 5/16” Hex head driver with 2-inch extension
8. 1/4” Hex head driver

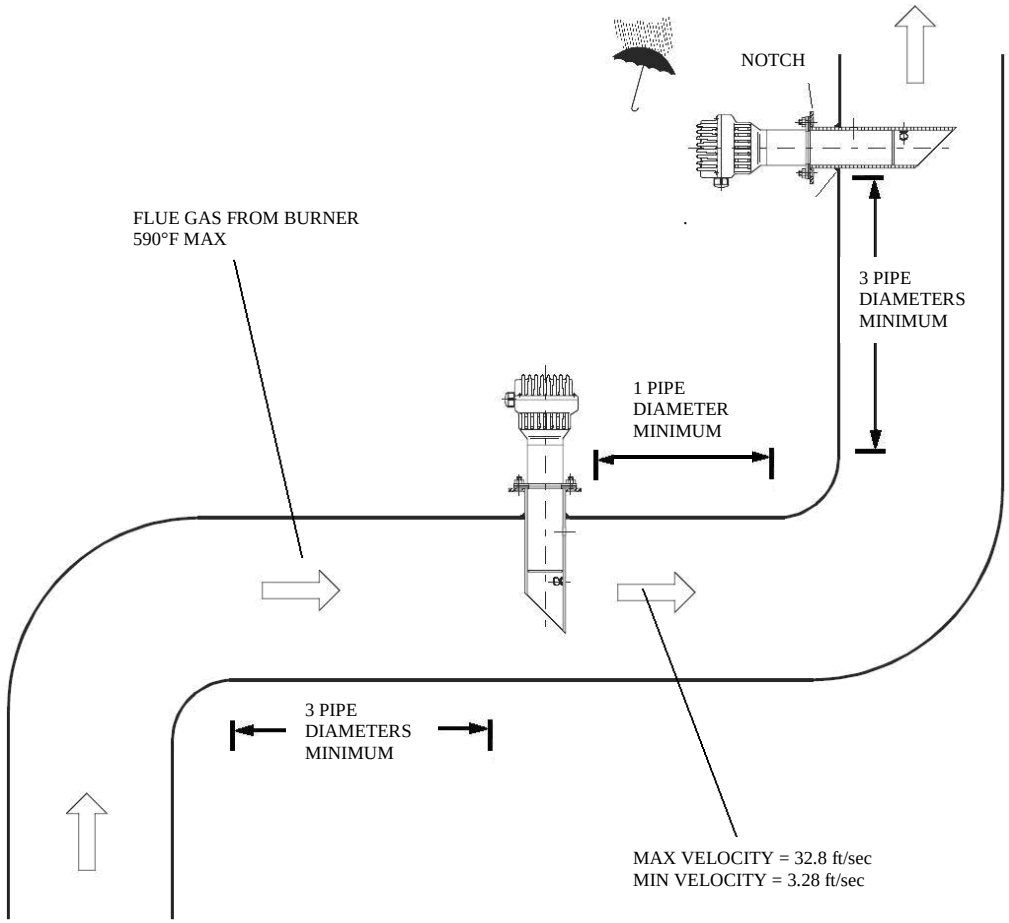
Personal Protective Equipment

- Safety glasses
- Cut resistant gloves

Mounting and Assembly

1. Determine a suitable location for the AGO collector in the double-wall portion of the exhaust stack. See Figure 2 for guidance.

Fig.2 Mounting Location Guide



2. Peel off sticker backing and put sticker on outer wall of double-wall stack so that one of the red centerlines on the sticker is in line with the centerline of the stack.

3. Center punch the intersection of the red centerlines (middle of sticker).

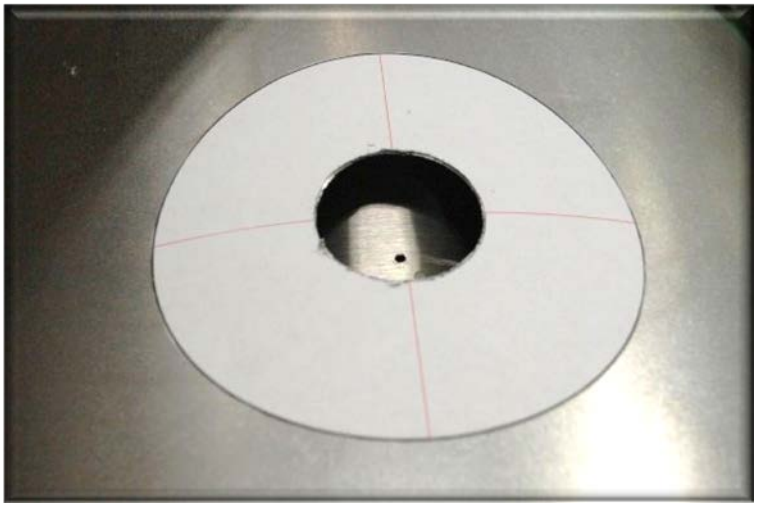
4. Chuck the 1/8" drill bit in the drill. At the intersection of the red centerlines, drill a 1/8" hole through both walls of the stack as shown in Figure 3. Be careful to drill into the stack as straight (perpendicular) as possible.

Fig.3 Sticker Placement and Pilot Hole Preparation



5. Chuck the 2-1/8” hole-saw into the drill. Set the drill to the lowest speed possible. If a clamping secondary handle accessory is available, place it over the front end of the drill/driver for more stability, as shown in Figure 4. Follow the 1/8” hole with the pilot bit on the hole-saw. Cut through the outer wall of the stack with slow speed and moderate pressure. Do not cut through the inner stack at this point. The stack should look like Figure 4 after this step.

Fig.4 Result after cutting the first 2-1/8” hole & Secondary Handle





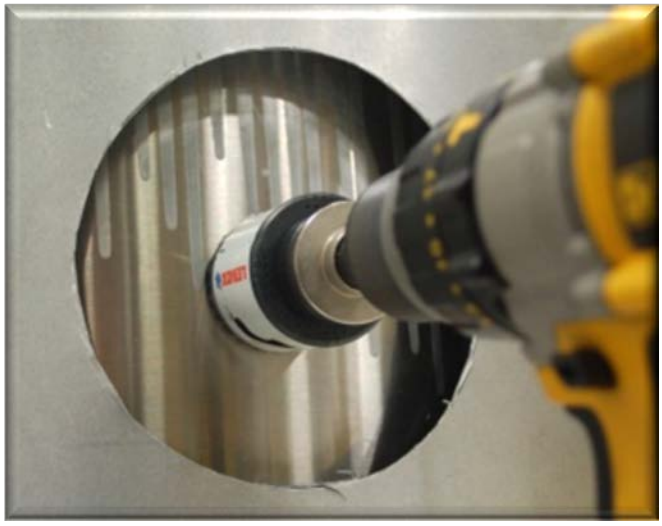
6. Use the aviation snips to cut a 6" diameter hole in the outer wall of the stack, starting from the middle hole and working toward the outer circle of the template in a clockwise, spiral pattern. Figure 5 shows the process of shearing the 6” hole. The finished hole should look like Figure 6.

Fig.5 Shearing 6” Hole with Aviation Snips



7. Use the drill with the 2-1/8” hole-saw to cut a hole through the inner stack, following the existing 1/8” hole with the pilot bit on the hole-saw. (See Figure 7) **NOTE: The inner stack is typically stainless steel, and can be difficult to cut with a hole-saw. Use a sharp hole-saw, moderate pressure and very slow speed. If necessary, take periodic breaks to let the hole saw cool in order to avoid dulling the saw teeth.**

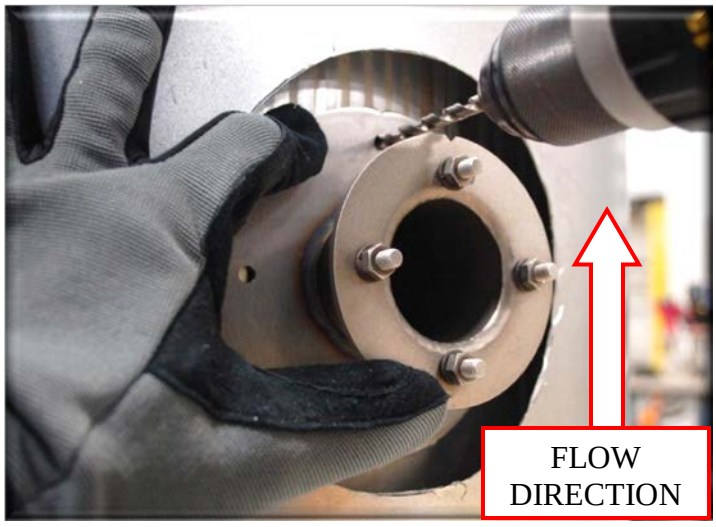
Fig.6 Resulting 6” Hole & Cutting the Second 2-1/8” Hole



8. After the 2-1/8” hole is cut through the inner stack, insert the collector into the hole. The flanges’ v-groove notches must be pointing in the direction of flow in order for the collector to scoop the exhaust. (See Figure 7)

9. Chuck the 7/32” drill bit in the drill. This drill bit will just fit through the (8) clearance holes in the curved collector flange. Hold the collector in place and use the drill plus the bit to mark the center of the top hole onto the inner stack. (See Figure 7) **NOTE: Do not drill through the inner stack with this bit. This step is only meant to put a mark on the inner stack.**

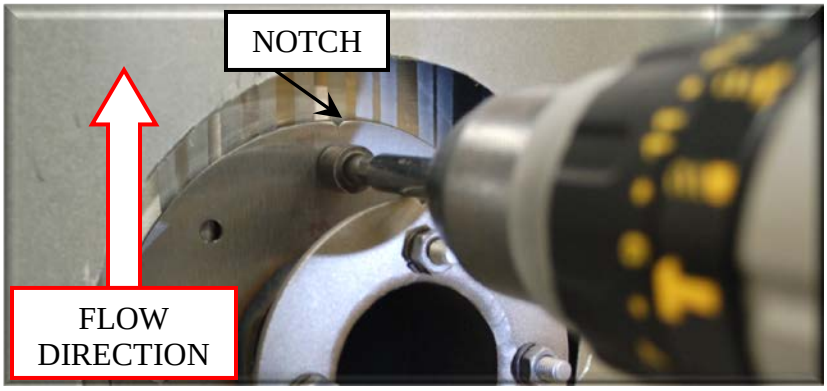
Fig.7 Collector Orientation & Marking the Top Hole



10. Remove the collector. Chuck the 1/8" drill bit in the drill. Using the mark made in the previous step, drill through the stack. Keep the bit as perpendicular as possible in order to avoid the bit "walking" out of the marking.

11. Replace the collector and put it in the correct orientation. Chuck the 5/16" hex driver with extension in the drill. Take one of the #12 sheet metal screws and fasten the collector to the inner stack using the pre-drilled hole. (See Figure 8) **NOTE: Do not use excessive torque on the screw! The inner stack is typically not very thick and the screws can strip out if excessive torque is used. Set the torque clutch on the cordless drill/driver to a lower setting if possible.**

Fig.8 Driving the First #12 Sheet Metal Screw



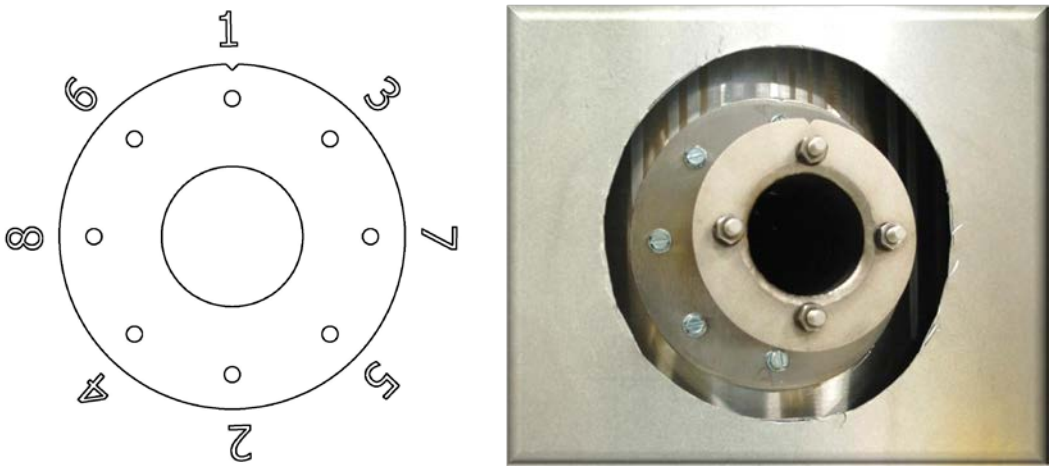
12. Chuck the 7/32" drill bit in the drill. This drill bit will just fit through the (8) clearance holes in the curved collector flange. Using the drill plus drill bit, mark the center of the (7) remaining holes onto the inner stack. **NOTE: Do not drill through the inner stack with this bit. This step is only meant to put a mark on the inner stack.**

13. Chuck the 5/16" hex driver with extension in the drill. Remove the #12 screw and the collector. Chuck the 1/8" drill bit in the drill. Drill the (7) remaining marks (created in the previous step) through the inner stack. Keep the bit as perpendicular as possible in order to avoid the bit "walking" out of the marking.

14. Replace the collector and put it in the correct orientation. Chuck the 5/16" hex driver plus extension in the drill. Install the (8) #12 sheet metal screws in the order outlined in Figure 9. This is an important part of creating a good seal. **NOTE: Do not use excessive torque on the screw! The inner stack is typically not very thick and the screws can strip out if excessive torque is used. Set the torque clutch on the cordless drill/driver to a lower setting if possible.**

    When finished, the installed collector should look like Figure 9.

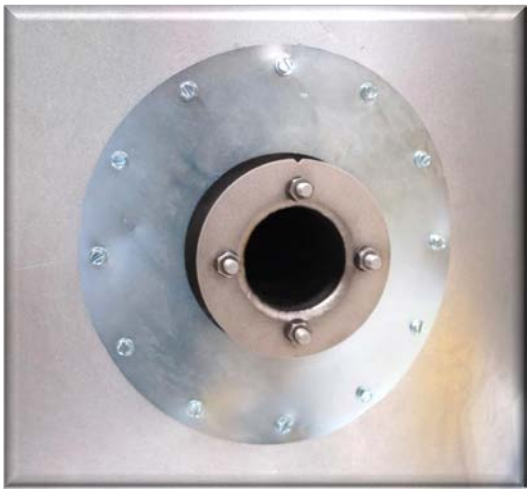
Fig.9 Fastening Order & #12 Fasteners Installed



15. Install a small piece of high temperature insulation around the collector flange and between the stack walls.

16. Fasten the Escutcheon plate to the outer wall of the stack with the (12) #8 self-piercing screws. Follow a similar fastening order as Figure 9. Drilling a pilot hole for the screws should not be necessary. The collector should look like Figure 10 after this step.

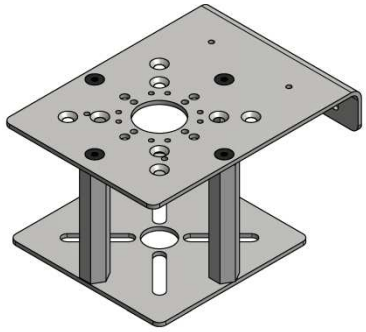
Fig.10 Final Installation

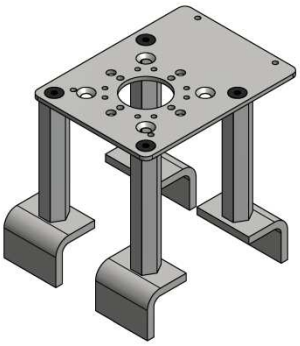


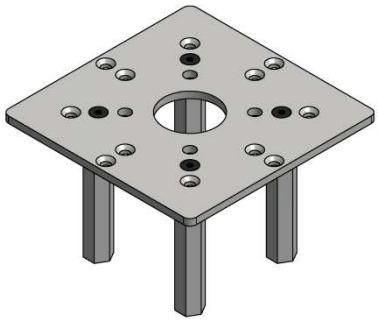
17. The installation of the collector is now complete. The QGO20 O2 sensor can now be mounted to the collector using the nuts and washers on the studs of the collector.

BRx Series

BR-AS… Bracket Assemblies for use with SQM… Actuators







Description

BRx… series bracket assemblies installed with Cxx… series couplings precisely mount a Siemens SQM… actuator to a valve or damper.

Features

- Engineered for precise shaft alignment
- Rigid and robust design
- Multiple mounting options for simple installation
- Standoff options accommodate a variety of shaft lengths

Application

BRx… series bracket assemblies assist installation of any Siemens SQM… actuator to a variety of valves or dampers. The modular bracket design provides options to easily mount SQM… actuators. BRx… series bracket assemblies are engineered for use with Cxx… series couplings.

Product Part Numbers

For bracket assembly part number identification only. Not all possible part number combinations are available. See Tables 1, 2, and 3 on the following pages for available bracket assembly part number combinations.

BR-AS 2 1 - 18 4 - 2 - 00

Bracket Assembly

Actuator Bracket
1 = 8" x 6" bracket for SQM3/4/5... actuators
2 = 6" x 4.5" bracket for SQM3/4/5... actuators
3 = 7.25" x 7.25" bracket for SQM9... actuators

Actuator
1 = SQM3..., SQM4..., or SQM5…
3 = SQM9...

Standoff Length
6 = 2.80"
10 = 3.00"
14 = 3.90"
16 = 4.15"
18 = 4.50"
22 = 6.30"

Number of Standoffs
4 = Standard

Mounting Options
0 = Threaded studs
1 = Pillow block bracket
2 = Weld mounts
3 = Blank bracket

Additional Descriptor
00 = Standard

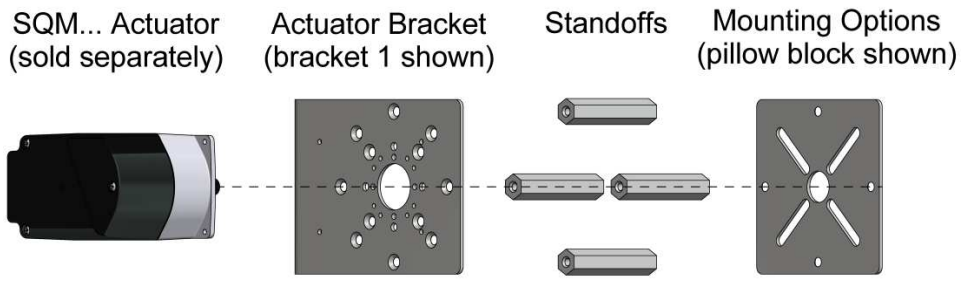


Figure 1: Components of Bracket Assemblies

Product Part Numbers (continued)

Bracket assembly part numbers are listed in Tables 1, 2, and 3. For help selecting the proper part number, see pages 5-7.

Note: All necessary mounting hardware is included with the bracket assembly.

Table 1: Bracket Assemblies Using Actuator Bracket 1

Mounting Type	Standoff Length	Assembly Part Number
Pillow Block Bracket	2.80”	BR-AS11-64-1-00
	3.00”	BR-AS11-104-1-00
	3.90”	BR-AS11-144-1-00
	4.15”	BR-AS11-164-1-00
	4.50”	BR-AS11-184-1-00
	6.30”	BR-AS11-224-1-00
Weld Mounts	2.80”	BR-AS11-64-2-00
	3.00”	BR-AS11-104-2-00
	3.90”	BR-AS11-144-2-00
	4.15”	BR-AS11-164-2-00
	4.50”	BR-AS11-184-2-00
	6.30”	BR-AS11-224-2-00
Blank Bracket	2.80”	BR-AS11-64-3-00
	3.00”	BR-AS11-104-3-00
	3.90”	BR-AS11-144-3-00
	4.15”	BR-AS11-164-3-00
	4.50”	BR-AS11-184-3-00
	6.30”	BR-AS11-224-3-00
Threaded Studs	2.80”	BR-AS11-64-0-00
	3.00”	BR-AS11-104-0-00
	3.90”	BR-AS11-144-0-00
	4.15”	BR-AS11-164-0-00
	4.50”	BR-AS11-184-0-00
	6.30”	BR-AS11-224-0-00

Product Part Numbers (continued)

Table 2: Bracket Assemblies Using Actuator Bracket 2

Mounting Type	Standoff Length	Assembly Part Number
Weld Mounts	2.80”	BR-AS21-64-2-00
	3.00”	BR-AS21-104-2-00
	3.90”	BR-AS21-144-2-00
	4.15”	BR-AS21-164-2-00
	4.50”	BR-AS21-184-2-00
	6.30”	BR-AS21-224-2-00
Blank Bracket	2.80”	BR-AS21-64-3-00
	3.00”	BR-AS21-104-3-00
	3.90”	BR-AS21-144-3-00
	4.15”	BR-AS21-164-3-00
	4.50”	BR-AS21-184-3-00
	6.30”	BR-AS21-224-3-00
Threaded Studs	2.80”	BR-AS21-64-0-00
	3.00”	BR-AS21-104-0-00
	3.90”	BR-AS21-144-0-00
	4.15”	BR-AS21-164-0-00
	4.50”	BR-AS21-184-0-00
	6.30”	BR-AS21-224-0-00

Table 3: Bracket Assemblies Using Actuator Bracket 3

Mounting Type	Standoff Length	Assembly Part Number
Pillow Block Bracket	3.90”	BR-AS33-144-1-00
	4.15”	BR-AS33-164-1-00
	4.50”	BR-AS33-184-1-00
	6.30”	BR-AS33-224-1-00
Weld Mounts	3.90”	BR-AS33-144-2-00
	4.15”	BR-AS33-164-2-00
	4.50”	BR-AS33-184-2-00
	6.30”	BR-AS33-224-2-00
Blank Bracket	3.90”	BR-AS33-144-3-00
	4.15”	BR-AS33-164-3-00
	4.50”	BR-AS33-184-3-00
	6.30”	BR-AS33-224-3-00
Threaded Studs	3.90”	BR-AS33-144-0-00
	4.15”	BR-AS33-164-0-00
	4.50”	BR-AS33-184-0-00
	6.30”	BR-AS33-224-0-00

Product Part Numbers (continued)

The following three steps are to be used as a guide for choosing a proper bracket assembly part number. None of the components listed below may be ordered separately. See pages 11-15 for dimensions of each bracket component.

1. Select a Mounting Option

Pillow Block Bracket



This bracket is used when mounting Siemens SQM… actuators to an air damper that uses pillow block bearings to support the shafts. The bracket sits above the pillow block with mounting screws going through the diagonal slots in the bracket.

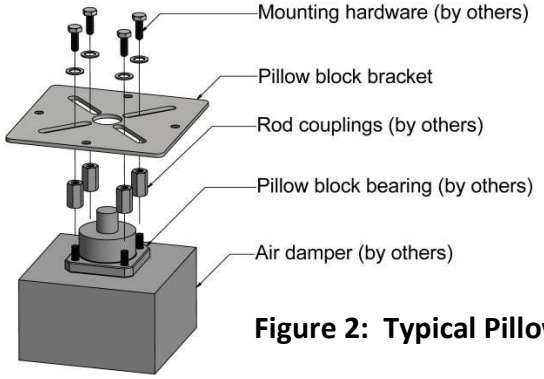


Figure 2: Typical Pillow Block Mounting

Weld Mounts



Weld mount brackets provide an easy and secure installation option. A standoff is bolted to the bracket which is non-galvanized and can be easily welded for mounting. Four weld mounts are included in a bracket assembly, one for each standoff.

Blank Bracket



The blank bracket kit allows custom holes to be drilled and tapped. Four holes around the outside of the bracket are provided to mount standoffs on the 5.00” bolt circle.

Threaded Studs



Use ¼”-20 threaded studs to mount the bracket assembly directly to a valve or damper. 1.25” long threaded studs are provided with each assembly.

Product Part Numbers (continued)

2. Select an Actuator Bracket

Bracket 1



Actuator mounting bracket 1 is approximately 8.0” x 6.0” in size and may be used with SQM3…, SQM4…, or SQM5… actuators. There is a 90° bend at the end of the bracket for the option of securing the bracket assembly from the side.

Bracket 2



Actuator mounting bracket 2 is approximately 6.0” x 4.5” in size and may be used with SQM3…, SQM4…, or SQM5… actuators.

Bracket 3



Actuator mounting bracket 3 is approximately 7.25” x 7.25” in size and is to be used with SQM9… actuators.

3. Select a Standoff Length

Standoffs



Each bracket assembly comes with four standoffs. Standoffs are available in different lengths to accommodate a variety of valve or damper shafts. The “Standoff Selection Guide” on the following page determines the standoff length required.

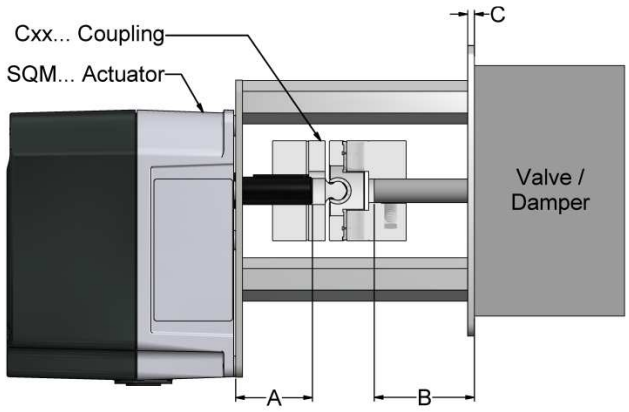
Product Part Numbers (continued)

Standoff Selection Guide

Standoffs are available in the following lengths:

- 2.80”
- 3.00”
- 3.90”
- 4.15”
- 4.50”
- 6.30”

Use the guide below to find the minimum and maximum standoff lengths allowed. These are determined by the minimum and maximum shaft engagement in the coupling. Then, select a size from the list above that falls between the calculated minimum and maximum lengths. If more than one length of standoff is suitable, select the one that is closest to the average of the minimum and maximum lengths. If none of the standoff lengths are suitable, contact SCC Inc. for more information.



Dimension A: Actuator Shaft Length
For SQM3x.xxx... actuators: A = 0.99"
For SQM4x.xx5... actuators: A = 0.99"
For SQM4x.xx7... actuators: A = 1.54"
For SQM5x.xx7... actuators: A = 1.71"
For SQM9x.xxx... actuators: A = 1.77"

Dimension B: Valve / Damper Shaft Length
Measure the shaft length on the valve or damper

Dimension C: Thickness of Valve / Damper Bracket
Mounting with pillow block bracket: C = 0.135"
Mounting with weld mounts: C = 1.50"
Mounting with blank bracket: C = 0.135
Mounting with threaded studs: C = 0"

D: Correction
For SQM3x.xxx... actuators: D = 0.27
For SQM4x.xx5... actuators: D = 0.27
For SQM4x.xx7... actuators: D = 0
For SQM5x.xx7... actuators: D = 0
For SQM9x.xxx... actuators: D = 0

Figure 3: Standoff Selection Guide

For bracket assemblies being combined with a CC… or CD… coupling:

Minimum allowable standoff length = A + B + D + 0.44 - C
Maximum allowable standoff length = A + B + 1.08 - C

For bracket assemblies being combined with a CF… or CH… coupling:

Minimum allowable standoff length = A + B + D + 0.74 - C
Maximum allowable standoff length = A + B + 1.30 - C

For bracket assemblies being combined with a CJ… or CK… coupling:

Minimum allowable standoff length = A + B + 0.66 - C
Maximum allowable standoff length = A + B + 1.61 - C

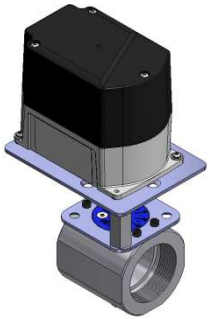
Accessories

Cxx… Couplings



Cxx… series couplings precisely connect Siemens SQM… actuators to a wide variety of valves and dampers. Cxx… series couplings are highly recommended with any BRx… series bracket assembly. See Document No. CPBK-1000 for more information on Cxx couplings.

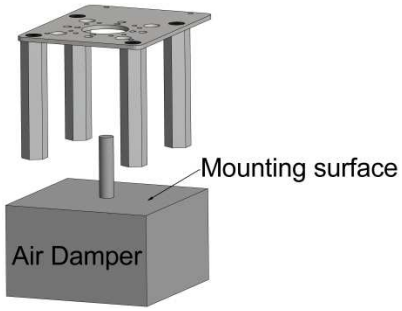
VA… Valve Actuator Assemblies



Pre-built valve actuator assemblies can be ordered to ensure proper shaft alignment and engagement. Assemblies include the valve, actuator, coupling, and bracket which are configured, tested, and shipped as an assembly. Contact SCC Inc. for more information.

Specifications

Physical characteristics	Flat brackets	Zinc-Plated Steel
	Weld mounts	Low Alloy Steel (non-galvanized)
	Standoffs	Aluminum
	Fasteners	Alloy Steel
Operating environment	Ambient temperature	-4 to 140°F [-20 to 60°C]
	Mounting surface temperature	-40 to 150°F [-40 to 66°C]*
		*Consult SCC Inc. for higher mounting surface temperatures.



Installation

- Bracket assemblies can be indexed in 45° or 90° increments relative to the valve or damper depending on the actuator bracket (see below).

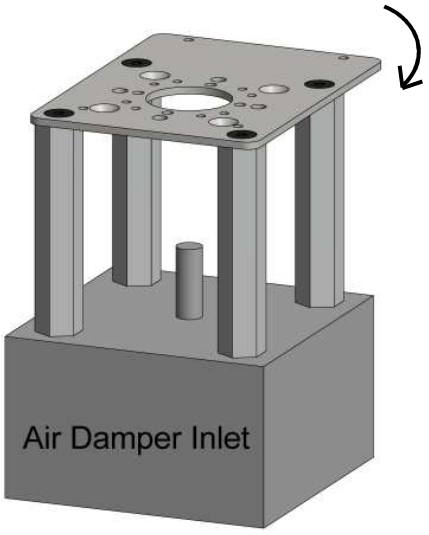


Figure 4: Bracket Assembly Indexing

- All bracket assemblies include the fasteners to mount an SQM… actuator to the actuator bracket. Some bracket assemblies include additional hardware that will not be used. Based on the SQM… actuator being mounted, use Table 4 to determine which mounting screws are necessary. Table 4 also details the manner by which the screws mount the actuator to the actuator bracket.

Table 4: Actuator Mounting Screws

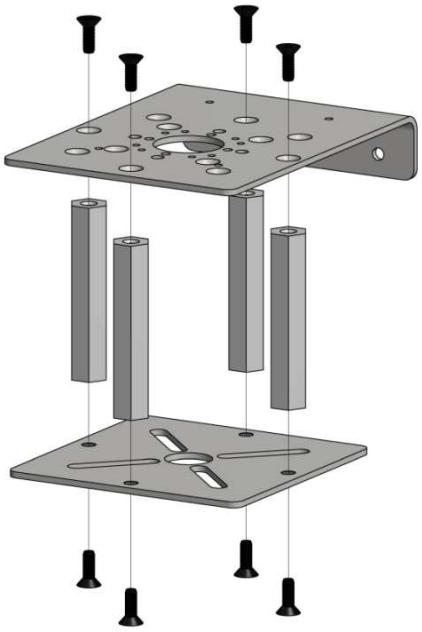
Actuator	Quantity of Screws	Type of Screws	Mounting Method
SQM3…	2	#14 thread-forming	Self-tap into actuator
SQM4…	4	M5 thread-forming	Self-tap into bracket
SQM5…	3	M5 thread-forming	Thread into actuator
SQM9…	4	M10 hex head	Thread into actuator

- Use medium strength blue Loctite (#242) on all fasteners that are not accompanied by lock washers.

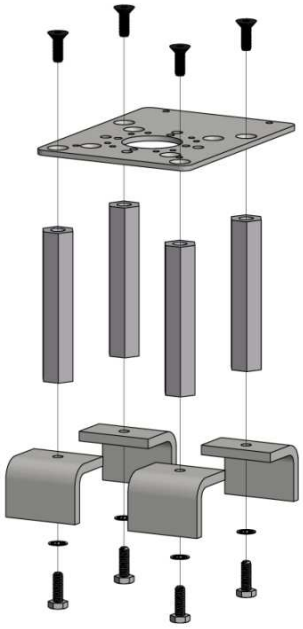
- If using a CF… or CH… coupling, the standoffs must be mounted on the 5.00” bolt circle. If standoffs are mounted on the 3.25” bolt circle, the set screws in the coupling will interfere with the standoffs. Consult SCC if the 3.25” bolt circle must be used with a CF… or CH… coupling.

Installation (continued)

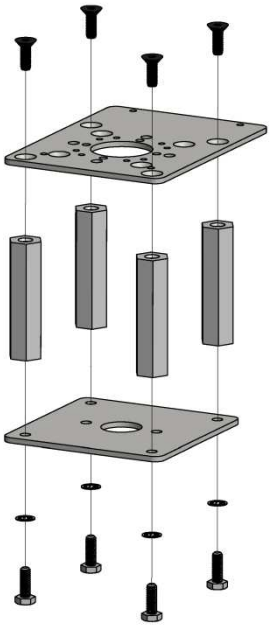
Installation with pillow block bracket:



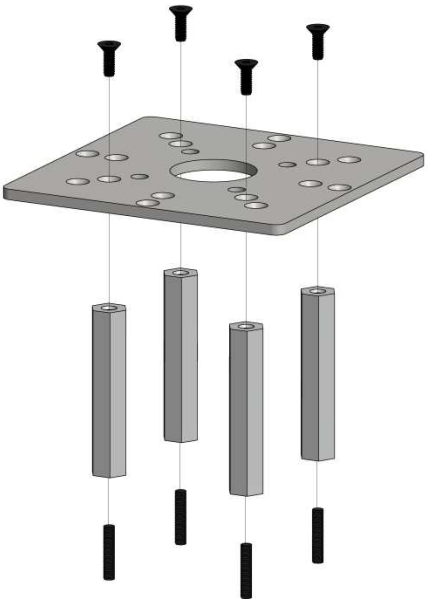
Installation with weld mounts:



Installation with blank bracket



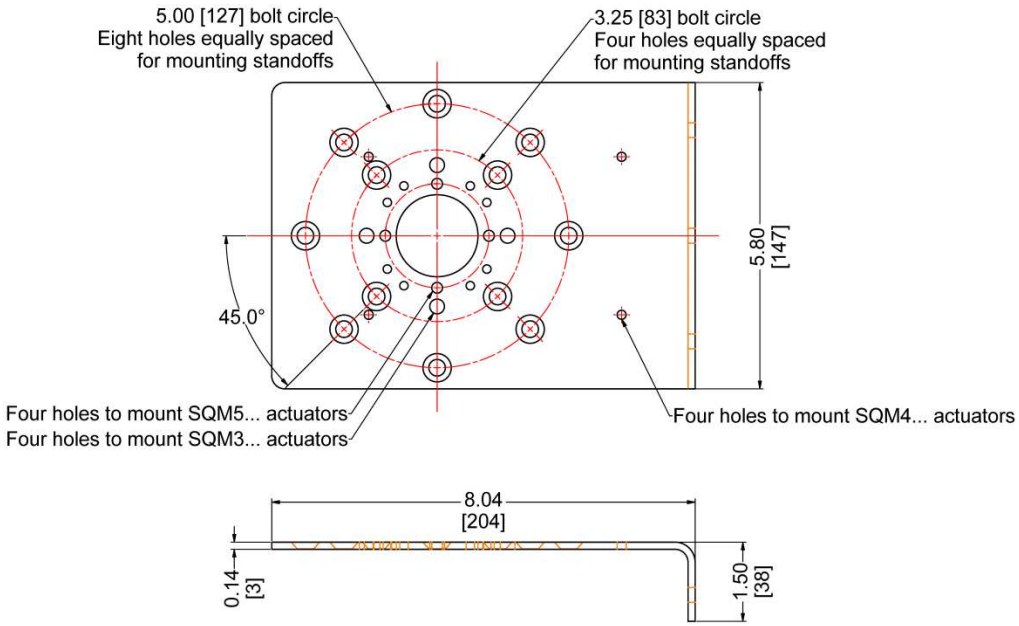
Installation with threaded studs



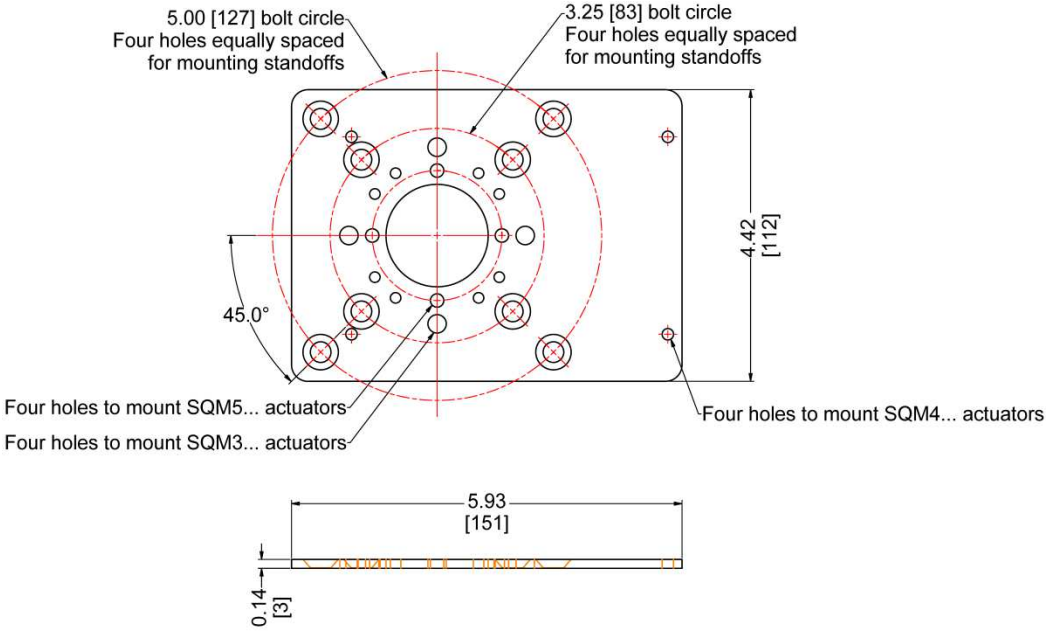
Dimensions

Dimensions in inches; millimeters in brackets

Actuator Bracket 1



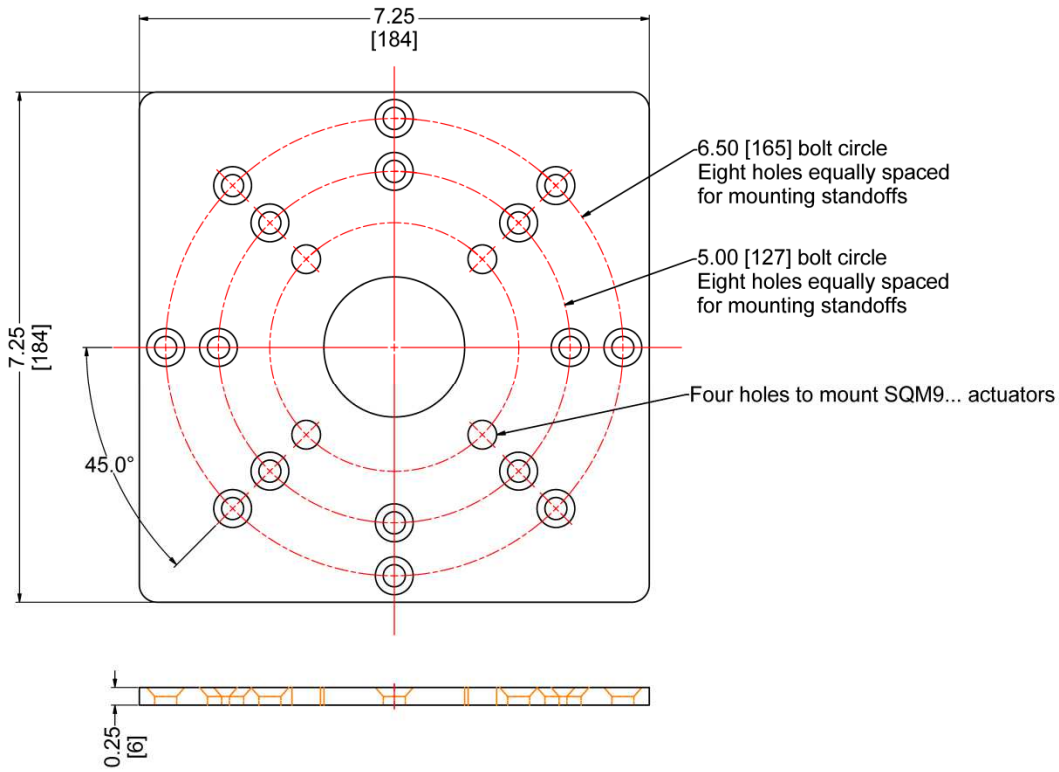
Actuator Bracket 2



Dimensions (continued)

Dimensions in inches; millimeters in brackets

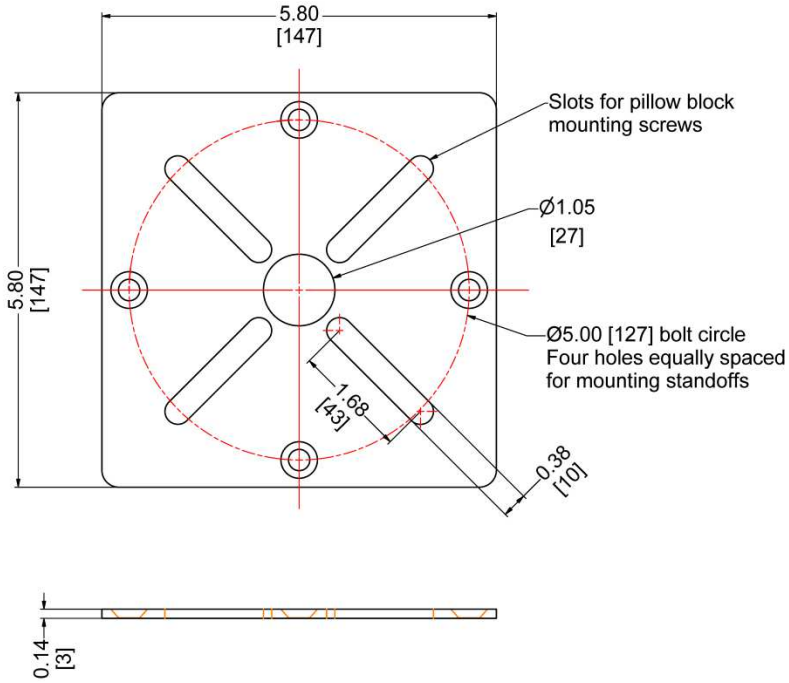
Actuator Bracket 3



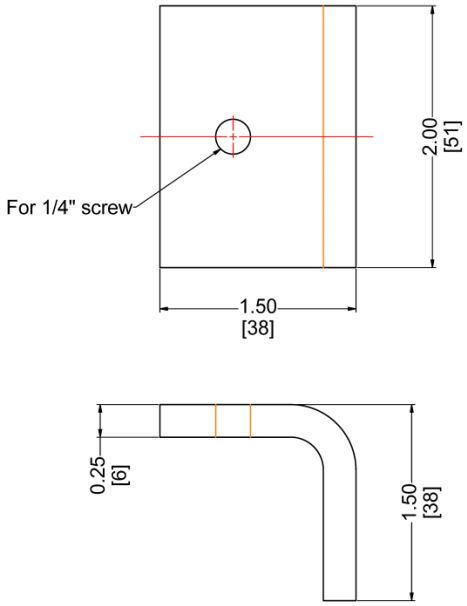
Dimensions (continued)

Dimensions in inches; millimeters in brackets

Mounting Option 1 - Pillow Block Bracket



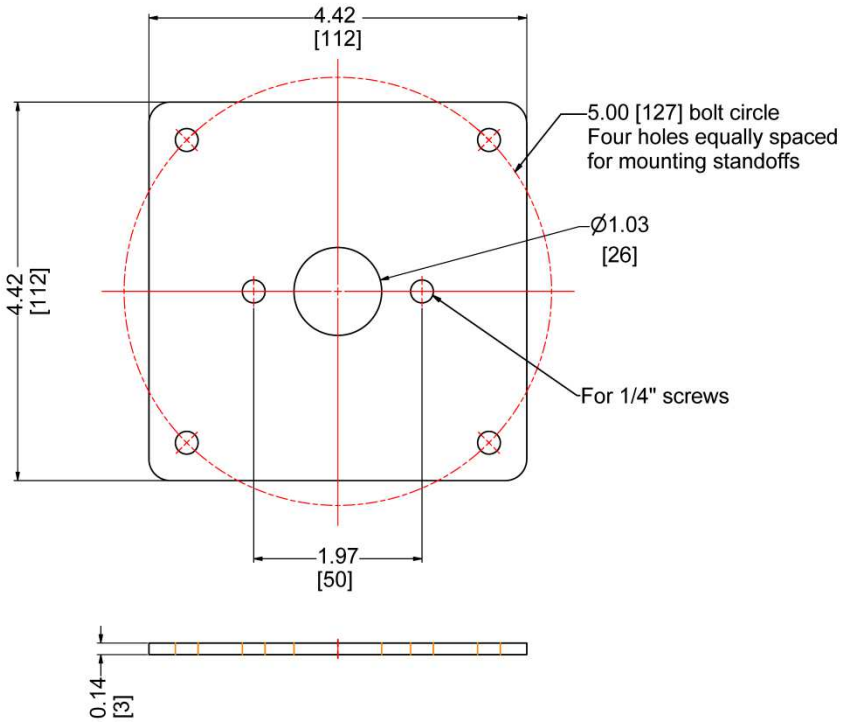
Mounting Option 2 - Weld Mounts



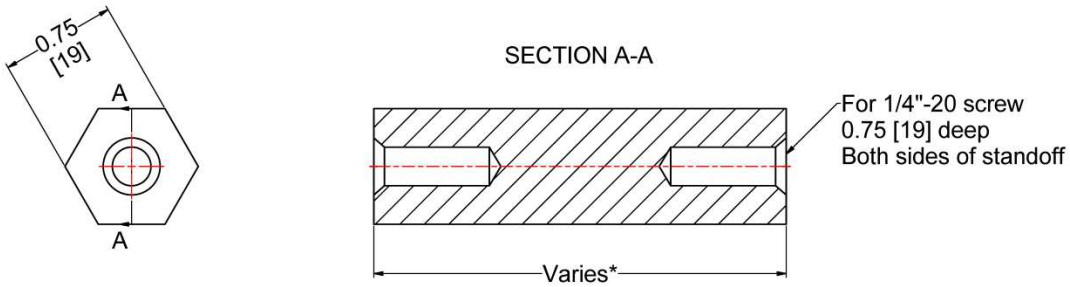
Dimensions (continued)

Dimensions in inches; millimeters in brackets

Mounting Option 3 - Blank Bracket



Standoffs



*Available standoff lengths are 2.80 [71], 3.00 [76], 3.90 [99], 4.15 [105], 4.50 [114], 6.30 [160]

Dimensions (continued)

Dimensions in inches; millimeters in brackets

Bracket Assembly

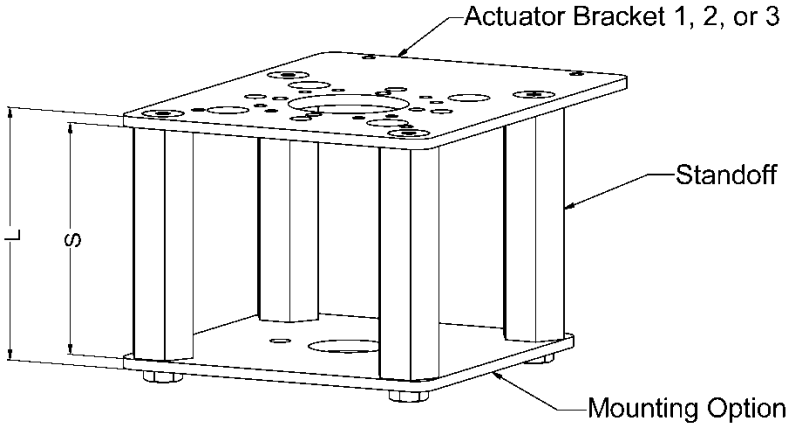


Table 5: Bracket Assembly Lengths

Actuator Bracket	Standoff Length (S)	Mounting Option			
		Pillow Block Bracket (L)	Weld Mounts (L)	Blank Bracket (L)	Threaded Studs (L)
1 or 2	**2.80”**	3.07 [78]	4.43 [113]	3.07 [78]	2.93 [74]
	3.00”	3.27 [83]	4.63 [118]	3.27 [83]	3.13 [80]
	3.90”	4.17 [106]	5.53 [140]	4.17 [106]	4.03 [102]
	4.15”	4.42 [112]	5.78 [147]	4.42 [112]	4.28 [109]
	4.50”	4.77 [121]	6.13 [156]	4.77 [121]	4.63 [118]
	6.30”	6.57 [167]	7.93 [201]	6.57 [167]	6.43 [163]
3	**2.80”**	3.18 [81]	4.54 [115]	3.18 [81]	3.04 [77]
	3.00”	3.38 [86]	4.74 [120]	3.38 [86]	3.24 [82]
	3.90”	4.28 [109]	5.64 [143]	4.28 [109]	4.14 [105]
	4.15”	4.53 [115]	5.89 [150]	4.53 [115]	4.39 [112]
	4.50”	4.88 [124]	6.24 [158]	4.88 [124]	4.74 [120]
	6.30”	6.68 [170]	8.04 [204]	6.68 [170]	6.54 [166]

Information in this publication is based on current specifications. The company reserves the right to make changes in specifications and models as design improvements are introduced. Product or company names mentioned herein may be the trademarks of their respective owners. © 2009 SCC Inc.

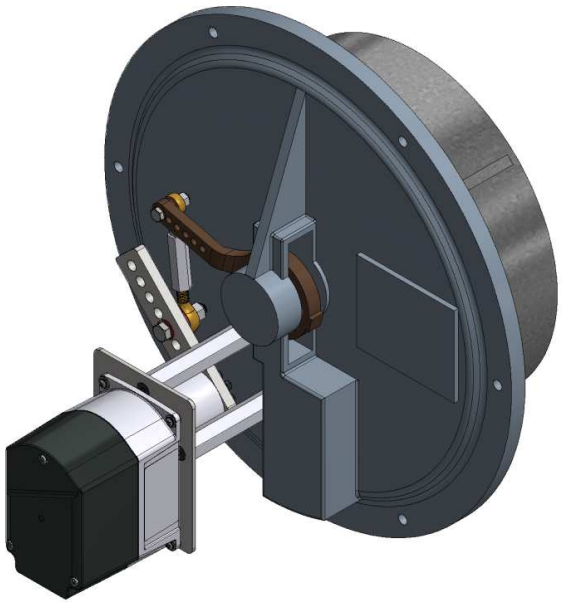
SCC Inc.

Installation Instructions

Document No. CPBK-4100

February 24, 2014

BR…CBAIR Rotary Air Damper Retrofit Kits



Product Description

A BR…CBAIR retrofit kit reliably mounts an SQM33, SQM45, or SQM48 actuator to a Cleaver Brooks boiler rotary air damper with an outer flange diameter of 18.25”.

Recommended Installation Tools

The following tools / supplies are recommended for bracket assembly installation:

1. Fine tip marker
2. Center punch (with hammer)
3. Drill with #6 (0.204”) drill bit
4. Aluminum tapping fluid (Tap Magic)
5. Tap holder with ¼”-20 spiral-point tap
6. Drill and tap guide (included in kit)
7. Set of standard open end wrenches up to ¾”. Should have two 7/16” and two 3/8” wrenches.
8. Set of standard hex keys
9. Phillips screwdriver
10. Medium threadlocker

Components Supplied

Figure 1 shows all of the components that are supplied with a BR…CBAIR retrofit kit.

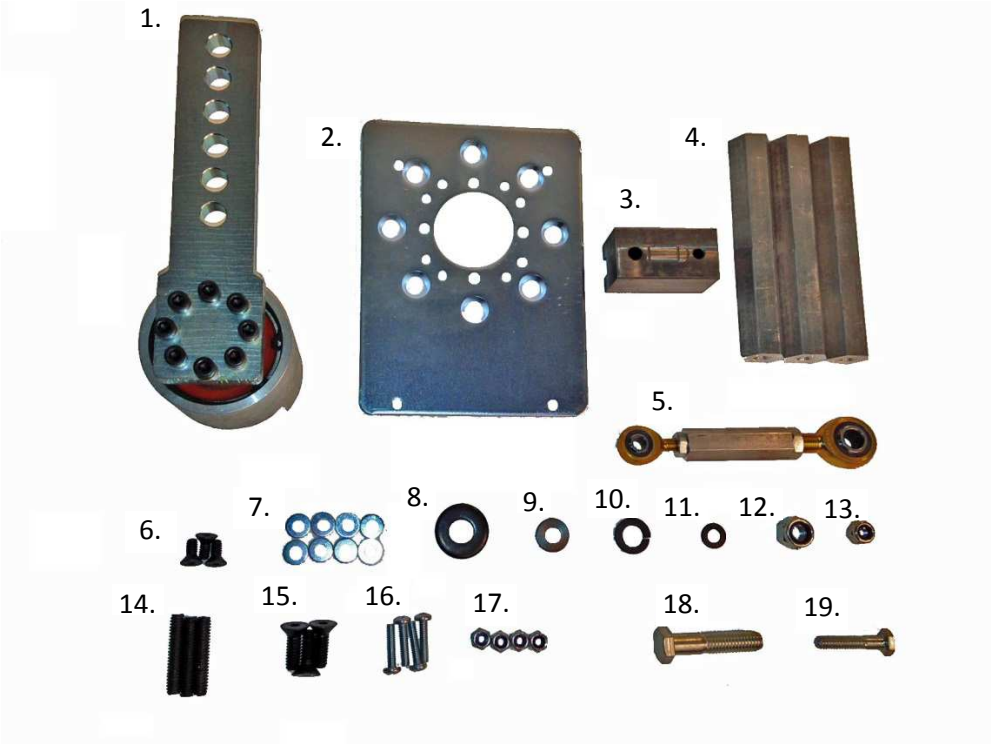


Figure 1: Components Included in a BR…CBAIR Rotary Air Damper Retrofit Kit

1. Bearing block crank arm assembly
2. Actuator base plate
3. Drill / tap guide
4. 4.5” hex standoffs (qty 3)
5. Turnbuckle assembly
6. #10-24 x 0.44” flat head screws (qty 3)
7. #8 SAE flat washers (qty 8)
8. 3/8” spacer
9. 1/4” spacer
10. 3/8” lock washer
11. 1/4” lock washer
12. 3/8” lock nut
13. 1/4” lock nut
14. 1/4”-20 x 1.25” studs (qty 3)
15. 1/4”-20 x 0.75” flat head screws (qty 3)
16. #8-32 x 0.75” pan head screws (qty 4)
17. #8-32 lock nuts (qty 4)
18. 3/8”-16 x 1.75” hex head screw
19. 1/4”-20 x 1.25” hex head screw

Installation Procedure

1. Unbolting and removing the drawer / air damper assembly from the boiler is recommended (see Figure 2). This drawer assembly has an outer diameter of approximately 18.25”.

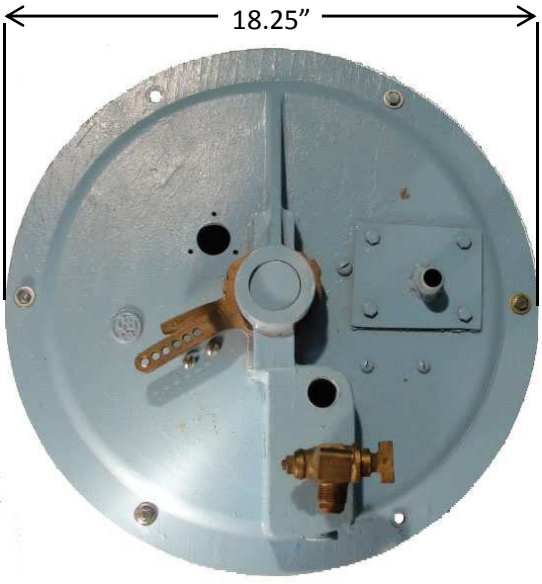


Figure 2: Typical Drawer / Air Damper Assembly

2. Mark the positions to be drilled using the actuator base plate as a template. The holes to be drilled are at the 12, 3, and 6 o’clock positions on the actuator base plate. The actuator base plate should be flush against the casting as shown in Figure 3.

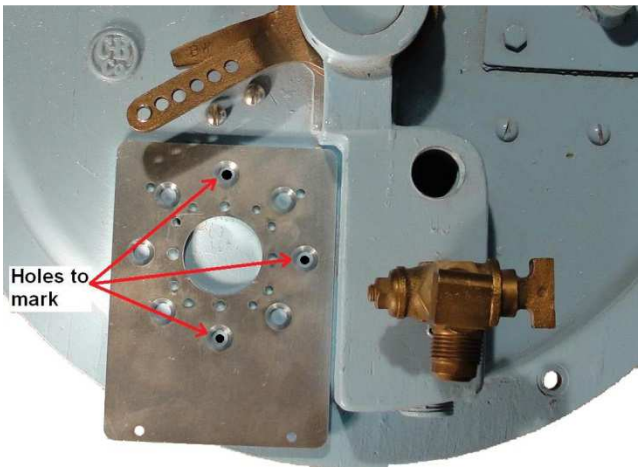


Figure 3: Using the Actuator Base Plate as a Template

3. After the positions are marked, center punch each. Then using the #6 drill bit and drill, start each hole no more than 1/8" deep. **NOTE: Accurate marking of the holes is very important so that the standoffs are properly located and will line up with the actuator base plate. Accuracy on this step is recommended.**

   After this step, the drawer should look like Figure 4.



Figure 4: Drawer with Holes Marked and Started

4. Insert the #6 drill bit through the "D" side of the drill / tap guide and into one of the holes started in step 3. Press the drill / tap guide firmly against the face of the drawer so the hole is drilled as perpendicular to the face as possible. Drill completely through the drawer assembly. Repeat the same procedure on the other two holes started in step 3. This arrangement is shown in Figure 5 below.

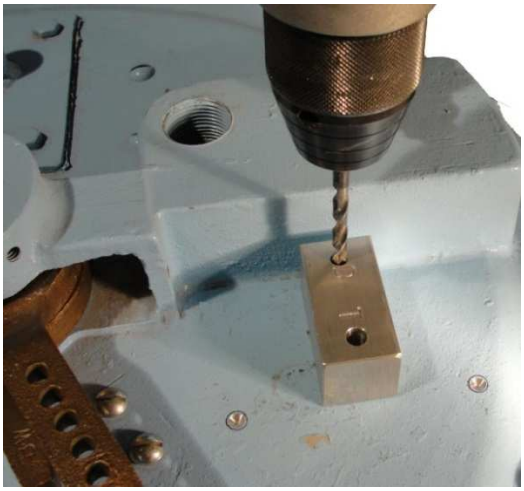


Figure 5: Drilling Holes Perpendicular to Drawer Face

5. After the holes are drilled, they can be tapped with a ¼”-20 tap. A spiral-point tap and aluminum tapping fluid (Tap Magic) are recommended for tapping these holes. Using the side of the drill / tap guide marked “T”, press the guide firmly against the drawer face and tap each of the 3 drilled holes. Figure 6 illustrates a spiral-point tap and the use of the drill / tap guide.



Figure 6: Tapping Holes with Guide and Spiral-Point Tap

6. By hand, thread one ¼”-20 x 1.25” stud into one end of a hex standoff until the stud cannot be threaded in any further. Repeat twice more so that all three standoffs have ¼”-20 studs threaded into one end. Thread stud / standoff assemblies into holes that were just tapped in step 5. Tighten standoffs; however do not tighten to the point of twisting off the studs or stripping the threads out of the drawer. At this point, the assembly should look like Figure 7.

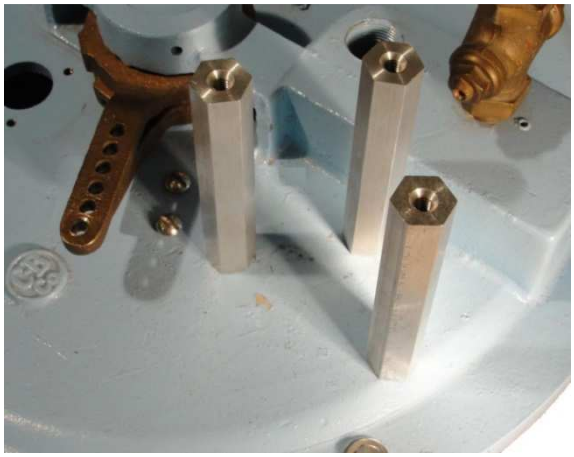


Figure 7: Standoffs Installed and Tightened

7. Place a small amount of medium threadlocker on the ¼”-20 x 0.75” flat head screws. Thread the screws through the plate and into the standoffs. Figure 8 shows the assembly after this step.

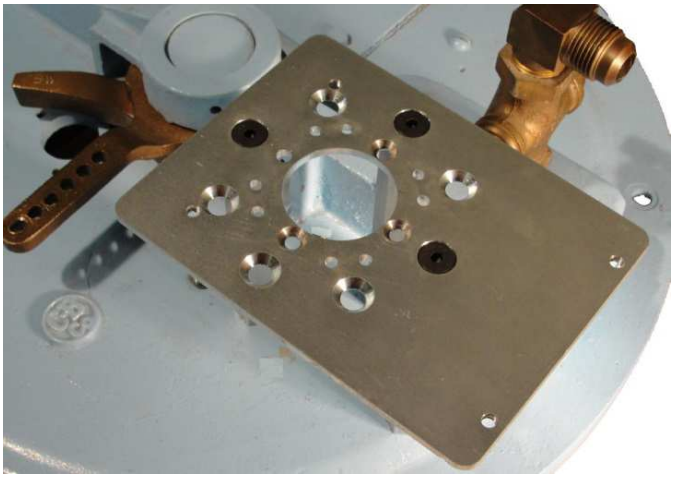


Figure 8: Actuator Base Plate Installed

8. Place a small amount of medium threadlocker on the #10-24 x 0.44” flat head screws. Install the bearing block assembly onto the actuator base plate by threading the screws through the plate and into the bearing block with the lever arm at approximately the 8 o’clock position. Figure 9 shows the assembly after this step.

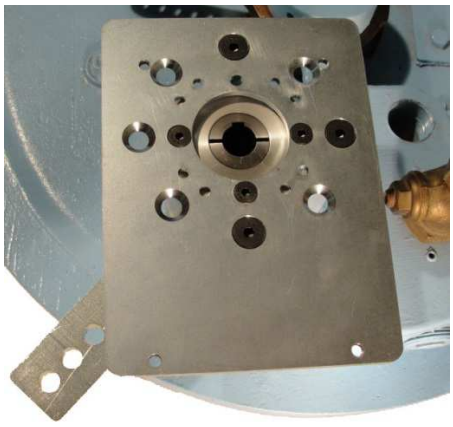




Figure 9: Bearing Block Installed

9. Mount the SQM… actuator to the actuator base plate using the four #8-32 x 0.75” pan head screws, eight #8 SAE washers, and four #8-32 locknuts. Figure 10 shows the assembly after this step.

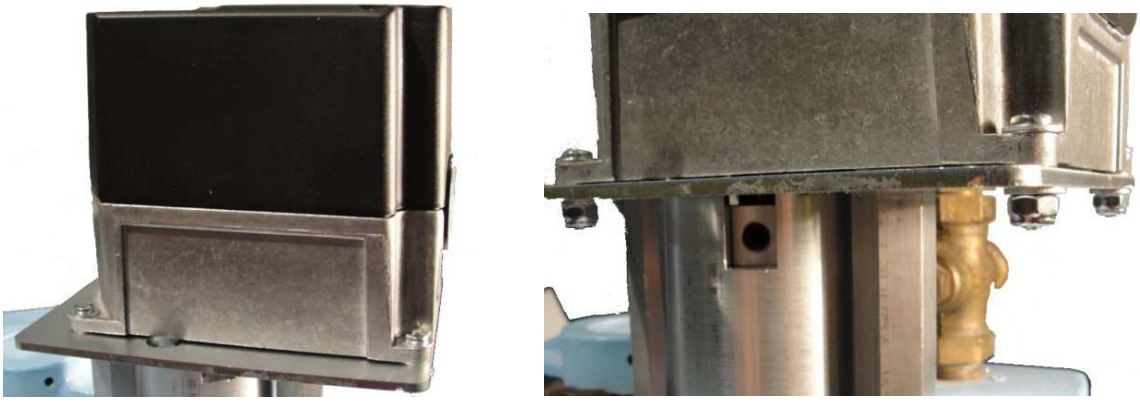


Figure 10: SQM… Actuator Installed

10. Tighten clamp collar set screws. These three screws squeeze the bearing block shaft and clamp the actuator shaft. Two of the set screws can be accessed and tightened with the actuator in the 0-degree position. The third set screw (which is blocked by a standoff when the actuator is at the 0-degree position) needs to be tightened when the actuator is at approximately the 20-degree position. Two of these set screws are shown in Figure 11 below.

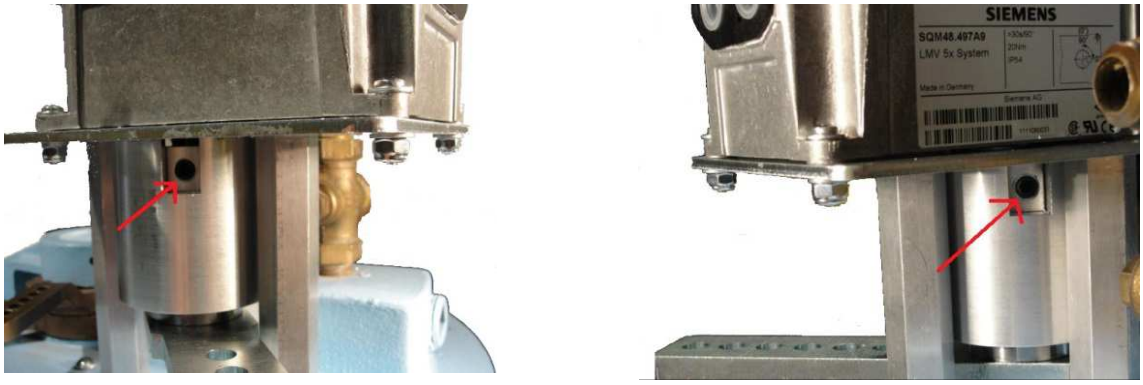


Figure 11: Tightening Clamp Collar Set Screws

11. Adjust the turnbuckle assembly. The turnbuckle assembly will get longer or shorter as the center hex piece is rotated since one rod end has right-hand threads and the other rod end has left-hand threads. The length of the turnbuckle assembly will vary slightly from installation to installation. Figure 12 shows the approximate length of the turnbuckle assembly for this installation. Figure 12 also shows the maximum distance each rod end can be extended out of the hex piece while still maintaining safe thread engagement.

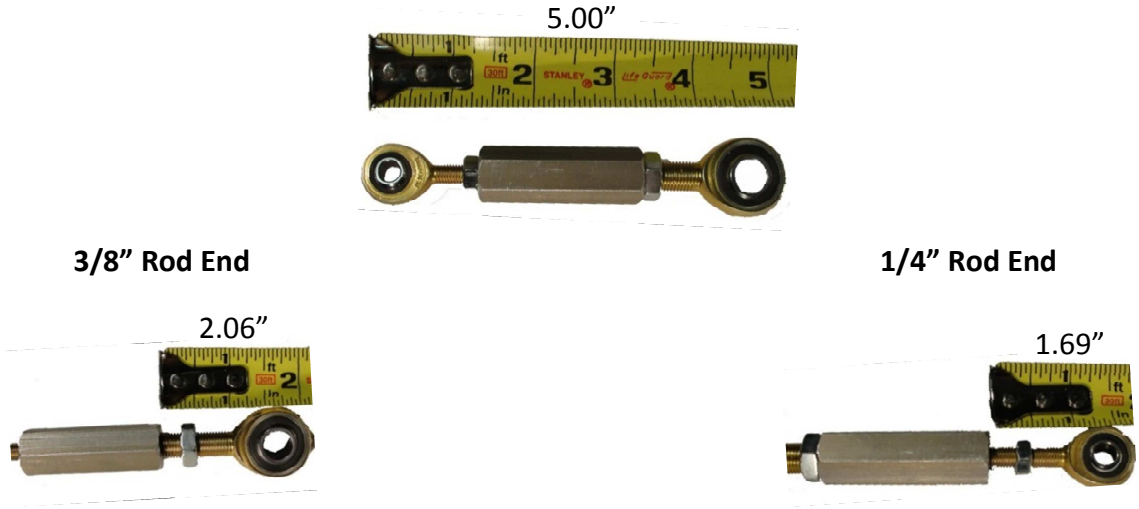


Figure 12: Turnbuckle Assembly Length / Extension Limits

12. Using the 3/8”-16 x 1.75” and ¼”-20 x 1.25” bolts in combination with the lock washers, spacers, and lock nuts, install the turnbuckle assembly. The smaller rod end (1/4”) of the turnbuckle assembly connects to the existing bronze crank arm on the air damper, and the larger rod end (3/8”) connects to the bearing block assembly crank arm. Install the lock washers, spacers, and lock nuts as detailed in Figure 13 below.

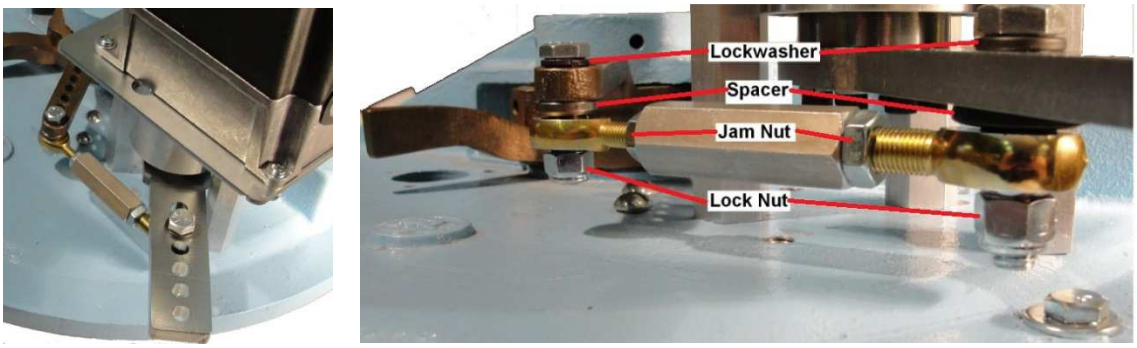


Figure 13: Turnbuckle Installation

13. After both the bolts that go through the crank arms are tightened, the hex piece (middle) of the turnbuckle assembly can be turned to adjust the position of the air damper crank arm relative to the bearing block assembly crank arm. After the turnbuckle is adjusted as desired, tighten both jam nuts against the hex piece to lock the turnbuckle adjustment. Also make sure that the set screws that hold the air damper crank arm (bronze-colored) to the air damper are tightened thoroughly.

14. If using an SQM45 or SQM48 actuator, skip this step. If using an SQM33 actuator, remove the fastener from the air damper that is utilized to stop the damper's movement from beyond closed as shown in Figure 14 below. **Note: This is a critical step because the SQM33 needs to reference beyond this point.**



Figure 14: Remove Mechanical Stop Screw for SQM33 Actuator

15. The mechanical installation is now complete, and should look similar to Figure 15. **Note: The travel on an SQM45 or SQM48 actuator from the air damper shut stop to the air damper open stop should be approximately 84-86 degrees.**

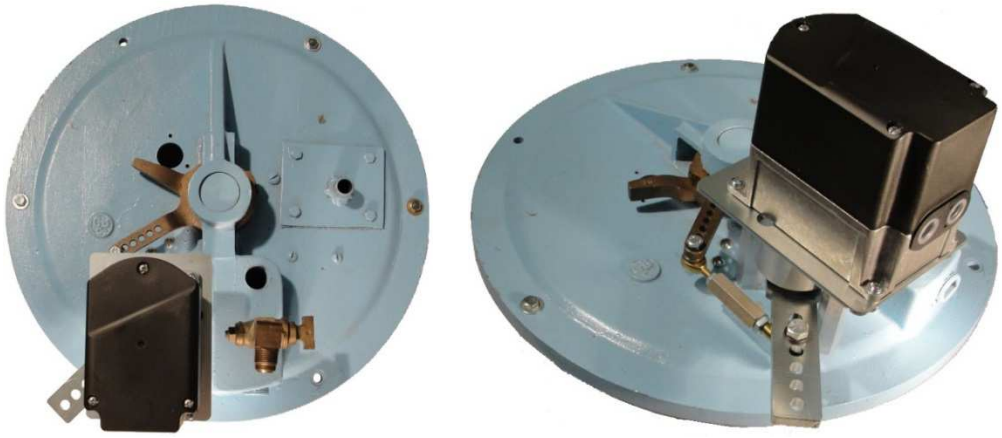


Figure 15: Completed Mechanical Installation

LMV Settings

LMV3

The following parameters must be set in the LMV3 to ensure the block arm can swing to reference the SQM33 actuator without bumping into the hex standoffs:

601.01: 0 (Air actuator will reference on closed side)
602.01: 0 (Air actuator will rotate counterclockwise when looking at the shaft)

If using an LMV36, the following additional parameters must be set for the second fuel:

608.01: 0 (Air actuator will reference on closed side – fuel 1)
609.01: 0 (Air actuator will rotate counterclockwise when looking at the shaft – fuel 1)

In addition, the SQM33 actuator can only travel approximately 85 degrees until the fully open stop is engaged. When setting purge positions and commissioning the fuel air ratio curve, do not set the air actuator position above 85 degrees.

LMV5

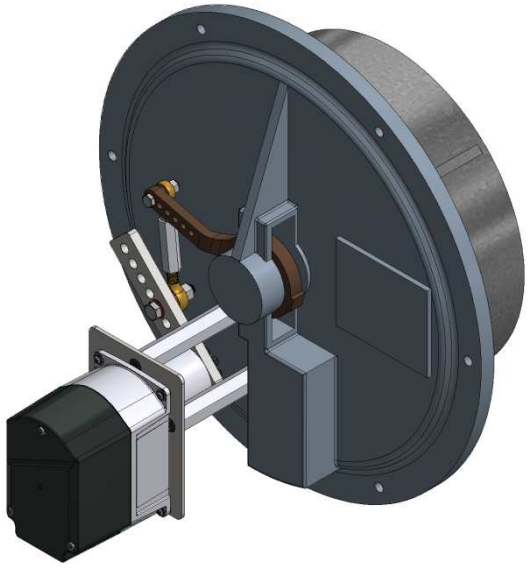
For proper rotation, the SQM45 or SQM48 actuator must turn counterclockwise when looking at the actuator shaft. This means that the air actuator must be set to standard rotation in the LMV5. This can be done through the following menu path:

Params & Display > Actuators > DirectionRot > AirActuator = **standard**

In addition, the SQM45 or SQM48 actuator can only travel approximately 85 degrees until the fully open stop is engaged. When setting purge positions and commissioning the fuel air ratio curve, do not set the air actuator position above 85 degrees.

Information in this publication is based on current specifications. The company reserves the right to make changes in specifications and models as design improvements are introduced. Product or company names mentioned herein may be the trademarks of their respective owners. © 2009 SCC Inc.

BR…CBAIR Rotary Air Damper Retrofit Kits



Product Description

A BR…CBAIR retrofit kit reliably mounts an SQM33, SQM45, or SQM48 actuator to a Cleaver Brooks boiler rotary air damper with an outer flange diameter of 18.25”.

Features

- Accessory to a Siemens LMV3 or LMV5 system
- Robust bracket design engineered for precise shaft alignment
- Easy installation with readily available tools

Product Part Numbers

Table 1: Available Bracket Assembly Part Numbers

Part Number	Description
BR-3345CBAIR	SQM33… or SQM45… actuator to Cleaver Brooks rotary air damper
BR-48CBAIR	SQM48… actuator to Cleaver Brooks rotary air damper

Components

Figure 1 shows the components included with a BR…CBAIR retrofit kit. See Installation Instructions CPBK-4100 for more information.

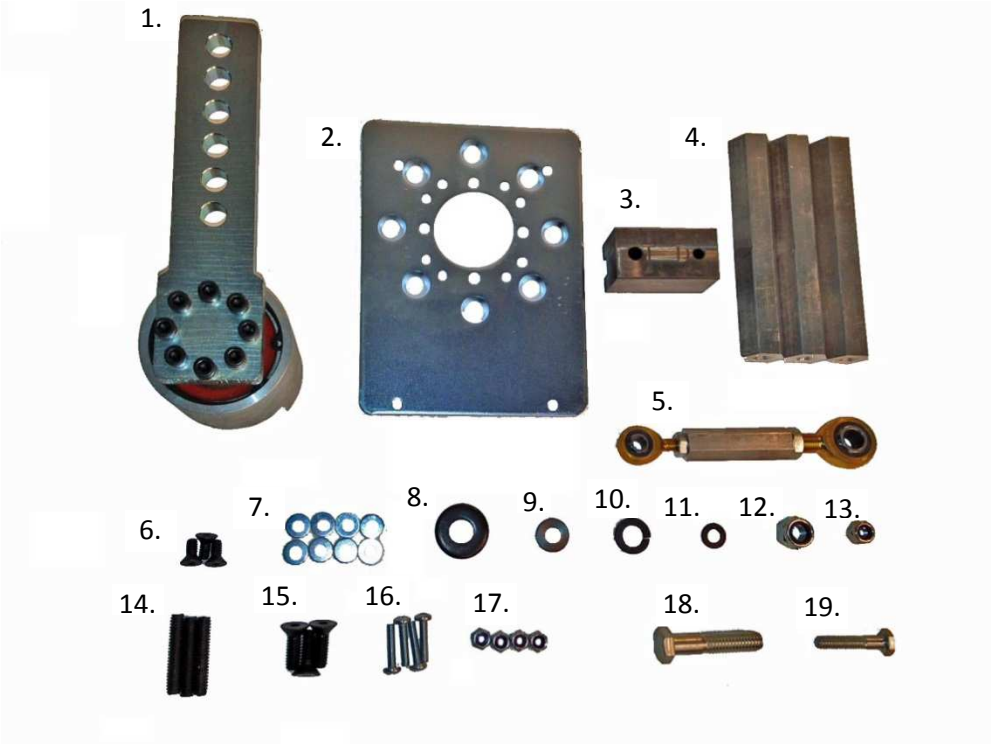
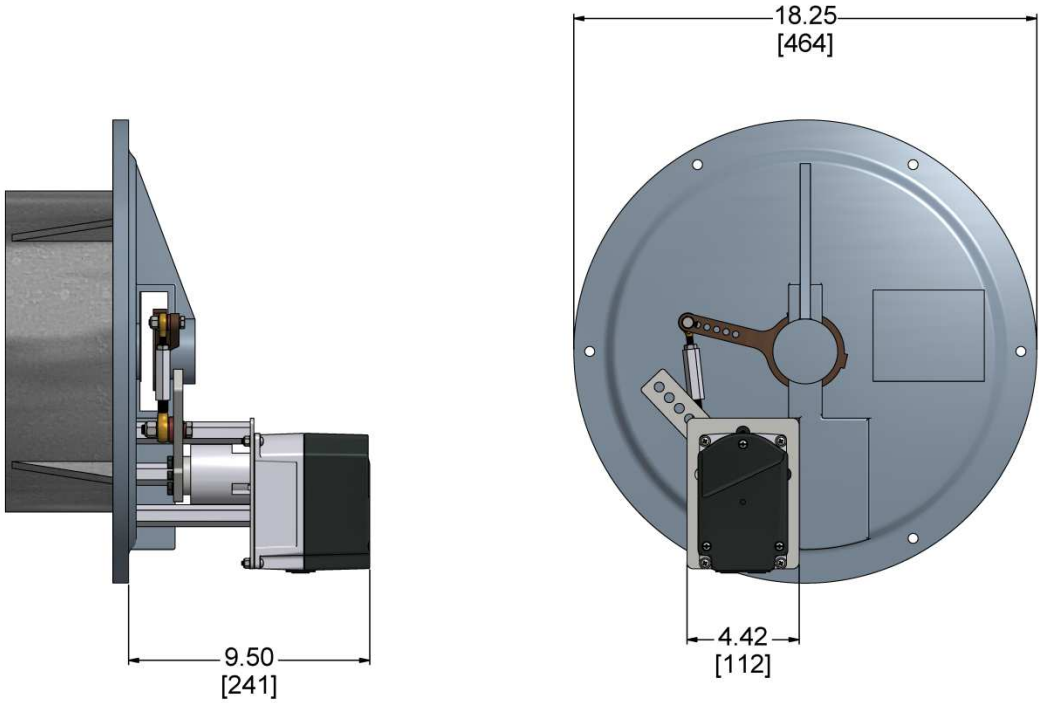


Figure 1: Components Included in a BR…CBAIR Rotary Air Damper Retrofit Kit

1. Bearing block crank arm assembly
2. Actuator base plate
3. Drill / tap guide
4. 4.5” hex standoffs (qty 3)
5. Turnbuckle assembly
6. #10-24 x 0.44” flat head screws (qty 3)
7. #8 SAE flat washers (qty 8)
8. 3/8” spacer
9. 1/4” spacer
10. 3/8” lock washer
11. 1/4” lock washer
12. 3/8” lock nut
13. 1/4” lock nut
14. 1/4”-20 x 1.25” studs (qty 3)
15. 1/4”-20 x 0.75” flat head screws (qty 3)
16. #8-32 x 0.75” pan head screws (qty 4)
17. #8-32 lock nuts (qty 4)
18. 3/8”-16 x 1.75” hex head screw
19. 1/4”-20 x 1.25” hex head screw

Dimensions

Dimensions in inches; millimeters in brackets



Information in this publication is based on current specifications. The company reserves the right to make changes in specifications and models as design improvements are introduced. Product or company names mentioned herein may be the trademarks of their respective owners. © 2009 SCC Inc.

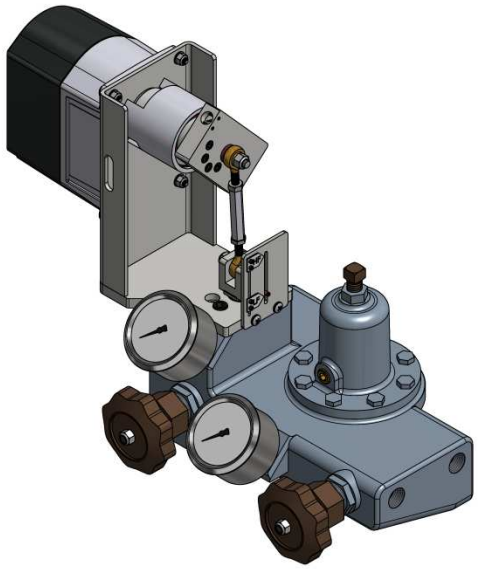
SCC Inc.

Installation Instructions

Document No. CPBK-5100

March 20, 2014

BR…CBOIL Fuel Oil Controller Retrofit Kits



Product Description

A BR…CBOIL retrofit kit reliably mounts an SQM33, SQM45, or SQM48 actuator to a Cleaver Brooks fuel oil controller.

Recommended Installation Tools

The following tools / supplies are recommended for bracket assembly installation:

1. 1/8” pin punch (with hammer)
2. Set of standard hex keys
3. #2 Phillips screwdriver
4. 3/16” flathead screwdriver
5. 7/16” open end wrench
6. 9mm open end wrench
7. 12” crescent wrench
8. Wooden or plastic V-block

Components Supplied

Figure 1 shows the components in a BR…CBOIL retrofit kit.

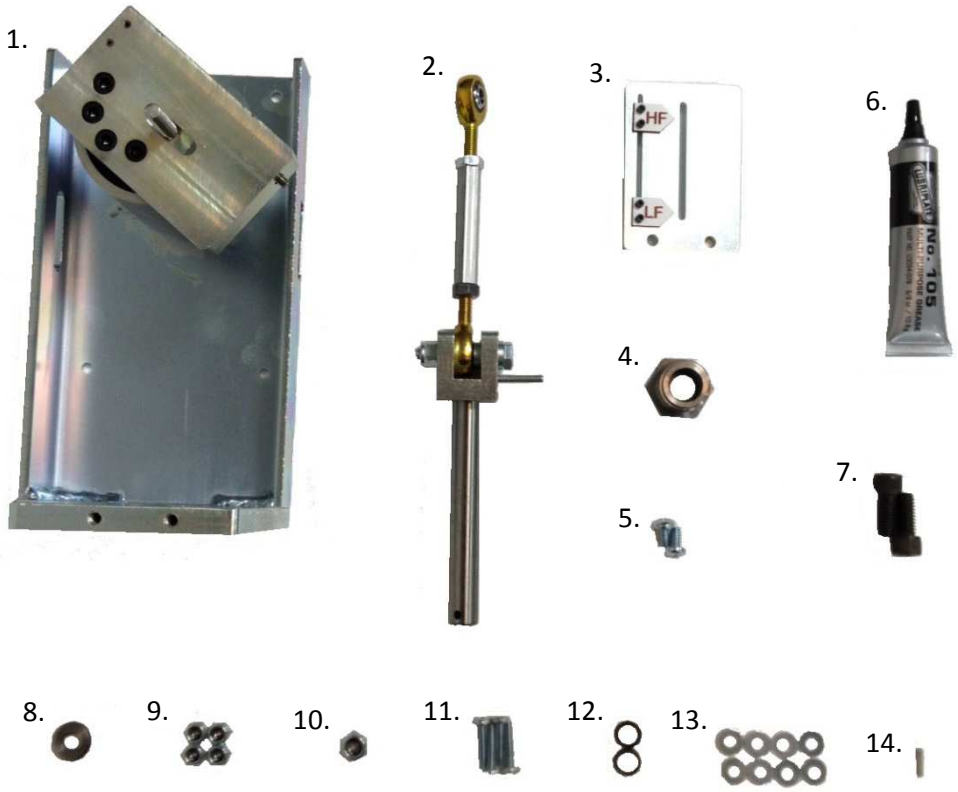


Figure 1: Components Included in a BR…CBOIL Fuel Oil Controller Retrofit Kit

1. Bearing block bracket assembly
2. Stem assembly
3. Position indicator bracket
4. Packing nut
5. #10-24 x 3/8” pan head screws (qty 2)
6. Lubriplate grease
7. 5/16”-18 x 3/4” socket head screws (qty 2)
8. 1/4” spacer
9. #8-32 lock nuts (qty 4)
10. 1/4”-20 lock nut
11. #8-32 x 3/4” pan head screws (qty 4)
12. 5/16” lock washers (qty 2)
13. #8 SAE washers (qty 8)
14. 1/8” x 7/16” roll pin

Installation Procedure

1. Measure the stroke of the existing oil valve from low fire to high fire. This can be done by setting the boiler at low fire and making a mark on the valve stem going into the fuel oil controller. Then using a tape measure, measure the vertical height that the stem raises when the boiler is modulated up to high fire. Write this number down for later.

2. Close all necessary valves to isolate the fuel oil controller. Detach the oil modulating cam assembly and any additional linkage currently hooked up to the fuel oil controller. Pull out the stem that moves in and out of the controller. The grooved pin connected to the end of the stem must be re-used in this assembly. Using the pin punch, V-block, and hammer, knock the roll pin out of the stem to detach the grooved pin as shown in Figure 2. Take care not to damage or mar the surface of the grooved pin. All other components of the cam assembly including the stem are not re-used.

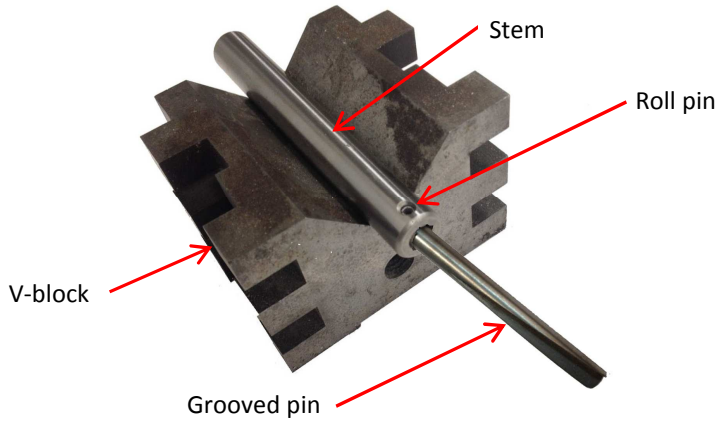


Figure 2: Disassembly of Oil Modulating Cam Assembly

3. Use some of the Lubriplate grease to lubricate the valve packing inside of the fuel oil controller. If the packing is being replaced, completely grease each individual piece of the packing before inserting into the controller. Proper packing order can be seen in Figure 3. If the packing is being reused, do not remove the packing from the controller because damage to the packing may result. Instead, apply grease to the inner diameter of each piece of the packing as best as possible. **NOTE: Use a significant amount of grease to form a thick layer on all surfaces of the packing which may rub against the valve stem.**



Figure 3: Order of Pieces in Packing Assembly

4. Using a hammer and the 1/8” pin punch, attach the grooved pin saved from step 1 to the stem assembly using the 1/8” x 7/16” roll pin. The roll pin must be recessed below the surface of the stem on both sides or the roll pin will damage the packing. **NOTE: During this step, take extreme care not to damage or mar the surface of the new valve stem. It is recommended to use a wooden or plastic V-block in order to perform this installation. Even a small nick or scratch in the stem may allow oil to leak out of the valve packing after installation.** Once step 4 is complete, the stem assembly should look like Figure 4 below.



Figure 4: Reassembled Stem and Pin

5. Slide the packing nut over the valve stem. Place the ¼" spacer over the threaded rod protruding from the bracket assembly. The bracket and stem assemblies should then look like Figure 5 below.

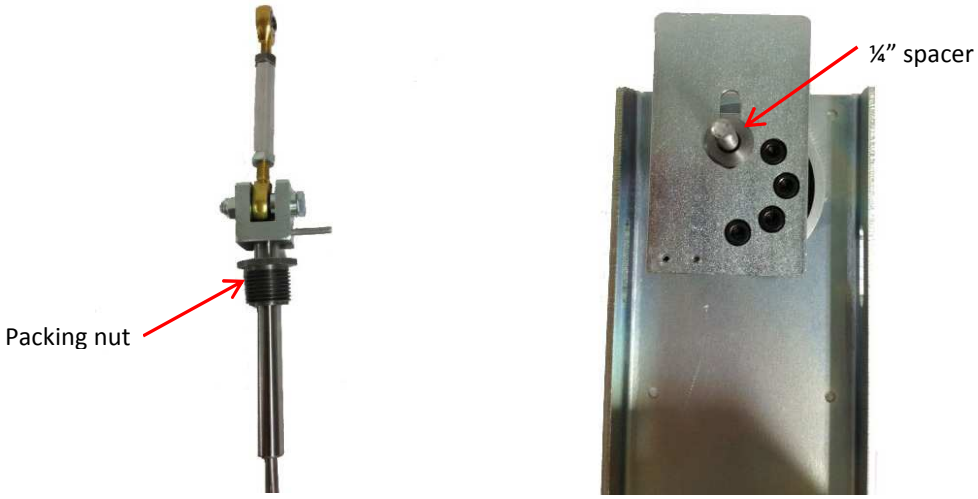


Figure 5: Placement of Packing Nut and ¼" Spacer

Slide the valve stem through the threaded hole of the bracket assembly so that the roll pin sticking out of the stem assembly points in the direction shown in Figure 6 below. At the same time, slide the open rod end from the stem assembly over the threaded rod.

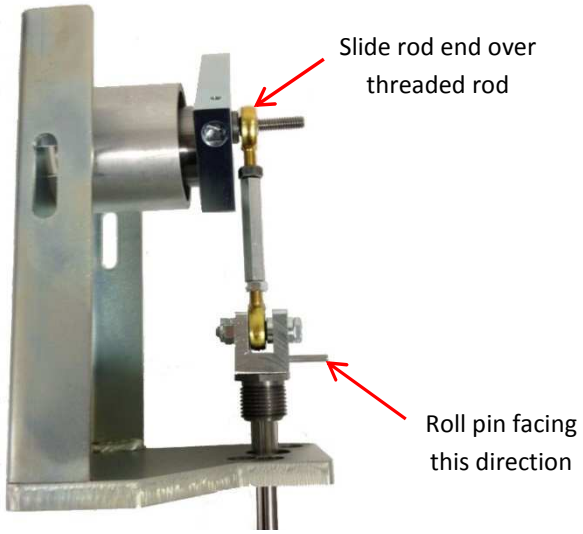


Figure 6: Correct Roll Pin Direction

Using the ¼”-20 lock nut, tighten the rod end into place against the bracket assembly. Turn the packing nut by hand to begin threading it into the bracket. Only turn the packing nut so that one thread is engaged and then stop. The packing nut will be tightened more in a later step. Once step 4 is complete, the assembly should look like Figure 7.

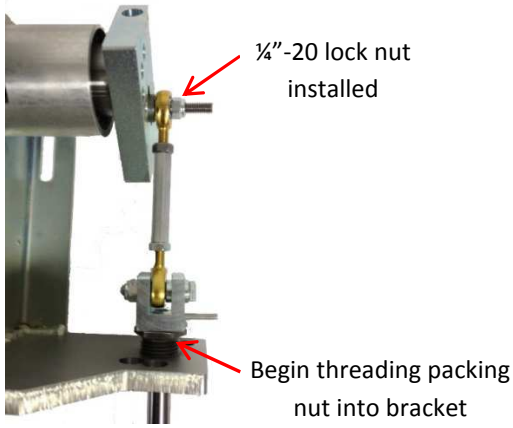


Figure 7: Completed Bracket and Stem Assembly

6. Attach indicator bracket to main bracket assembly by screwing the two #10-24 pan head screws into the threaded holes in the side of the bracket assembly. The roll pin from the stem assembly should slide into the wider slot in the indicator bracket. This bracket also doubles as an anti-rotation device so that the stem assembly does not rotate during boiler operation. The assembly should appear as shown in Figure 8.

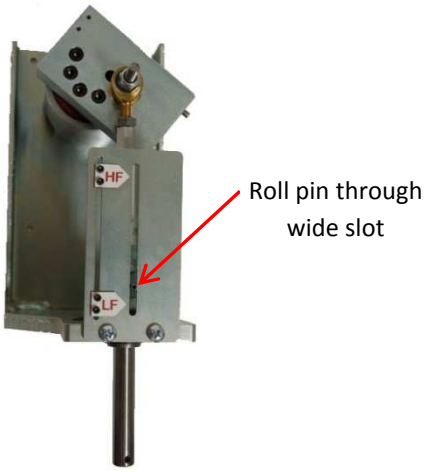


Figure 8: Position Indicator Assembly

7. Use some of the remaining Lubriplate grease to thoroughly lubricate the valve stem. Carefully lower the assembly shown in Figure 8 down onto the fuel oil controller, taking great care not to damage the packing with the grooved pin or the valve stem.

8. Attach the bracket assembly to the fuel oil controller using the two 5/16”-18 socket head cap screws with lockwashers through two of the four remaining holes in the bottom of the bracket. There are two possible ways to perform this mounting (see Figure 9).

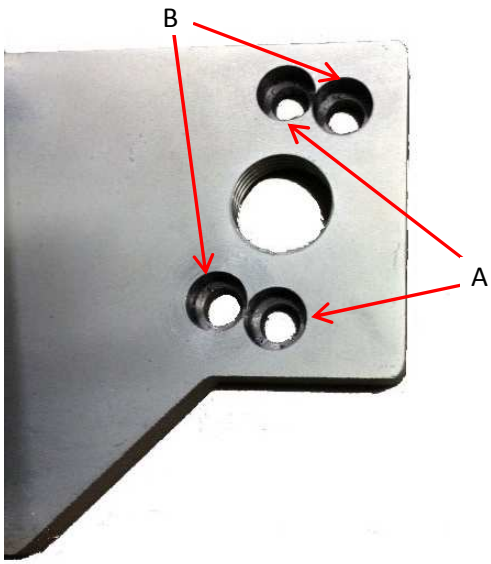


Figure 9: Possible Mounting Options

Use mounting holes labeled A if possible. If there are components attached to the boiler that prevent using these mounting holes, mounting holes B should be utilized to swing the entire assembly away from the boiler by 32°. If using mounting holes B, the supply pressure gauge on the controller may need to be moved. If this is the case, use a ¼” pipe nipple to extend the pressure gauge away from the fuel oil controller. Once a mounting option has been chosen, tighten down the 5/16”-18 socket head screws with a ¼” hex key. After step 8, the assembly should look like Figure 10.



Figure 10: Bracket Mounted to Fuel Oil Controller

9. Screw packing nut into bracket in order to tighten the valve packing. It is recommended to first tighten the packing nut by hand as much as possible. Then using a crescent wrench, tighten the packing by another half-turn. This should make the packing sufficiently tight around the stem, but still allow the stem to slide easily through the packing. Move the stem up and down by hand. If it feels too loose, tighten the nut slightly. **NOTE: Do NOT over tighten the packing nut! The packing nut can always be tightened later if necessary.** Figure 11 shows approximately where the packing nut should be after this step.

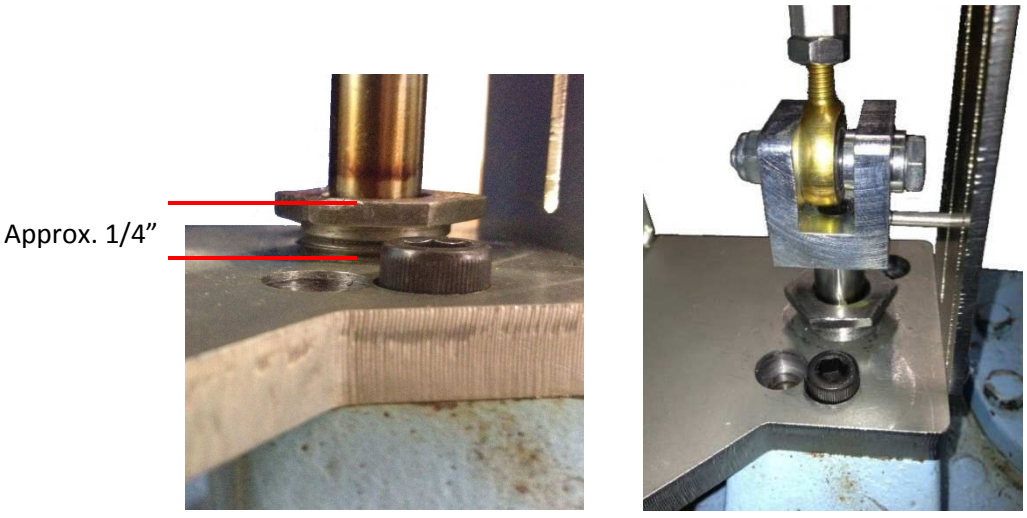


Figure 11: Packing Nut Tightened

10. Mount the SQM… actuator to the bracket assembly using the four #8-32 x 0.75” pan head screws, the eight #8 SAE washers, and the four #8-32 locknuts. Figure 12 shows the assembly after this step.

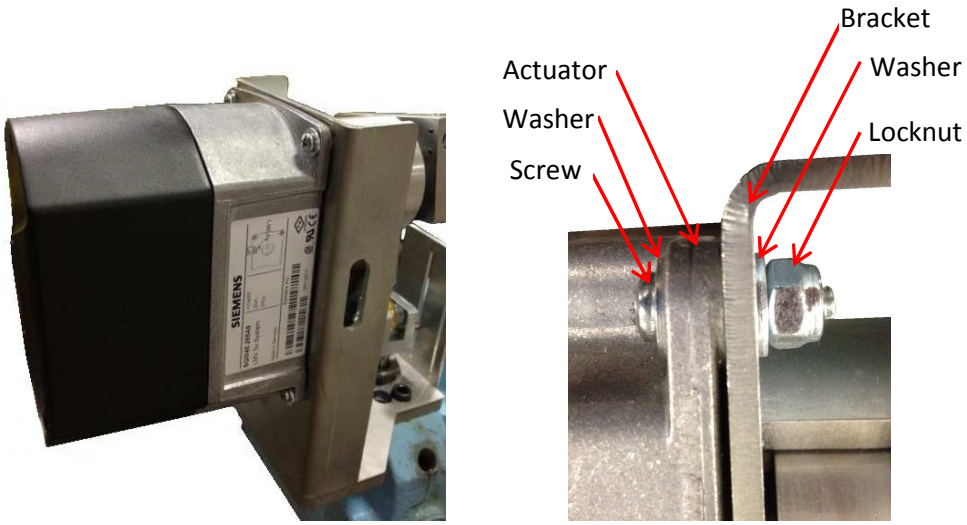


Figure 12: Actuator Mounted to Bracket

11. Tighten the three clamp collar set screws. These screws squeeze the bearing block shaft and clamp the actuator shaft. All three screws can be tightened with the actuator in the 0° position by using a 5/32” hex key through the slots in the bracket assembly. Figure 13 shows these set screws.

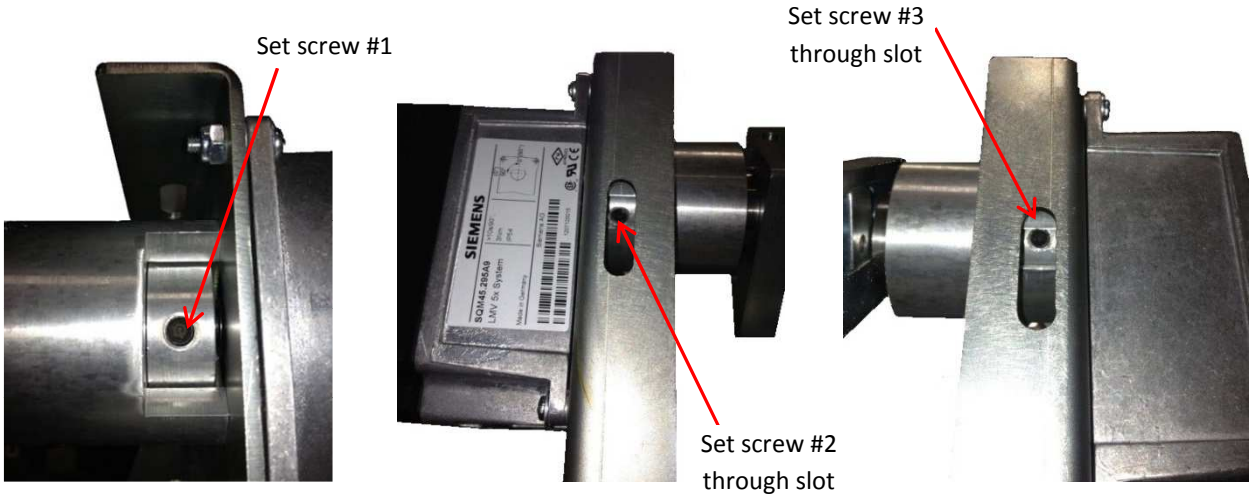


Figure 13: Clamp Collar Set Screws

12. The mechanical assembly is complete. An example of what the finished assembly looks like is shown in Figure 14.



Figure 14: Completed Mechanical Assembly

LMV Settings

1. If there is an existing fuel-air ratio curve for oil, make sure to erase all of the points on this curve:

   LMV3: 201 (fuel 0) or 301 (fuel 1) = 0 (displayed as --)
   LMV5: Params & Display > RatioControl > OilSettings > CurveParams > Curve Settings

2. The SQM… actuator must turn clockwise (with the shaft pointing away from you) to raise the valve stem assembly and increase the flow of oil to the burner. Likewise, a counterclockwise rotation will lower the valve stem and decrease the flow of oil to the burner.

   LMV3: 602.00 (fuel 0) or 609.00 (fuel 1) = **0**
   LMV5: Params & Display > Actuators > DirectionRot > OilActuator = **standard**

3. For an LMV3 only, the SQM33 actuator must be allowed to reference. With this retrofit kit, the actuator needs to reference on the open side.

   LMV3: 601.00 (fuel 0) or 608.00 (fuel 1) = **1**

4. For an LMV5 only, the actuator must be addressed as the oil actuator by using the following menu path:

   LMV5: Params & Display > Actuators > Addressing > OilActuator

5. For an LMV5 only, make sure that the oil actuator is activated:

   LMV5: Params & Display > RatioControl > OilSettings > OilActuator = **activated**

6. Set the home position of the oil actuator to 5 degrees:

   LMV3: 501.00 (fuel 0) or 504.00 (fuel 1) = **5.0°**
   LMV5: Params & Display > RatioControl > OilSettings > SpecialPositions > HomePos > HomePosOil = **5.0°**

7. Ignition position of the oil actuator should initially be set to 5 degrees as well:

   LMV3: In curve settings (P0), 0F = **5.0°**
   LMV5: Params & Display > RatioControl > OilSettings > SpecialPositions > IgnitionPos > IgnitionPosOil = **5.0°**

LMV Settings (continued)

8. Set the program stop to phase 52 so that the ignition position can be changed during the initial startup of the boiler:

   LMV3: Done automatically during the commissioning process
   LMV5: Params & Display > RatioControl > OilSettings > SpecialPositions > ProgramStop = **52 Interv 2**

Adjustment Process

Once the LMV settings are programmed properly, the adjustment process can begin. There are two ways to make adjustments to this assembly, and both will need to be utilized to get proper operation of the boiler. A general description of both adjustments is presented below.

a. **Alter the length of the turnbuckle assembly –** The turnbuckle assembly will get longer or shorter as the center hex piece is rotated since one rod end has right-hand threads and the other rod end has left-hand threads. In order to do this, the jam nuts on either end of the middle hex piece must first be loosened. Once that is done, the hex piece can be turned by hand in order to lengthen or shorten the turnbuckle assembly. When the desired length is achieved, the jam nuts need to be tightened so that the hex piece cannot rotate.

The turnbuckle assembly is shipped at its maximum length of 4.47". Making the turnbuckle assembly longer than 4.47" will result in insufficient thread engagement of the rod ends. The minimum turnbuckle length is 3.52". Figure 15 below shows the turnbuckle assembly and its maximum and minimum lengths.

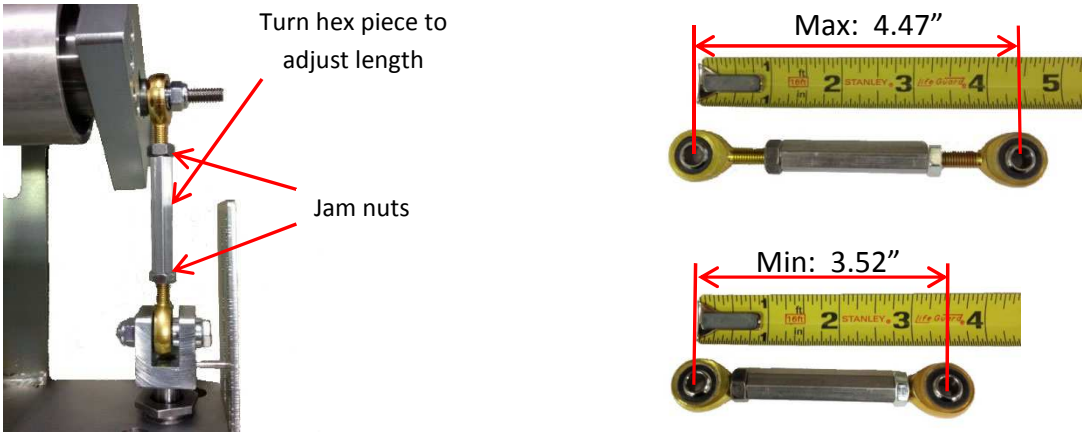


Figure 15: Turnbuckle Assembly

Adjustment Process (continued)

b. **Adjust the stroke length of the valve stem** – As the actuator shaft rotates, the valve stem will move in and out of the controller to control oil flow into the burner. For a 90° rotation of the actuator shaft, the stroke length of the valve stem can be adjusted between ½" and 1½". The assembly ships at a default stroke length of ¾". See Figure 16 below that shows where to position the threaded rod in order to achieve the desired stroke length.

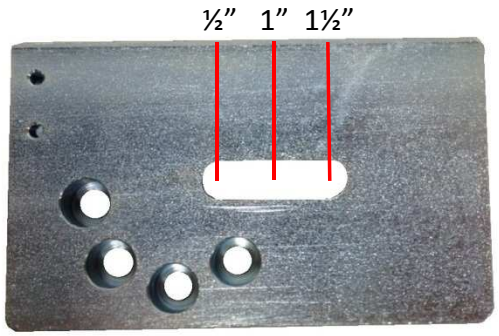


Figure 16: Stroke Length for a 90° Rotation

The stroke length should initially be set to approximately 1/8" longer than the stroke determined in step 1 of these instructions. In order to adjust the stroke length, the #10 set screw and ¼"-20 lock nut shown in Figure 17 must first be loosened. Then using a flathead screwdriver, turn the head of the jackscrew to adjust the stroke length. Once the desired stroke length has been achieved, tighten down both the #10 set screw and the ¼"-20 lock nut.

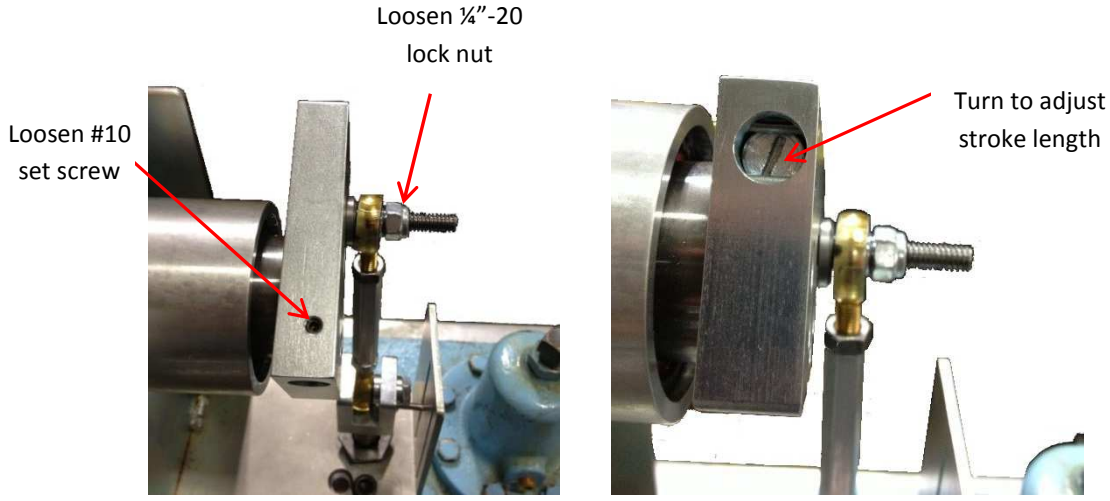


Figure 17: Stroke Length Adjustment Process

Adjustment Process (continued)

1. Verify that the SQM… actuator is wired correctly.

2. Verify that the LMV settings are set as outlined in the previous section called “LMV Settings”.

3. If safe to do, power on the LMV and verify that the LMV is in phase 12 (standby) and that the SQM… actuator mounted to the oil controller is at home position (5.0°).

4. Ensure that the turnbuckle assembly is at maximum length (see Figure 15 on page 12). This can be verified by measuring the distance that the anti-rotation roll pin is from the bottom of the slot in the indicator bracket. This should be roughly 7/16” as seen in Figure 18 below.

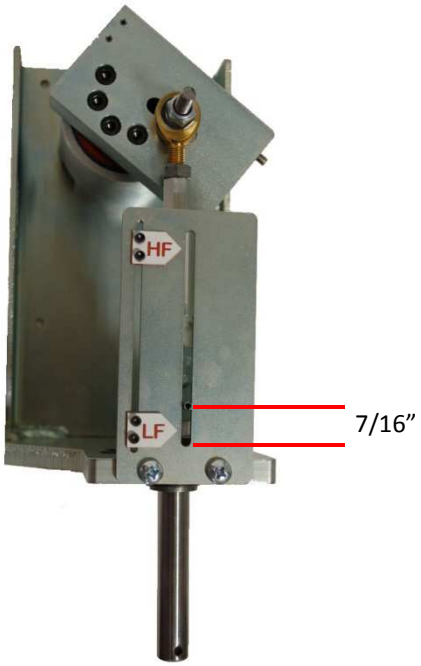


Figure 18: Distance from Roll Pin to Bottom of Slot

5. Ensure the correct manual valves in the oil supply line are open or closed.

6. Verify correct ignition positions in the LMV for all actuators (and VSD). If correct, attempt to light off on oil.

7. Verify correct supply oil pressure to the fuel oil controller (approximately 40 psi).

Adjustment Process (continued)

8. If the burner does not light off due to lack of oil, shorten the turnbuckle slightly (one full revolution of the center hex piece) and attempt to light off again.

   NOTE: The above step must not be repeated more than 6 times without checking for oil accumulation in the boiler!

9. Once the burner lights off successfully on oil, tighten the turnbuckle jam nuts and snug the lock nut.

10. Adjust the ignition positions of the air and oil actuators in the LMV to achieve satisfactory combustion at the ignition / low fire point.

11. Mark the low fire point on the indicator bracket as shown in Figure 19 below.

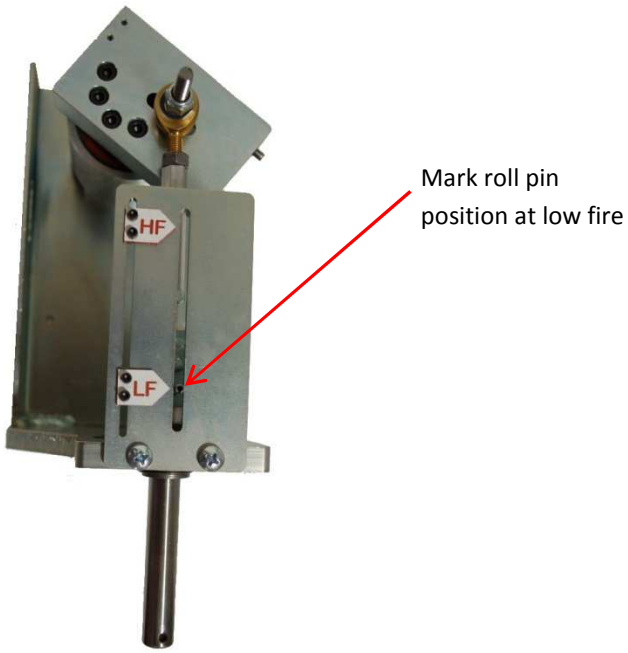


Figure 19: Mark the Low Fire Position

12. After verifying that no fuel/air ratio control points have been previously entered for oil, de-activate the program stop in the LMV5.

    LMV5: Params & Display > RatioControl > OilSettings > SpecialPositions > ProgramStop = **deactivated**

Adjustment Process (continued)

13. Tune the fuel-air ratio control curve. This step is outlined in detail in the LMV literature.

14. The SQM… actuator stroke should be at least 30 degrees from ignition / low fire to high fire. If this is not at least 30 degrees, the following corrective actions are recommended:

    a. Return to low fire. Shorten the stroke of the linkage and adjust the turnbuckle as necessary to maintain the low fire point (as marked on bracket). **NOTE: Do not extend turnbuckle past its maximum length!**

    b. Re-tune the fuel-air ratio curves. The stroke should exceed 30 degrees from low fire to high fire.

15. Mark the high fire position on the indicator bracket as shown in Figure 20 below.



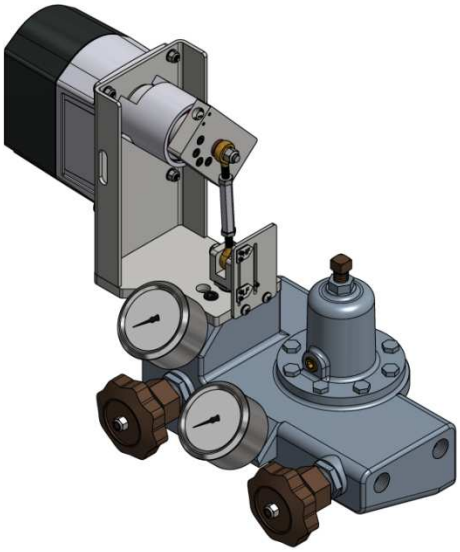
Figure 20: Mark the High Fire Position

Maintenance

It is common for oil to eventually begin to slowly leak out of the top of the packing after some time. If this happens, give the packing nut a half-turn. **NOTE: Do not over tighten the packing nut! A half-turn is sufficient to prevent further leakage out of the top of the packing.**

Information in this publication is based on current specifications. The company reserves the right to make changes in specifications and models as design improvements are introduced. Product or company names mentioned herein may be the trademarks of their respective owners. © 2009 SCC Inc.

BR…CBOIL Fuel Oil Controller Retrofit Kits



Product Description

A BR…CBOIL retrofit kit reliably mounts an SQM33, SQM45, or SQM48 actuator to a Cleaver Brooks fuel oil controller.

Features

- Accessory to a Siemens LMV3 or LMV5 linkageless system
- Robust bracket design engineered for precise shaft alignment
- Fully adjustable stroke and low-fire position
- Easy installation with readily available tools
- Visual position indication
- Two mounting options
- Crank arm turns on sealed ball bearings
- Turnbuckle linkage utilizes zero-lash rod ends

Product Part Numbers

Table 1: Available Bracket Assembly Part Numbers

Part Number	Description
BR-45CBOIL	SQM33… or SQM45… actuator to Cleaver Brooks fuel oil controller
BR-48CBOIL	SQM48… actuator to Cleaver Brooks fuel oil controller

Components

Figure 1 shows the components included with a BR…CBOIL retrofit kit. See Installation Instructions CPBK-5100 for more information.

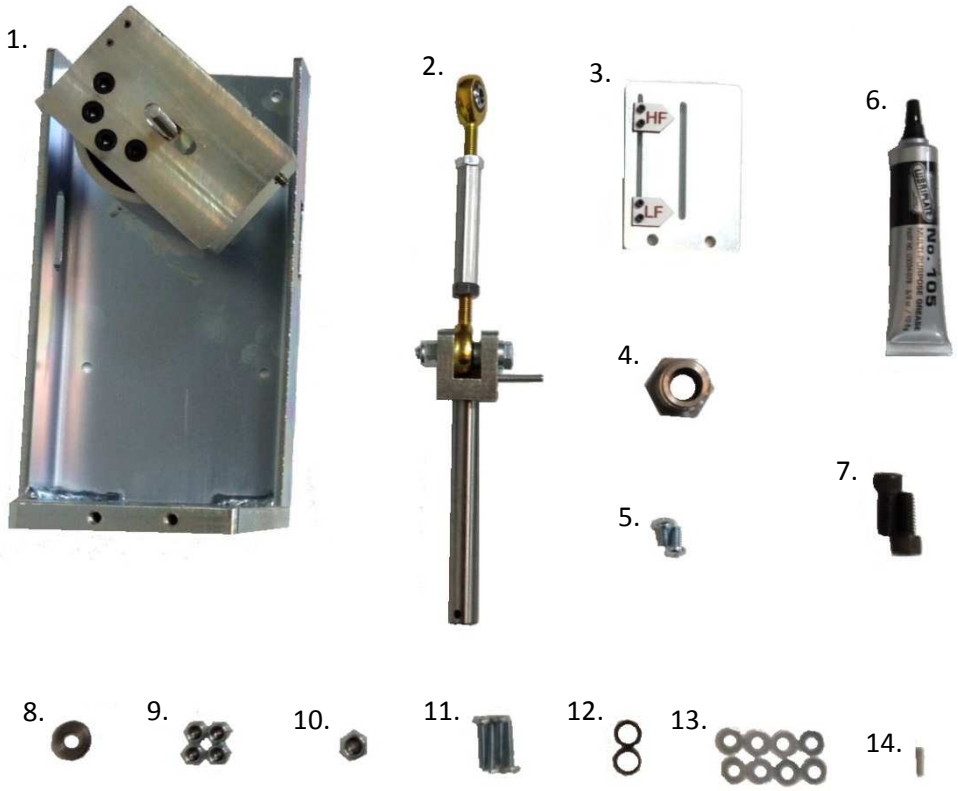


Figure 1: Components Included in a BR…CBOIL Fuel Oil Controller Retrofit Kit

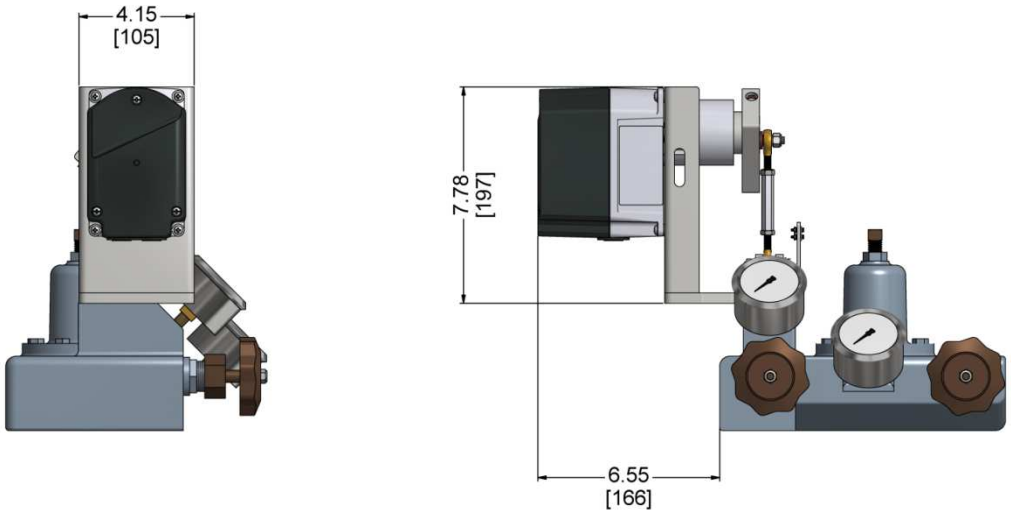
1. Bearing block bracket assembly
2. Stem assembly
3. Position indicator bracket
4. Packing nut
5. #10-24 x 3/8” pan head screws (qty 2)
6. Lubriplate grease
7. 5/16”-18 x 3/4” socket head screws (qty 2)
8. 1/4” spacer
9. #8-32 lock nuts (qty 4)
10. 1/4”-20 lock nut
11. #8-32 x 3/4” pan head screws (qty 4)
12. 5/16” lock washers (qty 2)
13. #8 SAE washers (qty 8)
14. 1/8” x 7/16” roll pin

Note: The grooved pin (not shown) from the fuel oil controller must be reused with this retrofit kit.

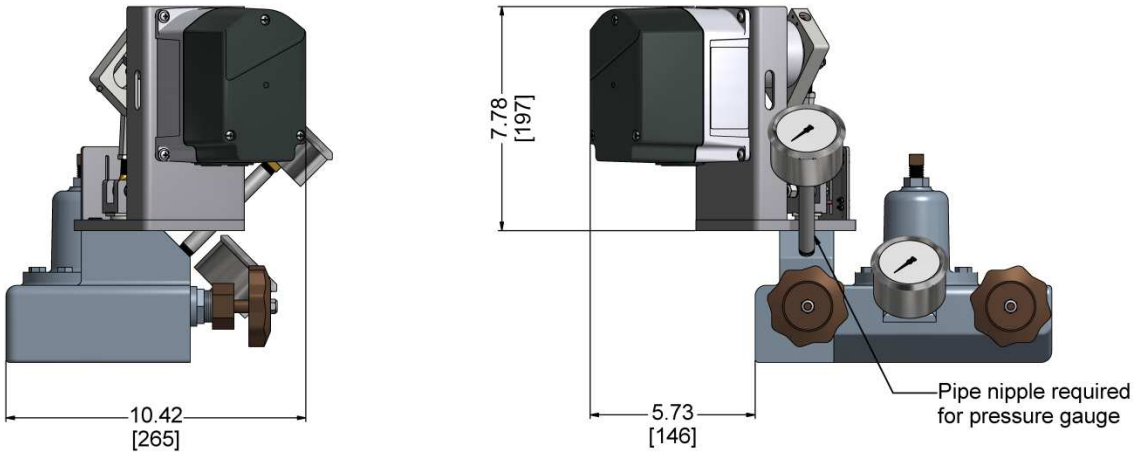
Dimensions

Dimensions in inches; millimeters in brackets

Mounting Option A



Mounting Option B (rotated 32° away from boiler)



Information in this publication is based on current specifications. The company reserves the right to make changes in specifications and models as design improvements are introduced. Product or company names mentioned herein may be the trademarks of their respective owners. © 2009 SCC Inc.

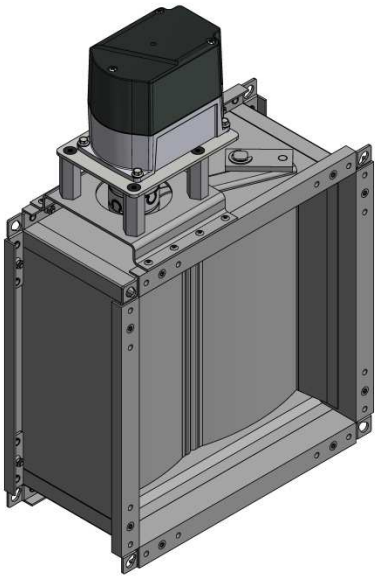
SCC Inc.

Installation Instructions

Document No. CPBK-3100

November 5, 2013

BR…LUC Lucoma Air Damper Bracket Assemblies



Product Description

A BR…LUC bracket assembly reliably mounts an SQM33, SQM45, or SQM48 actuator to any Lucoma air damper size 8” x 8” through 28” x 28”.

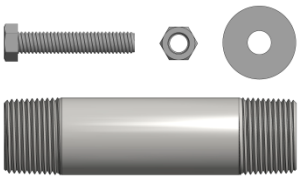
Accessories

BR-LUC-BAT



Optional bracket alignment tool ensures the SQM… actuator shaft and Lucoma air damper shaft are aligned. See step 3 on page 5 for more information.

BR-LUC-18SE



Accessory kit including components to remove the 18mm shaft extension during BR…LUC installation. Kit includes a 1” NPT x 5” pipe nipple, 3/8”-16 x 2” hex head bolt, 3/8”-16 hex nut, and 3/8” washer.

Components Supplied

Figure 1 shows all of the components that are supplied with a BR…LUC bracket assembly.

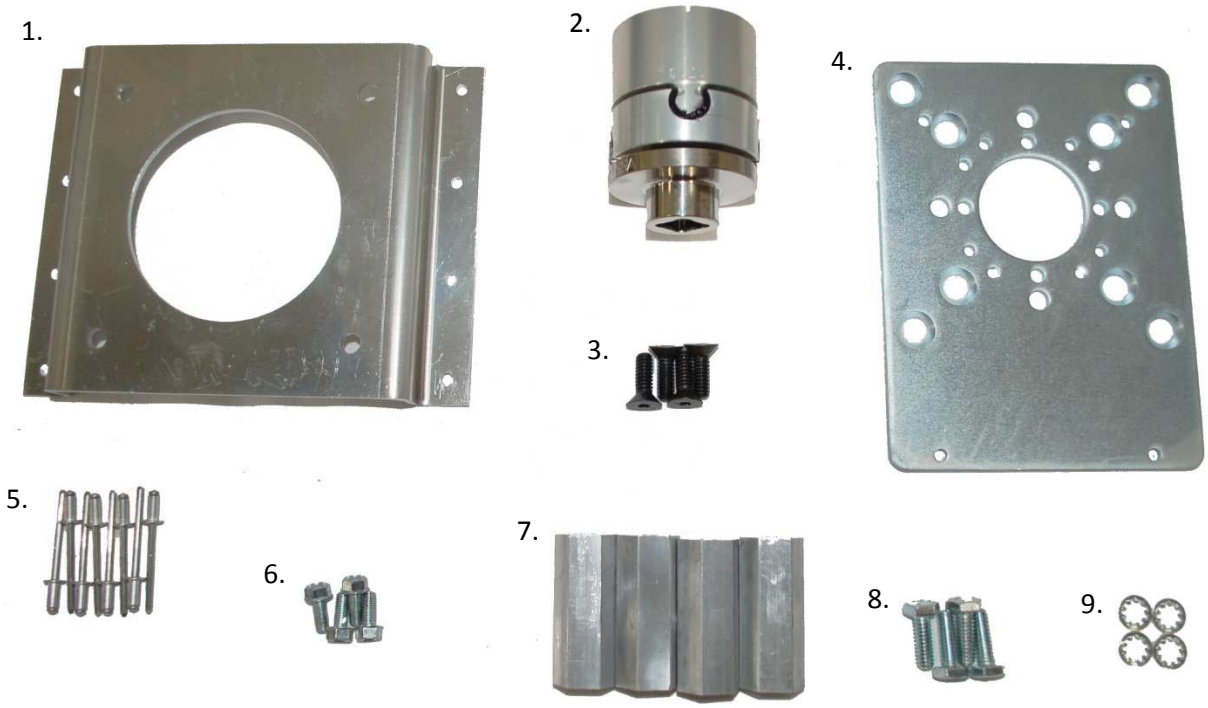


Figure 1: Components Included in a Lucoma Air Damper Bracket Assembly

1. Damper mounting bracket
2. Zero backlash coupling
3. 1/4”-20 x 3/4” flat socket head cap screws (qty 4)
4. Actuator mounting bracket
5. 5/32” pop rivets (qty 8)
6. M5 x 12mm thread-forming screws (qty 4)
7. 1.9” standoffs (qty 4)
8. 1/4”-20 x 3/4” hex head cap screws (qty 4)
9. 1/4” lock washers (qty 4)

Recommended Installation Tools

The following tools / supplies are recommended for bracket assembly installation:

- Drill
- 5/32” drill bit
- 1/4” and 5/32” hex keys
- 7/16” and 3/4” open end wrenches
- 8mm socket, 1/4” drive
- 6-7” ratchet extension, 1/4” drive
- Pop rivet installation tool
- Loctite #242 (blue)

If the Lucoma air damper has the 18mm shaft extension and mounting bracket attached (see step 1 below), the following additional tools are recommended:

- 1” NPT pipe nipple, 5” long
- 3/8”-16 hex head bolt, 2” long
- 3/8”-16 hex nut
- Thick 3/8” washer with outer diameter of at least 1.25”

} Accessory kit with part number BR-LUC-18SE

- 11/64” drill bit
- 5/16” drill bit
- 3/8”-16 tap

Installation Procedure

1. Lucoma air dampers may include an 18mm round shaft extension and a mounting bracket attached as shown in Figure 2 below.

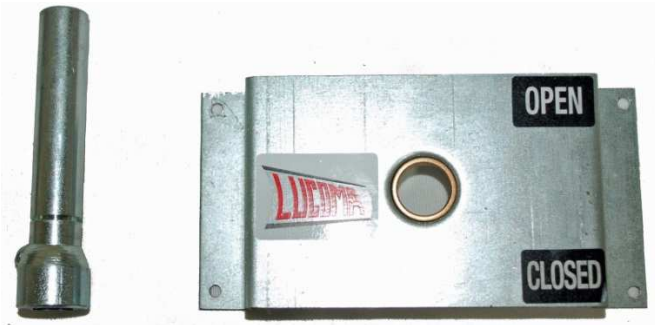


Figure 2: 18mm Shaft Extension and Lucoma Mounting Bracket

Both the 18mm shaft extension and mounting plate must be removed before installation of the BR…LUC bracket assembly. If the damper does not have either of these pieces, skip to step 3. Use the 11/64” drill bit to drill out the center of the four rivets mounting the Lucoma bracket to the damper. Once the centers are drilled out, the top and bottom of the rivet should fall off easily. After the rivets have been completely removed, pull the Lucoma mounting bracket off of the shaft extension.

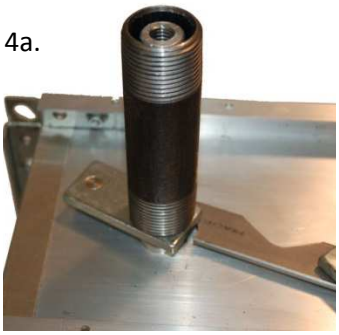
2. Using the 5/16” drill bit, drill a hole approximately 2” deep in the center of the 18mm shaft extension. Then, tap the hole with the 3/8”-16 tap. The shaft extension should appear as shown in Figure 3.



Figure 3: Tapped Hole in Shaft Extension

Slide the 1” NPT pipe nipple over the shaft extension (see Figure 4a). Then, screw the 3/8”-16 hex nut most of the way onto the 3/8”-16 screw. Slide the 3/8” washer onto the screw after the nut. Next, thread the screw into the tapped hole of the shaft extension until the nut and washer are flush against the pipe nipple. The damper will appear as shown in Figure 4b below.

4a.



4b.

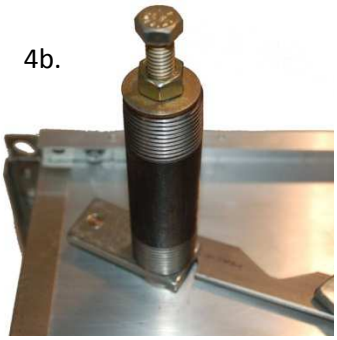


Figure 4: Ready to Remove Shaft Extension

Using the 9/16” open end wrench, tighten the hex nut against the washer. This should begin pulling off the shaft extension. Continue tightening the hex nut until the shaft extension has been completely removed. Lift the pipe nipple and shaft extension off of the damper. The 14mm square shaft should now be exposed as shown in Figure 5.

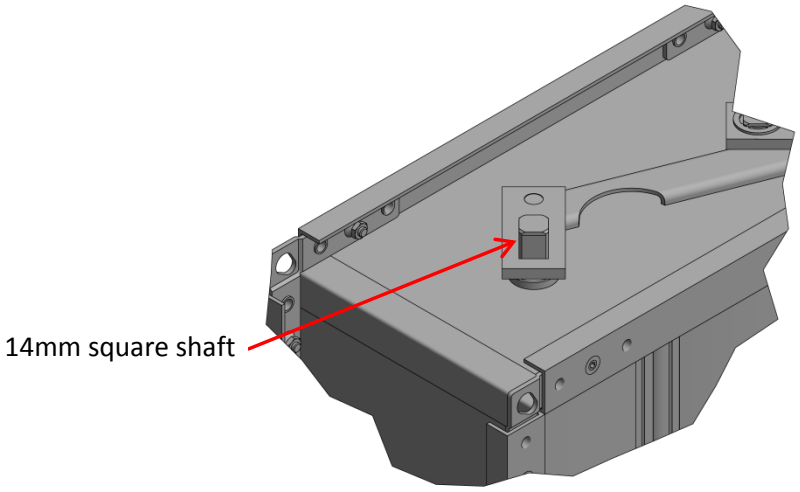


Figure 5: 14mm Square Shaft Exposed

3. The next step is to drill holes for the damper mounting bracket. This is easily done with the optional BR-LUC-BAT alignment tool, but can be done without the tool. The two methods for drilling the holes are as follows:

   <u>With BR-LUC-BAT alignment tool</u>

   Slide the alignment tool over the longest 14mm square shaft of the Lucoma damper. Then, slide the damper mounting bracket over the alignment tool, and line up the edge of the bracket with the edge of the damper as shown in Figure 6.

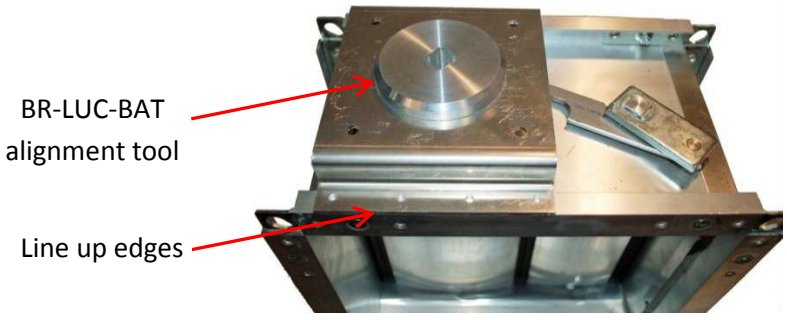


Figure 6: Aligning Bracket with Alignment Tool

Without alignment tool

Slide the coupling over the longest 14mm square shaft of the Lucoma damper. Then, place the damper mounting bracket over the coupling so that the coupling is in the center of the large hole in the bracket. Line up the edge of the bracket with the edge of the damper as shown in Figure 7 below.

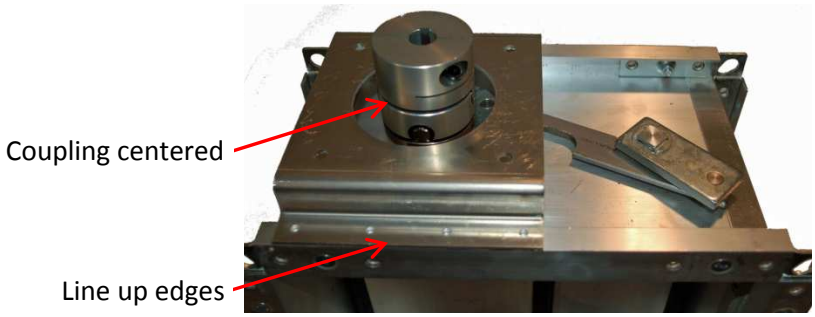


Figure 7: Aligning Bracket with Coupling

4. Once the bracket is in place, put the 5/32" drill bit in the drill. The eight holes on the damper mounting bracket are also 5/32" and will be used as a guide for the drill bit. Spin the drill a few times in each of the eight holes to mark the center (if mounting on an 8" x 8" damper, only six of the holes in the bracket will be used as shown in Figure 8). Next, remove the bracket and the coupling or alignment tool. Still using the 5/32" drill bit, drill eight holes through the lip of the damper at the eight marked positions.

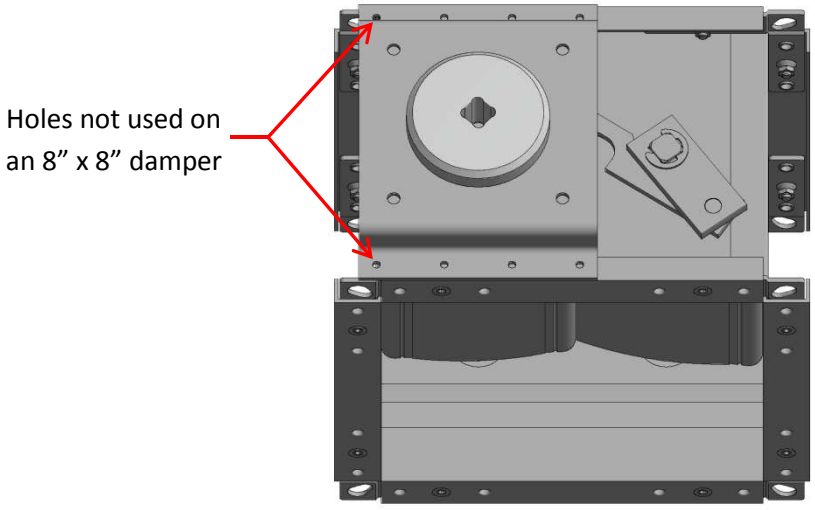


Figure 8: Only Six Holes Used on an 8" x 8" Air Damper

5. Open the damper to its fully open position. Slide the coupling over the damper shaft so that the keyway (for SQM48 actuators) or flat of the "D" (for SQM33 and SQM45 actuators) points towards the nearest side of the damper as shown in Figure 9 below. Note that on 3-blade dampers, the coupling is mounted to the center 14mm shaft, so the keyway or flat of the "D" may point towards either side of the damper.

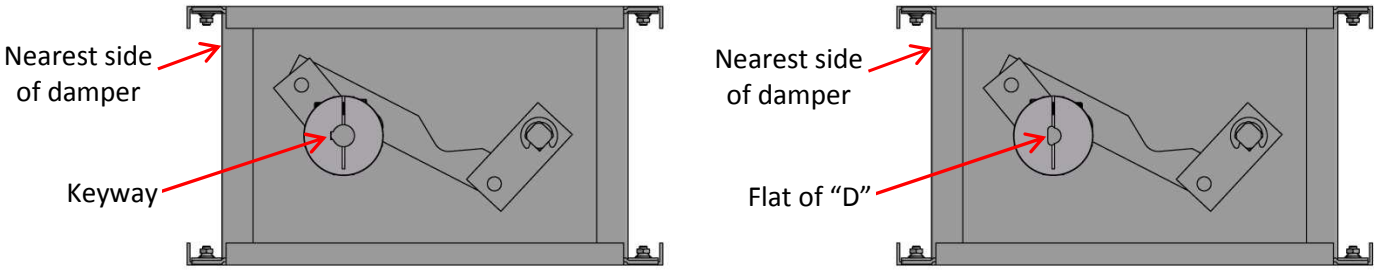


Figure 9: Coupling Alignment

Once the coupling is in the proper position, raise it up off of the damper's linkage approximate 1/16" as shown in Figure 10. Then, tighten both set screws with approximately 120 in-lb of torque using the 5/32" hex key.

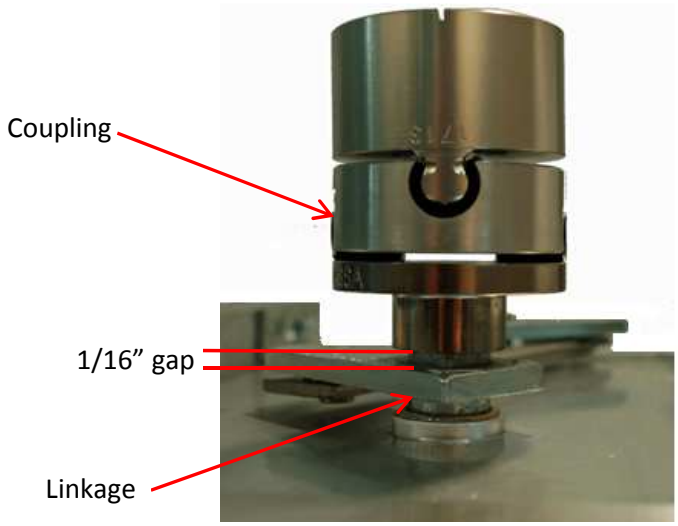


Figure 10: Coupling 1/16" Above Damper Linkage

6. Mount the four standoffs to the actuator mounting bracket using the four 1/4"-20 flat socket head screws, the 5/32" hex key, and the 3/4" open end wrench. Use blue Loctite (#242) on the four screws. The screws should go through the four outermost holes on the actuator mounting bracket as shown in Figure 11.

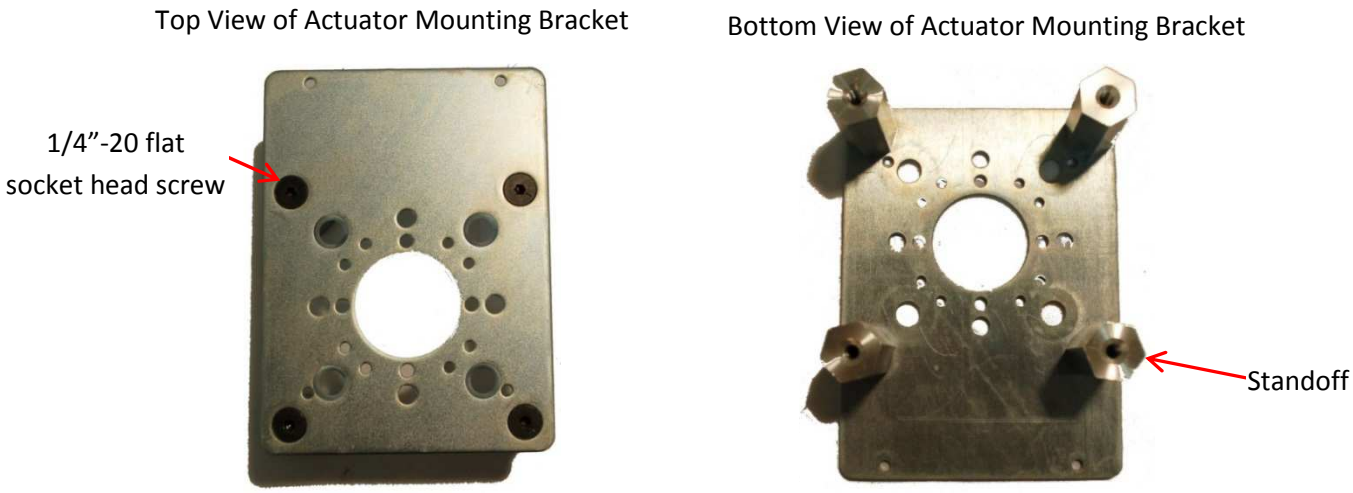


Figure 11: Standoffs Mounted

7. Assemble damper mounting bracket to standoffs using the four 1/4”-20 hex head cap screws, four 1/4” lock washers, and the 7/16” open end wrench. Make sure to mount the damper bracket so that its mounting ears are parallel to the long edge of the actuator mounting bracket as shown in Figure 12.

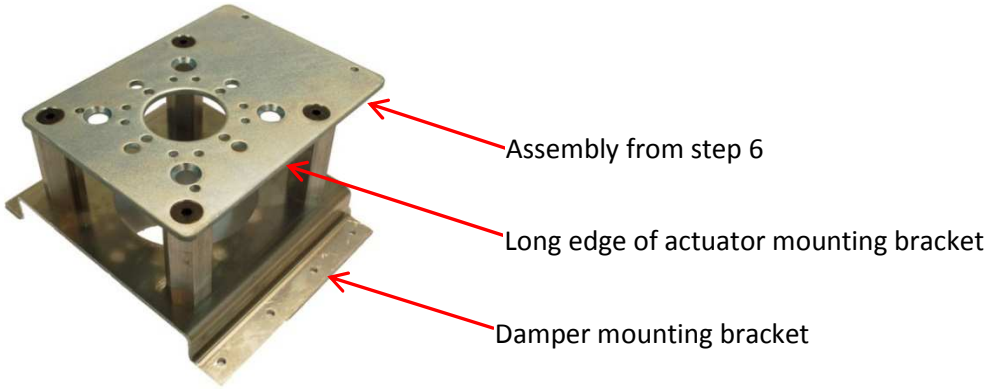


Figure 12: Damper Mounting Bracket Assembly

8. Place the completed bracket assembly over the coupling, and line up the eight holes on the damper mounting bracket with the drilled holes on the lip of the air damper. One end of the actuator mounting bracket sticks out from the rest of the bracket assembly. Make sure that the keyway or flat of the “D” in the coupling is facing away from that end of the actuator mounting bracket. Once properly oriented, install a pop rivet in each of the eight holes. Note that only six rivets will be used on an 8” x 8” air damper. Once complete, the assembly should look as shown in Figure 13.

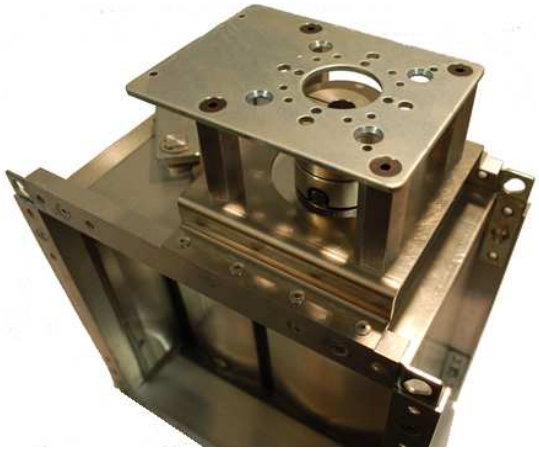


Figure 13: Bracket Assembly Mounted to Air Damper

9. Using the 8mm socket and ratchet extension, mount the actuator on top of the bracket assembly with the four M5 x 12mm thread-forming screws. Finally, tighten the clamp screw on the coupling with approximately 150 in-lb of torque. The completed bracket assembly should look as shown in Figure 14.

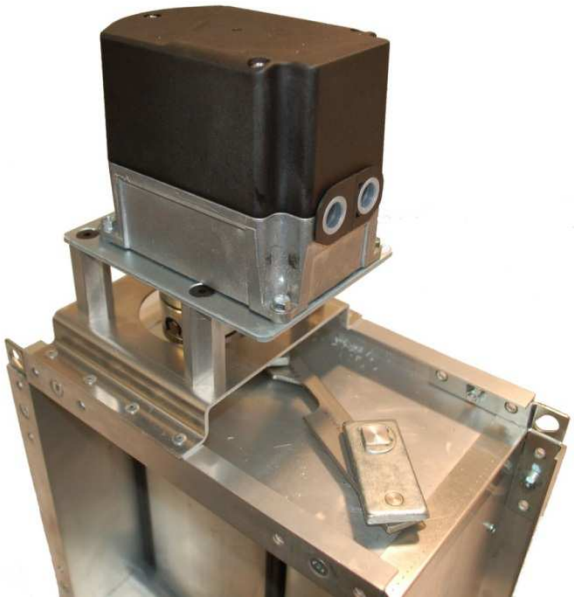


Figure 14: Completed Bracket Assembly

Information in this publication is based on current specifications. The company reserves the right to make changes in specifications and models as design improvements are introduced. Product or company names mentioned herein may be the trademarks of their respective owners. © 2009 SCC Inc.

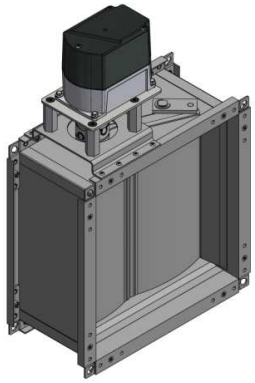
SCC Inc.

Technical Instructions

Document No. CPBK-3000

November 5, 2013

BR…LUC Lucoma Air Damper Bracket Assemblies



Product Description

A BR…LUC bracket assembly reliably mounts an SQM33, SQM45, or SQM48 actuator to any Lucoma air damper size 8” x 8” through 28” x 28”.

Features

- Accessory to a Siemens LMV3 or LMV5 system
- Robust bracket design engineered for precise shaft alignment
- Assembly includes flexible coupling with zero backlash
- Easy installation with readily available tools

Product Part Numbers

Table 1: Available Bracket Assembly Part Numbers

Part Number	Description
BR-SQM3345-LUC	SQM33… or SQM45… actuator to 8x8 through 28x28 Lucoma air damper
BR-SQM48-LUC	SQM48… actuator to 8x8 through 28x28 Lucoma air damper

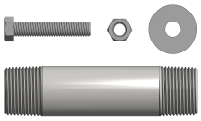
Accessories

BR-LUC-BAT



Optional bracket alignment tool ensures the SQM… actuator shaft and Lucoma air damper shaft are aligned. BR-LUC-BAT tool may be used on multiple installations. See page 5 of Installation Instructions CPBK-3100 for more information.

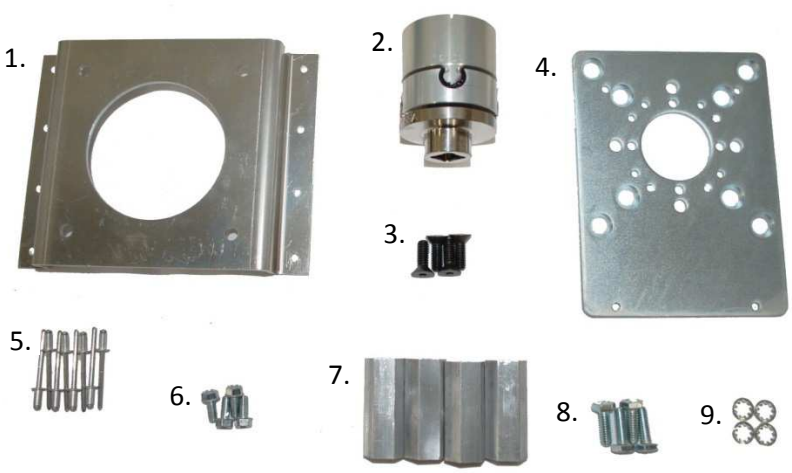
BR-LUC-18SE



Accessory kit including readily available components to remove the 18mm shaft extension during BR…LUC installation. The 18mm shaft extension is not included with all Lucoma air dampers. If installed, it must be removed for the BR…LUC bracket assembly.

Components

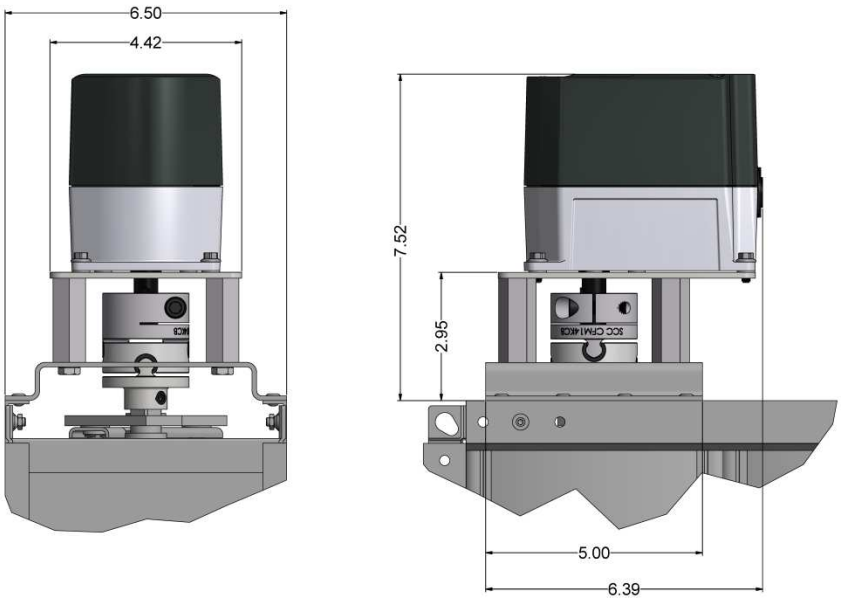
Figure 1 shows the components included with a BR…LUC bracket assembly. See Installation Instructions CPBK-3100 for more information.



1. Damper mounting bracket
2. Zero backlash coupling
3. 1/4”-20 x 3/4” flat socket head cap screws (qty 4)
4. Actuator mounting bracket
5. 5/32” pop rivets (qty 8)
6. M5 x 12mm thread-forming screws (qty 4)
7. 1.9” standoffs (qty 4)
8. 1/4”-20 x 3/4” hex head cap screws (qty 4)
9. 1/4” lock washers (qty 4)

Figure 1: Components Included in a Lucoma Air Damper Bracket Assembly

Dimensions



Information in this publication is based on current specifications. The company reserves the right to make changes in specifications and models as design improvements are introduced. Product or company names mentioned herein may be the trademarks of their respective owners. © 2009 SCC Inc.

SCC Inc.

Technical Instructions

Document No. CPBK-1000

August 30, 2013

Cxx Series

CC… CF… and CJ… Couplings for use with SQM… Actuators



Description

Cxx… series couplings precisely connect Siemens SQM… actuators to a valve or damper.

Features

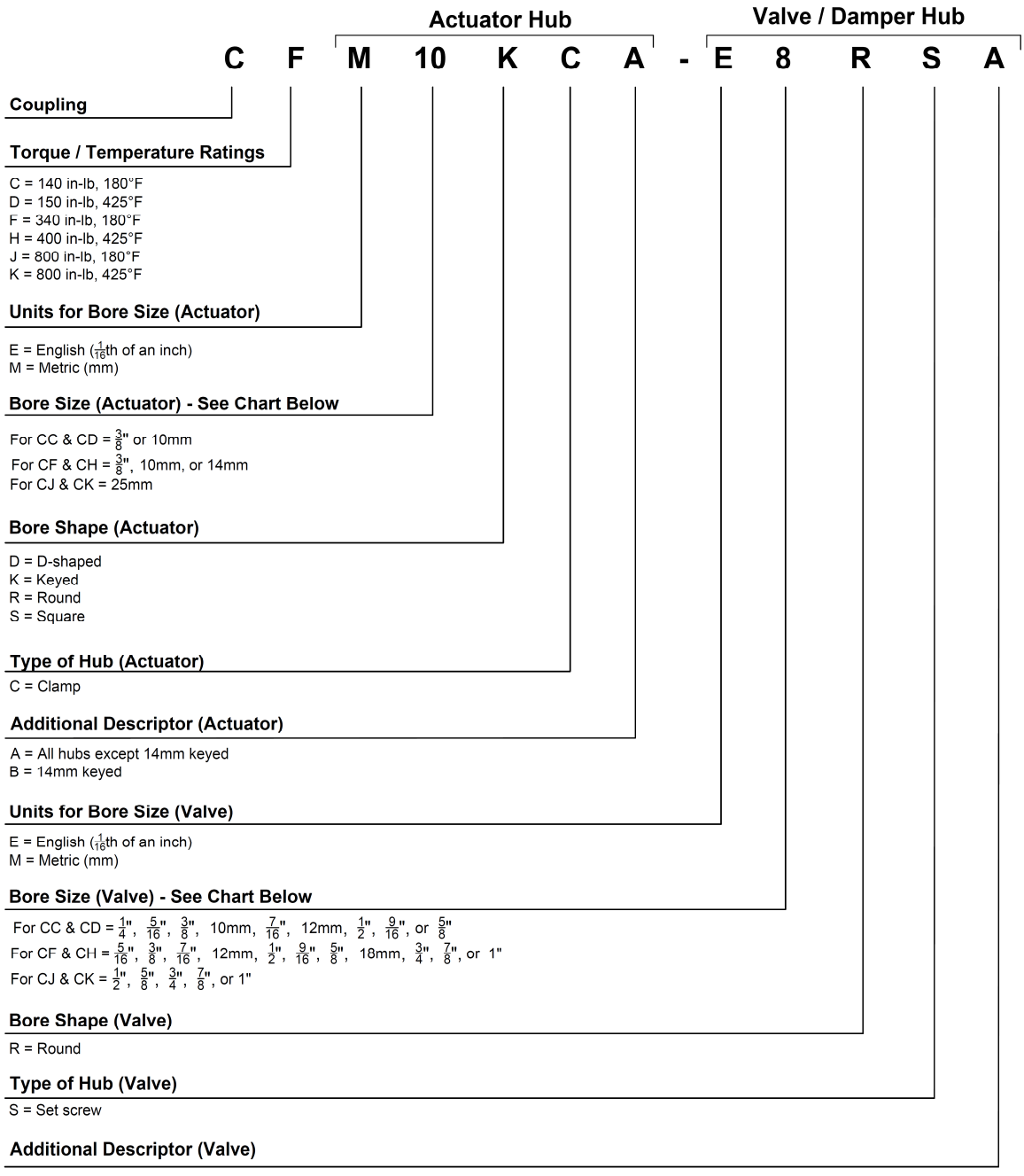
- Allow up to 3° of angular shaft misalignment to prevent actuator binding
- Allow up to 0.063” of parallel shaft misalignment to prevent side loads on the actuator and valve shafts
- High temperature versions available for FGR applications
- Will accommodate English shaft sizes from ¼” to 1”
- Will accommodate Metric shaft sizes from 10mm to 25mm
- Zero backlash, torsionally stiff
- Robust and flexible design
- Maintenance-free

Application

Cxx couplings connect Siemens actuators to a wide variety of valves and dampers. The flexible coupling design minimizes side loads on the actuator and valve shafts due to minor misalignment, which helps prevent actuator binding and improves control performance and reliability.

Product Part Numbers

For coupling part number identification only. Not all possible part number combinations are available. See Table 1 on the following page for available coupling part number combinations.



Part Number Segment	4	5	6	7	8	9	10	11	12	13	14	15	16
English Bore Size (inch)	1/4"	5/16"	3/8"	7/16"	1/2"	9/16"	5/8"	11/16"	3/4"	13/16"	7/8"	15/16"	1"
Metric Bore Size (mm)	4	5	6	7	8	9	10	11	12	13	14	15	16

Product Part Numbers (continued)

Beginning with the "Part Number Starts With" column and using the previous page as a guide, go from left to right across the table to select a coupling assembly.

Table 1: Available Coupling Assemblies

Specifications		Part Number				
Torque	Temperature	Part Number Starts With:	Actuator Hub	-	Valve/Damper Hub	
					English	Metric
140 in-lb	180°F	CC	E6RCA E6SCA M10DCA M10KCA	-	E4RSA E5RSA E6RSA E7RSA E8RSA E9RSA E10RSA	M10RSA M12RSA
150 in-lb	425°F	CD				
340 in-lb	180°F	CF	E6SCA M10DCA M10KCA M14KCB	-	E5RSA E6RSA E7RSA E8RSA E9RSA E10RSA E12RSA E14RSA E16RSA	M12RSA M18RSA
400 in-lb	425°F	CH				
800 in-lb	180°F	CJ	M25KCA	-	E8RSA E10RSA E12RSA E14RSA E16RSA	
	425°F	CK				

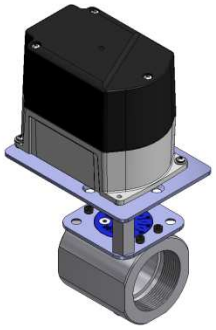
Accessories

BR… Bracket Kits



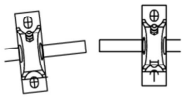
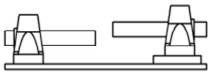
Bracket kits are available to mount Siemens SQM… actuators to a wide range of dampers. See Document No. CPBK-2000 for more information.

VA… Valve Actuator Assemblies



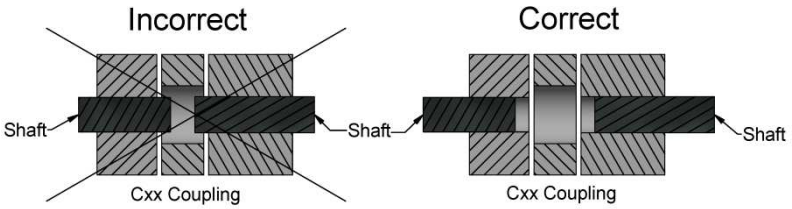
Pre-built valve actuator assemblies can be ordered to ensure proper shaft alignment and engagement. Assemblies include the valve, actuator, coupling, and bracket which are configured, tested, and shipped as an assembly. Contact SCC Inc. for more information.

Specifications

Physical characteristics	Fasteners	Alloy steel
	Body (all sizes)	Anodized aluminum
	CC…, CF…, CJ… standard bushings	Polymer
	CD…, CH…, CK… high-temp bushings	High-temp polymer
	Weight – CC… and CD…	0.25 lbs. [113 g]
	Weight – CF… and CH…	0.70 lbs. [318 g]
	Weight – CJ… and CK…	1.35 lbs. [612 g]
Operating environment	Temperature - standard assembly	-20 to 180°F [-29 to 82°C]
	Temperature - high-temp assembly	-40 to 425°F [-40 to 218°C]
	Max. angular misalignment 	3°
	Max. parallel misalignment 	0.063” [1.6 mm]

Installation

- Neither the actuator shaft nor the valve / damper shaft should protrude into the center hub of the coupling (see below). See “Dimensions” for more information.

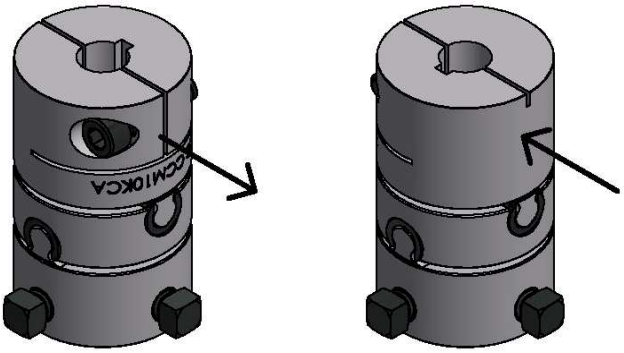


- When coupling actuators to round shafts, ensure the shaft is in the correct rotary position before tightening set screws.

- Once the proper rotary position of the valve / damper shaft relative to the actuator shaft is achieved, set screws and / or clamp bolts should be tightened to the proper torque. See “Dimensions” for appropriate tightening torques.

- Couplings must be used with actuator mounting brackets that do not permit shaft misalignment to exceed 3° angular and 0.063” parallel when actuator applies maximum torque to the valve / damper shaft. Cxx couplings transfer torque only. The actuator shaft will not act as an anchor point to brace a flexible bracket. See Document No. CPBK-2000 for more information on bracket kits.

- Every coupling ships as a complete assembly consisting of an actuator hub, midsection, and valve / damper hub. To switch between assembly options, slide one end hub out of engagement, rotate 180°, and slide the hub back for re-engagement (see below).



Dimensions

CC… and CD… Model Couplings

Dimensions in inches; millimeters in brackets

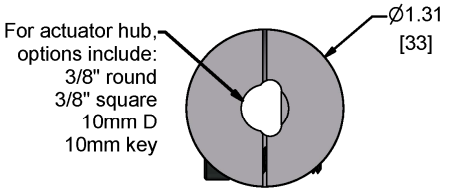
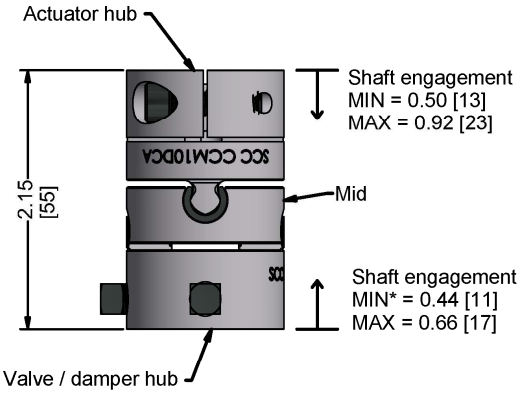
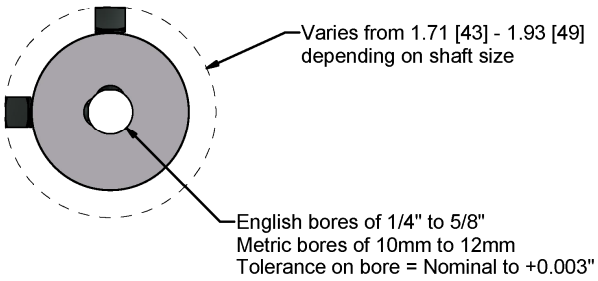


Table 2: CC... and CD... Coupling Fastener Tightening Torques

Size	Type	Tightening Torque	Coupling Hubs
#8-32	Socket set screw	20 in-lb	1/4" round set screw hub
1/4-20	Square head set screw	180 in-lb	5/16" and larger round set screw hubs
#12-24	Socket head clamp screw	90 in-lb	All clamp hubs





*If mounting coupling on a 5/16" round valve / damper shaft, minimum shaft engagement is 0.50 [13]

Dimensions (continued)

CF… and CH… Model Couplings

Dimensions in inches; millimeters in brackets

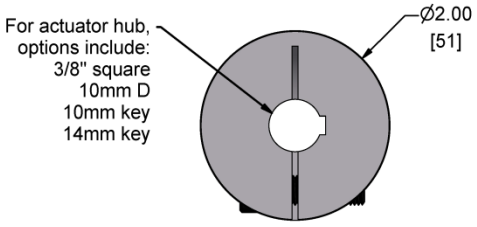
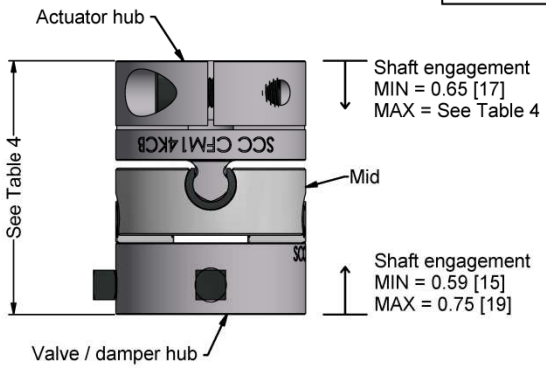


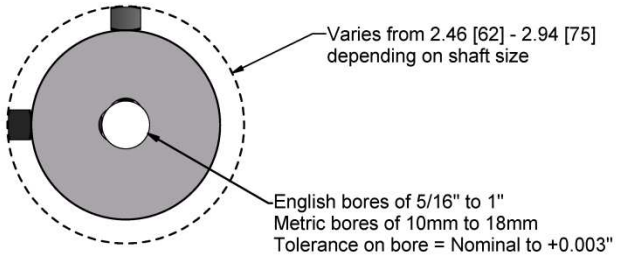
Table 3: CF... and CH... Coupling Fastener Tightening Torques

Size	Type	Tightening Torque	Coupling Hubs
1/4-20	Square head set screw	180 in-lb	5/16" and 3/8" round set screw hubs
5/16-18	Square head set screw	350 in-lb	7/16" and larger round set screw hubs
5/16-24	Socket head clamp screw	150 in-lb	All clamp hubs

Table 4: CF... and CH... Coupling Length and Engagement

-	14mm keyed actuator shaft	Any other actuator shaft
Max. shaft engagement	1.05 [27]	0.95 [24]
Overall coupling length	2.67 [68]	2.57 [65]





Dimensions (continued)

CJ… and CK… Model Couplings

Dimensions in inches; millimeters in brackets

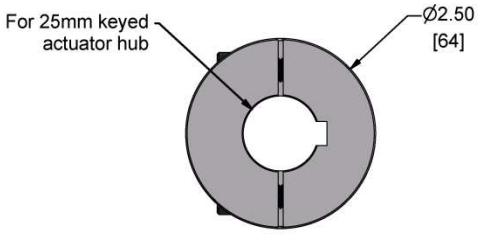
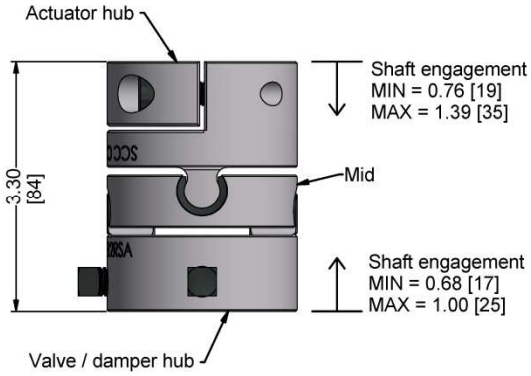
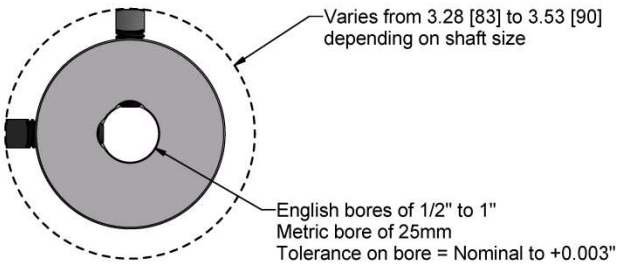


Table 5: CJ... and CK... Coupling Fastener Tightening Torques

Size	Type	Tightening Torque	Coupling Hubs
3/8-16	Square head set screw	700 in-lb	All set screw hubs
5/16-24	Socket head clamp screw	150 in-lb	All clamp hubs



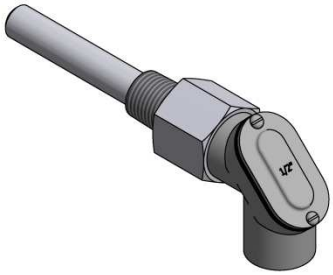


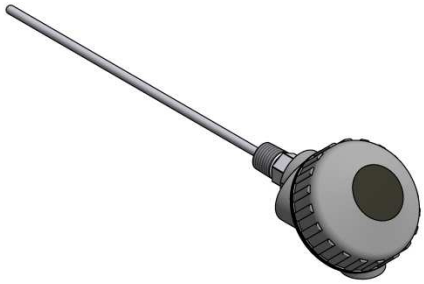
Information in this publication is based on current specifications. The company reserves the right to make changes in specifications and models as design improvements are introduced. Product or company names mentioned herein may be the trademarks of their respective owners. © 2009 SCC Inc.

QAx… Series

QAC… QAE… QAM…
Temperature Sensors







Description

QAx… temperature sensors are resistance temperature detectors (RTDs). RTDs work on the principal that the resistance of the sensing element changes as a direct function of the temperature.

Features

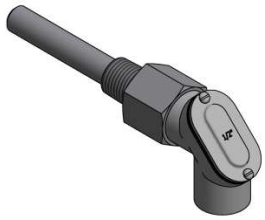
- Accurate and reliable indication of temperature
- Easy installation requiring no special tools
- Suitable for media -58 °F to 900 °F depending on model

Application

QAx… sensors are used to measure water, steam, air, or exhaust temperature. A variety of sensors are available in order to meet the needs of different applications. QAx temperature sensors are capable of reliably measuring temperatures as low as -58 °F or as high as 900 °F.

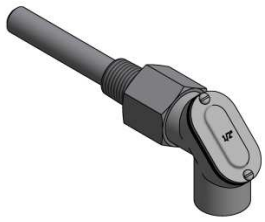
Specifications

QAE2012.001



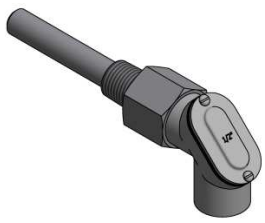
Sensing element	Platinum, 1000 Ohm, 2-wire
Characteristic	385 (see Appendix A, page 8)
Operating temperature	-4 to 374 °F [-20 to 190 °C]
Accuracy	See Appendix A, page 10
Process connection	1/2” NPT on thermowell
Thermowell	2.5” insertion, stainless steel
Weather head	Aluminum, 1/2” NPT
Primary use	Water / ambient air temperature sensor for LMV5x / RWF40 / RWF50 / RWF55

QAE2020.001



Sensing element	Platinum, 100 Ohm, 3-wire
Characteristic	385 (see Appendix A, page 8)
Operating temperature	-4 to 374 °F [-20 to 190 °C]
Accuracy	See Appendix A, page 10
Process connection	1/2” NPT on thermowell
Thermowell	2.5” insertion, stainless steel
Weather head	Aluminum, 1/2” NPT
Primary use	Water temperature sensor for LMV5x / RWF10 / RWF40 / RWF50 / RWF55

QAE2020.005



Sensing element	Nickel, 1000 Ohm, 2-wire
Characteristic	LG (see Appendix A, page 9)
Operating temperature	-13 to 266 °F [-25 to 130 °C]
Accuracy	See Appendix A, page 10
Process connection	1/2” NPT on thermowell
Thermowell	2.5” insertion, stainless steel
Weather head	Aluminum, 1/2” NPT
Primary use	Water / ambient air temperature sensor for LMV5x / RWF40 / RWF55

Specifications (continued)

QAE2012.903



Sensing element	Platinum, 100 Ohm, 3-wire
Characteristic	385 (see Appendix A, page 8)
Operating temperature	-50 to 900 °F [-46 to 482 °C]
Accuracy	See Appendix A, page 10
Process connection	1/2” NPT on thermowell
Thermowell	4” insertion, stainless steel
Weather head	Aluminum, 3/4” NPT
Primary use	Water / steam temperature sensor for LMV5x / RWF10 / RWF40 / RWF50 / RWF55

QAE2012.9002



Sensing element	Platinum, 1000 Ohm, 2-wire
Characteristic	385 (see Appendix A, page 8)
Operating temperature	-50 to 900 °F [-46 to 482 °C]
Accuracy	See Appendix A, page 10
Process connection	1/2” NPT on thermowell
Thermowell	4” insertion, stainless steel
Weather head	Aluminum, 3/4” NPT
Primary use	Water / steam temperature sensor for LMV5x / RWF10 / RWF40 / RWF50 / RWF55

Specifications (continued)

QAC22



Sensing element	Nickel, 1000 Ohm, 2-wire
Characteristic	LG (see Appendix A, page 9)
Operating temperature	-58 to 158 °F [-50 to 70 °C]
Accuracy	See Appendix A, page 10
Process connection	None
Thermowell	None
Weather head	Integral, hole for M16 connection
Primary use	Ambient air temperature sensor for LMV52 / RWF40 / RWF55

QAM-P210



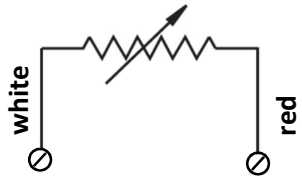
Sensing element	Platinum, 1000 Ohm, 2-wire
Characteristic	385 (see Appendix A, page 8)
Operating temperature	-50 to 900 °F [-46 to 482 °C]
Accuracy	See Appendix A, page 10
Probe	1/4” diameter, 10” long, stainless steel
Process connection	1/2” NPT
Thermowell	None
Weather head	Aluminum, 3/4” NPT
Primary use	Exhaust temperature sensor for LMV52

Wiring

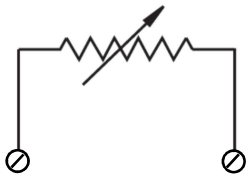
QAE2012.001, QAE2020.005



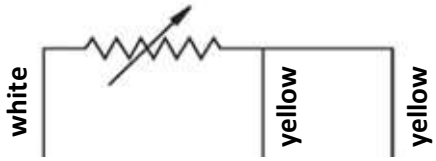
QAE2012.9002, QAM-P210



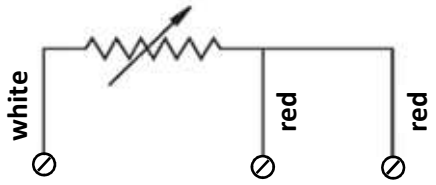
QAC22



QAE2020.001



QAE2012.903



G1+	M1	I1	RWF40… water / steam
3	4	5	RWF10… water / steam
11	12	14	RWF55… water / steam
11	12	13	RWF50… water / steam
X60.1	X60.2	X60.4	LMV5x… water / steam

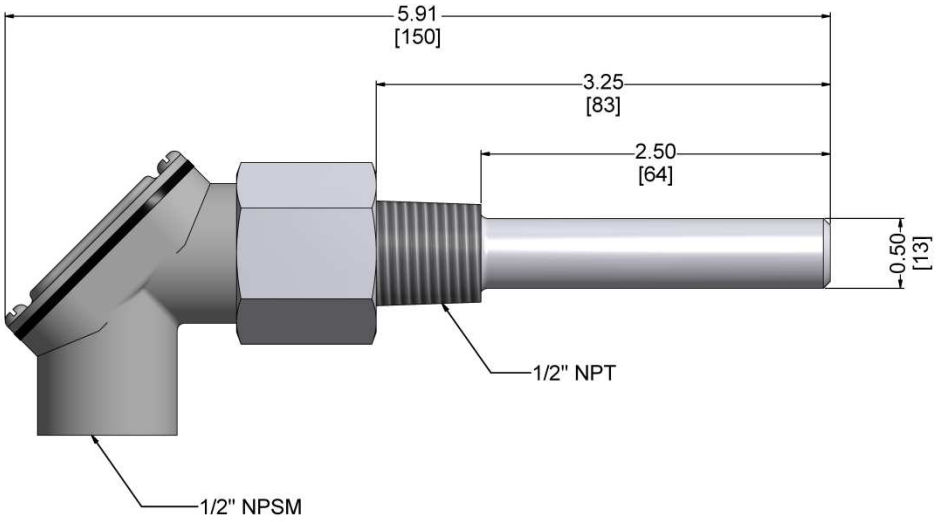
G1+	M1	RWF40… water / steam
B9	M9	RWF40… ambient air
11	14	RWF55… water / steam
31	32	RWF55… ambient air
11	13	RWF50… water / steam
X60.3	X60.4	LMV5x… water / steam
X86.1	X86.2	LMV52… ambient air
X87.1	X87.2	LMV52… exhaust

Note: There is no polarity when wiring a 2-wire RTD.

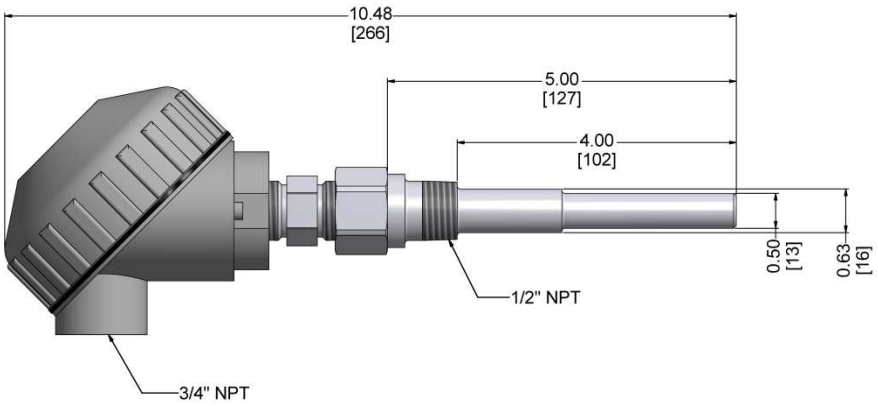
Dimensions

Dimensions in inches; millimeters in brackets

QAE2012.001, QAE2020.001, QAE2020.005



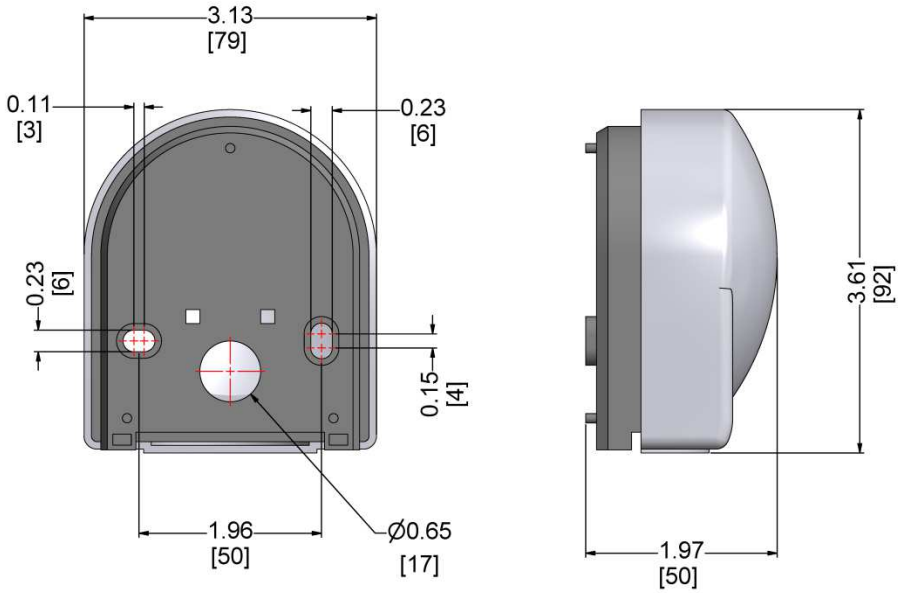
QAE2012.903, QAE2012.9002



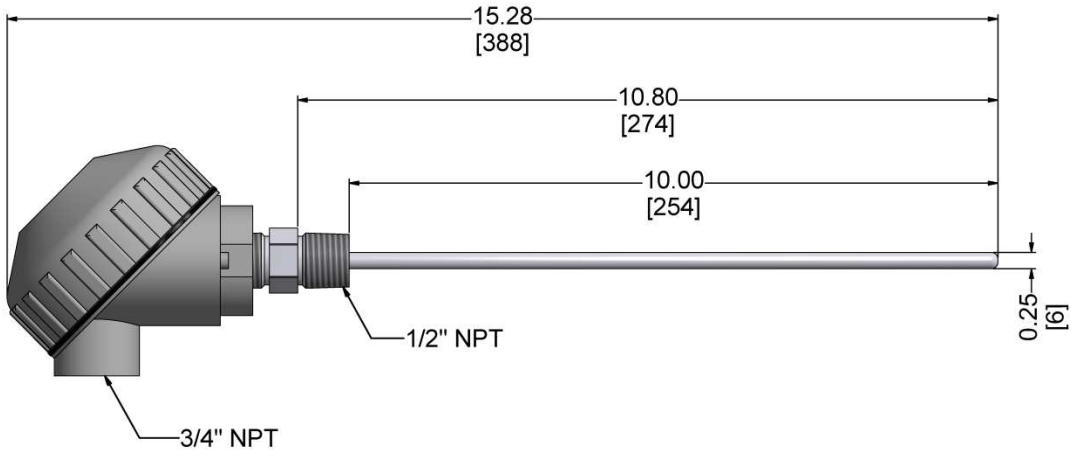
Dimensions (continued)

Dimensions in inches; millimeters in brackets

QAC22



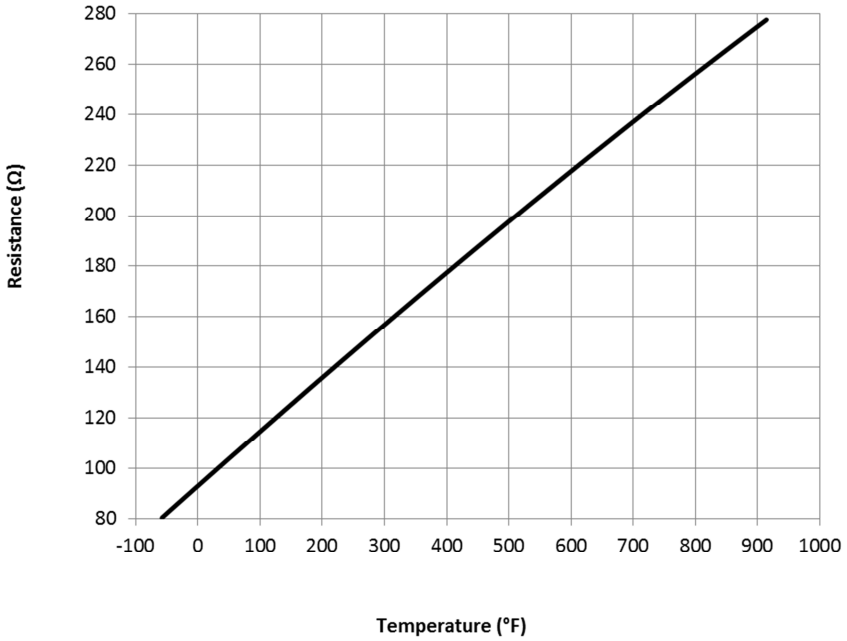
QAM-P210



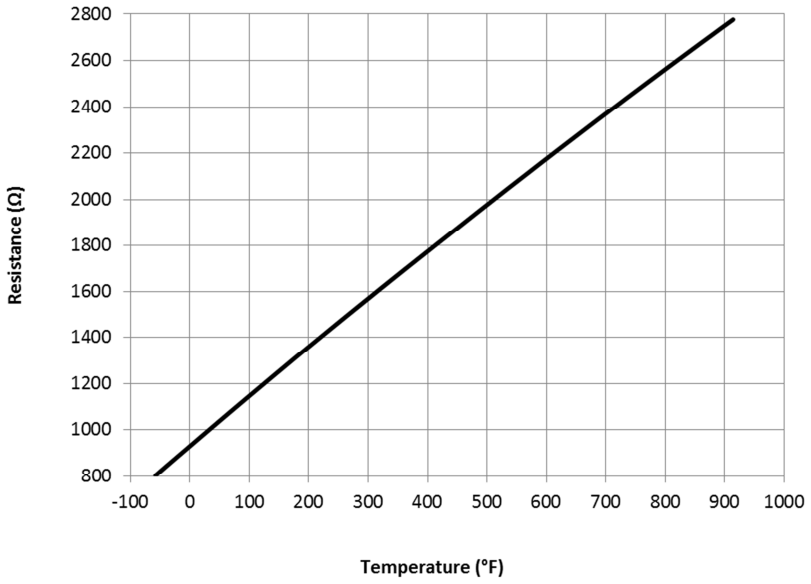
Appendix A

Resistance vs. Temperature Charts

Pt100, 385 characteristic (QAE2012.903, QAE2020.001)



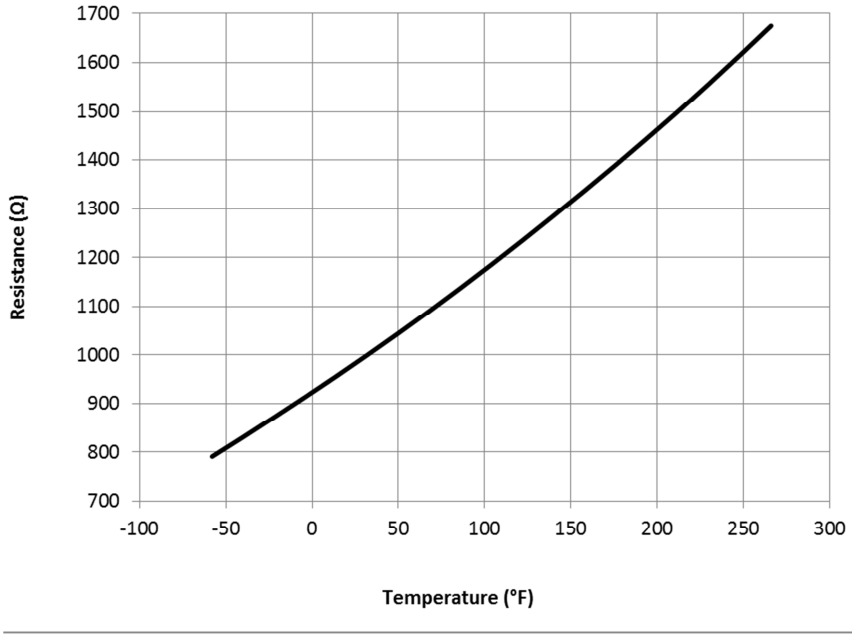
Pt1000, 385 characteristic (QAE2012.001, QAE2012.9002, QAM-P210)



Appendix A (continued)

Resistance vs. Temperature Charts

Ni1000, LG characteristic (QAC22, QAE2020.005)



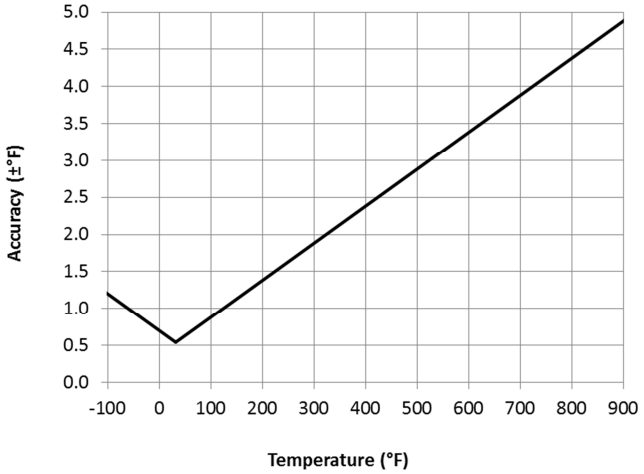
Appendix A (continued)

Accuracy

Pt100 and Pt1000 Sensors (QAE2012.001, QAE2012.903, QAE2012.9002, QAE2020.001, QAM-P210)

Accuracy = ± [0.54 + (0.005 x |T - 32|)]

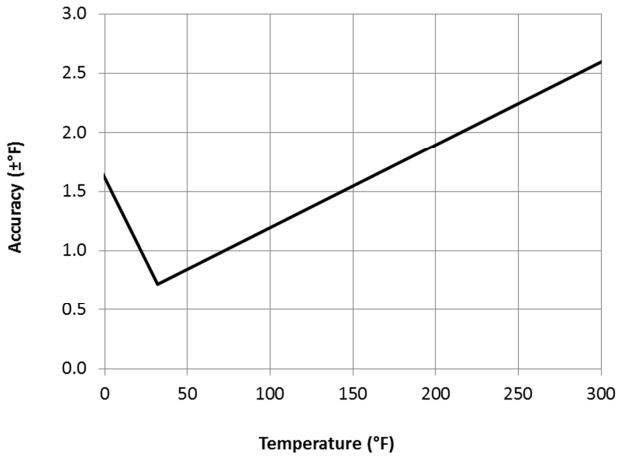
T = Temperature in degrees Fahrenheit



Ni1000 Sensors (QAC22, QAE2020.005)

For T < 32: Accuracy = ± [0.72 + (0.028 x |T - 32|)]
For T > 32: Accuracy = ± [0.72 + (0.007 x |T - 32|)]

T = Temperature in degrees Fahrenheit

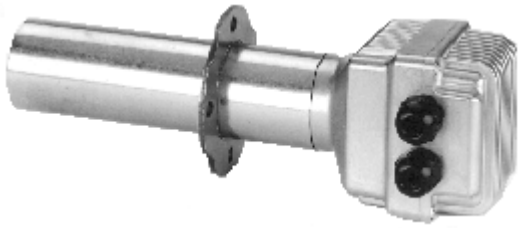


Information in this publication is based on current specifications. The company reserves the right to make changes in specifications and models as design improvements are introduced. Product or company names mentioned herein may be the trademarks of their respective owners. © 2009 SCC Inc.

SIEMENS



QGO20.000D17



QGO20.000D27

Oxygen Sensor QGO20...

Basic Documentation

The QGO20... and this Basic Documentation are intended for use by OEMs which integrate the oxygen sensor in their products!

1 Supplementary documentation

Data Sheet QGO20… N7842

Contents

1 Supplementary documentation 3

2 Safety notes 7

2.1 Warning notes 7
2.2 Engineering notes 8
2.3 Installation and mounting notes 8
2.4 Electrical connection of the oxygen sensor 9
2.5 Commissioning notes 9
2.6 Standards and certificates 10
2.7 Service notes 10
2.8 Disposal notes 10

3 Overview 11

4 Assortment connections 12

5 Technical data 13

6 Description of functions 14

6.1 Functioning principle of the measuring cell 14
6.2 Impact of the cell's temperature 16
6.3 Impact of the reference gas 17
6.4 Switching on and switching off 18
6.5 Aging 18

7 Mechanical design of the sensor 19

8 Mounting and connecting the sensor 20

8.1 Mounting 20
8.2 Connection 21

9 Connection diagram 22

10 Dimensions 23

11 List of figures 24

12 Index 25

13 Addendum 26

2 Safety notes

2.1 Warning notes



To avoid injury to persons, damage to property or the environment, the following warning notes must be observed!

Do not open, interfere with or modify the sensor!

- All activities (mounting, installation, service, etc.) must be performed by qualified staff
- Before making any wiring changes in the connection area, completely isolate the plant from mains supply (all-polar disconnection). Ensure that the plant cannot be inadvertently switched on again and that it is indeed dead. If not observed, there is a risk of electric shock hazard
- Ensure protection against electric shock hazard by providing adequate protection for the connection terminals
- During operation, the sensor's connecting head must be kept closed; all 3 screws must be securely tightened
- Each time work has been carried out (mounting, installation, service work, etc.); check to ensure that wiring of connected lines is in an orderly state and make the safety checks as described in *Commissioning notes*. Keep cables away from extremely hot plant equipment or sensor parts
- Ensure that the hot QGO20... does not get into contact with explosive or inflammable gases
- There is a risk of burning since the measuring cell works at an operating temperature of 700 °C and other accessible parts can get very hot too (>60 °C)
- To prevent injury caused by the hot sensor tube, remove the QGO20... from the AGO20... only after the equipment has cooled down
- Fall or shock can adversely affect the safety functions and lead to dangerous conditions. Such sensors must not be put into operation, even if the measuring cell does not exhibit any damage
- Always keep the sensor's flue gas inlet and outlet free from dirt, this extended the response time of the sensor
- Before cleaning the inlet and outlet, allow the QGO20... to cool down for at least 1 hour. When using compressed air for cooling (only after the sensor has completely cooled down), pressures up to 0.5 bar are permitted. If this is not observed, the sensor can be damaged in a way that inadmissibly high CO levels in the flue gases can occur
- Ensure that air cannot enter the space between burner and measuring parts. In particular, the mounting flange must be completely gas-tight
- Always fit the sensor such that the connecting section (head plus flange) is free so that air can freely circulate. Otherwise, there is a risk of false measurements, which can lead to dangerous conditions
- The environment must be free from chemicals such as vapors from solvents
- During burner operation, QGO20... must be kept on operating temperature via associated control unit (LMV52... with PLL52...)
- Air must not be allowed to join the flue gases between the burner and the measuring equipment. Ensure that the sensor's mounting flange is completely tight
- Mount the sensor such that the connecting part (head to flange) is free so that the exchange of air is ensured. Otherwise, measurements might get distorted, possibly leading to dangerous situations
- Ensure that there are no chemicals, such as solvent vapors, near the sensor

2.2 Engineering notes

- If the burner is shut down for no more than 1 or 2 weeks, do not switch off the QGO20... and the associated control unit (LMV52... with PLL52...)
- To ensure a good response, always use the QGO20... together with the AGO20...
- Flue gas temperatures at the QGO20... must not exceed 300 °C, since higher temperatures can destroy the sensor
- Use the QGO20... only in connection with natural gas and light oil since other types of fuel can damage the sensor due to the aggressive substances contained in them
- Heavy metals in the fuel, such as lead, cadmium etc., destroy the sensor element and therefore may not be contained
- Silicones and silicone vapors in the flue gas can damage the sensor element and therefore may not be contained
- Following element in the flue gas reduces the life cycle of the sensor elements and should not be contained:
  Silicon, sulfur, phosphor, boric, bismuth, copper and halogens (F, CI, Br, I) and their compounds (e.g. FCKW)
- NOx, SOx and reducing atmospheres, such as CO by an incomplete burning, impair the life time of the sensor element depending on the concentration and the influence time

2.3 Installation and mounting notes

- Ensure that the relevant national safety regulations are complied with
- To facilitate mounting, both the QGO20... and AGO20... carry markings (refer to Mounting Instructions M7842 (4 319 2366 0))
- The flue gas flow passing the measuring cell must be homogeneous, with no or only little turbulence. When mounted too close to air dampers or pipe bends, faulty measurements can occur
- The exchange of fresh air in the connection area of the sensor with the reference air slots must be ensured and may never be covered up (by insulation or similar)
- The sensor should not be exposed to aggressive gases (NOx, etc.). This applies to both the gas and air side since aggressive gases can drastically shorten the sensor's life
- Disturbances can distort the measurements (this can lead to dangerous conditions in connection with O2 trim control):
  – If flueways are not tight, false air can join the flue gases. In that case, the oxygen content acquired by the sensor is above the real content
  – When flue gas velocities are low, the sensor will respond more slowly since the flue gases need more time to pass the measuring cell. In that case, it is recommended to mount the sensor in an inclined position
  – The further the sensor is mounted from the flame, the longer the dead time

☞ Note
For detailed information on mounting, refer to Mounting Instructions M7842 (4 319 2366 0).

2.4 Electrical connection of the oxygen sensor

It is important to achieve practically disturbance- and loss-free signal transmission:
- Never run the sensor cable together with other cables; use a separate cable
- Observe the permissible length of the sensor cables and the relevant specification (see Technical data)

2.5 Commissioning notes

- To prevent the collection of condensate inside the QGO20…, do not put the burner into operation before the sensor's heating up phase is completed
- To prevent false measurements, observe a heating up time of at least 2 hours when commissioning the plant, otherwise at least 1 hour

During the sensor's heating up phase, temperature differences between the inner and outer electrode generate thermo-electric voltages which, in that phase, falsify the acquired oxygen value.
When commissioning the control system, the heating up times specified in *Engineering notes* must therefore be observed.
It is also recommended to keep the sensor activated during short burner off periods (1 to 2 days).

Prior to commissioning, make the following mounting final checks:
- Check to ensure that the sensor is correctly fitted to the flange mounting nozzle
- Ensure that the signal and power supply lines are correctly connected

Electronic circuit
- Activate the electronic circuit
- Wait until the sensor has reached its normal operating temperature, the residual oxygen content is displayed on the associated control unit (LMV52... with PLL52...) and has stabilized. For more details, refer to the Basic Documentation of the associated control unit (LMV52... with PLL52...)

After the final mounting check, a first functional check can be made:

Functional check

During the prepurge phase, the actual O_2 value must be at a level of about 20.9%. It can be read off with the help of the handheld terminal AZL52...

It is also possible to make a functional check of the QGO20... based on a comparative measurement.
Comparative measurement means that, during burner operation, the actual oxygen value is measured with a flue gas analyzer and will then be compared with the value acquired by the QGO20...

☞ Note
Flue gas analyzers measure «dry», the QGO20... measures *wet*.
The conversion is made with the help of the conversion table contained in the Addendum to this Basic Documentation.

2.6 Standards and certificates

ISO 9001: 2008
Cert. 00739

ISO 14001: 2004
Cert. 38233

Only QGO20.000D17

Only in connection with LMV52... and PLL52...

Conformity to EEC directives
- Electromagnetic compatibility EMC (immunity) 2004/108/EC
- Directive for gas appliances 2009/142/EC

2.7 Service notes

After no more than 3 months of operation following commissioning, check the sensor's internal resistance. If it exceeds 30 Ω, shorter the service interval to 3 months. Sensors having an internal resistance of >100 Ω should no longer be used for control tasks since their response is too slow. For this reason, to ensure proper functioning, sensors with a resistance of >100 Ω should be replaced.

- Make certain that the sensor's inlet and outlet are always kept free from dirt
- Inlet and outlet orifices have to be checked on a regular basis for contaminations. Flow frequently has to be done depends on the contamination that has been found. If a contamination is being found, the QGO20… can be cleaned with using compressed air or a metal brush after the sensor has cooled down. Before use of compressed air the sensor must cool down for min. 1 hour, otherwise the sensor might be destroyed and during the following operation the combustion might be incomplete
- The grid of the inlet and outlet orifices must not be damaged at cleaning. If grid is damaged or the sensor can not be cleaned completely, the sensor must be replaced. The replaced sensor must not be used again
- Check flange gasket on each service visit and replace if necessary
- Always keep the sensor's flue gas inlet and outlet free from dirt
- On each service visit, check to ensure that the flange is completely tight and replace gasket if necessary
- Check the AGO20… flue gas collector at regular intervals and clean if necessary
- After cleaning and heating up, check oxygen measurement and control in the burner's entire working range

2.8 Disposal notes

The oxygen sensor contains electrical and electronic components and must not be disposed of together with household waste.
Local and currently valid legislation must be observed.

3 Overview

The QGO20... is an oxygen sensor that is used to acquire the residual oxygen content of flue gases in heat generating plants that burn natural gas or light fuel oil. In connection with the control unit (LMV52... with PLL52...), QGO20... monitors and controls the combustion process. For mounting the QGO20..., flue gas collectors type AGO20... are available. They can be welded directly into the chimney. The QGO20... in connection with the AGO20... is suited for use on all types of heat generating plant which burn natural gas or light fuel oil with flue gas temperatures up to 300 °C at the test point.

When used in connection with burner controls type LMV52… for residual oxygen control, the efficiency of combustion will be improved and oxygen emissions minimized.

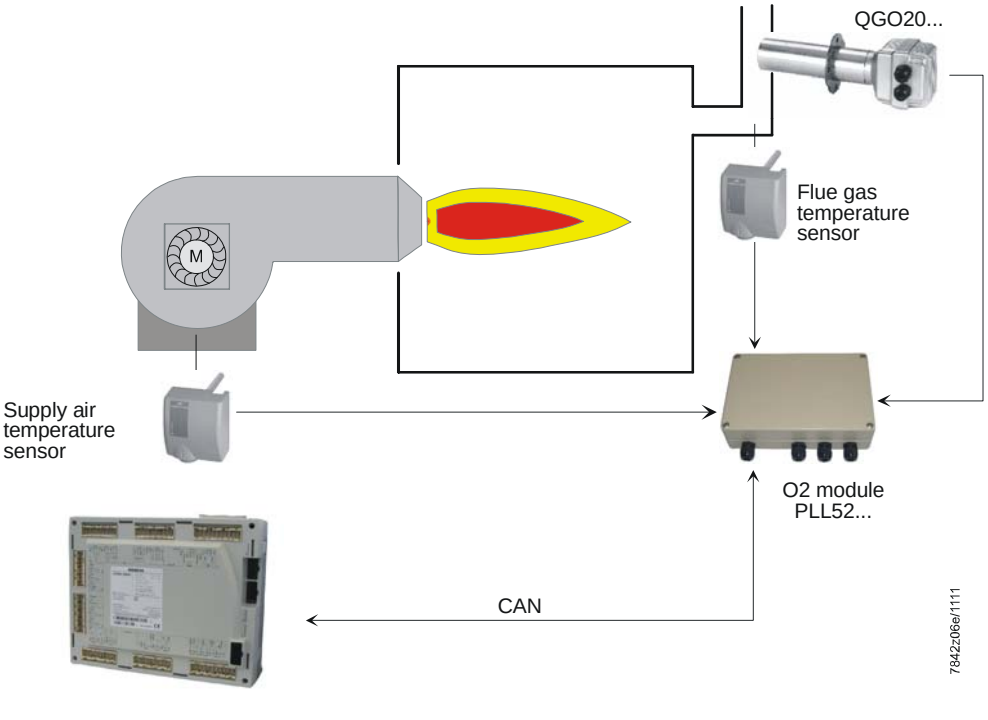


Figure 1: Example General overview

4 Assortment connections

Oxygen sensor, complete with flange gasket

- AC 230 V	**QGO20.000D27**
- AC 120 V	**QGO20.000D17**

Control unit for measurement and control the rest of oxygen

- Refer to Basic Documentation P7550	**LMV52... with PLL52...**



Flue gas collectors

- For chimney diameters up to 400 mm	**AGO20.001A**
- For chimney diameters above 400 mm	**AGO20.002A**

Flange gasket for service **5 759 2021 0**

5 Technical data

General unit data

Operating voltage of measuring cell's	
- QGO20.000D27	AC 230 V ±15%
- QGO20.000D17	AC 120 V ±15% (only with LMV52... and PLL52...)
Mains frequency	50/60 Hz ±6%
Power consumption	Max. 90 W, typically 35 W (controlled)
Perm. mounting position	Refer to Mounting Instructions M7842 (4 319 2366 0)
Degree of protection	IP40, to be ensured through installation
Weight (net)	Approx. 0.9 kg
Signal lines	
- Shielded 6-core cable	Twisted pairs
- Shielding connected to terminal GND of the PLL52...	
- Proposal for cable	LifYCY3x2x0.2 or LYCY3x2x0.2
Measuring system	Zirconium dioxide measuring cell as an oxygen ion conductor
Perm. flow rate of flue gas (only with AGO20...)	1...10 m/s
Perm. types of fuel	Light oil (EL) or natural gas (H)
Measuring range	0.2...20.9% O_2
Perm. cable length	Max. 100 m
Recommended cable length	<10 m
Power supply lines (mains cable)	
- Wire dia.	Min. 1 mm²
Cable type	QGO20.000D27: e.g. NYM 3 x 1.5 QGO20.000D17: UL AWM Style 1015/MTW or CSA-AWM/TEW
Required operating temperature of measuring cell	700 °C ±50 °C

Environmental conditions

Storage	DIN EN 60721-3-1
Climatic conditions	Class 1K3
Mechanical conditions	Class 1M2
Temperature range	-20...+60 °C
Humidity	<95% r.h.
Transport	DIN EN 60721-3-2
Climatic conditions	Class 2K2
Mechanical conditions	Class 2M2
Temperature range	-25...+70 °C
Humidity	<95% r.h.
Operation	DIN EN 60721-3-3
Climatic conditions	Class 3K5
Mechanical conditions	Class 3M2
Temperature range	
- Flange	Max. 250 °C
- Connecting head	Max. 70 °C
- Flue gas	≤300 °C
Humidity	<95% r.h.

Attention!
Condensation, formation of ice and ingress of water are not permitted!

AGO20...

Tube	DN50, steel X5 CrNi 18 9
Tube length	**303 Stainless Steel**
- For AGO20.001A	180 mm
- For AGO20.002A	260 mm
Flange	DN50, steel X5 CrNi 18 9

6 Description of functions

6.1 Functioning principle of the measuring cell

The measuring cell of the QGO20... is made of ceramics (ZrO_2) stabilized with Y_2O_3. At temperatures above 500 °C, oxygen ions can diffuse through the ceramics material. It carries a porous platinum layer on both sides, which serve as electrodes.

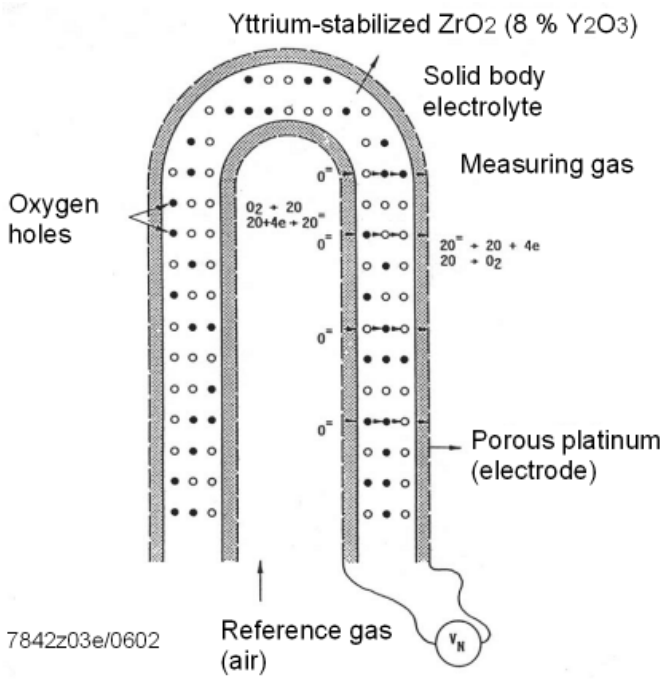


Figure 2: Functioning principle of the measuring cell

The diffusion of ions starts when concentrations on both sides of the cell differ.
The diffusion of oxygen ions carries electrical charges that generate an electrical field across the platinum electrodes.
When in equilibrium, the diffusion force compensates the force of the electrical field.
On the one hand, the porous platinum electrodes serve for the catalytic conversion of the molecules into ions, and vice versa
($O_2 \Leftrightarrow 20 + 2e$), on the other, for the acquisition of voltage.
The voltage across the electrodes is the so-called Nernst voltage. The magnitude of this voltage is dependent on the difference in oxygen concentration and the cell's temperature.

$$V_N = \frac{R \times T}{4 \times F} \ln \frac{O_{2\text{-Ref.}}}{O_2} = (mV)$$

where	V_N	=	Nernst voltage
	R	=	gas constant 8.3 J/K
	F	=	Faraday constant 96.486 As
	T	=	absolute cell temperature (K)
	O_2-Ref.	=	Oxygen content of reference gas (air: 20.9%)
	O_2	=	oxygen content of measured gas

that is = $\frac{R}{4 \times F}$ = 21.5 $\frac{\mu V}{K}$ or

$\frac{R \times T}{4 \times F}$ = 20.9 mV at T = 700 °C = 973 K

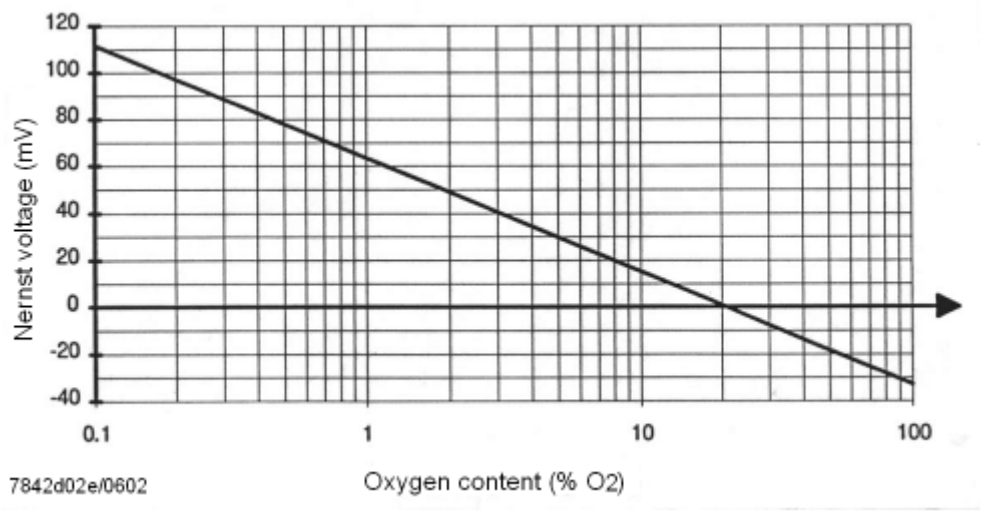


Figure 3: Nernst voltage as a function of the oxygen concentration at a cell temperature of 700 °C

6.2 Impact of the cell's temperature

The slope of the curve changes on a change of cell temperature.
The lower the temperature, the lower the Nernst voltage and the higher the displayed oxygen concentration.
The higher the temperature, the higher the Nernst voltage and the lower the displayed oxygen concentration.

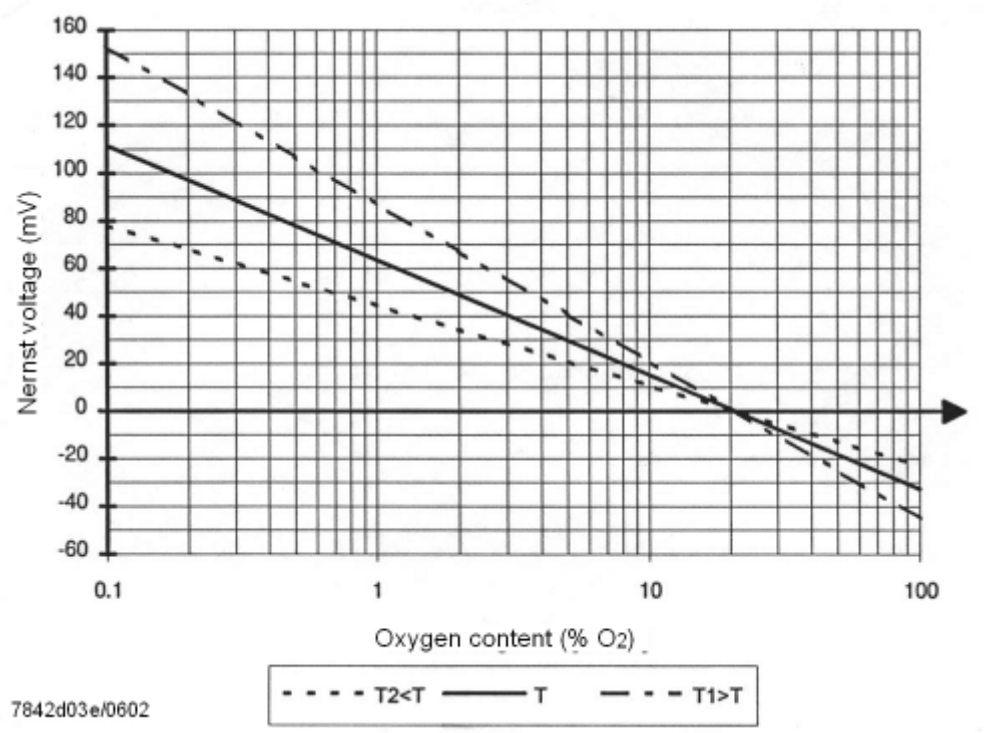


Figure 4: Impact of the cell's temperature on the oxygen value

To limit the error, the temperature in the PLL52... is also considered when calculating the oxygen value and monitored for a minimum temperature.
The actual temperature is continuously acquired and serves as an input variable for controlling the cell's temperature and for calculating the actual oxygen content.

6.3 Impact of the reference gas

When the oxygen concentration of the reference gas changes, the point of intersection of the straight line with the abscissa will change (20.9%).

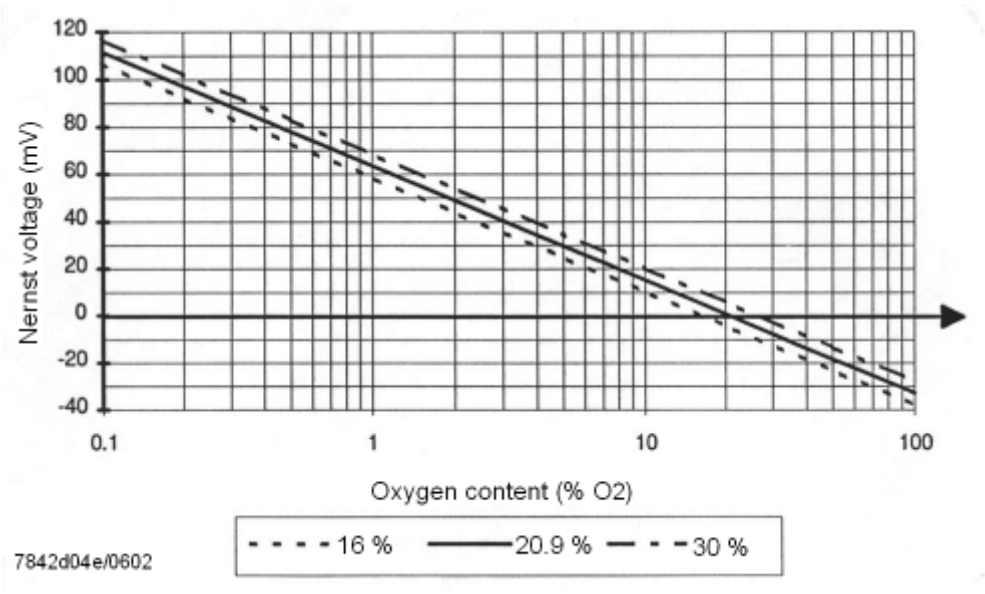


Figure 5: Nernst voltage as a function of the reference gas

Note
The QGO20... is a device that does not measure the absolute but the relative oxygen value.
The result is calculated based solely on the ratio of the partial pressures of the reference gas (ambient air) and the measuring gas.

6.4 Switching on and switching off

When switching the sensor on or off, temperature differences generate thermo-electric voltages of up to 100 mV (both positive and negative).
These can produce erroneous measurements during the heating up phase.
It is recommended to observe the heating up times specified in *Engineering notes*.

6.5 Aging

Due to aging, the characteristics *internal resistance* and *response time* can change.
The LMV52... with PLL52... measures these characteristics at regular intervals and triggers an alarm should programmable limits be exceeded.

Assessment of aging with the help of the LMV52... with PLL52... and AZL52...

On the display, the following 2 values can be checked:
- Internal resistance: Max. 150 Ω
- Response time: Max. 5 seconds

If one of these 2 limits is exceeded, the QGO20... must be replaced.

7 Mechanical design of the sensor

The function of the oxygen sensor is ensured by the following components:

1) **Measuring cell**
The measuring cell acquires differences in oxygen concentrations and delivers a Nernst voltage.

2) **Gas routing**
Ensures exchange of the measuring gases in the vicinity of the measuring cell.

3) **Heating**
The heating maintains the cell's temperature at 700 °C.

4) **Thermocouple**
The thermocouple acquires the temperature in the cell and delivers a signal of about 40 µV/K, which is used for temperature control.

5) **Connecting head**
The connecting head contains the sensor's connection terminals and the temperature compensation element. The compensation element delivers a current of about 1 µA/K which represents the temperature inside the head. The sum of head temperature and thermocouple temperature gives the absolute temperature in the measuring zone (normally 973 K).

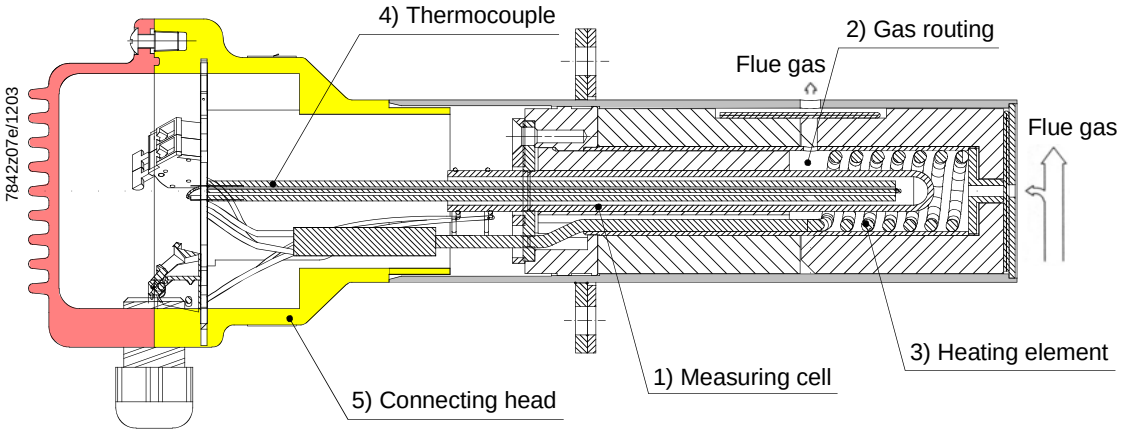


Figure 6: Mechanical design of the oxygen sensor

8 Mounting and connecting the sensor

8.1 Mounting

To simplify mounting in the chimney, different types of AGO20... flue gas collectors are available.

The AGO20... provides 2 functions:

1. Collection of flue gases and passing them to the sensor (Figure 7), adapting the sensor to the chimney.
2. Serving as a flange for accepting and mounting the QGO20... It is welded gas-tight directly into the end section of the flue gas pipe.

For mounting position, refer to Mounting Instructions M7842 (4 319 2366 0).
To reduce the response time in the case of low flow rate, the AGO20... can also be mounted in an inclined position (Figure 7).
It must be ensured that the hole closest to the sensor head protrudes into the chimney.

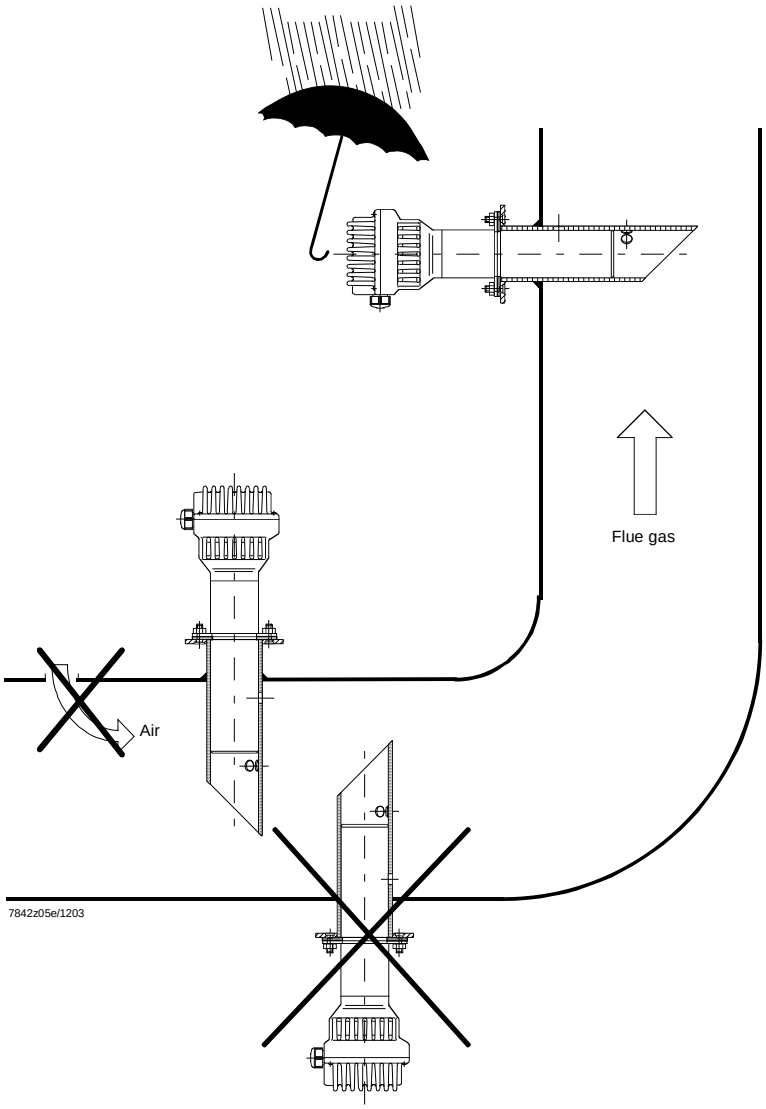


Figure 7: Mounting position of QGO20...

8.2 Connection

Figure 8 shows the connection of the QGO20... to the PLL52...

Note
The signal lines require shielded 6-core cables with twisted pairs.
The shielding is to be connected to terminal GND of the PLL52...

- Open the cover only when the main switch is off so that both live and neutral conductors are disconnected
- There is a risk of burning since the measuring cell works at an operating temperature of 700 °C

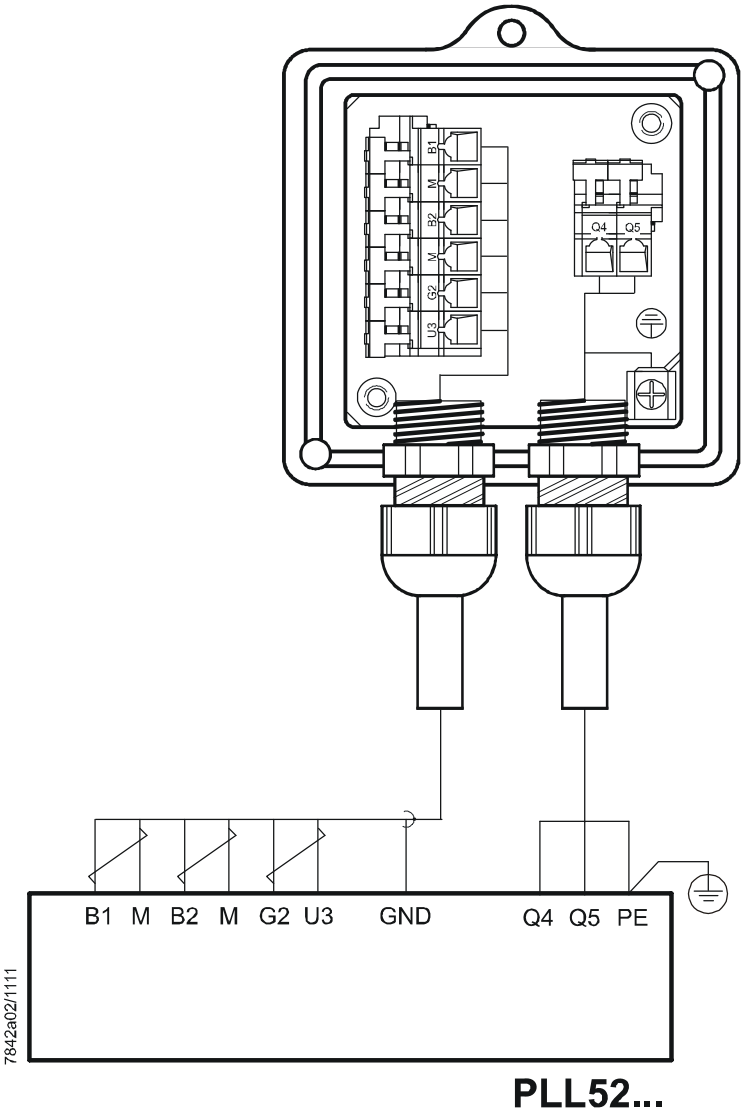


Figure 8: Connection

9 Connection diagram

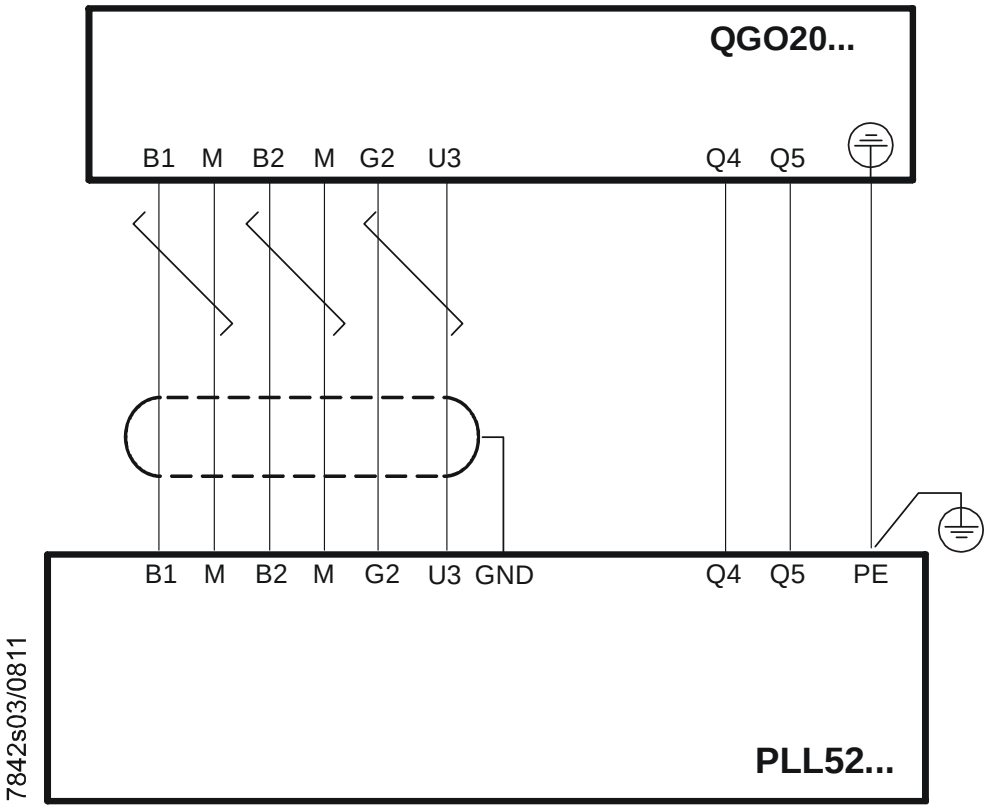


Figure 9: Connection diagram

Legend

B1	(+)	Signal of oxygen measuring cell
B2	(+)	Thermocouple voltage
G2	(-)	Supply temperature compensation element
GND		Electrical ground for shielding
M	(-)	Electrical ground for signals *B1* and *B2*
M	(-)	
Q4		Sensor heating with mains connection
Q5		Sensor heating with mains connection
U3	(+)	Signal of temperature compensation element
⏚		Protective earth (PE)

10 Dimensions

Dimensions in mm

QGO20.000D27

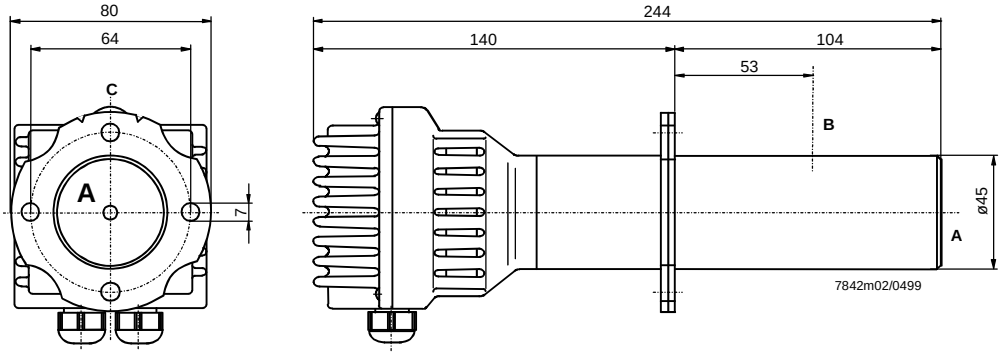


Figure 10: Dimension QGO20.000D27

QGO20.000D17

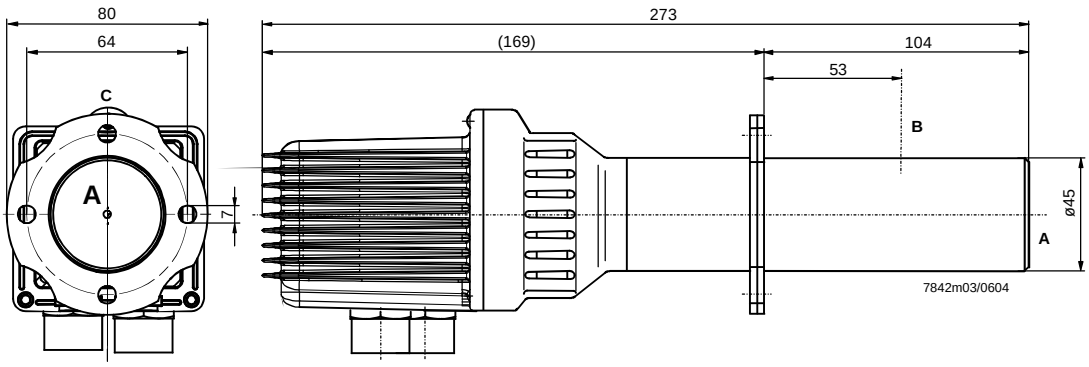


Figure 11: Dimension QGO20.000D17

AGO20...

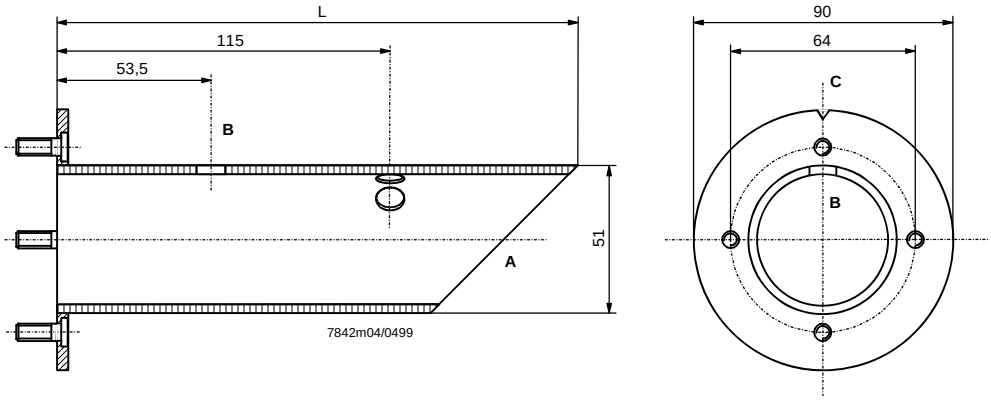


Figure 12: Dimension AGO20

Legend

A Flue gas inlet
B Flue gas outlet
C Notch on the flange marking the flue gas outlet side
L 180 mm for AGO20.001A
260 mm for AGO20.002A

11 List of figures

Figure 1: Example General overview 11
Figure 2: Functioning principle of the measuring cell 14
Figure 3: Nernst voltage as a function of the oxygen concentration at a cell temperature of 700 °C 15
Figure 4: Impact of the cell's temperature on the oxygen value 16
Figure 5: Nernst voltage as a function of the reference gas 17
Figure 6: Mechanical design of the oxygen sensor 19
Figure 7: Mounting position of QGO20... 20
Figure 8: Connection 21
Figure 9: Connection diagram 22
Figure 10: Dimension QGO20.000D27 23
Figure 11: Dimension QGO20.000D17 23
Figure 12: Dimension AGO20 23
Figure 13: Table with the different types of flue gas analyzers (figures in %) 26

12 Index

A

Accortment connections ... 12
Addendum ... 26

C

Connecting head ... 19
Connection diagram ... 22
Control unit ... 12

D

Description of functions ... 14
- **Aging** ... 18
- Assessment of aging with the help of the LMV52 with PLL52 and AZL52 ... 18
- **Functioning principle of the measuring cell** ... 14
- **Impact of the cell's temperature** ... 16
- **Impact of the reference gas** ... 17
- **Switching on and switching off** ... 18

Dimensions ... 23
- AGO20 ... 23
- QGO20.000D17 ... 23
- QGO20.000D27 ... 23

F

Flange gasket ... 12
Flue gas collectors ... 12

G

Gas routing ... 19

H

Heating ... 19

M

Measuring ... 19
Mechanical design of the sensor ... 19
Mounting and connecting the sensor ... 20
- **Connection** ... 21
- **Mounting** ... 20

O

Overview ... 11
Oxygen sensor ... 12

S

Safety notes ... 7
- **Commissioning notes** ... 9
- **Disposal notes** ... 10
- **Electrical connection of the oxygen sensor** ... 9
- **Engineering notes** ... 8
- Functional check ... 9
- **Installation and mounting notes** ... 8
- **Service notes** ... 10
- **Standards and certificates** ... 10
- **Warning notes** ... 7

T

Technical data ... 13
- **AGO20** ... 13
- **Environmental conditions** ... 13
- **General unit data** ... 13

Thermocouple ... 19

13 Addendum

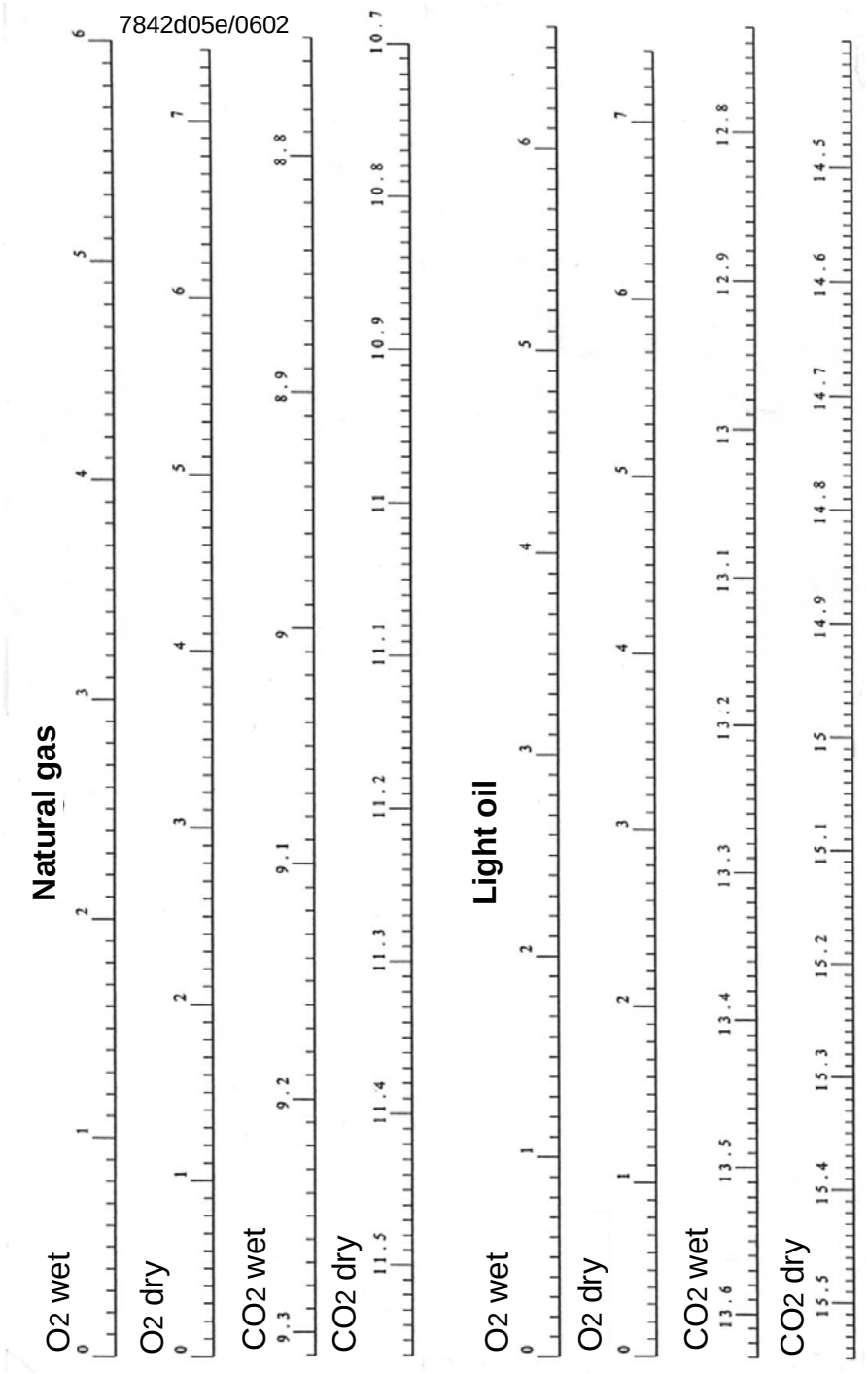


Figure 13: Table with the different types of flue gas analyzers (figures in %)

Siemens AG Infrastructure & Cities Sector Building Technologies Division
Berliner Ring 23
D-76437 Rastatt
Tel. +49 7222 598-279
Fax +49 7222 598-269
www.siemens.com

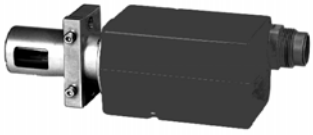
© 2013 Siemens AG Infrastructure & Cities Sector
Building Technologies Division
Subject to change!



QRA7… with clamp



QRA10...



QRA53..., QRA55... with clamp



QRA2... with clamp

Flame Detectors

QRA2...
QRA10...
QRA53...
QRA55...
QRA73…
QRA75…

The UV flame detectors are designed for use with Siemens burner controls, for the supervision of gas or oil flames.

The QRA... and this Data Sheet are intended for use by OEMs which integrate the flame detectors in their products.

Use

The flame detectors are used for the supervision of gas flames, yellow- or blue-burning oil flames and for ignition spark proving.

Flame detector	For use with burner control type	Operating mode
QRA2..., QRA10...	LGB2... / LGB4... with AGQ1... LFL... LFE1... LFE10... LMG... with AGQ2... LME21… / LME22… / LME39… with AGQ3… / LME7... LMV2… / LMV3... LMV5… with AGQ1…	Intermittent
QRA53..., QRA55...	LGK16... LGI16...	Continuous operation
QRA73…, QRA75…	LMV5…	Continuous operation

Warning notes



To avoid injury to persons, damage to property or the environment, the following warning notes must be observed!

- All activities (mounting, installation and service work, etc.) must be performed by qualified staff
- Before making any wiring changes in the connection area, completely isolate the plant from mains supply (all-polar disconnection). Ensure that the plant cannot be inadvertently switched on again and that it is indeed dead. If not observed, there is a risk of electric shock hazard.
- Ensure protection against electric shock hazard by providing adequate protection for the terminals. If this is not observed, there is a risk of electric shock
- Each time work has been carried out (mounting, installation, service work, etc.), check to ensure that wiring is in an orderly state. If this is not observed, there is a risk of electric shock
- Halogen lamps, welding equipment, special lamps or ignition sparks may produce sufficient radiation for the detector's UV cell to ignite. X-rays and gamma radiation can also generate erroneous flame signals. If this is not observed, there is a risk of loss of safety functions
- Fall or shock can adversely affect the safety functions. Such units must not be put into operation, even if they do not exhibit any damage. If this is not observed, there is a risk of loss of safety functions and a risk of electric shock

Mounting notes

- Ensure that the relevant national safety regulations are complied with

Installation notes

- Always run the high-voltage ignition cables separate while observing the greatest possible distance to the detector and to other cables

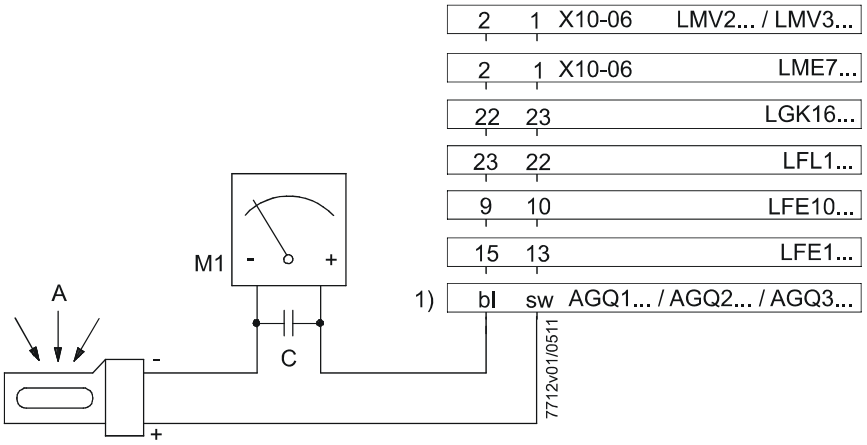
Electrical connection of the flame detector

It is important to achieve practically disturbance- and loss-free signal transmission:

- Never run the detector cable together with other cables
  – Line capacitance reduces the magnitude of the flame signal
  – Use a separate cable
- Observe the permissible lengths of the detector cable (refer to «Technical data» in the Data Sheet of the relevant burner control)

Trouble-free burner operation is ensured only when the intensity of UV radiation at the detector's location is high enough for the detector's UV cell to ignite during each half wave. The **intensity of UV radiation** at the detector's location **is checked** through **measurement of the detector current**

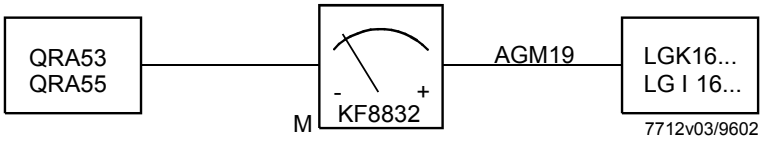
Measuring circuit for QRA2..., QRA10..., QRA5...series D and QRA5...series G



Legend

1) Connection of micro-ammeter across AGQ1... / AGQ2... / AGQ3... adapter and flame detector
A Incidence of radiation
M Micro-ammeter (DC), internal resistance ≤ 5000 Ω
C Electrolytic capacitor 100...470 µF, DC 10...25 V

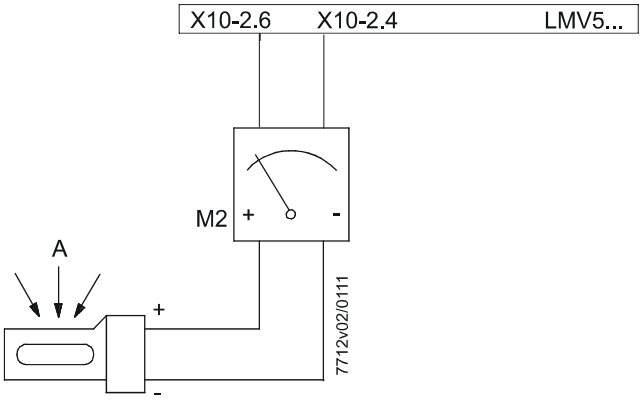
Measuring circuit for QRA5... up to the C-series and QRA5...series E



Note!
The KF8832 flame detector current measuring device must not be used in continuous operation!

Minimum detector current values required:
Refer to the Data Sheet of the relevant burner control or to the Operating Instructions of the KF8832.

Measuring circuit for QRA7...



Legend

M2 Voltmeter direct current voltage
Measurement range 0...10 V
Internal resistance Ri ≥10 MΩ

Certificates

Conformity to EEC directives

- Electromagnetic compatibility EMC (immunity)	2004/108/EC
- Low-voltage directive	2006/95/EC

ISO 9001: 2008
Cert. 00739

ISO 14001: 2004
Cert. 38233

Service notes

Use the KF8832 service unit for short periods of time only.

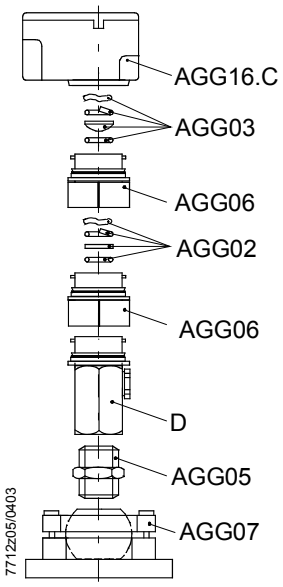
Disposal notes

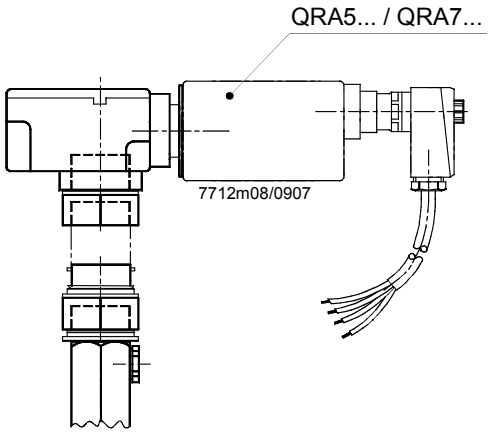


The flame detector contains electrical and electronic components and must not be disposed of together with domestic waste.
Local and currently valid legislation must be observed.

Mechanical design

Flame detectors QRA2...	Plastic housing, metalized to prevent static charging caused by the air flow from the fan. For mounting direct on the burner. The detectors can be supplied with or without securing flange (version 4 241 8855 0/4 241 8898 0) and clamp (refer to «Type summary»).
Flame detectors QRA10...	Die-cast aluminum housing with a 1 in. mounting coupling (D) and connection facility for cooling air. The housing of this detector has a bayonet fitting which allows it to be secured either directly to the 1 in. mounting coupling or to the AGG06 glass holder. The 1 in. mounting coupling can be screwed to a viewing tube or to the AGG07 ball head. The Pg cable gland can be removed and replaced, if some other detector cable shall be used.
Flame detectors QRA5..., QRA7…	The detector's UV cell is located behind a swiveling shutter at the front end of the detector tube which is flanged to the housing. A quartz-glass window protects the tube and the shutter against dirt. The detector's housing accommodates a stepper motor to drive the shutter and the electronics to control the shutter. Using the AGG16.C adapter, this flame detectors can be mounted either directly on the burner, on a viewing tube or on a combustion chamber viewing hole.
Plug AGM19	AGM19 complete with cable for the connection of QRA53... and QRA55... flame detectors.
Adapter AGG16.C	AGG16.C for QRA53..., QRA55..., made of die-cast aluminum with a 1 in. mounting coupling. The 1 in. mounting coupling (D) is attached to the housing with a bayonet fitting.





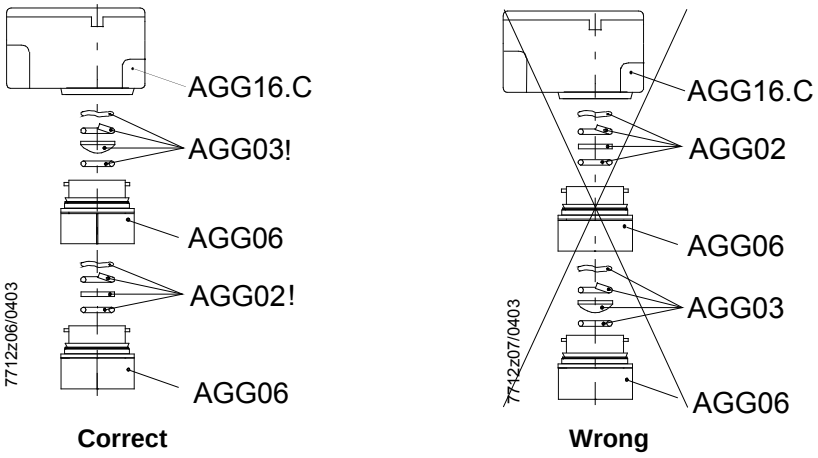
QRA5... / QRA7… with AGG16.C and AGG06

Note!
AGG03 or AGG02 can also be fitted in the 1 in. mounting coupling (D) of the AGG16.C (or QRA10...). An adapter combination with AGG06 glass holder, mounting coupling and ball joint for QRA53..., QRA55..., QRA7… and QRA10... is possible.

Connector AGM23	Connector AGM23 with cable for the electrical connection of flame detector QRA7…
Connector AGM23U	Connector AGM23 with wires for the electrical connection of flame detector QRA7… in US design

Glass and quartz-glass lens holder AGG06

The glass and quartz-glass lens holder AGG06 serves for holding the AGG03 lens and the AGG02 heat insulation glass.
The lens is used to increase the sensitivity, and the heat insulation glass provides protection against high temperatures, thus extending the life of the UV cell.
The AGG06 also allows various combinations of lens, heat insulation glass and 1 in. mounting coupling.
When using the lens and the heat insulation glass, the AGG06 with the lens must be mounted as close as possible to the flame detector.



Correct **Wrong**

AGG06 has a bayonet fitting with which it is attached either to the housing of the AGG16.C or to the housing of the QRA10... and the 1 in. mounting coupling.
By undoing the bayonet fittings on both sides, the AGG06 glass holder(s) can be easily detached from the combination of QRA10... or AGG16.C and QRA53... or QRA55....
This facilitates straightforward cleaning of the glass or lens without having to remove them from the AGG06 glass holder.
The intermediate rings are used for the smooth running of the bayonet fittings, especially where – after removal of the flame detector – the hole to the combustion chamber serves as a viewing tube.
By fitting the intermediate ring to the appropriate bayonet connection, the combination can be undone where required by rotating the housing of the QRA10... or AGG16.C

Quartz-glass lens AGG03

AGG03 with spring washer and O-ring for increasing the sensitivity.

Heat insulation glass AGG02

AGG02 with spring washer and O-ring, offering the same mounting choices as AGG03.
This heat insulation glass is required on applications where the temperature at the flame detector exceeds 80 °C.

Mounting coupling (D)

Using the bayonet fitting, the 1 in. mounting coupling can be attached either to the AGG06, the AGG16.C or the QRA10... flame detector.
The mounting coupling is supplied with the QRA10... or AGG16.C.

Nipple AGG05

1 in. nipple AGG05 for connecting the 1 in. mounting coupling (D) to the AGG07 ball head.

Ball head AGG07

AGG07 with 1 in. internal thread.
Connection on AGG05 and for use with the 1 in. mounting coupling and AGG06.
The AGG07 is used for mounting on a rigid surface, such as the boiler wall.
It facilitates optimum adjustment of the viewing angle.

Type summary

Flame detectors

Type reference	Sensitivity	Flange and clamp	Terminal cover	Spare UV tube
QRA2	Normal	Without	Black	AGR 4 502 1131 0
QRA2(1)	Normal	With 4 241 8855 0 / 4 199 8806 0	Black	AGR 4 502 1131 0
QRA2(2)	Normal	With 4 241 8898 0 / 4 199 8806 0	Black	AGR 4 502 1131 0
QRA2.9 [1])	Normal	Without	Black	AGR 4 502 1131 0
QRA2M	High	Without	Green	AGR 4 502 4065 0
QRA2M(1)	High	With 4 241 8855 0 / 4 199 8806 0	Green	AGR 4 502 4065 0
QRA2M(2)	High	With 4 241 8898 0 / 4 199 8806 0	Green	AGR 4 502 4065 0
QRA10.C	Normal	---	---	AGR 4 502 1131 0
QRA10M.C	High	---	---	AGR 4 502 4065 0

1) With heat-resistant housing for ambient temperatures up to 200 °C (short-time, up to a few seconds)

Type reference	Sensitivity	Detector tube length	Mains voltage	Spare UV tube
QRA53.E27	Normal	125 mm	AC 220...240 V	AGR 4 502 4065 0
QRA53.E17	Normal	125 mm	AC 100...110 V	AGR 4 502 4065 0
QRA53.G27	High	125 mm	AC 220...240 V	AGR 4 502 4065 0
QRA53.G17	High	125 mm	AC 100...110 V	AGR 4 502 4065 0
QRA55.E27	Normal	69 mm	AC 220...240 V	AGR 4 502 4065 0
QRA55.E17	Normal	69 mm	AC 100...110 V	AGR 4 502 4065 0
QRA55.G27	High	69 mm	AC 220...240 V	AGR 4 502 4065 0
QRA55.G17	High	69 mm	AC 100...110 V	AGR 4 502 4065 0

Type reference	Sensitivity	Detector tube length	Mains voltage	Spare UV tube
QRA73.A27	Normal	125 mm	AC 230 V +10 / -15 %	AGR 4 502 4065 0
QRA73.A17	Normal	125 mm	AC 120 V +10 / -15 %	AGR 4 502 4065 0
QRA75.A27	Normal	69 mm	AC 230 V +10 / -15 %	AGR 4 502 4065 0
QRA75.A17	Normal	69 mm	AC 120 V +10 / -15 %	AGR 4 502 4065 0

Note!
Mounting Instruction for replacing of spare UV tube, refer to 4 319 9513 0 (M7712.5)!

Note!
All QRA5... and QRA7... are delivered complete with clamp. Use of the detector requires a connecting cable **AGM19 / AGM23** / **AGM23U** (refer to «Accessories» for QRA5... / QRA7...).

Accessories for QRA2... and QRA5... and QRA7… when ordered as single items

Part	For use with	Part number
Flange rounded [1])	QRA2...	**4 241 8855 0**
Flange straight [2])	QRA2...	**4 241 8898 0**
Clamp [1]) [2])	QRA2...	**4 199 8806 0**
Clamp for direct mounting	QRA5... / QRA7…	**4 199 1034 0**

1) Supplied with QRA2...(1) types
2) Supplied with QRA2...(2) types

Accessories for QRA2...



AGG09 IP40-Kit
- cable sealing element Ø 5...8 mm

Accessories for QRA5... / QRA7…



AGG16.C adapter
- for flame detector mounting QRA53... and QRA55... / QRA7…



AGM19 connecting cable
- cable length 2 m
- with plug for QRA53..., QRA55...



KF8832 unit for measuring the detector current
- with QRA53..., QRA55... recommended for use with detector types up to the C-series



AGM23 connecting cable
- cable length 2 m
- with plug for QRA7…



AGM23U connecting cable
- cable length 4 m
- with plug for QRA7…
- US design

Accessories for
QRA10... and AGG16.C

AGG02 heat insulation glass
- with spring washer and O-ring

AGG03 quartz-glass lens
- with spring washer and O-ring
- for detectors of the B-series, lens AGG01 is available



AGG05 nipple 1 in.



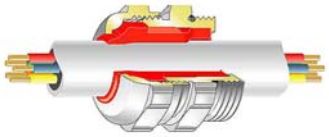
AGG06 glass and quartz-glass lens holder
- with intermediate ring



AGG07 ball head
- with 1 in. internal thread
- swivel range 13°



AGG08 IP65-kit for QRA10...
- for different types of cable diameter







Cable sealing element ∅ in mm	**Color**
4...6,5 mm	Yellow
6,5...9,5	Black
9...15	Red

Ordering

When ordering, please give type references according to «Type summary».

Technical data

General detector data	Average life of UV cell	Approx. 10,000 hours at max. 50 °C, higher ambient temperatures reduce considerably the cell's life
	Perm. combustion chamber pressure	
	- QRA10...	Max. 50 mbar
	- QRA10... + AGG03 or AGG02	Max. 500 mbar
	Degree of protection	
	- QRA2...	IP20
		Note! IP40 conforming to DIN EN 60529 when using adequate cable entries (e.g. AGG09).
	- QRA10...	IP54 (IP65 with AGG08)
	- QRA5x.E... / QRA5x.G...	IP65
	- QRA7…	IP65
	Mounting position	Optional
	Weight	
	- AGG01	Approx. 10 g
	- AGG02	Approx. 10 g
	- AGG03	Approx. 10 g
	- AGG05	Approx. 170 g
	- AGG06	Approx. 160 g
	- AGG07	Approx. 1330 g
	- AGG16.C	Approx. 650 g
	- QRA2...	Approx. 46 g
	- QRA10...	Approx. 740 g
	- QRA10... + AGG03	Approx. 750 g
	- QRA5x.E..., QRA5x.G...	Approx. 700 g
	- QRA7…	Approx. 700 g
	Ignition cable (only QRA2...)	2 x 0.75 mm²; 5.1 mm dia.

Environmental conditions	**Storage**	IEC 60721-3-1
	Climatic conditions	Class 1K3
	Mechanical conditions	Class 1M2
	Temperature range	-20...+60 °C
	Humidity	<95 % r.h.
	Transport	IEC 60721-3-2
	Climatic conditions	Class 2K2
	Mechanical conditions	Class 2M2
	Temperature range	-20...+60 °C
	Humidity	<95 % r.h.
	Operation	IEC 60721-3-3
	Climatic conditions	Class 3K3
	Mechanical conditions	Class 3M3
	Temperature range	-20...+60 °C
	Humidity	<95 % r.h.

Caution!
Condensation, formation of ice and ingress of water are not permitted!
If this is not observed, there is a risk of loss of safety functions and a risk of electric shock.

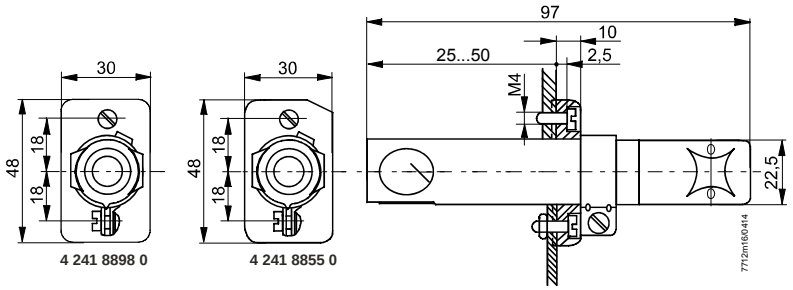
Function

With this type of flame supervision, the UV radiation emitted by gas or oil flames is used to generate the flame signal.
The radiation detector consists of a UV-sensitive cell with 2 electrodes, which ignite when illuminated with radiation in the 190...270 nm range of the spectrum, thereby triggering a current in the flame detector circuit.
The UV cell does not respond to glowing firebrick in the combustion chamber, daylight or light from boiler room illumination.

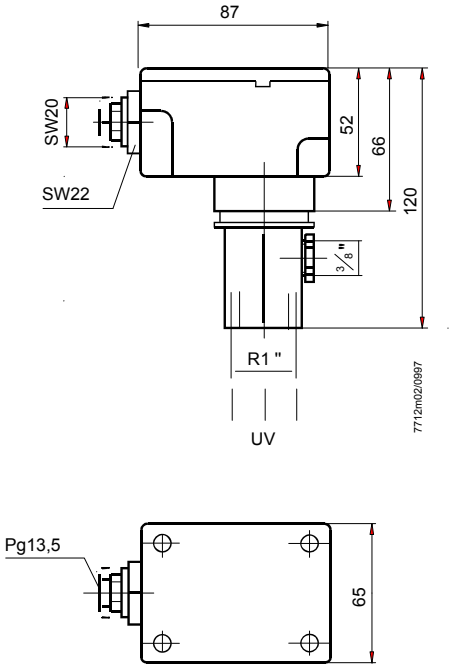
Dimensions (cont´d)

Dimensions in mm

QRA2...

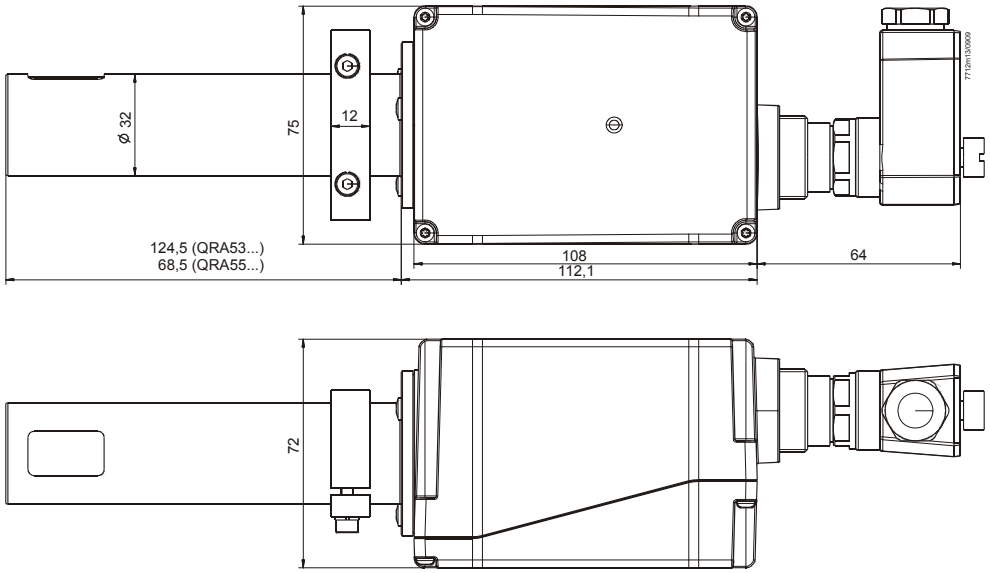


QRA10...

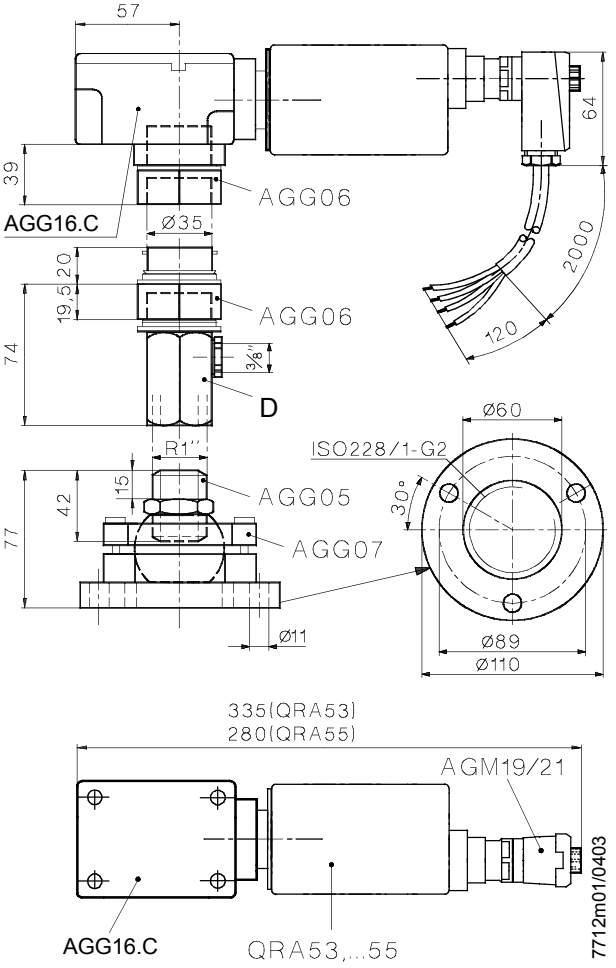


Dimensions in mm

QRA5x.E... /
QRA5x.G...

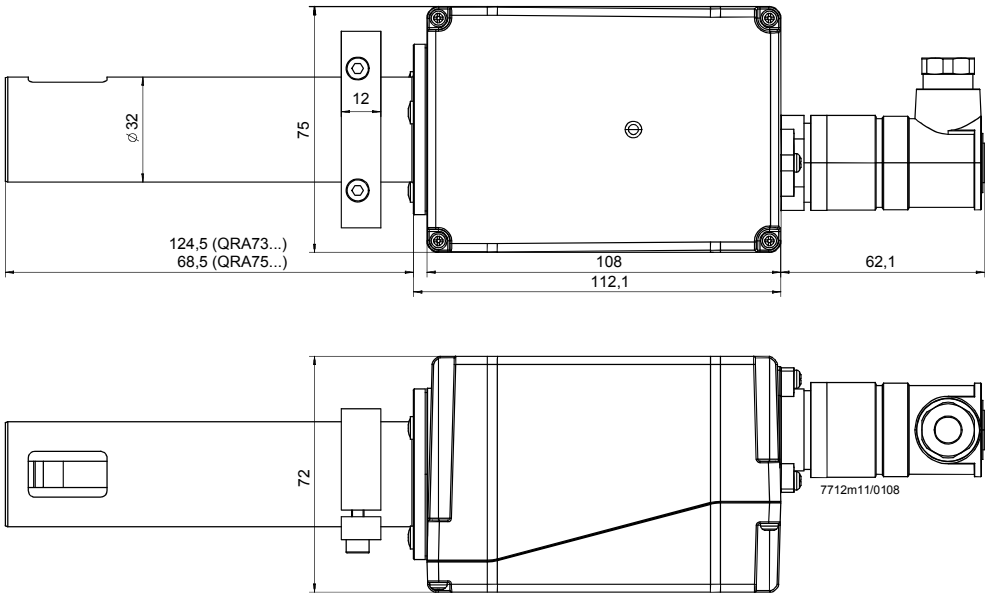


QRA5... with AGG05, AGG06, AGG07, AGG16.C and AGM19

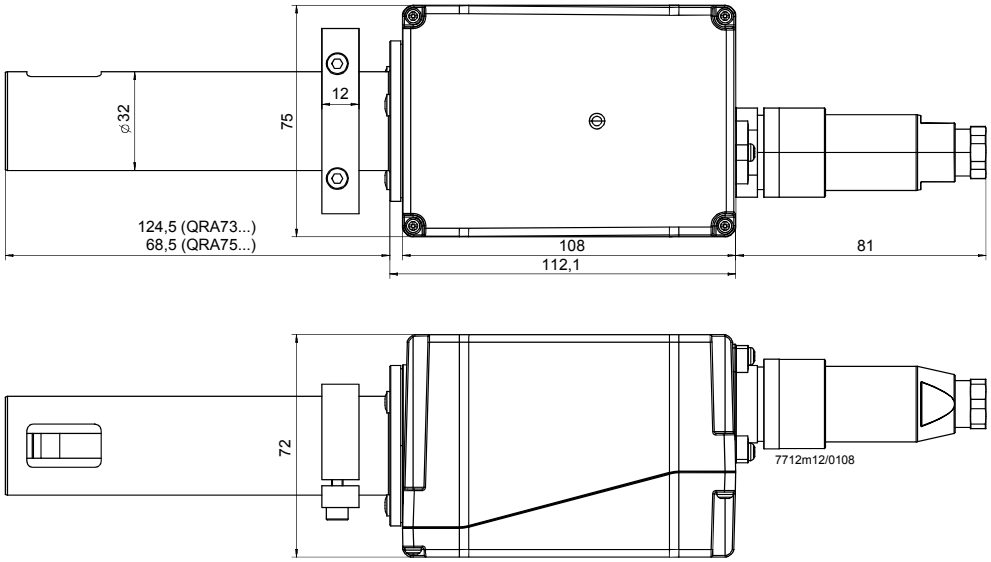


Dimensions in mm

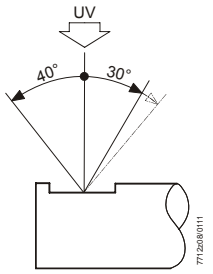
QRA7… with AGM23



QRA7… with AGM23U



Incidence of radiation for QRA5... / QRA7...

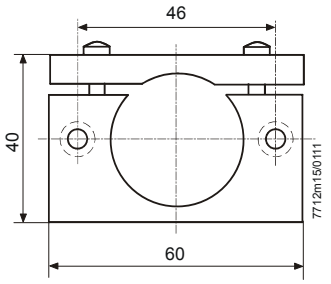


Dimensions in mm

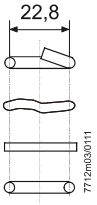
Accessories

4 199 1034 0

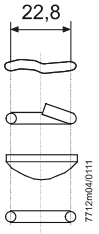
Clamp for direct mounting on the burner or the AGG16.C



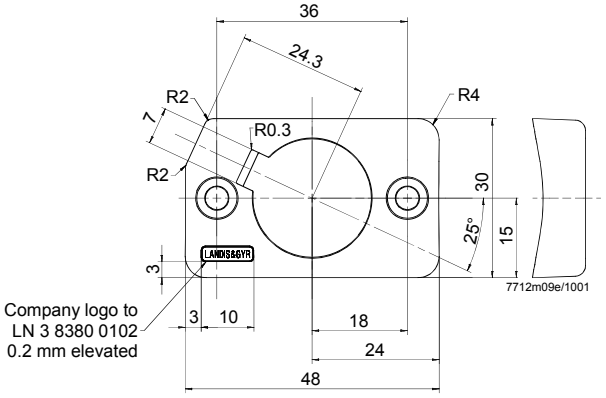
AGG02



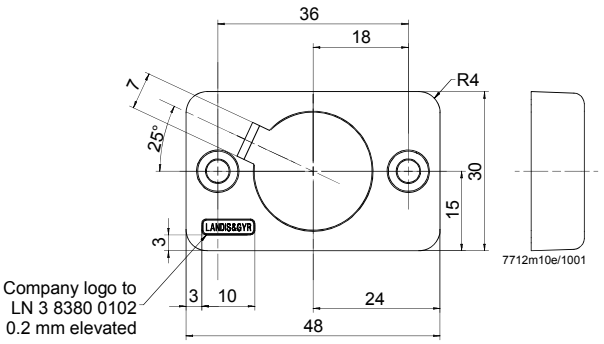
AGG03



4 241 8855 0



4 241 8898 0



©2014 Siemens AG Infrastructure & Cities Sector Building Technologies Division
Subject to change!



Infrared Flame Detectors QRI...

Infrared flame detectors for use with Siemens burner controls, for the supervision of gas, oil and other flames that emit infrared light.
The QRI... are suited for burners of any capacity, either in continuous or intermittent operation.

The QRI... and this Data Sheet are intended for use by OEMs which integrate the flame detectors in their products.

Use, features

Key features of the QRI... flame detectors:
- Detector with infrared-sensitive flame detecting element
- Integrated flame signal amplifier
- Designed for frontal and lateral (90°) illumination
- Suited for use with burner controls type LMV5...
- Secured to the burner with flange and clamp

The spectral sensitivity of the QRI... is a maximum of about 2 µm covering infrared radiation emitted by gas, oil, and coal flames as well as other sources of infrared light. Owing to electronic self-supervision of the flame signal, the QRI... can be used in connection with suitable burner controls designed for burners in continuous or intermittent operation.
The sensitivity of the QRI... is such that it must be fitted behind the burner's baffle plate.

Warning notes



To avoid injury to persons, damage to property or the environment, the following warning notes must be observed!

Do not open, interfere with or modify the flame detector!

- All activities (mounting, installation and service work etc.) must be performed by qualified staff. If not observed, there is a risk of impairment of safety functions and of electric shock hazard
- Before making any wiring changes in the connection area, completely isolate the plant from mains supply (all-polar disconnection). Ensure that the plant cannot be inadvertently switched on again and that it is indeed dead. If not observed, there is a risk of electric shock hazard
- Ensure protection against electric shock hazard by providing adequate protection for the burner control's connection terminals. If not observed, there will be a risk of electric shock
- Each time work has been carried out (mounting, installation, service work, etc.), check to ensure that wiring is in an orderly state and that the correct terminals of the LMV5... are used and make the safety checks as described in *Commissioning notes.* If not observed, there is a risk of impairment of safety functions and of electric shock hazard
- Make certain that none of the 3 connecting wires of the QRI... is connected to terminal X10-02 pin 3 (mains voltage **L**)! Risk of damage to QRI... and LMV5...!
- Due to its mounting location behind the baffle plate, the flame detector has high signal sensitivity and, therefore, identifies small variations in infrared radiation as a flame. For this reason, make certain that so-called heat streaks after loss of flame (emitted for example by after-glowing combustion chamber lining) will not reach the detector as these would simulate a flame. Air turbulence or similar may modulate infrared radiation emitted by hot boiler or burner components in a way that a flame will be simulated. Likewise, moving parts in the detector's viewing range can cause infrared radiation from the boiler (or a viewing tube) to be modulated, thereby possibly generating sporadic detector signals. Strong burner or detector vibrations can also produce variations in radiation. For this reason, the burner or boiler manufacturer must make certain that such modulated radiation cannot reach the flame detector. For example, loose cables (moving up and down in the fan's airstream) are not permitted within the detector's viewing range. If this is not observed, there is a risk of loss of safety functions
- Consider carefully the use of infrared flame supervision if several burners use the same combustion chamber (if this is not observed, there is a risk of loss of safety functions). In general, this type of flame supervision is not suited for the specific supervision of individual burners
- Check to ensure that the burner will initiate lockout when – while the burner is running – the flame detector is removed from its fixing on the burner and – without moving it – is exposed to room lighting
- Fall or shock can adversely affect the safety functions. Such units must not be put into operation even if they do not exhibit any damage

Mounting notes

- Ensure that the relevant national safety regulations are complied with
- Secure the flame detector to the burner with the clamp and flange provided. With the clamp's fixing screw loosened, the detector can be correctly adjusted toward the flame. This adjustment can be checked by watching the intensity of the flame signal on the AZL5... display and operating unit of the LMV5... burner control, or with the help of the measuring circuit (see *Detector signal measurement*)
- Ensure that the connection between the metal surface of the flange and the burner's earthed housing is electrically conductive

Installation notes

Locate the detector such that, if possible, only the flickering peripheral range of the flame will be detected. The view at hot boiler walls or other hot boiler or burner components must be restricted as much as possible. This can be attained by clearly confined viewing conditions behind narrow baffle plates. If this is not possible, a viewing tube should be used to restrict the viewing range to a smaller area of the flame. Length, diameter and alignment of the viewing tube must be determined through testing, depending on the size of burner and boiler

The viewing range should be reduced to such an extent that:

a) the minimum detector output signal required is attained over the burner's entire output range (for details, refer to the Basic Documentation of the LMV5... (P7550)

b) after loss of flame, the valve's operating voltage is switched off by the burner control as required by the standards (see *Commissioning notes*).

Electrical connection of the flame detectors

It is important to achieve practically disturbance- and loss-free signal transmission:

- Never run the detector cable together will other cables
  - Line capacitance reduces the magnitude of the flame signal
  - Use a separate cable
- Observe the permissible length of the detector cables (see *Technical data*)
- Always run the ignition cable separate while observing the greatest possible distance to other cables (min. 3 cm)
- Test the flame detector on all applications. When used in connection with the LMV5..., the test is to be made with a test routine (for details, see the Basic Documentation P7550)
- Make certain that the detector's cable does not get into contact with hot burner or boiler surfaces
- Use an AC voltmeter (Ri = 10 MΩ) to ensure that there is no voltage across the reference line (blue wire = **N** of the LMV5...) and the burner housing (**PE**)

Commissioning notes

- When commissioning the plant or when doing maintenance work, make the following safety checks:

	Safety check	**Anticipated response**
a)	Burner startup with flame detector darkened	Lockout at the end of safety time (TSA)
b)	Burner startup with flame detector exposed to extraneous light (e.g. light from an incandescent lamp interrupted at about 20 Hz)	Lockout at the end of the prepurge time
c)	Simulation of flame failure during operation. For that purpose, darken the flame detector during operation and maintain this state	Lockout or restart, depending on the burner control's configuration
d)	Check the safety time in operation in the event of loss of flame; for that purpose, disconnect manually the fuel valves from power and check the time the burner control requires from this manual disconnection until the valves' power supply is turned off	Burner control disconnects power supply to the valves within the period of time allowed for the relevant plant

- Make a loss-of-flame test with the AZL5... of the LMV5... burner control

Standards and certificates

Only in connection with the burner control

Conformity to EEC directives

- Electromagnetic compatibility EMC (immunity)	2004/108EC
- Directive for gas appliances	2009/142/EC
- Low-voltage directive	2006/95EC

ISO 9001: 2008
Cert. 00739

ISO 14001: 2004
Cert. 38233

For use in the U.S. / Canada, the flame detectors carry the marks.

Service notes

To clean the detector's lens, use a soft, clean cloth (free from oil and solvents).

Disposal notes

The flame detector contains electrical and electronic components and must not be disposed of together with domestic waste.
Local and currently valid legislation must be observed.

Mechanical design

The QRI... has an impact-proof housing made of black plastic. The lens is fitted in a dust-tight position.
The QRI... can be secured to the burner within its adjusting range, using the clamp and the flange provided.
The 3-core connecting cable is ready connected to the QRI... and features cable strain relief.
Depending on the type of burner construction, there are flame detectors for frontal or lateral illumination available.

Type summary

Type reference	Illumination	Cable length (L)	Cable end	Accessories
QRI2A2.B180B	Frontal	180 cm	Stripped	---
QRI2B2.B180B	Lateral	180 cm	Stripped	---
QRI2B2.B180B1	Lateral	180 cm	Stripped	4 241 8855 0 Flange with radius and clamp

When ordering, please give the complete type reference according to *Type summary*.



Flange, with radius **4 241 8855 (**



Flange, straight **4 241 8898 (**



Clamp **4 199 8806 (**



Mounting kit for frontal illumination **AGG2.110**
Consisting of heat insulating piece AGG15 (¾“ 14-NPSM thread), heat insulation glass, adapter sleeve and clamp



Adapter, protective sleeve Pg9 / ½“ 14-NPSM thread **AGG2.12(**



Mounting coupling **AGG04**

Adapter of ¾“ 14-NPSM thread for a European pipe thread (G1").



Heat insulating piece (spare part) **AGG15**

Mounting of the mounting coupling AGG04 and the mounting kit AGG2.110



Technical data

General detector data	Operating voltage	
	- Operation	DC 14 V ±5%
	- Test	DC 21 V ±5%
	Signal voltage	DC 0...5 V
	Length of connecting cable	Max. 180 cm
	Degree of protection	IP54
	Power consumption	<0.5 W
	Length of auxiliary detector cable	Max. 100 m
	Safety class	II
	Vibrations to IEC 6068-2-6	Max. 1 g / 10...500 Hz
	Weight incl. cable 180 cm	Approx. 0.175 kg
	Mounting position	Optional

Environmental conditions	**Storage**	DIN EN 60721-3-1
	Climatic conditions	Class 1K3
	Mechanical conditions	Class 1M2
	Temperature range	-20...+60 °C
	Humidity	<95% r.h.
	Transport	DIN EN 60721-3-2
	Climatic conditions	Class 2K2
	Mechanical conditions	Class 2M2
	Temperature range	-20...+60 °C
	Humidity	<95% r.h.
	Operation	DIN EN 60721-3-3
	Climatic conditions	Class 3K5
	Mechanical conditions	Class 3M2
	Temperature range	-20...+60 °C short-time (max. 1 min) up to 75 °C
	Humidity	<95% r.h.

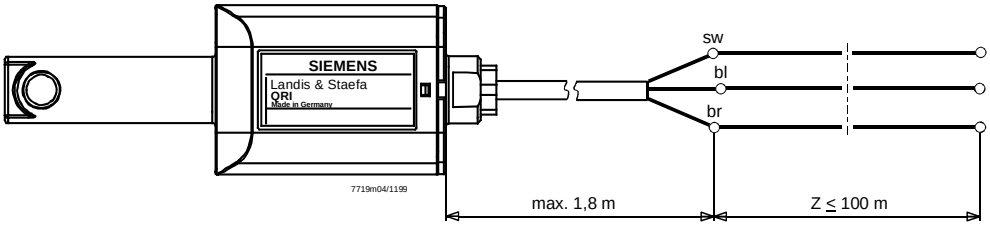


Attention!
Condensation, formation of ice and ingress of water are not permitted!
If not observed, the safety functions are no longer ensured and there will be a risk of electric shock.

With this type of flame supervision, the changes in infrared radiation are used to generate the flame signal. The flame-detecting element is an infrared-sensitive photoresistor whose spectral sensitivity covers the range of approximately 1...3 µm. The detector does not respond to constant radiation or radiation with mains frequency harmonics (e.g. 50 Hz or multiples thereof). The suppression of these radiation frequencies is made electronically, directly dependent on the current mains frequency at which the relevant burner control (e.g. LMV5...) is operated. As a result, filtering takes place within a very narrow band, which means that the signal generated by the flame can almost completely be utilized since the frequency and the rate of change of infrared radiation constantly change. Hence, the detector's ability to capture the flame's radiation behind the burner's baffle plate is extremely high. As a result of the high level of sensitivity, constant or mains frequency-harmonic extraneous light sources remain undetected only if the detector itself is not moved. Due to its short-wave spectrum, the ignition spark will not be detected. The detector's analog output signal (0... approx. +5 V) is a measure of the changes of the flame's radiation intensity.

Maximum detector cable length

If the connecting cable length of 180 cm is not sufficient, the burner manufacturer can extend it up to a maximum of 100 m (also see *Installation notes*).

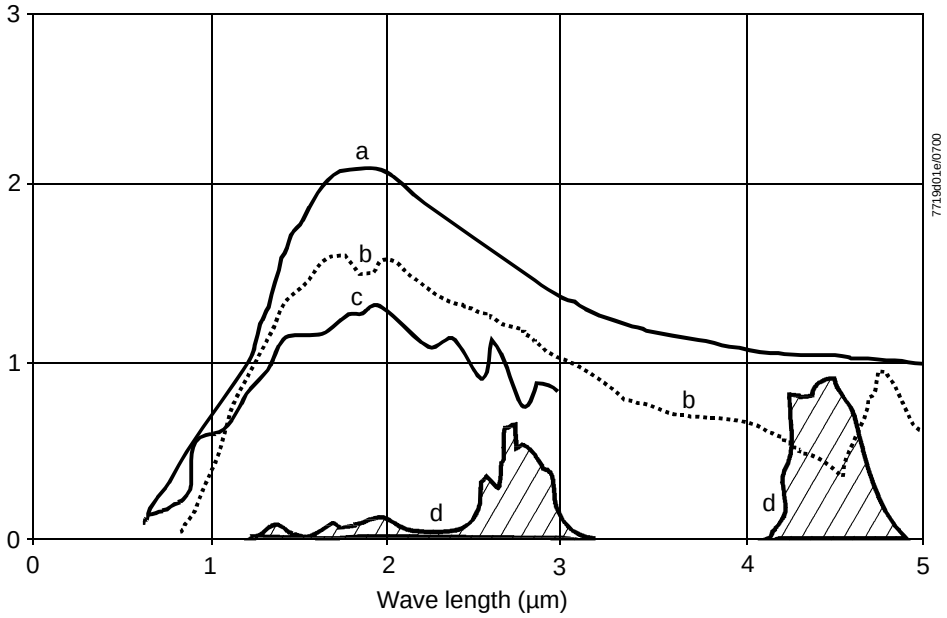


Legend

bl	Blue wire = reference line	sw	Black wire = signal line
br	Brown wire = power line	Z	Extension cable

Flames

Relative intensity of radiation

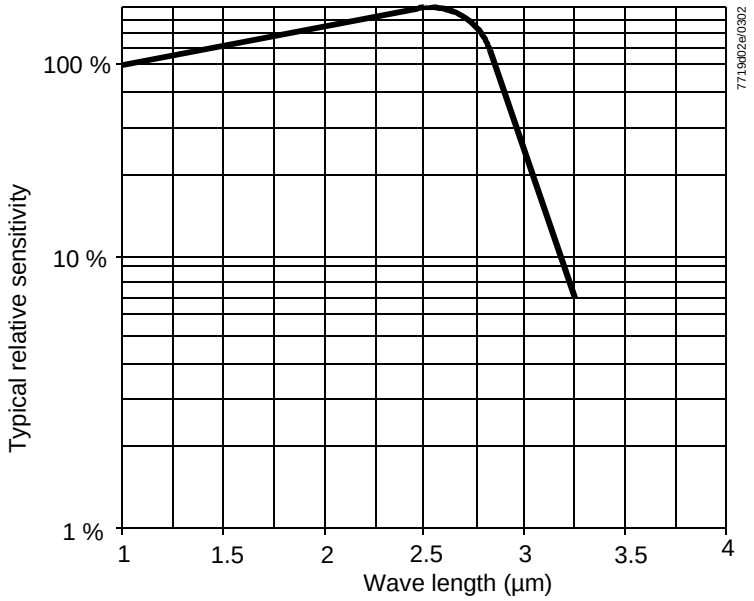


Spectral emission of radiation of luminous and nonluminous flames at 1,500 K (extract from VDI Report no. 423, 1981).

Legend

a Black body radiation
b Pulverized coal flame
c Oil flame
d Gas flame

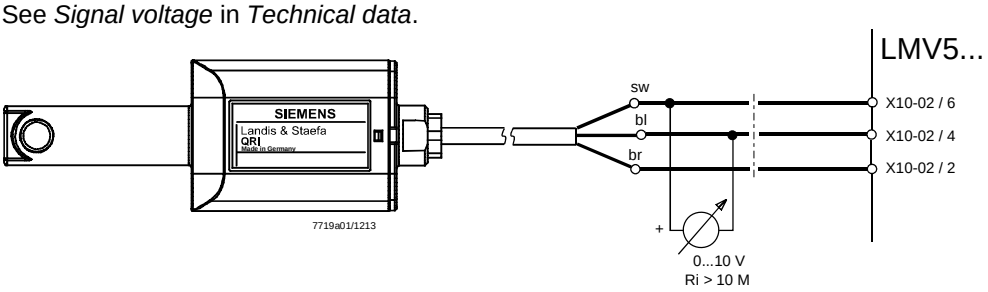
Sensitivity of flame detector



Measuring circuit and connection examples

Measurement of the detector current

See *Signal voltage* in *Technical data*.

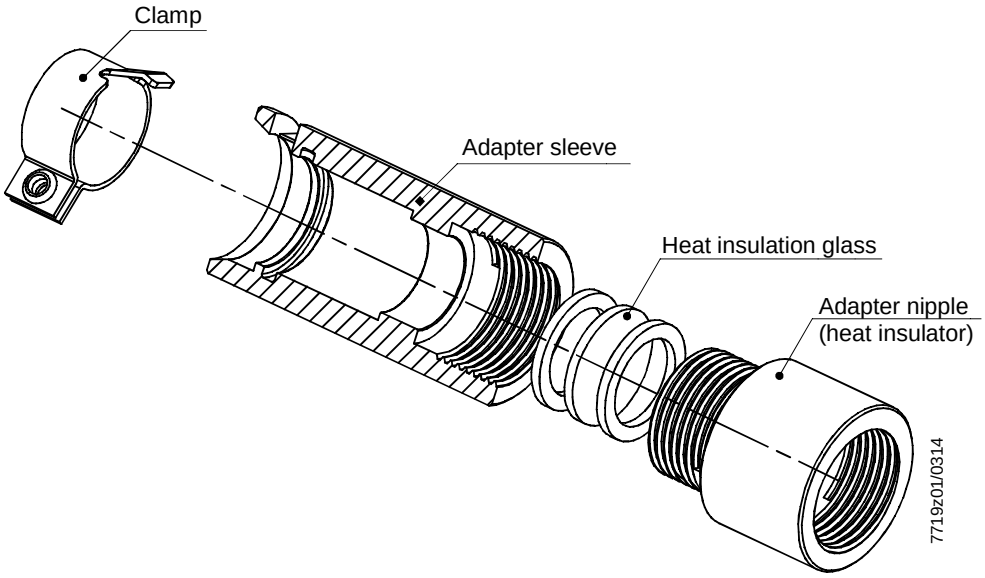


Measurement of the detector's signal with a Voltmeter is not normally required since the flame signal's intensity is shown on the AZL5... display and operating unit.

Drawing of disposition

AGG2.110

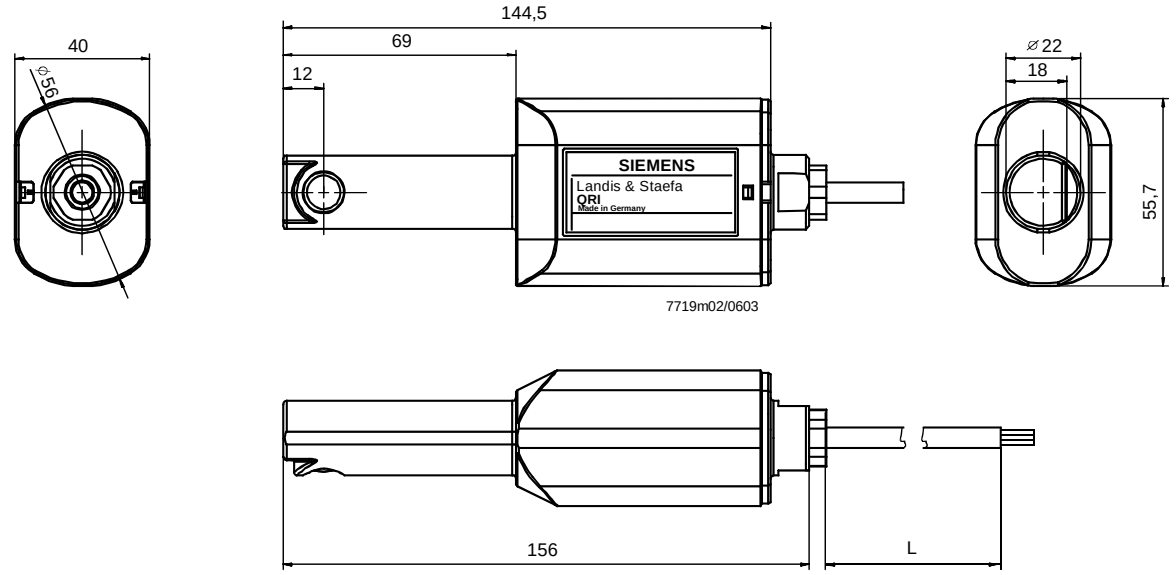
Mounting kit is supplied completely assembled.



Dimensions

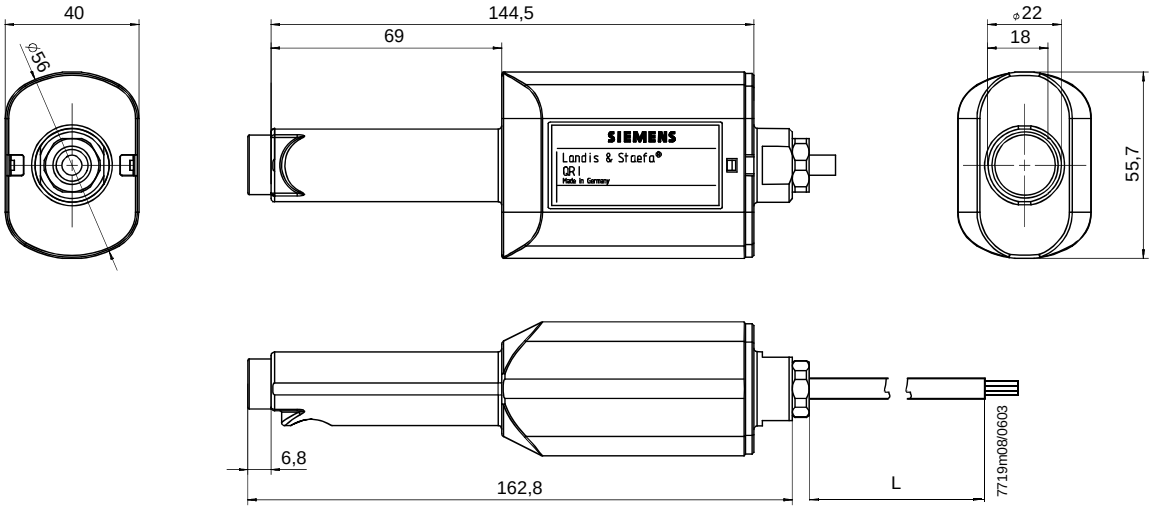
Dimensions in mm

QRI2B...
for lateral illumination



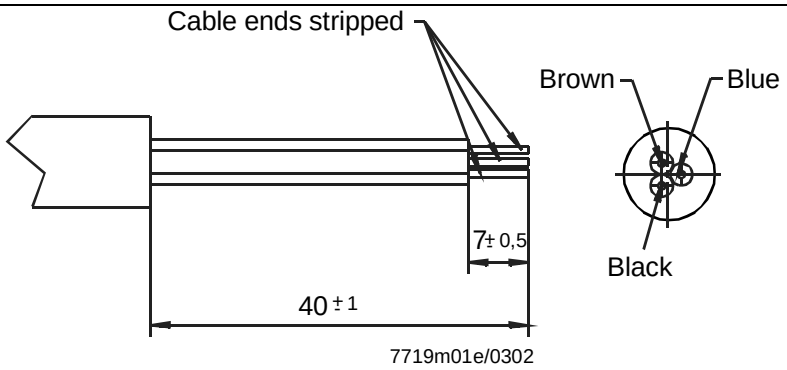
Legend L Available cable length (see *Type summary*)

QRI2A...
for frontal illumination



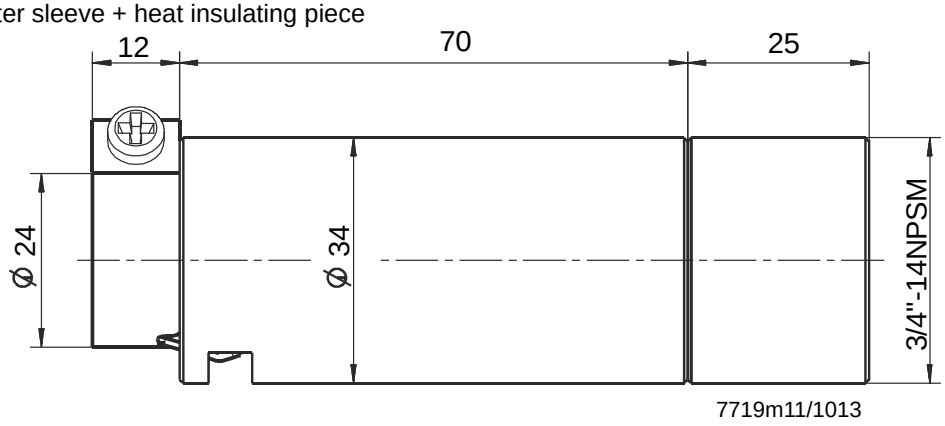
Dimensions (cont'd)

Connecting cable

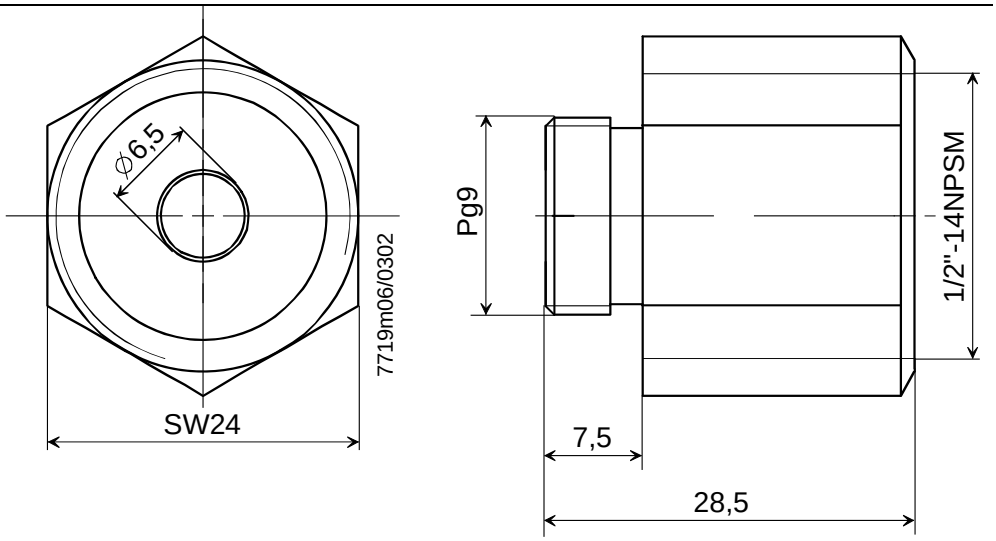


Mounting kit AGG2.110

Clamp (4 199 8806 0) + adapter sleeve + heat insulating piece

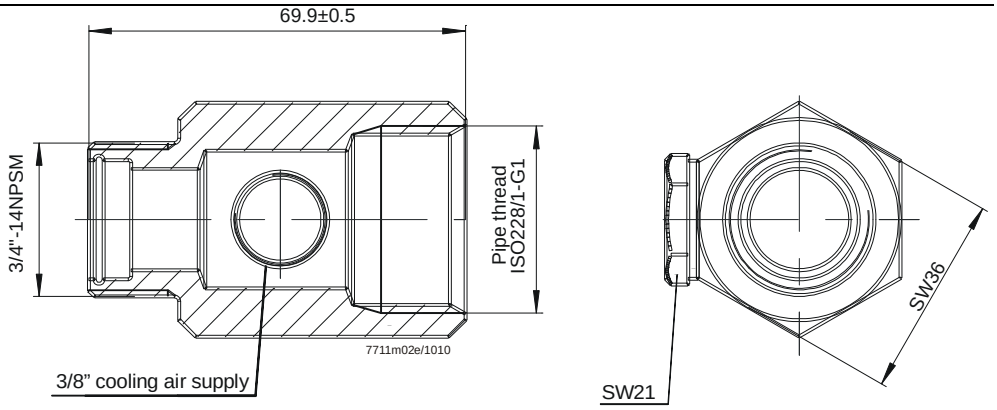


Adapter AGG2.120

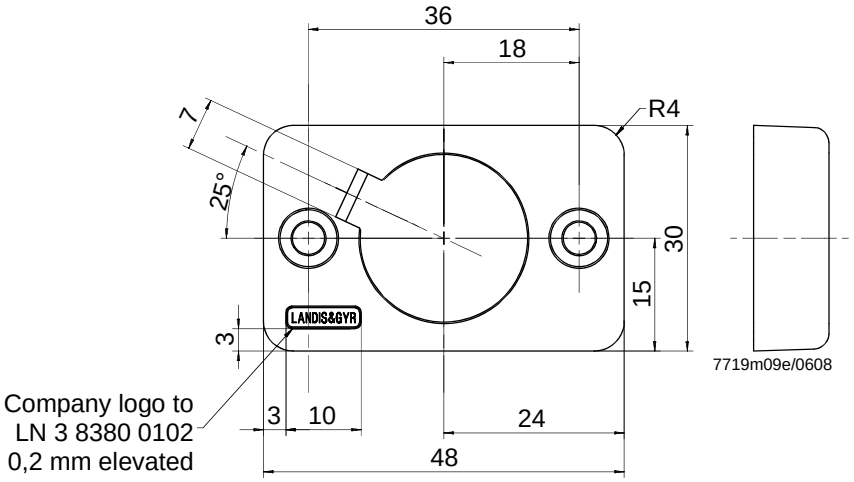


Dimensions (cont'd)

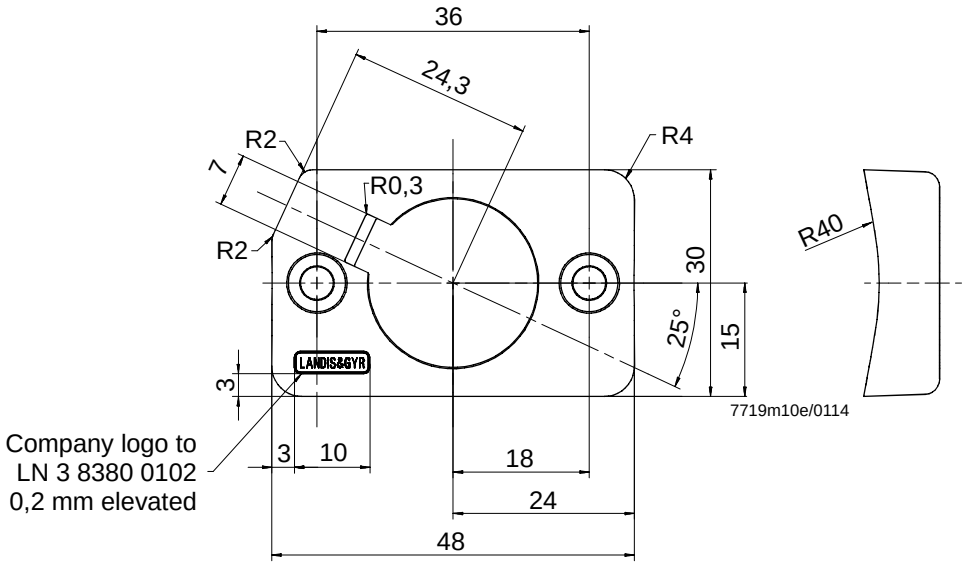
Mounting coupling
AGG04



Flange straight
4 241 8898 0



Flange with radius
4 241 88550



© 2014 Siemens AG Infrastructure & Cities Sector Building Technologies Division
Subject to change!

SIEMENS



RWF50.2 and RWF50.3

Compact universal controllers

Optimized for temperature and pressure control in connection with modulating or multistage burners and air conditioning systems

User Manual

The RWF50.2/RWF50.3 and this User Manual are intended for use by OEMs which integrate the controllers in their products!

Caution!
All safety, warning and technical notes contained in the Data Sheet on the RWF50… (N7866) also apply to this document!

Supplementary documentation

Data Sheet RWF50... ..... N7866
Environmental Declaration RWF50... .....E7866

Contents

1 Introduction 8

1.1 General notes 8
1.2 Typographical conventions 9
1.2.1 Safety notes 9
1.2.2 Warning symbols 9
1.2.3 Notification symbols 10
1.2.4 Presentation 10
1.3 Description 11
1.4 Block structure 12

2 Identification of product no. 13

2.1 Type field 13
2.2 Scope of delivery 13

3 Installation 14

3.1 Installation site and climatic conditions 14
3.2 Dimensions 14
3.3 Side-by-side mounting 15
3.4 Mounting the controller in a panel cutout 15
3.5 Removing the controller from the panel cutout 16
3.6 Cleaning the front 16

4 Electrical connections 17

4.1 Installation notes 17
4.2 Galvanic separation 18
4.3 Assignment of terminals 19

5 Operating modes 21

5.1 Low-fire operation 21
5.2 High-fire operation 22
5.2.1 Modulating burner, 3-position output 22
5.2.2 Modulating burner, analog output 23
5.2.3 2-stage burner, 3-position output 24
5.2.4 2-stage burner, analog output 25
5.3 Burner shutdown 26
5.4 Predefined setpoint 27
5.5 Response threshold (q) 28
5.6 Cold start of plant 29
5.7 Thermal shock protection (TSS) 31

6 Operation 32

6.1 Meaning of display and buttons 32
6.2 Basic display 33
6.3 User level 34
6.4 Manual control, modulating burner 35
6.5 Manual control, 2-stage burner 36
6.6 Starting the self-setting function 37
6.7 Display of software version 38

7 Parameterization PArA 39

8 Configuration ConF 41

8.1 Analog input InP1 42
8.2 Controller Cntr 43
8.3 Thermal shock protection (TSS) rAFC 44
8.4 Control outputs OutP 45
8.5 Binary input binF 46
8.6 Display diSP 47

9 Self-setting function 48

9.1 Self-setting function in high-fire operation 48
9.2 Checking the controller parameters 50

10 PC software ACS411 51

10.1 Safety notes 51
10.2 Setting the correct system parameters 51
10.3 Changing the parameters 51
10.4 Place of installation 52
10.5 License and liability regulations 52
10.6 Procurement of PC software ACS411 52
10.7 Languages 52
10.8 Operating systems : Operating 52
10.9 Prerequisites for hardware 52
10.10 Installation 53
10.11 Others 53
10.11.1 Use of USB port : Use of 53
10.11.2 Powering the controller via the USB port : Powering the controller via the port 53

11 What to do if 54

11.1 Alarm messages: 54
11.2 Others 54

12 Technical data 55

12.1 Inputs 55

12.1.1 Resistance thermometers 55
12.1.2 Input signals 55
12.1.3 Binary input D1 55
12.2 Monitoring the measuring circuit 56
12.3 Controller outputs OutP Controller o 56
12.4 Controller 56
12.5 Electrical data 57
12.6 Housing 57
12.7 Environmental conditions 58
12.8 Segment display 58
12.9 Standards and certificates 58

13 Key 59

14 List of figures 61

1 Introduction

1.1 General notes

Please read this User Manual before switching on the controller. Keep the User Manual in a safe place which can be accessed by all users at all times.

Version!
This User Manual describes all necessary settings (applicable to controller software version XXX.01.01).

⇨ Reference!
See chapter 6.7 *Display of software version.*

Should any problems arise during commissioning, do not make any unauthorized manipulations on the unit. You could endanger your rights under the warranty terms! Please contact us in such a case.

1.2 Typographical conventions

1.2.1 Safety notes

This User Manual contains information which must be observed to ensure your own personal safety and to prevent damage to equipment and property. The instructions and notes are highlighted by warning triangles, a hand or arrow symbol and are presented as follows, depending on the hazard level:

Qualified personnel

Only **qualified personnel** are allowed to install and operate the equipment. Qualified personnel in the context of the safety-related notes contained in this document are persons who are authorized to commission, ground and tag devices, systems and electrical circuits in compliance with established safety practices and standards.

Correct use

Note the following:

The controller may only be used on the applications described in the technical documentation and only in connection with devices or components from other suppliers that have been approved or recommended by Siemens.

The product can only function correctly and safely if shipped, stored, set up and installed correctly, and operated and maintained as specified.

1.2.2 Warning symbols

The symbols for **Caution** and **Attention** are used in this User Manual under the following conditions:



Caution

This symbol is used where there may be a **danger to personnel** if the instructions are disregarded or not strictly observed!



Attention

This symbol is used where **damage to equipment or data** can occur if the instructions are disregarded or not strictly observed!



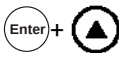
Attention

This symbol is used if **precautionary measures must be taken** when handling electrostatically sensitive components.

1.2.3 Notification symbols

	**Note**	This symbol is used to draw your **special attention** to a remark.
⇨	**Reference**	This symbol refers to **additional information** in other documents, chapters or sections.
abc[1]	**Footnote**	Footnotes are **comments, referring to specific parts of the text.** They consist of 2 parts: 1) **Markings** in the text are arranged as continuous superscript numbers 2) **Footnote text** is placed at the bottom of the page and starts with a number and a period
*	**Action**	An asterisk indicates that **a required action** is described. The individual steps are indicated by asterisks, for example: * Press 

1.2.4 Presentation

	**Buttons**	Buttons are shown in a circle. Either symbols or text are possible. If a button has multiple assignments, the text shown is always the text corresponding to the function currently used.
	**Button combinations**	Two buttons shown in combination with a plus sign means that they must be pressed simultaneously.
ConF → InP → InP1	**Command chain**	Arrows between words serve for finding parameters at the configuration level more easily or for navigating in the ACS411 setup program.

1.3 Description

Use in heating plants

The RWF50... is used primarily for the control of temperature or pressure in oil- or gas-fired heating plants. Depending on the model, it is employed as a compact 3-position controller without feedback of angular positioning or as a modulating controller with an analog output. An external switch is provided to convert it to a 2-position controller for controlling 2-stage burners. The built-in thermostat function switches the burner on and off.

Cooling controller

The controller's operating mode can be changed from heating to cooling, or vice versa.

⇨ Reference!
See chapter 8.2 *Controller* Cntr.

RWF50...

The controllers feature two 4-digit 7-segment displays for the actual value (red) and the setpoint (green).
The RWF50.2 has a 3-position output consisting of 2 relays to open or close a controlling element.
The RWF50.3 has an analog output.

Control

In modulating mode, the RWF50... operates as a PID controller. In 2-stage mode, the RWF50... provides control based on the set switching threshold. Using the binary input, a change to a second setpoint can be made or the setpoint can be shifted. Standard feature is a self-setting function used to determine the PID control parameters.

Mounting

The controller insert measures 48 x 48 x 104 mm and is especially suited for installation in control panels. All electrical connections are made via screw terminals at the rear of the unit.

1.4 Block structure

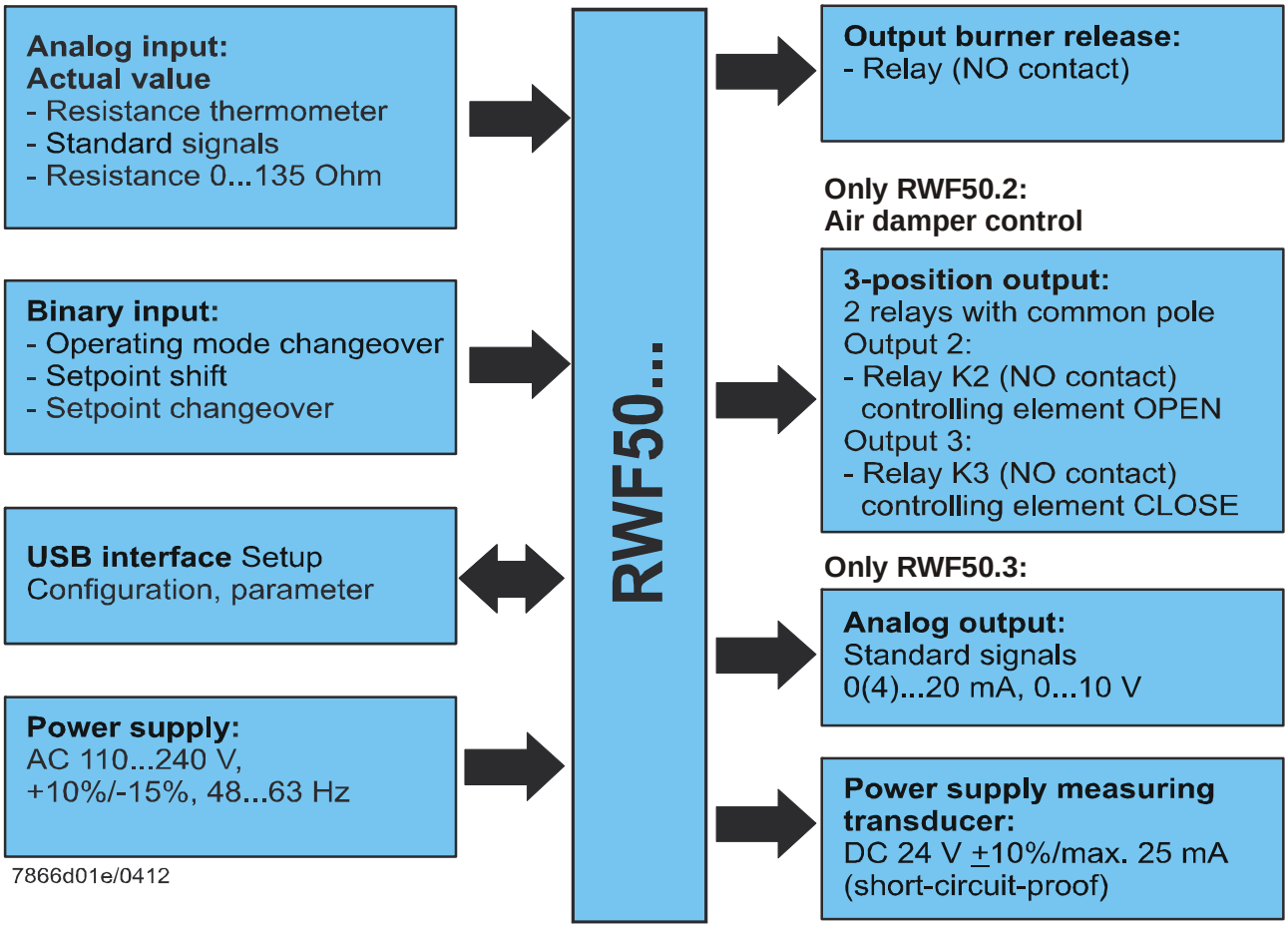


Figure 1: Block structure

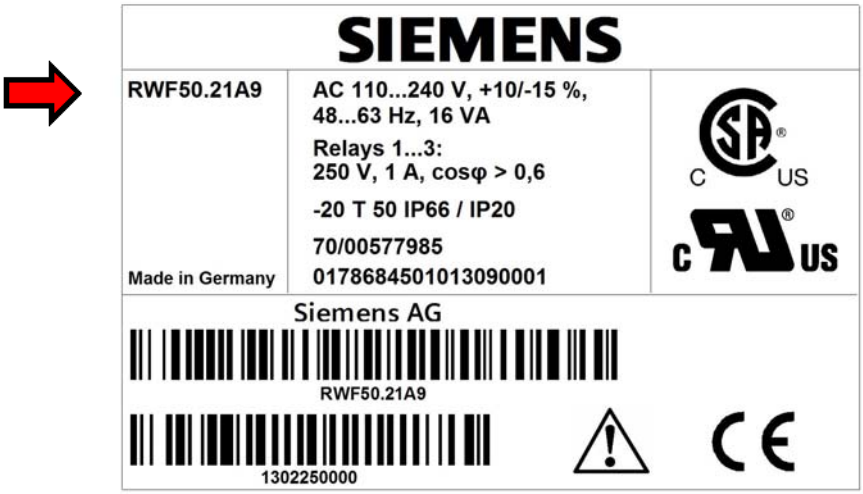
2 Identification of product no.

2.1 Type field

Location:

The type field is glued onto the housing. The arrow below indicates the product no.

Example



Attention!
Mains supply must correspond to the operating voltage given on the type field.

Product nos. :

Product no.	Description
RWF50.20A9	Basic version with 3-position output – single pack
RWF50.21A9	Basic version with 3-position output – multipack
RWF50.30A9	Basic version with analog output – single pack
RWF50.31A9	Basic version with analog output – multipack

30 PACK IS DISCONTINUED

2.2 Scope of delivery

- Type of controller as ordered
- User Manual

3 Installation

3.1 Installation site and climatic conditions

- The installation site should be free from vibrations, dust and corrosive media
- The controller should be installed away from sources of electromagnetic fields, such as variable speed drives or high-voltage ignition transformers

Relative humidity: ≤95% (noncondensing)
Ambient temperature: -20...50 °C
Storage temperature: -40...70 °C

3.2 Dimensions

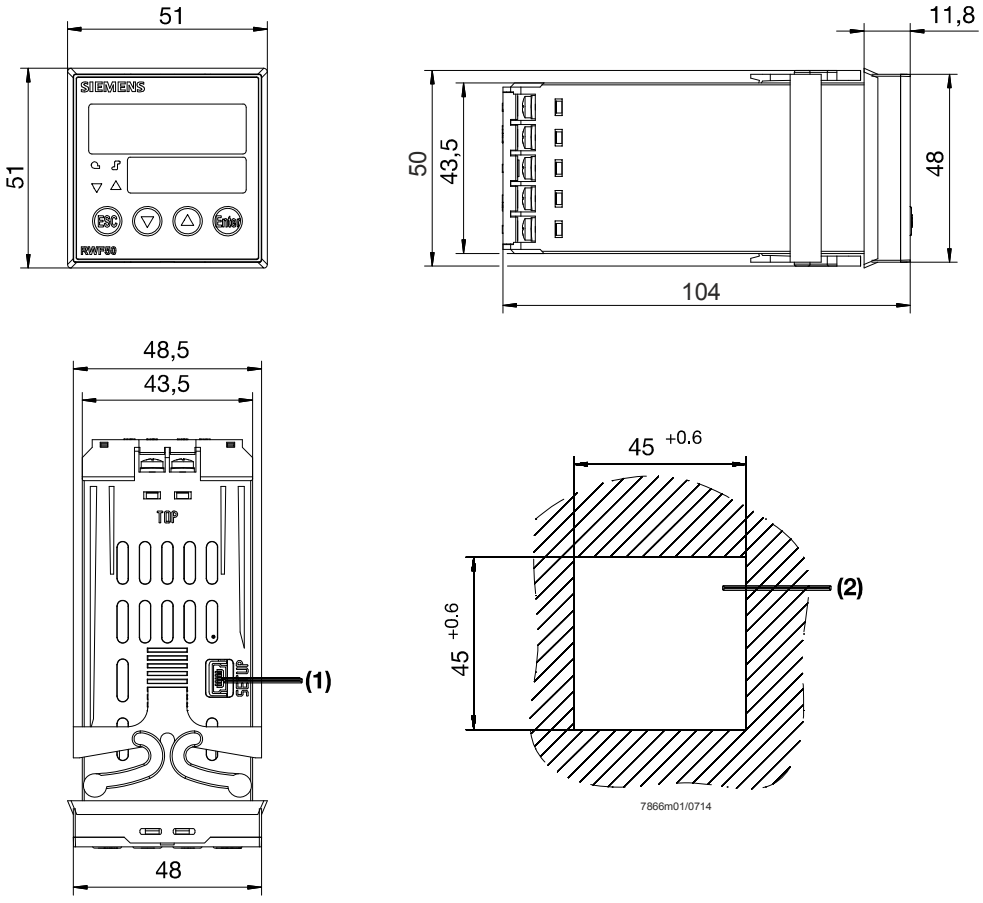


Figure 2: Dimensions of RWF50...

Key
(1) USB interface setup
(2) Panel cutout

3.3 Side-by-side mounting

If several controllers are mounted side-by-side or above one another in a control panel, the horizontal distance between panel cutouts must be a minimum of 11 mm and the vertical distance a minimum of 50 mm.

3.4 Mounting the controller in a panel cutout

* Remove the frame
* Fit the seal supplied with the controller

Attention!
The controller must be installed with the seal, preventing water or dirt from entering the housing!

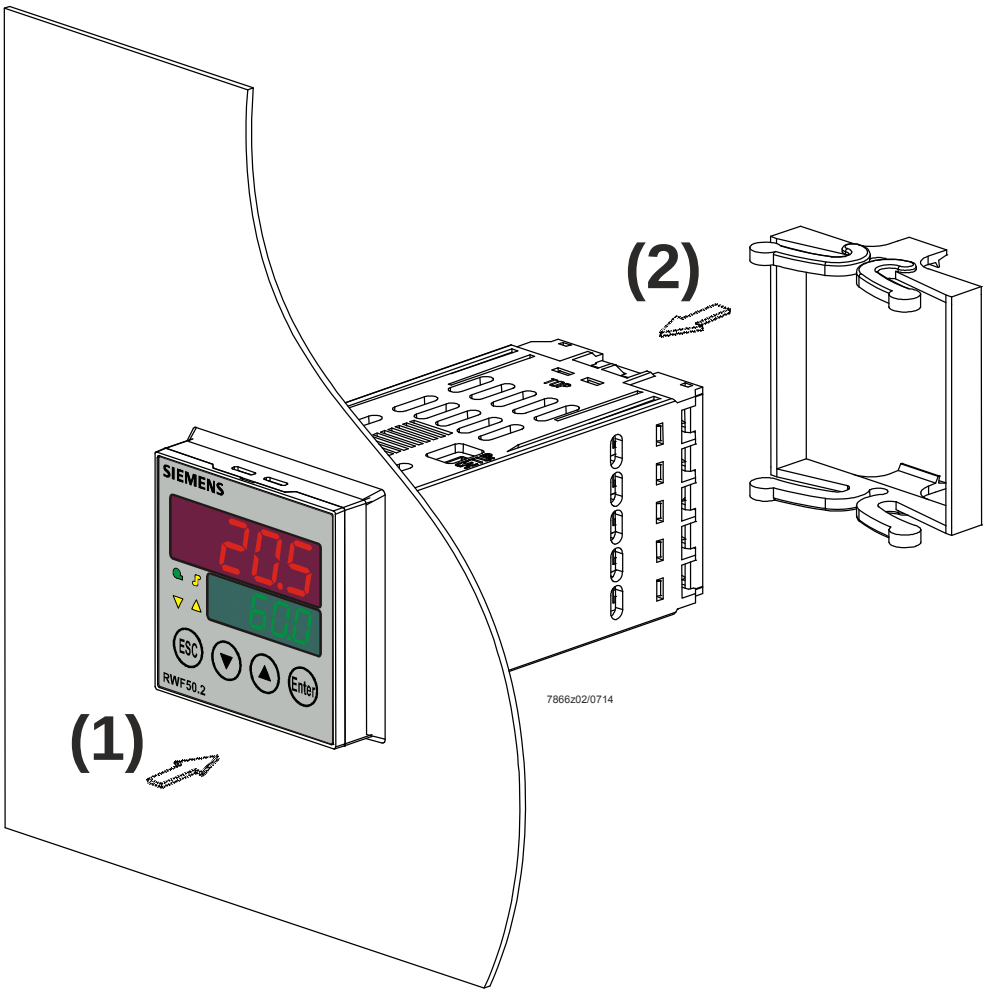


Figure 3: Mounting in a panel cutout

* Insert the controller from the front into the panel cutout (1) and make certain the seal is correctly fitted
* Fit the frame from the rear (2) and let it engage in the grooves

3.5 Removing the controller from the panel cutout

Attention!
When removing the controller, make certain that all cables are disconnected and that they do not get squeezed between control panel and housing.

3.6 Cleaning the front

The front of the controller can be cleaned with normal washing/rinsing agents or detergents.

Attention!
The front of the controller is **not** resistant to corrosive acids, caustic solutions and abrasive cleaners. Do not clean with high-pressure cleaners!

4 Electrical connections

4.1 Installation notes

Safety regulations

- The choice of cable, installation and electrical connections of the controller must conform to VDE 0100 *Regulations for the installation of power circuits with nominal voltages below AC 1000 V*, or the relevant local regulations
- The electrical connections must be made by qualified personnel
- If contact with live parts is possible while working on the unit, the controller must be disconnected from power supply (all-polar disconnection)

Connection of external components



Caution!
When connecting external components to the safety extra low-voltage inputs or outputs of the RWF50... (terminals 11, 12, 13, D1, DG, G+, G-, A+, A-, and USB port), it must be made certain that no dangerous active voltage are introduced to the RWF50...
This can be achieved by using capsulated components with double/reinforced insulation or SELV components, for example. If not observed, there is a risk of electric shock.

Screw terminals



Caution!
All screw terminals at the rear of the unit must always be properly tightened. This applies to unused terminals as well.

Fusing



Caution!
- Fusing on site must not exceed 20 A
- The fuse on the controller side (AC 250 V/1.6 A slow) conforms to IEC 60127-4
- To prevent the relay contacts from welding in the event of short-circuit in the load circuit, fusing of the output relays must give consideration to the maximum permissible relay current

  ⇨ Reference!
  See chapter 12.3 *Controller outputs* OutP.
- No other loads may be connected to the controller's main power supply terminals

Suppression of interference

- The electromagnetic compatibility and interference suppression levels conform to the standards and regulations listed under *Technical data*

  ⇨ Reference!
  See chapter 12.5 *Electrical data*.
- Input, output and supply cables should be routed separately, not parallel to one another
- All input and output lines without connection to the power supply network must be shielded and twisted. They must not be run close to live components or live cables. On the controller side.

Incorrect use

- The controller is not suited for installation in areas with explosion hazard
- Incorrect settings on the controller (setpoint, data of parameter and configuration levels) can affect proper functioning of the process or lead to damage.
  Safety devices independent of the controller, such as overpressure relief valves or temperature limiters/monitors should therefore always be provided, and only be capable of adjustment by qualified personnel. Please observe the relevant safety regulations. Since self-setting cannot be expected to handle all possible control loops, the stability of the resulting actual value should be checked

4.2 Galvanic separation

The illustration shows the maximum test voltages between the electrical circuits.

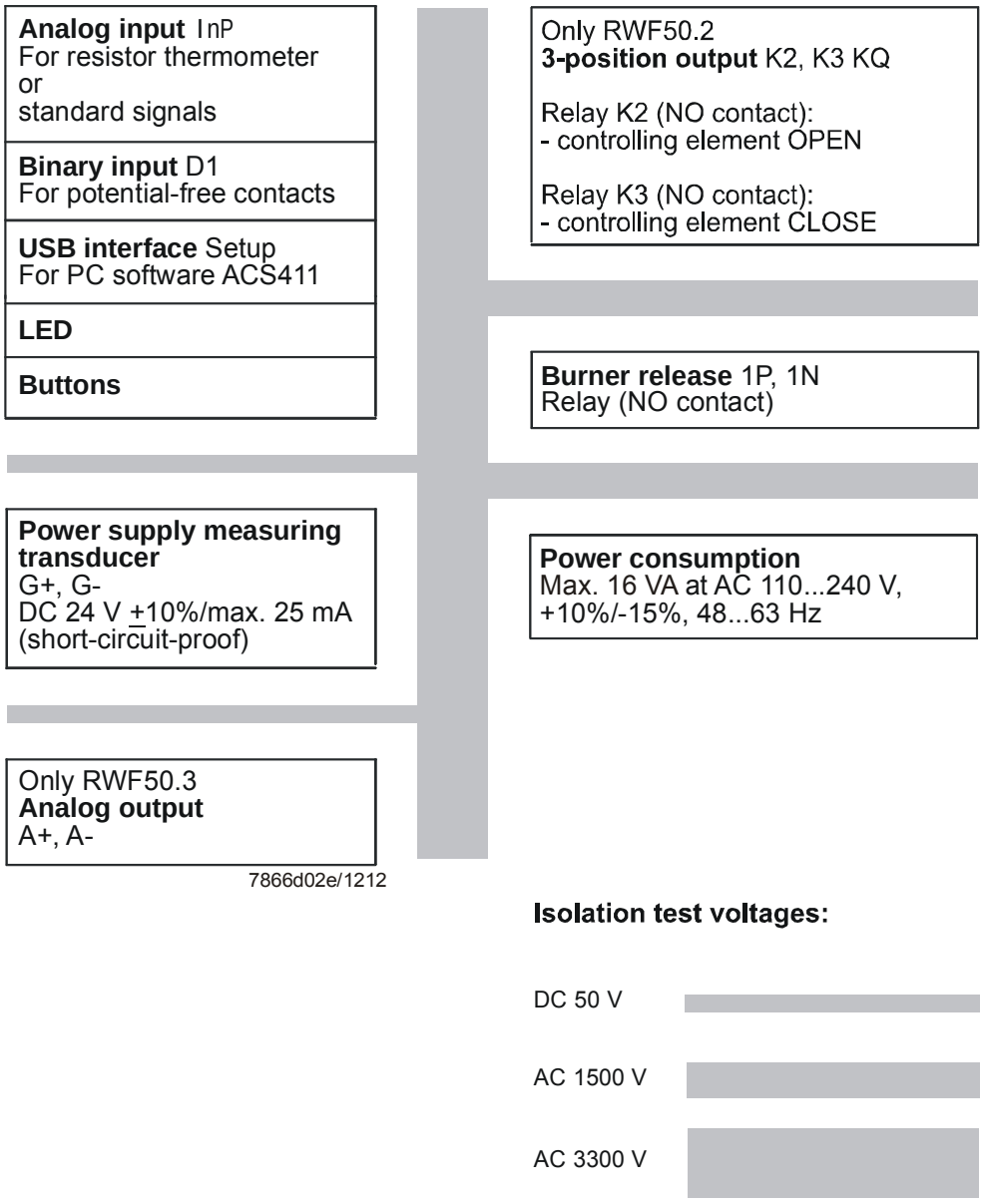
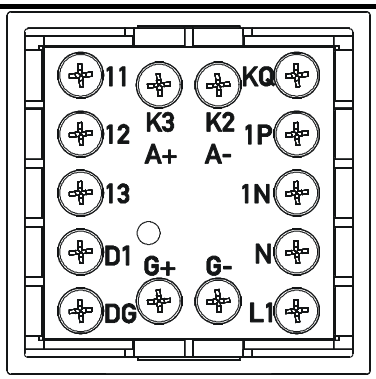


Figure 4: Test voltages

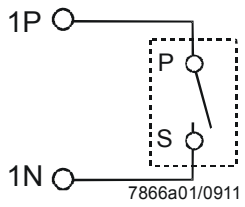
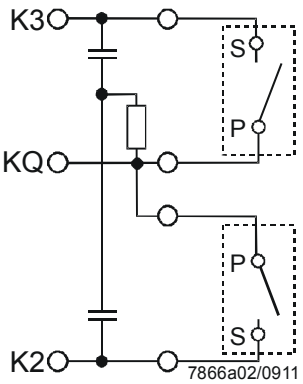
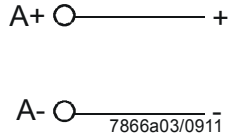
4.3 Assignment of terminals

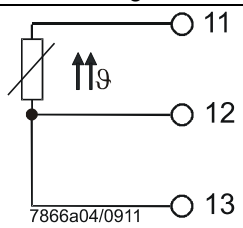
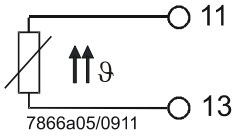
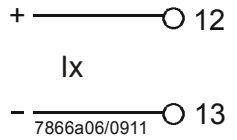
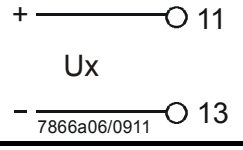
Caution!
Electrical connections must always be made by qualified personnel!

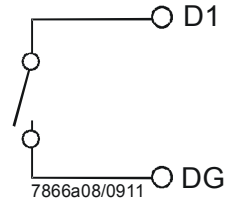


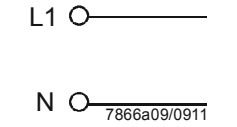
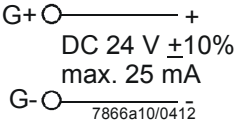
7866z09/0911

Figure 5: Assignment of terminals

Outputs	Display LED	Terminal no.	Connection diagram
Relay *Burner release*: Relay K1: P, 1N		1P pole 1N NO contact	 7866a01/0911
Only RWF50.2 3-position output: Relay K3: Controlling element CLOSE Relay K2: Controlling element OPEN		K3 NO contact KQ common pole K2 NO contact	 7866a02/0911
Only RWF50.3 Analog output A+, A- DC 0(4)...20 mA, DC 0...10 V		A+ A-	 7866a03/0911

Analog input InP1	**Terminal no.**	Connection diagram
Resistance thermometer in 3-wire circuit	11 12 13	
Resistance thermometer in 2-wire circuit	11 13	
Current input DC 0...20 mA, 4...20 mA	12 13	
Voltage input DC 0...5 V, 1...5 V, 0...10 V	11 13	

Binary inputs binF	**Terminal no.**	**Connection diagram**
Binary input D1	D1	
Common ground DG	DG	

Power supply	**Terminal no.**	**Connection diagram**
Power supply AC 110...240 V +10%/-15%, 48...63 Hz	L1 Live conductor N Neutral conductor	
Power supply measuring transducer (short-circuit-proof)	G+ G-	

5 Operating modes

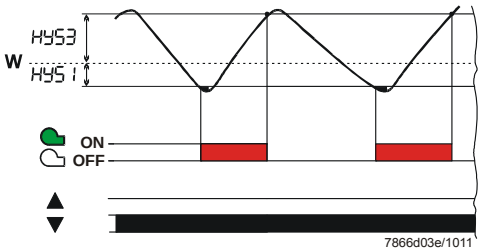
5.1 Low-fire operation

Low-fire operation means that only small amounts of heat are drawn from the boiler. Using relay K1 *Burner release*, the 2-position controller ensures control to the setpoint by switching the burner on and off like a thermostat.

Thermostat function

This mode of control is known as the thermostat function. An adjustable switching differential ensures that the burner's switching frequency can be selected, aimed at reducing wear.

Heating controller

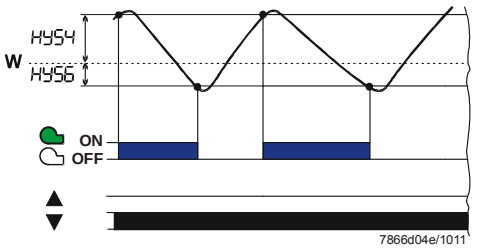


Modulating and 2-stage operation:
Actual value lies between switch-on threshold HYS1 and switch-off threshold HYS3.

Figure 6: Control sequence of heating controller

Cooling controller

If the controller is set to cooling mode, temperature limits HYS4 and HYS6 apply. In that case, relay K1 *Burner release* is used for controlling the cooling equipment.



Modulating and 2-stage operation:
Actual value lies between switch-on threshold HYS4 and switch-off threshold HYS6.

Figure 7: Control sequence of cooling controller

5.2 High-fire operation

High-fire operation means that large amounts of heat are drawn from the boiler so that the burner runs continuously. If the heating load during low-fire operation rises to a level where the actual value begins to fall below switch-on threshold **HYS1** , the controller will not immediately switch to a higher burner output, but first makes a dynamic test of the control deviation and switches to the higher output only when an adjustable threshold (q) is exceeded (**A**).

⇨ Reference!
See chapter 5.5 *Response threshold (q).*

Operating mode changeover

- In high-fire operation – depending on the application – the burner can be fired in **modulating** or **2-stage** operation, then burning larger amounts of fuel than in low-fire operation. **Binary input D1** can be used to switch between modulating and 2-stage operation
  - Contacts **D1** and **DG** open: Modulating burner operation
  - Contacts **D1** and **DG** closed: 2-stage burner operation

⇨ Reference!
See chapter 8.5 *Binary functions* binF.

5.2.1 Modulating burner, 3-position output

Only RWF50.2

Area (1)

In area (1), the thermostat function is active. The lowest burner stage is switched on below switch-on threshold **HYS1** and switched off above switch-off threshold **HYS3**.

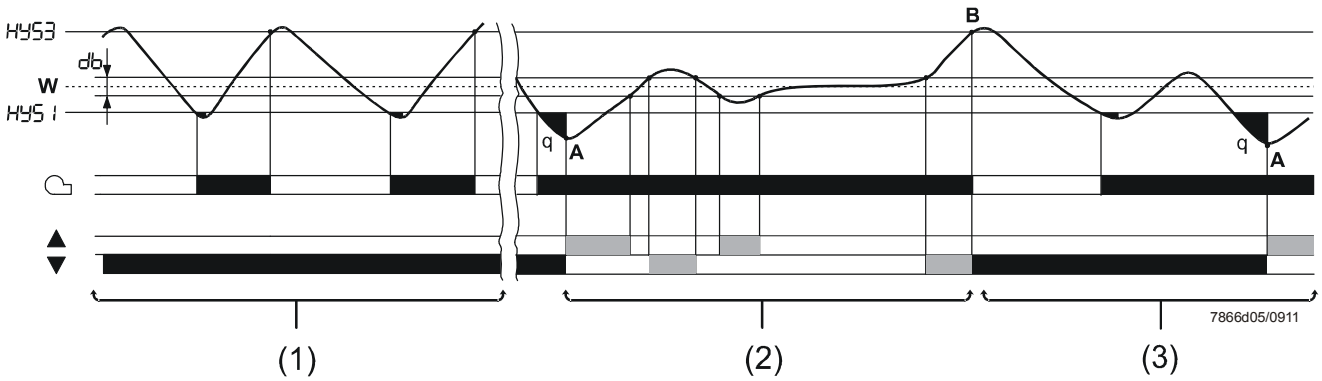


Figure 8: Control sequence of modulating burner, 3-position output

Area (2)

Here, operating mode *Modulating burner* is shown. In high-fire operation, the 3-position controller acts on an actuator via relay K2 (OPEN) and relay K3 (CLOSE). When the actual value falls below the setpoint, the response threshold (q) at point (A) is reached and the controlling element opens (greater heat output). When the actual value lies within the dead band **db**, the controlling element remains inactive. When the actual value exceeds **db**, the controlling element closes (smaller heat output).

Area (3)

If the actual value exceeds the upper switch-off threshold **HYS3** in spite of the lowest heating stage, the controller switches the burner off (B). The controller only starts low-fire operation when the actual value falls below switch-on threshold **HYS1** again. If the response threshold (q) is exceeded, the controller switches to high-fire operation (A).

⇨ Reference!
See chapter 5.5 *Response threshold (q).*

5.2.2 Modulating burner, analog output

Only RWF50.3

Area (1) Thermostat function active.

Area (2) The RWF50.3 as a modulating controller provides control to the adjusted setpoint. Angular positioning is ensured via the analog output in the form of a standard signal.

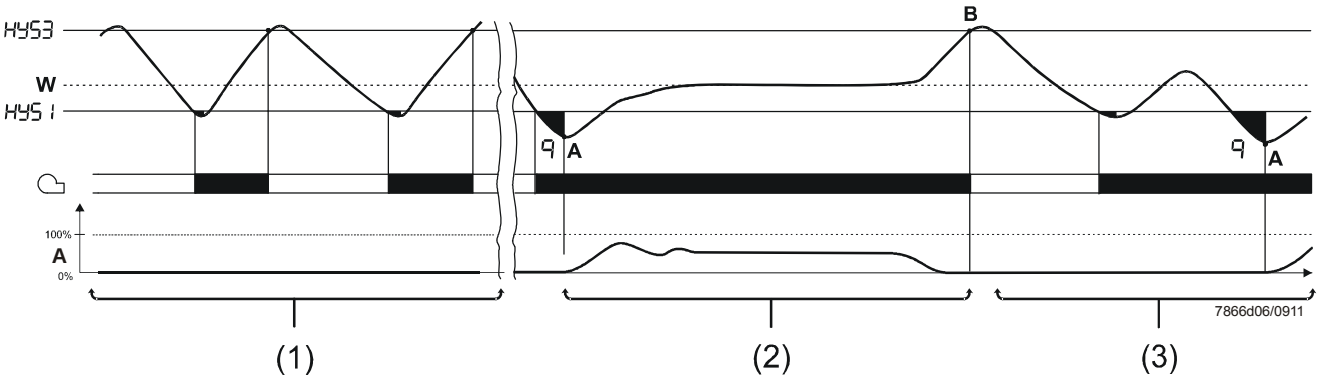


Figure 9: Control sequence of modulating burner, analog output

Area (3) The controller behaves as described in chapter 5.2.1 *Modulating burner, 3-position output*.

Cooling controller If the controller is set to cooling mode, the respective values HYS4 and HYS6 apply.

Starting from a high actual value, the controller now controls the connected cooling equipment in low-fire operation. In high-fire operation, the cooling output is controlled via relays K2 and K3 or the analog output. The response threshold (q) calculates automatically (now in the reverse sense) the point from which the cooling output is to be increased.

5.2.3 2-stage burner, 3-position output

Only RWF50.2

In area (1), the thermostat function is active. In area (2), the RWF50.2 as a **2-position controller** acts on the second stage via relay K2 (OPEN) and relay K3 (CLOSE) by switching on at switch-on threshold HYS1 and switching off at switch-off threshold HYS2.

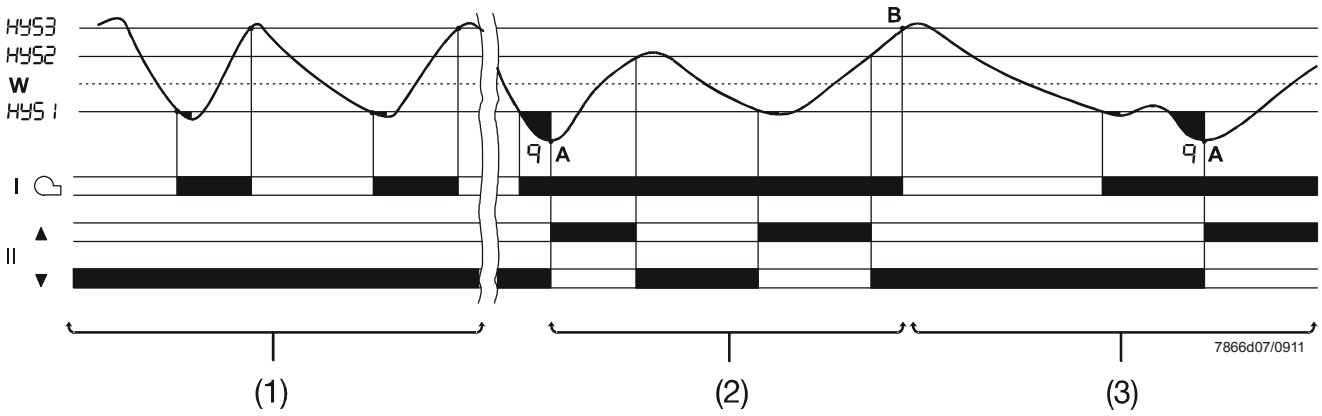


Figure 10: Control sequence of 2-stage burner, 3-position output

In area (3), the actual value exceeds the upper switch-off threshold HYS3 and the controller shuts down the burner (**B**). The controller only starts low-fire operation when the actual value falls again below switch-on threshold HYS1. If the response threshold (q) is exceeded, the controller switches to high-fire operation (**A**).

⇨ Reference!
See chapter 5.5 *Response threshold (q).*

5.2.4 2-stage burner, analog output

Only RWF50.3

In this case, a digital standard signal switches the second stage on via the analog output (terminals **A+** and **A-**) when reaching switch-on threshold **HYS1** and off at the lower switch-off threshold **HYS2**.

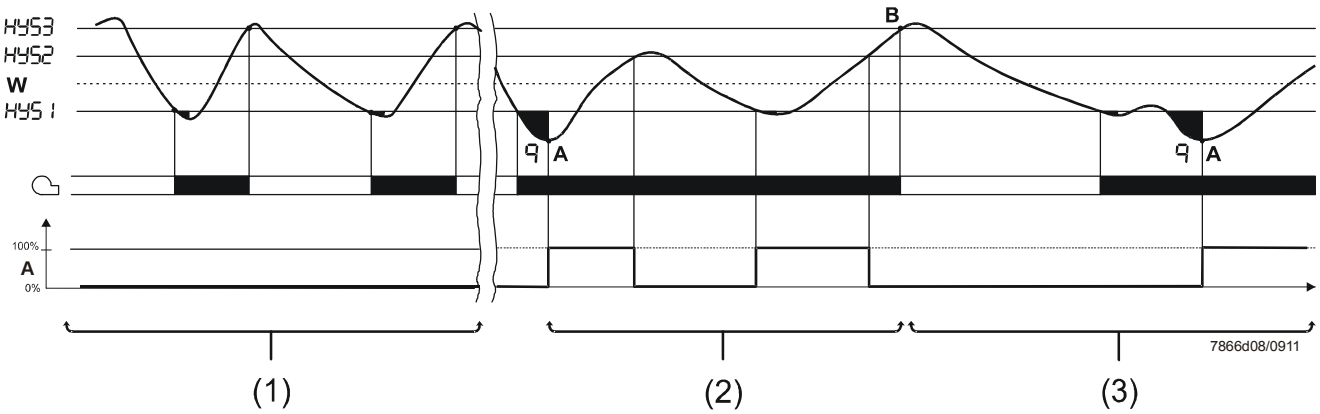


Figure 11: Control sequence of 2-stage burner, analog output

Cooling controller

If the controller is set to cooling mode, the respective values of HYS4, HYS5 and HYS6 apply.

Starting from a high actual value, the controller now controls the connected cooling equipment in low-fire operation. In high-fire operation, the second stage and thus the cooling output are controlled via relays K2 and K3 or the analog output. The response threshold (q) calculates automatically (now in the reverse sense) the point from which the cooling output is to be increased.

5.3 Burner shutdown

In the event of a sensor failure at the analog input InP1, the controller cannot monitor the actual value. Burner shutdown will automatically be triggered to guard against overheating.

Functions

- Burner off
- 3-position output for closing the controlling element
- Self-setting function is ended
- Manual control is ended

5.4 Predefined setpoint

The setpoint is predefined within the selected setpoint limits via the buttons or the ACS411 software. Using an external contact, the setpoint can also be shifted or changed over.

⇨ Reference!
See chapter 8.5 *Binary functions* binF.

Setpoint changeover or setpoint shift

Depending on the function selected for the binary input, the effective controller setpoint can change between setpoint **SP1** and setpoint SP2 or can be shifted by the amount of dSP. A contact at binary input D1 controls the changeover or shift.

Entry

The values for setpoints SP1, SP2 and dSP are to be entered at the operating level.

⇨ Reference!
See chapter 6 *Operation.*

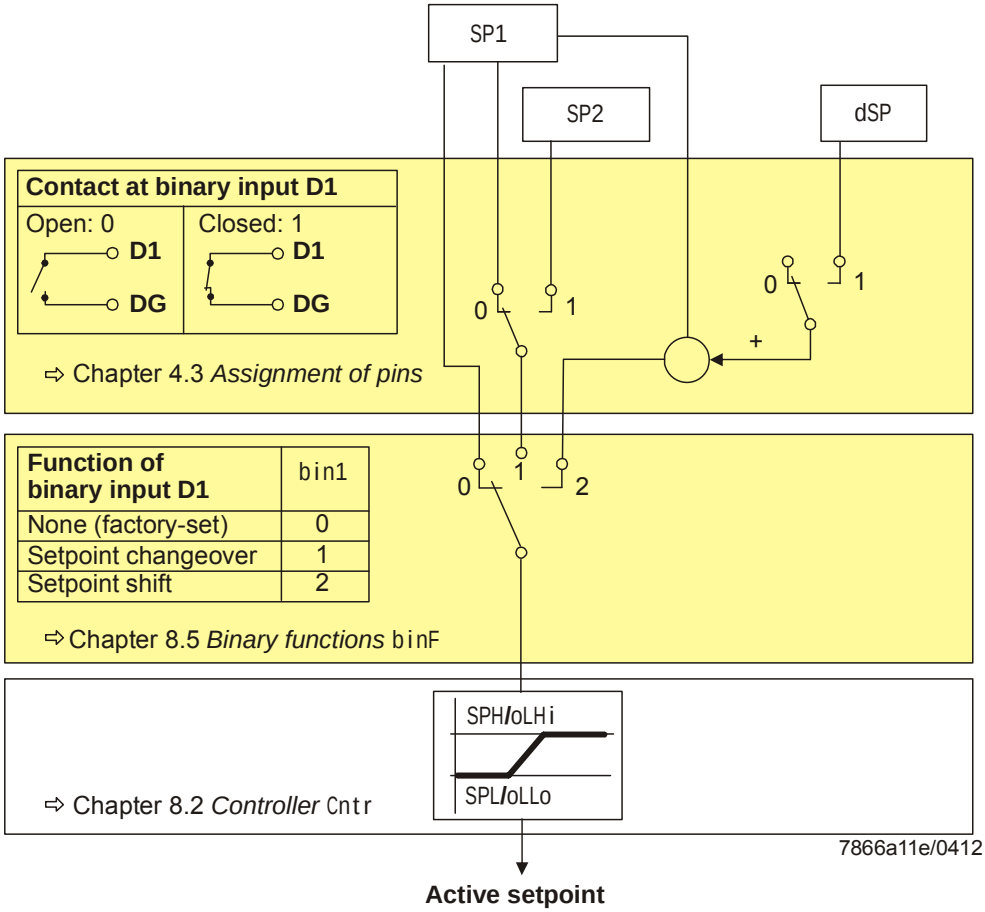


Figure 12: Setpoint changeover or setpoint shift

5.5 Response threshold (q)

The response threshold (q) defines for what period of time and how much the actual value is allowed to drop before the system switches to high-fire operation.
An internal mathematical calculation using an integration function determines the sum of all areas qeff = q1 + q2 + q3 as shown in the graph. This takes place only when the control deviation (x-w) falls below the value of switch-on threshold HYS1. If the actual value increases, integration is stopped.
If *qeff* exceeds the preset response threshold (q) (can be adjusted at the parameter level), this causes the second burner stage to switch on or – in the case of the 3-position controller/modulating controller – the controlling element to open.
If the current boiler temperature reaches the required setpoint, *qeff* is reset to 0.

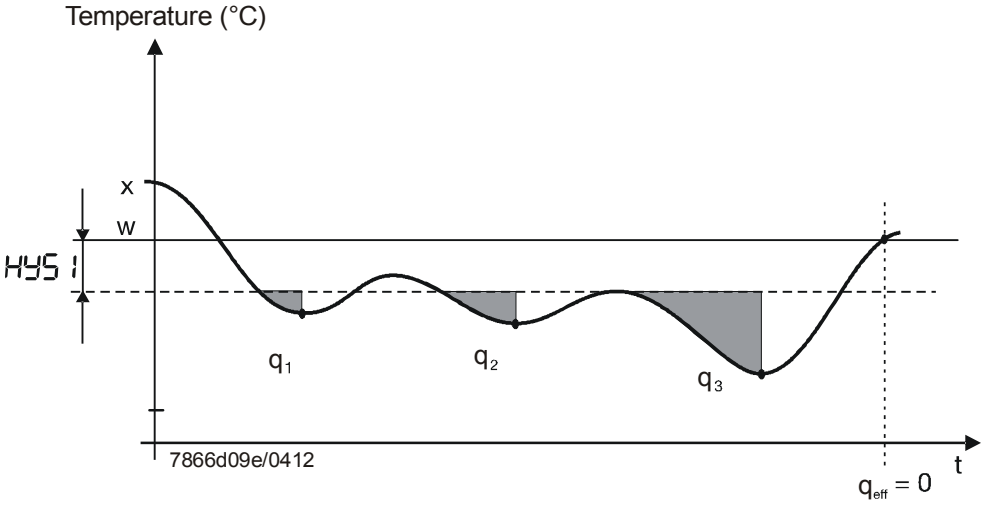


Figure 13: Control sequence response threshold (q)

In contrast to time-dependent switching on, load-dependent switching on offers the advantage of capturing the dynamics of the actual value.
Also, monitoring the progression of the actual value during the change from low-fire to high-fire ensures low switching frequencies to reduce wear and to extend running times.

Cooling controller

The response threshold (q) also works (in the reverse sense) in the case of cooling mode.

5.6 Cold start of plant

Interlocking

Note!
Functions *Cold start of plant* and *Thermal shock protection (TSS)* are interlocked.
Only one function can be activated, but never both at the same time.

Heating controller

When a heating system is switched off for a longer period of time, the actual value will drop of course.
To achieve a faster control response, the controller immediately starts in high-fire operation as soon as the control deviation (x-w) drops below a certain limit value.

This limit is calculated as follows:

Limit value = 2 x (HYS1-HYS3)

In that case, the response threshold (q) is inactive, independent of operating mode and controlled variable (temperature or pressure).

Example

Operating mode: Modulating, 3-position output
HYS1 = -5 K
HYS3 = +5 K
w = 60 °C

Limit value = 2 x (-5-5) = 2 x (-10) = -20 K

At an actual value below 40 °C, heating up immediately starts in low-fire operation, and not in thermostat mode.

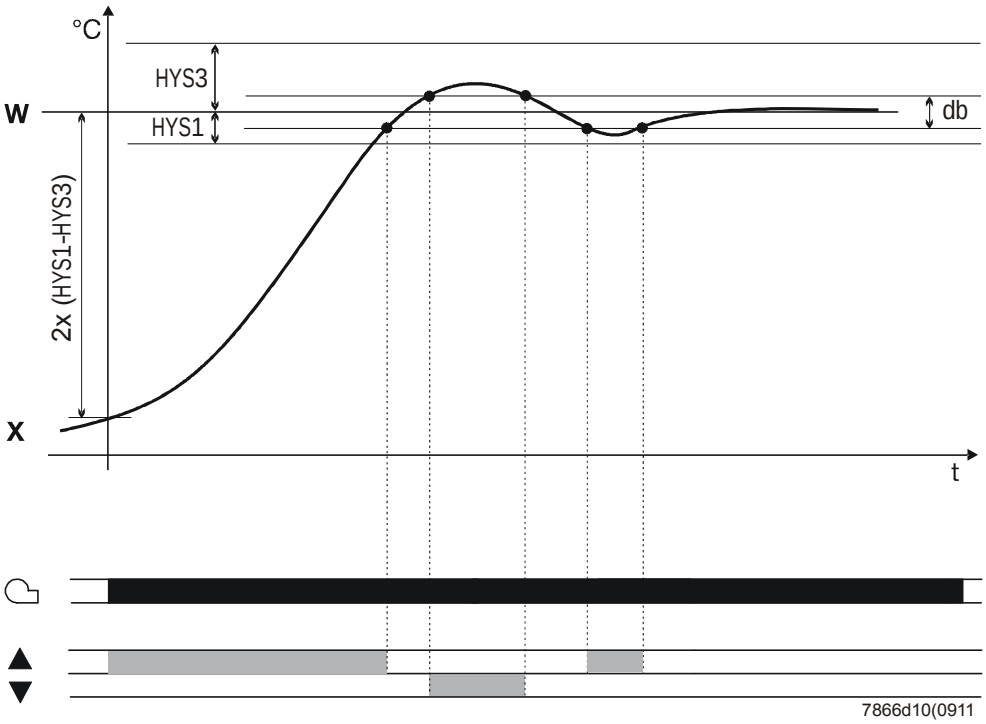


Figure 14: Control sequence *Cold start of plant*

Cooling controller

Cold start of plant also works when the RWF50… is used as a cooling controller.

In that case, the limit value is calculated as follows:
Limit value = 2 x (HYS4-HYS6)

Example

Operating mode: Modulating 3-position output
HYS4 = 5 K
HYS6 = -5 K
w = -30 °C

Limit value = 2 x (5 +5) = 2 x (10) = +20 K

When the actual value lies above -10 °C, cooling is immediately started in high-fire mode in place of low-fire mode.

5.7 Thermal shock protection (TSS)

Interlocking

Note!
Functions *Cold start of plant* and *Thermal shock protection (TSS)* are interlocked. Only one function can be activated, but never both at the same time.

The controller comes with thermal shock protection (TSS) deactivated; it can be activated at the configuration level.

⇨ Reference!
See chapter 8.3 *Thermal shock protection (TSS)* rAFC.

Function

The function is automatically activated when the actual value drops below the adjustable limit value rAL (exceeds the adjustable limit value with the cooling controller). In that case, the setpoint is approached via a ramp function.
Gradient and slope of the ramp rASL are adjustable. The setpoint ramp has a symmetrical tolerance band toLP. If, during the startup phase, the actual value leaves the tolerance band, the setpoint ramp is stopped until the actual value returns to a level within the tolerance band. The startup phase is ended when the setpoint of the ramp function reaches the final setpoint SP1.

Note!
When thermal shock protection (TSS) is active, the controller operates in low-fire operation. The response threshold (q) is active.

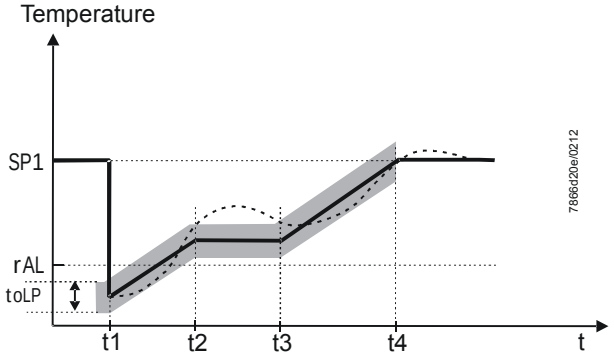


Figure 15: Thermal shock protection (TSS)

Key

Setpoint (w)
Actual value (x)

6 Operation

6.1 Meaning of display and buttons

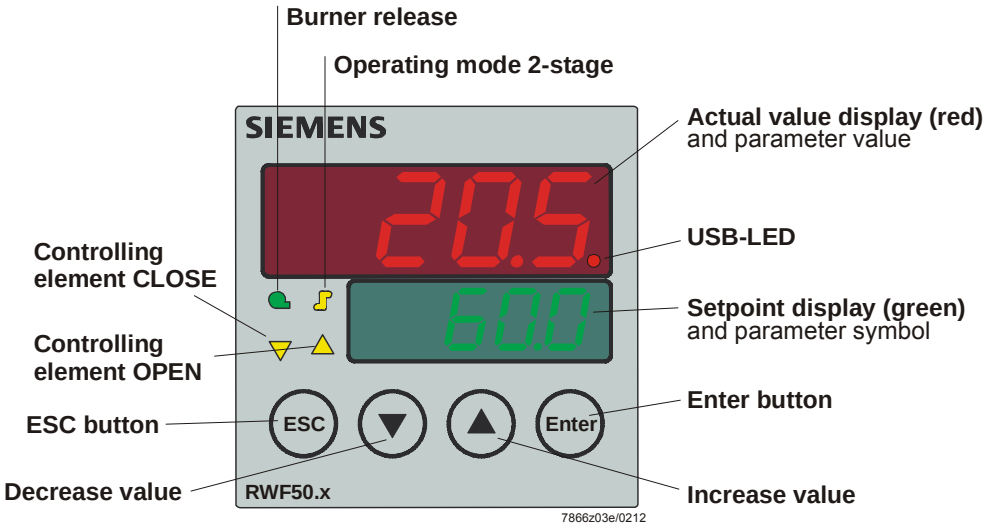


Figure 16: Meaning of display and buttons

Initialization

The two 7-segment displays (red and green) show hyphens and all LEDs light up for about 5 seconds.

Basic display

The upper display (red) shows the actual value.
The lower display (green) shows the setpoint.

⇨ Reference!
See chapter 8.6 *Display* diSP.

Parameter display

When entering parameters, the parameter symbol at the bottom (green) and the set value at the top (red) appear.

Self-setting function

The actual value is shown on the actual value display (red) and tUnE flashes on the setpoint display (green).

⇨ Reference!
See chapter 9 *Self-setting function.*

Flashing actual value display

The actual value display (red) shows 9999 flashing.

⇨ Reference!
See chapter 11 *What to do if ...*

Manual control

The setpoint display (green) shows HAnd flashing.

⇨ Reference!
See chapter 6.4 *Manual control of a modulating burner.*

6.2 Basic display

When switching power on, the displays show hyphens for about 5 seconds.

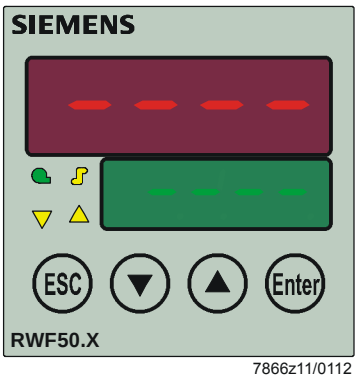


Figure 17: Display start

The state that follows is called *normal display*.
Default display is the actual value and the current setpoint.
Other values can be displayed at the configuration level or via PC software ACS411.

⇨ Reference!
See chapter 8.6 *Display* diSP.

Manual control, self-setting, the user, parameter and configuration levels can be activated from here.

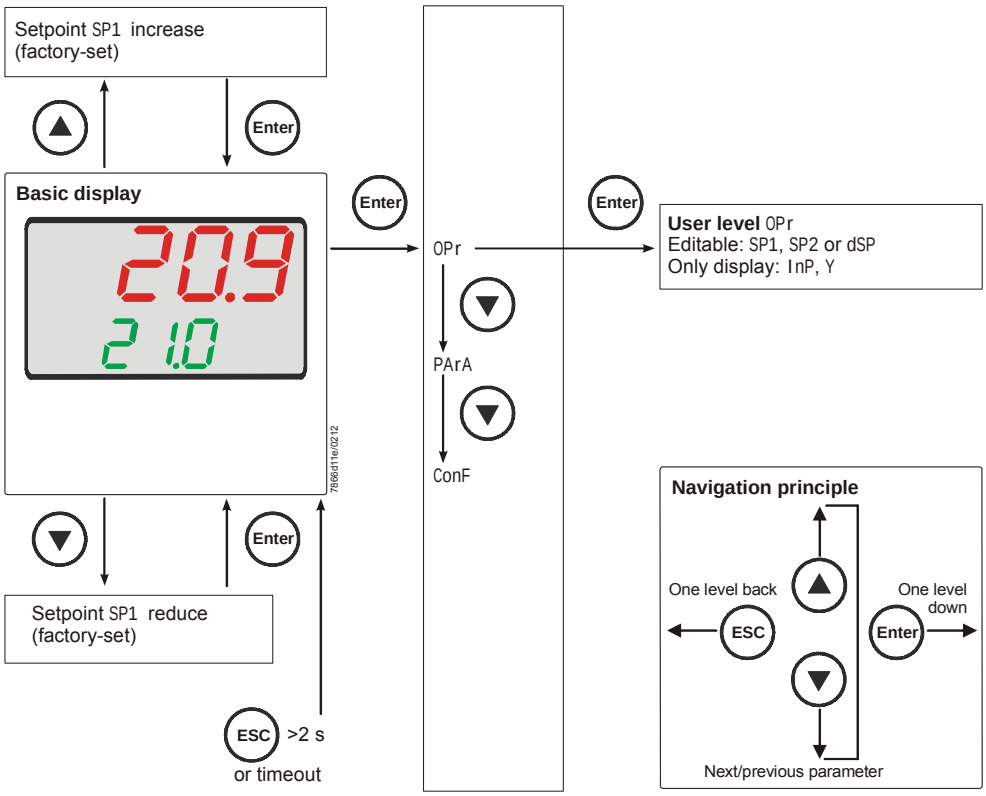


Figure 18: Basic display

6.3 User level

This level is started from the basic display.
Setpoints SP1, SP2 or dSP can be altered.
The values of InP (analog input) and Y (current angular positioning between 0...100%) can be displayed.

Changing the setpoints

* From the basic display, press Enter so that OPr appears
* Press Enter so that SP1 appears
* Press Enter and SP1 flashes
* Press ▲ or ▼ to adjust the required setpoint and press Enter to confirm

Timeout

Timeout after about 180 seconds.

☞ Note!
If the setpoint is not stored, the basic display changes after the timeout tout and the former setpoint is maintained.
The value changes only within the permitted range.

6.4 Manual control, modulating burner

Note!
Manual control can only be activated if the thermostat function **energized** relay K1. If the thermostat function **deenergized** relay K1 during manual control, manual control is ended.

* Press ESC for 5 seconds

HAnd appears on the lower display, alternating with the value for manual control.

RWF50.2
3-position controller

* Open and close fuel-air ratio control by pressing ▲ and ▼

Relay K2 opens the controlling element as long as ▲ is kept depressed.
Relay K3 closes the controlling element as long as ▼ is kept depressed.

The 2 yellow arrows indicate when relay K2 opens or relay K3 closes the controlling element.

RWF50.3
Modulating controller

* Change angular positioning by pressing ▲ or ▼
* Adopt flashing new angular positioning by pressing Enter

Per default, the analog output delivers the current angular positioning.

* Return to automatic operation by keeping ESC depressed for 5 seconds

Note!
When activating manual control, angular positioning is set to 0 until another entry is made.

6.5 Manual control, 2-stage burner

* Press ESC for 5 seconds
* Press ▲ briefly

RWF50.2	RWF50.3
Relay K2 is active Relay K3 is inactive	The analog output delivers the highest value (depending on setting DC 10 V or 20 mA)
Controlling element opens	

* Or press ▼ briefly

RWF50.2	RWF50.3
Relay K2 is inactive Relay K3 is active	The analog output delivers the lowest value (depending on setting DC 0 V, 4 mA, or 0 mA)
Controlling element closes	

* Return to automatic operation by pressing ESC for 5 seconds



Note!
If the thermostat function **deenergizes** relay K1 during manual control, manual control is ended.

6.6 Starting the self-setting function

Start * Press ▲ + ▼ for 5 seconds

Cancel * Cancel with ▲ + ▼

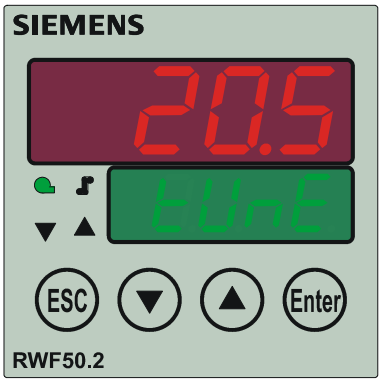


Figure 19: Display of self-setting function

When **tUnE** stops flashing, the self-setting function has been ended.

The parameters calculated by the controller are automatically adopted!

☞ Note!
It is not possible to start **tUnE** in manual control or low-fire operation.

6.7 Display of software version

* Press Enter + ▲

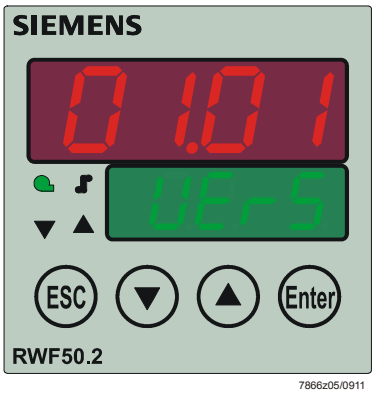


Figure 20: Display of software version

Segment test

* Press Enter + ▲ again.

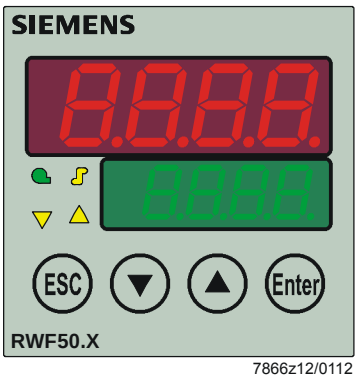


Figure 21: Display segment test

All display segments and LEDs light up; the actual value display (red) flashes for about 10 seconds.

7 Parameterization PArA

Here, set the parameters associated directly with the controller's adaptation to the controlled system after the plant has been put into operation.

Note!
The display of the individual parameters depends on the type of controller.

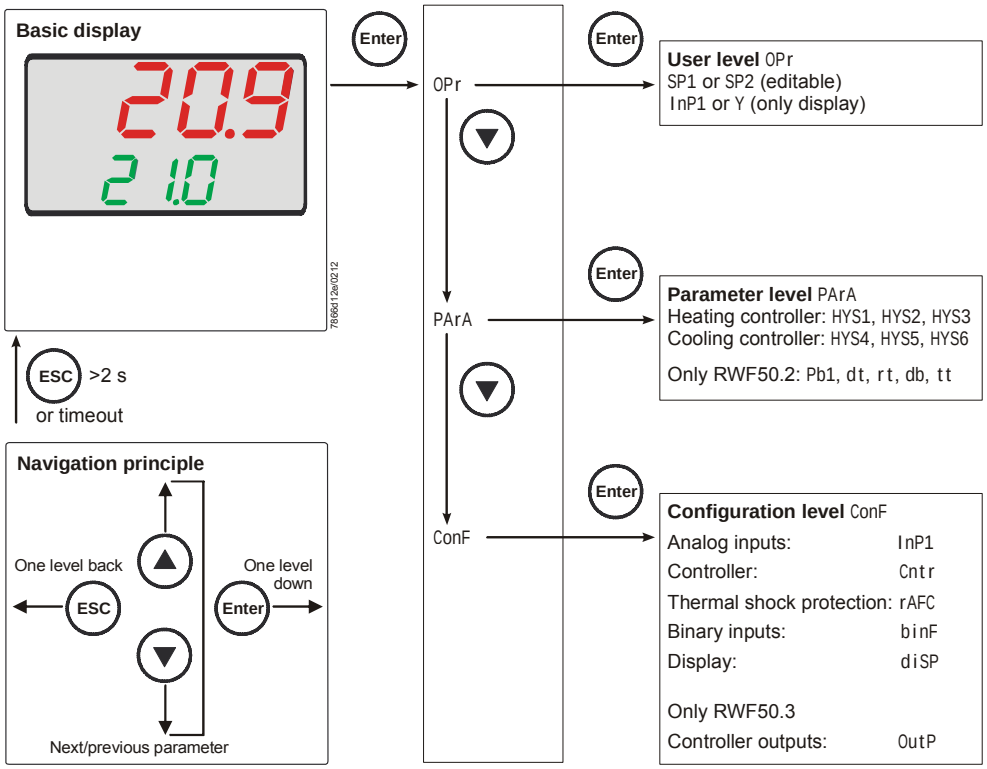


Figure 22: Parameterization

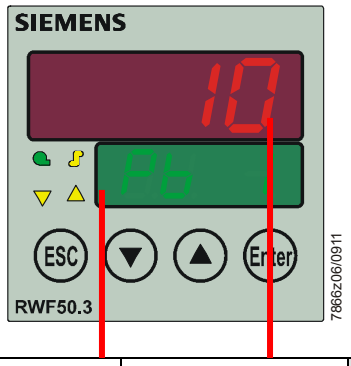
Access to this level can be locked.

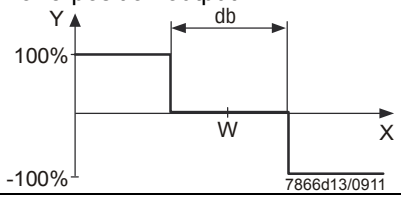
Reference!
See chapter 8.6 *Display* diSP.

* From the basic display, press Enter so that **OPr** appears
* Press ▼ so that **PArA** appears
* Press Enter so that the first parameter of the parameter level is displayed

Display of controller parameters

The parameters are shown on the lower setpoint display (green) and their values on the upper/actual value display (red).



Parameter	Display	Value range	Factory setting	Remarks
Proportional band ¹	Pb1	1...9999 digit	10	Influences the controller's P-action
Derivative time	dt	0...9999 s	80	Influences the controller's D-action With dt = 0, the controller has no D-action
Integral action time	rt	0...9999 s	350	Influences the controller's I-action With rt = 0, the controller has no I-action
Dead band (neutral zone) ¹	db	0.0...999.9 digit	1	For 3-position output 
Controlling element running time	tt	10...3000 s	15	Running time of the positioning valve for use with modulating controllers
Switch-on threshold Heating controller ¹	HYS1	-1999...0.0 digit	-5	⇨ Reference! See chapter 5.2 *High-fire operation*
Switch-off threshold stage II Heating controller ¹	HYS2	0.0...HYS3 digit	3	⇨ Reference! See chapter 5.2 *High-fire operation*
Switch-off threshold Heating controller ¹	HYS3	0.0...9999 digit	5	⇨ Reference! See chapter 5.2 *High-fire operation*
Switch-on threshold Cooling controller ¹	HYS4	0.0...9999 digit	5	⇨ Reference! See chapter 5.2 *High-fire operation*
Switch-off threshold stage II Cooling controller ¹	HYS5	HYS6...0.0 digit	-3	⇨ Reference! See chapter 5.2 *High-fire operation*
Switch-off threshold Cooling controller ¹	HYS6	-1999...0.0 digit	-5	⇨ Reference! See chapter 5.2 *High-fire operation*
Response threshold	q	0.0...999.9	0	⇨ Reference! See chapter 5.5 *Response threshold (q)*

¹ Setting of decimal place has an impact on this parameter

Note!
When using the RWF50… as a modulating controller only, or as a modulating controller without the burner release function (1P, 1N), parameter HYS1 must be set to 0 and parameters HYS2 and HYS3 must be set to their **maximum** values.

Otherwise, for example, when using default parameter HYS1 (factory setting -5), the 3-position controller is only released when the control deviation reaches -5 K.

8 Configuration ConF

Here, the settings (e.g. acquisition of measured value or type of controller) required directly for commissioning a certain plant are made and, for this reason, there is no need to change them frequently.

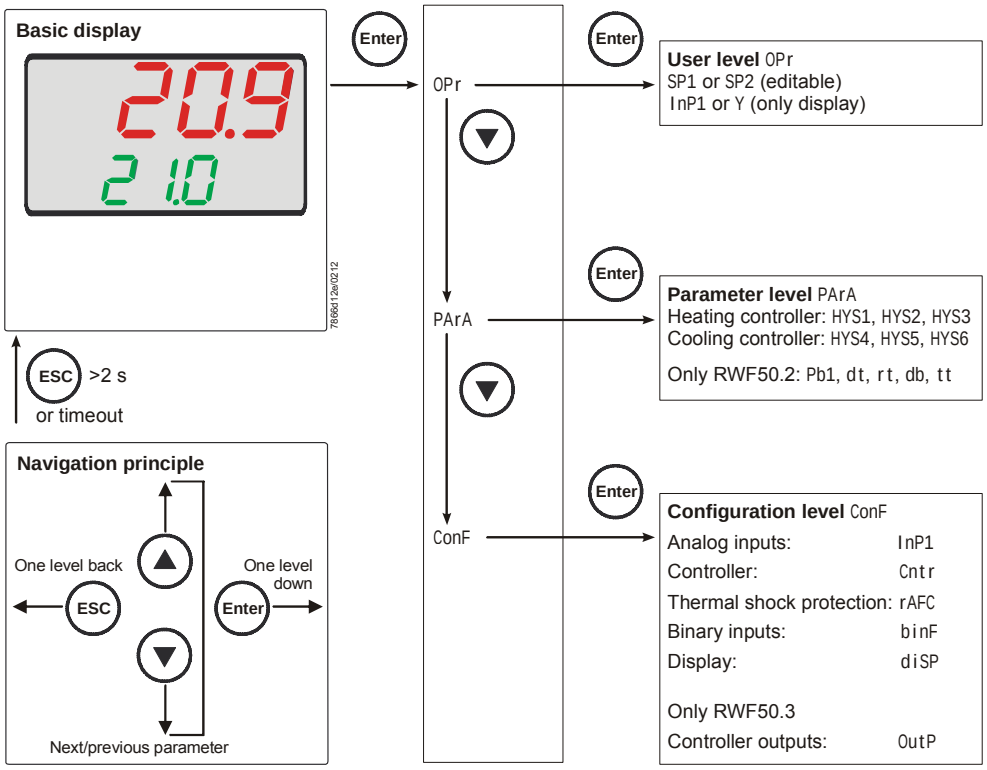


Figure 23: Configuration

Access to this level can be locked.

⇨ Reference!
See chapter 8.6 *Display* diSP.

☞ Note!
The following tables show the default settings in columns *Value/selection* and *Description* in **bold** printing.

8.1 Analog input InP1

An analog input is available.

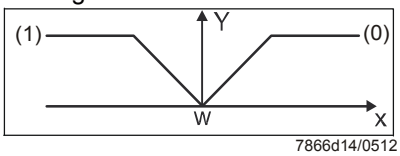
ConF ➔ InP ➔ InP1 ➔

Parameter	Value/ selection	Description
Sensor type SEn1 Sensor type	**1** 2 3 4 5 6 7 15 16 17 18 19	**Resistance thermometer Pt100, 3-wire** Resistance thermometer Pt100, 2-wire Resistance thermometer Pt1000, 3-wire Resistance thermometer Pt1000, 2-wire Resistance thermometer LG-Ni1000, 3-wire Resistance thermometer LG-Ni1000, 2-wire 0...135 Ohm 0...20 mA 4...20 mA DC 0...10 V DC 0...5 V DC 1...5 V
Correction of measured value OFF1 Offset	-1999... **0...** +9999	Using the measured value correction (offset), a measured value can be corrected to a certain degree, either up or down **Example:** Measured value / Offset / Displayed values 294.7 / +0.3 / 295.0 295.3 / -0.3 / 295.0
Caution! **Measured value correction:** To make the calculation, the controller uses the corrected value (displayed value). This value does not represent the value acquired at the point of measurement. If not correctly used, inadmissible values of the control variable can be produced. Measured value corrections must therefore be made within certain limits only.		
Start of display SCL1 Scale low level	-1999... **0...** +9999	In the case of a measuring transducer with standard signal, the physical signal is assigned a display value here Example: 0…20 mA = 0…1500 °C
End of display SCH1 Scale high level	-1999... **100...** +9999	The range of the physical signal can be crossed by 20%, either up or down, without getting a signal informing about the crossing
Filter time constant dF1 Digital filter	0.0... **0.6...** 100.0...	Is used to adapt the digital 2nd order input filter (time in s; 0 s = filter OFF) If the input signal changes abruptly, about 26% of the change are captured after a time corresponding to the filter time constant dF (2 x dF: approx. 59%; 5 x dF: approx. 96%) When the filter time constant is great: - Great attenuation of interference signals - Slow response of actual value display to changes of the actual value - Low limit frequency (low-pass filter)
Temperature unit Unit Temperature unit	**1** 2	**Degrees Celsius** **Degrees** Fahrenheit Unit of temperatures

8.2 Controller Cntr

Here, the type of controller, operating action, setpoint limits and presettings for self-optimization are selected.

ConF ➔ Cntr ➔

Parameter	Value/ selection	Description
Controller type CtYP Controller type	1 2	3-position controller (RWF50.2) Modulating controller (RWF50.3)
Operating action CACt Control direction	**1** 0	**Heating controller** Cooling controller  7866d14/0512 (0) = cooling controller: The controller's angular positioning (Y) is >0 when the actual value (x) lies above the setpoint (w) (1) = heating controller: The controller's angular positioning (Y) is >0 when the actual value (x) lies below the setpoint (w)
Setpoint limitation start SPL Setpoint limitation low	**-1999...** +9999	Setpoint limitation prevents values from being entered outside the defined range.
Setpoint limitation end SPH Setpoint limitation high	-1999... **+9999**	
Self-optimization	**0** 1	**Free** Locked Self-optimization can only be disabled or enabled via the ACS411 setup program If disabled via ACS411 PC software, self-optimization cannot be started via the controller's buttons Setting in the ACS411 setup program ➔ Controller ➔ Self-optimization Self-optimization is also disabled when the parameter level is locked
Lower working range limit oLLo Lower operation range limit	**-1999...** +9999	☞ Note! If the setpoint with the respective hysteresis exceeds the upper working range limit, the switch-on threshold is substituted by the working range limit.
Upper working range limit oLHi Upper working range limit	-1999... **+9999**	☞ Note! If the setpoint with the respective hysteresis drops below the lower working range limit, the switch-off threshold is substituted by the working range limit.

8.3 Thermal shock protection (TSS) rAFC

The RWF50… can be operated as a fixed value controller with or without ramp function.

ConF ➔ rAFC ➔

Parameter	Value/ selection	Description
Function FnCt Function	**0** 1 2	**Switched off** Gradient Kelvin/minute Gradient Kelvin/hour ☞ Note! With **FnCt** = 1 or 2, *Thermal shock protection* (TSS) is automatically activated as soon as the actual value drops below the adjustable absolute limit value **rAL** (heating controller) or exceeds it (cooling controller).
Ramp slope rASL Ramp slope	**0.0...** 999.9	Slope of ramp slope (only with functions 1 and 2)
Tolerance band ramp toLP Tolerance band ramp	**2 x |HYS1| = 10**...9999	Width of tolerance band (in K) about the setpoint (only with function 1 and 2) Heating controller: Smallest possible factory setting: **2 x |HYS1| = 10 K** To monitor the actual value in connection with thermal shock protection (TSS), a tolerance band can be laid about the setpoint curve. If the limit values are crossed, the ramp is stopped. ⇨ Reference! See chapter 5.7 *Thermal shock protection (TSS).* Cooling controller: Smallest possible factory setting: **2 x |HYS4| = 10 K**
☞ Note! In the event of a faulty sensor or manual control, the ramp function is stopped. The outputs behave the same way they do when the measuring range is crossed (configurable). Functions *Cold start of plant* and *Thermal shock protection (TSS)* are interlocked. Only one function can be activated, but never both at the same time.		
Limit value rAL Ramp limit	**0**...250	**Heating controller:** If the actual value lies below this limit value, the setpoint is approached in the form of a ramp until final setpoint SP1 is reached. **Cooling controller:** If the actual value lies above this limit value, the setpoint is approached in the form of a ramp until final setpoint SP1 is reached.

8.4 Control outputs OutP

With the RWF50.2, configuration of the outputs relates to the binary outputs (K2 and K3), and with the RWF50.3, to the analog outputs (A+ and A-). The burner is released via relay K1.

The switching states of relay K1 *Burner release* (LED green), relay K2 *Controlling element OPEN,* and relay K3 *Controlling element CLOSE* (yellow LED arrows) are indicated on the controller front.

Only RWV50.2...

Binary outputs

The binary outputs of the RWF50.2 offer no setting choices.

Only RWF50.3...

Analog output

The RWF50.3 has an analog output.

The analog output offers the following setting choices:

ConF ➔ OutP ➔

Parameter	Value/ selection	Description
Function FnCt Function	1 **4**	Analog input InP1 is delivered **Controller's angular positioning is delivered (modulating controller)**
Signal type SiGn Type of signal	**0** 1 2	**0...20 mA** 4...20 mA DC 0...10 V Physical output signal
Value when out of range rOut Value when out of range	**0**...101	Signal (in percent) when measuring range is crossed 101 = last output signal
Zero point OPnt Zero point	-1999... **0...** +9999	A value range of the output variable is assigned to a physical output signal
End value End End value	-1999... **100...** +9999	

8.5 Binary input binF

This setting decides on the use of the binary input.

⇨ Reference!
See chapter 5.4 *Predefined setpoint.*

ConF ➔ binF ➔

Parameter	Value/ selection	Description
Binary input bin1 Binary inputs	**0** 1 2 4	**No function** Setpoint changeover Setpoint shift Changeover of operating mode Burner modulating: Contacts D1 and DG open Burner 2-stage: Contacts D1 and DG closed

8.6 Display diSP

By configuring the position of the decimal point and automatic changeover (timer), both LED indications can be adapted to the respective requirements. Timeout tout for operation and the locking of levels can be configured as well.

ConF ➔ diSP ➔

Parameter	Value/ selection	Description
Upper display diSU Upper display	 0 **1** 4 6 7	Display value for upper display Switched off **Analog input** InP1 Controller's angular positioning Setpoint End value with thermal shock protection
Lower display diSL Lower display	 0 1 4 **6** 7	Display value for lower display Switched off Analog input InP1 Controller's angular positioning **Setpoint** End value with thermal shock protection
Timeout tout	0... **180**... 255	Time (s) on completion of which the controller returns automatically to the basic display, if no button is pressed
Decimal point dECP Decimal point	**0** 1 2	**No decimal place** One decimal place Two decimal places If the value to be displayed cannot be shown with the programmed decimal point, the number of decimal places is automatically reduced. If the measured value drops again, the number of decimal places is increased until the programmed value is reached
Locking of levels CodE	**0** 1 2 3	**No locking** Locking of configuration level Locking of parameter level Locking of keyboard

9 Self-setting function

9.1 Self-setting function in high-fire operation

Note!
tUnE is only possible in high-fire operation, in *modulating burner* mode.

Self-setting function **tUnE** is a proper software function unit integrated in the controller. In *modulating* mode, **tUnE** tests in high-fire operation the response of the controlled system to angular positioning steps according to a special procedure. A complex control algorithm uses the response of the controlled system (actual value) to calculate and automatically store the control parameters for a PID or PI controller (set dt = 0!). The **tUnE** procedure can be repeated any number of times.

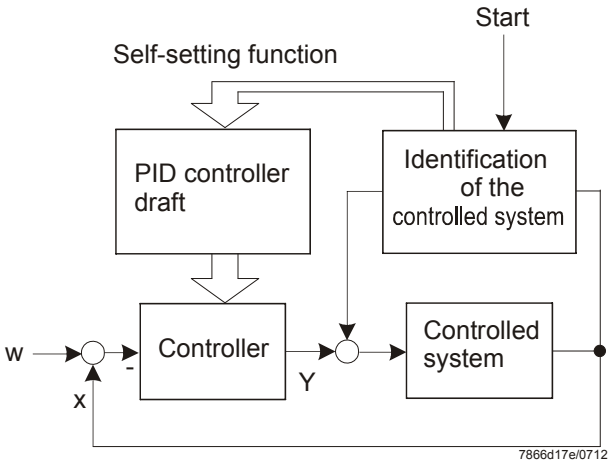


Figure 24: Self-setting function in high-fire operation

2 procedures

The **tUnE** function uses 2 different methods that are automatically selected depending on the dynamic state of the actual value and the deviation from the setpoint at startup. **tUnE** can be started from within any dynamic actual value sequence.
If there is a **great difference between actual value and setpoint** when **tUnE** is activated, a switching line is established about which the controlled variable performs forced oscillations during the self-setting process. The switching line is set to such a level that the actual value should not exceed the setpoint.

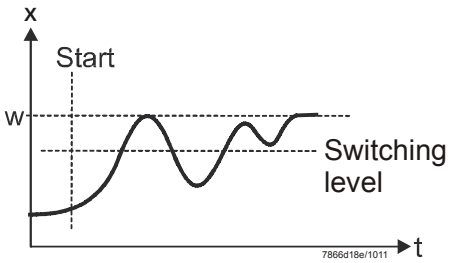


Figure 25: Great difference between actual value and setpoint

With a **small deviation** between setpoint and actual value (after the controlled system has settled, for instance), forced oscillation about the setpoint is performed.

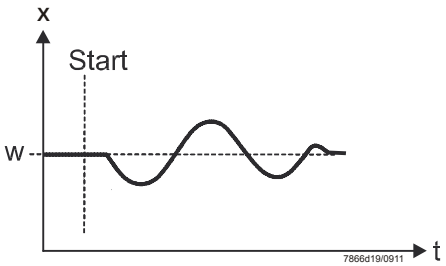


Figure 26: Small control deviation

The data of the controlled system recorded for the forced oscillations are used to calculate the controller parameters **rt**, **dt**, **Pb1** and a filter time constant dF1 for actual value filtering that is optimized for this controlled system.

Conditions

- High-fire operation in *modulating burner* mode
- The thermostat function (relay K1) must be constantly activated; otherwise **tUnE** will be canceled and no optimized controller parameters will be adopted
- The above mentioned actual value oscillations during the self-setting process must not exceed the upper threshold of the thermostat function (increase if necessary, and lower the setpoint)

☞ Note!
A successfully started *Self-setting* function is automatically aborted after 2 hours. This could occur in the case of a controlled system that responds slowly, for example, where, even after 2 hours, the described procedures cannot be successfully completed.

9.2 Checking the controller parameters

Optimum adjustment of the controller to the controlled system can be checked by recording a startup sequence with the control loop closed. The following diagrams indicate possible incorrect adjustments, and their correction.

Example

The response to a setpoint change is shown here for a 3rd order controlled system for a PID controller. The method used for adjusting the controller parameters can, however, also be applied to other controlled systems. A suitable value for **dt** is **rt/4**.

Pb too small

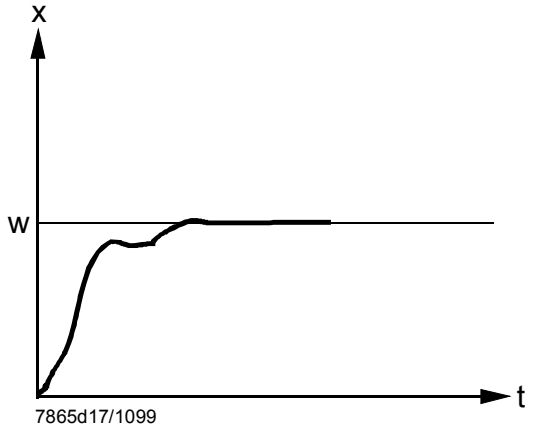


Figure 27: Pb too small

Pb too large

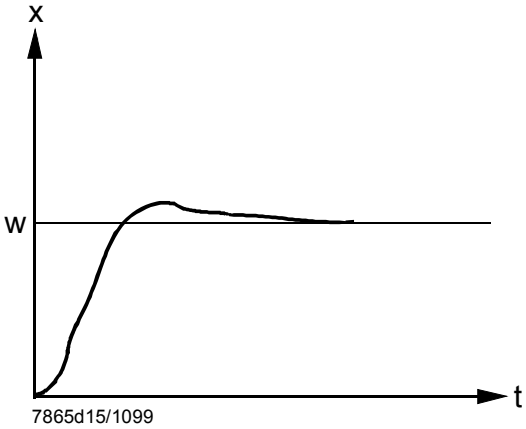


Figure 28: Pb too large

rt, dt too small

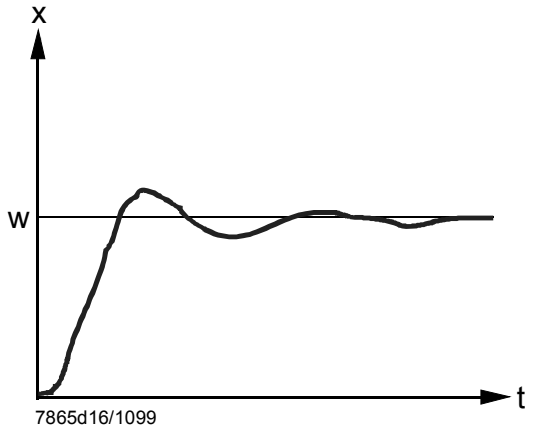


Figure 29: rt, dt too small

rt, dt too large

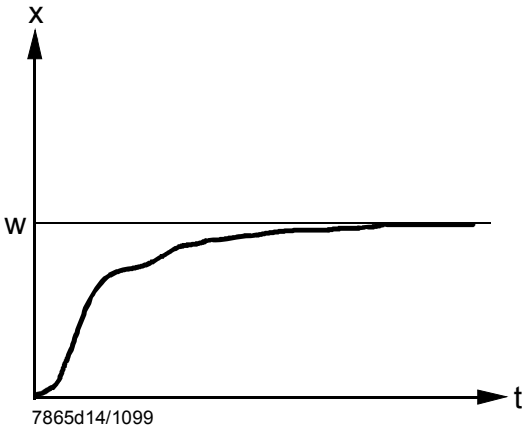


Figure 30: rt, dt too large

Optimum adjustment

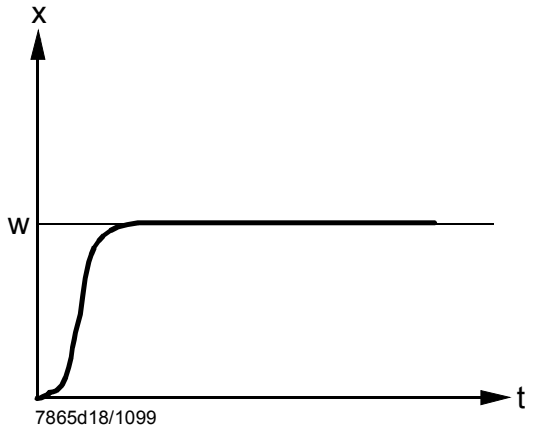


Figure 31: Optimum adjustment

10 PC software ACS411

PC software ACS411 is an operating module for use with the RWF50… universal controller and designed for the following basic tasks:

- Visualization of system state covering the following data:
  - Parameters
  - Process data
  - Configuration and parameterization of the controller (individual parameters)
  - Saving and restoration of parameter sets

A USB cable can be used to establish the connection between PC (USB plug type A, 4 pins) and RWF50... (USB plug type Mini B, 5 pins).

Note!
The cable must be purchased on site.

10.1 Safety notes

Caution!
PC software ACS411 is a convenient tool for use by qualified personnel, designed to commission and optimize the universal controller. Since the required actions and settings are safety-related, the user has a special obligation to exercise due care. Although specific technical measures have been taken to prevent incorrect entry of data and wrong parameter values, the user must check the correct function of the plant in a conventional way both during and after commissioning and – if required – ensure manual shutdown.

10.2 Setting the correct system parameters

Caution!
It should be noted that the characteristics of the universal controller are determined primarily by the parameter settings made, rather than by the type of unit. It is especially the OEM which is responsible for making certain that the controller's parameter settings are in compliance with the standards covering the respective application or type of plant. Responsibility for the parameter settings is assumed by the person who, in accordance with the access rights, makes or has made changes at the respective setting level. The detailed descriptions and safety notes given in the User Manual on the system components must also be observed.

10.3 Changing the parameters

Caution!
After changing parameters, all parameters must be checked via the unit's display to ensure they are correctly set – without making use of the PC software ACS411.

10.4 Place of installation



Caution!
PC software ACS411 is designed for use on site, that is, within viewing and hearing distance of the respective combustion plant. This means that remote control is not permitted.

10.5 License and liability regulations



Note!
For ENDUSER LICENSE AGREEMENT for PC software ACS411, refer to program menu item *Info* ➔ *Software documentation*.
IMPORTANT – PLEASE READ CAREFULLY!

10.6 Procurement of PC software ACS411

For ordering the ACS411 software and updates, please contact your supplier or heating engineer.

10.7 Languages

PC software ACS411 is available in English and German. To select the language you require, go to program menu item *File* ➔ *Default settings* ➔ *Program language* (ACS411 setup program must be restarted).

10.8 Operating systems : Operating

- Windows 2000 SP4
- Windows 7 - 32 bit
- Windows 7 - 64 bit
- Windows VISTA
- Windows XP

10.9 Prerequisites for hardware

- Free hard disk memory: 300 MB
- RAM: 512 MB

10.10 Installation

Note!
First, install PC software ACS411; then, connect the controller. If not observed, an error message is delivered.

PC software ACS411 is supplied on a CD.

* Insert CD in the CD or DVD drive.
  Setup starts automatically.

* Follow the instructions appearing on the screen.

* Connect PC and controller via the USB cable.
  New hardware is identified and USB driver installed.
  This may take a few minutes.

* Follow further instructions given on the screen and wait until the installation is successfully completed.

10.11 Others

10.11.1 Use of USB port : Use of

Use

The USB port is intended for temporary use to make the parameter settings, the configuration and for work in connection with commissioning.
When using the USB port, the controller can be securely operated, tested and set with no need for using the mains cable.

10.11.2 Powering the controller via the USB port : Powering the controller via the port

Using the HUB: Using the

If the controller shall be powered via the USB port, a HUB with power supply is required, capable of delivering at least 500 mA at every outlet.

Switching off: Switching off

When supplying power via the USB port, relays and analog output are deenergized to reduce power consumption.

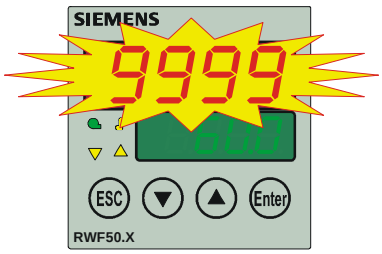
Note!
Check to ensure that power supply to the measuring converter (G+ and G-) is not connected. This increases power usage via the USB port as well.

Measuring accuracy:

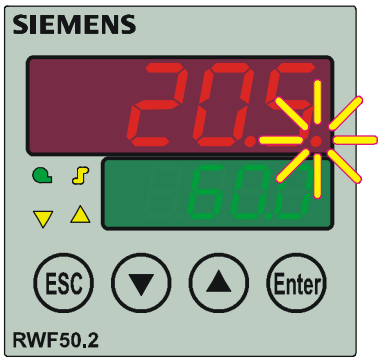
The measuring accuracy specified in chapter 12 *Technical data* does not apply when powering the controller via the USB port.

11 What to do if ...

11.1 Alarm messages:

Display	Cause	Remedy
9999 flashing  7866z07/0112	**Measured value exceeded limit** The measured value is too great, lies outside the measuring range, or the sensor is faulty --- **Measured value dropped below limit** The measured value is too small, lies outside the measuring range, or the sensor has a short-circuit	* Check to see if sensor and connecting line are damaged or have a short-circuit ⇨ Reference! See chapter 4.3 *Assignment of pins* * Check to see if the correct sensor is selected or connected ⇨ Reference! See chapter 8.1 *Analog input* InP1

11.2 Others

Display	Cause	Remedy
On the upper display, the decimal place to the right is lit  7866z08/0911	USB connection	Remove USB connection ⇨ Reference! See chapter 10 *PC software ACS411*

12 Technical data

12.1 Inputs

12.1.1 Resistance thermometers

Type	Measuring range	Measuring accuracy [a]	Impact of ambient temperature
Pt100; DIN EN 60751	-200...850 °C (-328...1562 °F)	≤0.1%	50 ppm/K
Pt1000; DIN EN 60751	-200...850 °C (-328...1562 °F)	≤0.1%	50 ppm/K
LG-Ni1000	-50...+160 °C (-58...320 °F)	≤0.1%	50 ppm/K
0...135 Ω		≤0.25%	50 ppm/K

[a] Accuracies relate to the maximum measuring range.

Line resistance	Max. 30 Ω per line with 3-wire circuit
Line balancing	Not required with 3-wire circuits. With 2-wire circuits, line balancing can be performed by making an actual value correction

12.1.2 Input signals

Measuring range	Measuring accuracy [a]	Impact of ambient temperature
Voltage DC 0...10 V Input resistance R_E >2 MΩ	≤0.1%	100 ppm/K
Voltage DC 0(1)...5 V Input resistance R_E >2 MΩ	≤0.2%	200 ppm/K
Current 0(4)...20 mA Voltage drop ≤2 V	≤0.1%	100 ppm/K

[a] Accuracies relate to the maximum measuring range.

12.1.3 Binary input D1

Potentialfree contact for the following functions, depending on the configuration:
- No function
- Setpoint readjustment
- Setpoint changeover
- Operating mode changeover

12.2 Monitoring the measuring circuit

In the event of error, the outputs assume defined states (configurable).

Measuring transducer	Measured value crossed limit	Sensor/line has short-circuit	Sensor/line interrupted
Resistance thermometer	●	●	●
Voltage 1...5 V	●	●	●
0...5 V, 0...10 V	(●)	---	---
Current 4...20 mA	●	●	●
0...20 mA	(●)	---	---

● = detected

(●) = detected only if measuring range is exceeded

- = not detected

12.3 Controller outputs OutP Controller o

Relay K1 (NO) 1P, 1N (burner release)	
Contact rating	Max. 1 A at AC 250 V at cosφ >0.6
Contact life	100,000 switching cycles at high-fire
Contact protection	Varistor
Power supply for transducer G+, G-	DC 24 V ±10%/max. 25 mA short-circuit-proof

The following relay data are those specified by the supplier.

Only RWF50.2

Relay K2, KQ (controlling element OPEN)	
Contact rating	Max. 1 A at AC 250 V and cosφ >0.6
Contact life	100,000 switching cycles at high-fire
Contact protection	RC combination
Relay K3, KQ (controlling element CLOSE)	
Contact rating	Max. 1 A at AC 250 V at cosφ >0.6
Contact life	100,000 switching cycles at high-fire
Contact protection	RC unit

Relay data are those specified by the supplier.

Only RWF50.3

Analog output A+, A-	
Voltage	DC 0...10 V short-circuit-proof
Load resistance	R_{Last} ≥500 Ω
Accuracy	≤0.25%, ±50 ppm/K
Current	0...20 mA/4...20 mA
Load resistance	R_{Last} ≤500 Ω
Accuracy	≤0.25%, ±50 ppm/K

12.4 Controller

Type of controller	
- RWF50.2	Modulating controller
- RWF50.3	Continuous controller
Controller structure	P/PI/PD/PID
Sampling time	250 ms

12.5 Electrical data

Power supply (switching network section)	AC 110...240 V +10/-15% 48...63 Hz
Electrical safety	To DIN EN 60730, part 1 Overvoltage category II Degree of contamination 2
Power consumption	Max. 16 VA
Data backup	EEPROM
Electrical connection	At the rear via screw terminals
- Cross-sectional area - Stranded wire with	0.25...1.5 mm² fine-wired - Ferrules to DIN 46228 - Pin-type cable socket to DIN 46231 - Crimp-type cable socket in fork-form for M3 thread (dimensions to DIN 46237)
With UL applications	Use of the cable lug or ferrules to UL486A-B (UL listed or recognized)
Tightening torque	0.5 Nm
Electromagnetic compatibility	DIN EN 61326-1
Emitted interference	Class B
Immunity	Meeting industrial requirements

12.6 Housing

Type of housing	Made of Makrolon for control panel mounting to DIN IEC 61554 (use in indoor)
Color	Light-grey RAL7035
Mounting depth	92 mm
Mounting position	Optional
Degree of protection	To DIN EN 60529 Front side IP66 Rear IP20
Weight - RWF50.2 - RWF50.3	(Fully equipped) Approx. 170 g Approx. 168 g

12.7 Environmental conditions

Storage	DIN IEC 60721-3-1
Climatic conditions	Class 1K3
Mechanical conditions	Class 1M2
Temperature range	-40...70 °C
Humidity	<95% r.h.
Transport	DIN IEC 60721-3-2
Climatic conditions	Class 2K2
Mechanical conditions	Class 2M2
Temperature range	-40...70 °C
Humidity	<95% r.h.
Operation	DIN IEC 60721-3-3
Climatic conditions	Class 3K3
Mechanical conditions	Class 3M3
Temperature range	-20...50 °C
Humidity	<95% r.h.
Installation altitude	Max. 2,000 m above sea level

Attention!
Condensation, formation of ice and ingress of water are not permitted!

12.8 Segment display

Height of numerals	
- Upper display	10 mm
- Lower display	7 mm
Color	
- Upper display	Red
- Lower display	Green
Digits	4 (including 0, 1 or 2 decimal places, configurable)
Range of display	-1999...9999

12.9 Standards and certificates

Conformity to EEC directives

- Electromagnetic compatibility EMC (immunity)	2004/108/EC
- Low-voltage directive, to DIN EN 60730-1	2006/95/EC

ISO 9001: 2008
Cert. 00739

ISO 14001: 2004
Cert. 38233

13 Key

A	Switch-on point for high-fire when response threshold (q) is reached
B	Switch-off point for burner
bin1	Binary input 1
binF	Binary input
CACt	Operating action
Cntr	Controller
CodE	Level lockout
ConF	Configuration
CtYP	Controller type
db	Dead band
dECP	Decimal point
dF1	Filter time constant
diSL	Lower display
diSP	Display
diSU	Upper display
dSP	Setpoint
dt	Derivative action time
End	End value
FnCt	Function
HYS1	Switch-on threshold heating controller
HYS2	Switch-off threshold heating controller
HYS3	Switch-off threshold heating controller
HYS4	Switch-on threshold cooling controller
HYS5	Switch-off threshold cooling controller
HYS6	Switch-off threshold cooling controller
InP	Analog input
InP1	Analog input 1
OFF1	Correction of measured value
oLHi	Upper working range limit
oLLo	Lower working range limit
OPnt	Zero point
OPr	User
OutP	Control outputs
PArA	Parameter
Pb	Proportional range
Pb1	Proportional range 1
q	Response threshold
qeff	Sum of all integrals
rAFC	Thermal shock protection
rAL	Limit value
rASL	Ramp slope
rOut	Value when out of range
rt	Integral action time
SCH1	End of display
SCL1	Start of display
SEn1	Sensor type
SiGn	Signal type
SP1	Setpoint 1
SP2	Setpoint 2
SPH	Setpoint limitation end
SPL	Setpoint limitation start
t	Time
t1	Power ON (startup at actual value)
t2	Actual value of ramp stop outside tolerance band
t3	Actual value returned to tolerance band

t4	Setpoint reached, thermal shock protection (TSS) no longer active
toLP	Tolerance band of ramp
tout	Timeout
tt	Running time of controlling element
Unit	Unit of temperature
W	Setpoint
Y	Angular positioning

14 List of figures

Figure 1: Block structure 12
Figure 2: Dimensions of RWF50 14
Figure 3: Mounting in a panel cutout 15
Figure 4: Test voltages 18
Figure 5: Assignment of terminals 19
Figure 6: Control sequence of heating controller 21
Figure 7: Control sequence of cooling controller 21
Figure 8: Control sequence of modulating burner, 3-position output 22
Figure 9: Control sequence of modulating burner, analog output 23
Figure 10: Control sequence of 2-stage burner, 3-position output 24
Figure 11: Control sequence of 2-stage burner, analog output 25
Figure 12: Setpoint changeover or setpoint shift 27
Figure 13: Control sequence response threshold (q) 28
Figure 14: Control sequence *Cold start of plant* 29
Figure 15: Thermal shock protection (TSS) 31
Figure 16: Meaning of display and buttons 32
Figure 17: Display start 33
Figure 18: Basic display 33
Figure 19: Display of self-setting function 37
Figure 20: Display of software version 38
Figure 21: Display segment test 38
Figure 22: Parameterization 39
Figure 23: Configuration 41
Figure 24: Self-setting function in high-fire operation 48
Figure 25: Great difference between actual value and setpoint 49
Figure 26: Small control deviation 49
Figure 27: Pb too small 50
Figure 28: Pb too large 50
Figure 29: rt, dt too small 50
Figure 30: rt, dt too large 50
Figure 31: Optimum adjustment 50

Index

A

ACS411

- **Changing the parameters** ... 51
- **Installation** ... 53
- **Languages** ... 52
- **License and liability regulations** ... 52
- **Others** ... 53
- **PC software ACS411** ... 51
- **Place of installation** ... 52
- **Prerequisites for hardware** ... 52
- **Procurement of PC software ACS411** ... 52
- **Safety notes** ... 51
- **Setting the correct system parameters** ... 51

C

Configuration

- **Analog input InP1** ... 42
- Analog output ... 45
- **Binary functions binF** ... 46
- Binary output ... 45
- **Control outputs OutP** ... 45
- **Controller Cntr** ... 43
- **Display diSP** ... 47
- **Thermal shock protection (TSS) rAFC** ... 44

Configuration ConF ... 41

E

Electrical connection

- **Connection of external components** ... 17

Electrical connections ... 17

- **Assignment of terminals** ... 19
- **Fusing** ... 17
- **Galvanic separation** ... 18
- **Incorrect use** ... 17
- **Installation notes** ... 17
- **Safety regulations** ... 17
- **Screw terminals** ... 17
- **Suppression of interference** ... 17

I

Identification of product no. ... 13

- **Location** ... 13
- **Product nos.** ... 13
- **Scope of delivery** ... 13
- **Type field** ... 13

Installation ... 14

- **Cleaning the front** ... 16
- **Dimensions** ... 14
- **Installation site and climatic conditions** ... 14
- **Mounting the controller in a panel cutout** ... 15
- **Removing the controller from the panel cutout** ... 16
- **Side-by-side mounting** ... 15

Introduction ... 8

- **Block structure** ... 12
- **Control** ... 11
- **Cooling controller** ... 11
- **Correct use** ... 9
- **Description** ... 11
- **General notes** ... 8
- **Mounting** ... 11
- **Notification symbols** ... 10
- **Presentation** ... 10
- **Qualified personnel** ... 9
- **Safety notes** ... 9
- **Typographical conventions** ... 9
- **Use in heating plants** ... 11
- **Warning symbols** ... 9

K

Key ... 59

O

Operating modes ... 21

- **2-stage burner, 3-position output** ... 24
- **2-stage burner, analog output** ... 25
- **Burner shutdown** ... 26
- **Cold start of plant** ... 29
- **Cooling controller** ... 21, 23, 25, 28, 30
- Entry ... 27
- **Heating controller** ... 21, 29
- **High-fire operation** ... 22
- **Interlocking** ... 29, 31
- **Low-fire operation** ... 21
- **Modulating burner, 3-position output** ... 22
- **Modulating burner, analog output** ... 23
- **Operating mode changeover** ... 22
- **Predefined setpoint** ... 27
- **Response threshold (q)** ... 28
- **Setpoint changeover or setpoint shift** ... 27
- **Thermal shock protection** ... 31
- **Thermostat function** ... 21

Operation ... 32

- **3-position controller** ... 35
- **Basic display** ... 33
- **Basic display** ... 32
- **Cancel** ... 37
- Changing the setpoints ... 34
- **Display of software version** ... 38
- **Flashing actual value display** ... 32
- **Initialization** ... 32
- **Manual control** ... 32
- **Manual control, 2-stage burner** ... 36
- **Manual control, modulating burner** ... 35
- **Meaning of display and buttons** ... 32
- **Modulating controller** ... 35
- **Parameter display** ... 32
- Segment test ... 38
- **Self-setting function** ... 32
- **Start** ... 37
- **Starting the self-setting function** ... 37

Timeout....34
User level....34
P
Parameterization
Display of controller parameters....40
Parameterization PArA....39
PC software ACS411
Measuring accuracy....53
Operating systems....52
Powering the controller via the USB port....53
Use of USB port....53
Using the HUB....53
PC-Software ACS411
Switching off....53
S
Self-setting function....48
2 procedures....49
Checking the controller parameters....50
Conditions....49
Self-setting function in high-fire operation....48
T
Technical data....55
Binary input D1....55
Controller....56
Controller outputs OutP....56
Electrical data....57
Environmental conditions....58
Housing....57
Input signals....55
Inputs....55
Monitoring the measuring circuit....56
Resistance thermometers....55
Segment display....58
Standards and certificates....58
W
What to do if…....54
Alarm messages....54
Others....54

Siemens AG Infrastructure & Cities Sector Building Technologies Division
Berliner Ring 23
D-76437 Rastatt
Tel. +49 7222 598 279
Fax +49 7222 598 269
www.siemens.com

© 2014 Siemens AG Infrastructure & Cities Sector
Building Technologies Division
Subject to change!

SIEMENS



RWF55.5 and RWF55.6

Compact universal controllers

Optimized for temperature and pressure control in connection with modulating or multistage burners and air conditioning systems

User Manual

The RWF55.5/RWF55.6 and this User Manual are intended for use by OEMs which integrate the controllers in their products!

Caution!
All safety, warning and technical notes contained in the Data Sheet on the RWF55 (N7867) also apply to this document!

CC1U7867en
05.11.2013

Building Technologies Division
Infrastructure & Cities Sector

Supplementary documentation

Data Sheet RWF55 ..... N7867
Environmental Declaration RWF55 .....E7867

Contents

1 Introduction ... 8

1.1 General notes ... 8
1.2 Typographical conventions ... 9
1.2.1 Safety notes ... 9
1.2.2 Warning symbols ... 9
1.2.3 Notification symbols ... 10
1.2.4 Presentation ... 10
1.3 Description ... 11
1.4 Block structure ... 12

2 Identification of product no. ... 13

2.1 Type field ... 13
2.2 Scope of delivery ... 13

3 Installation ... 14

3.1 Installation site and climatic conditions ... 14
3.2 Dimensions ... 14
3.3 Side-by-side mounting ... 15
3.4 Mounting the controller in a panel cutout ... 15
3.5 Removing the controller from the panel cutout ... 16
3.6 Cleaning the front ... 16

4 Electrical connections ... 17

4.1 Installation notes ... 17
4.2 Galvanic separation ... 18
4.3 Assignment of terminals ... 19

5 Operating modes ... 22

5.1 Low-fire operation ... 22
5.2 High-fire operation ... 23
5.2.1 Modulating burner, 3-position output ... 23
5.2.2 Modulating burner, analog output ... 24
5.2.3 2-stage burner, 3-position output ... 25
5.2.4 2-stage burner, analog output ... 26
5.3 Burner shutdown ... 27
5.4 Predefined setpoint ... 28
5.4.1 Setpoint changeover SP1 / SP2 or setpoint shift analog via InP2 ... 29
5.4.2 Setpoint changeover SP1 / external setpoint via InP2 ... 30
5.4.3 Setpoint shifting SP1 analog via InP2 / binary via dSP ... 31
5.4.4 External setpoint, setpoint shifting binary via dSP ... 32
5.5 Weather-compensated setpoint shifting ... 33

5.6 Response threshold (q) 34
5.7 Cold start of plant 35
5.8 Thermal shock protection (TSS) 37

6 Operation 38

6.1 Meaning of display and buttons 38
6.2 Basic display 40
6.3 User level 41
6.4 Manual control, modulating burner 42
6.5 Manual control, 2-stage burner 43
6.6 Starting the self-setting function 44
6.7 Display of software version 45

7 Parameterization PArA 46

8 Configuration ConF 49

8.1 Analog input InP1 50
8.2 Analog input InP2 52
8.3 Analog input InP3 53
8.4 Controller Cntr 54
8.5 Thermal shock protection (TSS) rAFC 55
8.6 Alarm function AF 56
8.7 Control outputs OutP 58
8.8 Binary input binF 59
8.9 Display diSP 60
8.10 Interface IntF 61

9 Self-setting function 62

9.1 Self-setting function in high-fire operation 62
9.2 Checking the controller parameters 64

10 PC software ACS411 65

10.1 Safety notes 65
10.2 Setting the correct system parameters 65
10.3 Changing the parameters or the plant's configuration 65
10.4 Place of installation 66
10.5 License and liability regulations 66
IMPORTANT – PLEASE READ CAREFULLY! 66
10.6 Procurement of PC software ACS411 66
10.7 Languages 66
10.8 Operating systems : Operating 66
10.9 Prerequisites for hardware 66
10.10 Installation 67
10.11 Others 67

10.11.1 Use of USB port : Use of 67
10.11.2 Powering the controller via the USB port : Powering the controller via the port 67

11 Modbus interface 68

11.1 User level 68
11.2 Parameter level 69
11.3 Configuration level 70
11.4 Remote operation 70
11.5 Device data 71
11.6 Device state 71

12 Profibus-DP interface 72

12.1 RS-485 Technology transfer 72
12.2 Wiring 77
12.3 Parameter list 77

13 What to do if 78

13.1 Alarm messages: 78
13.2 Others 78

14 Technical data 79

14.1 Inputs 79
14.1.1 Analog input InP1 (actual value) 79
14.1.2 Analog input InP2 (external setpoint, setpoint shifting) 81
14.1.3 Analog input InP3 (outside temperature) 81
14.1.4 Binary input D1 81
14.1.5 Binary input D2 82
14.2 Monitoring the measuring circuit 83
14.3 Controller outputs OutP Controller o 84
14.4 Controller 85
14.5 Electrical data 85
14.6 Housing 85
14.7 Environmental conditions 86
14.8 Segment display 86
14.9 Standards and certificates 86

15 Key 87

16 List of figures 89

1 Introduction

1.1 General notes

Please read this User Manual before switching on the controller. Keep the User Manual in a safe place which can be accessed by all users at all times.

Version!
This User Manual describes all necessary settings (applicable to controller software version XXX.01.01).

⇨ Reference!
See chapter 6.7 *Display of software version.*

1.2 Typographical conventions

1.2.1 Safety notes

This User Manual contains information which must be observed to ensure your own personal safety and to prevent damage to equipment and property. The instructions and notes are highlighted by warning triangles, a hand or arrow symbol and are presented as follows, depending on the hazard level:

Qualified personnel

Only **qualified personnel** are allowed to install and operate the equipment. Qualified personnel in the context of the safety-related notes contained in this document are persons who are authorized to commission, ground and tag devices, systems and electrical circuits in compliance with established safety practices and standards.

Correct use

Note the following:

The controller may only be used on the applications described in the technical documentation and only in connection with devices or components from other suppliers that have been approved or recommended by Siemens.

The product can only function correctly and safely if shipped, stored, set up and installed correctly, and operated and maintained as specified.

1.2.2 Warning symbols

The symbols for **Caution** and **Attention** are used in this User Manual under the following conditions:



Caution

This symbol is used where there may be a **danger to personnel** if the instructions are disregarded or not strictly observed!



Attention

This symbol is used where **damage to equipment or data** can occur if the instructions are disregarded or not strictly observed!



Attention

This symbol is used if **precautionary measures must be taken** when handling electrostatically sensitive components.

1.2.3 Notification symbols

☞	**Note**	This symbol is used to draw your **special attention** to a remark.
⇨	**Reference**	This symbol refers to **additional information** in other documents, chapters or sections.
abc[1]	**Footnote**	Footnotes are **comments, referring to specific parts of the text.** They consist of 2 parts: 1) **Markings** in the text are arranged as continuous superscript numbers 2) **Footnote text** is placed at the bottom of the page and starts with a number and a period
*	**Action**	An asterisk indicates that **a required action** is described. The individual steps are indicated by asterisks, for example: * Press ▲

1.2.4 Presentation

ESC	**Buttons**	Buttons are shown in a circle. Either symbols or text are possible. If a button has multiple assignments, the text shown is always the text corresponding to the function currently used.
Enter + ▲	**Button combinations**	Two buttons shown in combination with a plus sign means that they must be pressed simultaneously.
ConF → InP → InP1	**Command chain**	Arrows between words serve for finding parameters at the configuration level more easily or for navigating in the ACS411 setup program.

1.3 Description

Use in heating plants

The RWF55 is used primarily for the control of temperature or pressure in oil- or gas-fired heating plants. Depending on the setting, it is employed as a compact 3-position controller or as a modulating controller with an analog output. An external switch is provided to convert it to a 2-position controller for controlling 2-stage burners. The built-in thermostat function switches the burner on and off.

Cooling controller

The controller's operating mode can be changed from heating to cooling, or vice versa.

⇨ Reference!
See chapter 8.4 *Controller* Cntr.

RWF55

The controllers feature two 4-digit 7-segment displays for the actual value (red) and the setpoint (green).
The RWF55 has a 3-position output consisting of 2 relays to open or close a controlling element.
There is also an analog output and a multifunctional relay (K6), which can be used to set 12 different switching functions.

Interface

The controllers feature an RS-485 interface Modbus slave as standard.

Option

Additionally, the RWF55.6 features a Profibus DP interface.

Control

In modulating mode, the RWF55 operates as a PID controller. In 2-stage mode, the RWF55 provides control based on the set switching threshold.
You have the option of specifying the setpoint of the RWF55 on the controller or externally via an interface.
The user uses it for control the temperature or pressure of a heating boiler or cooling system.
It is possible to adjust the minimum and maximum setpoint limits.
2 binary inputs are used to execute functions such as setpoint changeover, setpoint shifting or operating mode changeover.
Standard feature is a self-setting function used to determine the PID control parameters.

Mounting

The controller insert measures 48 x 96 x 122 mm and is especially suited for installation in control panels. All electrical connections are made via screw terminals at the rear of the unit.

1.4 Block structure

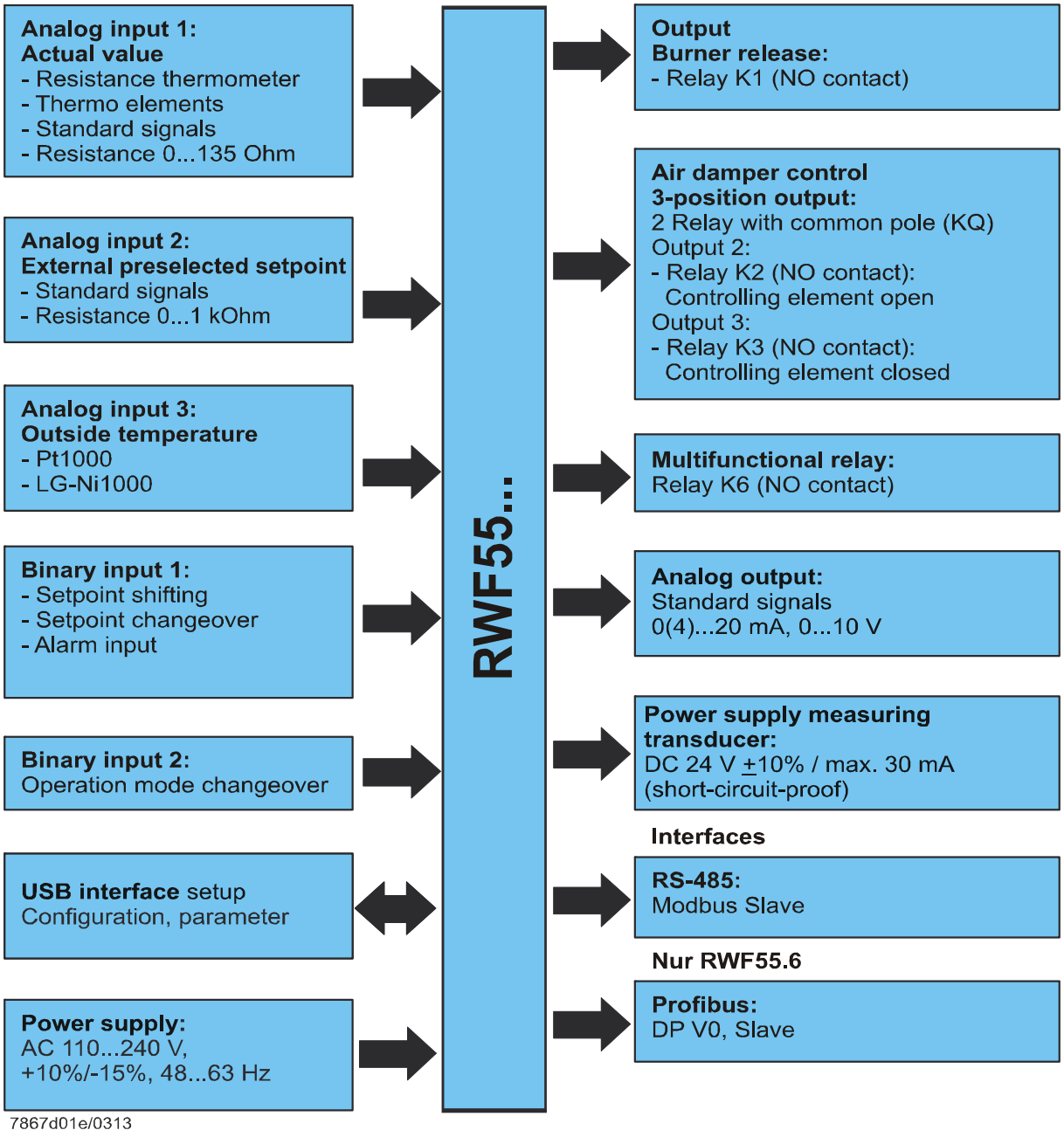


Figure 1: Block structure

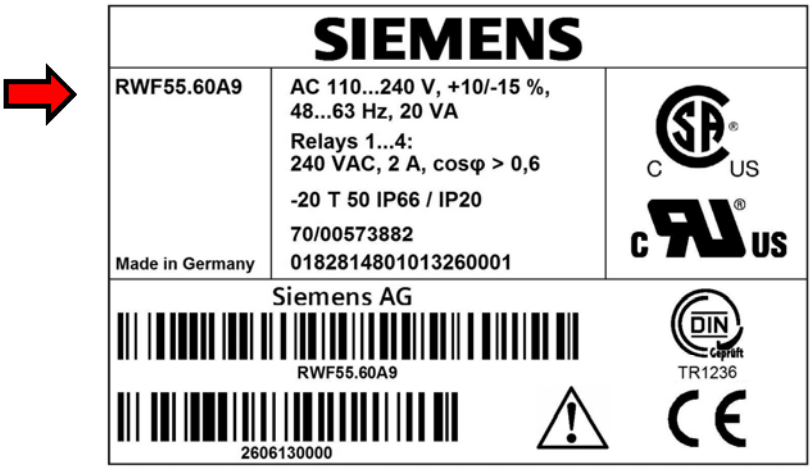
2 Identification of product no.

2.1 Type field

Location:

The type field is glued onto the housing. The arrow below indicates the product no.

Example



Attention!
Mains supply must correspond to the operating voltage given on the type field.

Product nos. :

Product no.	Description
RWF55.50A9	Full version with 3-position output, analog output, RS-485 – single pack
RWF55.51A9	Full version with 3-position output, analog output, RS-485 – multipack (20 pieces)
RWF55.60A9	Full version with 3-position output, analog output, RS-485 Profibus-DP – single pack
RWF55.61A9	Full version with 3-position output, analog output, RS-485 Profibus-DP – multipack (20 pieces)

2.2 Scope of delivery

- Type of controller as ordered
- User Manual (only single pack)

3 Installation

3.1 Installation site and climatic conditions

- The installation site should be free from vibrations, dust and corrosive media
- The controller should be installed away from sources of electromagnetic fields, such as variable speed drives or high-voltage ignition transformers

Relative humidity: ≤95% (noncondensing)
Ambient temperature: -20...50 °C
Storage temperature: -40...70 °C

3.2 Dimensions

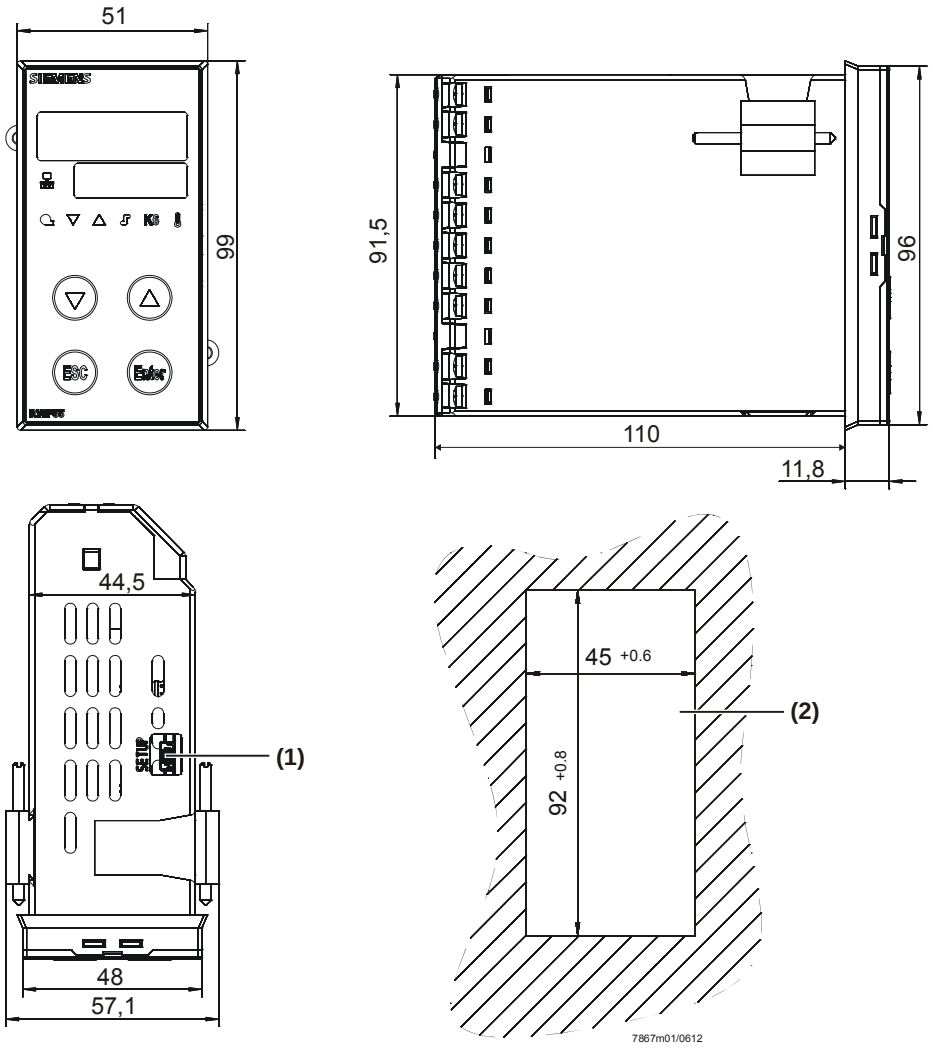


Figure 2: Dimensions of RWF55

Key
(1) USB interface setup
(2) Panel cutout

3.3 Side-by-side mounting

If several controllers are mounted side-by-side or above one another in a control panel, the horizontal distance between panel cutouts must be a minimum of 11 mm and the vertical distance a minimum of 50 mm.

3.4 Mounting the controller in a panel cutout

* Remove the mounting clips

* Fit the seal supplied with the controller

Attention!
The controller must be installed with the seal, preventing water or dirt from entering the housing!

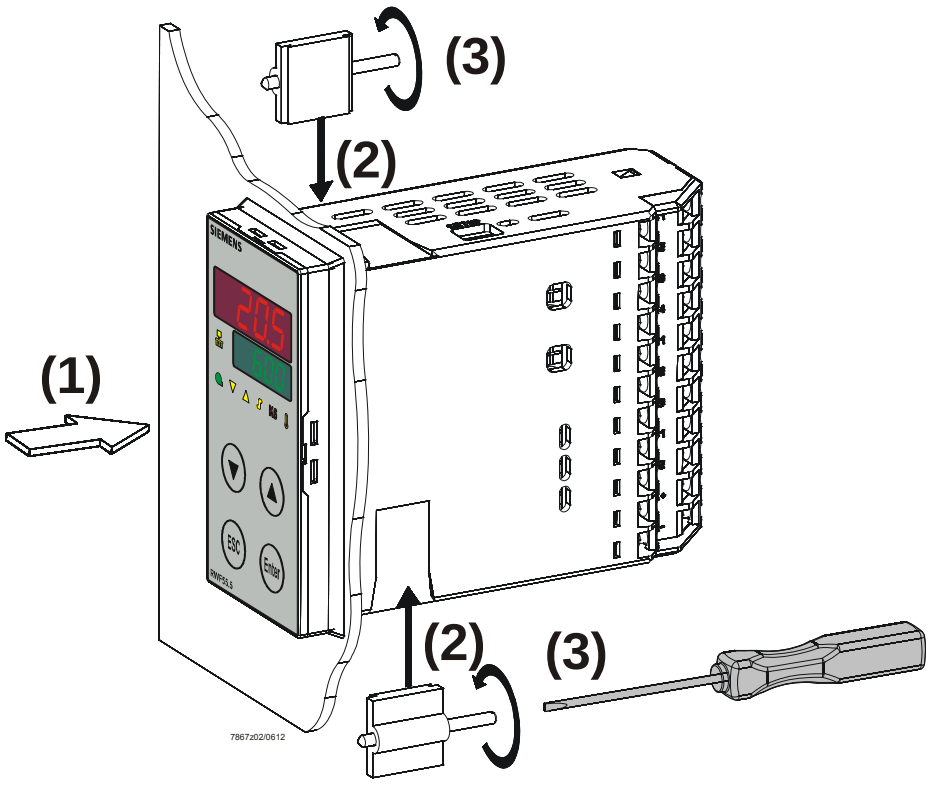


Figure 3: Mounting in a panel cutout

* Insert the controller from the front into the panel cutout (1) and make certain the seal is correctly fitted
* Working from the rear side of the panel, push the mounting clips into the guide slots on the side of the controller (2) and tighten them evenly using a screwdriver (3) until the controller housing is seated firmly in the panel cutout.

3.5 Removing the controller from the panel cutout

Attention!
When removing the controller, make certain that all cables are disconnected and that they do not get squeezed between control panel and housing.

3.6 Cleaning the front

The front of the controller can be cleaned with normal washing/rinsing agents or detergents.

Attention!
The front of the controller is **not** resistant to corrosive acids, caustic solutions and abrasive cleaners. Do not clean with high-pressure cleaners!

4 Electrical connections

4.1 Installation notes

Safety regulations

- The choice of cable, installation and electrical connections of the controller must conform to VDE 0100 *Regulations for the installation of power circuits with nominal voltages below AC 1000 V*, or the relevant local regulations
- The electrical connections must be made by qualified personnel
- If contact with live parts is possible while working on the unit, the controller must be disconnected from power supply (all-polar disconnection)
- When connecting the RWF55 to an external PELV circuit, the existing internal SELV circuit becomes a PELV circuit.
  The protection against electric shock hazard through double or reinforced insulation and voltage limitation is still present.
  No connection to protective earth is required.
- Equipment connected to the SELV circuit must have a safe separation from dangerous contact voltages in accordance with DIN EN 61140 (e.g. through double or reinforced insulation in accordance with DIN EN 60730-1).

Connection of external components



Caution!
When connecting external components to the safety extra low-voltage inputs or outputs of the RWF55 (terminals 11, 12, 13, 14, 21, 22, 23, 31, 32, D1, D2, DG, G+, G-, A+, A- and USB port, RS-485- and Profibus interface), it must be made certain that no dangerous active voltage are introduced to the RWF55.
This can be achieved by using capsulated components with double/reinforced insulation or SELV components, for example. If not observed, there is a risk of electric shock.

Screw terminals



Caution!
All screw terminals at the rear of the unit must always be properly tightened. This applies to unused terminals as well.

Fusing



Caution!
- Fusing on site must not exceed 20 A
- The fuse on the controller side (AC 250 V/1.6 A slow) conforms to IEC 60127-4
- To prevent the relay contacts from welding in the event of short-circuit in the load circuit, fusing of the output relays must give consideration to the maximum permissible relay current
  ⇨ Reference!
  See chapter 14.3 *Controller outputs* OutP.
- No other loads may be connected to the controller's main power supply terminals

Suppression of interference

- The electromagnetic compatibility and interference suppression levels conform to the standards and regulations listed under *Technical data*
  ⇨ Reference!
  See chapter 14.5 *Electrical data.*
- Input, output and supply cables should be routed separately, not parallel to one another
- All input and output lines without connection to the power supply network must be shielded and twisted. They must not be run close to live components or live cables.

Incorrect use

- The controller is not suited for installation in areas with explosion hazard
- Incorrect settings on the controller (setpoint, data of parameter and configuration levels) can affect proper functioning of the process or lead to damage.
  Safety devices independent of the controller, such as overpressure relief valves or temperature limiters/monitors should therefore always be provided, and only be capable of adjustment by qualified personnel. Please observe the relevant safety regulations. Since self-setting cannot be expected to handle all possible control loops, the stability of the resulting actual value should be checked

4.2 Galvanic separation

The illustration shows the maximum test voltages between the electrical circuits.

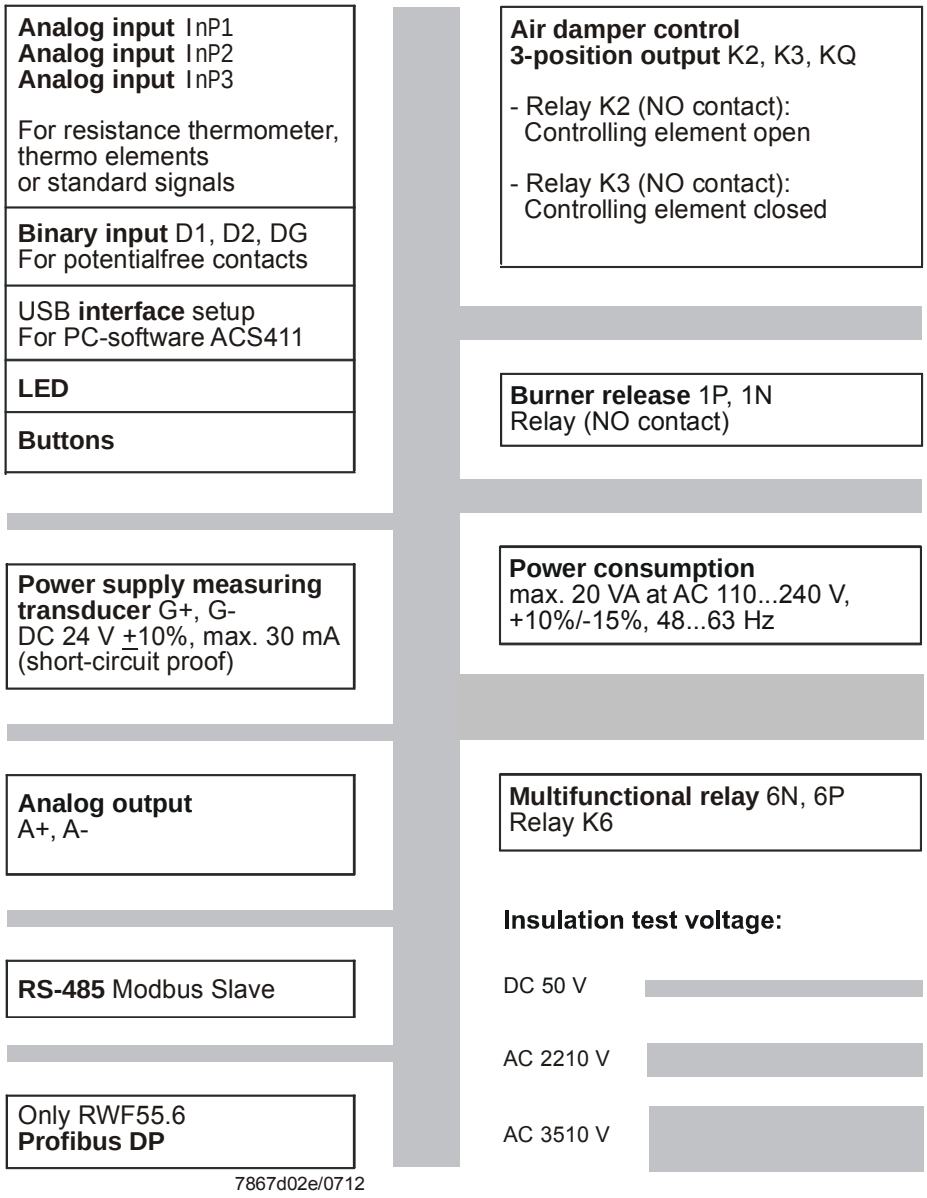


Figure 4: Test voltages

4.3 Assignment of terminals

Caution!
Electrical connections must always be made by qualified personnel!

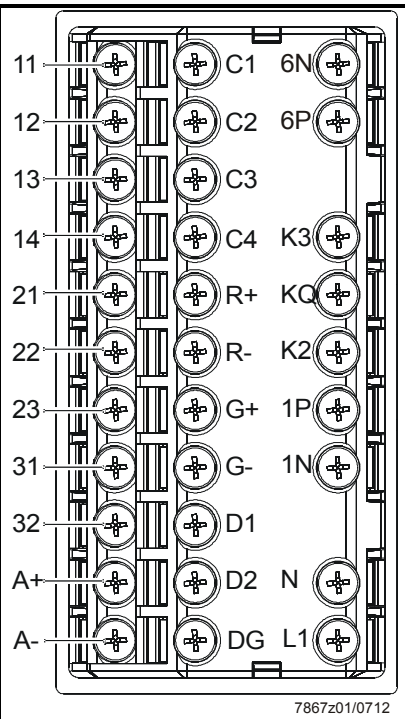
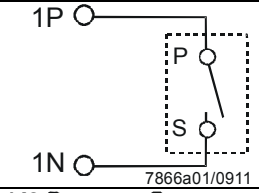
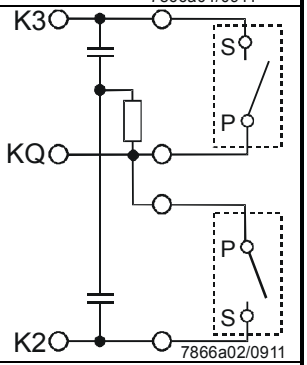
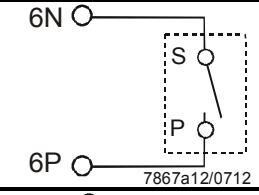
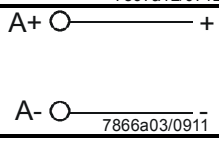
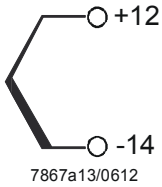
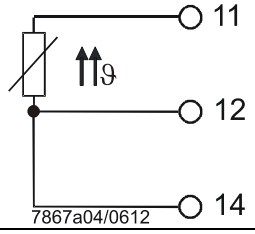
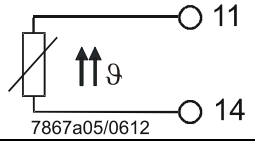
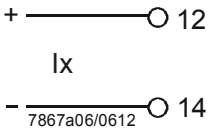
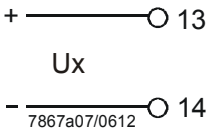
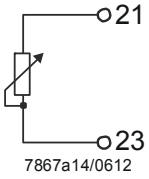
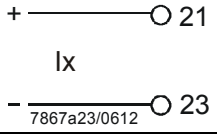
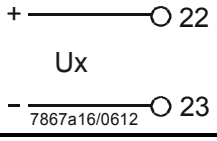
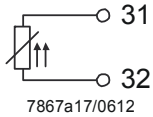


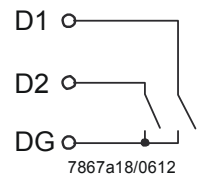
Figure 5: Assignment of terminals

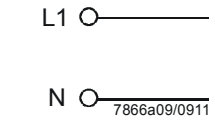
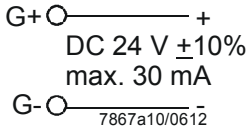
Outputs	Display LED	Terminal no.	Connection diagram
Relay *Burner release*: Relay K1: 1P, 1N		1P pole 1N NO contact	
3-position output: Relay K3: Controlling element CLOSE Relay K2: Controlling element OPEN		K3 NO contact KQ common pole K2 NO contact	
Multifunctional relay K6: 6N, 6P	K6	6N NO contact 6P pole	
Analog output A+, A- DC 0(4)...20 mA, DC 0...10 V		A+ A-	

Analog input InP1 (actual value)	**Terminal no.**	**Connection diagram**
Thermal element	12 14	
Resistance thermometer in 3-wire circuit	11 12 14	
Resistance thermometer in 2-wire circuit 0...135 Ω	11 14	
Current input DC 0...20 mA, 4...20 mA	12 + 14 -	
Voltage input DC 0...5 V, DC 1...5 V, DC 0...10 V	13 + 14 -	

Analog input InP2 (external setpoint or setpoint shifting)	**Terminal no.**	**Connection diagram**
Resistance thermometer in 2-wire circuit 0...1000 Ω	21 23	
Current input DC 0...20 mA, 4...20 mA	21 + 23 -	
Voltage input DC 0...5 V, 1...5 V, 0...10 V	22 + 23 -	

Analog input InP3 (outside temperature)	**Terminal no.**	**Connection diagram**
Resistance thermometer in 2-wire circuit	31 32	

Binary inputs binF	**Terminal no.**	**Connection diagram**
Binary input D1	D1	
Binary input D2	D2	
Common ground DG	DG	

Power supply	**Terminal no.**	**Connection diagram**
Power supply AC 110...240 V +10%/-15%, 48...63 Hz	L1 Live conductor N Neutral conductor	
Power supply measuring transducer (short-circuit-proof)	G+ G-	

Interface	**Terminal no.**	**Connection diagram**
RS-485	R+ R-	RxD/TxD + RXD/TxD -
Only RWF55.6 Profibus DP	C1 C2 C3 C4	VP (+5 V) RxD/TxD-P (B) RxD/TxD-N (A) DGND

5 Operating modes

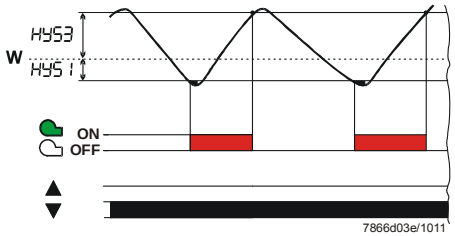
5.1 Low-fire operation

Low-fire operation means that only small amounts of heat are drawn from the boiler. Using relay K1 *Burner release*, the 2-position controller ensures control to the setpoint by switching the burner on and off like a thermostat.

Thermostat function

This mode of control is known as the **thermostat function**. An adjustable switching difference ensures that the burner's switching frequency can be selected, aimed at reducing wear.

Heating controller

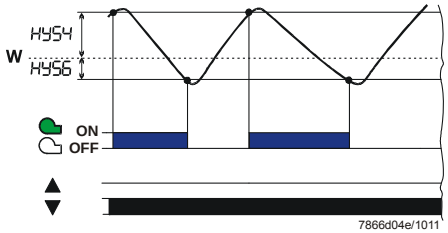


Modulating and 2-stage operation:
Actual value lies between switch-on threshold **HYS1** and switch-off threshold **HYS3**.

Figure 6: Control sequence of heating controller

Cooling controller

If the controller is set to cooling mode, temperature limits **HYS4** and **HYS6** apply. In that case, relay K1 *Burner release* is used for controlling the cooling equipment.



Modulating and 2-stage operation:
Actual value lies between switch-on threshold **HYS4** and switch-off threshold **HYS6**.

Figure 7: Control sequence of cooling controller

5.2 High-fire operation

High-fire operation means that large amounts of heat are drawn from the boiler so that the burner runs continuously. If the heating load during low-fire operation rises to a level where the actual value begins to fall below switch-on threshold **HYS1** , the controller will not immediately switch to a higher burner output, but first makes a dynamic test of the control deviation and switches to the higher output only when an adjustable threshold (q) is exceeded (**A**).

⇨ Reference!
See chapter 5.6 *Response threshold (q).*

Operating mode changeover

- In high-fire operation – depending on the application – the burner can be fired in **modulating** or **2-stage** operation, then burning larger amounts of fuel than in low-fire operation. **Binary input D2** can be used to switch between modulating and 2-stage operation
  - Contacts **D2** and **DG** open: Modulating burner operation
  - Contacts **D2** and **DG** closed: 2-stage burner operation

⇨ Reference!
See chapter 8.8 *Binary functions* binF.

5.2.1 Modulating burner, 3-position output

Area (1)

In area (1), the thermostat function is active. The lowest burner stage is switched on below switch-on threshold **HYS1** and switched off above switch-off threshold **HYS3**.

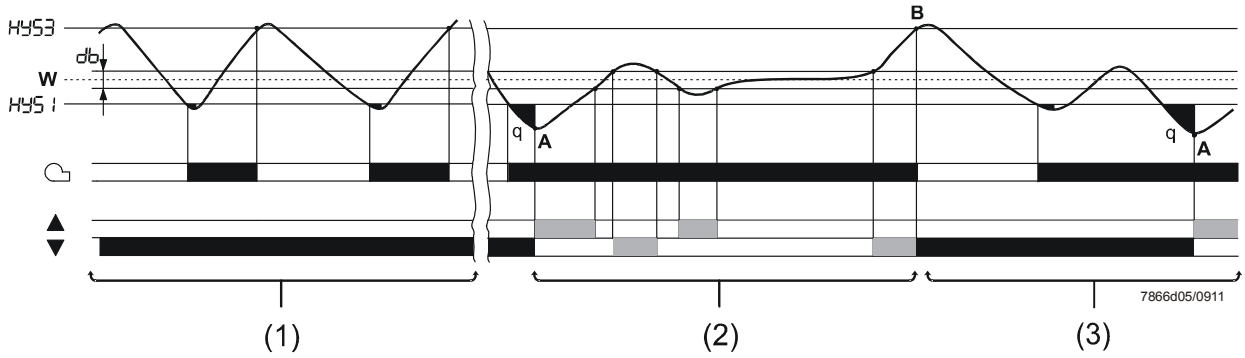


Figure 8: Control sequence of modulating burner, 3-position output

Area (2)

Here, operating mode *Modulating burner* is shown. In high-fire operation, the 3-position controller acts on an actuator via relay K2 (OPEN) and relay K3 (CLOSE). When the actual value falls below the setpoint, the response threshold (q) at point (A) is reached and the controlling element opens (greater heat output). When the actual value lies within the dead band **db**, the controlling element remains inactive. When the actual value exceeds **db**, the controlling element closes (smaller heat output).

Area (3)

If the actual value exceeds the upper switch-off threshold **HYS3** in spite of the lowest heating stage, the controller switches the burner off (B). The controller only starts low-fire operation when the actual value falls below switch-on threshold **HYS1** again. If the response threshold (q) is exceeded, the controller switches to high-fire operation (**A**).

⇨ Reference!
See chapter 5.6 *Response threshold (q).*

5.2.2 Modulating burner, analog output

Area (1) Thermostat function active.

Area (2) The RWF55 as a modulating controller provides control to the adjusted setpoint. Angular positioning is ensured via the analog output in the form of a standard signal.

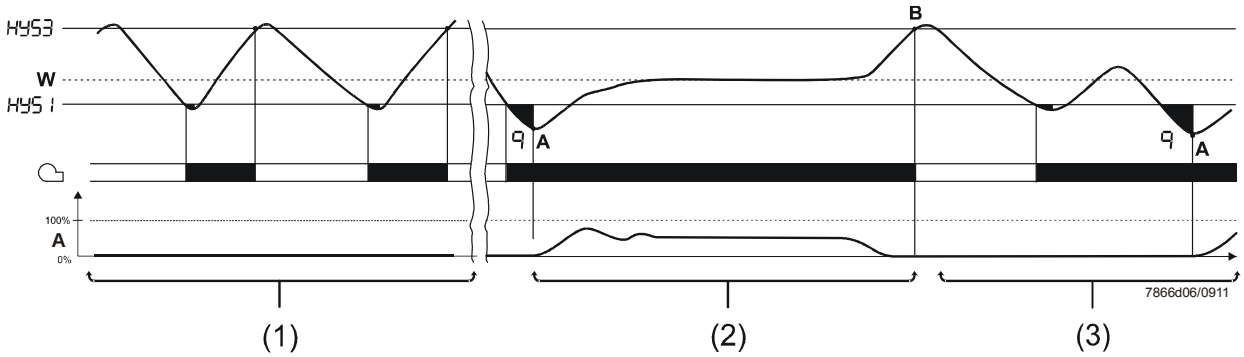


Figure 9: Control sequence of modulating burner, analog output

Area (3) The controller behaves as described in chapter 5.2.1 *Modulating burner, 3-position output*.

Cooling controller If the controller is set to cooling mode, the respective values HYS4 and HYS6 apply.

Starting from a high actual value, the controller now controls the connected cooling equipment in low-fire operation. In high-fire operation, the cooling output is controlled via relays K2 and K3 or the analog output. The response threshold (q) calculates automatically (now in the reverse sense) the point from which the cooling output is to be increased.

Output Angular positioning is ensured via the analog output in the form of a standard signal.

Note!
The modulating controller must be configured.

Reference!
See chapter 8.4 *Controller Cntr*

5.2.3 2-stage burner, 3-position output

In area (1), the thermostat function is active. In area (2), the RWF55 as a **2-position controller** acts on the second stage via relay K2 (OPEN) and relay K3 (CLOSE) by switching on at switch-on threshold HYS1 and switching off at switch-off threshold HYS2.

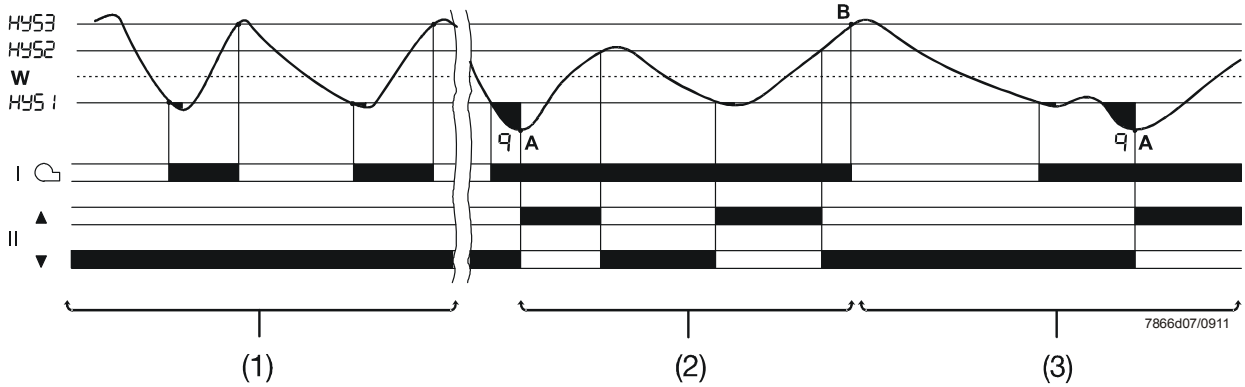


Figure 10: Control sequence of 2-stage burner, 3-position output

In area (3), the actual value exceeds the upper switch-off threshold HYS3 and the controller shuts down the burner (**B**). The controller only starts low-fire operation when the actual value falls again below switch-on threshold HYS1. If the response threshold (q) is exceeded, the controller switches to high-fire operation (**A**).

⇨ Reference!
See chapter 5.6 *Response threshold (q).*

5.2.4 2-stage burner, analog output

In this case, a digital standard signal switches the second stage on via the analog output (terminals **A+** and **A-**) when reaching switch-on threshold **HYS1** and off at the lower switch-off threshold **HYS2**.

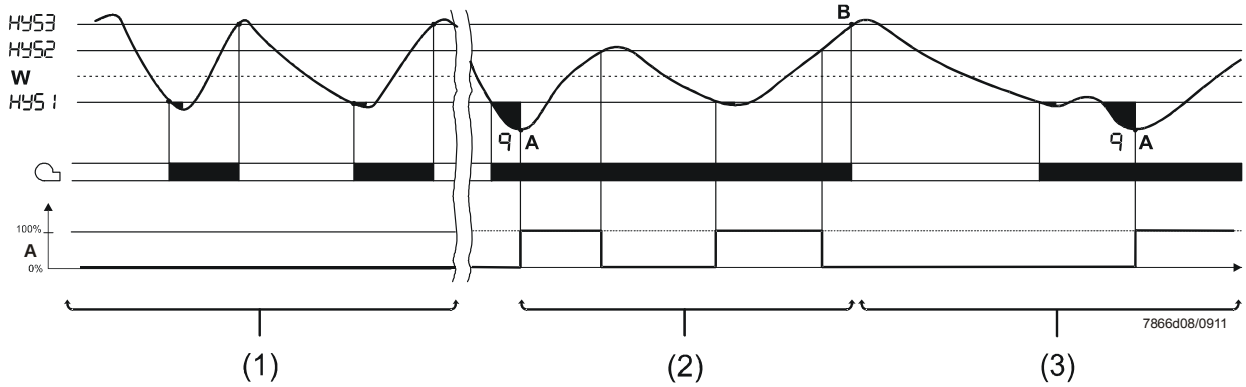


Figure 11: Control sequence of 2-stage burner, analog output

Cooling controller

If the controller is set to cooling mode, the respective values of HYS4, HYS5 and HYS6 apply.

Starting from a high actual value, the controller now controls the connected cooling equipment in low-fire operation. In high-fire operation, the second stage and thus the cooling output are controlled via relays K2 and K3 or the analog output. The response threshold (q) calculates automatically (now in the reverse sense) the point from which the cooling output is to be increased.

5.3 Burner shutdown

In the event of a sensor failure, the controller cannot monitor the actual value of the boiler temperature (analog input InP1). Burner shutdown will automatically be triggered to guard against overheating.
The same applies to acquiring the external setpoint using analog input InP2.

Functions

- Burner off
- 3-position output for closing the controlling element
- Self-setting function is ended
- Manual control is ended

5.4 Predefined setpoint

The setpoints (SP1, SP2 or dSP) are predefined within the selected setpoint limits via the buttons or the ACS411 software.
It is possible to shift the setpoint using either an analog or a binary signal, to change it via an external contact, or to influence it using a weather-compensated method.

⇨ Reference!
See chapter 8.8 *Binary functions* binF.

Setpoint changeover	**Shifting**	**Binary input D1**	**Information**	
SP1	Analog via InP2	Open	⇨	Reference! See chapter 5.4.1 *Setpoint changeover* SP1/SP2*, or shifting analog via* InP2
SP2	Analog via InP2	Closed		
SP1		Open	⇨	Reference! See chapter 5.4.2 *Setpoint changeover* SP1 */ external setpoint via* InP2
External setpoint via InP2		Closed		
	Setpoint SP1 analog via InP2, no binary shifting	Open	⇨	Reference! See chapter 5.4.3 *Setpoint shifting* SP1 *analog via* InP2 */ binary via* dSP
	Setpoint SP1 analog via InP2, binary shifting about setpoint dSP	Closed		
	External setpoint via InP2, no binary shifting	Open	⇨	Reference! See chapter 5.4.4 *External setpoint, setpoint shifting binary via* dSP
	External setpoint via InP2, binary shifting about setpoint dSP	Closed		

5.4.1 Setpoint changeover SP1 / SP2 or setpoint shift analog via InP2

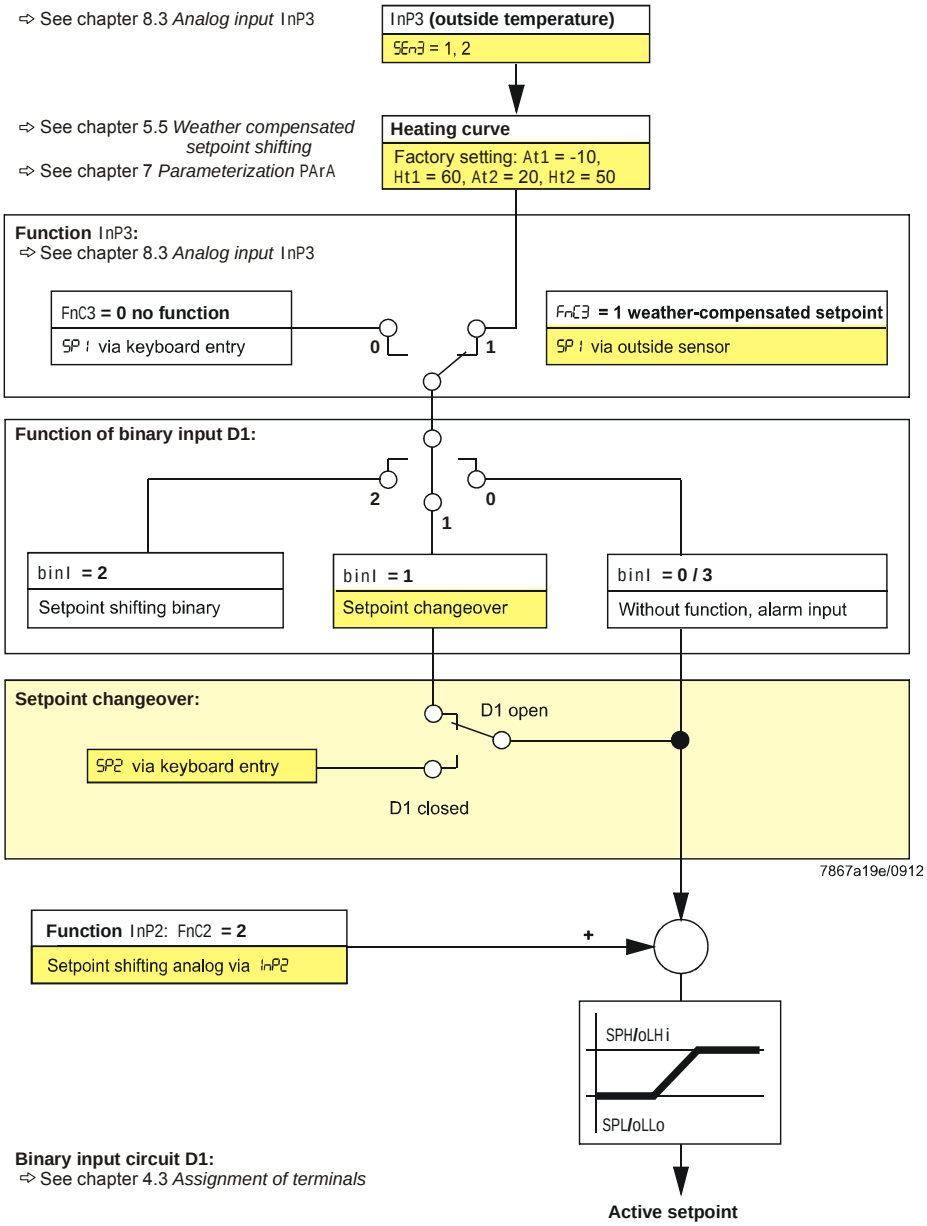


Figure 12: Setpoint changeover or setpoint shift

5.4.2 Setpoint changeover SP1 / external setpoint via InP2

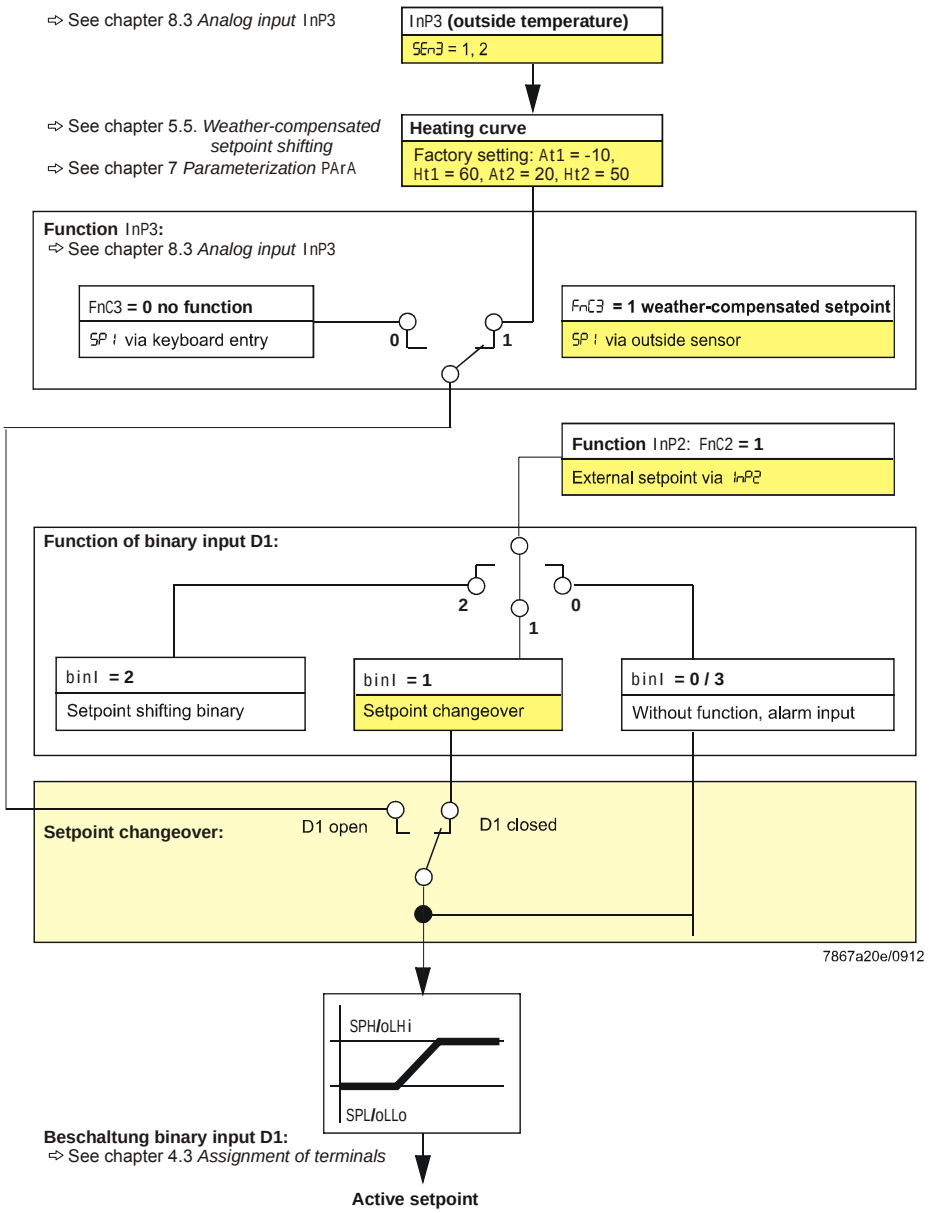


Figure 13: Setpoint changeover SP1 / external setpoint

5.4.3 Setpoint shifting SP1 analog via InP2 / binary via dSP

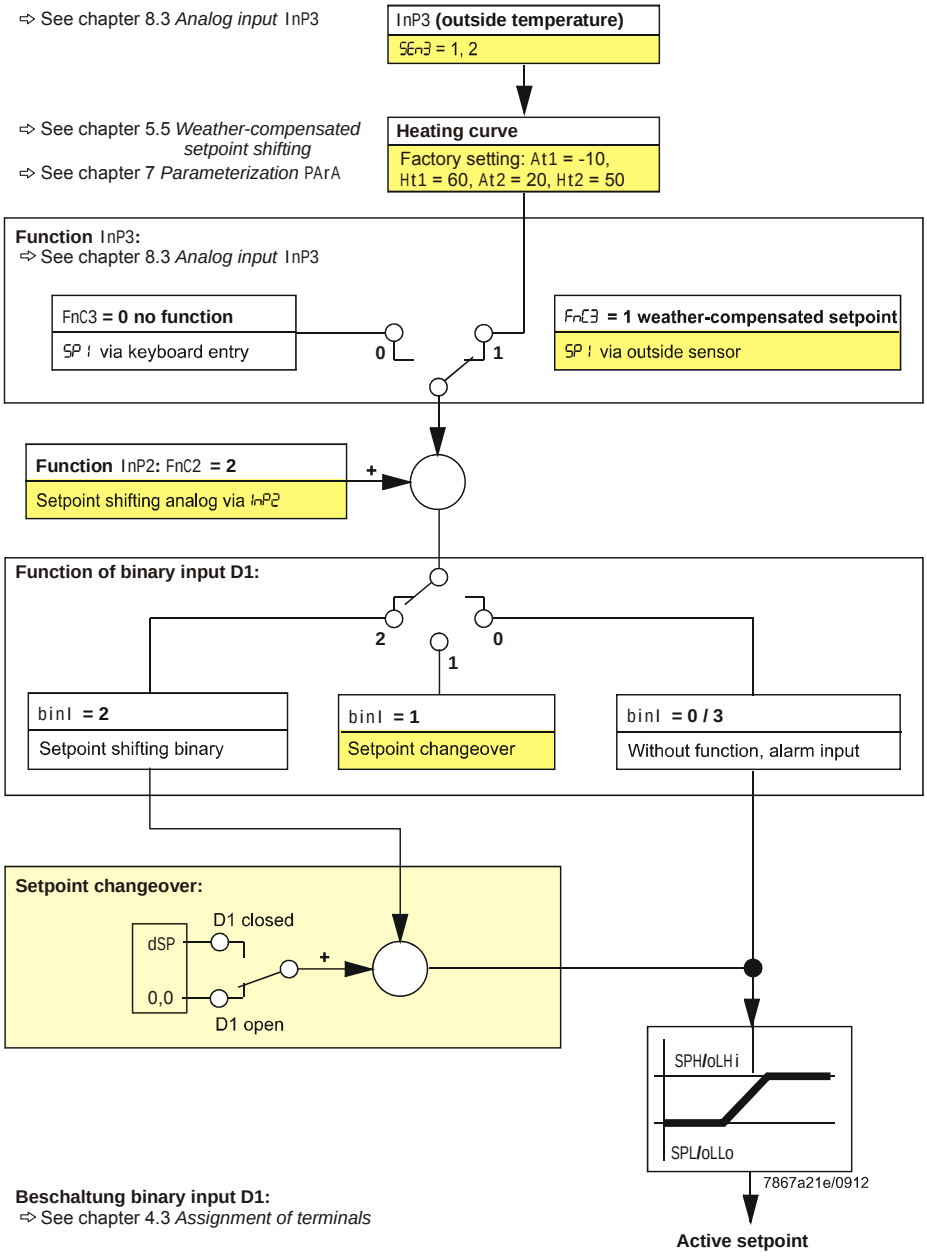


Figure 14: Setpoint shifting analog / binary

5.4.4 External setpoint, setpoint shifting binary via dSP

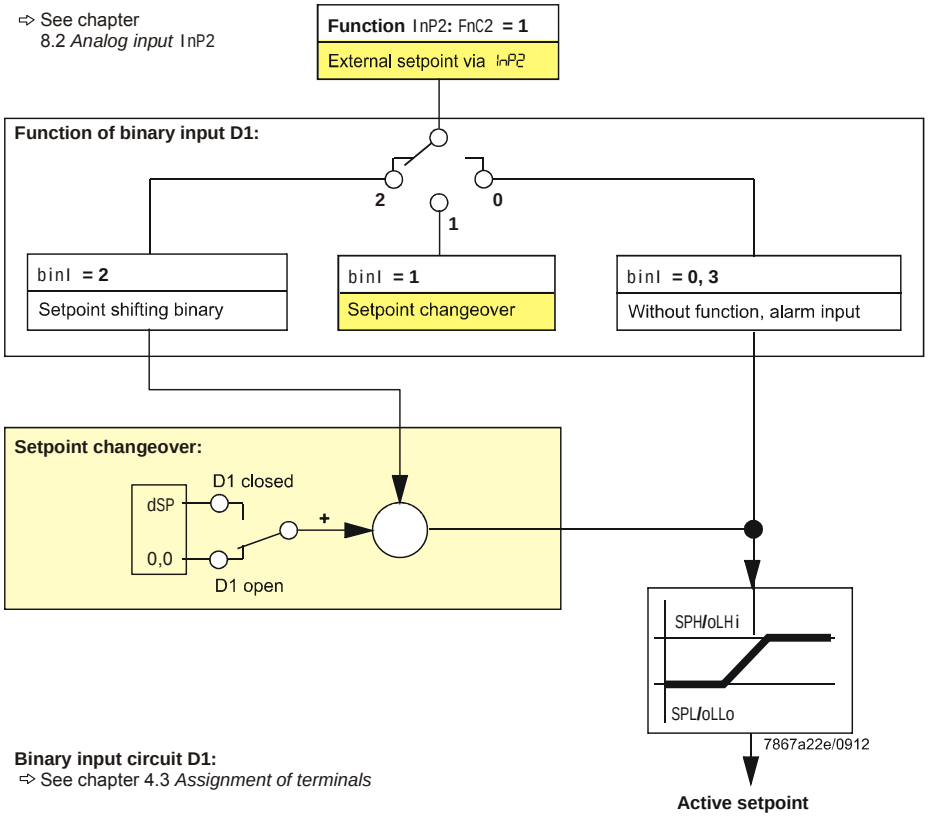


Figure 15: External setpoint, setpoint shifting binary via dSP

5.5 Weather-compensated setpoint shifting

The RWF55 can be configured so that weather-compensated setpoint shifting is activated when an LG-Ni1000 outside sensor or a Pt1000 is connected.

⇨ Reference!
See chapter 8.3 *Analog input* InP3

To take into account the time response of a building, weather-compensated setpoint shifting uses the attenuated outside temperature rather than the current outside temperature.
This attenuated outside temperature is determined on the basis of the current outside temperature and a filter constant. With the RWF55, this filter value (parameter dF3) can be adjusted. In the event of a power failure, this filter is reset. The minimum and maximum setpoints can be set using the lower setpoint limit SPL and the upper setpoint limit SPH.
The system also prevents the lower working range limit oLLo and upper working range limit oLHi from exceeding/dropping below the system temperature limits.

☞ **Note!**
Each RWF55 must have its own separate outside sensor (no parallel connection).
This function has been optimized for heating systems with DHW.

Heating curve

The heating curve describes the relationship between the boiler temperature setpoint and the outside temperature. It is defined by 2 curve points. For 2 outside temperatures, the user defines the boiler temperature setpoint that is required in each case. The heating curve for the weather-compensated setpoint is calculated on this basis. The effective boiler temperature setpoint is limited by the upper setpoint limit SPH and the lower setpoint limit SPL.

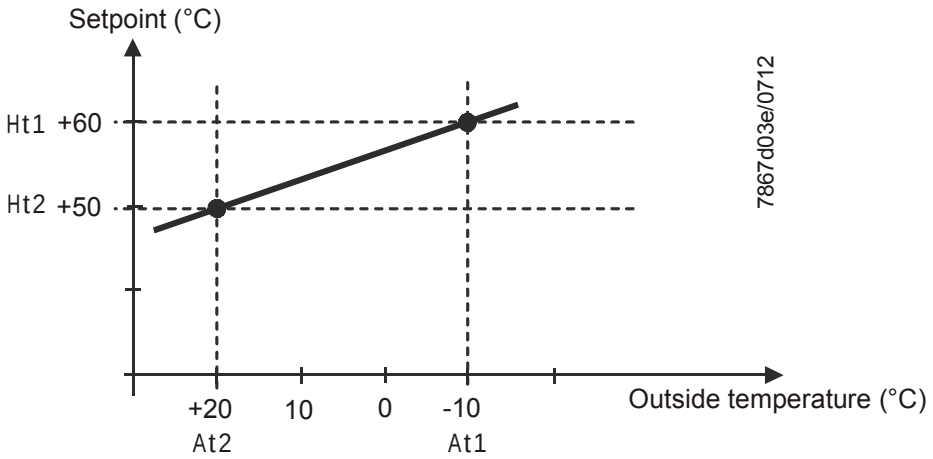


Figure 16: Heating curve slope

The two curve points are set at the parameter level.

⇨ Reference!
See chapter 7 *Parameterization* PArA

5.6 Response threshold (q)

The response threshold (q) defines for what period of time and how much the actual value is allowed to drop before the system switches to high-fire operation.
An internal mathematical calculation using an integration function determines the sum of all areas qeff = q1 + q2 + q3 as shown in the graph. This takes place only when the control deviation (x-w) falls below the value of switch-on threshold HYS1. If the actual value increases, integration is stopped.
If *qeff* exceeds the preset response threshold (q) (can be adjusted at the parameter level), this causes the second burner stage to switch on or – in the case of the 3-position controller/modulating controller – the controlling element to open.
If the current boiler temperature reaches the required setpoint, *qeff* is reset to 0.

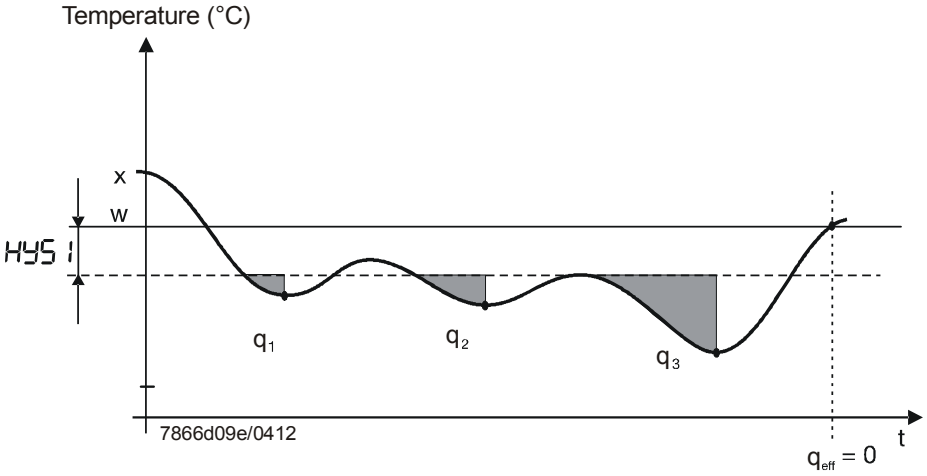


Figure 17: Control sequence response threshold (q)

In contrast to time-dependent switching on, load-dependent switching on offers the advantage of capturing the dynamics of the actual value.
Also, monitoring the progression of the actual value during the change from low-fire to high-fire ensures low switching frequencies to reduce wear and to extend running times.

Cooling controller

The response threshold (q) also works (in the reverse sense) in the case of cooling mode.

5.7 Cold start of plant

Interlocking

Note!
Functions *Cold start of plant* and *Thermal shock protection (TSS)* are interlocked.
Only one function can be activated, but never both at the same time.

Heating controller

When a heating system is switched off for a longer period of time, the actual value will drop of course.
To achieve a faster control response, the controller immediately starts in high-fire operation as soon as the control deviation (x-w) drops below a certain limit value.

This limit is calculated as follows:

Limit value = 2 x (HYS1-HYS3)

In that case, the response threshold (q) is inactive, independent of operating mode and controlled variable (temperature or pressure).

Example

Operating mode: Modulating, 3-position output
HYS1 = -5 K
HYS3 = +5 K
w = 60 °C

Limit value = 2 x (-5 - 5) = 2 x (-10) = -20 K

At an actual value below 40 °C, heating up immediately starts in low-fire operation, and not in thermostat mode.

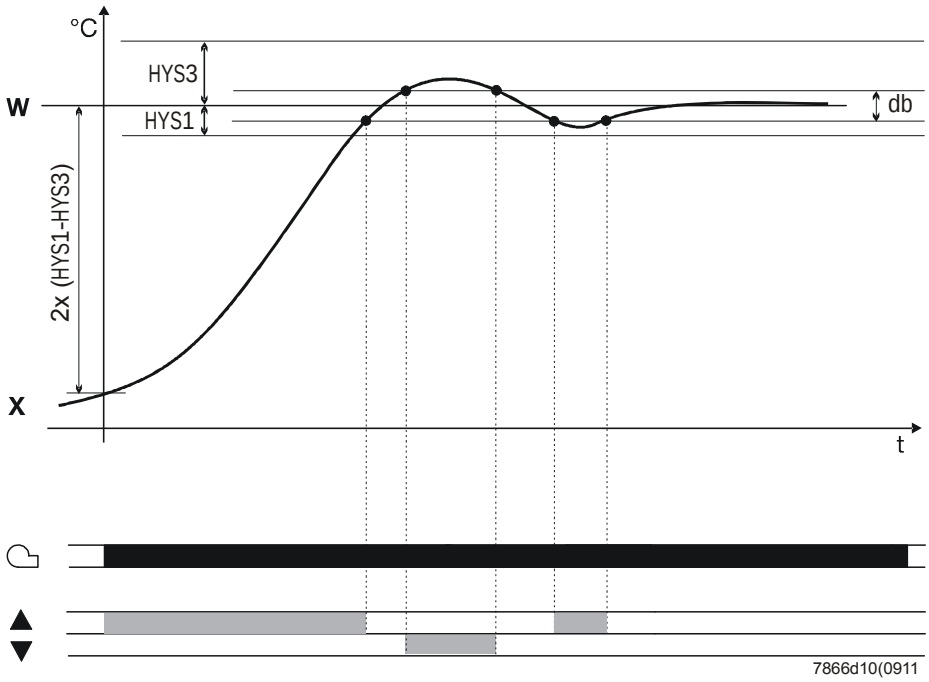


Figure 18: Control sequence *Cold start of plant*

Cooling controller

Cold start of plant also works when the RWF55 is used as a cooling controller.

In that case, the limit value is calculated as follows:
Limit value = 2 x (HYS4-HYS6)

Example

Operating mode: Modulating 3-position output
HYS4 = 5 K
HYS6 = -5 K
w = -30 °C

Limit value = 2 x (5 + 5) = 2 x (10) = +20 K

When the actual value lies above -10 °C, cooling is immediately started in high-fire mode in place of low-fire mode.

5.8 Thermal shock protection (TSS)

Interlocking

Note!
Functions *Cold start of plant* and *Thermal shock protection (TSS)* are interlocked. Only one function can be activated, but never both at the same time.

The controller comes with thermal shock protection (TSS) deactivated; it can be activated at the configuration level.

⇨ Reference!
See chapter 8.5 *Thermal shock protection (TSS)* rAFC.

Function

The function is automatically activated when the actual value drops below the adjustable limit value rAL (exceeds the adjustable limit value with the cooling controller). In that case, the setpoint is approached via a ramp function.
Gradient and slope of the ramp rASL are adjustable. The setpoint ramp has a symmetrical tolerance band toLP. If, during the startup phase, the actual value leaves the tolerance band, the setpoint ramp is stopped until the actual value returns to a level within the tolerance band. The startup phase is ended when the setpoint of the ramp function reaches the final setpoint SP1.

Note!
When thermal shock protection (TSS) is active, the controller operates in low-fire operation. The response threshold (q) is active.

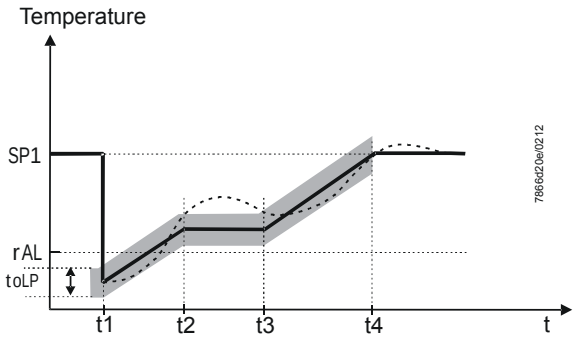


Figure 19: Thermal shock protection (TSS)

Key

Setpoint (w)
Actual value (x)

6 Operation

6.1 Meaning of display and buttons

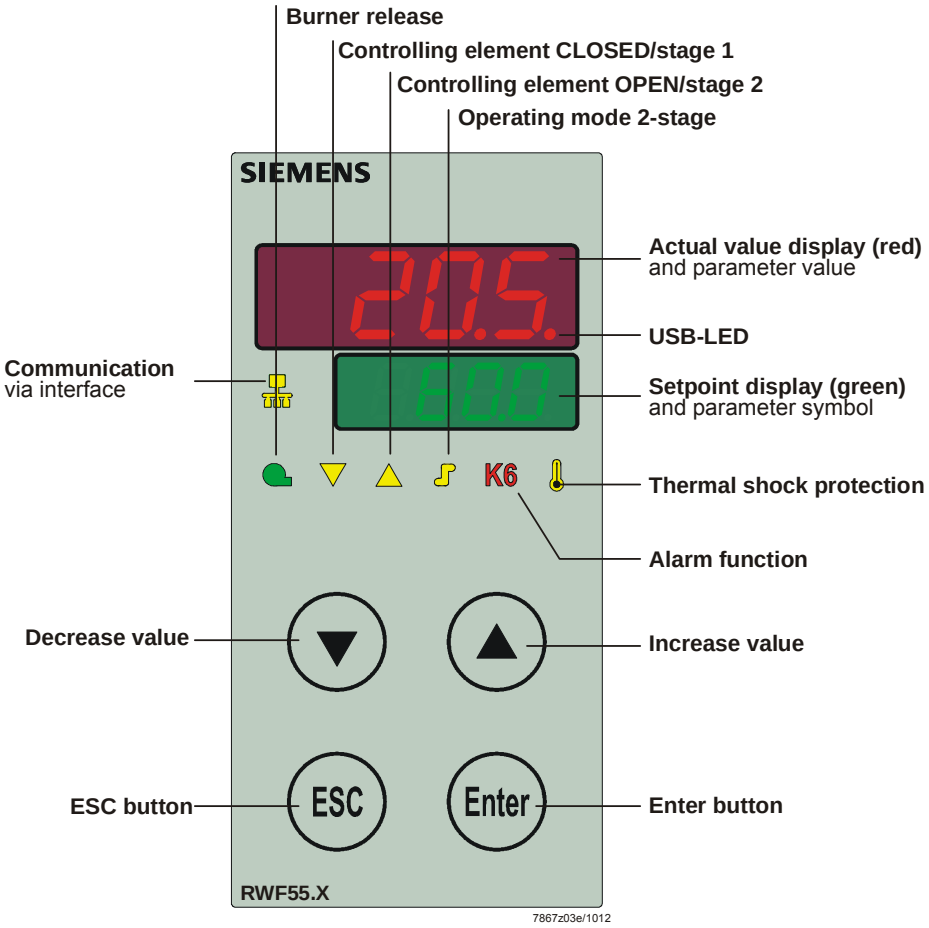


Figure 20: Meaning of display and buttons

Initialization

The two 7-segment displays (red and green) show hyphens and all LEDs light up for about 5 seconds.

Basic display

The upper display (red) shows the actual value.
The lower display (green) shows the setpoint.

⇨ Reference!
See chapter 8.9 *Display* diSP.

Parameter display

When entering parameters, the parameter symbol (green) and the set value (red) appear.

Self-setting function

The actual value is shown on the actual value display (red) and **tUnE** flashes on the setpoint display (green).

⇨ Reference!
See chapter 9.1 *Self-setting function in the high-fire operation.*

Flashing actual value display

The actual value display (red) shows **9999** flashing → Alarm message.

⇨ Reference!
See chapter 13 *What to do if ...*

Manual control

The setpoint display (green) shows **HAnd** flashing.

⇨ Reference!
See chapter 6.4 *Manual control of a modulating burner.*

6.2 Basic display

When switching power on, the displays show hyphens for about 5 seconds.

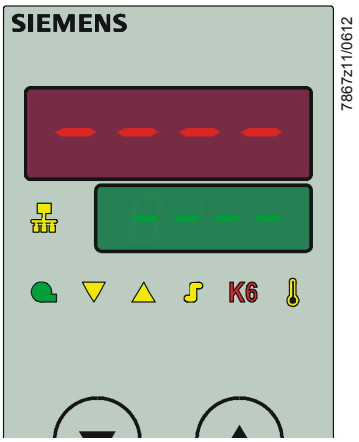


Figure 21: Display start

The state that follows is called *normal display*.
Default display is the actual value and the current setpoint.
Other values can be displayed via configuration level or via PC software ACS411.

⇨ Reference!
See chapter 8.9 *Display* diSP.

Manual control, self-setting, the user level, parameter level and configuration levels can be activated from here.

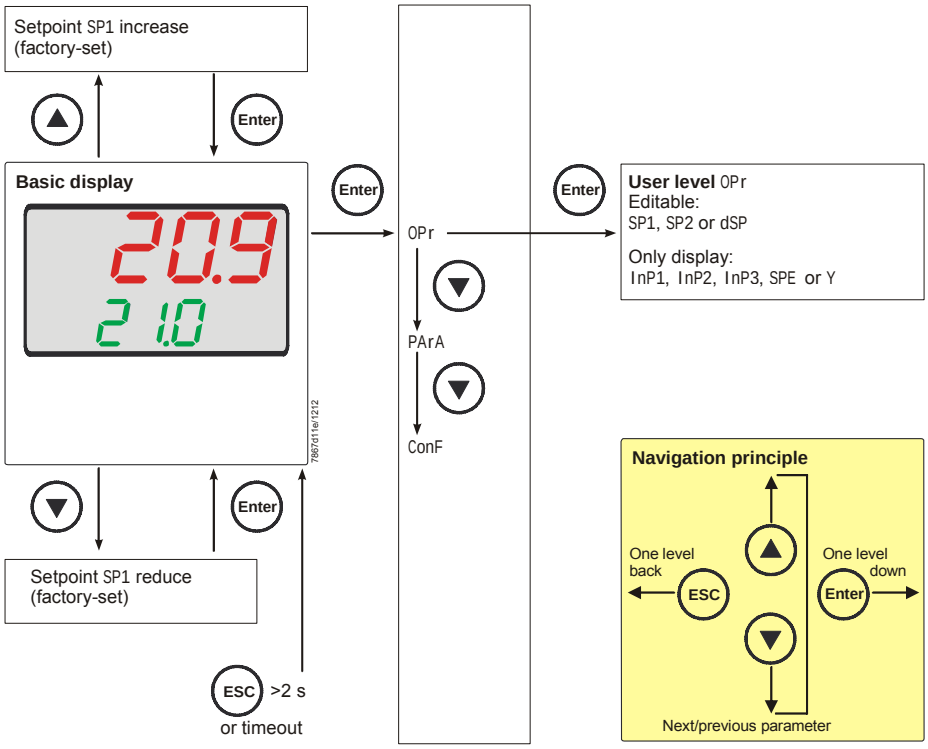


Figure 22: Basic display

6.3 User level

This level is started from the basic display.
Setpoints SP1, SP2 or dSP can be altered.
The values of the analog inputs InP1, InP2, InP3 and SPE (external setpoint) and InP3 (actual angular positioning between 0...100%) can be displayed.

Changing the setpoints

Changing SP1, SP2 or dSP.

* From the basic display, press Enter so that **OPr** appears

SP1

* Press Enter so that **SP1** appears
* Press Enter and **SP1** flashes
* Press ▲ or ▼ to adjust the required setpoint and press Enter to confirm

SP2

SP2 only appears if **setpoint changeover** is set (binary input bin1 = 1).

* From the basic display, press Enter so that **OPr** appears
* Press Enter so that **SP1** appears
* Press ▼ to change over to SP2
* Press Enter and **SP2** flashes
* Press ▲ or ▼ to adjust the required setpoint and press Enter to confirm

dSP

dSP only appears if **setpoint shifting** is set (binary input bin1 = 2).

* From the basic display, press Enter so that **OPr** appears
* Press Enter so that **SP1** appears
* Press ▼ to change over to dSP
* Press Enter and **dSP** flashes
* Press ▲ or ▼ to adjust the required setpoint and press Enter to confirm

Timeout

Timeout after about 180 seconds.

☞ Note!
If the setpoint is not stored, the basic display changes after the timeout tout and the former setpoint is maintained.
The value changes only within the permitted range.

6.4 Manual control, modulating burner

Note!
Manual control can only be activated if the thermostat function **energized** relay K1. If the thermostat function **deenergized** relay K1 during manual control, manual control is ended.

* Press ESC for 5 seconds

HAnd appears on the lower display, alternating with the value for manual control (with continuous controller).

3-position controller

* Open and close fuel-air ratio control by pressing ▲ and ▼

Relay K2 opens the controlling element as long as ▲ is kept depressed.
Relay K3 closes the controlling element as long as ▼ is kept depressed.

The 2 yellow arrows indicate when relay K2 opens or relay K3 closes the controlling element.

Modulating controller

* Change angular positioning by pressing ▲ or ▼
* Adopt flashing new angular positioning by pressing Enter

Per default, the analog output delivers the current angular positioning.

* Return to automatic operation by keeping ESC depressed for 5 seconds

Note!
When activating manual control, angular positioning is set to 0 until another entry is made.

6.5 Manual control, 2-stage burner

Note!
Manual control can only be activated if the thermostat function **active** relay K1. If the thermostat function **inactive** relay K1 during manual control, manual control is ended.

* Press ESC for 5 seconds
* Press ▲ briefly

Relay K2 / K3	Analog output A- / A+
Relay K2 is active Relay K3 is inactive	The analog output delivers the highest value (depending on setting DC 10 V or 20 mA)
Controlling element opens	

* Or press ▼ briefly

Relay K2 / K3	Analog output A- / A+
Relay K2 is inactive Relay K3 is active	The analog output delivers the lowest value (depending on setting DC 0 V, 4 mA, or 0 mA)
Controlling element closes	

* Return to automatic operation by pressing ESC for 5 seconds

6.6 Starting the self-setting function

Start

* Press ▲ + ▼ for 5 seconds

Cancel

* Cancel with ▲ + ▼

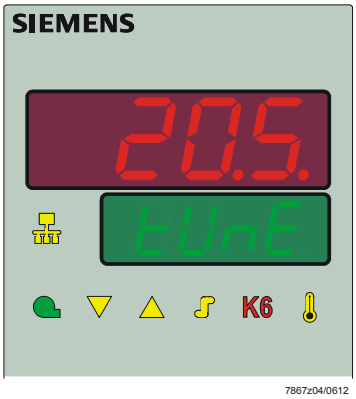


Figure 23: Display of self-setting function

When **tUnE** stops flashing, the self-setting function has been ended.

The parameters calculated by the controller are automatically adopted!

☞ Note!
It is not possible to start **tUnE** in manual control or low-fire operation.

6.7 Display of software version

* Press Enter + ▲

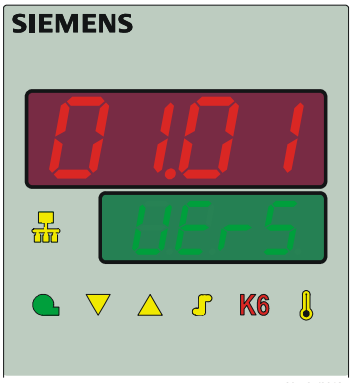


Figure 24: Display of software version

Segment test

* Press Enter + ▲ again.

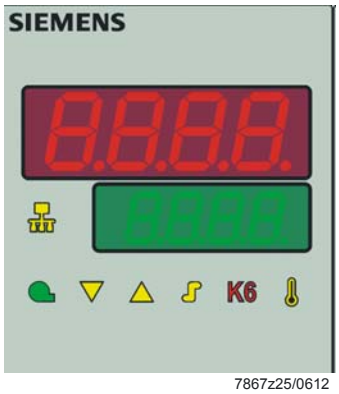


Figure 25: Display segment test

All display segments and LEDs light up; the actual value display (red) flashes for about 10 seconds.

7 Parameterization PArA

Here, set the parameters associated directly with the controller's adaptation to the controlled system after the plant has been put into operation.

Note!
The display of the individual parameters depends on the type of controller.

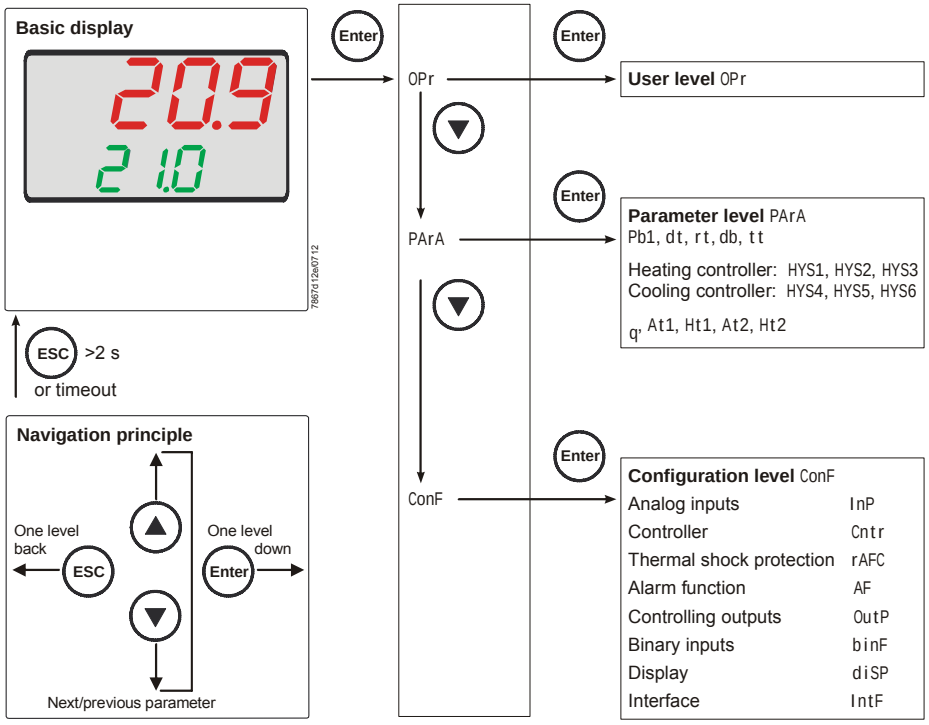


Figure 26: Parameterization

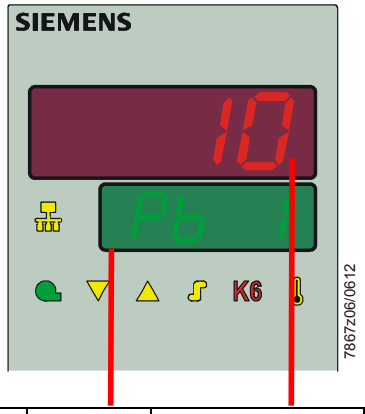
Access to this level can be locked.

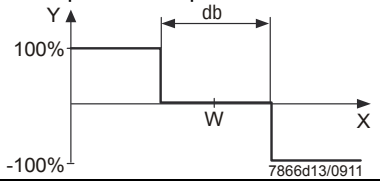
Reference!
See chapter 8.9 *Display* diSP.

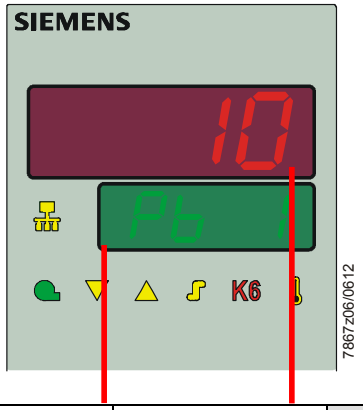
* From the basic display, press Enter so that **OPr** appears
* Press ▼ so that **PArA** appears
* Press Enter so that the first parameter of the parameter level is displayed

Display of controller parameters

The parameters are shown on the lower setpoint display (green) and their values on the upper/actual value display (red).



Parameter	Display	Value range	Factory setting	Remarks
Proportional band ¹	Pb1	1...9999 digit	10	Influences the controller's P-action
Derivative time	dt	0...9999 s	80	Influences the controller's D-action With dt = 0, the controller has no D-action
Integral action time	rt	0...9999 s	350	Influences the controller's I-action With rt = 0, the controller has no I-action
Dead band (neutral zone) ¹	db	0.0...999.9 digit	1	For 3-position output 
Controlling element running time	tt	10...3000 s	15	Running time of the positioning valve for use with modulating controllers
Switch-on threshold Heating controller ¹	HYS1	-1999...0.0 digit	-5	⇨ Reference! See chapter 5.2 *High-fire operation*
Switch-off threshold stage II Heating controller ¹	HYS2	0.0...HYS3 digit	3	⇨ Reference! See chapter 5.2 *High-fire operation*
Switch-off threshold Heating controller ¹	HYS3	0.0...9999 digit	5	⇨ Reference! See chapter 5.2 *High-fire operation*
Switch-on threshold Cooling controller ¹	HYS4	0.0...9999 digit	5	⇨ Reference! See chapter 5.2 *High-fire operation*
Switch-off threshold stage II Cooling controller ¹	HYS5	HYS6...0.0 digit	-3	⇨ Reference! See chapter 5.2 *High-fire operation*
Switch-off threshold Cooling controller ¹	HYS6	-1999...0.0 digit	-5	⇨ Reference! See chapter 5.2 *High-fire operation*
Response threshold	q	0.0...999.9	0	⇨ Reference! See chapter 5.6 *Response threshold (q)*



Parameter	Display	Value range	Factory setting	Remarks
Outside temperature Curve point 1 [1]	At1	-40...120	-10	⇨ Reference! See chapter 5.5 *Weather-compensated setpoint shifting*
Boiler temperature Curve point 1 [1]	Ht1	SPL...SPH	60	⇨ Reference! See chapter 5.5 *Weather-compensated setpoint shifting*
Outside temperature Curve point 2 [1]	At2	-40...120	20	⇨ Reference! See chapter 5.5 *Weather-compensated setpoint shifting*
Boiler temperature Curve point 2 [1]	Ht2	SPL...SPH	50	⇨ Reference! See chapter 5.5 *Weather-compensated setpoint shifting*

[1] Setting of decimal place has an impact on this parameter

Note!
When using the RWF55… as a modulating controller only, or as a modulating controller without the burner release function (1P, 1N), parameter HYS1 must be set to 0 and parameters HYS2 and HYS3 must be set to their **maximum** values.

Otherwise, for example, when using default parameter HYS1 (factory setting -5), the 3-position controller is only released when the control deviation reaches -5 K.

8 Configuration ConF

Here, the settings (e.g. acquisition of measured value or type of controller) required directly for commissioning a certain plant are made and, for this reason, there is no need to change them frequently.

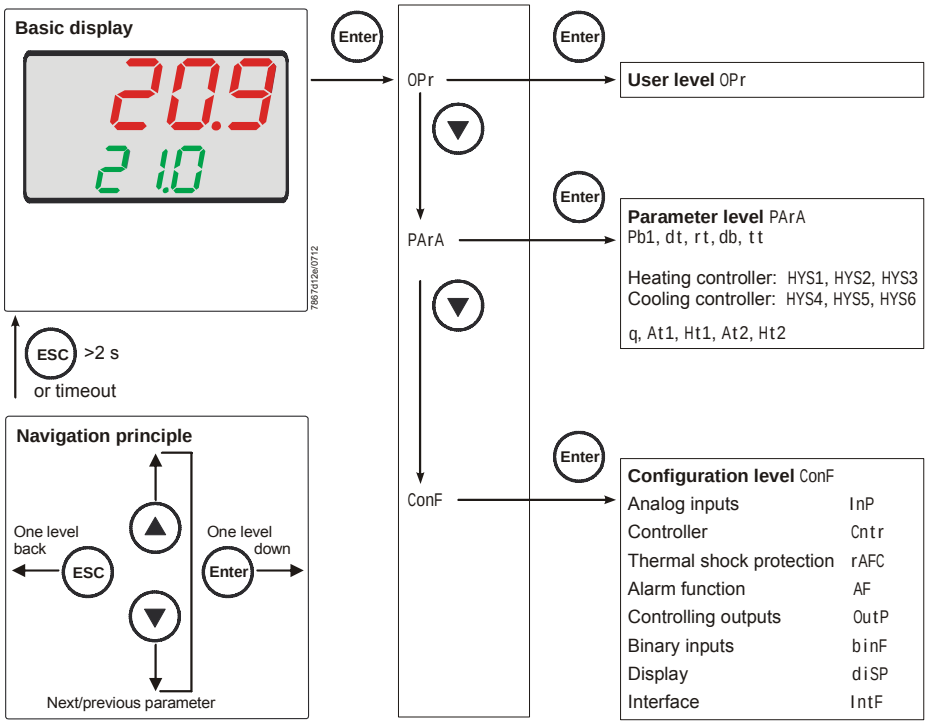


Figure 27: Configure

Access to this level can be locked.

⇨ Reference!
See chapter 8.9 *Display* diSP.

☞ Note!
The following tables show the default settings in columns *Value/selection* and *Description* in **bold** printing.

8.1 Analog input InP1

This input is used to acquire the actual value.

ConF ➔ InP ➔ InP1 ➔

Parameter	Value/ selection	Description
Sensor type SEn1 Sensor type	**1** 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19	**Resistance thermometer Pt100, 3-wire** Resistance thermometer Pt100, 2-wire Resistance thermometer Pt1000, 3-wire Resistance thermometer Pt1000, 2-wire Resistance thermometer LG-Ni1000, 3-wire Resistance thermometer LG-Ni1000, 2-wire 0...135 Ohm Cu-CuNi T Fe-CuNi J NiCr-Ni K NiCrSi-NiSi N Pt10Rh-Pt S Pt13Rh-Pt R Pt30Rh-Pt6Rh B 0...20 mA 4...20 mA DC 0...10 V DC 0...5 V DC 1...5 V
Correction of measured value OFF1 Offset	-1999... **0...** +9999	Using the measured value correction (offset), a measured value can be corrected to a certain degree, either up or down **Example:** Measured value / Offset / Displayed values 294.7 / +0.3 / 295.0 295.3 / -0.3 / 295.0
Caution! **Measured value correction:** To make the calculation, the controller uses the corrected value (displayed value). This value does not represent the value acquired at the point of measurement. If the measured value correction function is used incorrectly (e.g., overcompensation of measured values → measurement error only present temporarily), this may lead to undesirable plant states.		
Start of display SCL1 Scale low level	-1999... **0...** +9999	In the case of a measuring transducer with standard signal, the physical signal is assigned a display value here Example: 0…20 mA = 0…1500 °C
End of display SCH1 Scale high level	-1999... **100...** +9999	The range of the physical signal can be crossed by 20%, either up or down, without getting a signal informing about the crossing

Parameter	Value/ selection	Description
Filter time constant dF1 Digital filter	0.0... **0.6...** 100.0...	Is used to adapt the digital 2nd order input filter (time in s; 0 s = filter off) If the input signal changes abruptly, about 26% of the change are captured after a time corresponding to the filter time constant **dF** (2 x dF: approx. 59%; 5 x dF: approx. 96%) When the filter time constant is great: - Great attenuation of interference signals - Slow response of actual value display to changes of the actual value - Low limit frequency (low-pass filter)
Temperature unit Unit Temperature unit	**1** 2	**Degrees Celsius** **Degrees** Fahrenheit Unit of temperatures

8.2 Analog input InP2

This input can be used to specify an external setpoint or carry out setpoint shifting.

ConF ➔ InP ➔ InP2 ➔

Parameter	Value/ selection	Description
Function FnC2	**0** 1 2 3	**No function** External setpoint (display SPE) Setpoint shifting (display dSP) Angular positioning feedback
Sensor type SEn2 Sensor type	**1** 2 3 4 5 6	**0...20 mA** 4...20 mA 0...10 V 0...5 V 1...5 V Resistance teletransmitter
Correction of measured value OFF2 Offset	-1999... **0...** +9999	Using the measured value correction function (offset), a measured value can be corrected by a certain amount, either up or down. **Example:** Measurement value / Offset / Display value 294.7 / +0.3 / 295.0 295.3 / -0.3 / 295.0
⚠	**Caution!** **Measured value correction:** To make the calculation, the controller uses the corrected value (displayed value). This value does not represent the value acquired at the point of measurement. If the measured value correction function is used incorrectly (e.g., overcompensation of measured values → measurement error only present temporarily), this may lead to undesirable plant states.	
Start of display SCL2 Scale low level	-1999... **0...** +9999	In the case of a measuring transducer with standard signal, the physical signal is assigned a display value here. Example: 0…20 mA = 0…1500 °C
End of display SCH2 Scale high level	-1999... **100...** +9999	The physical signal range can be undershot/exceeded by 20% without a measuring range overshoot/undershoot signal being issued.
Filter time constant dF2 Digital filter	0.0... **2...** 100.0...	Is used to adapt the digital 2nd order input filter (time in s; 0 s = filter off). If the input signal changes abruptly, about 26% of the change is captured after a time corresponding to the filter time constant **dF** (2 x dF: approx. 59%; 5 x dF: approx. 96%). If the filter time constant is large: - High attenuation of interference signals - Slow response of actual value display to changes in the actual value - Low limit frequency (low-pass filter)

8.3 Analog input InP3

This input is used to acquire the outside temperature.

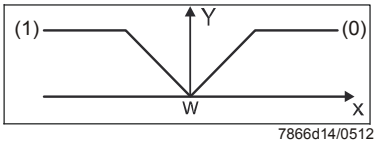
ConF ➔ InP ➔ InP3 ➔

Parameter	Value/ selection	Description
Sensor type SEn3 Sensor type	**0** 1 2	**Switched-off** Resistance thermometer Pt1000 in 2-wire circuit Resistance thermometer LG-Ni1000 in 2-wire circuit
Function FnC3	**0** 1	**No function** Weather-compensated setpoint
Correction of measured value OFF3 Offset	-1999... **0...** +9999	Using the measured value correction function (offset), a measured value can be corrected by a certain amount, either up or down. **Example:** Measurement value / Offset / Display value 294.7 / +0.3 / 295.0 295.3 / -0.3 / 295.0
⚠		**Caution!** **Measured value correction:** To make the calculation, the controller uses the corrected value (displayed value). This value does not represent the value acquired at the point of measurement. If the measured value correction function is used incorrectly (e.g., overcompensation of measured values → measurement error only present temporarily), this may lead to undesirable plant states.
Filter time constant dF3 Digital filter	0.0... **1278...** 1500.0...	Is used to adapt the digital 2nd order input filter (time in s; 0 s = filter off). If the input signal changes abruptly, about 26% of the change is captured after a time corresponding to the filter time constant **dF** (2 x dF: approx. 59%; 5 x dF: approx. 96%). If the filter time constant is large: - High attenuation of interference signals - Slow response of actual value display to changes in the actual value - Low limit frequency (low-pass filter)

8.4 Controller Cntr

Here, the type of controller, operating action, setpoint limits and presettings for self-optimization are selected.

ConF ➔ Cntr ➔

Parameter	Value/ selection	Description
Controller type CtYP Controller type	**1** 2	**3-position controller** Modulating controller
Operating action CACt Control direction	0 **1**	Cooling controller **Heating controller**  7866d14/0512 (0) = cooling controller: The controller's angular positioning (Y) is >0 when the actual value (x) lies above the setpoint (w) (1) = heating controller: The controller's angular positioning (Y) is >0 when the actual value (x) lies below the setpoint (w)
Setpoint limitation start SPL Setpoint limitation low	-1999... **0...** +9999	Setpoint limitation prevents values from being entered outside the defined range. The setpoint limits are not active in the case of predefining setpoints via the interface. In the case of an external setpoint with correction, the correction value is limited to SPL / SPH.
Setpoint limitation end SPH Setpoint limitation high	-1999... **+100...** +9999	
Self-optimization	**0** 1	**Free** Locked Self-optimization can only be disabled or enabled via the ACS411 setup program If disabled via ACS411 PC software, self-optimization cannot be started via the controller's buttons Setting in the ACS411 setup program ➔ Controller ➔ Self-optimization Self-optimization is also disabled when the parameter level is locked
Lower working range limit oLLo Lower operation range limit	**-1999...** +9999	☞ Note! If the setpoint with the respective hysteresis exceeds the upper working range limit, the switch-on threshold is substituted by the working range limit.
Upper working range limit oLHi Upper working range limit	-1999... **+9999**	☞ Note! If the setpoint with the respective hysteresis drops below the lower working range limit, the switch-off threshold is substituted by the working range limit.

8.5 Thermal shock protection (TSS) rAFC

The RWF55… can be operated as a fixed value controller with or without ramp function.

ConF ➔ rAFC ➔

Parameter	Value/ selection	Description
Function FnCt Function	**0** 1 2	**Switched off** Gradient Kelvin/minute Gradient Kelvin/hour ☞ Note! With **FnCt** = 1 or 2, *Thermal shock protection* (TSS) is automatically activated as soon as the actual value drops below the adjustable absolute limit value **rAL** (heating controller) or exceeds it (cooling controller).
Ramp slope rASL Ramp slope	**0.0...** 999.9	Slope of **ramp** slope (only with functions 1 and 2)
Tolerance band ramp toLP Tolerance band ramp	**2 x |HYS1| = 10**...9999	Width of tolerance band (in K) about the setpoint (only with function 1 and 2) Heating controller: Smallest possible factory setting: **2 x |HYS1| = 10 K** To monitor the actual value in connection with thermal shock protection (TSS), a tolerance band can be laid about the setpoint curve. If the limit values are crossed, the ramp is stopped. ⇨ Reference! See chapter 5.8 *Thermal shock protection (TSS).* Cooling controller: Smallest possible factory setting: **2 x |HYS4| = 10 K**
☞ Note! In the event of a faulty sensor or manual control, the ramp function is stopped. The outputs behave the same way they do when the measuring range is crossed (configurable). Functions *Cold start of plant* and *Thermal shock protection (TSS)* are interlocked. Only one function can be activated, but never both at the same time.		
Limit value rAL Ramp limit	**0**...250	**Heating controller:** If the actual value lies below this limit value, the setpoint is approached in the form of a ramp until final setpoint SP1 is reached. **Cooling controller:** If the actual value lies above this limit value, the setpoint is approached in the form of a ramp until final setpoint SP1 is reached.

8.6 Alarm function AF

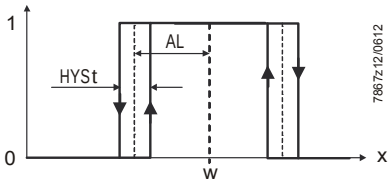
ConF ➔ AF ➔

The alarm function can be used to monitor the analog inputs. If the limit value is exceeded, multifunctional relay K6 is activated (depending on the switching characteristic). The alarm function can have different switching functions (**Ik1** to **Ik8**) and can be set to a deviation from the active setpoint or to a fixed limit value.

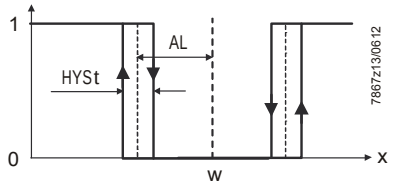
Limit value AL relative to setpoint (w)

In the case of alarm functions **Ik1** to **Ik6**, the actual value InP1 is monitored in relation to a limit value AL that has to be set (with the absolute value dependent on the setpoint (w)).

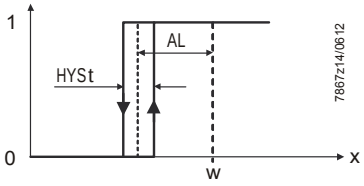
Ik1



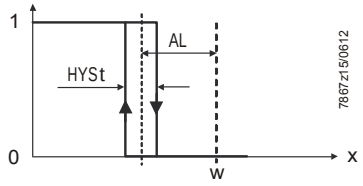
Ik2



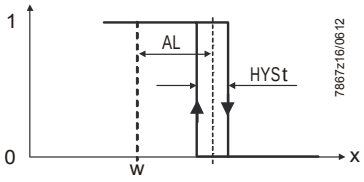
Ik3



Ik4



Ik5



Ik6

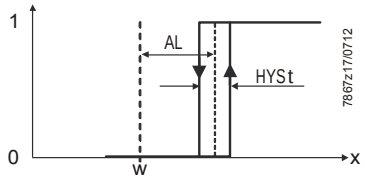
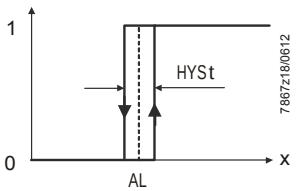


Figure 28: Alarm function Ik1...Ik6

Fixed limit value AL

In the case of alarm functions **Ik7** and **Ik8**, all analog inputs InP1... InP3 can be monitored in relation to a fixed limit value AL that has to be set.

Ik7



Ik8

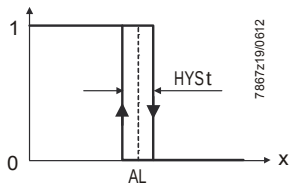


Figure 29: Alarm function Ik7 and Ik8

Parameter	Value/ selection	Description
Function FnCt Function	**0** 1 2 3 4 5 6 7 8 9 10 11 12	**Without function** **Ik1** monitored input InP1 **Ik2** monitored input InP1 **Ik3** monitored input InP1 **Ik4** monitored input InP1 **Ik5** monitored input InP1 **Ik6** monitored input InP1 **Ik7** monitored input InP1 **Ik8** monitored input InP1 **Ik7** monitored input InP2 **Ik8** monitored input InP2 **Ik7** monitored input InP3 **Ik8** monitored input InP3
Limit value AL Alarm value	-1999... **0...** +9999	Limit value or deviation from setpoint to be monitored (see alarm functions **Ik1** to **Ik8**: limit value AL). Limit value range for **Ik1** and **Ik2**: 0...9999
Switching difference HYSt Hysteresis	0... **1...** 9999	Switching difference in relation to limit value (see alarm functions **Ik1** to **Ik8**: hysteresis HYSt).
Response by Out of Range ACrA Response by out of range	 **0** 1	Switching state in the case of measuring range overshoot or undershoot (Out of Range). **Switched-off** ON

8.7 Control outputs OutP

For fuel-air ratio control purposes, the RWF55 has the binary outputs (K2, K3) and the analog output (A+, A-).
The burner is released via relay K1.

The switching states of relay K1 *Burner release* (LED green), relay K2 *Controlling element OPEN,* and relay K3 *Controlling element CLOSE* (yellow LED arrows) are indicated on the controller front.

Binary outputs

The binary outputs of the RWF55 offer no setting choices.

Analog output

The RWF55 has an analog output.

The analog output offers the following setting choices:

ConF ➔ OutP ➔

Parameter	Value/ selection	Description
Function FnCt Function	0 1 2 3 **4**	No function Input InP1 is delivered Input InP2 is delivered Input InP3 is delivered **Controller's angular positioning is delivered (modulating controller)**
Signal type SiGn Type of signal	**0** 1 2	**0...20 mA** 4...20 mA DC 0...10 V Physical output signal
Value when out of range rOut Value when out of range	**0**...101	Signal (in percent) when measuring range is crossed 101 = last output signal
Zero point OPnt Zero point	-1999... **0...** +9999	A value range of the output variable is assigned to a physical output signal
End value End End value	-1999... **100...** +9999	

8.8 Binary input binF

This setting decides on the use of the binary inputs.

⇨ Reference!
See chapter 5.4 *Preselected setpoint*

ConF ➔ binF ➔

Parameter	Value/ selection	Description
Binary inputs bin1 Binary input 1	**0** 1 2 3	**No function** Setpoint changeover Setpoint shift Alarm input
bin2 Binary input 2	**4**	**Changeover of operating mode** Burner modulating: Contacts D2 and DG open Burner 2-stage: Contacts D2 and DG closed

8.9 Display diSP

By configuring the position of the decimal point and automatic changeover (timer), both LED indications can be adapted to the respective requirements. Timeout tout for operation and the locking of levels can be configured as well.

ConF ➔ dISP ➔

Parameter	Value/ selection	Description
Upper display diSU Upper display		Display value for upper display
	0	Switched off
	1	**Analog input** InP1
	2	Analog input InP2
	3	Analog input InP3
	4	Controller's angular positioning
	6	Setpoint
	7	End value with thermal shock protection
Lower display diSL Lower display		Display value for lower display
	0	Switched off
	1	Analog input InP1
	2	Analog input InP2
	3	Analog input InP3
	4	Controller's angular positioning
	6	**Setpoint**
	7	End value with thermal shock protection
Timeout tout	0... **180**... 255	Time (s) on completion of which the controller returns automatically to the basic display, if no button is pressed
Decimal point dECP Decimal point	**0**	**No decimal place**
	1	One decimal place
	2	Two decimal places If the value to be displayed cannot be shown with the programmed decimal point, the number of decimal places is automatically reduced. If the measured value drops again, the number of decimal places is increased until the programmed value is reached
Locking of levels CodE	**0**	**No locking**
	1	Locking of configuration level
	2	Locking of parameter level
	3	Locking of keyboard

8.10 Interface IntF

The controller can be integrated into a data network using an optional RS-485 interface or an optional Profibus DP interface.

ConF ➔ IntF ➔

Parameter	Value/ selection	Description
Baud rate bdrt Baud rate	**0** 1 2 3	**4800 Baud** 9600 Baud 19200 Baud 38400 Baud
Device address Modbus Adr Device address	0... **1**... 254	Address in the data network
Device address Profibus dP Device address	0...**125**	Only RWF55.6
Remote Detection Timer dtt Remote detection timer	0... **30**... 7200 s	0 = Switched-off



Note!
If communication is taking place via the setup interface, the other interfaces are inactive.

9 Self-setting function

9.1 Self-setting function in high-fire operation

Note!
tUnE is only possible in high-fire operation, in *modulating burner* mode.

Self-setting function **tUnE** is a proper software function unit integrated in the controller. In *modulating* mode, **tUnE** tests in high-fire operation the response of the controlled system to angular positioning steps according to a special procedure. A complex control algorithm uses the response of the controlled system (actual value) to calculate and automatically store the control parameters for a PID or PI controller (set dt = 0!). The **tUnE** procedure can be repeated any number of times.

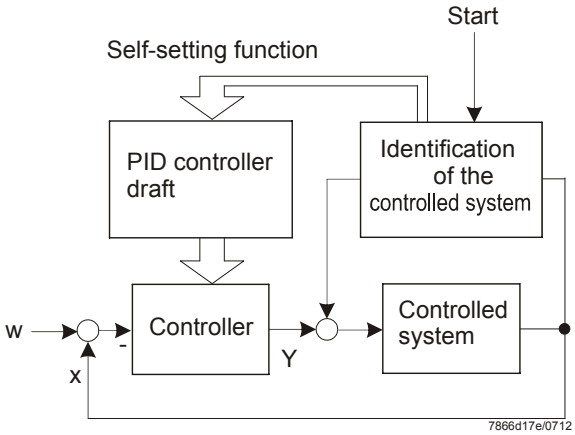


Figure 30: Self-setting function in high-fire operation

2 procedures

The **tUnE** function uses 2 different methods that are automatically selected depending on the dynamic state of the actual value and the deviation from the setpoint at startup. **tUnE** can be started from within any dynamic actual value sequence.
If there is a **great difference between actual value and setpoint** when **tUnE** is activated, a switching line is established about which the controlled variable performs forced oscillations during the self-setting process. The switching line is set to such a level that the actual value should not exceed the setpoint.

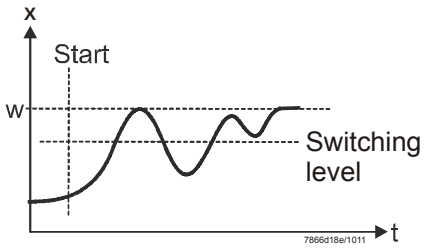


Figure 31: Great difference between actual value and setpoint

With a **small deviation** between setpoint and actual value (after the controlled system has settled, for instance), forced oscillation about the setpoint is performed.

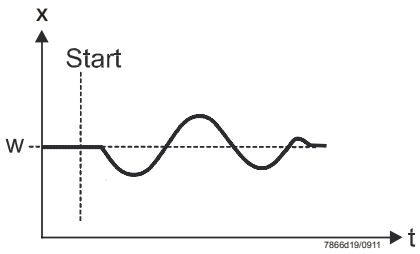


Figure 32: Small control deviation

The data of the controlled system recorded for the forced oscillations are used to calculate the controller parameters **rt**, **dt**, **Pb1** and a filter time constant dF1 for actual value filtering that is optimized for this controlled system.

Conditions

- High-fire operation in *modulating burner* mode
- The thermostat function (relay K1) must be constantly activated; otherwise **tUnE** will be canceled and no optimized controller parameters will be adopted
- The above mentioned actual value oscillations during the self-setting process must not exceed the upper threshold of the thermostat function (increase if necessary, and lower the setpoint)

☞ Note!
A successfully started *Self-setting* function is automatically aborted after 2 hours. This could occur in the case of a controlled system that responds slowly, for example, where, even after 2 hours, the described procedures cannot be successfully completed.

9.2 Checking the controller parameters

Optimum adjustment of the controller to the controlled system can be checked by recording a startup sequence with the control loop closed. The following diagrams indicate possible incorrect adjustments, and their correction.

Example

The response to a setpoint change is shown here for a 3rd order controlled system for a PID controller. The method used for adjusting the controller parameters can, however, also be applied to other controlled systems. A suitable value for **dt** is **rt/4**.

Pb too small

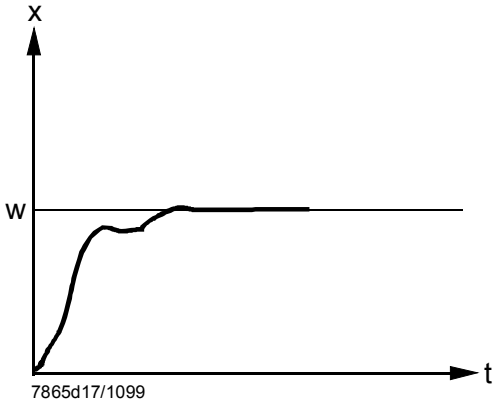


Figure 33: Pb too small

Pb too large

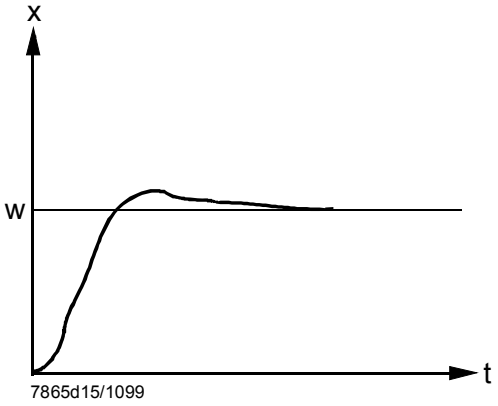


Figure 34: Pb too large

rt, dt too small

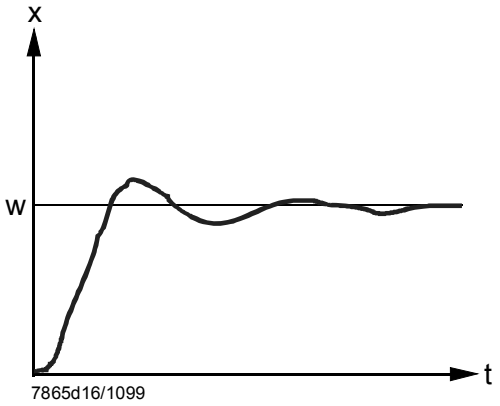


Figure 35: rt, dt too small

rt, dt too large

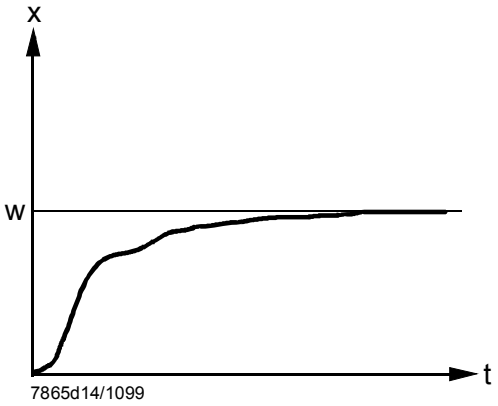


Figure 36: rt, dt too large

Optimum adjustment

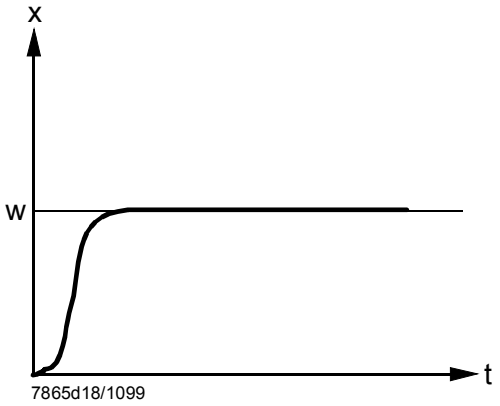


Figure 37: Optimum adjustment

10 PC software ACS411

PC software ACS411 is an operating module for use with the RWF55… universal controller and designed for the following basic tasks:

- Visualization of system state covering the following data:
  - Parameters
  - Process data
  - Configuration and parameterization of the controller (individual parameters)
  - Saving and restoration of parameter sets

A USB cable can be used to establish the connection between PC (USB plug type A, 4 pins) and RWF55 (USB plug type Mini B, 5 pins).

Note!
The cable must be purchased on site.

10.1 Safety notes

Caution!
PC software ACS411 is a convenient tool for use by qualified personnel, designed to commission and optimize the universal controller. Since the required actions and settings are safety-related, the user has a special obligation to exercise due care. Although specific technical measures have been taken to prevent incorrect entry of data and wrong parameter values, the user must check the correct function of the plant in a conventional way both during and after commissioning and – if required – ensure manual shutdown.

10.2 Setting the correct system parameters

Caution!
It should be noted that the characteristics of the universal controller are determined primarily by the parameter settings made, rather than by the type of unit. It is especially the OEM which is responsible for making certain that the controller's parameter settings are in compliance with the standards covering the respective application or type of plant. Responsibility for the parameter settings is assumed by the person who, in accordance with the access rights, makes or has made changes at the respective setting level. The detailed descriptions and safety notes given in the User Manual on the system components must also be observed.

10.3 Changing the parameters or the plant's configuration

Caution!
After changing parameters, all parameters must be checked via the unit's display to ensure they are correctly set – without making use of the PC software ACS411.

10.4 Place of installation



Caution!
PC software ACS411 is designed for use on site, that is, within viewing and hearing distance of the respective combustion plant. This means that remote control is not permitted.

10.5 License and liability regulations



Note!
For ENDUSER LICENSE AGREEMENT for PC software ACS411, refer to program menu item *Info* ➔ *Software documentation*.
IMPORTANT – PLEASE READ CAREFULLY!

10.6 Procurement of PC software ACS411

For ordering the ACS411 software and updates, please contact your supplier or heating engineer.

10.7 Languages

PC software ACS411 is available in English and German. To select the language you require, go to program menu item *File* ➔ *Default settings* ➔ *Program language* (ACS411 setup program must be restarted).

10.8 Operating systems : Operating

- Windows 2000 SP4
- Windows 7 - 32 bit
- Windows 7 - 64 bit
- Windows VISTA
- Windows XP

10.9 Prerequisites for hardware

- Free hard disk memory: 300 MB
- RAM: 512 MB

10.10 Installation

Note!
First, install PC software ACS411; then, connect the controller. If not observed, an error message is delivered.

PC software ACS411 is supplied on a CD.

* Insert CD in the CD or DVD drive.
  Setup starts automatically.

* Follow the instructions appearing on the screen.

* Connect PC and controller via the USB cable.
  New hardware is identified and USB driver installed.
  This may take a few minutes.

* Follow further instructions given on the screen and wait until the installation is successfully completed.

10.11 Others

10.11.1 Use of USB port : Use of

Use

The USB port is intended for temporary use to make the parameter settings, the configuration and for work in connection with commissioning.
When using the USB port, the controller can be securely operated, tested and set with no need for using the mains cable.

10.11.2 Powering the controller via the USB port : Powering the controller via the port

Using the HUB: Using the

If the controller shall be powered via the USB port, a HUB with power supply is required, capable of delivering at least 500 mA at every outlet.

Switching off: Switching off

When supplying power via the USB port, relays and analog output are deenergized to reduce power consumption.

Note!
Check to ensure that power supply to the measuring converter (G+ and G-) is not connected. This increases power usage via the USB port as well.

Measuring accuracy:

The measuring accuracy specified in chapter 12 *Technical data* does not apply when powering the controller via the USB port.

11 Modbus interface

The tables that follow in this chapter specify the addresses of the readable and writable words that the customer is able to access. The customer may read and/or write the values using SCADA programs, PLCs, or similar.

The entries under *Access* have the following meanings:

R/O **R**ead **O**nly, value can only be read
R/W **R**ead/**W**rite, value can be read and written

The number of characters specified under *Data type* in the case of character strings includes the final **\0**.

Example:

Char10 means that the text is up to **9** characters long. The final **\0** character is then added to this.

11.1 User level

Address	Access	Data type	Signal reference	Parameter
0x0000	R/O	Float	X1	Analog input InP1
0x0002	R/O	Float	X2	Analog input InP2
0x0004	R/O	Float	X3	Analog input InP3
0x0006	R/O	Float	WR	Actual setpoint
0x0008	R/W	Float	SP1	Setpoint 1
0x000A	R/W	Float	SP2 (= dSP)	Setpoint 2
0x1035	R/O	Float	---	Analog input InP3 (unfiltered)
0x1043	R/O	Float	---	Actual angular positioning
0x1058	R/O	Word	B1	Burner alarm

11.2 Parameter level

Address	Access	Data type	Signal reference	Parameter
0x3000	R/W	Float	Pb1	Proportional range 1
0x3004	R/W	Float	dt	Derivative action time
0x3006	R/W	Float	rt	Integral action time
0x300C	R/W	Float	db	Dead band
0x3012	R/W	Word	tt	Controlling element running time
0x3016	R/W	Float	HYS1	Switch-on threshold
0x3018	R/W	Float	HYS2	Switch-off threshold down
0x301A	R/W	Float	HYS3	Switch-off threshold up
0x301C	R/W	Float	HYS4	Switch-on threshold (cooling)
0x301E	R/W	Float	HYS5	Switch-off threshold down (cooling)
0x3020	R/W	Float	HYS6	Switch-off threshold up (cooling)
0x3022	R/W	Float	**q**	Reaction threshold
0x3080	R/W	Float	At1	Outside temperature 1
0x3082	R/W	Float	Ht1	Boiler temperature 1
0x3084	R/W	Float	At2	Outside temperature 2
0x3086	R/W	Float	Ht2	Boiler temperature 2

11.3 Configuration level

Address	Access	Data type	Signal reference	Parameter
0x3426	R/W	Float	SCL1	Start of display input 1
0x3428	R/W	Float	SCH1	End of display input 1
0x3432	R/W	Float	SCL2	Start value input 2
0x3434	R/W	Float	SCH2	End value input 2
0x3486	R/W	Float	SPL	Start of setpoint limitation
0x3488	R/W	Float	SPH	End of setpoint limitation
0x342A	R/W	Float	OFFS1	Offset input E1
0x3436	R/W	Float	OFFS2	Offset input E2
0x343A	R/W	Float	OFFS3	Offset input E3
0x1063	R/W	Word	FnCt	Ramp function
0x1065	R/W	Float	rASL	Ramp slope
0x1067	R/W	Float	toLP	Tolerance band ramp
0x1069	R/W	Float	rAL	Limit value
0x1075	R/W	Float	dtt	Remote Detection Timer
0x1077	R/W	Float	dF1	Filter constant input 1
0x1079	R/W	Float	dF2	Filter constant input 2
0x107B	R/W	Float	dF3	Filter constant input 3
0x107D	R/O	Float	oLLo	Lower working range limit
0x107F	R/O	Float	oLHi	Upper working range limit
0x106D	R/W	Word	FnCt	Alarm relay function
0x106F	R/W	Float	AL	Alarm relay limit value (limit value alarm)
0x1071	R/W	Float	HYSt	Alarm relay hysteresis

11.4 Remote operation

Address	Access	Data type	Signal reference	Parameter
0x0500	R/W	Word	REM	Activation remote operation *
0x0501	R/W	Word	rOFF	Controller OFF in remote setpoint **
0x0502	R/W	Float	rHYS1	Switch-on threshold remote
0x0504	R/W	Float	rHYS2	Switch-off threshold down remote
0x0506	R/W	Float	rHYS3	Switch-off threshold up remote
0x0508	R/W	Float	SPr	Setpoint remote
0x050A	R/W	Word	RK1	Burner release remote operation
0x050B	R/W	Word	RK2	Relay K2 remote operation
0x050C	R/W	Word	RK3	Relay K3 remote operation
0x050D	R/W	Word	RK6	Relay K6 remote operation
0x050E	R/W	Word	rStEP	Step-by-step control remote operation
0x050F	R/W	Float	rY	Angular positioning output remote operation
0x0511	R/W	Float	rHYS4	Switch-on threshold remote (cooling)
0x0513	R/W	Float	rHYS5	Switch-off threshold down remote (cooling)
0x0515	R/W	Float	rHYS6	Switch-off threshold up remote (cooling)

Legend

* = Local

** = Controller OFF

11.5 Device data

Address	Access	Data type	Signal reference	Parameter
0x8000	R/O	Char12	---	Software version
0x8006	R/O	Char14	---	VdN number

11.6 Device state

Address	Access	Data type	Signal reference	Parameter
0x0200	R/O	Word	---	Outputs and states
			Bit 0	Output 1
			Bit 1	Output 3
			Bit 2	Output 2
			Bit 3	Output 4
			Bit 8	Hysteresis limitation
			Bit 9	Control system
			Bit 10	Self-optimization
			Bit 11	Second setpoint
			Bit 12	Measuring range overshoot InP1
			Bit 13	Measuring range overshoot InP2
			Bit 14	Measuring range overshoot InP3
			Bit 15	Calibration mode
0x0201	R/O	Word	---	Binary signals and hardware detection
			Bit 0	Operation mode 2-stage
			Bit 1	Manual mode
			Bit 2	Binary input D1
			Bit 3	Binary input D2
			Bit 4	Thermostat function
			Bit 5	First controller output
			Bit 6	Second controller output
			Bit 7	Alarm relay
			Bit 13	Analog output available
			Bit 14	Interface available

12 Profibus-DP interface

12.1 RS-485 Technology transfer

Transmission is carried out in accordance with the RS-485 standard. This covers all areas in which high transmission speeds and simple, inexpensive installation technology are required. A twisted, shielded copper cable with a wire pair is used for this purpose.
The bus structure enables non-reacting coupling and decoupling of stations or gradual commissioning of the system. Subsequent extensions have no effect on stations that are already in operation.
A transmission speed of between 9.6 kbit/s and 12 Mbit/s can be selected. This is selected as a standard value for all devices on the bus during system commissioning.

Basic features

Network topology	Linear bus, active bus terminator at both ends, branching only permitted with baud rates of <1.5 Mbit/s
Medium	Shielded, twisted cable
Number of stations	32 stations in each segment without repeaters. With repeaters, can be extended to 126 (maximum of 9 repeaters permitted)
Connectors	Preferably 9-pin D-Sub connectors

Structure

All devices must be connected in a line structure. Up to 32 nodes (masters or slaves) may be interconnected within this kind of segment. If there are more than 32 nodes, repeaters must be used (to increase the number of devices, for example).

Cable length

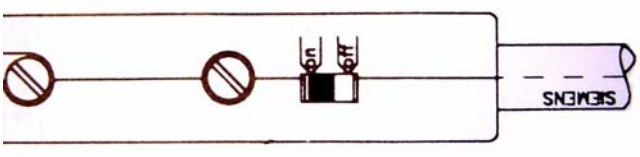
The maximum cable length depends on the transmission speed. The cable length specified can be increased by using repeaters. It is recommended that you do not connect more than 3 repeaters in series.

Baud rate (kbit/s)	9.6	19.2	93.75	187.5	500	1500	12000
Range/ segment	1200 m	1200 m	1200 m	1000 m	400 m	200 m	100 m

Range in relation to transmission speed.

Bus terminator

At the beginning and end of each segment, the bus is terminated by terminators. To enable fault-free operation, you must ensure that the two bus terminators are constantly supplied with power. The terminators are located in the Profibus connectors and can be activated by moving the slide switch to ON.



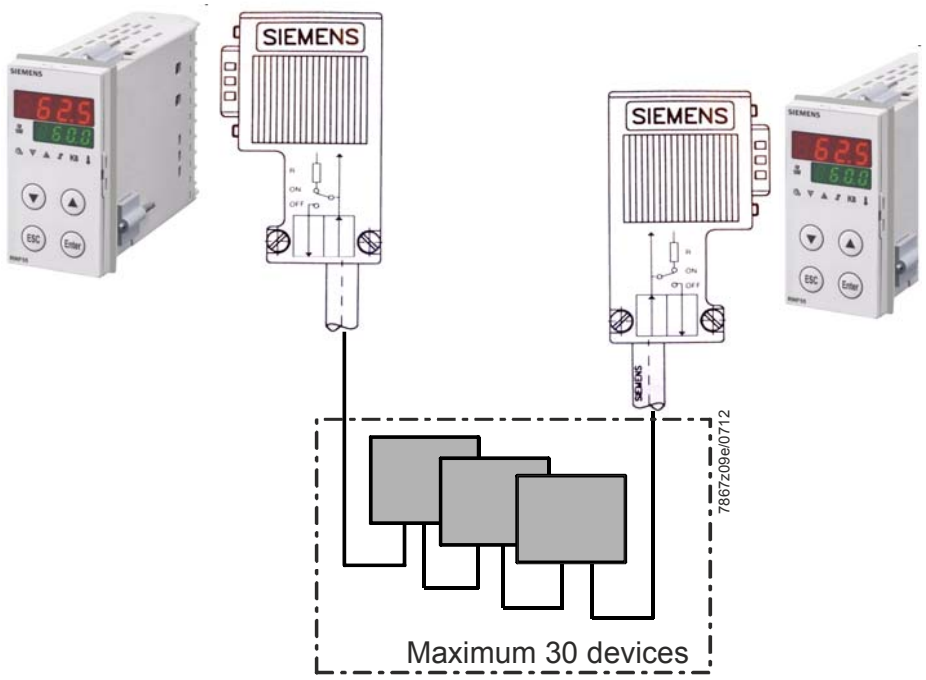


Figure 38: Bus terminator

Cable data

The cable length specifications relate to cable type A described below:

Surge impedance	135...165 Ω
Capacitance per unit length	<30 pf/m
Loop resistance	110 Ω/km
Cross-sectional area	>0.34 mm²

Preferably, a 9-pin D-Sub connector should be used for Profibus networks with RS-485 transmission technology. The pin assignments on the connector and the wiring specifications are listed at the end of this chapter.
Several manufacturers offer Profibus DP cables and connectors. Please consult the Profibus product catalog (www.profibus.com) for designations and reference addresses.

Attention!
When connecting the devices, make sure you do not mix up the data lines. You must use shielded data lines. The braided shield and the foil shield underneath it (where applicable) should be connected at both sides and with a good conductive connection to protective ground.
Additionally, where possible you must ensure that data lines are laid separately from all power cables.

As an example of an appropriate cable, we recommend the following from Siemens:

Simatic Net Profibus 6XV1
Order no.: 830-0AH10
* (UL) CMX 75 °C (Shielded) AWG 22 *

Data rate

With data rates of ≥1.5 Mbit/s, branching must be avoided during installation.

Note!
For additional installation information, please refer to the Profibus DP installation guidelines (order no. 2.111) from the PNO.

Address:
Profibus Nutzorganisation e.V.
Haid- und Neu-Straße 7
76131 Karlsruhe

Internet: www.profibus.com

Recommendation:
Please observe the installation information provided by the PNO, especially in cases where variable speed drives are being used simultaneously.

Wiring and bus termination

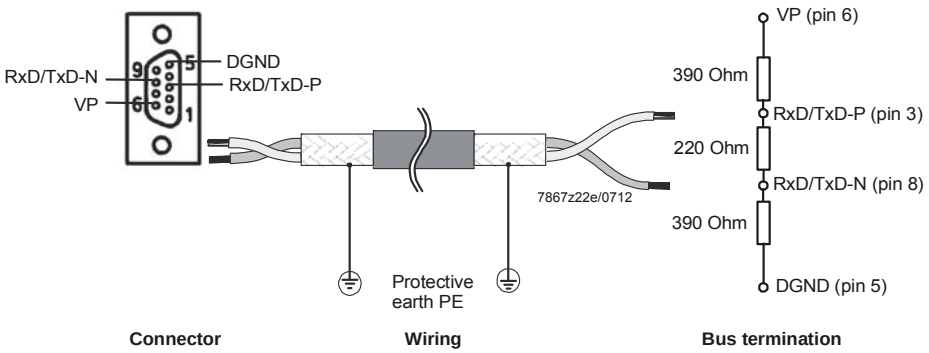


Figure 39: Wiring and bus termination

Profibus DP is designed for fast data exchange at field level. In this case, the central control devices (such as the PLC/PC) communicate with distributed field devices (such as I/Os, screen recorders, and controllers) via a fast serial connection. Data exchange with these distributed devices is usually cyclical.
The communication functions required for this are defined by basic Profibus DP functions in accordance with IEC 61158 and IEC 61784.

Basic functions

The central control device (master) reads input messages from the slaves cyclically and writes output messages to the slaves cyclically. The bus cycle time must be shorter than the program cycle time of the central PLC. As well as cyclical user data transfer, Profibus DP is able to carry out high-performance diagnostics and commissioning functions.

Technology transfer
- RS-485 twisted 2-wire line
- Baud rate of 9.6 kbit/s upto 12 Mbit/s

Bus access
- Master and slave devices, maximum 126 nodes on a bus (with repeater)

Communication
- Point-to-point (user data traffic)
- Cyclical master-slave user data traffic

Operation states
- Operate — Cyclical transfer of input and output data
- Clear — Inputs are read; outputs remain in a safe state
- Stop — Only master-master data transfer is possible

Synchronization
- Sync-Mode — Not supported by the RWF55
- Freeze-Mode — Not supported by the RWF55

Functionality
- Cyclical user data transfer between DP master and DP slave(s)
- Dynamic activation or deactivation of individual DP slaves
- Checking of DP slave configuration
- Address assignment for DP slaves via the bus
- Configuration of DP master via the bus
- Maximum 246 bytes of input/output data possible per DP slave

Protection functions

- Threshold monitoring for DP slaves
- Access protection for inputs/outputs of DP slaves
- Monitoring of user data traffic with adjustable monitoring timer for DP master

Device types

- DP master class 2, e.g., programming/configuration devices
- DP master class 1, e.g., central automation devices such as PLC, PC, etc.
- DP slave, e.g., devices with binary or analog inputs/outputs, controllers, recorders, etc.

Cyclical data traffic

Data traffic between the DP master and DP slaves is automatically processed by the DP master in a fixed, constantly recurring order. The user specifies the assignment of a DP slave to a DP master during bus system configuration. The DP slaves to be included in or excluded from cyclical user data traffic are also defined.
The data traffic between the DP master and DP slaves is divided into parameter setting, configuration, and data transfer phases. Before a DP slave is included in the data transfer phase, the DP master checks (in the parameter setting and configuration phase) whether the desired configuration that has been configured matches the actual device configuration.
As part of this check, the device type, format information, and length information as well as the number of inputs and outputs must match. As a result of this, the user is provided with reliable protection against parameter setting errors. As an addition to the user data transfer function that the DP master performs automatically, it is also possible to send new parameter setting data to the DP slaves if requested by the user.

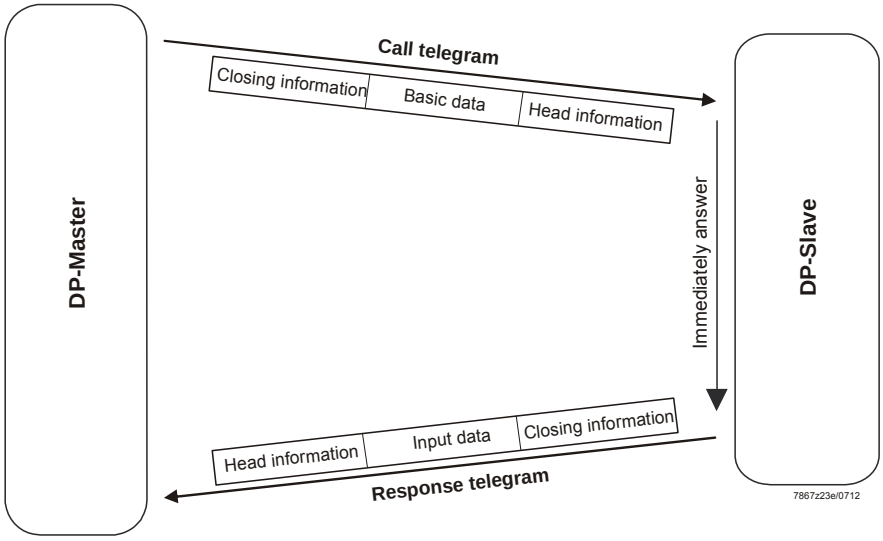
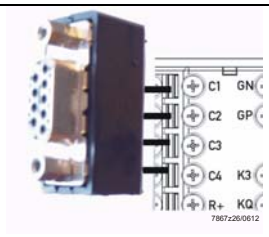


Figure 40: User data transfer with Profibus DP

12.2 Wiring

Assignment of 9-pole D-SUB jack

COM2 D-SUB jack		**Pin:** Signal on the device terminal strip 1	**Description**
6		C1: VP	Power supply - plus
3		C2: RxD/TxD-P	Received data/transmission data - plus
8		C3: RxD/TxD-N	Received data/transmission data - minus
5	Figure 41: COM2 D-SUB jack	C4: DGND	Ground

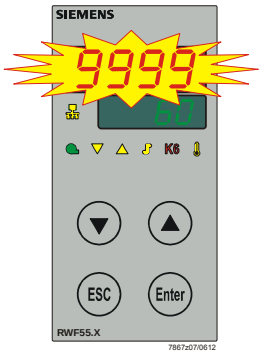
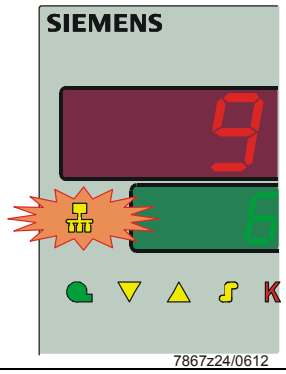
12.3 Parameter list

Signal reference	Access	Data type	Parameter
X1	RO	Float	Analog input InP1
X2	RO	Float	Analog input InP2
SP1	R/W	Float	Setpoint 1
SP2 (dSP)	R/W	Float	Setpoint 2
---	RO	Word	Outputs and states
---	RO	Word	Binary signal and Hardware character
Pb1	R/W	Float	Proportional range 1
dt	R/W	Float	Derivative action time
rt	R/W	Float	Integral action time
REM	RO	Word	Status remote operation
X3	RO	Float	Analog input InP3
AL	R/W	Word	Limit value alarm
B1	RO	Float	Burner alarm
WR	RO	Float	Actual setpoint

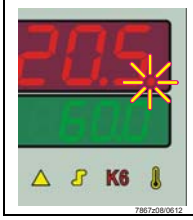
Note!
The respective address ranges are given in the *.gsd file

13 What to do if ...

13.1 Alarm messages:

Display	Cause	Remedy
9999 flashing 	**Measured value exceeded limit** The measured value is too great, lies outside the measuring range, or the sensor is faulty (9999 flashing). --- **Measured value dropped below limit** The measured value is too small, lies outside the measuring range, or the sensor has a short-circuit (-1999 flashing).	* Check to see if sensor and connecting line are damaged or have a short-circuit ⇨ Reference! See chapter 4.3 *Assignment of pins* * Check to see if the correct sensor is selected or connected ⇨ Reference! See chapter 14.1.1 *Analog input* `InP1` (actual value)
The yellow communication symbol (top left) flashes 	Interface communication via Profibus, Modbus or PC software ACS411 (USB) is active	No remedy required, normal RWF55 behavior.

13.2 Others

Display	Cause	Remedy
On the upper display, the decimal place to the right is lit 	USB connection	Remove USB connection ⇨ Reference! See chapter 10 *PC software ACS411*

14 Technical data

14.1 Inputs

14.1.1 Analog input InP1 (actual value)

For resistance thermometers, thermal elements or standard signals with 2nd order digital filters (configurable).

Sampling time	250 ms

Resistance thermometers

Type	Measuring range	Measuring accuracy [a]	Impact of ambient temperature
Pt100; DIN EN 60751	-200...850 °C (-328...1562 °F)	≤0,05%	50 ppm/K
Pt1000; DIN EN 60751	-200...850 °C (-328...1562 °F)	≤0,05%	50 ppm/K
LG-Ni1000	-50...+160 °C (-58...320 °F)	≤0,05%	50 ppm/K
0...135 Ω		≤0,05%	50 ppm/K

[a] Accuracies relate to the maximum measuring range.

Line resistance	Max. 30 Ω per line with 3-wire circuit
Line balancing	Not required with 3-wire circuits. With 2-wire circuits, line balancing can be performed by making an actual value correction

Thermal elements

Type	Measuring range	Measuring accuracy [a]	Impact of ambient temperature
Fe-CuNi **J** DIN EN 60584	-200...+1200 °C (-328...+2192 °F)	≤0.25%	≤100 ppm/K
NiCr-Ni **K** DIN EN 60584	-200...+1372 °C (-328...+2502 °F)	≤0.25%	≤100 ppm/K
Cu-CuNi **T** DIN EN 60584	-200...+400 °C (-328...+752 °F)	≤0.25%	≤100 ppm/K
NiCrSi-NiSi **N** DIN EN 60584	-100...+1300 °C (-148...+2372 °F)	≤0.25%	≤100 ppm/K
Pt-RhPt **S** DIN EN 60584	-50...+1768 °C (-58...+3214 °F)	≤0.25%	≤100 ppm/K
Pt-RhPt **R** DIN EN 60584	-50...+1768 °C (-58...+3214 °F)	≤0.25%	≤100 ppm/K
Pt-RhPt **B** DIN EN 60584	0...1820 °C (32...3308 °F)	≤0.25%	≤100 ppm/K

[a] Accuracies relate to the maximum measuring range.

Cold-function temperature	Internal

Standard signals

Measuring range	Measuring accuracy [a]	Impact of ambient temperature
Voltage DC 0...5 V Input resistance R_E >2 MΩ	≤0.2%	200 ppm/K
Voltage DC 0...10 V Input resistance R_E >2 MΩ	≤0.1%	100 ppm/K
Voltage DC 1...5 V Input resistance R_E >2 MΩ	≤0.2%	200 ppm/K
Current 0...20 mA Voltage drop ≤2 V	≤0.1%	100 ppm/K
Current 4...20 mA Voltage drop ≤2 V	≤0.1%	100 ppm/K

[a] Accuracies relate to the maximum measuring range.

14.1.2 Analog input InP2 (external setpoint, setpoint shifting)

Resistance measurement 0...1 kΩ or standard signals without linearization.

Sampling time	750 ms

Resistance thermometer

Resistance (2-wire circuit)	0...1 kΩ linear ≤0.05% 50 ppm/K

Standard signals

Measuring range	Measuring accuracy [a]	Impact of ambient temperature
Voltage DC 0...5 V Input resistance RE >2 MΩ	≤0.2%	200 ppm/K
Voltage DC 0...10 V Input resistance RE >2 MΩ	≤0.1%	100 ppm/K
Voltage DC 1...5 V Input resistance RE >2 MΩ	≤0.2%	200 ppm/K
Current 0...20 mA Voltage drop ≤2 V	≤0.1%	100 ppm/K
Current 4...20 mA Voltage drop ≤2 V	≤0.1%	100 ppm/K

[a] Accuracies relate to the maximum measuring range.

14.1.3 Analog input InP3 (outside temperature)

For resistance thermometers in 2-wire circuit, with fixed filter time constant.

Sampling time	6 s

Resistance thermometer

Type	Measuring range	Measuring accuracy [a]	Impact of ambient temperature
Pt1000 DIN EN 60751	-200...+850 °C (-328...+1562 °F)	≤0.05%	50 ppm/K
LG-Ni1000	-50...+160 °C (-58...+320 °F)	≤0.05%	50 ppm/K

[a] Accuracies relate to the maximum measuring range.

14.1.4 Binary input D1

Potentialfree contact for the following functions, depending on the configuration:
- No function
- Setpoint shifting
- Setpoint changeover
- Alarm input

14.1.5 Binary input D2

Potentialfree contact for operating mode changeover:

Burner modulating, if contacts D2 and DG are open	LED operating mode, 2-stage, **does not** light up on the front
Burner 2-stage, if contacts D2 and DG are closed	LED operating mode, 2-stage, **lights up** on the front

14.2 Monitoring the measuring circuit

In the event of error, the outputs assume defined states (configurable).

Measuring transducer	Measured value crossed limit	Sensor/line has short-circuit	Sensor/line interrupted
Resistance thermometer	●	●	●
Thermal elements	●	---	●
Voltage DC 1...5 V DC 0...5 V DC 0...10 V	 ● (●) (●)	 ● --- ---	 ● --- ---
Current DC 4...20 mA DC 0...20 mA	 ● (●)	 ● ---	 ● ---

● = detected

(●) = detected only if measuring range is exceeded

--- = not detected

⇨ Reference!
See chapter 13.1 *Alarm messages.*

14.3 Controller outputs OutP Controller o

Galvanic separation between supply voltage, analog inputs, and controller outputs.

⇨ Reference!
See chapter 4.2 *Galvanic separation*

Relay K1 (NO contact) **1P, 1N** (burner release)	
Contact rating	Max. 2 A at AC 240 V at cosφ >0.6
Contact life	250,000 switching cycles at high-fire
Contact protection	Varistor
Power supply for transducer G+, G-	DC 24 V ±10%/max. 30 mA, short-circuit-proof

The following relay data are those specified by the supplier.

Relay K2, KQ (controlling element OPEN)	
Contact rating	Max. 2 A at AC 450 V and cosφ >0.6
Contact life	200.000 switching cycles at high-fire
Contact protection	RC combination
Relay K3, KQ (controlling element CLOSE)	
Contact rating	Max. 2 A at AC 240 V at cosφ >0.6
Contact life	200.000 switching cycles at high-fire
Contact protection	RC unit
Relay K6 (NO contact)**, 6P, 6N** (multifunctional relay)	
Contact rating	Max. 2 A at AC 240 V at cosφ >0.6
Contact life	200.000 switching cycles at high-fire
Contact protection	Varistor

Relay data are those specified by the supplier.

Analog output A+, A-	
Voltage	DC 0...10 V short-circuit-proof
Load resistance	R_{Last} ≥500 Ω
Accuracy	≤0.25%, ±50 ppm/K
Current	0...20 mA/4...20 mA
Load resistance	R_{Last} ≤500 Ω
Accuracy	≤0.25%, ±50 ppm/K

Interface RS-485

Baudrate	4800 Baud 9600 Baud 19200 Baud 38400 Baud
Protocol	Modbus
Unit address	1...99

Profibus interface

Only present with RWF55.6!

14.4 Controller

Type of controller	3-position controller and continuous controller
Controller structure	P/PI/PD/PID
Sampling time	250 ms

14.5 Electrical data

Power supply (switching network section)	AC 110...240 V +10/-15% 48...63 Hz
Electrical safety	To DIN EN 60730, part 1 Overvoltage category III Degree of contamination 2
Safety class I	With internal separation from SELV electrical circuits
SELV voltage	Max. 30 V
Power consumption	Max. 20 VA
Data backup	EEPROM
Electrical connection	At the rear via screw terminals
- Cross-sectional area - Stranded wire with	0.25...1.5 mm² fine-wired - Ferrules to DIN 46228 - Pin-type cable socket to DIN 46231 - Crimp-type cable socket in fork-form for M3 thread (dimensions to DIN 46237)
With UL applications	Use of the cable lug or ferrules to UL486A-B (UL listed or recognized)
Tightening torque	0.5 Nm
Electromagnetic compatibility	DIN EN 61326-1
Emitted interference	Class B
Immunity	Meeting industrial requirements

14.6 Housing

Type of housing	Made of Makrolon for control panel mounting to DIN IEC 61554 (use in indoor)
Color	Light-grey RAL7035
Mounting depth	122 mm
Mounting position	Optional
Degree of protection	To DIN EN 60529 Front side IP66 Rear IP20 To UL50E and to NEMA 250 Front side type 5
Weight - RWF55.5 - RWF55.6	(Fully equipped) Approx. 329 g Approx. 342 g

14.7 Environmental conditions

Storage	DIN IEC 60721-3-1
Climatic conditions	Class 1K3
Mechanical conditions	Class 1M2
Temperature range	-40...70 °C
Humidity	<95% r.h.
Transport	DIN IEC 60721-3-2
Climatic conditions	Class 2K2
Mechanical conditions	Class 2M2
Temperature range	-40...70 °C
Humidity	<95% r.h.
Operation	DIN IEC 60721-3-3
Climatic conditions	Class 3K3
Mechanical conditions	Class 3M3
Temperature range	-20...50°C
Humidity	<95% r.h.
Installation altitude	Max. 2000 m above sea level

Attention!
Condensation, formation of ice and ingress of water are not permitted!

14.8 Segment display

Height of numerals	
- Upper display	10 mm
- Lower display	7 mm
Color	
- Upper display	Red
- Lower display	Green
Digits	4 (including 0, 1 or 2 decimal places, configurable)
Range of display	-1999...9999

14.9 Standards and certificates

Conformity to EEC directives

- Electromagnetic compatibility EMC (immunity)	2004/108/EC
- Low-voltage directive, to DIN EN 60730-1	2006/95/EC

ISO 9001: 2008
Cert. 00739

ISO 14001: 2004
Cert. 38233

15 Key

A	Switch-on point for high-fire when response threshold (q) is reached
ACrA	Response by Out of Range
Adr	Device address Modbus
AF	Alarm function
AL	Limit value
At1	Outside temperature 1
At2	Outside temperature 2
B	Switch-off point for burner
bdrt	Baudrate
bin1	Binary input 1
bin2	Binary input 2
binF	Binary input
CACt	Operating action
Cntr	Controller
CodE	Level lockout
ConF	Configuration
CtYP	Controller type
db	Dead band
dECP	Decimal point
dF1	Filter time constant
dF2	Filter time constant
dF3	Filter time constant
dFt	Data format
diSL	Lower display
diSP	Display
diSU	Upper display
dSP	Setpoint
dt	Derivative action time
dtt	Remote Detection Timer
End	End value
FnC2	Function
FnC3	Function
FnCt	Function
Ht1	Boiler temperature 1
Ht2	Boiler temperature 2
HYS1	Switch-on threshold heating controller
HYS2	Switch-off threshold heating controller
HYS3	Switch-off threshold heating controller
HYS4	Switch-on threshold cooling controller
HYS5	Switch-off threshold cooling controller
HYS6	Switch-off threshold cooling controller
HYSt	Switching difference
InP	Analog input
InP1	Analog input 1 (actual value)
InP2	Analog input 2 (external setpoint or setpoint shifting)
InP3	Analog input 3 (outside temperature)
IntF	Interface
OFF1	Correction of measured value
OFF2	Correction of measured value
OFF3	Correction of measured value
oLHi	Upper working range limit
oLLo	Lower working range limit
OPnt	Zero point
OPr	User
OutP	Control outputs

PArA	Parameter
Pb	Proportional range
Pb1	Proportional range 1
q	Response threshold
qeff	Sum of all integrals
rAFC	Thermal shock protection
rAL	Limit value
rASL	Ramp slope
rOut	Value when out of range
rt	Integral action time
SCH1	End of display
SCH2	End of display
SCL1	Start of display
SCL2	Start of display
SEn1	Sensor type
SEn2	Sensor type
SEn3	Sensor type
SiGn	Signal type
SP1	Setpoint 1
SP2	Setpoint 2
SPH	Setpoint limitation end
SPL	Setpoint limitation start
t	Time
t1	Power ON (startup at actual value)
t2	Actual value of ramp stop outside tolerance band
t3	Actual value returned to tolerance band
t4	Setpoint reached, thermal shock protection (TSS) no longer active
toLP	Tolerance band of ramp
tout	Timeout
tt	Running time of controlling element
Unit	Unit of temperature
W	Setpoint
Y	Angular positioning

16 List of figures

Figure 1: Block structure 12
Figure 2: Dimensions of RWF55 14
Figure 3: Mounting in a panel cutout 15
Figure 4: Test voltages 18
Figure 5: Assignment of terminals 19
Figure 6: Control sequence of heating controller 22
Figure 7: Control sequence of cooling controller 22
Figure 8: Control sequence of modulating burner, 3-position output 23
Figure 9: Control sequence of modulating burner, analog output 24
Figure 10: Control sequence of 2-stage burner, 3-position output 25
Figure 11: Control sequence of 2-stage burner, analog output 26
Figure 12: Setpoint changeover or setpoint shift 29
Figure 13: Setpoint changeover SP1 / external setpoint 30
Figure 14: Setpoint shifting analog / binary 31
Figure 15: External setpoint, setpoint shifting binary via dSP 32
Figure 16: Heating curve slope 33
Figure 17: Control sequence response threshold (q) 34
Figure 18: Control sequence *Cold start of plant* 35
Figure 19: Thermal shock protection (TSS) 37
Figure 20: Meaning of display and buttons 38
Figure 21: Display start 40
Figure 22: Basic display 40
Figure 23: Display of self-setting function 44
Figure 24: Display of software version 45
Figure 25: Display segment test 45
Figure 26: Parameterization 46
Figure 27: Configure 49
Figure 28: Alarm function lk1...lk6 56
Figure 29: Alarm function lk7 and lk8 56
Figure 30: Self-setting function in high-fire operation 62
Figure 31: Great difference between actual value and setpoint 63
Figure 32: Small control deviation 63
Figure 33: Pb too small 64
Figure 34: Pb too large 64
Figure 35: rt, dt too small 64

Figure 36: rt, dt too large 64
Figure 37: Optimum adjustment 64
Figure 38: Bus terminator 73
Figure 39: Wiring and bus termination 75
Figure 40: User data transfer with Profibus DP 76
Figure 41: COM2 D-SUB jack 77

Index

A

ACS411

- **Changing the parameters** ... 65
- **Installation** ... 67
- **Languages** ... 66
- **License and liability regulations** ... 66
- **Others** ... 67
- **PC software ACS411** ... 65
- **Place of installation** ... 66
- **Prerequisites for hardware** ... 66
- **Procurement of PC software ACS411** ... 66
- **Safety notes** ... 65
- **Setting the correct system parameters** ... 65

Alarm function AF

- Limit value AL relative to setpoint ... 56

C

Changing setpoint

- SP2 ... 41

Changing the setpoint

- SP1 ... 41

Configuration

- **Alarm function AF** ... 56
- **Analog input InP1** ... 50
- **Analog input InP2** ... 52
- **Analog input InP3** ... 53
- Analog output ... 58
- **Binary functions binF** ... 59
- Binary output ... 58
- **Control outputs OutP** ... 58
- **Controller Cntr** ... 54
- **Display diSP** ... 60
- **Interface IntF** ... 61
- **Thermal shock protection (TSS) rAFC** ... 55

Configuration ConF ... 49

D

Description

- **Interface** ... 11
- **Option** ... 11

E

Electrical connection

- **Connection of external components** ... 17

Electrical connections ... 17

- **Assignment of terminals** ... 19
- **Fusing** ... 17
- **Galvanic separation** ... 18
- **Incorrect use** ... 17
- **Installation notes** ... 17
- **Safety regulations** ... 17
- **Screw terminals** ... 17
- **Suppression of interference** ... 17

I

Identification of product no. ... 13

- **Location** ... 13
- **Product nos.** ... 13
- **Scope of delivery** ... 13
- **Type field** ... 13

Installation ... 14

- **Cleaning the front** ... 16
- **Dimensions** ... 14
- **Installation site and climatic conditions** ... 14
- **Mounting the controller in a panel cutout** ... 15
- **Removing the controller from the panel cutout** ... 16
- **Side-by-side mounting** ... 15

Introduction ... 8

- **Block structure** ... 12
- **Control** ... 11
- **Cooling controller** ... 11
- **Correct use** ... 9
- **Description** ... 11
- **General notes** ... 8
- **Mounting** ... 11
- **Notification symbols** ... 10
- **Presentation** ... 10
- **Qualified personnel** ... 9
- **Safety notes** ... 9
- **Typographical conventions** ... 9
- **Use in heating plants** ... 11
- **Warning symbols** ... 9

K

Key ... 87

M

Modbus interface ... 68

- **Configuration level** ... 70
- **Device data** ... 71
- **Device state** ... 71
- **Parameter level** ... 69
- **Remote operation** ... 70
- **User level** ... 68

O

Operating mode

- **Output** ... 24

Operating modes ... 22

- **2-stage burner, 3-position output** ... 25
- **2-stage burner, analog output** ... 26
- **Burner shutdown** ... 27
- **Cold start of plant** ... 35
- **Cooling controller** ... 22, 24, 26, 34, 36
- **External setpoint, setpoint shifting binary via dSP** ... 32
- **Heating controller** ... 22, 35
- Heating curve ... 33
- **High-fire operation** ... 23
- **Interlocking** ... 35, 37
- **Low-fire operation** ... 22
- **Modulating burner, 3-position output** ... 23

Modulating burner, analog output.....24
Operating mode changeover.....23
Predefined setpoint.....28
Response threshold (q).....34
Setpoint changeover SP1 / external setpoint via InP2.....30
Setpoint changeover SP1 / SP2 or setpoint shift analog via InP2.....29
Setpoint shifting SP1 analog via InP2 / binary via dSP.....31
Thermal shock protection.....37
Thermostat function.....22
Weather-compensated setpoint shifting.....33
Operation.....38
3-position controller.....42
Basic display.....40
Basic display.....38
Cancel.....44
Changing the setpoints.....41
Display of software version.....45
Flashing actual value display.....39
Initialization.....38
Manual control.....39
Manual control, 2-stage burner.....43
Manual control, modulating burner.....42
Meaning of display and buttons.....38
Modulating controller.....42
Parameter display.....38
Segment test.....45
Self-setting function.....38
Start.....44
Starting the self-setting function.....44
Timeout.....41
User level.....41
P
Parameterization
Display of controller parameters.....47
Parameterization PArA.....46
PC software ACS411
Measuring accuracy.....67
Operating systems.....66
Powering the controller via the USB port.....67
Use of USB port.....67
Using the HUB.....67
PC-Software ACS411
Switching off.....67
Profibus-DP interface.....72
Parameter list.....77
RS-485 Technology transfer.....72
Wiring.....77
R
RS-485 Technology transfer
Basic features.....72
Basic functions.....75
Bus terminator.....73
Cable data.....74
Cable length.....72
Cyclical data traffic.....76
Data rate.....74
Structure.....72
Wiring and bus termination.....75
S
Self-setting function.....62
2 procedures.....63
Checking the controller parameters.....64
Conditions.....63
Self-setting function in high-fire operation.....62
T
Technical data.....79
Binary input D2.....82
Controller.....85
Controller outputs OutP.....84
Electrical data.....85
Environmental conditions.....86
Housing.....85
Inputs.....79
Monitoring the measuring circuit.....83
Resistance thermometers.....79
Segment display.....86
Standard signals.....80
Standards and certificates.....86
Technical Data
Analog input InP1.....79
Analog input InP2.....81
Analog input InP3.....81
Binary input D1.....81
Interface RS-485.....84
Profibus interface.....84
Resistance thermometer.....81
Standard signals.....81
Thermal elements.....79
W
What to do if….....78
Alarm messages.....78
Others.....78
Wiring
Assignment of 9-pole D-Sub jack.....77

Siemens AG Infrastructure & Cities Sector Building Technologies Division
Berliner Ring 23
D-76437 Rastatt
Tel. +49 7222 598 279
Fax +49 7222 598 269
www.siemens.com

© 2013 Siemens AG Infrastructure & Cities Sector
Building Technologies Division
Subject to change!



Actuators

SQM45...
SQM48...

for air dampers and control valves of oil and gas burners

Electromotoric actuators

- **Torques:** **– SQM45... up to 3 Nm**
  – SQM48... up to 20 Nm
  – SQM48.6... up to 35 Nm
- **Running times: [1)] – SQM45... 10 ... 120 s**
  – SQM48... 30 ... 120 s
  – SQM48.6... 60 ... 120 s
  [1)] Depending on the type of basic unit (LMV5...)
- **Versions:** **– Choice of drive shafts (refer to «Type summary»)**

The actuators SQM45... / SQM48... and this Data Sheet are intended for use by OEMs which integrate the actuators in their products!

Use

The actuators of the SQM45... / SQM48... range are used to drive gas and air dampers, oil control valves and other ancillary equipment.
When used in connection with burner controls or electronic fuel / air ratio control, the associated controlling elements are controlled depending on burner output.

Warning notes

To avoid injury to persons, damage to property or the environment, the following warning notes must be observed!

Do not open, interfere with or modify the actuators!

- All activities (mounting, installation and service work, etc.) must be performed by qualified staff
- Before making any wiring changes in the connection area, completely isolate the plant from mains supply (all-polar disconnection). Ensure that the plant cannot be inadvertently switched on again and that it is indeed dead. If not observed, there is a risk of electric shock hazard
- Ensure protection against electric shock hazard by providing adequate protection for the actuator and for the connection terminals and by securing the housing cover
- Each time work has been carried out (mounting, installation, service work, etc.), check to ensure that wiring is in an orderly state
- Fall or shock can adversely affect the safety functions. Such units must not be put into operation, even if they do not exhibit any damage

Mounting notes

- Ensure that the relevant national safety regulations are complied with
- The connection between actuator drive shaft and controlling element must be **flexible but torsionally rigid couplings** with **free from backlash**

Positive connection

Note!
Possible connection with drive shaft or hub:
- Groove with Woodruff key
- Drive shaft with flat edge and matching counter piece

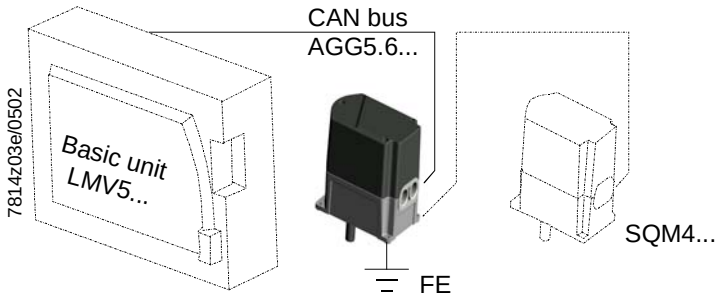
To avoid inadmissible loads and moments by mechanical overload, appropriate actions must be taken at the mechanical coupling

Example: Metal bellows clutches as compensating clutches with no mechanical play

Cable and cable shielding

Only the specified cable may be used (refer to Basic Documentation P7550). The cable's shielding must be connected to the printed circuit board using the tab provided.

Warning!
Ensure that the actuator's housing is connected to functional earth (FE) of the system.
If necessary, remove isolating layers of paint from the fixing points on the burner's casing or run separate earth wires. For detailed information, refer to «Installation Instructions for the LMV5… system» (J7550.1).



Working range of actuator

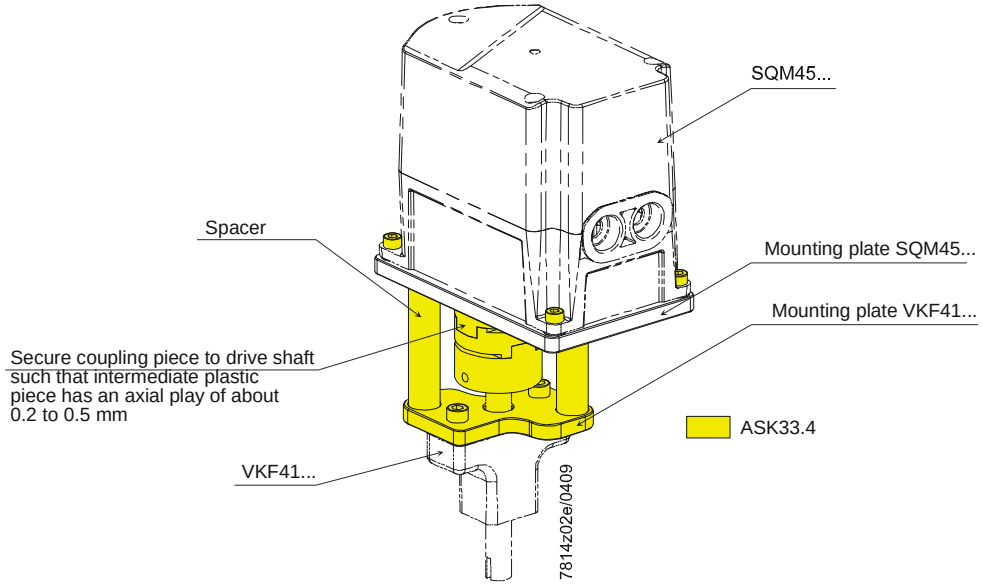
The working range is given on the type field and must be observed when mounting the actuator. To ensure the actuator is accurately located on the burner, a positioning pin of 6 mm diameter must be fitted on the mounting surface.

Mounting notes (cont´d)

IP54

To ensure **degree of protection IP54,** suitable M16 glands must be fitted in the actuator's M16 openings. The M16 glands used must feature cable strain relief. To ensure degree of protection IP54 during the actuator's entire service life, the bearing of the drive shaft must be located such that it will not be directly exposed to water or dust.

Mounting example



Installation notes

- To ensure protection against electric shock hazard, make certain that the AC 230 V section of the SQM4... is strictly segregated from the functional low-voltage section
- The holding torque is reduced when the actuator's power supply is switched off

Housing cover

Warning!
The housing cover may only be removed for short periods of time for wiring or when making the addressing. It must be made certain that dust or dirt will not get inside the actuator while such work is carried out.

ESD

Warning!
The actuator contains a printed circuit board with ESD-sensitive components. The top side of the board carries a cover which affords protection against direct contact. This protective cover must not be removed! The underside side of the board must not be touched.

Addressing

Addressing (assignment of functions) defines whether the SQM4... shall operate as a

- fuel actuator
- air damper actuator, or
- auxiliary actuator,

and is made with the display and operating unit AZL5... and the addressing button on the actuator, which is located under the housing cover (refer to Basic Documentation P7550).
The correct assignment of actuator functions can be checked with the help of flashing LEDs.

Cable length

For the maximum permissible cable length, refer to the Basic Documentation.

Topology

Cabling must be strictly serial (**no branching permitted!**).

Standards and certificates

Conformity to EEC directives
- Electromagnetic compatibility EMC (immunity) 2004/108/EC
- Low-voltage directive 2006/95/EC

ISO 9001: 2008
Cert. 00739

ISO 14001: 2004
Cert. 38233

Service notes

Replacement

When replacing an actuator, the following points must be checked and, if necessary, corrected:
- Addressing (assignment of functions)
- Bus termination
- Adjustment of the curvepoints of electronic fuel / air ratio control (e.g. with the LMV5...)

Disposal notes

The actuator contains electrical and electronic components and must not be disposed of together with domestic waste.
Local and currently valid legislation must be observed.

Mechanical design

Housing

The housing is made of die-cast aluminum.
The cover is made of impact-proof and heat-resistant plastic.

Color of cover: Black

Actuator

Stepper motor

Adjustment of switching points / position indication

In connection with the basic unit (e.g. LMV5...): Via the display and operating unit AZL5… (refer to Basic Documentation P7550).

Electrical connections

RAST3.5 terminals (supplied together with the AGG5.720 / AGG5.721).

Gear train

SQM45...: Spur gears made of plastic with small backlash and permanent lubrication.
SQM48...: Spur gears made of steel with small backlash and permanent lubrication.

Drive shaft

Made of black-finished steel, ready fitted to the front of the gear train (SQM48... uses a drive shaft made of hardened steel).

Mounting and fixing

The front of the gear train is used as the mounting surface. The actuator has 4 fixing holes and 1 elongated hole for the positioning pin.
Alternatively, the actuator can be secured from the side of the controlling element with 3 self-tapping screws.

Mounting kit ASK33.4

For mounting of SQM45.295A9 actuator on VKF41...C butterfly valve, an ASK33.4 mounting kit is always required.
The mounting kit consists of coupling with a preassembled mounting kit.

Type summary

Actuators SQM4...

Type reference	Drive shaft [1]	Running time (min.) for 90°	Nominal torque (max.)	Holding torque [2] (max.)	Radial bearing force (max.)
	no.	s	Nm	Nm	N
SQM45.291A9	1	10	3 [3) 4)]	1.5	190
SQM45.295A9	5	10	3 [3) 4)]	1.5	190
SQM48.497A9	7	30	20 [3) 4)]	20	420
SQM48.697A9	7	60	35 [3) 4)]	35	800

Legend

1) Refer to «Dimensions»
2) With operating voltage applied
3) Under nominal conditions 20 °C. Under extreme conditions (below –15 °C ambient temperature), the available torque is about 15 % lower
4) Under nominal conditions 20 °C. Under extreme conditions (above +50 °C ambient temperature), the torque is about 15 % lower

Ordering

When ordering, please give type references of actuator and accessories according to «Type summary».

In addition to the actuator, the following item is to be ordered **separately** and is also supplied as a separate item:

- Shielded cable
- Special terminals RAST3.5 as part of the AGG5.720 / AGG5.721 kit

Accessories

Accessories must be ordered as separate items.



Mounting plate **ASK33.1**
For mounting the SQM45.295A9 on the proportional controlling element VKP.
Refer to Mounting Instructions 74 319 0843 0 (M7646)



Mounting kit **ASK33.4**
For mounting of SQM45.295A9 on VKF41...C butterfly valve.
Refer to Mounting Instructions 74 319 0916 0 (M7813/7814)



CAN bus connecting cable **AGG5.641**
- Between LMV5... and system components
- Shielded 5-core cable
- Cable length 100 m
- 2 x 1,25 mm² + 1 x 0,5 mm² + 2 x 0,25 mm²



CAN bus connecting cable **AGG5.631**
- Between LMV5... and system components
- Shielded 5-core cable
- Cable length 100 m
- 3 x 0,5 mm² + 2 x 0,25 mm²



Separable cable entry (single packing) **AGG5.810**

Separable cable entry (packed in sets of 50) **AGG5.812**

Note!
Specified connecting cables are mandatory!

Technical data

Actuator	Operating voltage	AC 2 x 12 V via bus cable from the basic unit or via a separate transformer
	Safety class	III to IEC 730-1
	Power consumption	
	- SQM45...	9...15 VA
	- SQM48...	26...34 VA
	On time	50 %, max. 3 min. continuously
	Angular adjustment	Max. 90°
	Mounting position	Optional
	Degree of protection	To EN 60529, IP54, provided adequate cable entries are used
	Cable entry	SQM45... / SQM48...: Insertable threaded cable glands for 2 x M16
	Electrical connections	RAST3.5 terminals (for details, refer to the basic unit)
	Ferrules	Matching the dia. of the stranded wire
	Direction of rotation	Can be selected on the basic unit
	Torques and holding torques	Refer to «Type summary»
	Reproducibility (typically in the show-room condition)	± 0.2° (when used with the basic unit LMV5...)
	Running times	Refer to «Type summary» (can be selected on the basic unit)
	Life cycle	250,000 start cycles (CLOSE ⇨OPEN ⇨CLOSE) under load with the rated torque in the entire rotation angle range. 2,000,000 control cycles under load with 75% of rated torque in rotation angle range of 10°.
	Weight	
	- SQM45...	Approx. 1 kg
	- SQM48...	Approx. 1.6 kg
	Direction of rotation (when facing the shaft)	
	- Standard	Counterclockwise
	- Reverse	Clockwise

Environment conditions	**Storage**	DIN EN 60721-3-1
	Climatic conditions	Class 1K3
	Mechanical conditions	Class 1M2
	Temperature range	-20...+60 °C
	Humidity	<95 % r.h.
	Transport	DIN EN 60721-3-2
	Climatic conditions	Class 2K2
	Mechanical conditions	Class 2M2
	Temperature range	-20...+70 °C
	Humidity	<95 % r.h.
	Operation	DIN EN 60721-3-3
	Climatic conditions	Class 3K3
	Mechanical conditions	Class 3M3
	Temperature range	-20...+60 °C
	Humidity	<95 % r.h.



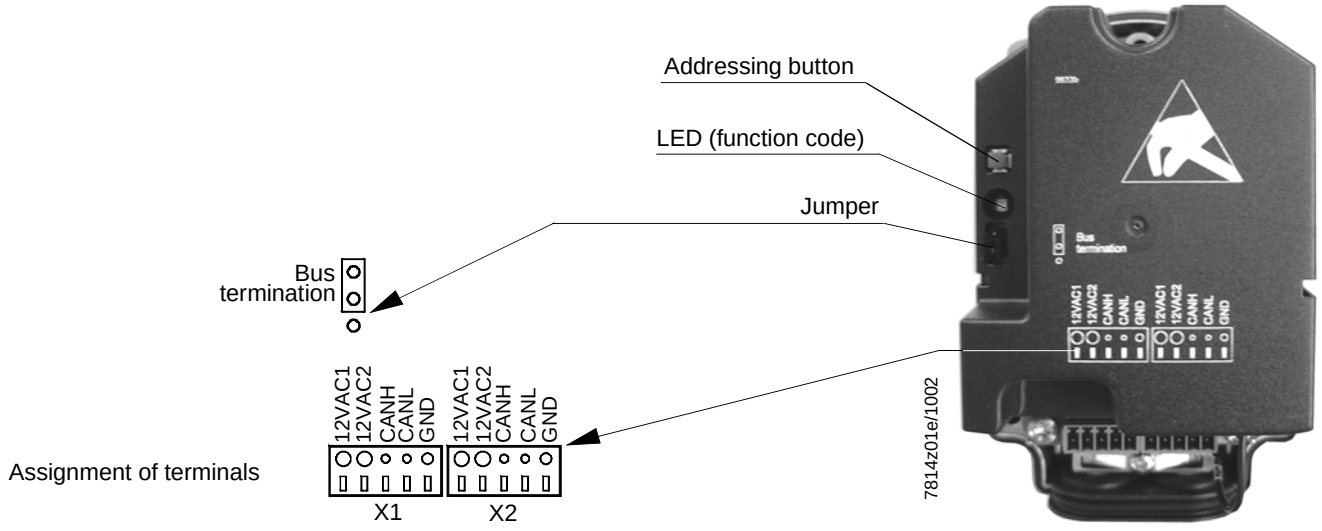
Warning!
Condensation, formation of ice and ingress of water are not permitted!

Function

The actuators SQM45... / SQM48... are of robust design and have a gear train with only small backlash.
Control and position feedback take place via a bus system (CAN).
The bus cable is also used for powering the actuators.
The actuators are driven by stepper motors and can be positioned with a resolution of 0.1°.
The characteristics and settings (running time, direction of rotation, limit positions) of the SQM4... are determined by the controlling basic unit (e.g. LMV5...; for details, refer to the Basic Documentation P7550 of the LMV5...).
The running times of the associated controlling elements are varied by the basic unit depending on the burner's control phase (e.g. startup phase: short running time; operation: long running time).

Terminating resistor

At the end of the serial bus cabling, a terminating resistor must be fitted.
For that purpose, a jumper must be set to BUS TERMINATION on the last actuator of the bus cable, which will activate the resistor.
On all the other actuators, that jumper must be set to the other position (deactivated).

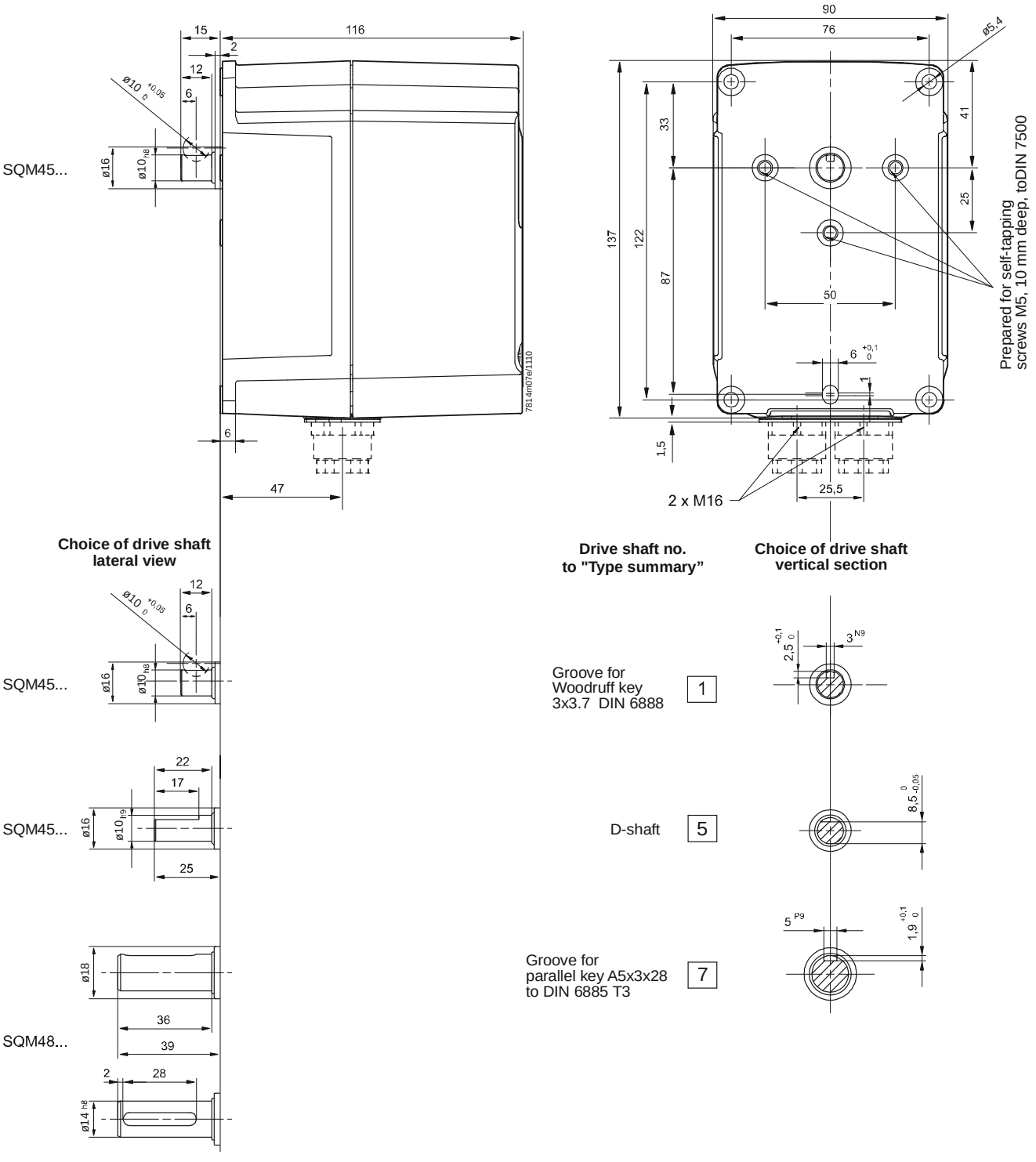


The 2 terminal blocks (X1 and X2) are identical.

Dimensions

Dimensions in mm

SQM45... / SQM48...



© 2014 Siemens AG Building Technologies Division
Subject to change!



Actuators SQM9...

Electromotoric actuators

- **Torques up to 60 Nm**
- **Running times [1]) 30...120 s**

[1]) Predefined by the basic unit (LMV5...)

The SQM9... and this Data Sheet are intended for use by OEMs which integrate the actuators in their products!

Use

The actuators are used to drive gas and air dampers, oil control valves, and other ancillary equipment.
In connection with the burner control or electronic fuel-air ratio control, the actuator is controlled depending on the burner's current output.

Warning notes



To avoid injury to persons, damage to property or the environment, the following warning notes must be observed!

Not permitted: Interventions or modifications.
To commission the actuator, the housing cover may be opened!

- Read the documentation on the actuators carefully and fully. If not observed, dangerous situations can occur
- All activities (mounting, settings and maintenance) must be performed by qualified and authorized personnel
- To ensure protection against electric shock, the connection terminals must have adequate touch protection. Make certain that noninsulated connections or wires cannot be touched
- Whenever work has been carried out (mounting, installation, service work, etc.), check to ensure that wiring is in an orderly state
- Fall or shock can adversely affect the safety functions. Such actuators must not be put into operation, even if they do not exhibit any damage
- Static charges must be avoided since they can damage the actuator's electronic components when touched.
  Recommendation: Use ESD equipment
- During operation, the actuator's surface can reach high temperatures.
  Recommendation: After operation, allow the actuator to cool down. If not observed, there is a risk of burning

Note!
Also not the enclosed Mounting Instruction 74 319 0842 0 (M7818)!

- Ensure that the relevant national safety regulations and notes on standards are complied with
- In geographical areas where DIN regulations apply, the mounting and installation requirements of VDE must be satisfied, especially DIN/VDE 0100, 0550 and DIN/VDE 0722
- The actuator must be disconnected from power before its cover is removed. This allows the actuator to cool down. During operation, the actuator's internal components get hot, especially the motor, which may reach 100 °C. If not observed, there is a risk of burning

Positive connection

Caution!
The drive shaft connection must be form-fitted using a key type A as per DIN 6885.

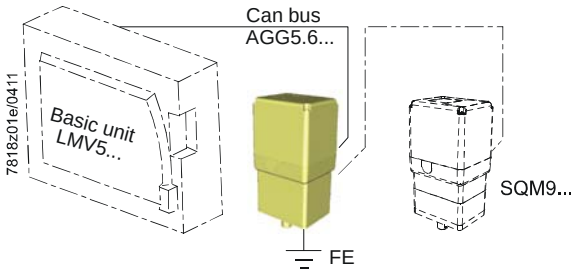
To avoid inadmissible loads and torques due to mechanical overload, appropriate measures must be taken at the mechanical coupling.

Example: Use metal bellows coupling without mechanical play.

Cable and cable shielding

Use of the specified cable is mandatory (see LMV5... Basic Documentation P7550). The cable's shield must be connected to the printed circuit board using the tab provided.

Caution!
Ensure that the actuator's housing is connected to functional earth (FE) of the system. If necessary, remove isolating layers of paint from the fixing points on the burner's casing or run separate earth wires. For detailed information, see *Installation Instructions for the LMV5... system* (J7550.1).



Working range of actuator

The working range is given on the type field and must be observed when mounting the actuator. To ensure the actuator is accurately located on the burner, a positioning pin of 6 mm diameter must be fitted on the mounting surface.

IP66 / NEMA 4

To ensure **degree of protection IP66/NEMA 4**, suitable M20 glands must be fitted in the actuator's M20 openings. The M20 glands used must provide cable strain relief.

Drive shaft

The actuator comes with the key fitted.
During transport, the key is held in the groove by means of an O-ring.
Remove the O-ring before mounting the actuator.

Installation notes

- Ensure that the electrical wiring is in compliance with national and local safety regulation
- Make certain that strain relief of the connected cables conforms to the relevant standards (e.g. as per DIN EN 60730 and DIN EN 60335)
- Ensure that spliced wires cannot get into contact with neighboring terminals. Use adequate ferrules
- Unused terminals of the actuator must be covered by dummy plugs
- The mechanical coupling between actuator and controlling element must be form-fitted
- The holding torque is reduced when the actuator is disconnected from power

Housing cover



Caution!
The housing cover may only be removed for short periods of time for wiring or when making the addressing. It must be made certain that dust or dirt does not get inside the actuator while such work is carried out. If the housing cover is removed and fitted again, power must be turned off to avoid short-circuits caused by conducting housing components.

ESD



Caution!
The actuator contains a printed circuit board with ESD-sensitive components. The top side of the board carries a cover which affords protection against direct contact. This protective cover must not be removed! The underside of the board must not be touched.

Addressing

Addressing (assignment of functions) defines whether the actuator shall operate as a …

- fuel actuator,
- air damper actuator, or
- auxiliary actuator,

and is made with the AZL5... display and operating unit and the addressing button under the actuator's housing cover (see LMV5... Basic Documentation P7550). The correct assignment of actuator functions can be checked with the help of flashing LEDs.

Cable length

For the maximum permissible cable length, see LMV5... Basic Documentation P7550.

Topology

Cabling must be strictly serial (**no branching permitted!**).

Standards and certificates

ISO 9001: 2008
Cert. 00739

ISO 14001: 2004
Cert. 38233

Service notes

Replacement

When replacing an actuator, the following points must be checked and corrected, if necessary:

- Addressing (assignment of functions)
- Bus termination
- Adjustment of curvepoints of electronic fuel-air ratio control (e.g. with the LMV5...)



Caution!
Before performing maintenance work, the actuator must be disconnected from power.

Disposal notes

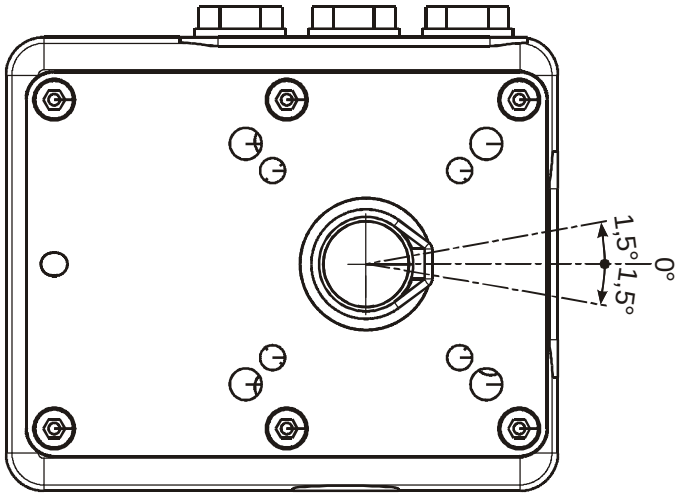


The actuator contains electrical and electronic components and must not be disposed of together with domestic waste.
Local and currently valid legislation must be observed.

Mechanical design

Housing	• Housing sections are made of die-cast aluminium and die-cast zinc • The housing is powder-coated (RAL 7032)
Drive motor	Stepper motor
Adjustment of switching points / position indication	In connection with the basic unit (e.g. LMV5...): Via the AZL5…display and operating unit (see LMV5... Basic Documentation P7550).
Electrical connections	• RAST3.5 connectors with screw clamps (supplied with the AGG5.720/AGG5.721) • Wiring via basic unit • Easy insertion of cables through large openings in the housing
Gear train	Spur gears made of steel with only little backlash and permanent lubrication.
Drive shaft	• Alloyed steel, hardened, ready fitted to the front of the gear train • The torque is transferred to the controlling element via a form-fitted key type A conforming to DIN 6885 • The actuator comes with the key fitted • During transport, the key is held in the groove by means of an O-ring • The O-ring must be removed prior to mounting

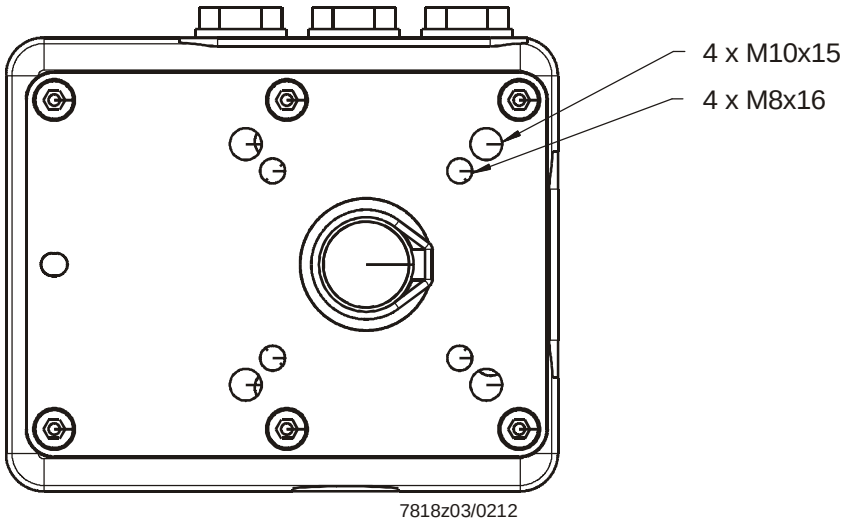
The actuator is supplied with the drive shaft in the following position:



7818z02/0411

Mounting and fixing

- The actuator is to be mounted from the side of the controlling element, using the 4 threaded holes M10 or M8 (see illustration)
- For tightening torques, see *Technical data*



Type summary (other types on request)

Product no.	Running time for 90° (min.)	Rated torque (max.)	Holding torque 1) (max.)	Radial force perpendicular to the drive shaft (max.)	Axial force in the direction of the drive shaft (max.)
	s	Nm	Nm	N	N
SQM91.391A9	30	60	60	1300	1000

1) Power applied

Ordering

When ordering, please give product no. of actuator according to *Type summary* and product nos. of accessories according to *Accessories*.

In addition to the actuator, the following items are to be ordered **separately** and are also supplied separately:

- Shielded cable
- RAST3.5 connectors with screw clamps (supplied with the AGG5.720/AGG5.721)

Accessories

Accessories must be ordered as separate items.



CAN bus connecting cable **AGG5.641**
- Between LMV5... and actuator or between actuators
- Shielded 5-core cable
- Cable length 100 m, 8 mm dia.
- Power supply 2 x 1.3 mm², 1 x 0.56 mm²
- Data line 2 x 0.22 mm²
- Double shielding
- See LMV5... Basic Documentation (P7550)



CAN bus connecting cable **AGG5.631**
- Shielded 5-core cable, 100 m
- See LMV5... Basic Documentation (P7550)

Specified connecting cables are mandatory!

Example X5-03



Connectors **AGG5.720**
- Standard connectors for gas/oil applications with up to 3 actuators

Connectors **AGG5.721**
- Extended connectors
  (in addition to AGG5.720, all plug-in variants are covered)

Technical data

General unit data	Operating voltage	AC 2 x 12 V via separate transformer, see LMV5... Basic Documentation P7550!
	Drive motor	2-phase stepper motor
	Power consumption	Approx. 40 VA at rated mains voltage
	On time	50% at a maximum operating time of 90 s without interruption
	Angular adjustment	Max. 0...90°
	Mounting position	Optional
	Degree of protection	IP66 as per EN 60529, provided adequate cable entries are used North America: NEMA4
	Safety class	The actuator is designed for operation in environments of safety class 2 (as per DIN EN 60730-1)
	External overload fuse	Max. 4 AT (slow) to DIN EN 60127/2-5
	Cable entry	Cable glands 3 x M20, adapter for ½" NPT protection well thread (packaged with the actuator)
	Electrical connections	RAST3.5 connectors with screw clamps (for details, see LMV5... basic unit)
	Ferrules	Must match the dia. of the stranded wire
	Direction of action	Selectable on the basic unit
	Direction of rotation (when facing the drive shaft)	
	- Standard	Counterclockwise
	- Reverse	Clockwise
	Rated torque and holding torque	See *Type summary*
	Running time	See *Type summary* (selectable on the basic unit)
	Life expectancy	Cycles (CLOSE ⇨ OPEN ⇨ CLOSE) at rated torque: typically 250,000
	Reproducibility of actuator positions across the usable angular range of 0...90°	±0.8° (typically, when used with the basic unit LMV5...)
	Drive shaft	Supplied as standard (not replaceable)
	Weight	Approx. 7.2 kg
	Tightening torques	
	- Cover screws	1 Nm
	- Fixing screws for the actuator	
	M10	26 Nm
	M8	16 Nm

Environmental conditions	**Storage**	IEC 60721-3-1
	Climatic conditions	Class 1K3
	Mechanical conditions	Class 1M2
	Temperature range	-20...60 °C
	Humidity	<95% r.h.
	Transport	IEC 60721-3-2
	Climatic conditions	Class 2K2
	Mechanical conditions	Class 2M2
	Temperature range	-20...70 °C
	Humidity	<95% r.h.
	Operation	IEC 60721-3-3
	Climatic conditions	Class 3K3
	Mechanical conditions	Class 3M3
	Temperature range	-20...+60 °C
	Humidity	<95% r.h.



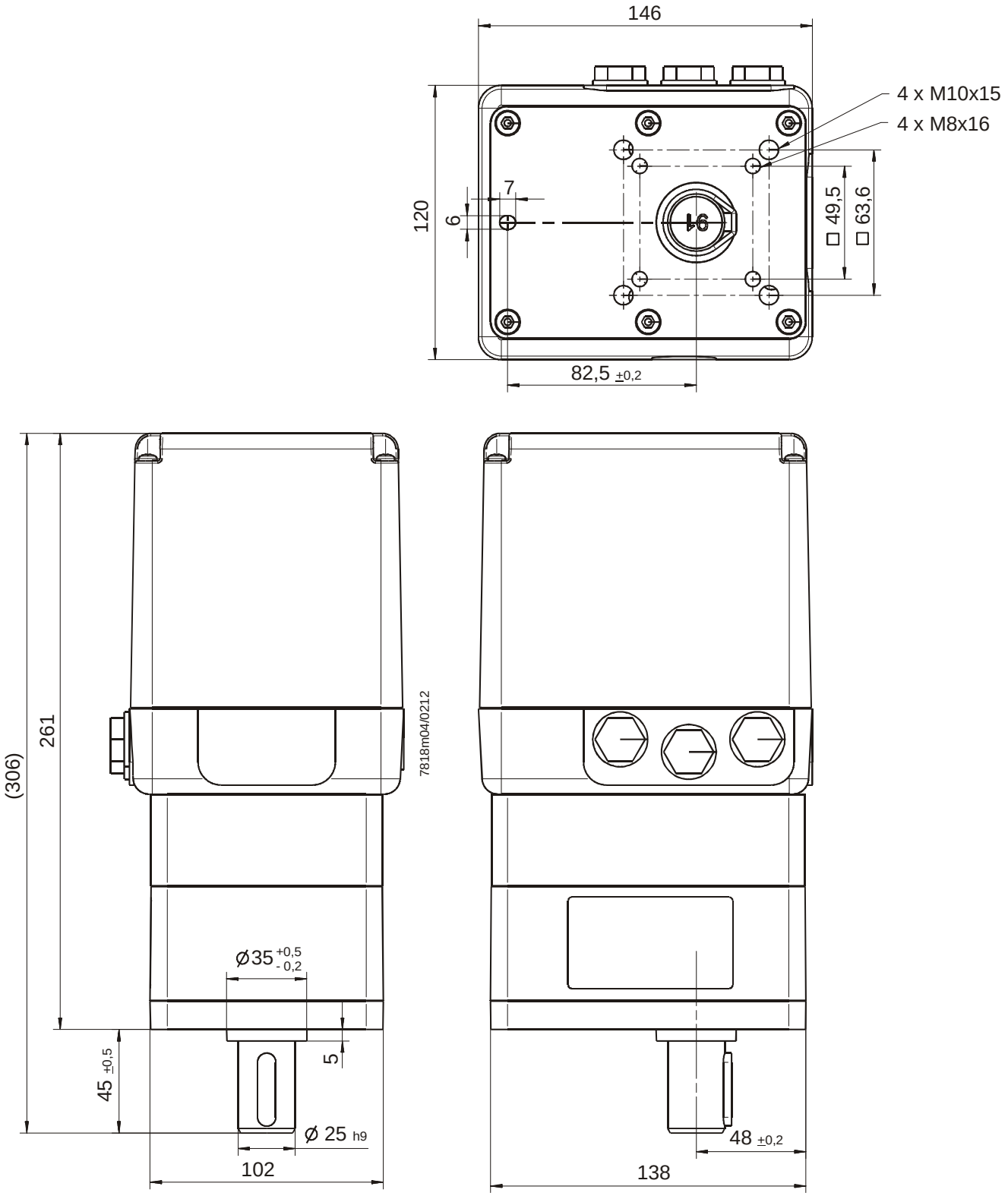
Caution!
Condensation and formation of ice are not permitted!

The actuators are of rugged design and have a gear train with only little backlash.
Control and position feedback take place via a bus system (CAN). The bus cable is also used for powering the actuators.
The actuators are driven by stepper motors and can be positioned with a resolution of 0.1°.
The characteristics and settings (running time, direction of rotation, limit positions) of the actuators are determined by the controlling basic unit (for details, see LMV5... Basic Documentation P7550).
The running times of the associated controlling elements are varied by the basic unit (LMV5...) depending on the burner's control phase (e.g. startup phase: short running time; operation: long running time).

Dimensions

Dimensions in mm

SQM9…



©2013 Siemens AG Infrastructure & Cities Sector Building Technologies Division
Subject to change!

SCC Inc.

Installation Instructions

Document No. TS-1100

June 20, 2014

TS Series

TS… Touchscreen Kits
for use with LMV3, LMV5 and RWF… Controls



Touchscreen

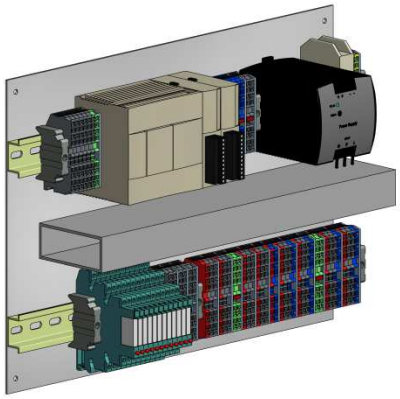


Plate Kit

Description

TS… series touchscreen kits provide a human machine interface (HMI) when used with a Siemens LMV3 or LMV5 linkageless control. Each kit provides boiler burner data collection and trending for a hydronic or steam boiler. An optional RWF… control for load or water level modulation easily interfaces with a TS… series touchscreen kit.

Each TS… touchscreen kit includes a 6” or 10” touchscreen along with a plate kit to be mounted inside a control panel (by others).

A PLC first-out annunciator option is available for additional analog, digital, and temperature inputs.

Flexible communication interface options to the building management system (BMS) provide streamlined data collection and monitoring.

Table of Contents

Compatible Controls and Accessories 3
Physical Connections 3
Logging In 4
Initial Configuration 6
Unit Type 7
Boiler Address 11
Expanded Annunciator Configuration 12
Analog Input Configuration 13
Boiler Overview Screen 17
Automatic / Manual Operation 19
Alarms 21
Inputs and Outputs 24
Fuel Statistics 25
LMV Controller Data 26
Feedwater & Warm Standby 27
Expanded Annunciator 30
Boiler Circulating Pump 31
Boiler Return Temperature Valve 32
Analog Inputs 34
Load Controller Settings 35
Parameter Backup 37
Datalogging and Trending 38
Screen Captures 43
Changing Passwords 44
Date and Time 46
Appendix – LMV5 Configuration for Modbus 48
Appendix – RWF40 Configuration for Modbus 49
Appendix – LMV3 Configuration for Modbus 50
Appendix – RWF55 Configuration for Modbus 51
Appendix – RWF10 Configuration for Modbus 52

Compatible Controls and Accessories

Controls

- LMV5... with internal load controller
- LMV5... with RWF40 or RWF55 external load controller
- LMV3... with RWF10, RWF40 or RWF55 external load controller

Accessories

- Feedwater control via RWF40 or RWF55 (steam boilers only)
- SCC Inc. Expanded Annunciation system

Physical Connections

The touchscreen communicates with the connected equipment via Modbus. Use the supplied terminal connections provided with the plate kit to wire the touchscreen, plate kit, and controllers. Connect any RS-485 devices in a daisy-chain with termination at the end of the chain (typically a 120-Ohm resistor). The following addresses are required for the connected equipment:

Table 1: Required Addressing of Controllers

Device	Required Address	Communication Type
LMV5x	1	RS-232
RWF40 (for load control)	2	RS-485
RWF40 (for feedwater)	3	RS-485
Expanded Annunciator	4	RS-485
LMV3x (via OCI412.10)	5	RS-485
RWF55 (for load control)	6	RS-485
RWF55 (for feedwater)	7	RS-485
RWF10 (for load control)	8	RS-485

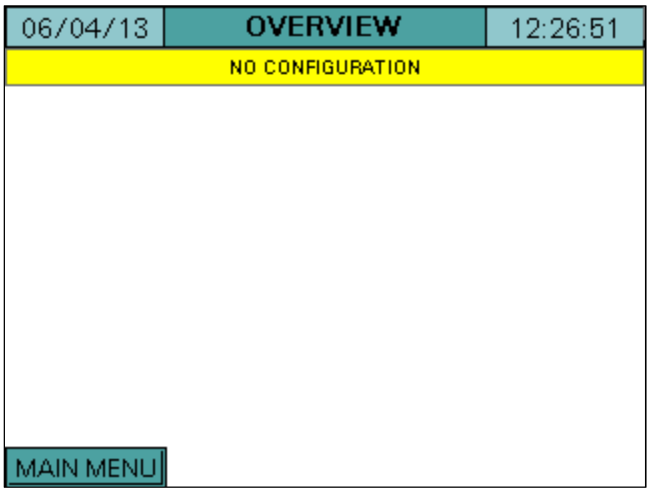
Communication via Modbus must be set with the following values:

- 19200 baud
- 8 stop bits
- 1 data bit
- no parity

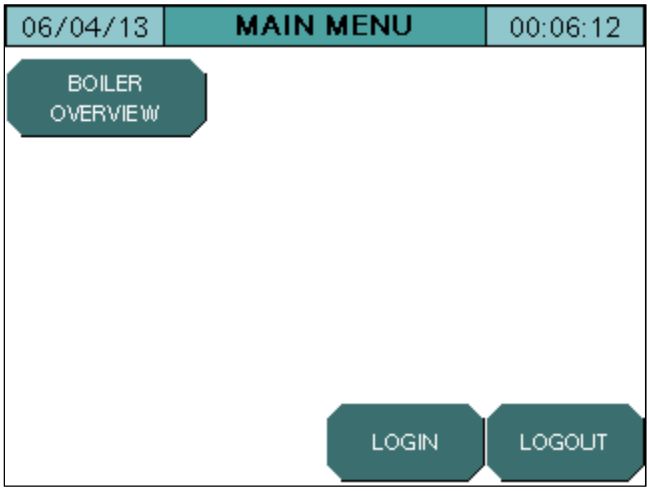
See the appendices for Modbus configuration details for each device. The address and configuration details for the Expanded Annunciator are fixed and do not need to be set.

Logging In

When the touchscreen is powered up, the OVERVIEW screen will appear.



Press **MAIN MENU** in the lower left corner to go to the MAIN MENU screen.

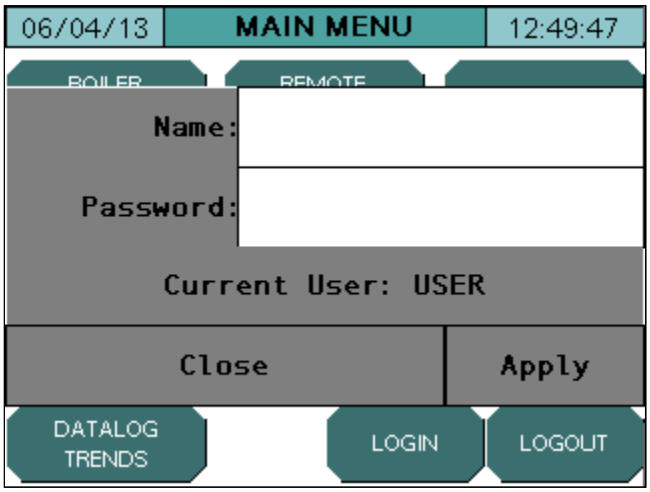


From here, different screens can be accessed depending on the access level. There are three access levels available:

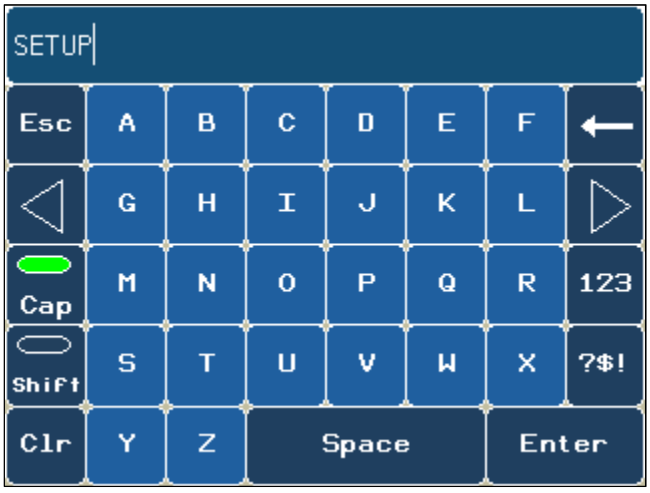
- USER: Allows access to viewing data, changing setpoints, and manual operation. No username or password required.
- TECH: Same access as USER level as well as access to changing operational parameters. Username and password required. The username is TECH. The default password is 9876.
- SETUP: Same access as TECH level as well as access to programming touchscreen configuration settings. Username and password required. The username is SETUP. The default password is START.

Logging In (continued)

In order to log in at the desired access level, press **LOGIN**. The LOGIN screen will appear.



Tap the area next to NAME and a keypad will pop up.



Use the keypad to enter the username for the desired access level. When finished, press **ENTER**.

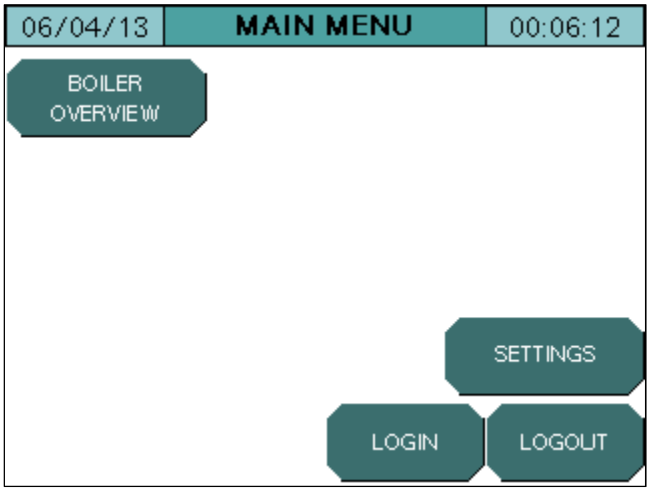
Next, tap the area next to PASSWORD and the same keypad will pop up again. Enter the password and then press **ENTER**.

When both the username and password have been entered, press **APPLY**. If successful, the CURRENT USER will change from USER to TECH or SETUP depending on the username and password that were entered. Hit **CLOSE** to leave the login screen.

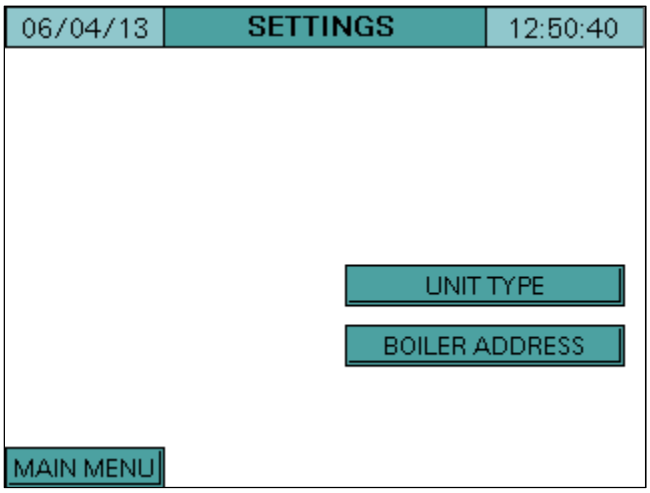
Initial Configuration

Access level: **SETUP**

The touchscreen needs to be configured for the connected equipment. Once logged in at the SETUP level, the SETTINGS tab will appear.



Press **SETTINGS** to display the SETTINGS screen.

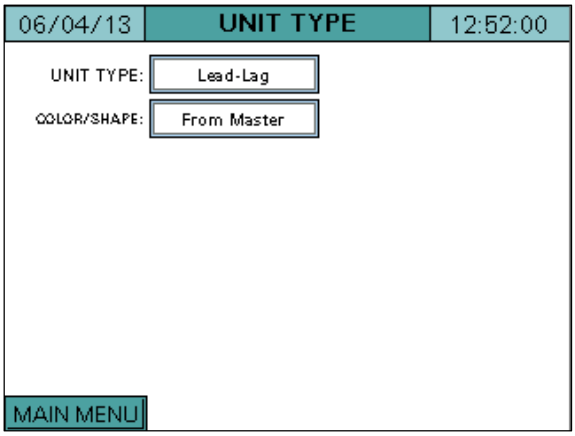


Initial Configuration (continued)

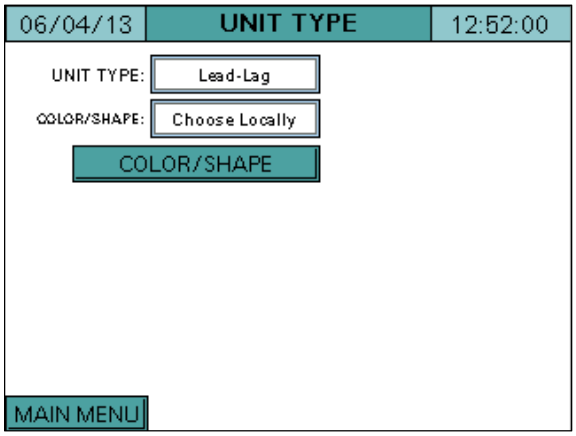
Unit Type

Press **UNIT TYPE** to display the UNIT TYPE screen. On the UNIT TYPE screen, the touchscreen is configured for the components it is connected to, including the type of boiler, the controller(s), and more.

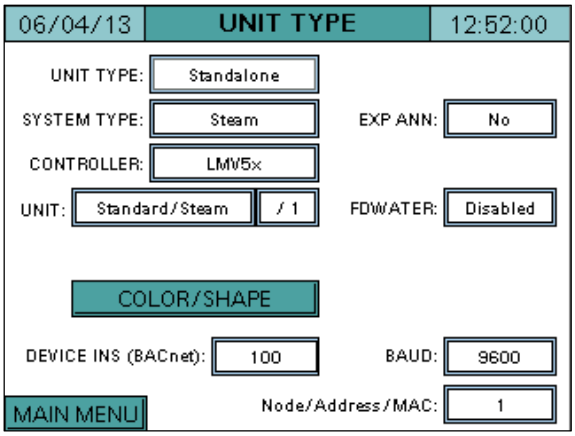
(1)



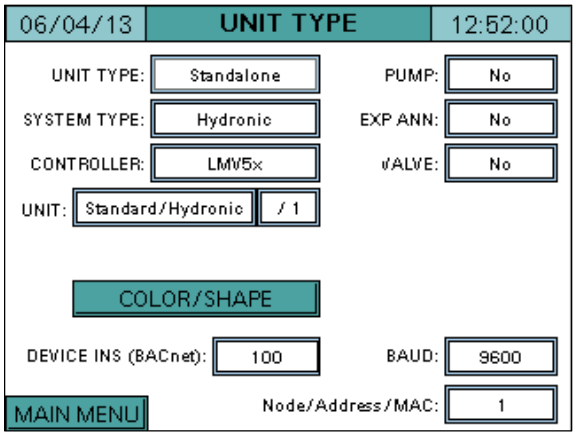
(2)



(3)



(4)



One of the four screens shown above will appear depending on the type of system that the touchscreen is configured for:

Screen 1 – Appears for lead/lag systems with boiler color coming from the Lead/Lag Master.
Screen 2 – Appears for lead/lag systems with boiler color coming from the local touchscreen.
Screen 3 – Appears for standalone steam boilers.
Screen 4 – Appears for standalone hydronic boilers.

Initial Configuration (continued)

UNIT TYPE – Configure the touchscreen as either a standalone unit or part of a lead/lag system.

- **Lead-Lag:** Choose this option when connected to a Lead/Lag Master panel.
- **Standalone:** Choose this option when no Lead/Lag Master panel is present.

SYSTEM TYPE – Choose the type of boiler that the touchscreen is connected to.

- **Hydronic:** Select this option for a hot water boiler.
- **Steam:** Select this option for a steam boiler.

CONTROLLER – Choose which Siemens controller(s) are connected to the touchscreen.

- **LMV5x:** Select this option when using an LMV5x and its internal load controller.
- **LMV5x/RWF40:** Select this option when using an LMV5x with an RWF40 as an external load controller.
- **LMV5x/RWF55:** Select this option when using an LMV5x with an RWF55 as an external load controller.
- **LMV3x/RWF10:** Select this option when using an LMV3x with an RWF10 as an external load controller.
- **LMV3x/RWF40:** Select this option when using an LMV3x with an RWF40 as an external load controller.
- **LMV3x/RWF55:** Select this option when using an LMV3x with an RWF55 as an external load controller.

UNIT – Choose the units and decimal places that will be displayed.

- **Standard/Hydronic:** Process variables are shown as temperatures in degrees Fahrenheit.
- **Metric/Hydronic:** Process variables are shown as temperatures in degrees Celsius.
- **Standard/Steam:** Process variables are shown as pressures in PSI.
- **/ 1:** No decimal place on all values.
- **/ 10:** One decimal place on all values.

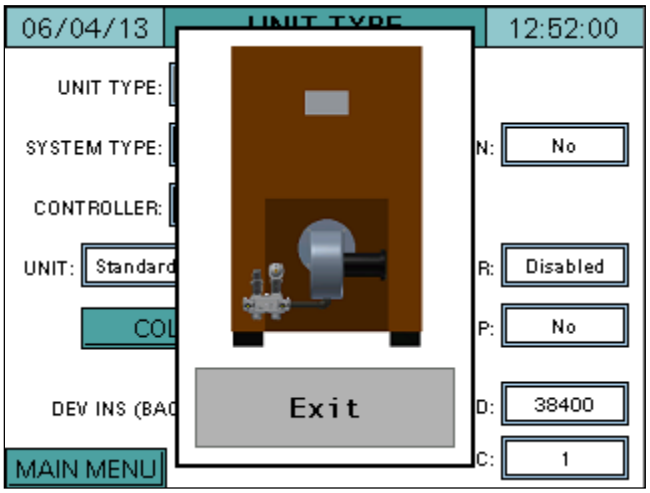
LMV3 ACTUATORS – Select the actuators being used on an LMV3x controller (LMV3x optioned boilers only).

- **None:** Choose this option when no actuators are being used.
- **Air Only:** Choose this option when only an air actuator is being used.
- **Fuel Only:** Choose this option when only a fuel actuator is being used.
- **Air & Fuel:** Choose this option when both air and fuel actuators are being used.

Initial Configuration (continued)

COLOR/SHAPE – Sets the visual representation for the boiler vessel on the OVERVIEW screen.

Press **COLOR/SHAPE** to pull up the current image of the boiler.



Tap the image to scroll through the available choices and press **EXIT** to confirm changes.

DEV INS (BACnet) – Sets the device instance for the optional QuickServer interface (for BACnet/IP or BACnet MS/TP communication only).

PUMP – Choose whether or not a boiler circulating pump is installed (only appears for hydronic boilers).

- **No:** Select this option if no pump is installed.
- **Yes:** Select this option if a pump is installed.

EXP ANN – Choose whether the Expanded Annunciation package is connected.

- **No:** Select this option if the Expanded Annunciation package is not connected.
- **Yes:** Select this option if the Expanded Annunciation package is connected.

VALVE – Choose whether or not a boiler return temperature valve is installed (only shows up for hydronic boilers).

- **No:** Select this option if no valve is installed.
- **Yes:** Select this option if a valve is installed.

Initial Configuration (continued)

FDWATER – Choose whether a feedwater system is installed with a Siemens controller (only shows up for steam boilers).

- **Disabled:** Select this option if there is no feedwater system installed with a Siemens controller.
- **RWF40:** Select this option if the feedwater is being controlled by an RWF40.
- **RWF55:** Select this option if the feedwater is being controlled by an RWF55.

WSB – Choose whether to enable the warm standby option (for steam boilers with the Expanded Annunciation package only).

- **No:** Warm standby is disabled.
- **Yes:** Warm standby is enabled. A shell temperature sensor is required to be connected to one of the following:
  - Terminal X60 on an LMV5x.
  - Analog input 3 on an RWF40 (set parameter df3 = 1).
  - Analog input 3 on an RWF55 (set parameter df3 = 1).
  - The dedicated RTD input on the Expanded Annunciation package (see Expanded Annunciator Configuration).

  If more than one sensor is installed in these locations, the touchscreen will use the following hierarchy to determine which sensor is used as the shell temperature:
  1. Dedicated RTD input on Expanded Annunciator package.
  2. Analog input 3 on either an RWF40 or RWF55.
  3. Terminal X60 on an LMV5x.

BAUD – Set the connection speed (for BACnet MS/TP or Modbus RTU communication only). Note: N2 Johnson Metasys is fixed at 9600 Bd regardless of this setting.

- 9600 Bd
- 19200 Bd
- 38400 Bd

Node/Address/MAC – This is used only for N2 Johnson Metasys, Modbus RTU, or BACnet MS/TP communications only. For N2 Johnson Metasys, this sets the node address. For Modbus RTU, this sets the slave address. For BACnet MS/TP, this sets the MAC address.

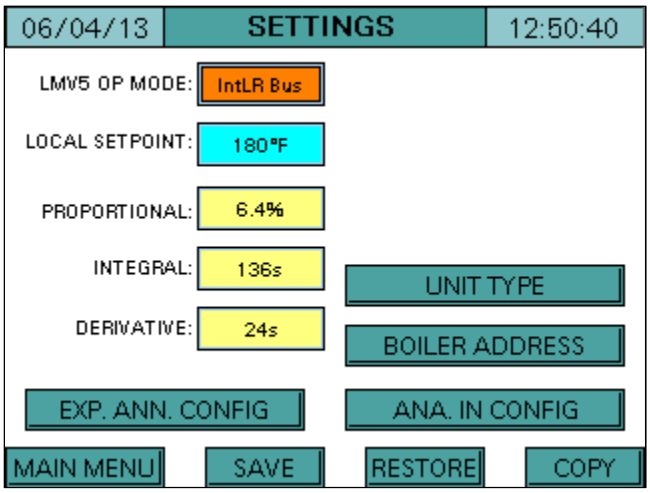
When finished, press **MAIN MENU** to return to the home screen.

Initial Configuration (continued)

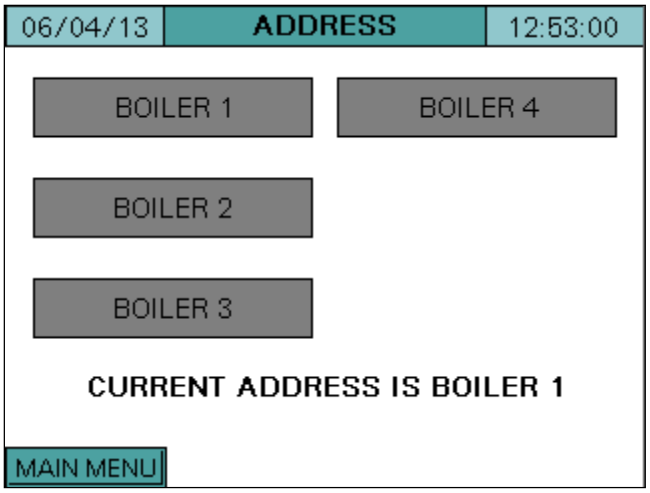
Boiler Address

The boiler address is used to give a unique name to each boiler. This must be set if the touchscreen is connected to a Lead/Lag Master or if multiple touchscreen kits are connected on the same Ethernet network.

From the MAIN MENU, press **SETTINGS**.



On the SETTINGS screen, press **BOILER ADDRESS**.



The boiler can be addressed as boiler 1, 2, 3, or 4. Tap the desired address. The address change will take effect immediately.

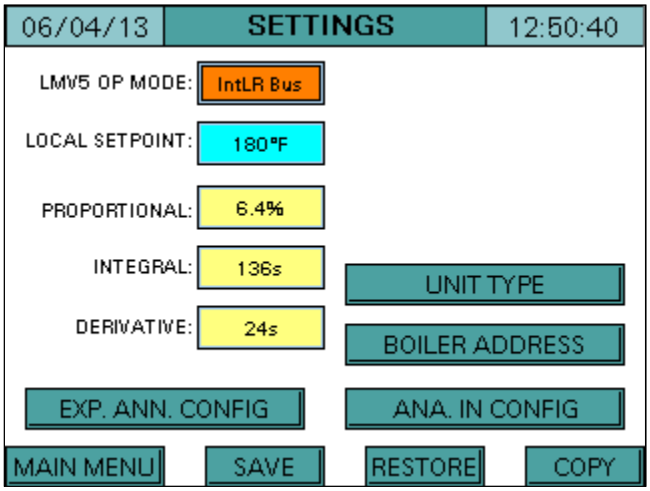
When finished, press **MAIN MENU** to return to the home screen.

Initial Configuration (continued)

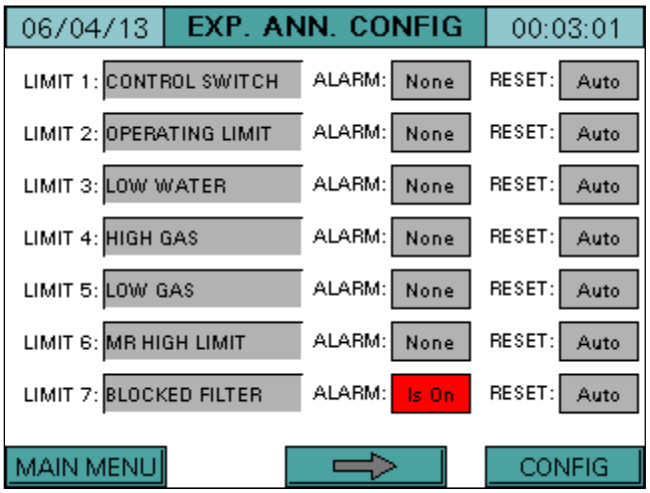
Expanded Annunciator Configuration

If the Expanded Annunciation package is equipped, the touchscreen is capable of first-out annunciation of up to thirteen limits with programmable labels. In order to program these limits, the EXP. ANN. CONFIG menu must be accessed.

From the MAIN MENU, press **SETTINGS**.



On the SETTINGS screen, press **EXP. ANN. CONFIG**.



Initial Configuration (continued)

Limits 1-7 are shown on the screen that appears. Limits 8-13 may be accessed by tapping the right arrow at the bottom of the screen.

LIMIT 1-13 – This is the user-configured name for each limit. Tap the area next to the limit and a keypad will appear. The name may be up to 16 characters long.

ALARM – Configures how each individual limit will alarm. Alarms are subject to a short (five-second) delay to ensure the alarm condition is present.

- **None:** Will not alarm regardless of the position the input is in.
- **Is Off:** Will alarm when the input is deactivated.
- **Is On:** Will alarm when the input is activated.
- **FO Off:** For first-out applications, will alarm when the input is deactivated only if the previous input is activated.

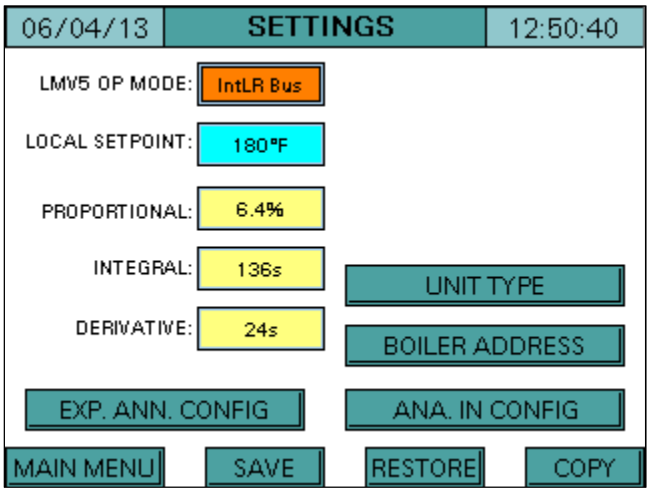
RESET – Configures whether the alarm will be an auto or manual reset alarm. Manual reset alarms can be reset using the **ALARM RESET** button on the ALARMS screen.

When finished, press **CONFIG** to go to the SETTINGS screen, or press **MAIN MENU** to return to the main menu.

Analog Input Configuration

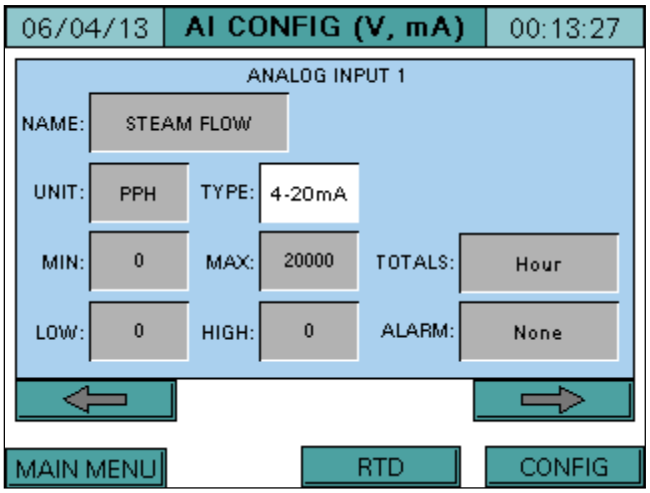
If the Expanded Annunciator package is equipped, the touchscreen is equipped with four programmable analog inputs and three programmable Pt1000 RTD temperature inputs. In order to configure these inputs, the ANA. IN CONFIG screen must be accessed.

From the MAIN MENU, press **SETTINGS**.



Initial Configuration (continued)

On the SETTINGS screen, press **ANA. IN CONFIG**.



The screen to configure analog input 1 will appear. Pressing the left or right arrows will toggle through the four available analog inputs. Use the following settings to configure each analog input:

NAME – Tap the area next to name and a keypad will appear. Enter any name for the analog input up to 10 characters in length.

UNIT – Tap the area next to unit and a keypad will appear. Enter the appropriate units for the analog input up to 4 characters in length.

TYPE – Configures the input signal for 0-10Vdc, 0-20mA, 2-10Vdc or 4-20mA.

MIN – Configures the low end of the scale for the analog input.

MAX – Configures the high end of the scale for the analog input.

TOTALS – Enables and sets the unit of time for totalization of the analog input.

- None – Disables totalization of the analog input.
- Hour – Enables totalization of the analog input in units/hour.
- Minute – Enables totalization of the analog input in units/minute.

LOW – Sets the low alarm threshold for the analog input (if enabled).

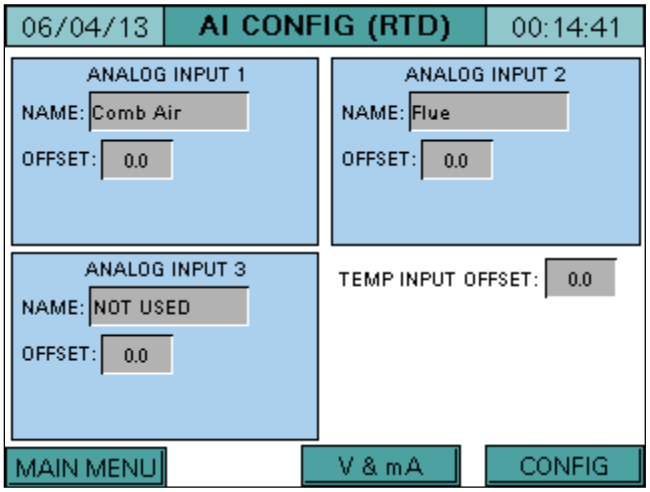
HIGH – Sets the high alarm threshold for the analog input (if enabled).

Initial Configuration (continued)

ALARM – Configures the type of alarm for the analog input. Manual reset alarms can be reset using the **ALARM RESET** button on the ALARMS screen. Alarms are subject to a short (five-second) delay to ensure the alarm condition is present.

- **None:** Disables the alarm.
- **Low Only:** Enables an auto reset low limit alarm.
- **Low MR:** Enables a manual reset low limit alarm.
- **High Only:** Enables an auto reset high limit alarm.
- **High MR:** Enables a manual reset high limit alarm.
- **Low High:** Enables an auto reset low limit and an auto reset high limit alarm.
- **LowMR High:** Enables a manual reset low limit and an auto reset high limit alarm.
- **Low HighMR:** Enables an auto reset low limit and a manual reset high limit alarm.
- **LowMR HighMR:** Enables a manual reset low limit and a manual reset high limit alarm.

When finished configuring the analog inputs, press **RTD** to go to the AI CONFIG (RTD) screen in order to configure the RTD temperature inputs.



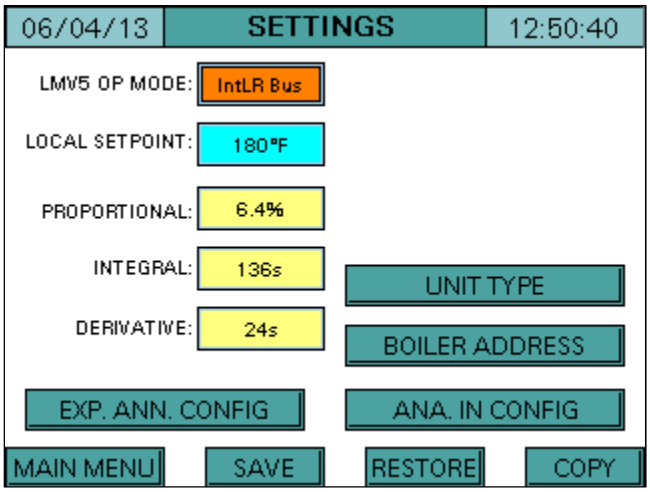
NAME – Tap the area next to name and a keypad will appear. Enter any name for the RTD input up to 10 characters in length.

OFFSET – Temperature offsets may be applied (negative or positive) to the RTD inputs to compensate for lead resistance.

TEMP INPUT OFFSET – Sets a temperature offset (negative or positive) for the dedicated shell temperature (steam boilers) or boiler return water temperature (hydronic boilers) RTD input.

When finished configuring both the analog and RTD inputs, press **CONFIG** to go back to the SETTINGS screen.

Initial Configuration (continued)



Press **SAVE** to store these configuration settings to the Expanded Annunciator memory. If this is not done, all settings will be lost upon a loss of power!

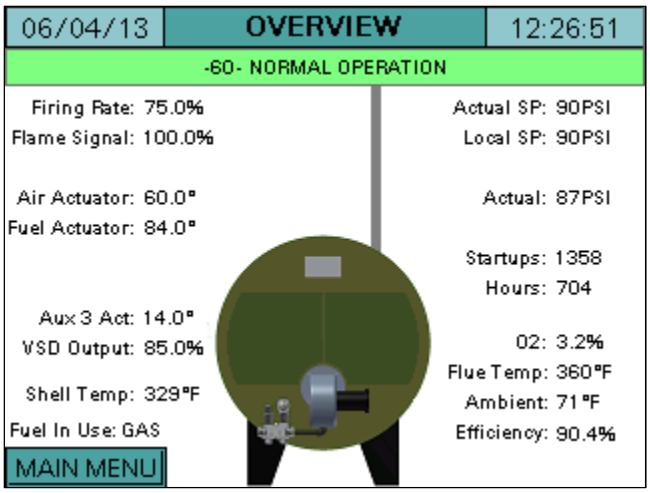
To revert back to the configuration settings saved in the Expanded Annunciator memory, press **RESTORE**.

Pressing **COPY** allows access to save configuration settings to or restore configuration settings from a USB drive or the touchscreen itself. For more information, see Parameter Backup.

Boiler Overview Screen

Access level: **USER**

The boiler overview screen displays the real-time data of the boiler. From the MAIN MENU screen, press **BOILER OVERVIEW**. The BOILER OVERVIEW screen will appear.



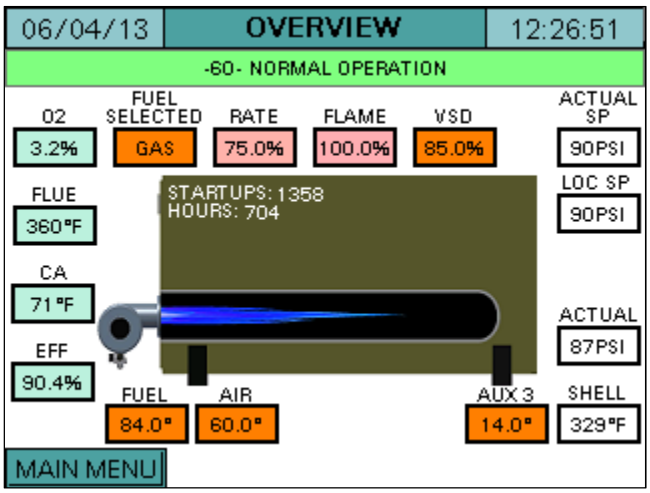
Only the parameters that are optioned and active are shown. Any others are hidden from the display for clarity. The following parameters may be shown on the overview screen:

Phase: The phase of the boiler is always displayed in a horizontal bar at the top of the screen.
Firing Rate: Displays the firing rate of the boiler from 0-100%.
Manual Active: Displayed in red text if the boiler is in manual mode.
Air Actuator: Displays the position of the air actuator.
Fuel Actuator: Displays the position of the current fuel actuator (gas or oil).
Aux1 Act: Displays the position of the auxiliary 1 actuator (LMV5x only).
Aux2 Act: Displays the position of the auxiliary 2 actuator (LMV5x only).
Aux3 Act: Displays the position of the auxiliary 3 actuator (LMV5x only).
VSD Output: Displays the speed of the VSD from 0-100%.
Shell Temp: Displays the current boiler shell temperature.
Fuel In Use: Displays the current fuel being used (GAS or OIL).
Actual SP: Displays the current setpoint of the boiler.
Local SP: Displays the local setpoint of the boiler.
Rem SP: Displays the remote setpoint of the boiler.
Actual: Displays the actual value of the boiler.
Startups: Displays the number of boiler startups on the selected fuel.
Hours: Displays the number of hours run on the selected fuel.
O2: Displays the current O2 percentage in the stack (LMV5x only).

Boiler Overview Screen (continued)

Flue Temp: Displays the current flue gas temperature (LMV5x only).
Ambient: Displays the current ambient temperature (LMV5x only).
Efficiency: Displays the current combustion efficiency (LMV5x only).

Pressing the title bar (**OVERVIEW**) allows the alternate overview screen to be displayed.



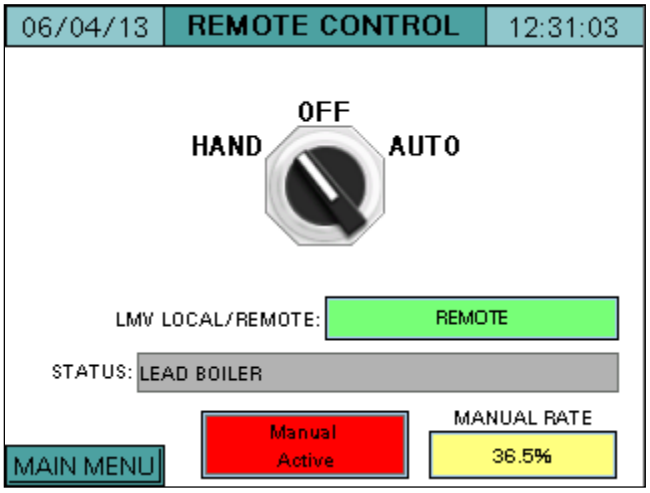
The screens may be toggled as desired and the last selected screen will remain in memory.

When finished, press **MAIN MENU** to return to the home screen.

Automatic / Manual Operation

Access level: **USER**

The HAND-OFF-AUTO mode of the boiler may be set at any time. From the MAIN MENU screen, press **REMOTE CONTROL**. The REMOTE CONTROL screen will appear.



HAND-OFF-AUTO – Sets the mode of the boiler to manually on, manually off, or automatic.

- **HAND:** The boiler is commanded to run in manual mode. If set to "Manual Inactive", the LMV LOCAL/REMOTE setting is LOCAL and the boiler operates off of the local setpoint. If set to "Manual Active", the LMV LOCAL/REMOTE setting changes to REMOTE and the boiler will go to the firing rate set in the MANUAL RATE box.
- **OFF:** The boiler is commanded to remain off. The LMV LOCAL/REMOTE setting will automatically change to REMOTE. The manual mode selection will be forced to "Manual Inactive".
- **AUTO:** The boiler is commanded to operate off of the remote setpoint of the touchscreen (for standalone boilers) or off of the settings of the Lead/Lag Master (for lead-lag systems). The LMV LOCAL/REMOTE setting is REMOTE. If communication is lost between the touchscreen and the LMV controller, the LMV LOCAL/REMOTE setting will switch to LOCAL and the boiler will operate off of the local setpoint.

LMV LOCAL/REMOTE – Displays the mode of the LMV controller.

- **LOCAL:** The boiler is commanded to run in local mode using the local setpoint.
- **REMOTE:** The boiler is commanded to run in remote mode using a remote setpoint or a remote firing rate.

Automatic / Manual Operation (continued)

STATUS – Displays the status of the boiler (only appears if connected to a Lead/Lag Master). The status message shown with lead/lag systems indicates the available status of the boiler. The boiler must be in AUTO and not be in lockout in order to be available. If the boiler is available it may be designated as a lead or lag boiler.

- **LEAD BOILER:** The boiler is currently the lead boiler.
- **FORMER LEAD – CHANGEOVER IN PROGRESS:** The boiler is transitioning from a lead boiler to a lag boiler.
- **LAG 1/2/3 BOILER:** The boiler is currently the first, second, or third lag boiler.
- **LAG 1/2/3 BOILER – STANDBY ACTIVE:** The boiler is currently the first, second, or third lag boiler and is in warm standby mode.
- **BOILER NOT AVAILABLE:** The boiler is not available due to one of a number of reasons (boiler is not in automatic mode, boiler is in lockout, boiler with LMV5x controller is not set for “IntLC Bus” or “ExtLC Bus”, etc.)
- **COMM FAULT – LOCAL OPERATION:** The touchscreen has lost communication with the Lead/Lag Master and is currently running in local mode operating on the local setpoint.

MANUAL ACTIVE/INACTIVE – Used to either enable or disable a manual firing rate of the boiler.

- **MANUAL INACTIVE:** The boiler will respect the current setpoint of the boiler.
- **MANUAL ACTIVE:** When in HAND mode, the boiler will operate at the firing rate set in the MANUAL RATE box.

MANUAL RATE: Sets the firing rate when the touchscreen is in HAND mode and MANUAL ACTIVE is selected. This rate has priority over any setpoint control.

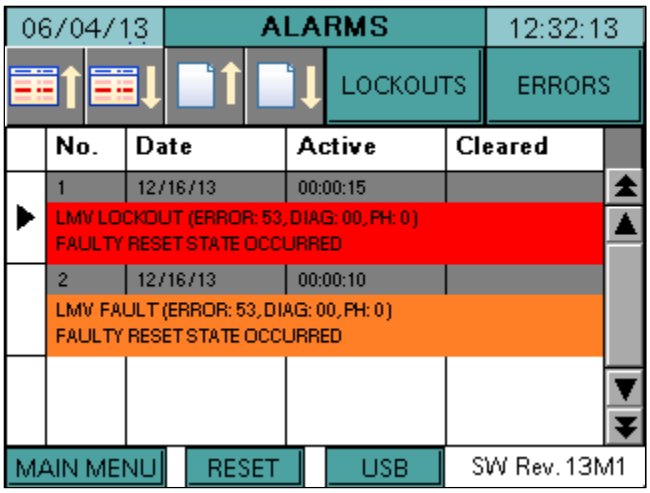
When finished, press **MAIN MENU** to return to the home screen.

Alarms

Access level: **USER**

Alarms are displayed on a dedicated alarm screen. The last 250 alarms are stored in memory and time stamped. When an alarm is present, a link to the alarm screen will flash in the lower-right corner of the OVERVIEW screen. Otherwise, this screen may be accessed from the main menu.

To access the alarm screen from the main menu, press **ALARMS**. The ALARMS screen will appear.



The ALARMS screen lists current alarms as well as older alarms. The color of the alarm indicates the category of the alarm.

Red – LMV lockouts. The text flashes when the alarm is currently active.
Orange – LMV faults.
Yellow/Green – Communication faults. The background is yellow when the alarm is currently active and green when communication is present.
Blue – All other alarms such as analog alarms, pump alarms, and expanded annunciator alarms. The text flashes when the alarm is currently active.

Information about the most recent 250 alarms will be displayed with the following information:

No. – Number of the alarm in the list (1 is most recent).
Date – Displays the date that the alarm occurred.
Active – Displays the time when the alarm became active.
Cleared – Displays the time when the alarm was cleared.

Alarms (continued)

The icons at the top of the screen may be used to navigate through the list of alarms:

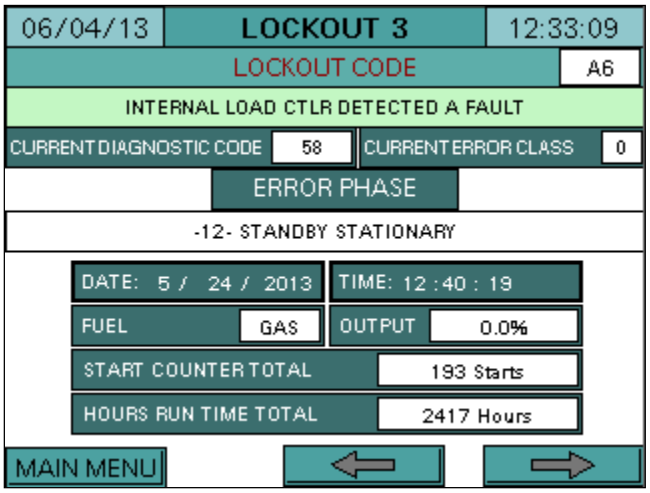
 Move up one alarm on list.

 Move down one alarm on list.

 Navigate up one page on list.

 Navigate down one page on list.

From the ALARMS screen, press **LOCKOUTS** to access the lockout history (only appears for LMV5x controllers). The 9 most recent lockouts are displayed (lockout 0 is the most recent).

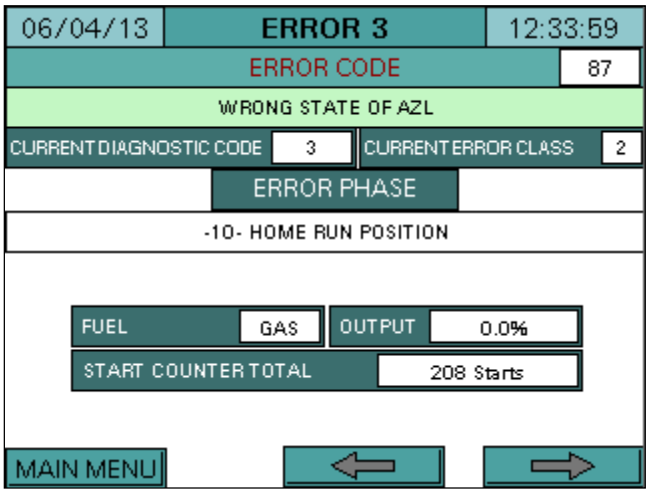


Press the left and right arrows at the bottom of the screen to toggle between lockouts. The following information is displayed on the screen for each lockout:

LOCKOUT CODE – Displays the LMV5x error code.
DESCRIPTION – Lists a description of the lockout in a horizontal bar at the top of the screen.
CURRENT DIAGNOSTIC CODE – Displays the LMV5x diagnostic code.
CURRENT ERROR CLASS – Not used.
ERROR PHASE – Displays what phase the LMV5x was in when the lockout occurred.
DATE – Displays the date when the lockout occurred.
TIME – Displays the time when the lockout occurred.
FUEL – Displays the fuel being used when the lockout occurred.
OUTPUT – Displays the firing rate when the lockout occurred.
START COUNTER TOTAL – Displays the start number when the lockout occurred.
HOURS RUN TIME TOTAL – Displays the total number of hours run before the lockout occurred.

Alarms (continued)

From the ALARMS screen, press **ERRORS** to access the fault history. The 21 most recent faults are displayed on an LMV5, and the 25 most recent faults are displayed on an LMV3 (fault 0 is the most recent).



Press the left and right arrows at the bottom of the page to toggle between faults. The following information is displayed on the screen for each fault:

ERROR CODE – Displays the LMV error code.
DESCRIPTION – Lists a description of the lockout in a horizontal bar at the top of the screen.
CURRENT DIAGNOSTIC CODE – Displays the LMV diagnostic code.
CURRENT ERROR CLASS – Not used.
ERROR PHASE – Displays what phase the LMV was in when the fault occurred.
FUEL – Displays the fuel being used when the fault occurred.
OUTPUT – Displays the firing rate when the fault occurred.
START COUNTER TOTAL – Displays the start number when the fault occurred.

From the ALARMS screen, press the **RESET** button to clear expanded annunciator alarms designated as manual reset. This button has no effect on LMV alarms.

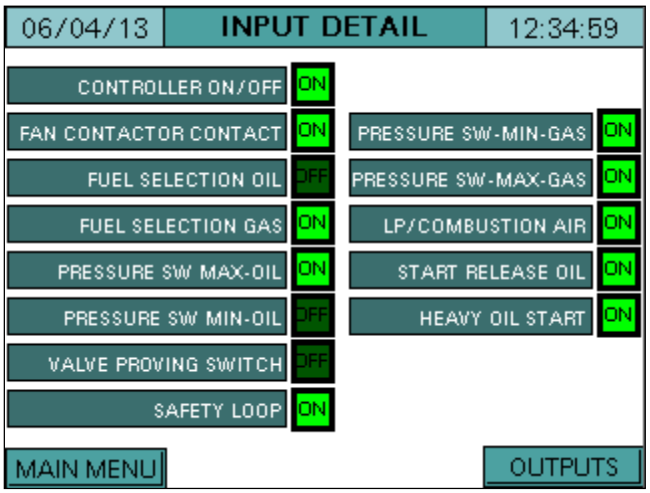
From the ALARMS screen, press **USB** to save the alarm log externally to a USB drive.

NOTE: If a boiler circulating pump is installed, an alarm is generated when feedback is not received within 20 seconds of the pump being commanded on. If this alarm appears, it must be reset using the **RESET** button. If connected to a Lead/Lag Master, this alarm is cleared from the ALARMS screen on the Lead/Lag Master. The alarm will also automatically clear if pump feedback is received while an alarm is present.

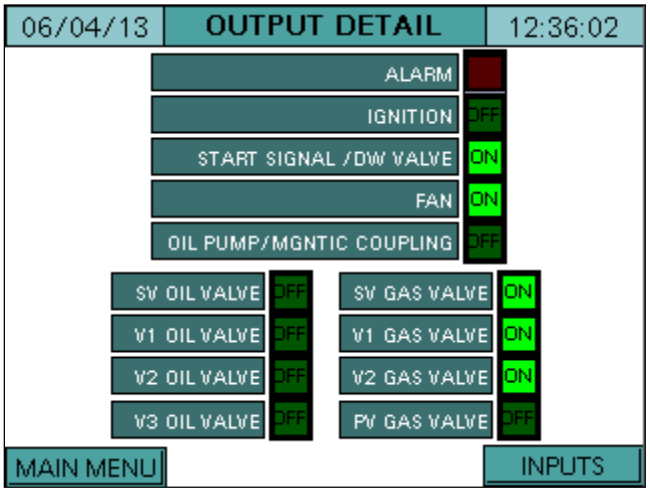
Input and Outputs

Access level: **USER**

The status of the LMV3x or LMV5x inputs and outputs may be viewed at any time. From the MAIN MENU screen, press **IN/OUT DETAIL**. The INPUT DETAIL screen will appear.



All inputs that are currently energized will display as ON with a bright green background. All inputs that are currently de-energized will display as OFF with a dull green background. To view the OUTPUT DETAIL screen, press **OUTPUTS**. The OUTPUT DETAIL screen will appear.

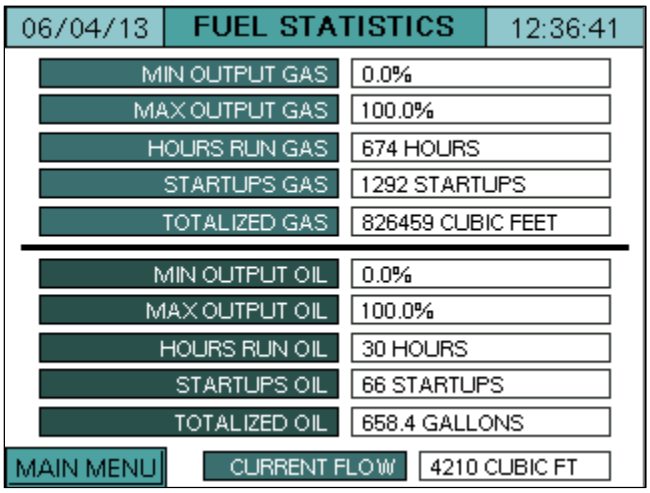


When the LMV3x or LMV5x controller is in alarm, the ALARM output will flash bright red. When the controller is not in alarm, the alarm output will be a dull red background. All other outputs that are currently energized will display as ON with a bright green background. All other outputs that are currently de-energized will display as OFF with a dull green background. To view the INPUT DETAIL screen again, press **INPUTS**. Otherwise, press **MAIN MENU**.

Fuel Statistics

Access level: **USER**

Both the LMV3x and LMV5x controllers keep track of certain fuel statistics. From the MAIN MENU screen, press **FUEL STATISTICS**. The FUEL STATISTICS screen will pop up.



MIN OUTPUT GAS/OIL – Displays the minimum allowable load output programmed in the LMV3x or LMV5x controller.

MAX OUTPUT GAS/OIL – Displays the maximum allowable load output programmed in the LMV3x or LMV5x controller.

HOURS RUN GAS/OIL – Displays the number of hours that the LMV3x or LMV5x controller has run on gas or oil.

STARTUPS GAS/OIL – Displays the number of startups that the LMV3x or LMV5x controller has had on gas or oil.

TOTALIZED GAS/OIL – Displays the totalized volume of gas (in cubic feet) or oil (in gallons) that has been used.

CURRENT FLOW – Displays the current flow rate of gas or oil (only appears if the current flow rate is greater than 0).

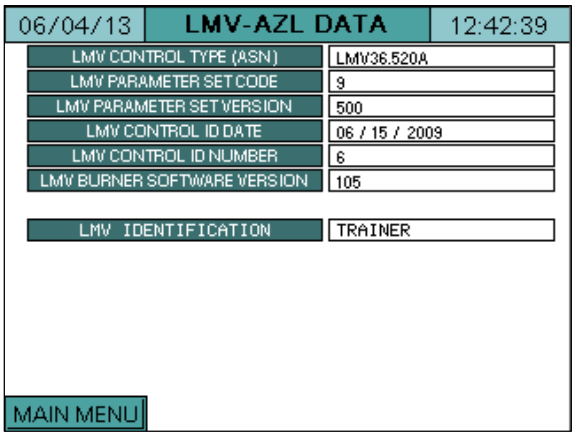
When finished, press **MAIN MENU** to return to the home screen.

LMV Controller Data

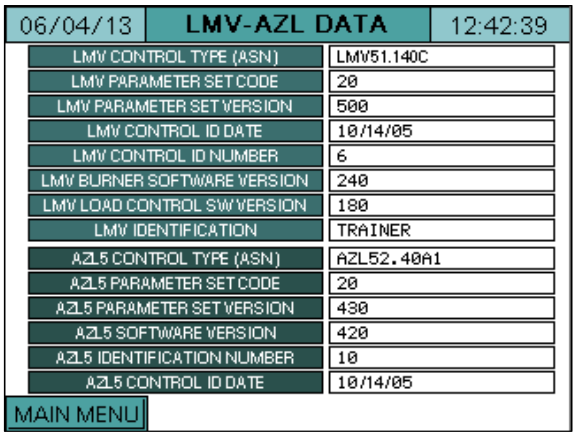
Access level: **USER**

The static details of the LMV controller may be viewed at any time. From the main menu, press **LMV DATA**.

(1)



(2)



One of the two screens shown above will appear depending on the controller that the touchscreen is connected to:

Screen 1 – Appears if the touchscreen is connected to an LMV3x controller.
Screen 2 – Appears if the touchscreen is connected to an LMV5x controller.

LMV CONTROL TYPE (ASN) – Displays the model number of the LMV controller.
LMV PARAMETER SET CODE – Displays the parameter set code of the LMV controller.
LMV PARAMETER SET VERSION – Displays the parameter set version of the LMV controller.
LMV CONTROL ID DATE – Displays the date of manufacture of the LMV controller (MM.DD.YY).
LMV CONTROL ID NUMBER – Displays the unit ID number of the LMV controller.
LMV BURNER SOFTWARE VERSION – Displays the software version of the LMV controller.
LMV LOAD CONTROL SW VERSION – Displays the load controller software version (LMV5x only).
LMV IDENTIFICATION – Displays the burner ID of the LMV controller.
AZL5 CONTROL TYPE (ASN) – Displays the model number of the AZL display (LMV5x only).
AZL5 PARAMETER SET CODE – Displays the parameter set code of the AZL display (LMV5x only).
AZL5 PARAMETER SET VERSION – Displays the parameter set version of the AZL display (LMV5x only).
AZL5 SOFTWARE VERSION – Displays the software version of the AZL display (LMV5x only).
AZL5 IDENTIFICATION NUMBER – Displays the unit ID number for the AZL display (LMV5x only).
AZL5 CONTROL ID DATE – Displays the date of manufacture of the AZL display (MM.DD.YY) (LMV5x only).

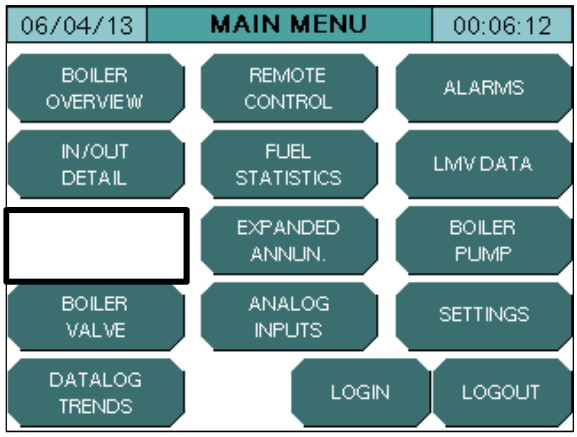
When finished, press **MAIN MENU** to return to the home screen.

Feedwater and Warm Standby

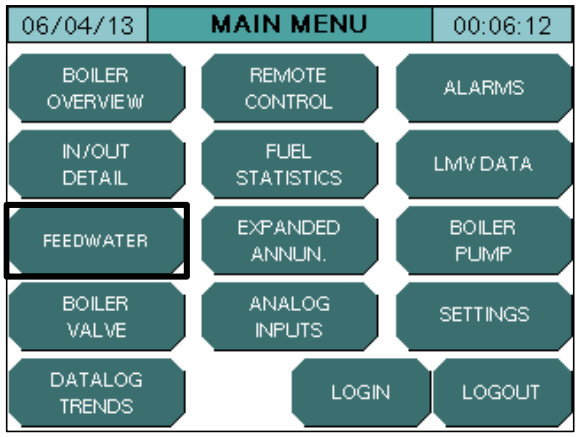
Access level: **TECH**

Feedwater and warm standby are covered on the same screen. Depending on the configuration settings of the touchscreen, the main menu will have one of the four options displayed below:

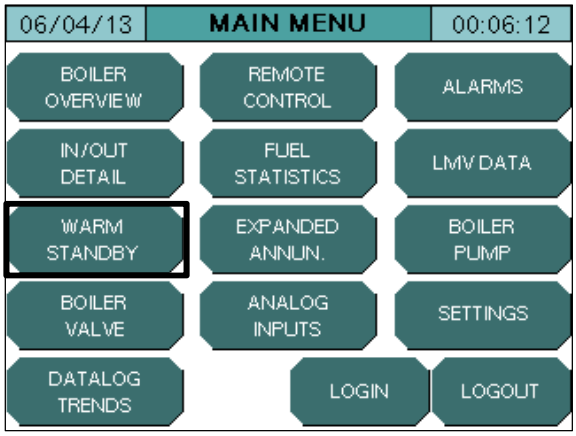
(1)



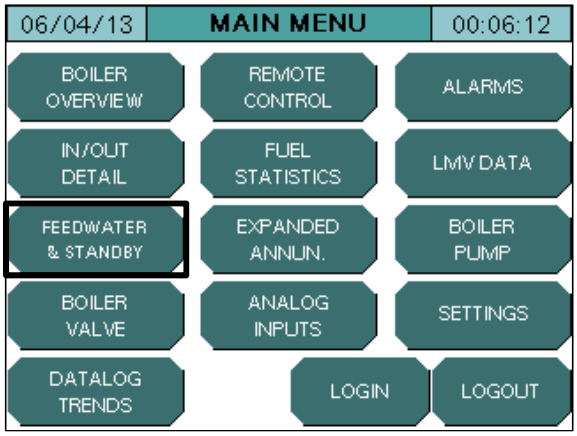
(2)



(3)



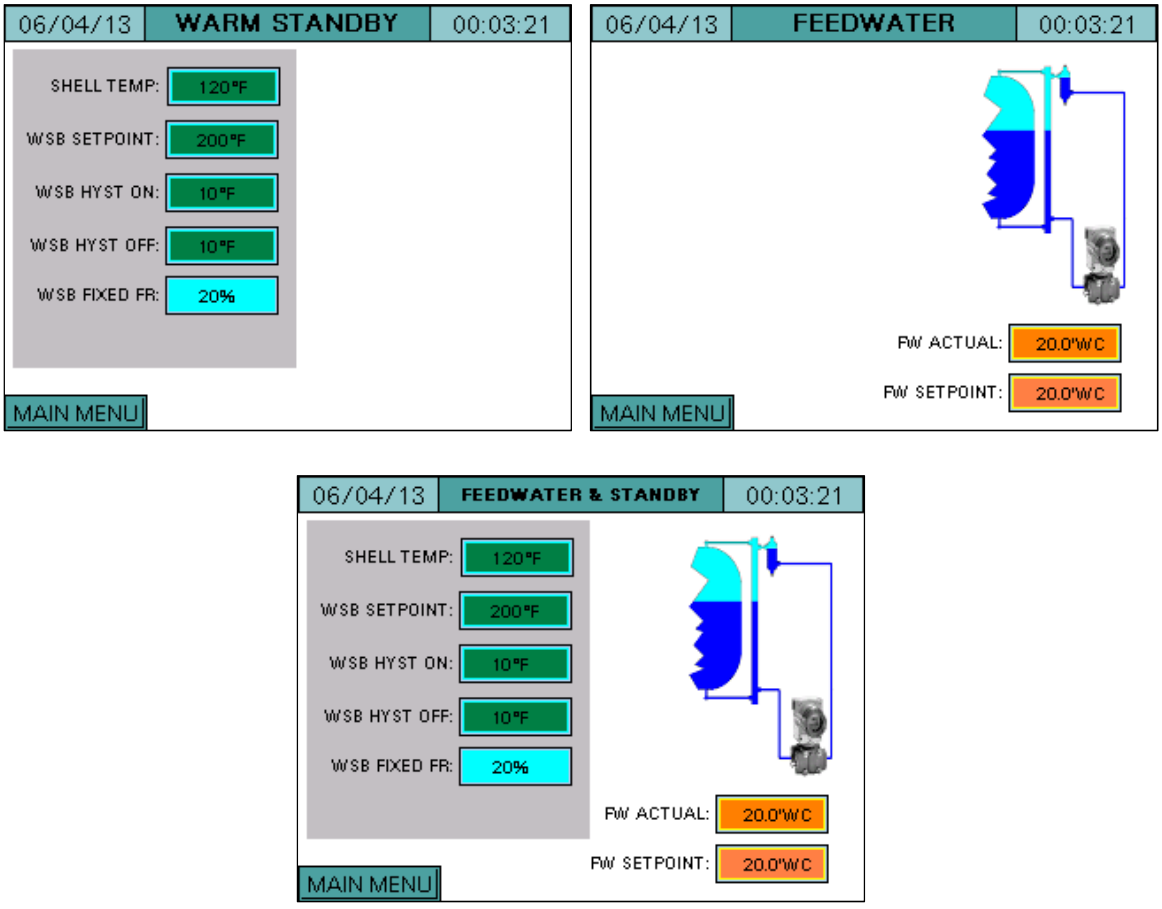
(4)



Screen 1 – Nothing will display for hydronic boilers or steam boilers with warm standby and feedwater control disabled.
Screen 2 – FEEDWATER screen is available for steam boilers with feedwater control enabled and warm standby disabled.
Screen 3 – WARM STANDBY screen is available for steam boilers with warm standby enabled and feedwater control disabled.
Screen 4 – FEEDWATER & STANDBY screen is available for steam boilers with both feedwater control and warm standby enabled.

Feedwater and Warm Standby (continued)

To access the feedwater and / or warm standby screen, press **FEEDWATER** / **WARM STANDBY** / **FEEDWATER & STANDBY** from the main menu. One of the following three screens will appear:



SHELL TEMP – Displays the boiler shell temperature on steam boilers. This is the temperature used for warm standby operation.

WSB SETPOINT – Sets the warm standby setpoint for steam boilers.

WSB HYST ON – Sets the temperature for enabling warm standby on steam boilers. This number is added to or subtracted from the warm standby setpoint. For example, if this parameter is set to -10°F with a setpoint of 120°F, warm standby is enabled at 110°F.

WSB HYST OFF – Sets the temperature for disabling warm standby on steam boilers. This number is added to or subtracted from the warm standby setpoint. For example, if this parameter is set to 10°F with a setpoint of 120°F, warm standby is disabled at 130°F.

Feedwater and Warm Standby (continued)

WSB FIXED FR – Sets the firing rate to be applied when the boiler is in warm standby mode based on shell temperature.

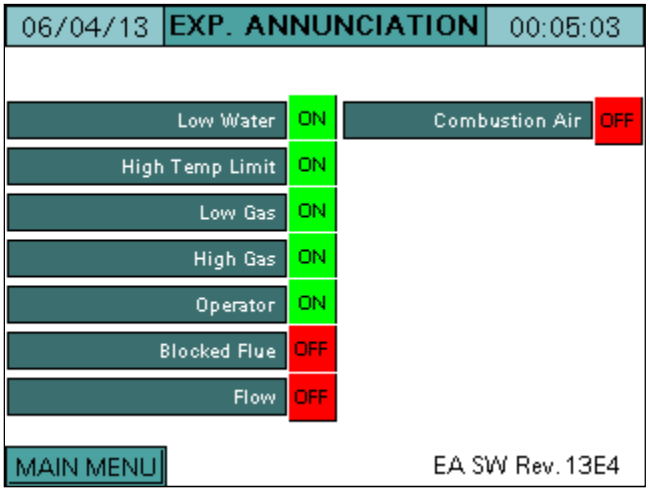
FW ACTUAL – Displays the current water level of the boiler.

FW SETPOINT – Displays the setpoint for the water level of the boiler.

Expanded Annunciator

Access level: **USER**

The limits programmed for annunciation can be viewed on the EXP. ANNUNCIATION screen. This option only appears if the Expanded Annunciation package is equipped and configured. To access this screen from the main menu, press **EXPANDED ANNUN**.



All of the limits configured for annunciation will be displayed in a "first-out" manner. Any limits that are made will display as ON with a bright green background. Any limits that are not made will show as OFF with a red background. The first limit displayed as OFF should be checked when troubleshooting an inoperative boiler.

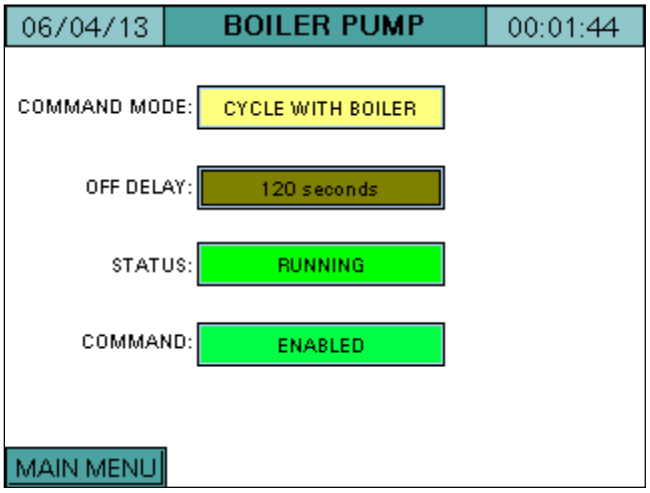
To change any of the configuration settings for the annunciation, go to the EXP. ANN. CONFIG screen accessed through the SETTINGS menu.

When finished, press **MAIN MENU** to return to the home screen.

Boiler Circulating Pump

Access level: **USER / TECH / SETUP**

For standalone hydronic systems or lead/lag systems, a boiler pump can be enabled or disabled from the touchscreen as long as the Expanded Annunciation package is equipped. The pump option can be enabled from the UNIT TYPE screen found in the SETTINGS menu. To access the BOILER PUMP screen, press **BOILER PUMP** from the main menu. This screen can be accessed from the USER level, but settings may only be changed from the TECH or SETUP levels.



COMMAND MODE – The command mode is the method of pump control used when in standalone mode or when connected to a Lead/Lag Master that is in a fault mode. When connected to a Lead/Lag Master in normal operation, the pump is controlled by the Lead/Lag Master. Setting may only be changed at the SETUP access level.

- **CYCLE WITH BOILER:** The pump will be commanded on when the boiler is commanded on. The pump will remain on after the boiler command is removed for the duration of the off delay period.
- **CONTINUOUS RUN:** The pump will be commanded on as long as the HAND-OFF-AUTO switch is not in OFF on the REMOTE OPERATION screen.

OFF DELAY – Sets the amount of time that the pump stays on after the boiler turns off when the pump is set to mode “CYCLE WITH BOILER”. Setting may be changed at TECH access level.

STATUS – The status of the pump is displayed.

- **RUNNING:** The pump is currently on.
- **IDLE:** The pump is currently off because it is commanded to be off.
- **ALARM:** The pump is currently off because it is in alarm.

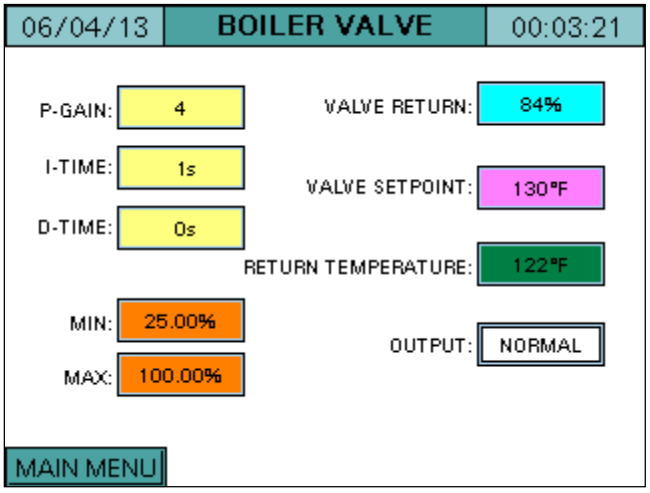
COMMAND – Displays whether or not the pump is currently being commanded on.

- **ENABLED:** The pump is being commanded on.
- **DISABLED:** The pump is being commanded off.

Boiler Return Temperature Valve

Access level: **USER / TECH**

For standalone hydronic systems, a boiler return temperature valve may be controlled through the touchscreen as long as the Expanded Annunciation package is equipped. The valve option can be enabled from the UNIT TYPE screen found in the SETTINGS menu. To access the BOILER VALVE screen, press **BOILER VALVE** from the main menu. This screen can be accessed from the USER level for viewing purposes, but TECH access level is required to change any of the settings.



P-GAIN – Sets the proportional gain for temperature control. Higher settings for the proportional gain cause a faster system response. The range of this setting is 0-999.

I-TIME – Sets the time of the integral component for temperature control. The integral component corrects for steady state error between the setpoint and actual temperature. Shorter times are more aggressive. A setting of zero eliminates the integral component. The range of this setting is 0-999.

D-TIME – Sets the time of the derivative component for temperature control. The derivative component corrects for the rate of increase/decrease of the actual temperature. Longer times are more aggressive. A setting of zero eliminates the derivative component. The range of this setting is 0-9999.

MIN – Sets the minimum allowable position of the return temperature valve.

MAX – Sets the maximum allowable position of the return temperature valve.

VALVE RETURN - Displays the current position of the return temperature valve from 0-100%.

VALVE SETPOINT – Sets the desired setpoint for the temperature of the boiler return water.

Boiler Return Temperature Valve (continued)

RETURN TEMPERATURE – Displays the current temperature of the boiler return water. If this value is reading incorrectly, a temperature offset can be applied through the SETTINGS menu. See Initial Configuration for more information.

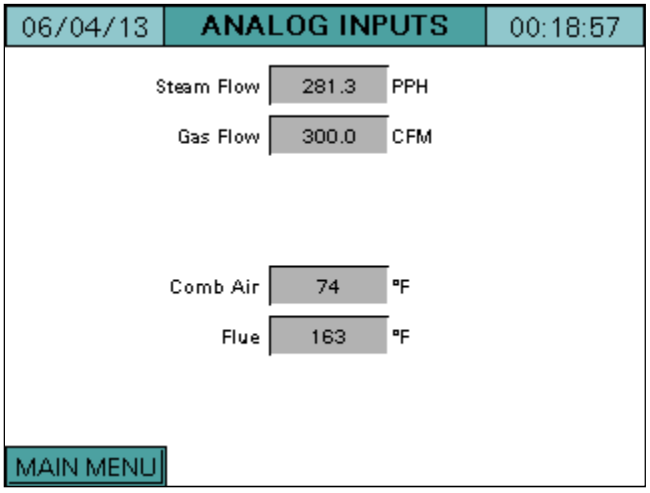
OUTPUT – Sets the behavior of the output to the return temperature valve.

- **NORMAL:** Sends 4mA when the valve should be diverting all water away from the boiler and 20mA when the valve should be diverting all water back to the boiler.
- **REVERSE:** Sends 20mA when the valve should be diverting all water away from the boiler and 4mA when the valve should be diverting all water back to the boiler.

Analog Inputs

Access level: **USER**

The values of the configured analog inputs and RTD inputs can be viewed on the ANALOG INPUTS screen. This option only appears if the Expanded Annunciation package is equipped and configured. To access this screen from the main menu, press **ANALOG INPUTS**.



All of the configured analog inputs and RTD inputs will be displayed. These values will update in real-time on the screen. Analog inputs are displayed on the top half of the screen, and RTD inputs are displayed on the bottom half of the screen.

To change any of the configuration settings for the analog or RTD inputs, go to the ANA. IN CONFIG screen accessed through the SETTINGS menu.

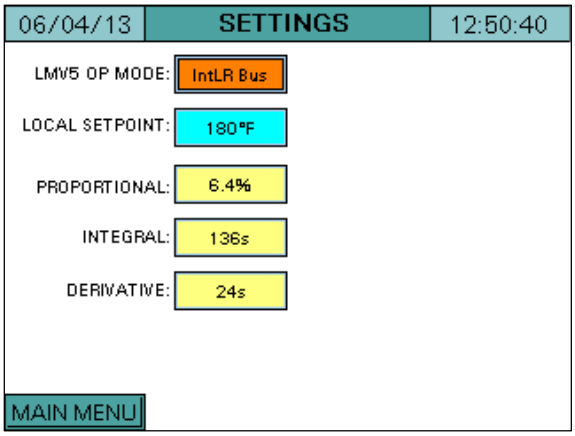
When finished, press **MAIN MENU** to return to the home screen.

Load Controller Settings

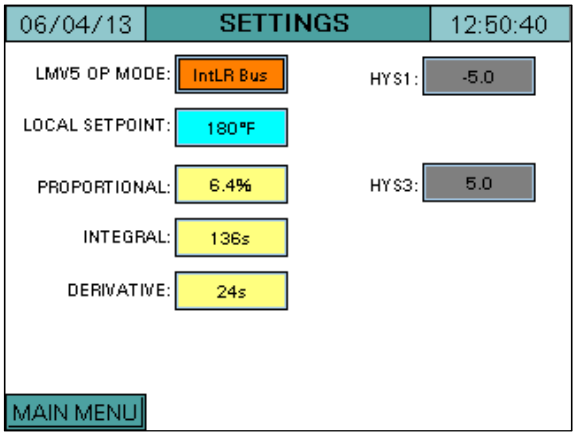
Access level: **USER / TECH**

The settings of the load controller can be viewed or configured from the SETTINGS screen. These settings can be viewed with USER level access or changed with TECH level access. To access the SETTINGS screen from the main menu, press **SETTINGS**.

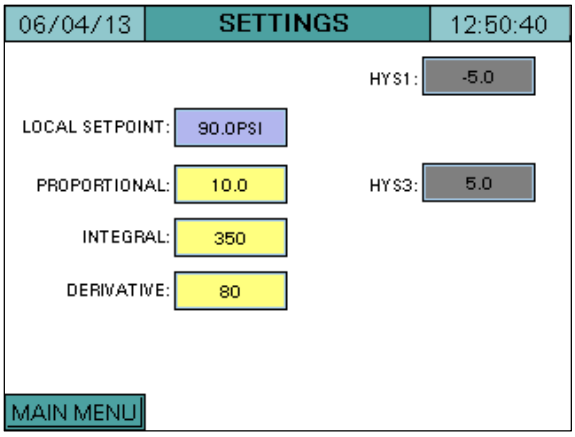
(1)



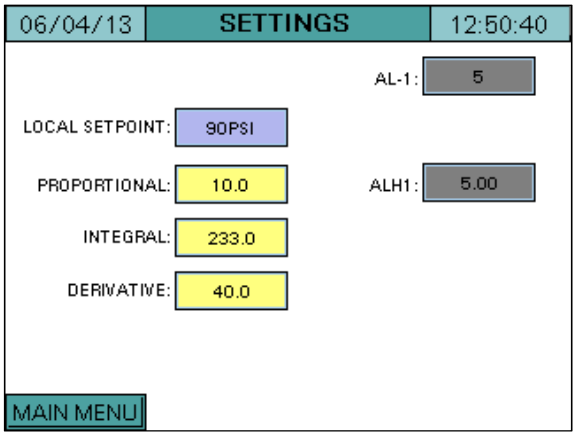
(2)



(3)



(4)



One of the four screens shown above will appear depending on the controller(s) being used:

Screen 1 – Appears for systems with just an LMV5x controller.
Screen 2 – Appears for systems with an LMV5x controller and an RWF40/55 load controller.
Screen 3 – Appears for systems with an LMV3x controller and an RWF40/55 load controller.
Screen 4 – Appears for systems with an LMV3x controller and an RWF10 load controller.

Load Controller Settings (continued)

LMV5 OP MODE – Displays the LMV5x load controller operating mode (LMV5x only).

LOCAL SETPOINT – Sets the local setpoint of the boiler. This parameter may be limited by "Ext MinSetpoint" and "Ext MaxSetpoint" on an LMV5x controller.

PROPORTIONAL – Sets the proportional band of the load controller. A proportional band of 10 means that the firing rate of the boiler will be 100% when the actual value is 10 below the setpoint. On the LMV5x, the proportional band is a percentage of 14.5 PSI (for steam boilers) or 212°F (for hydronic boilers). On an RWF10, RWF40, or RWF55 load controller, the proportional band is an absolute number.

INTEGRAL – Sets the time of the integral component of the load controller. The integral component corrects for steady state error between the setpoint and actual value. Shorter times are more aggressive. A setting of zero eliminates the integral component.

DERIVATIVE – Sets the time of the derivative component of the load controller. The derivative component corrects for the rate of increase/decrease of the actual value. Longer times are more aggressive. A setting of zero eliminates the derivative component and typically works well on boilers.

HYS1 – Sets the burner on point for RWF40 and RWF55 load controllers. For example, a value of -5 means the burner will turn on when the actual value is 5 below setpoint.

HYS3 – Sets the burner off point for RWF40 and RWF55 load controllers. For example, a value of 5 means the burner will turn off when the actual value is 5 above setpoint.

AL-1 – Sets the burner on point for an RWF10 load controller. For example, a value of 5 means the burner will turn on 5 below setpoint.

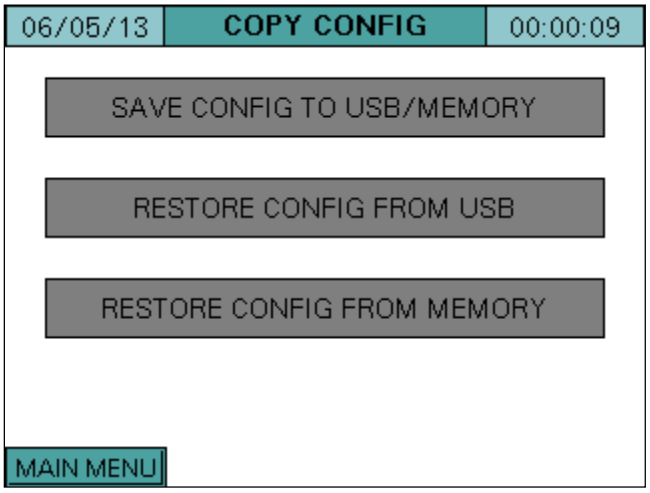
ALH1 – Sets the burner off point for an RWF10 load controller. This setting behaves differently for steam and hydronic boilers. For steam boilers, the span of the pressure transducer affects this setting. For example, if the span of the pressure transducer is 0-60 PSI, a value of 10 for ALH1 means the burner will turn off when the actual value is 6 (60*10%) above the burner on point. For hydronic boilers, a value of 10 means the burner will turn off when the actual value is 10 above the burner on point.

Parameter Backup

Access level: **SETUP**

The configuration settings of the touchscreen may be backed up to a USB drive or the touchscreen itself for archiving or migration to other touchscreen kits. A formatted USB drive is sent with each touchscreen kit. This can only be done if the Expanded Annunciation package is equipped.

Login at the SETUP level and press **SETTINGS**. At the bottom of the page, press **COPY**. The COPY CONFIG screen will appear.



To save a copy of the configuration settings to both a USB drive and the touchscreen memory, press **SAVE CONFIG TO USB/MEMORY**. Text will appear that says "WORKING(30s)…". After approximately 30 seconds, the text will disappear, indicating that the save process has completed. If no USB drive is connected, the settings will only be saved to the touchscreen memory.

To restore a set of configuration settings from a USB drive, press **RESTORE CONFIG FROM USB**. Text will appear that says "WORKING(30s)…". After approximately 30 seconds, the text will disappear, indicating that the restore process has completed. If no USB drive is connected, pressing **RESTORE CONFIG FROM USB** will have no effect.

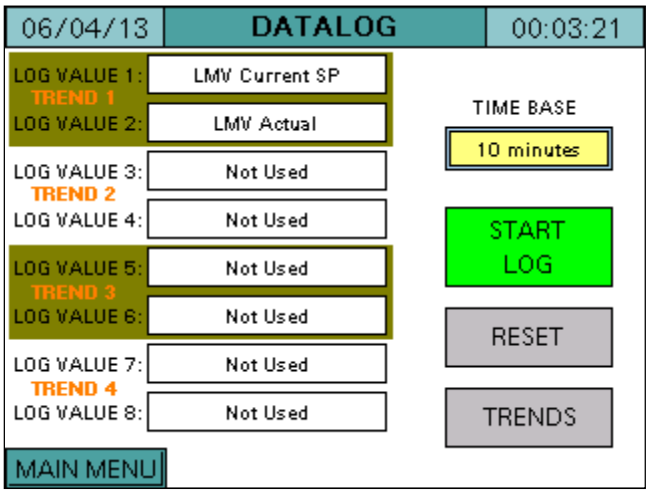
To restore a set of configuration settings from the touchscreen memory, press **RESTORE CONFIG FROM MEMORY**. Text will appear that says "WORKING(15s)…". After approximately 15 seconds, the text will disappear, indicating that the restore process has completed. If no configuration settings have previously been stored in the touchscreen memory, pressing **RESTORE CONFIG FROM MEMORY** will set the configuration settings back to their default settings.

Datalogging and Trending

Access level: **USER / TECH**

The touchscreen kit may be used to log up to eight different user-selectable values. The log is captured on a USB drive and is stored in a standard format readable with any text or spreadsheet editor. Each entry includes a date and time stamp. A new log file is created daily or anytime the power is cycled, so the maximum capacity of the log is only limited by the size of the USB drive connected.

To access the datalogging screen, login at the TECH access level and press **DATALOG TRENDS** from the main menu.



The following values may be chosen to be logged:

- **Not Used** – No data will be logged.
- **LMV Phase –** Logs the phase of the LMV controller.
- **LMV Fuel Actuator –** Logs the position of the LMV fuel actuator (gas or oil).
- **LMV Air Actuator –** Logs the position of the LMV air actuator.
- **LMV Aux1 Actuator –** Logs the position of the LMV aux1 actuator (LMV5x only).
- **LMV Aux2 Actuator –** Logs the position of the LMV aux2 actuator (LMV5x only).
- **LMV Aux3 Actuator –** Logs the position of the LMV aux3 actuator (LMV5x only).
- **LMV VSD Speed –** Logs the speed of the VSD.
- **LMV Fuel Type –** Lows the type of fuel being used (gas or oil).
- **LMV Output –** Lows the firing rate of the boiler.
- **LMV Current SP –** Logs the current setpoint of the boiler.
- **LMV Actual –** Logs the current temperature or pressure of the boiler.
- **LMV Flame Signal –** Logs the flame signal detected by the flame scanner.
- **LMV O2 Value –** Logs the percent O2 in the stack (LMV5x only.
- **LMV Supply Air Temp –** Logs the supply air temperature (LMV5x only).

Datalogging and Trending (continued)

- **LMV Flue Gas Temp –** Logs the flue gas temperature in the stack (LMV5x only).
- **LMV Combustion Eff –** Logs the combustion efficiency of the boiler (LMV5x only).
- **LMV Local SP –** Logs the local setpoint of the LMV controller.
- **LMV Remote SP –** Logs the remote setpoint being read by the LMV controller.
- **RWF Actual –** Logs the actual temperature or pressure being read by an RWF controller being used for load control.
- **RWF Current SP –** Logs the current setpoint of an RWF controller used for load control.
- **RWF Local SP –** Logs the local setpoint of an RWF controller used for load control.
- **RWF Remote SP –** Logs the remote setpoint of an RWF controller used for load control.
- **FW Actual –** Logs the water level being read by an RWF controller.
- **FW Current SP –** Logs the setpoint of the water level on an RWF controller.
- **RWF Local SP –** Logs the local setpoint of the water level on an RWF controller.
- **EA Temp Out –** Logs the shell temperature (steam boilers) or the return valve temperature (hydronic boilers).
- **EA Analog In 1 –** Displays the value being read by analog input 1 on the Expanded Annunciation package.
- **EA Analog In 2 –** Displays the value being read by analog input 2 on the Expanded Annunciation package.
- **EA Analog In 3 –** Displays the value being read by analog input 3 on the Expanded Annunciation package.
- **EA Analog In 4 –** Displays the value being read by analog input 4 on the Expanded Annunciation package.
- **EA Valve Output –** Displays the position of the return temperature valve.
- **EA RTD In 1 –** Displays the value being read by RTD input 1 on the Expanded Annunciation package.
- **EA RTD In 2 –** Displays the value being read by RTD input 2 on the Expanded Annunciation package.
- **EA RTD In 3 –** Displays the value being read by RTD input 3 on the Expanded Annunciation package.

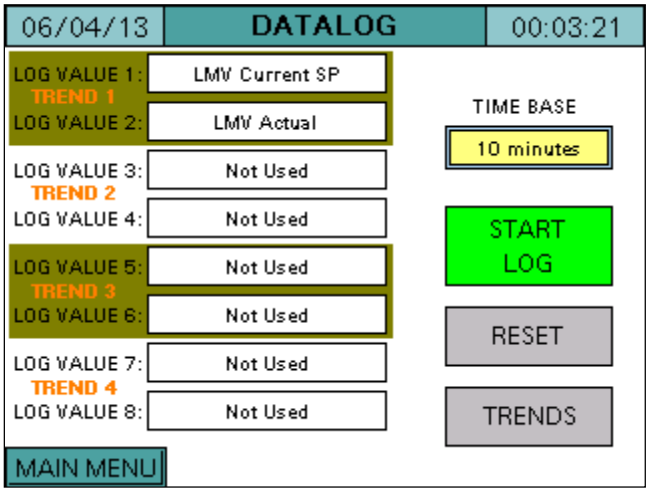
The time between each point is logged may be chosen by changing the setting of **TIME BASE**. The options for this setting are 10s, 20s, 30s, 1m, 2m, 5m, 10m, 15m, 30m, or 60m.

Pressing **RESET** at any time will set all 8 data log values back to “Not Used”.

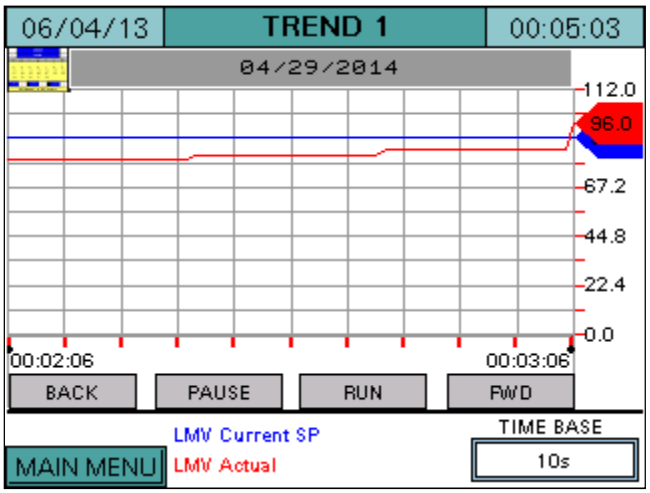
Once the datalog values and time base are selected, insert a USB drive and press **START LOG** to begin datalogging. All of the values selected will be stored in a spreadsheet. To stop datalogging, press **STOP LOG**. The USB drive may be removed once the datalogging is complete.

Datalogging and Trending (continued)

In addition to saving datalogs to a USB drive, trends of the eight values selected may be viewed at any time on the touchscreen. Four trend graphs are available, and each can log up to two values from the list. To view trends, press **TRENDS** (USER access level) or **DATALOG TRENDS** (TECH or SETUP access level) to access the DATALOG screen.



To view the trends of the values selected, press **TRENDS**.

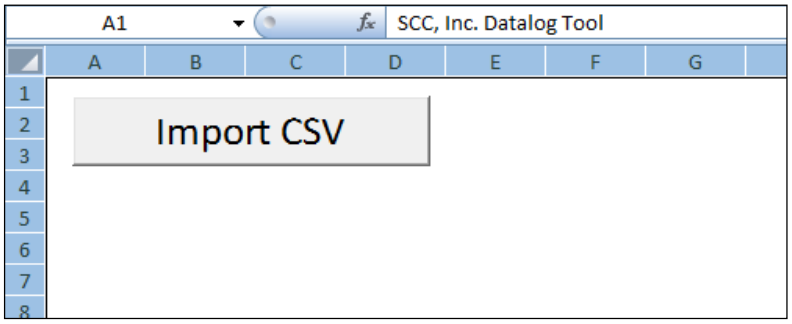


If no values are chosen for a particular trend, that trend will not operate. Each trend will record at a user-selectable interval (10s, 20s, 30s, 1m, 2m, 5m, 10m, 15m, 30m or 60m). This can be set by toggling through the options in the **TIME BASE** setting. The most recent 60 data points will be recorded in the trend. To toggle between trends, press **PREV** or **NEXT** at the top of the page. Trending can be paused at any time by pressing **PAUSE**. To initiate trending again after pausing, press **RUN**. To scroll backwards or forwards through the trend graph, press **BACK** or **FWD.**

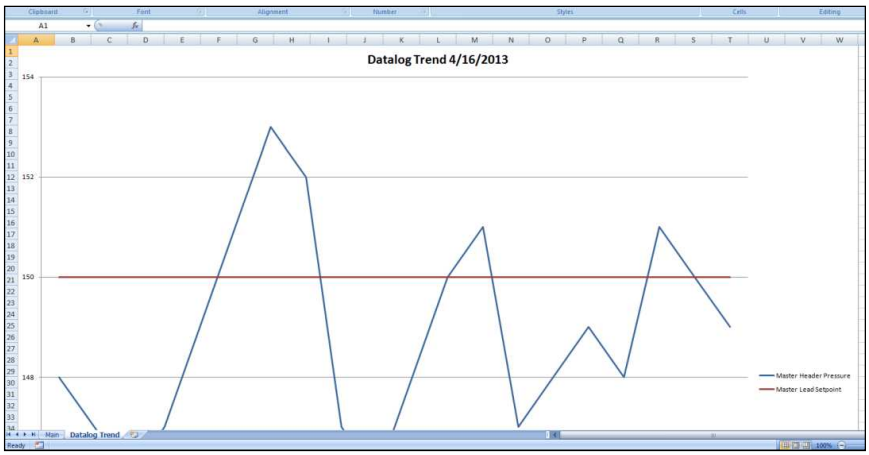
Datalogging and Trending (continued)

To access the datalog file, plug the USB drive provided with the touchscreen kit into a computer. Open the contents of the drive on the computer.

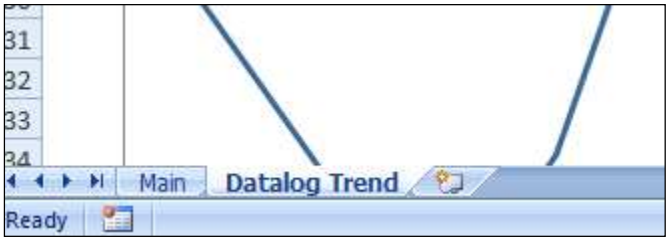
A Microsoft Excel datalog graphing utility (SCC Datalog Tool.xltm) is included on the USB drive. Macros must be enabled for this utility to operate. Open the SCC Datalog Tool and the following spreadsheet will appear.



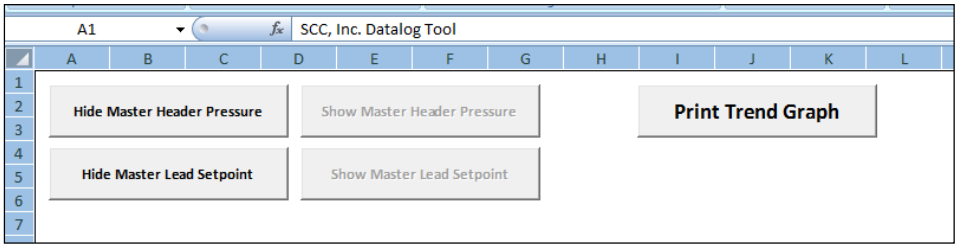
Click **Import CSV** and then navigate to the appropriate .csv file saved on the USB drive. If it is a valid log file, the data will be imported and graphed. Otherwise, an error message is displayed.



Each variable will be graphed using a different color. To turn a particular variable on or off, click on the **Main** tab in the lower left corner of the screen.



Datalogging and Trending (continued)



Press **Hide...** to hide a variable or **Show...** to show a variable that has been hidden. The utility may be run multiple times to print or save the graphs as desired.

To print the datalog, press **Print Trend Graph** and follow the standard prompts.

Screen Captures

The current screen image may be copied to a USB drive. Any screen with the exception of the main menu may be captured.

To perform a screen capture, plug in a USB drive. Press and hold the **MAIN MENU** button until the screen displays "SNAPSHOT SAVED TO USB".

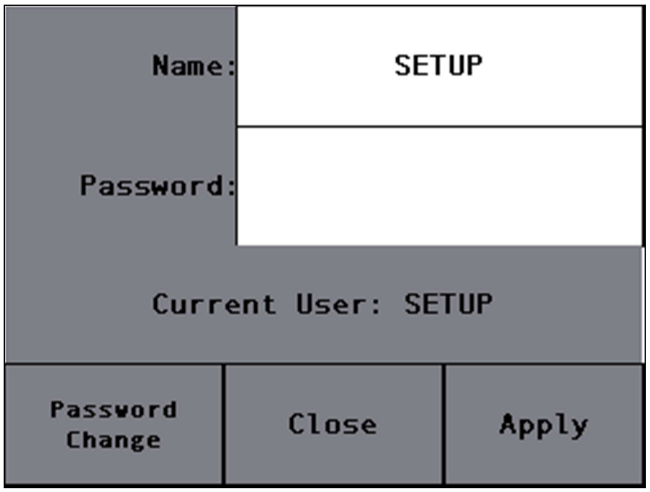
If there is no USB plugged in or an error while trying to save the snapshot, a message will display saying “SNAPSHOT SAVE ERROR”.

There is no limit to the number of screen captures that may be saved to the USB drive other than the capacity of the USB drive itself.

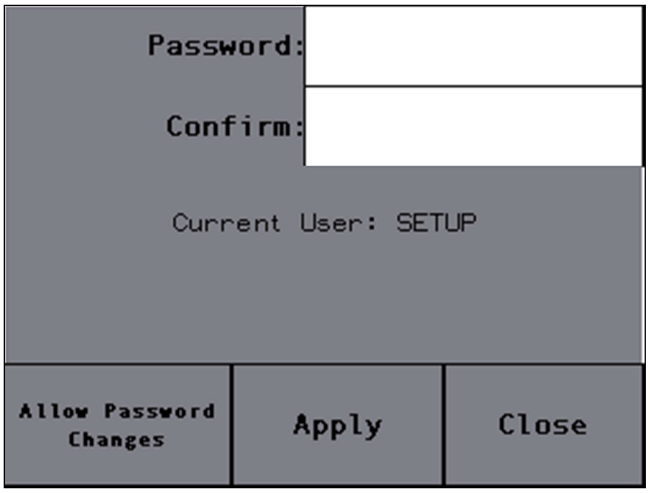
Changing Passwords

Access level: **SETUP**

By default, the TECH access level password is 9876 and the SETUP access level password is START. These default passwords may be changed at any time. To change passwords, press **LOGIN** from the main menu. Enter the appropriate information to log in at the SETUP access level and press **Apply**. The CURRENT USER will change to SETUP.

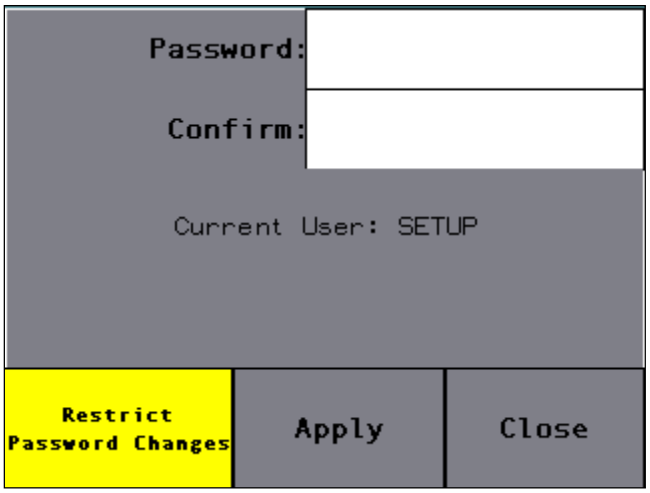


After that is done, press **Password Change.**



The SETUP password may be changed from this screen. Enter the new password twice and press **Apply** to make the change. To allow the TECH user access to change the TECH password, press **Allow Password Changes.**

Changing Passwords (continued)



If password changes have been allowed, the TECH user may now change their password by following the same procedure as described above for the SETUP user. To disallow the TECH user from changing the TECH password, press **Restrict Password Changes**.

Date and Time

Access level: **SETUP**

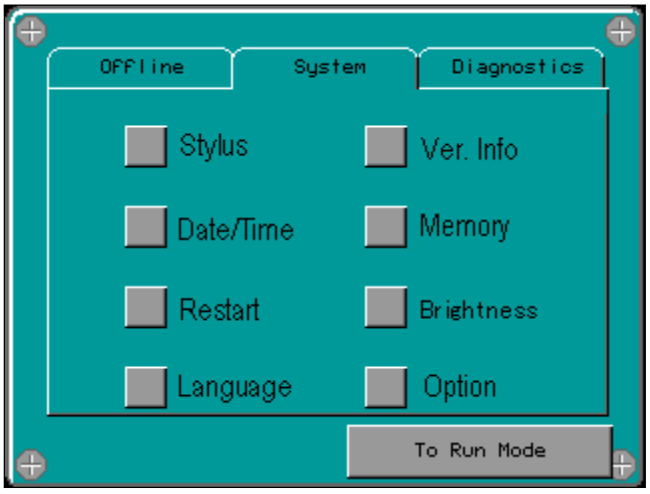
The date and time on the touchscreen is set a number of ways depending on the connected equipment.

If the touchscreen is connected to a Lead/Lag Master, the date and time on both the touchscreen and any connected LMV5x controllers are automatically set by the Lead/Lag Master.

On standalone touchscreens connected to an LMV5x controller, the date and time are read from the connected LMV5x controller.

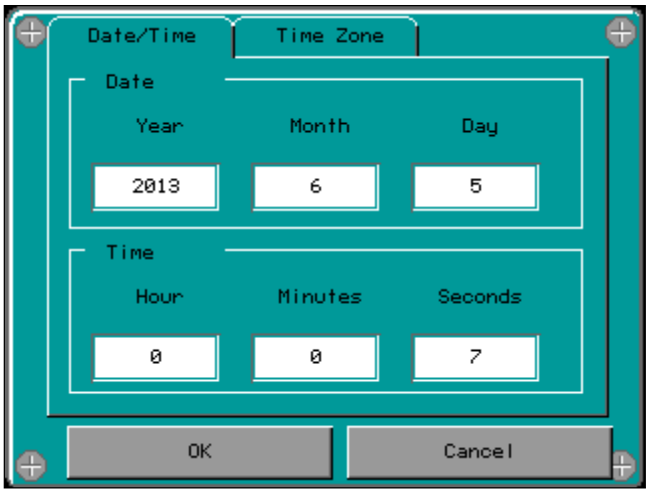
On standalone touchscreens connected to an LMV3x controller, no date and time will be automatically set. In this case, the date and time must be manually set on the touchscreen. When the touchscreen kit first boots up, a button reading **Date/Time** appears to allow for quick manual setting of the date and time. Otherwise, the date and time may be set by using the following procedure.

Log in at the SETUP access level and press **SETTINGS** from the main menu. Press and hold the word SETTINGS at the top of the screen. This brings up the HMI system configuration page.



Select **Date/Time**.

Date and Time (continued)



This screen will allow the date and time to be changed. When complete, press **OK**. When returned to the HMI system configuration page, press **To Run Mode** to apply the changes and return back to the SETTINGS screen.

Note: The time may not be retained following an extended power loss.

Appendix - LMV5 Configuration for Modbus

The LMV5x controller must be properly configured for Modbus operation. Use the **Select <** and **Select >** buttons to navigate up and down the screen and the **Enter** button when the desired option is selected with the cursor. Use **Esc** to go back to the previous menu. When a parameter needs to be changed, the **Select <** and **Select >** buttons allow the value to be changed and **Enter** confirms the change. Press the **Esc** button to return after the change is made.

First, activate the Modbus port on the AZL (no password required):

1. Operation > OptgModeSelect > Type of Gateway = **Modbus**
2. Operation > OptgModeSelect > **GatewayBASon**

Note: Older AZL units may read "GatewayDDCon" instead.

3. The AZL should now read "Gateway Mode active".

Next, set up the required parameters through the AZL (no password required):

1. Params & Display > Access w-out PW > AZL > Modbus > Address = **1**
2. Params & Display > Access w-out PW > AZL > Modbus > Baudrate = **19200 bit/s**
3. Params & Display > Access w-out PW > AZL > Modbus > Parity = **no**
4. Params & Display > Access w-out PW > AZL > Modbus > Timeout = **30s**

Last, change the controller mode to allow Modbus operation (no password required):
Params & Display > Access w-out PW > LoadController > Configuration > LC_OptgMode =
IntLC Bus

The changes take effect immediately (no reboot required).

Appendix - RWF40 Configuration for Modbus

The RWF40 must have the Modbus option in order to communicate with the system. The last three characters of the part number must be "B97" for Modbus to be optioned. If the last three characters of the part number are "A97", Modbus is not optioned.

To activate Modbus on the RWF40, make the following and parameters:

1. Press and hold **PGM** until the green display shows "AL".
2. Press and hold **PGM** until the green display shows "C111".
3. Press **PGM** twice so that the green display shows "C113".
4. Press the down arrow until the second red digit from the right flashes. Use the up arrow to change this value to "7". This parameter sets the baud rate at 19,200 bit/s.
5. Press the down arrow until the second red digit from the left flashes. Use the up arrow to change this value to "2" if the RWF40 is being used as a load controller or to "3" if the RWF40 is being used for a feedwater control. This parameter sets the Modbus address.
6. Press **PGM**. The red display should now read "0270" or "0370". If it does not, use the down and up arrows to adjust the value and then press **PGM** to confirm and save the values.
7. Press **EXIT** to return to the normal display. The changes take effect immediately (no reboot required).

Appendix - LMV3 Configuration for Modbus

The LMV3x controller must have the OCI412.10 option installed in order to communicate with the system via Modbus.

The service (heating engineer) password must be entered for these parameters to be accessed. The default service password is 9876. If the password has been changed, please consult the equipment OEM for the correct password.

To configure the LMV3x controller to communicate Modbus, use the following procedure:

1. Hold down both the **F** and the **A** buttons until the display reads "Code", followed by a string of seven underscores.
2. Use the **+** and **-** buttons to enter the password. Press **ENTER** (the button to the right of the display) after each entry, and again once the complete password is entered. If the password is incorrect, "Error" will be displayed and the process will have to be restarted.
3. If the password is entered successfully, the screen will display "Para" and then "400: Set" with the "400:" flashing.
4. Use the **-** button to navigate to "100: PArA", then press **ENTER**.
5. Use the **+** and **-** buttons to navigate to a flashing "141:". If this value does not read "1", press **ENTER** and then use the **+** and **-** buttons to change it to "1", then press **ENTER** to confirm the change. This parameter activates Modbus. To return to the parameter navigation, press the **+** and **-** buttons simultaneously (**ESC**). The display should return to flashing "141:". This procedure will be used to change all parameters.
6. Change "142:" to 120. This parameter sets the timeout.
7. Change "145:" to 5. This parameter sets the Modbus address.
8. Change "146:" to 1. This parameter sets the baud rate to 19200 bit/s.
9. Change "147:" to 0. This parameter sets the parity to none.
10. When all the parameters are entered, press **ESC** in two successions to back up to the main screen. The changes take effect immediately (no reboot required).

Appendix - RWF55 Configuration for Modbus

The RWF55 must be properly configured for Modbus operation.

Use the up and down arrow buttons to navigate through the menus and the **Enter** button when the desired menu is selected. Use **Esc** to go back to the previous menu. When a parameter needs to be changed, the up and down arrow buttons allow the value to be changed and **Enter** confirms the change. The parameter name will flash on the green display when the parameter entry mode is entered. Press the **Esc** button to return after the change is made.

To configure the RWF55 controller to communicate Modbus, use the following procedure:

1. Press **Enter** to go into the menu list. The green display should read "OPr".
2. ConF > IntF > r485 > bdrt = **2** (19200 bit/s baud rate)
3. ConF > IntF > r485 > dtt = **30** (timeout)
4. ConF > IntF > r485 > Adr = **6** (address for load control applications) **OR**
   ConF > IntF > r485 > Adr = **7** (address for feedwater applications)
5. Press **Esc** in four successions or until the parameter menus are completely exited. The changes take effect immediately (no reboot required).

Appendix - RWF10 Configuration for Modbus

The RWF10 must have the Modbus option in order to communicate with the system. This is an option card that is inserted into the controller when required.

To configure the RWF10 controller to communicate Modbus, use the following procedure:

1. Press the **LEVEL** (left-most) button until the red display reads "CN-t".
2. Press the **LEVEL** button again; the red display should read "PSEL".
3. If the value of "PSEL" does not read "Mod", use the up and down arrow buttons to change the value.
4. Press the **MODE** (loop with arrow on end, second from left) button to move to the next parameter, "U-No". Change the value to "8" with the up and down arrow buttons and then press **MODE**. This parameter sets the Modbus address.
5. Change parameter "bPS" to "19.2" and then press **MODE**. This parameter sets the baud rate to 19,200 bit/s.
6. Change parameter "PRtY" to "None" and then press **MODE**. This parameter sets the parity to none.
7. Change parameter "SdWt" to "20" and then press **MODE**. This parameter sets the timeout.
8. Once "PSEL" is displayed again, press and hold the **LEVEL** button to save the changes. The unit will reboot with the new parameters and the changes will take effect immediately.

Information in this publication is based on current specifications. The company reserves the right to make changes in specifications and models as design improvements are introduced. Product or company names mentioned herein may be the trademarks of their respective owners. © 2009 SCC Inc.

SCC Inc.

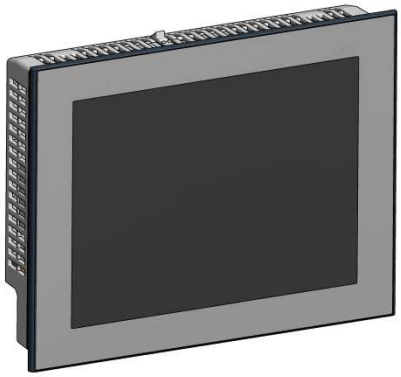
Technical Instructions

Document No. TS-1000

May 21, 2014

TS Series

TS… Touchscreen Kits
for use with LMV3, LMV5 and RWF… Controls



Touchscreen

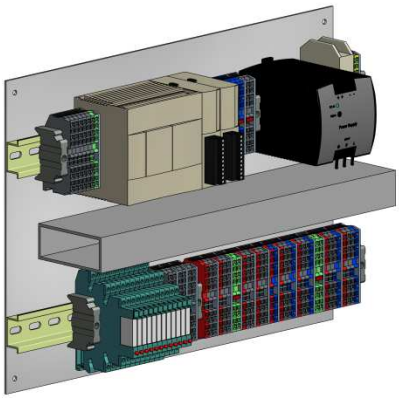


Plate Kit

Description

TS… series touchscreen kits provide a human machine interface (HMI) when used with a Siemens LMV3 or LMV5 linkageless control. Each kit provides boiler burner data collection and trending for a hydronic or steam boiler. An optional RWF… control for load or water level modulation easily interfaces with a TS… series touchscreen kit.

Each TS… touchscreen kit includes a 6” or 10” touchscreen along with a plate kit to be mounted inside a control panel (by others).

A PLC first-out annunciator option is available for additional analog, digital, and temperature inputs.

Flexible communication interface options to the building management system (BMS) provide streamlined data collection and monitoring.

Features

- Touchscreen interface with Siemens LMV… controllers
- Graphics for overview screen field-configured
- LMV… lockout and error log history
- Detailed annunciation of LMV… inputs and outputs
- Clear English text for alarms
- Alarms logging, history, and trending
- Four programmable analog inputs with labels, span, and type (0-10V, 2-10V, 0-20mA or 4-20mA) field-configured
- Pt1000 RTD temperature input for shell temperature (steam boilers) or boiler return temperature (hydronic boilers)
- Three field-configurable Pt1000 RTD temperature inputs
- First-out annunciation option including twelve 120 VAC inputs with field labeling capability
- Remote setpoint of the LMV… or RWF… via BMS
- Water level control option and status
- Pump and valve control for hydronic boilers
- Ethernet and Modbus communication
- Standard Modbus TCP/IP BMS communication
- Additional BMS communication options available
- Compatible with SCC Master Panel Lead Lag system

Application

TS… touchscreen kits are suited for hydronic boiler, steam boiler, and other applications utilizing an LMV3 or LMV5 linkageless control system.

Components

All TS… touchscreen kits include the following components:

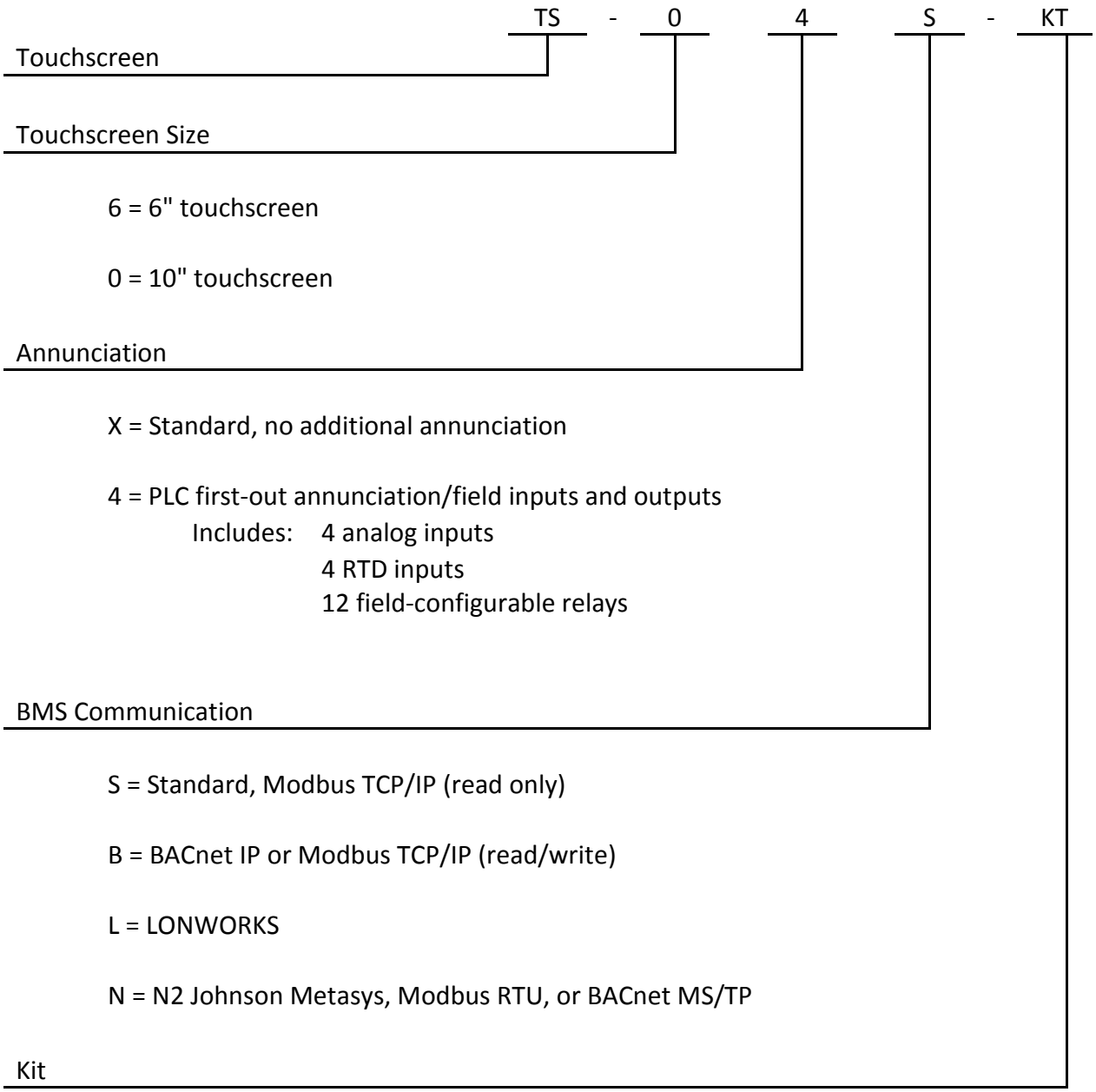
- 6” or 10” touchscreen
- Plate kit including power supply and branch circuit protection
- Cables for quick connections between the plate kit, touchscreen, and LMV… system
- Interconnect terminals for field wiring

The following optional additions are also available:

- PLC first-out annunciation including:
  - 4 analog inputs
  - 4 Pt1000 RTD inputs
  - 12 digital inputs with 120V field-configurable relays
  - 3 dry contacts (pump start, PLC communication fault, and PLC normal operation)
- BMS communication

Product Part Numbers

For touchscreen kit part number identification. See Table 1 for available kits.



Product Part Numbers (continued)

Table 1: Available TS… Touchscreen Kit Part Numbers

	Touchscreen Size		Annunciation		BMS Communication						
Part Number	6"	10"	Standard	PLC	Modbus TCP/IP (Read Only)	Modbus TCP/IP (Read/Write)	BACnet IP	BACnet MS/TP	LONWORKS	Modbus RTU	N2 Johnson
TS-6XS-KT	x		x		x						
TS-64S-KT	x			x	x						
TS-6XB-KT	x		x			x	x				
TS-64B-KT	x			x		x	x				
TS-6XL-KT	x		x						x		
TS-64L-KT	x			x					x		
TS-6XN-KT	x		x					x		x	x
TS-64N-KT	x			x				x		x	x
TS-0XS-KT		x	x		x						
TS-04S-KT		x		x	x						
TS-0XB-KT		x	x			x	x				
TS-04B-KT		x		x		x	x				
TS-0XL-KT		x	x						x		
TS-04L-KT		x		x					x		
TS-0XN-KT		x	x					x		x	x
TS-04N-KT		x		x				x		x	x

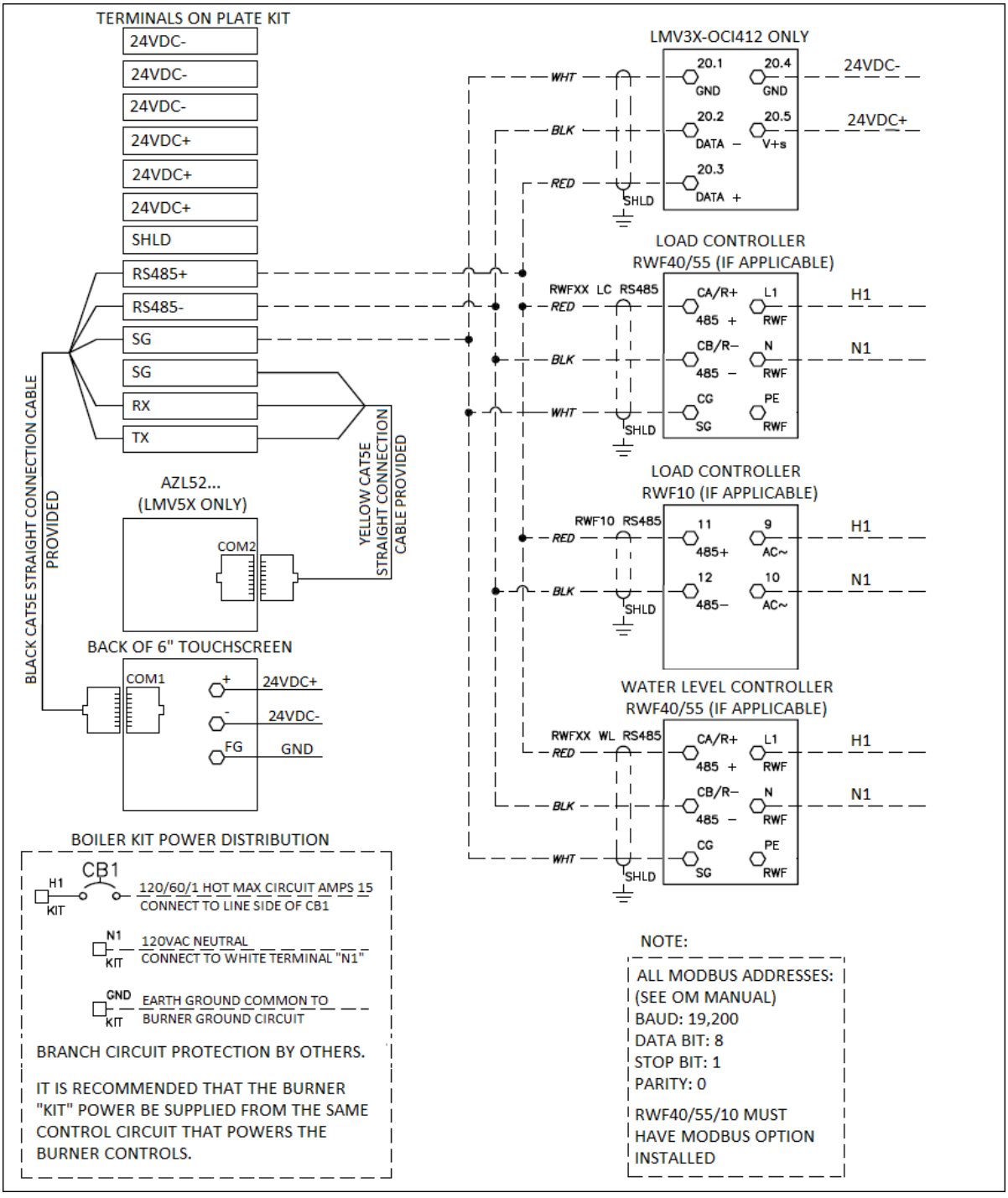
Specifications

		6” Touchscreen	10” Touchscreen
Physical characteristics	Main power	120 VAC	120 VAC
	Touchscreen power	24 VDC	24 VDC
	Power consumption	≤ 6.8 W	≤ 17 W
	Dry contacts	2 Amps	2 Amps
Operating environment	Operating temperature	32 to 122 °F [0 to 50 °C]	32 to 131 °F [0 to 55 °C]
	Humidity	Max. 80% with no condensation	Max. 85% with no condensation
	NEMA rating	4X (indoor use only)	4X (indoor use only)

Connections

Touchscreen Connections

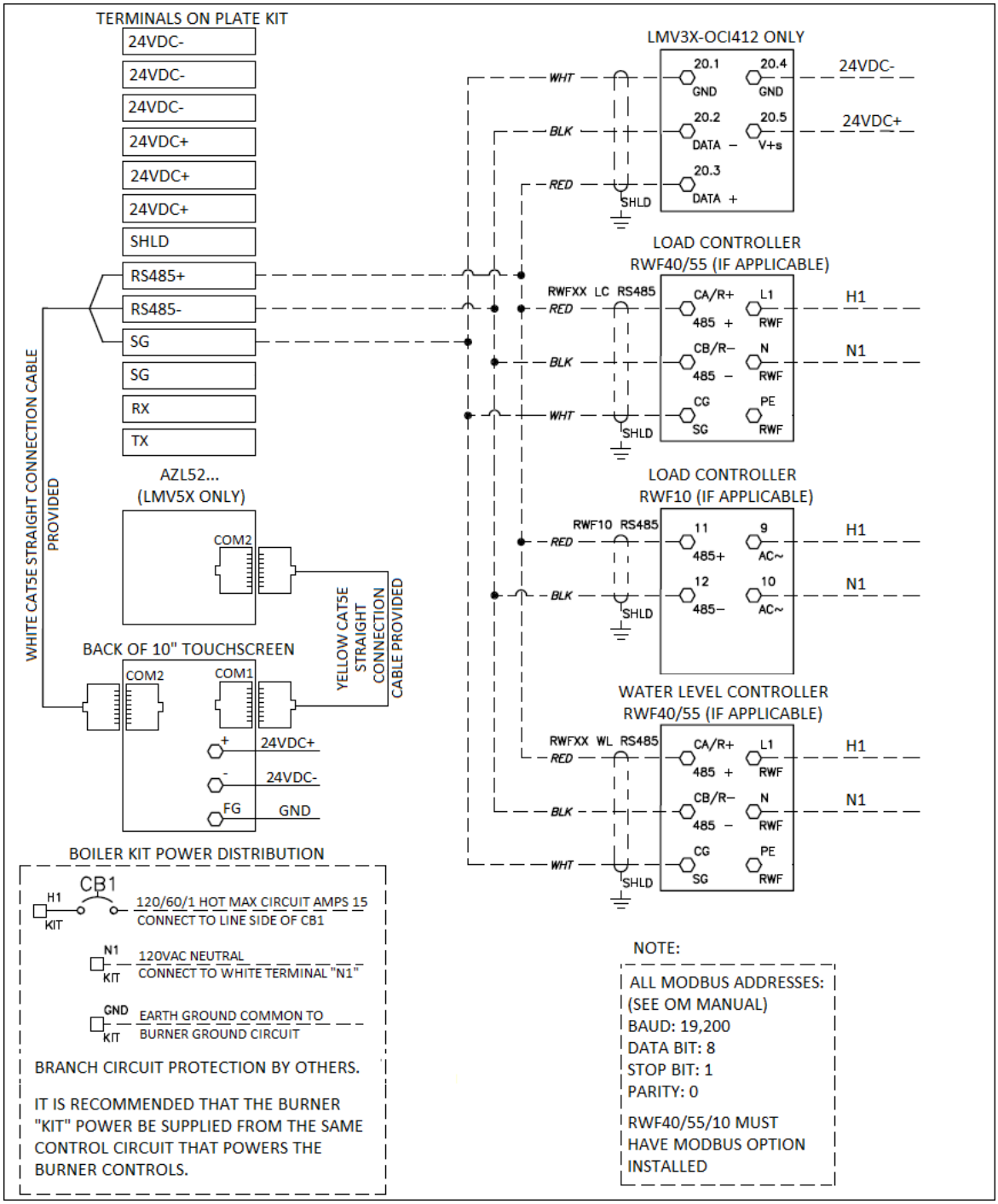
TS-6xx-KT (6” touchscreens)



Connections (continued)

Touchscreen Connections

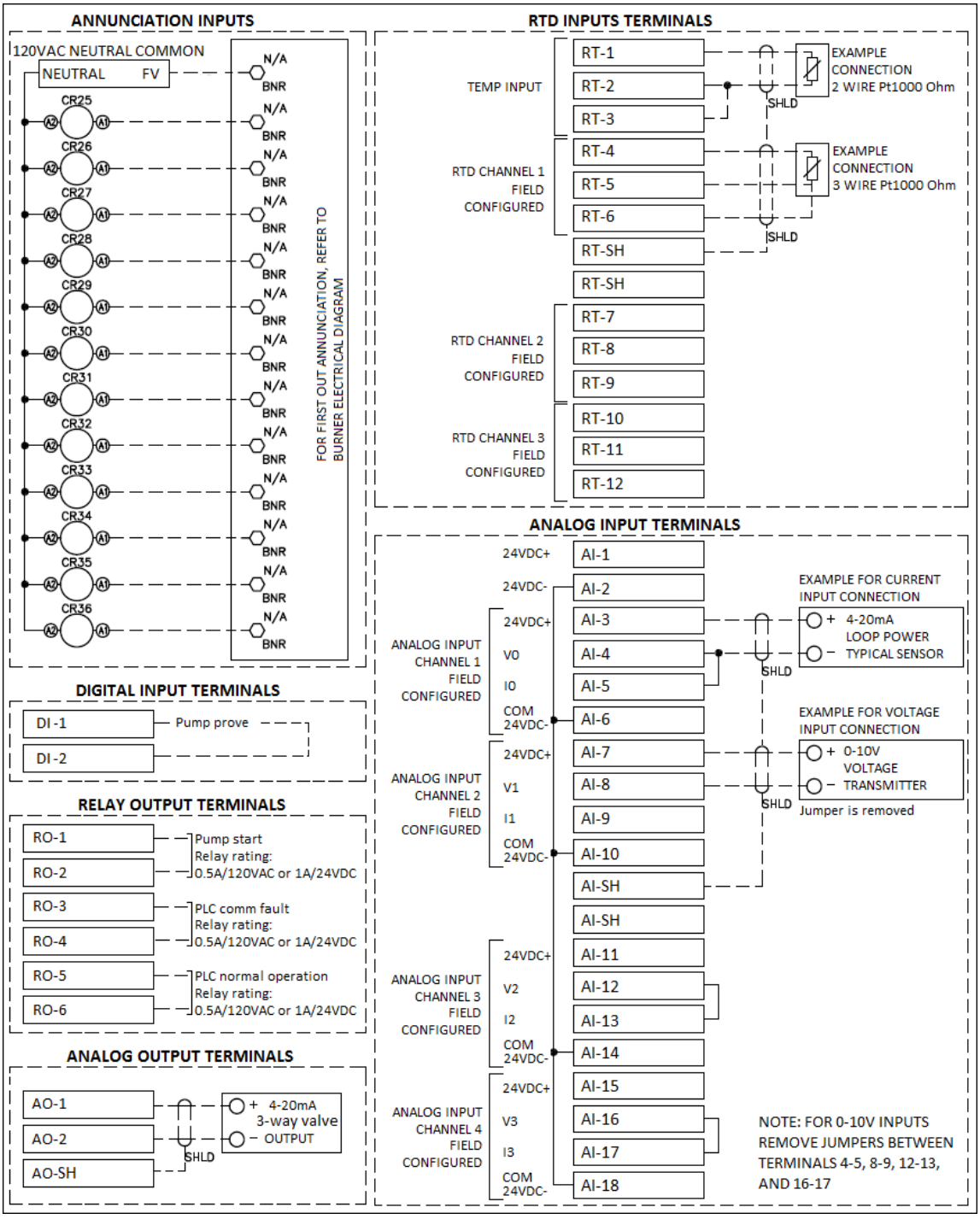
TS-0xx-KT (10” touchscreens)



Connections (continued)

Plate Kit Connections

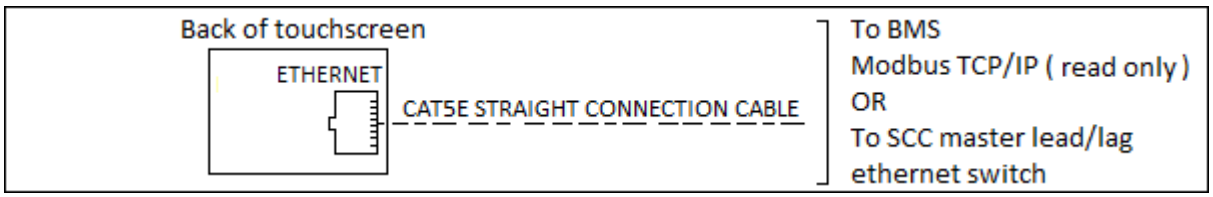
TS-x4x-KT (PLC first-out annunciation)



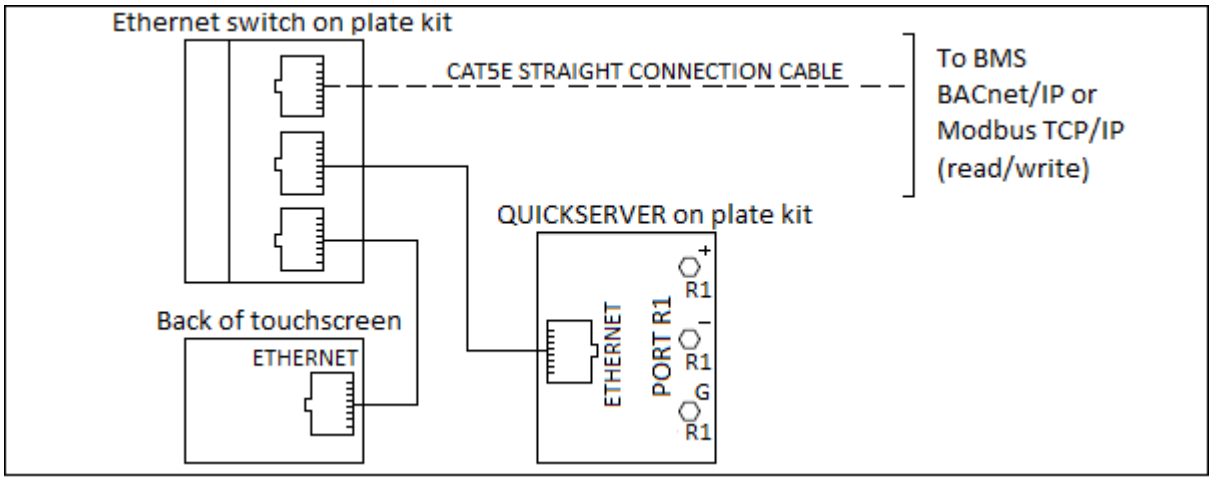
Connections (continued)

BMS Communications Connections

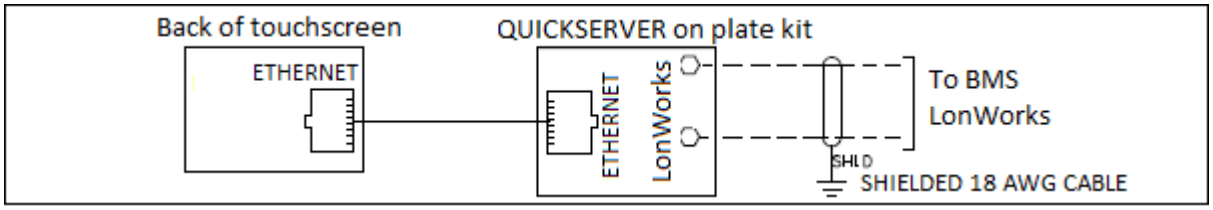
TS-xxS-KT (Modbus TCP/IP (read only) or SCC master lead-lag panel)



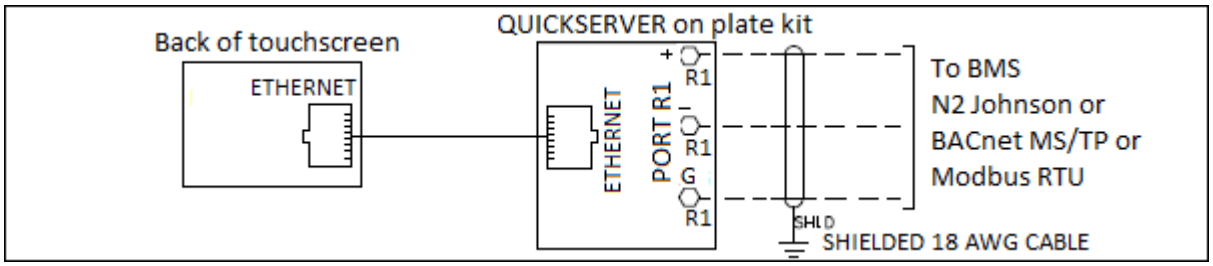
TS-xxB-KT (BACnet IP or Modbus TCP/IP (read/write))



TS-xxL-KT (LonWorks)



TS-xxN-KT (N2 Johnson Metasys, Modbus RTU, or BACnet MS/TP)



Dimensions

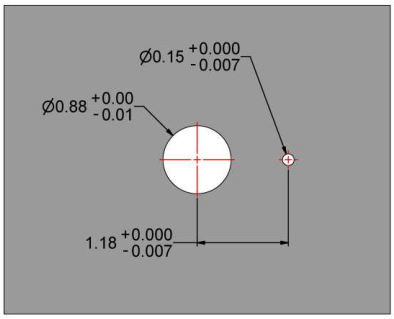
Dimensions in inches; millimeters in brackets

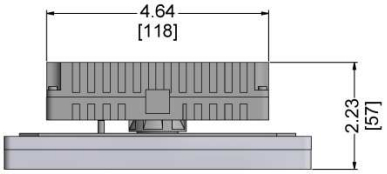
Touchscreens

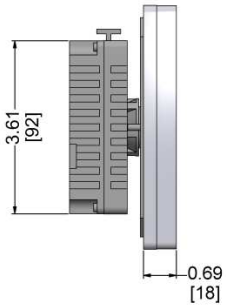
TS-6xx-KT (6” touchscreens)

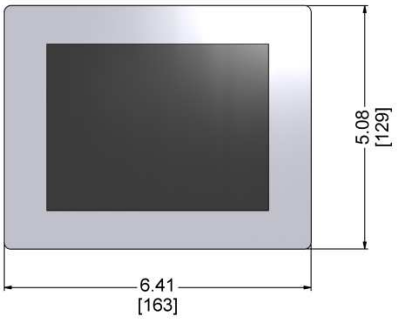
Installation:

Cutout required as shown below





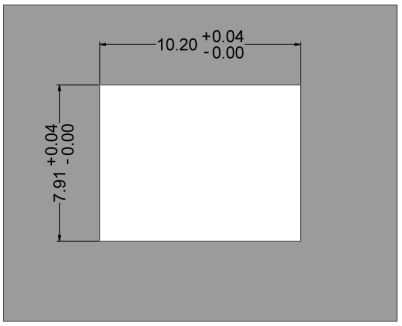


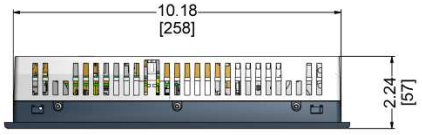


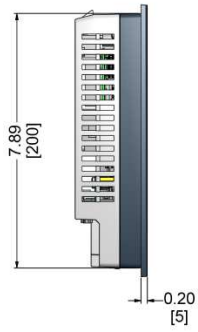
TS-0xx-KT (10” touchscreens)

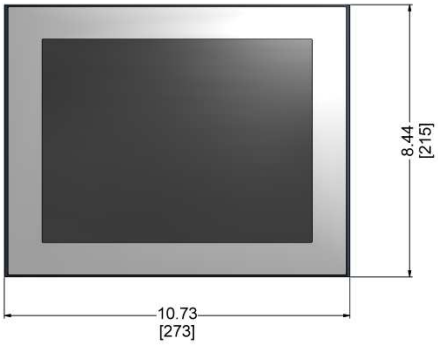
Installation:

Cutout required as shown below





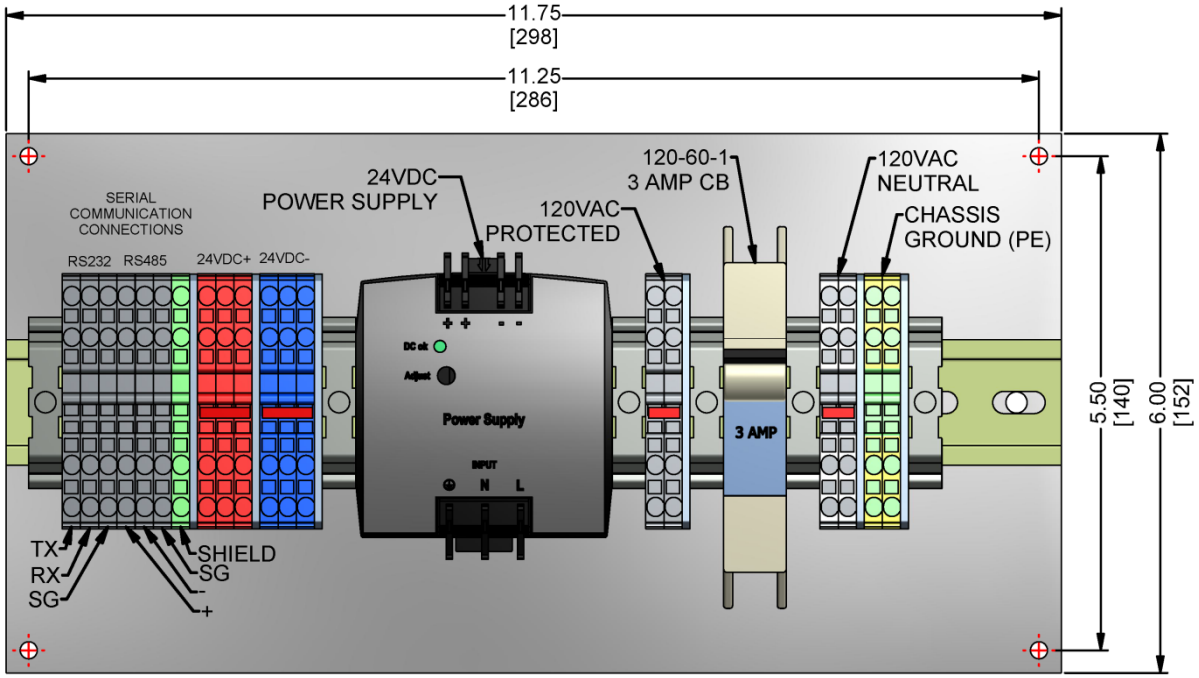




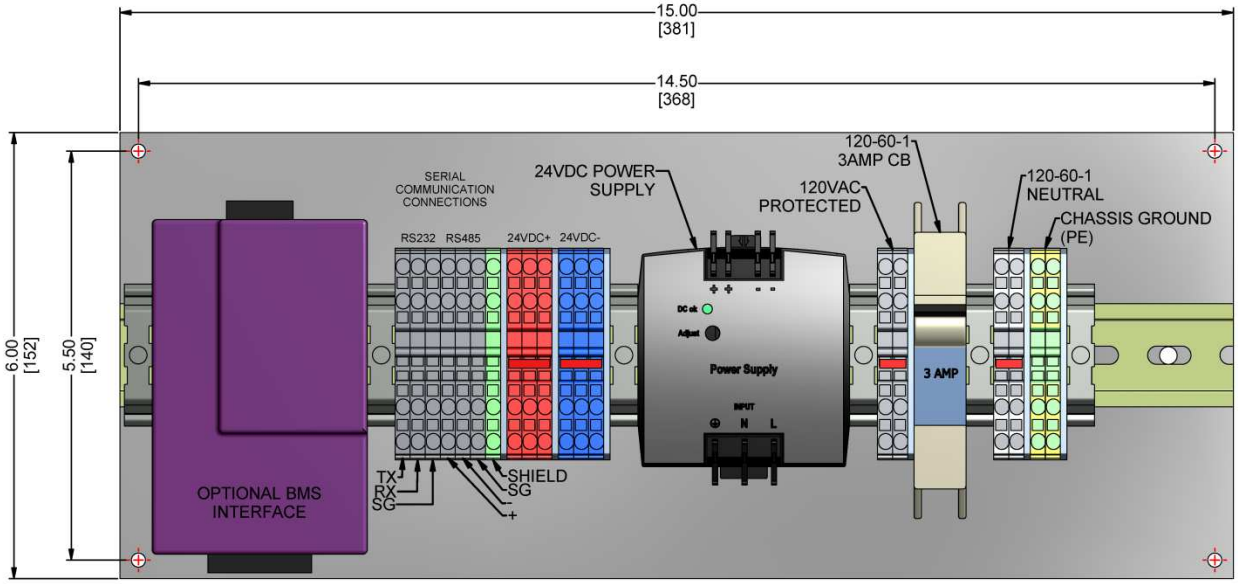
Dimensions (continued)

Plate Kits

TS-xXS-KT (No PLC; standard Modbus TCP/IP (read only) communication)



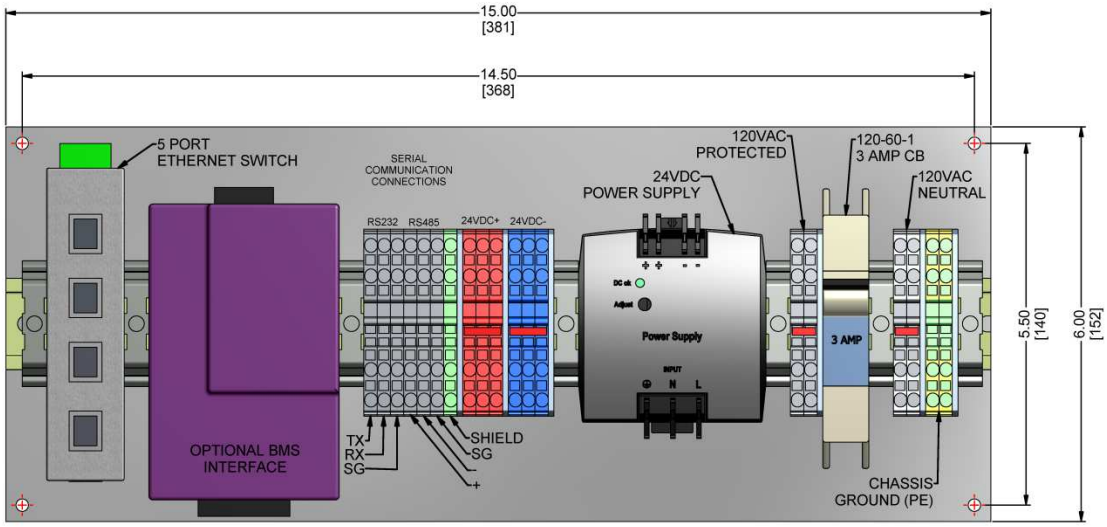
TS-xXL-KT, TS-xXN-KT (no PLC; Modbus RTU, N2, LON, or BACnet MS/TP communication)



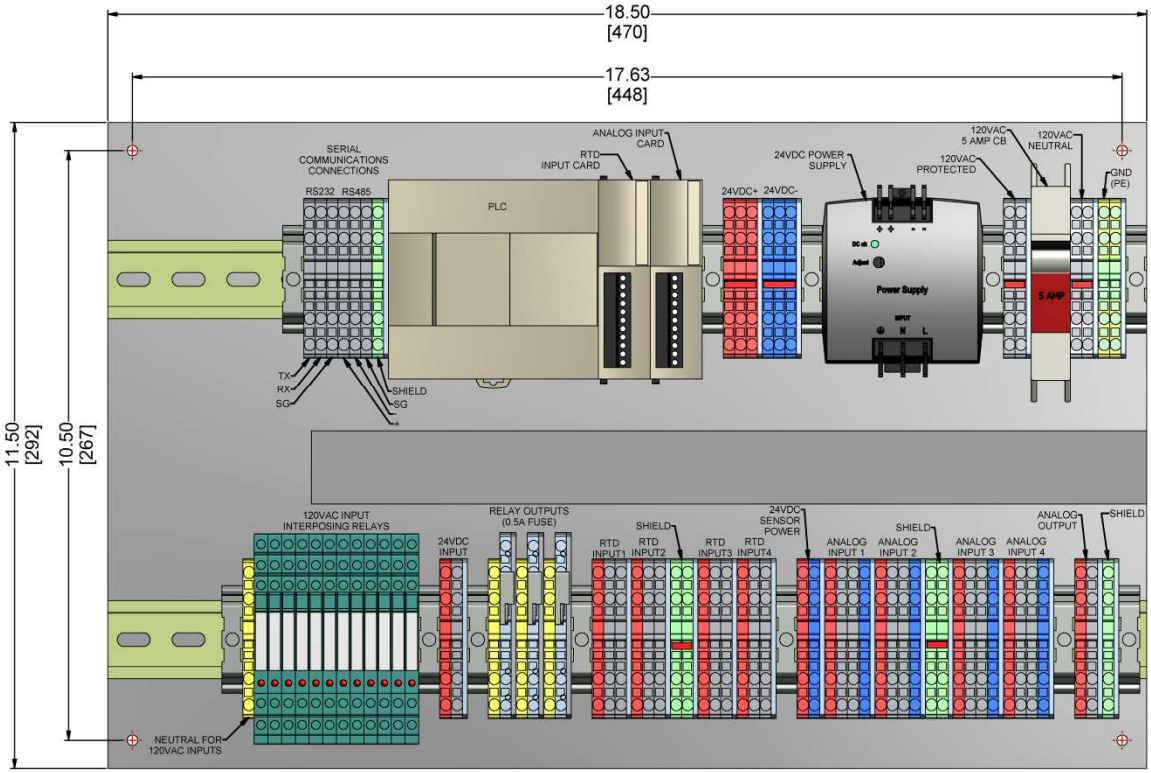
Dimensions (continued)

Plate Kits

TS-xXB-KT (no PLC; Modbus TCP/IP (read/write) or BACnet IP communication)



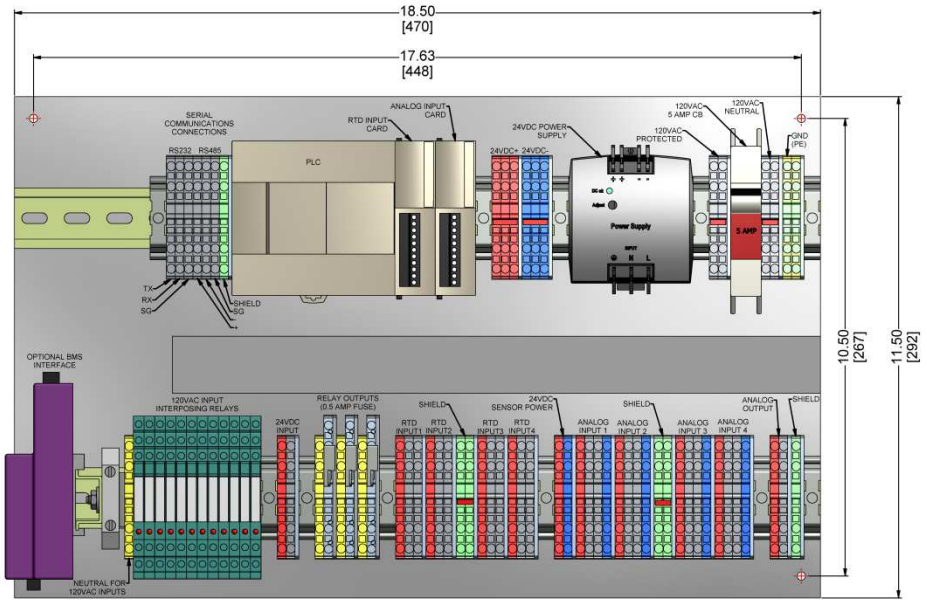
TS-x4S-KT (PLC; standard Modbus TCP/IP (read only) communication)



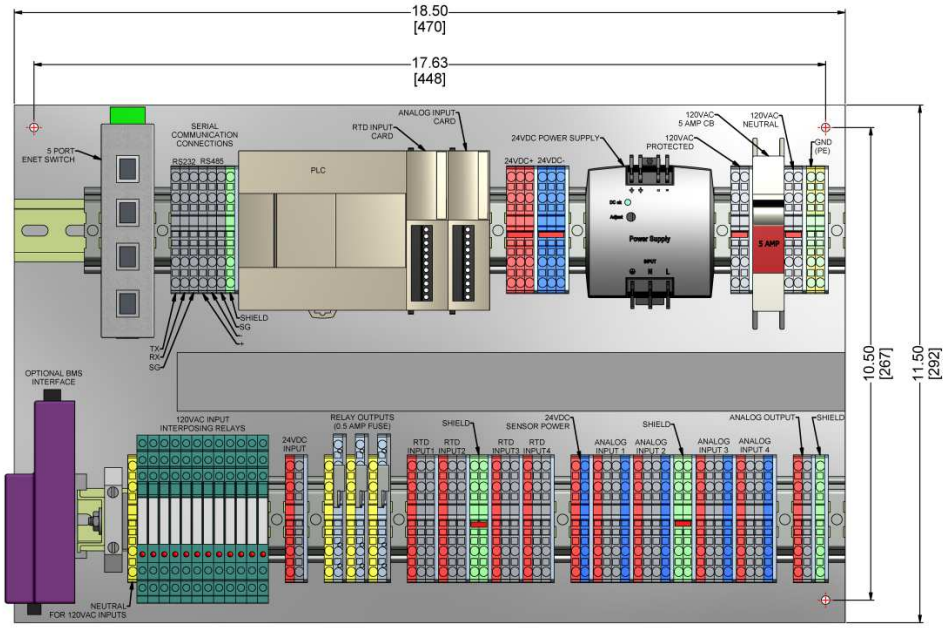
Dimensions (continued)

Plate Kits

TS-x4L-KT, TS-x4N-KT (PLC; Modbus RTU, N2, LON, or BACnet MS/TP communication)



TS-x4B-KT (PLC; Modbus TCP/IP (read/write) or BACnet IP communication)



Information in this publication is based on current specifications. The company reserves the right to make changes in specifications and models as design improvements are introduced. Product or company names mentioned herein may be the trademarks of their respective owners. © 2009 SCC Inc.

SCC Inc.

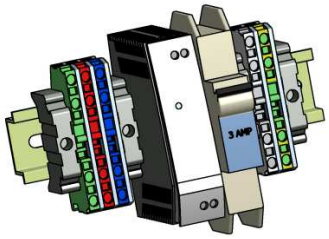
Technical Instructions

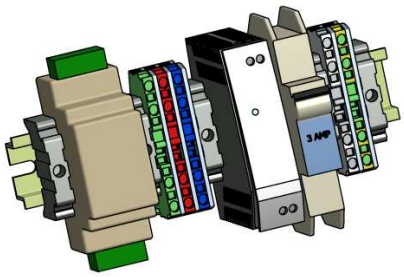
Document No. TS-1050

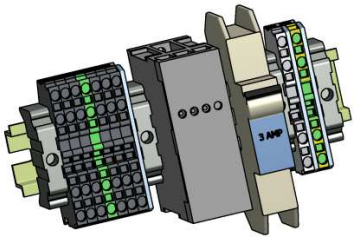
July 18, 2014

TS Series

TS… Serial Communication Kits
for use with LMV3, LMV5, and RWF… Controls







Description

TS… series serial communication kits provide a simple solution to connect Siemens LMV linkageless control systems to an SCC Master Lead/Lag System without a local touchscreen at each boiler.

The communication kit communicates serially between each LMV linkageless control system and an SCC Master Lead/Lag System for up to four boilers.

Features

- Serial standard RS485 Modbus Interface to SCC Master Lead/Lag System
- Daisy chains via shielded cable between all burners
- LMV3 or LMV5 serial RS485 communications

Application

TS… serial communication kits are suited for hydronic boilers, steam boilers, and other applications utilizing an LMV3 or LMV5 linkageless control system without local touchscreens at each boiler.

Components

TS… serial communication kits include the following components:

- 3 Amp circuit breaker
- 24 VDC power supply with TS-3X-KT or TS-3M-KT
- RS232 to RS485 converter with TS-5X-KT
- Field interconnecting terminals

Product Part Numbers

For communication kit part number identification only. See Table 1 for available part numbers.

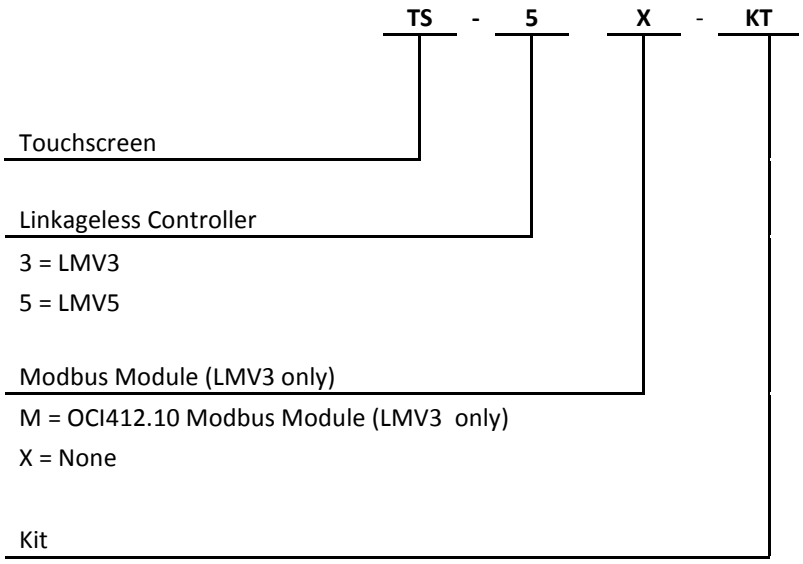


Table 1: Available Serial Communication Kits

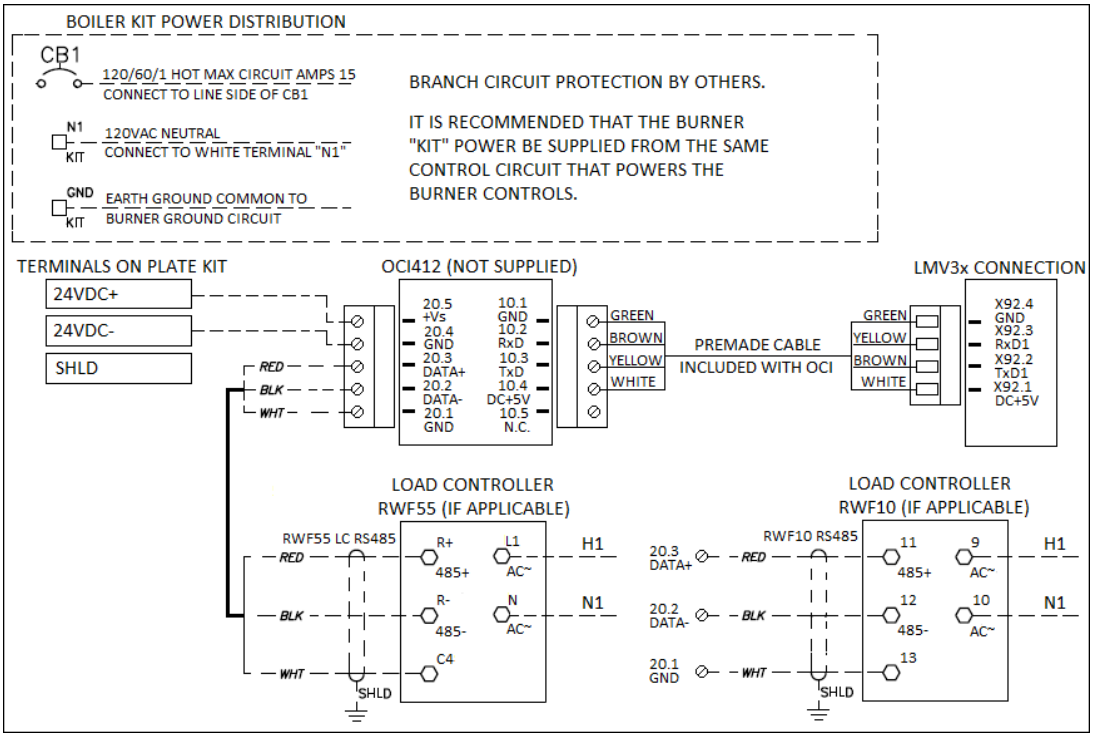
	Linkageless System		Modbus Module LMV3
Part Number	LMV3	LMV5	OCI412.10
TS-3X-KT	x		
TS-3M-KT	x		x
TS-5X-KT		x	

Specifications

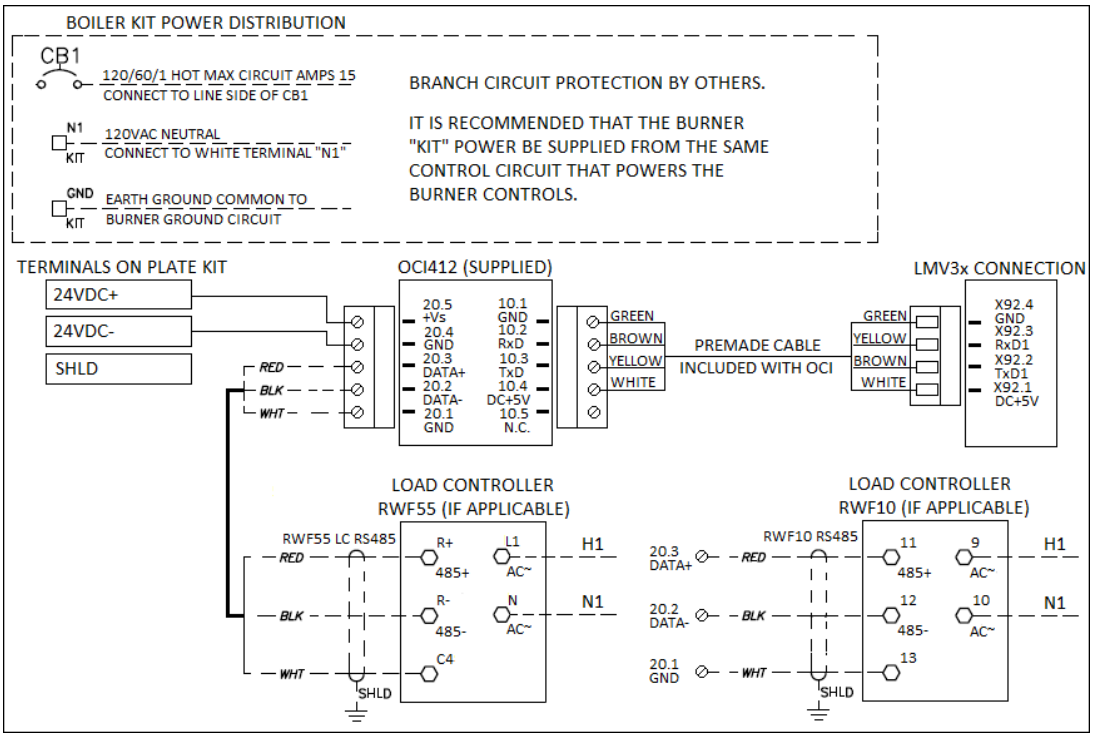
		TS-3X-KT, TS-3M-KT	TS-5X-KT
Electrical characteristics	Main power	120 VAC	120 VAC
	Component power	24 VDC/VAC	120 VAC
	Power consumption	≤ 60VA	5 VA max
Operating environment	Operating temperature	32 to 122 °F [0 to 50 °C]	-10 to 131 °F [-16 to 55 °C]
	Humidity	Max. 85% with no condensation	Max. 85% with no condensation

Field Connections

TS-3X-KT

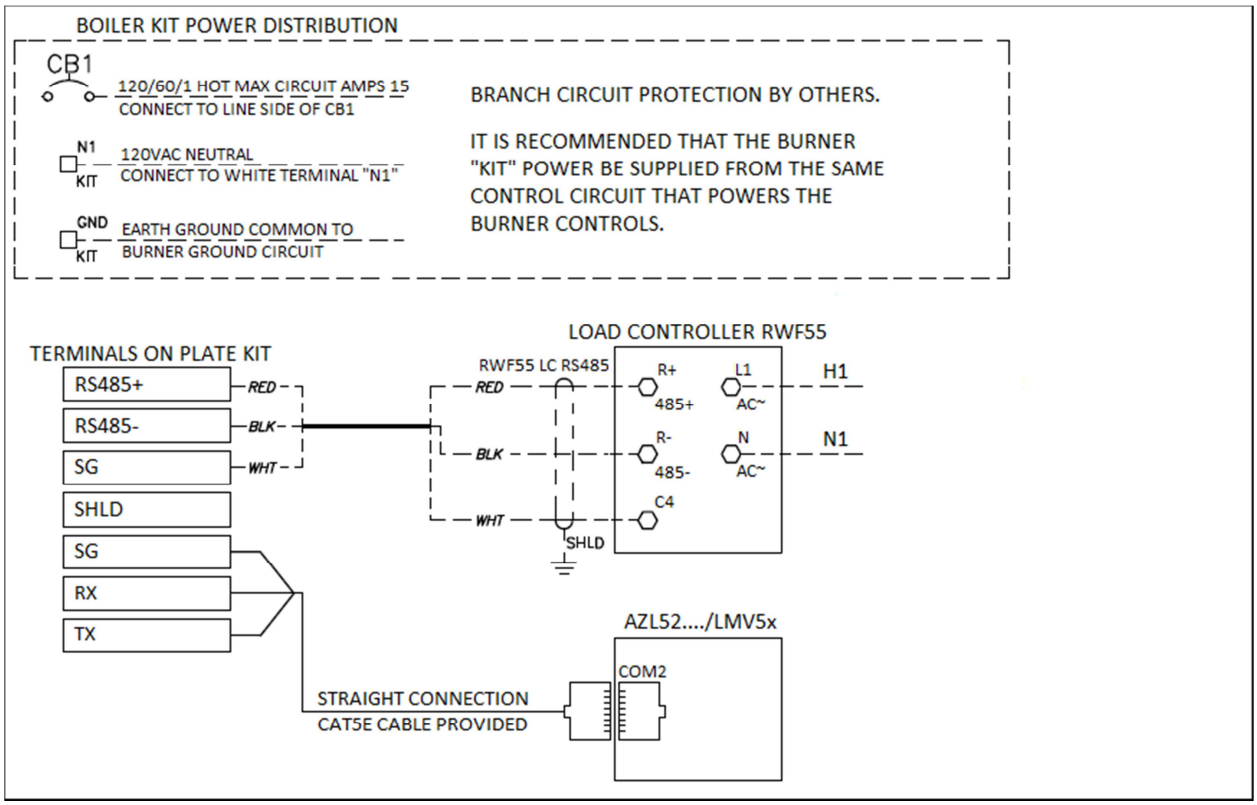


TS-3M-KT



Field Connections (continued)

TS-5X-KT



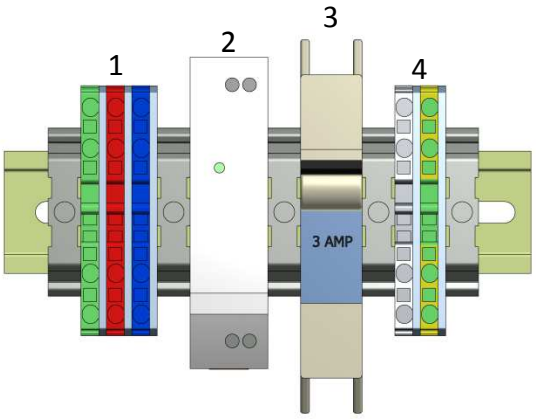
Note: For all RS-485 connections, use Belden cable 3106A (multi-conductor cable with twisted pair, EIA Industrial RS-485 PLTC/COM) or equivalent.

Table 2: Belden Cable 3106A Wire Color Designation

Electrical Diagram	Belden Cable 3106A
Red (RS485+)	Orange (RS485+)
Black (RS485-)	White (RS485-)
White (SG)	Blue (SG)

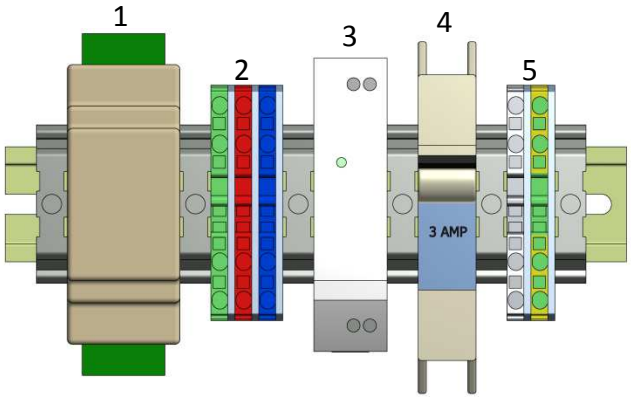
Parts Description

TS-3X-KT



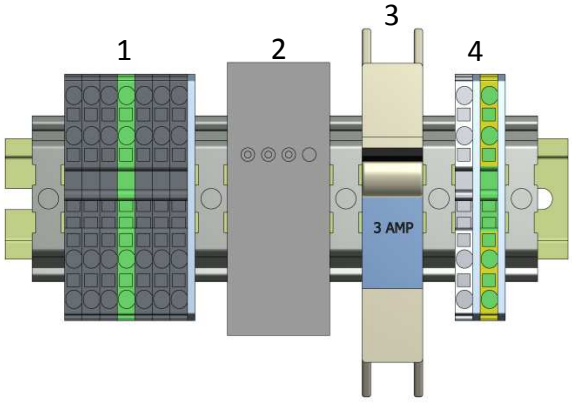
1- 24 VDC Terminals
2- 24 VDC Power Supply
3- 3 Amp Circuit Breaker
4- Neutral and Ground Power Terminals

TS-3M-KT



1- OCI Modbus RS485 Module
2- 24 VDC Terminals
3- 24 VDC Power Supply
4- 3 Amp Circuit Breaker
5- Neutral and Ground Power Terminals

TS-5X-KT

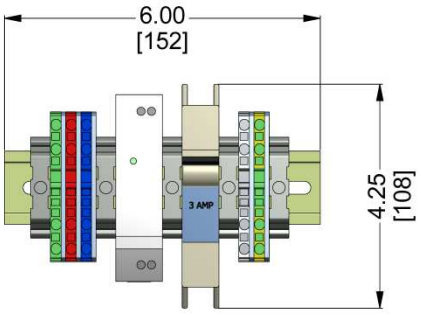


1- RS232-RS485 Modbus Interconnecting Terminals
2- Modbus Communication Module
3- 3 Amp Circuit Breaker
4- Neutral and Ground Power Terminals

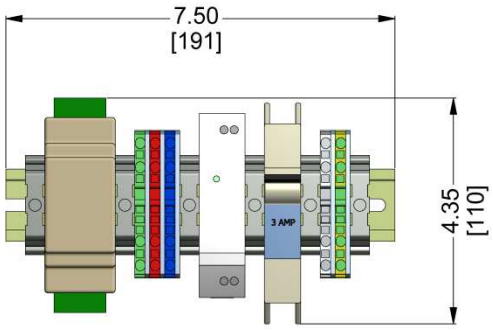
Dimensions

Dimensions in inches; millimeters in brackets

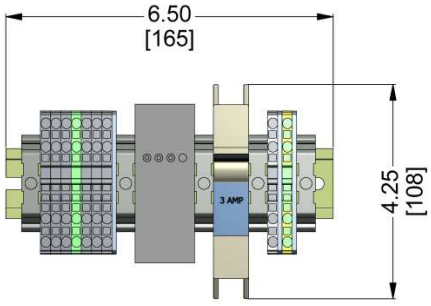
TS-3X-KT



TS-3M-KT



TS-5X-KT



Information in this publication is based on current specifications. The company reserves the right to make changes in specifications and models as design improvements are introduced. Product or company names mentioned herein may be the trademarks of their respective owners. © 2009 SCC Inc.

SCC Inc.

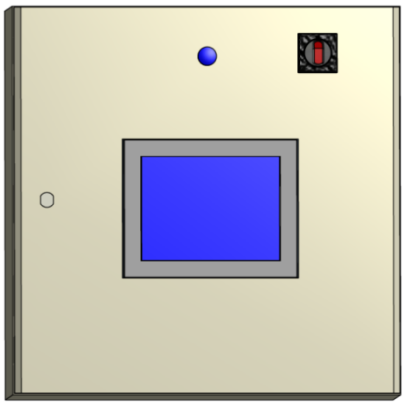
Technical Instructions

Document No. TS-2000

July 18, 2014

TS Series

TS-MS… Master Panels for Boiler Management, Lead/Lag, and Building Management System Interface



Description

A TS-MS… Series Master Lead/Lag Panel sequences and controls up to four boilers equipped with TS... communication kits (see Technical Document TS-1000 or TS-1050) or TS… complete combustion control enclosures (see Technical Document TS-4000).

A master panel controls hot water or steam boilers with Siemens LMV series linkageless control systems. Each panel includes a 7.5” or 10” touchscreen with a programmable logic controller.

Flexible communication interface options to the building management system (BMS) provide streamlined data collection, monitoring and controls. Additional options include pump controls and temperature measurement on steam boilers.

Features

- Manages the operation of individual boilers with Siemens LMV… controllers
- Boiler lead/lag with automatic boiler rotation
- Parallel or sequential modulation
- Remote setpoint adjustment via BMS
- Outside air reset (hydronic boilers)
- Pressure or temperature based warm standby
- Cycling pump control outputs for hydronic boilers
- Return valve modulating output
- Analog input with label, span and type (0-10V, 2-10V, 0-20mA or 4-20mA) field-configured
- Pt1000 RTD temperature inputs for supply and return water temperature and outside air reset for hydronic boilers (optional inputs for steam boilers)
- Metric or Standard units display
- Graphics for individual boiler overview screens automatically configure based on local touchscreen selections
- Individual boiler alarms and status
- Clear English text for alarms
- Alarms logging, history, and trending
- Ethernet communication
- Standard Modbus TCP/IP BMS communication
- Additional BMS communication options available

Application

TS-MS Lead/Lag Systems are suited for hydronic boilers, steam boilers and other applications utilizing LMV3 or LMV5 linkageless control systems.

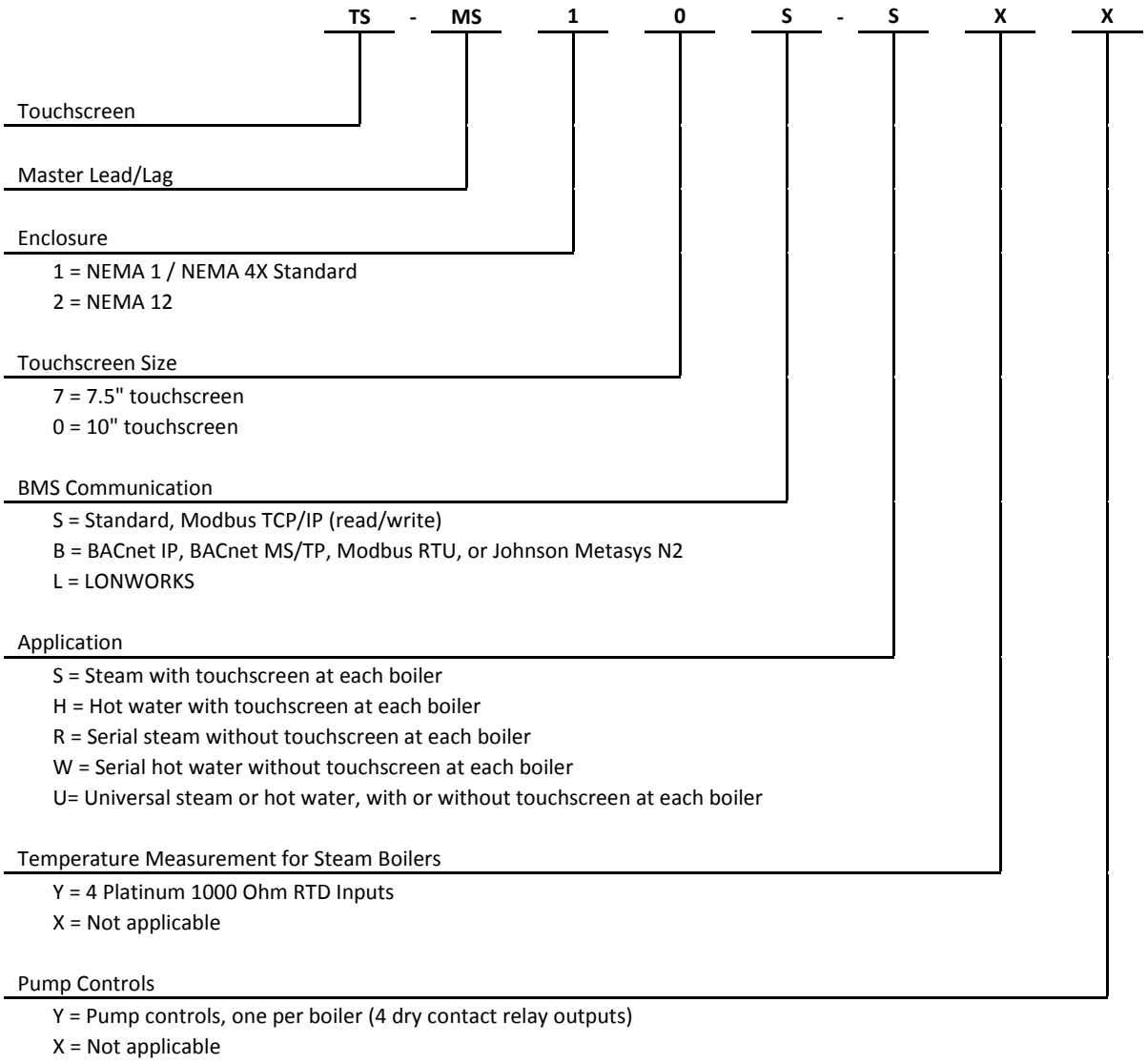
Components

All TS-MS… Master Panels include the following components:

- 7.5” or 10” touchscreen
- Power supply and branch circuit protection
- Programmable Logic Controller (PLC)
- Analog and digital inputs and outputs
- Interconnect terminals for field wiring

Product Part Numbers

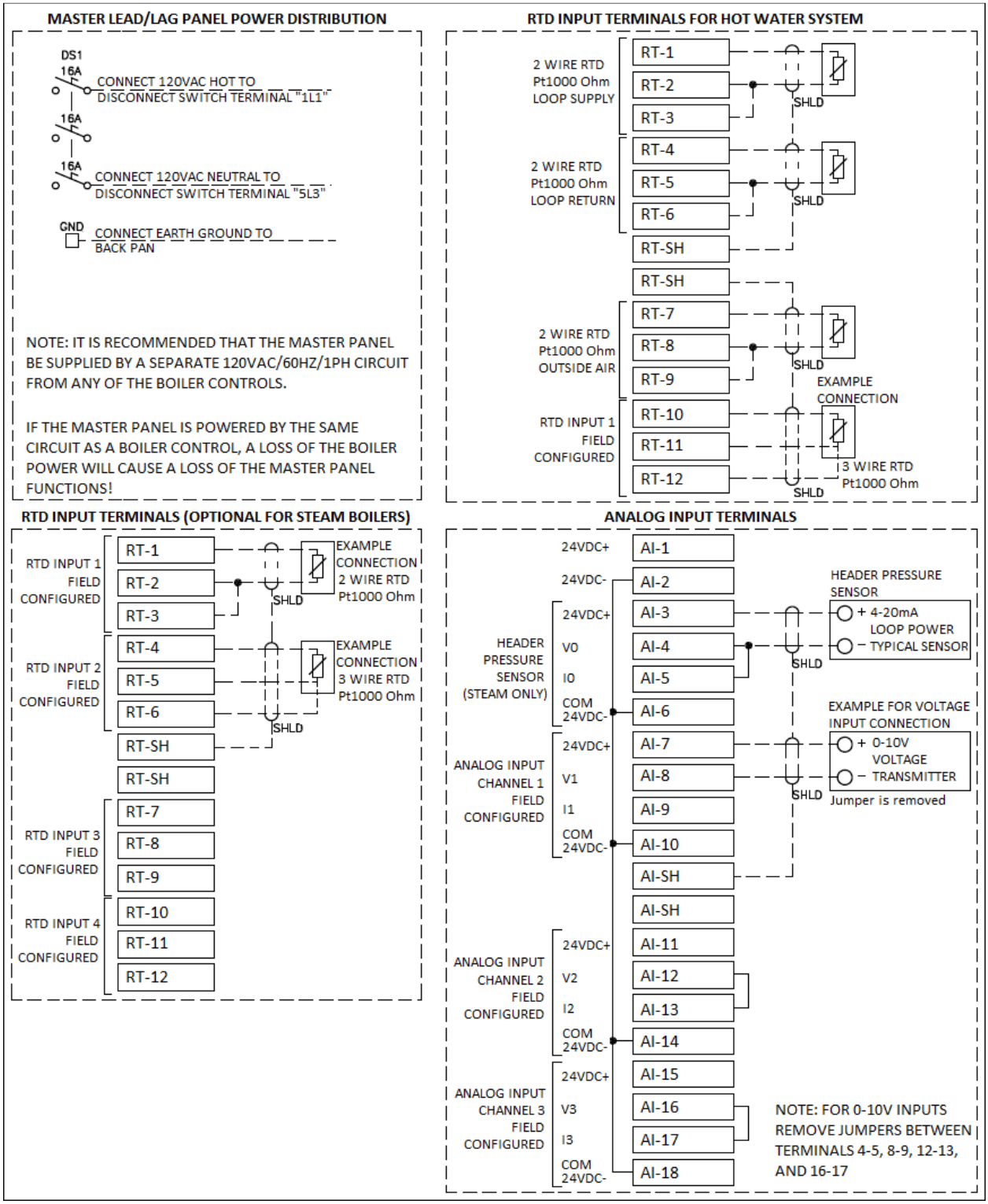
For Master Lead/Lag Panel part number identification.



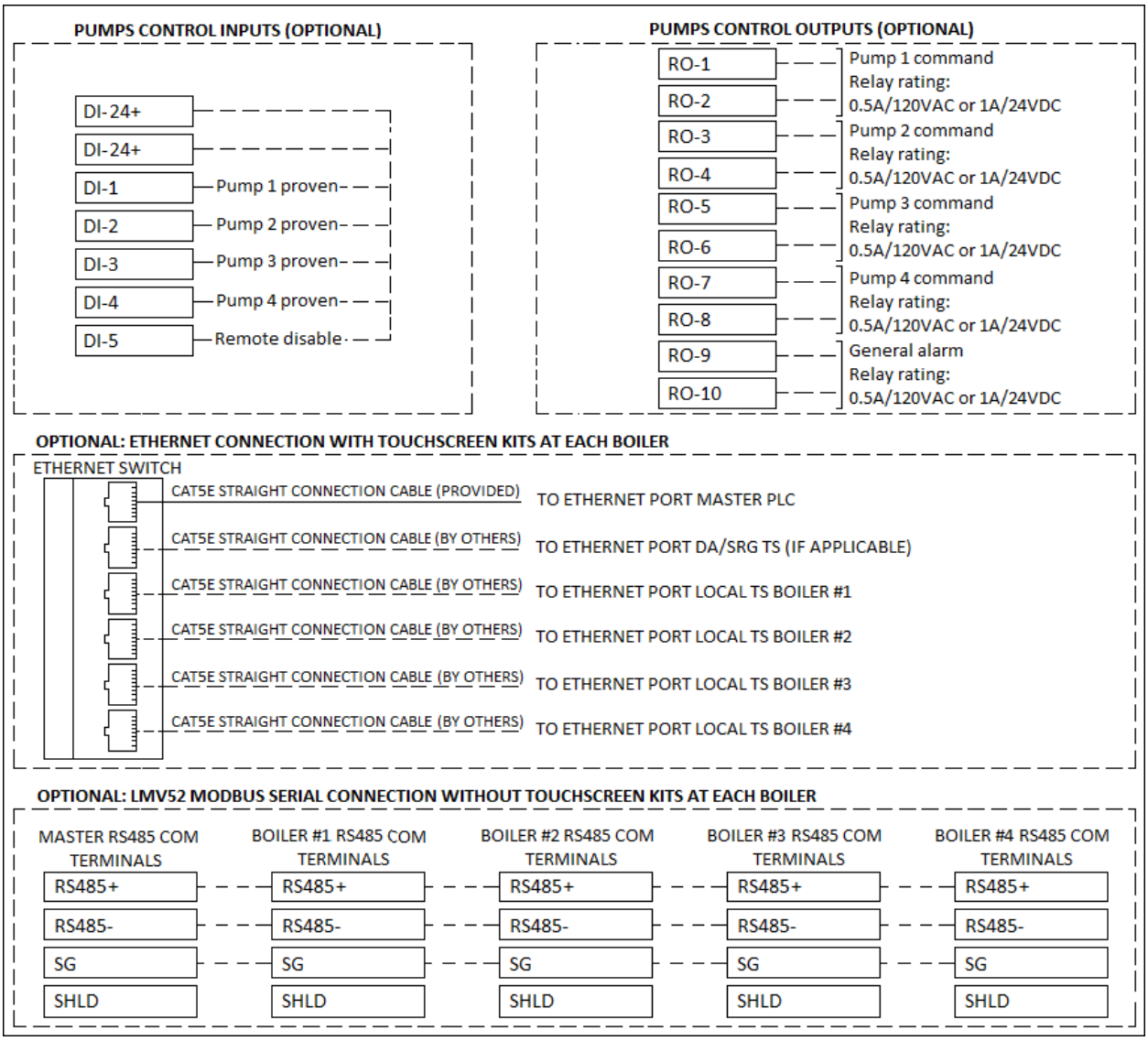
Specifications

		7.5” Touchscreen	10” Touchscreen
Physical characteristics	Main power	120 VAC	120 VAC
	Touchscreen power	24 VDC	24 VDC
	Power consumption	≤ 6.8 W	≤ 17 W
	Dry contacts	2 Amps	2 Amps
Operating environment	Operating temperature	32 to 122 °F [0 to 50 °C]	32 to 131 °F [0 to 55 °C]
	Humidity	Max. 80% with no condensation	Max. 85% with no condensation
	NEMA rating (Standard)	4X (indoor use only)	4X (indoor use only)
	NEMA rating (Optional)	NEMA 12	NEMA 12

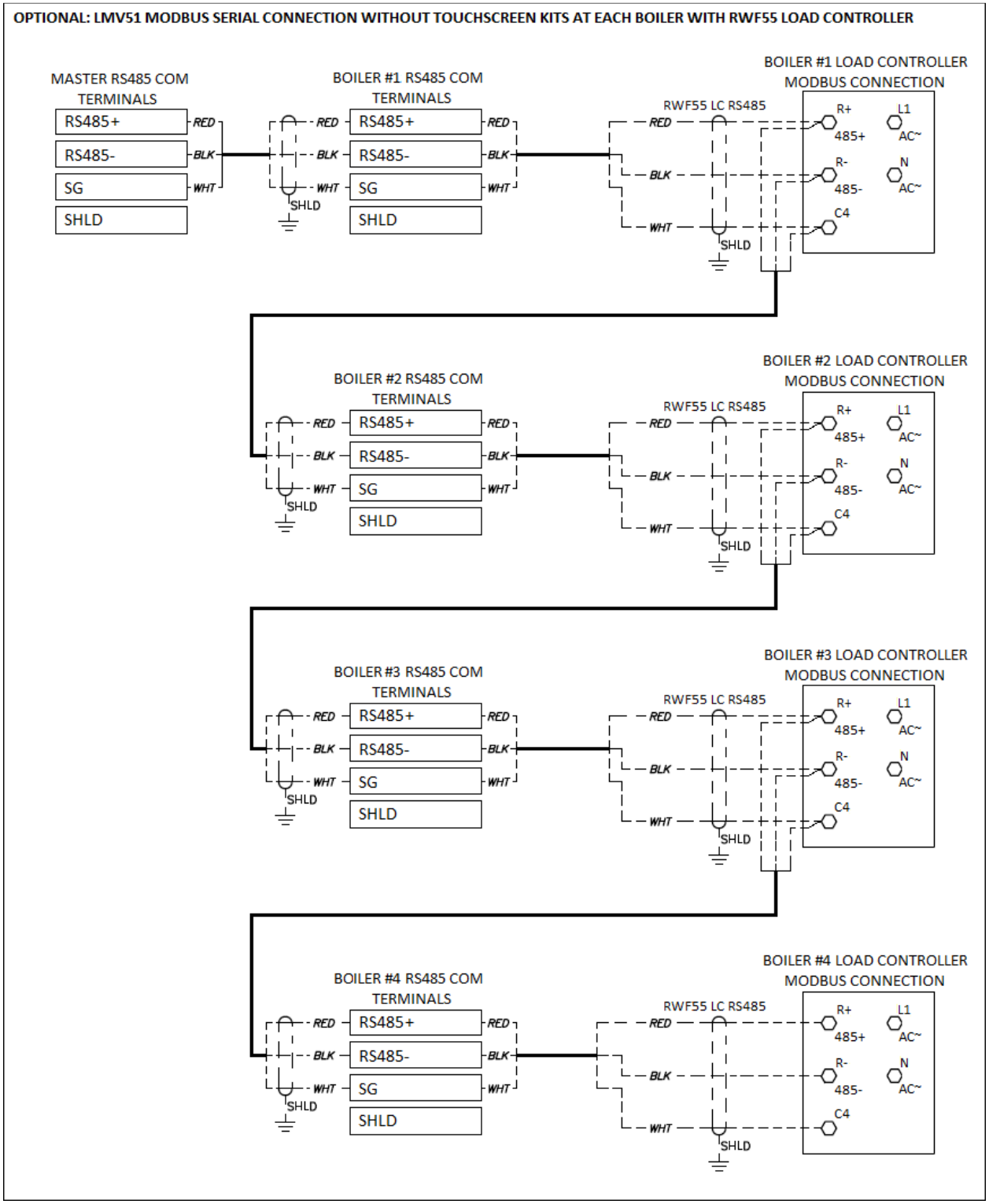
Field Connections



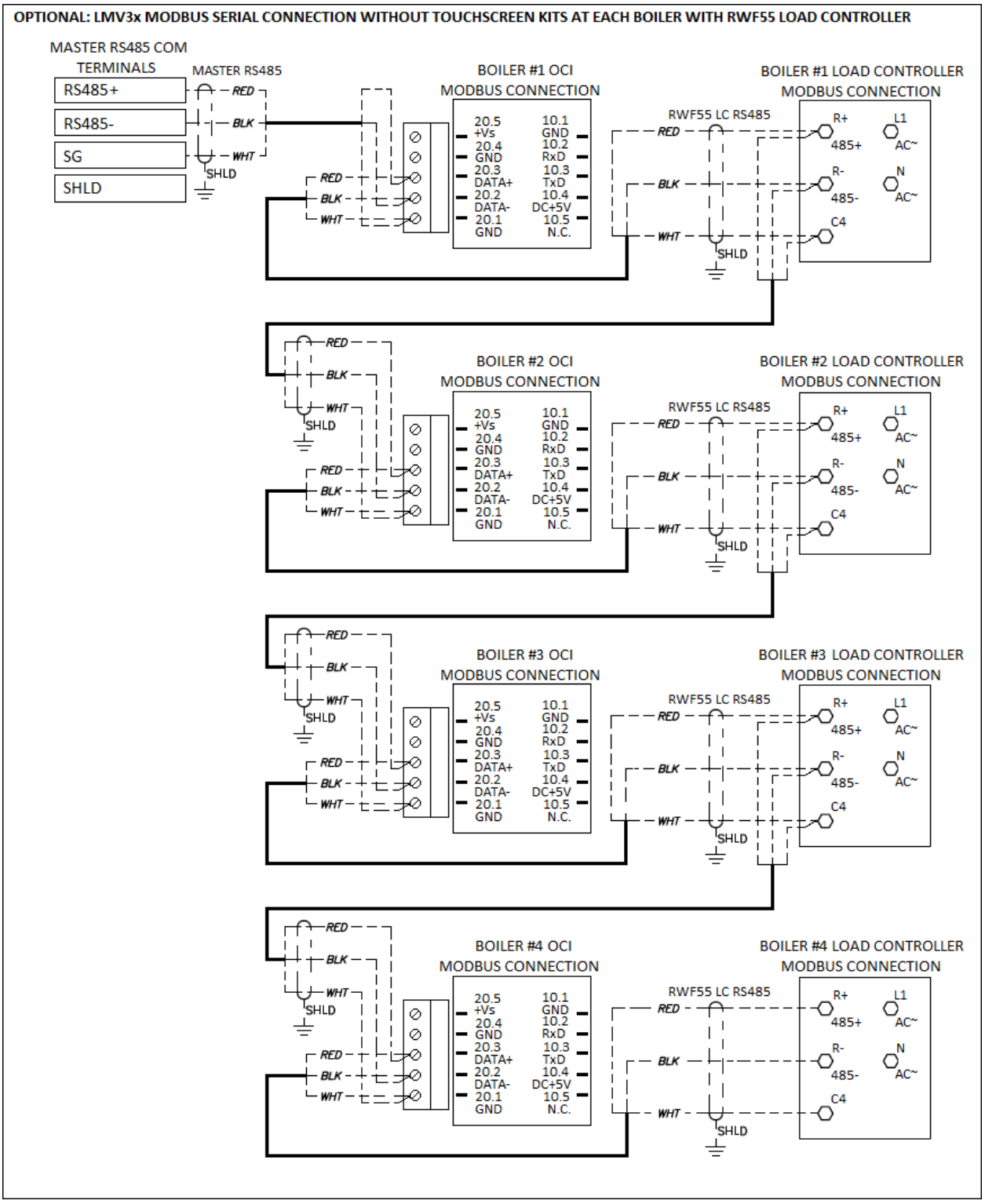
Field Connections (continued)



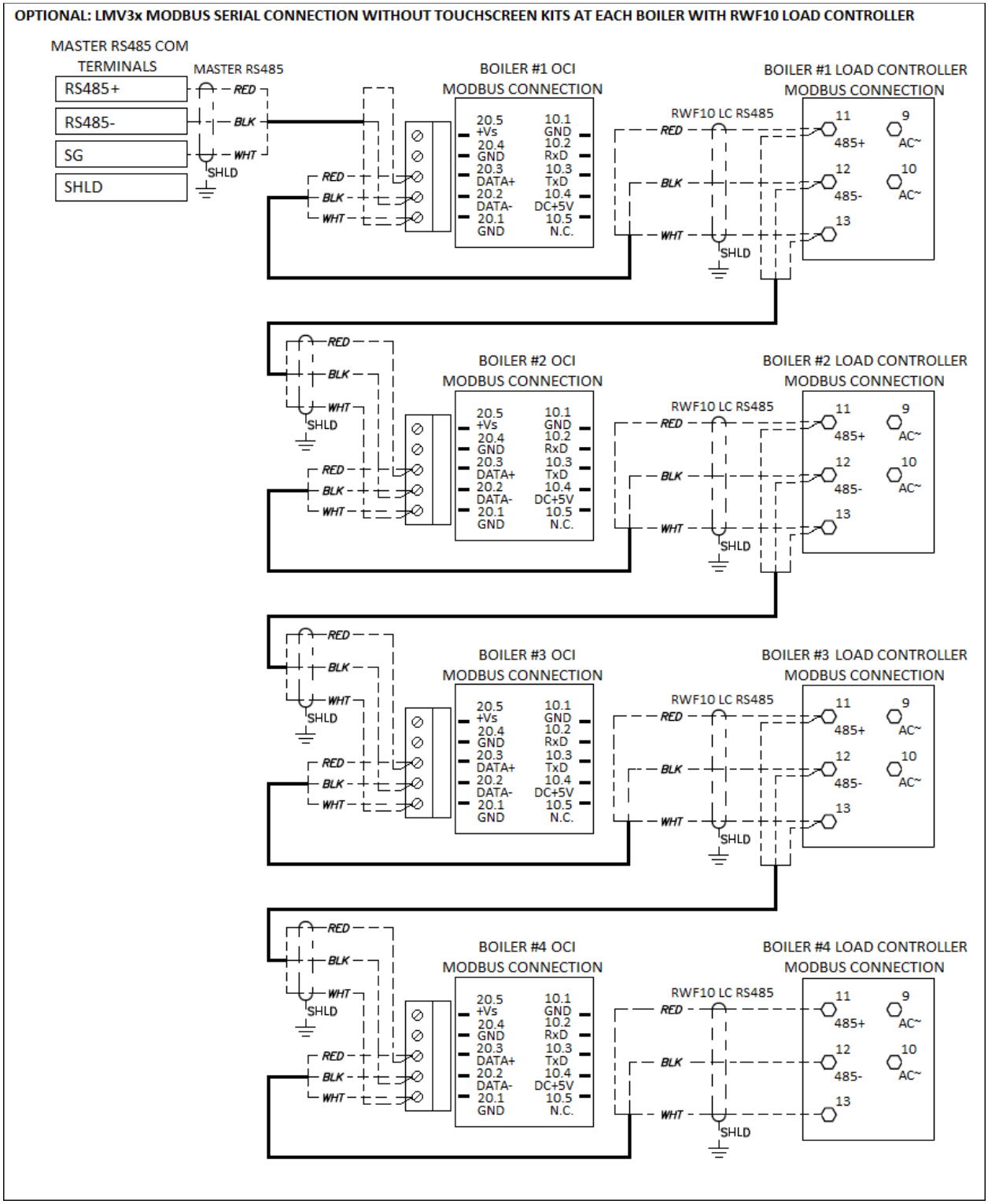
Field Connections (continued)



Field Connections (continued)



Field Connections (continued)

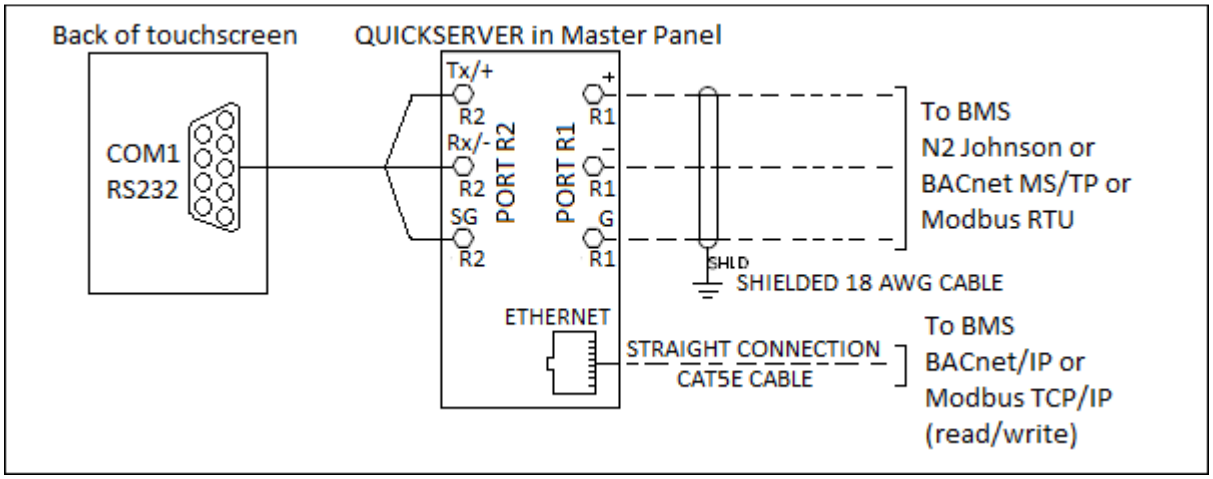


BMS Communications Connections

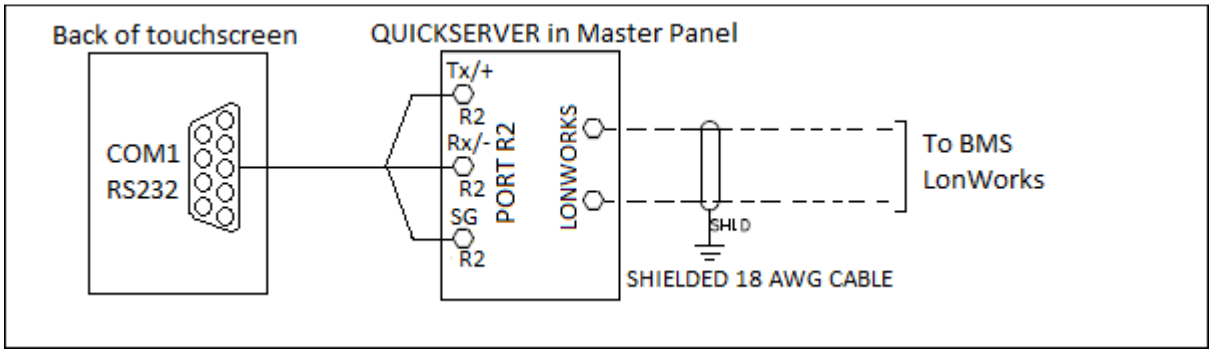
Standard (Modbus TCP/IP (read/write))



BACnet IP, BACnet MS/TP, Modbus RTU, or Johnson Metasys N2



LONWORKS

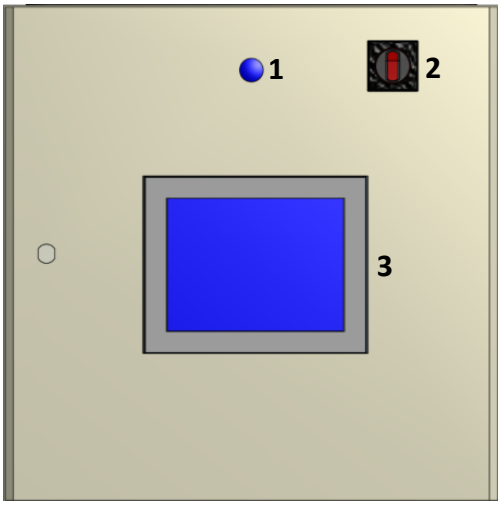


Note: For all RS-485 connections, use Belden cable 3106A (multi-conductor cable with twisted pair, EIA Industrial RS-485 PLTC/COM) or equivalent.

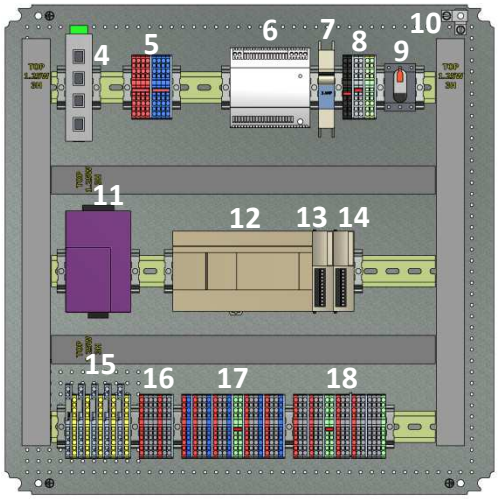
Table 1: Belden Cable 3106A Wire Color Designation

Electrical Diagram	Belden Cable 3106A
Red (RS485+)	Orange (RS485+)
Black (RS485-)	White (RS485-)
White (SG)	Blue (SG)

Enclosure Parts Description



Front

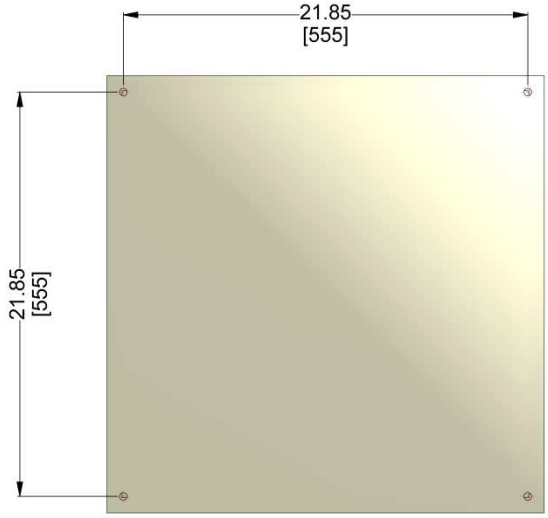


Back Pan

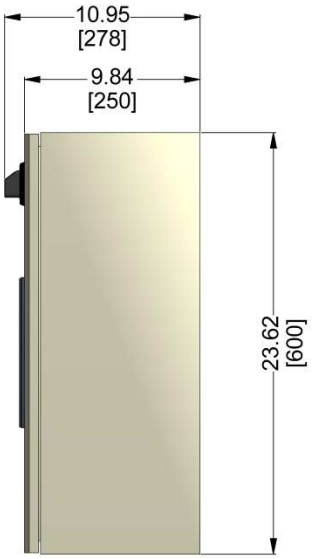
1- 24 VDC PLC normal indicator light
2- Main 120 VAC lockable disconnect handle
3- 7.5” or 10” touchscreen
4- 5-port Ethernet switch (provided only if there are touchscreen kits at each boiler)
5- 24 VDC connecting terminals
6- 24 VDC power supply
7- Circuit breaker
8- 120 VAC power terminals
9- 120 VAC main disconnect with UL lock
10- Grounding lugs
11- BMS interface module (provided only for communications other than Modbus TCP/IP)
12- Programmable Logic Controller (PLC)
13- Analog input module
14- RTD input module (always provided for hot water boilers; only provided if RTD option is selected for steam boilers)
15- Pump control output terminals (provided only if pump controls option is selected)
16- 24 VDC pump monitor digital input terminals (provided only if pump controls option is selected)
17- Analog input terminals (4-20 mA or 0-10 VDC)
18- 1000 Ohm Platinum RTD input terminals (always provided for hot water boilers; only provided if RTD option is selected for steam boilers)

Enclosure Dimensions

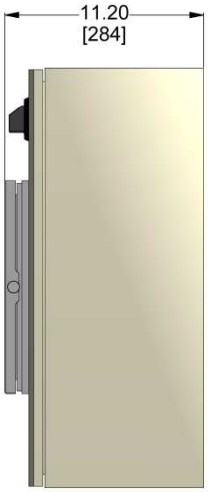
Dimensions in inches; millimeters in brackets



Back



Side (NEMA 1/NEMA 4X)



Side (NEMA 12 with cover)

Information in this publication is based on current specifications. The company reserves the right to make changes in specifications and models as design improvements are introduced. Product or company names mentioned herein may be the trademarks of their respective owners. © 2009 SCC Inc.

SIEMENS

Technical Instructions
Document No. 155-292
November 11, 2002

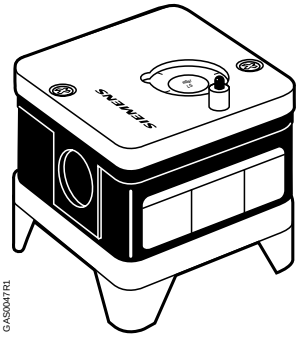
QP Series
Pressure Switches for Gas and Air

GAS0048R1

ISO 9001
REGISTERED FIRM

C UL US
LISTED

FM
APPROVED



GAS0047R1

Description

QP… pressure switches are used for gas and air pressure supervision on industrial and commercial burner applications.

The QPL31… series pressure switches break the electrical circuit when the pressure drops below the adjusted value.

The QPH31… series pressure switches break the electrical circuit when the pressure increases above the adjusted value.

Features

- UL listed for USA and Canada, FM approved, ISO 9001 certified; European approved versions available.
- Adjustable pressure range from 1 to 112 inches water column (WC).
- Automatic and manual reset models.
- Surge protected up to 15 psi.

Product Numbers

Table 1.

Product Number	Pressure Range		Execution
	Inches Water Column (WC)	mbar	
QPL31.050M00	1 to 20	2.5 to 50	Manual Reset Low
QPL31.140M00	7 to 55	17.5 to 137	
QPH31.050M00	2 to 20	5 to 50	Manual Reset High
QPH31.150M00	10 to 60	25 to 150	
QPL31.050A00	1 to 20	2.5 to 50	Automatic Reset Low
QPL31.075A00	5 to 30	12.5 to 75	
QPL31.280A00	28 to 112	70 to 280	
QPH31.050A00	2 to 20	5 to 50	Automatic Reset High
QPH31.090A00	5 to 35	12.5 to 87	
QPH31.280A00	28 to 112	70 to 280	

Specifications

Electrical rating	10A @ 125 to 250 Vac 1/3 HP @ 125 to 250 Vac
Maximum operating pressure	6 psi (400 mbar)
Maximum surge pressure	15 psi (1 bar) for 2 seconds
Operating temperature	–40°F to 140°F (–40°C to 60°C)

Operation

Range Adjustment

Remove the cover to adjust the pressure cut-off setting. Turn the range dial clockwise to increase the pressure setting, or counterclockwise to decrease the pressure setting.

Manual reset models

If the yellow ring of the reset button is above the cover, the switch is in the open position and must be manually reset before continuing burner operation.

Wiring

NOTE: Wiring must be performed by a licensed electrician.

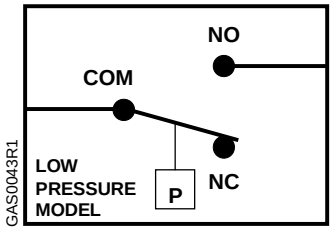


Figure 1. Typical Wiring for Low Pressure Models.

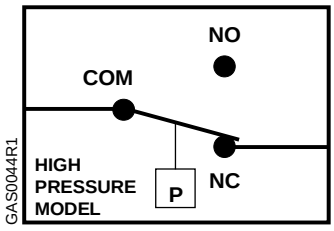
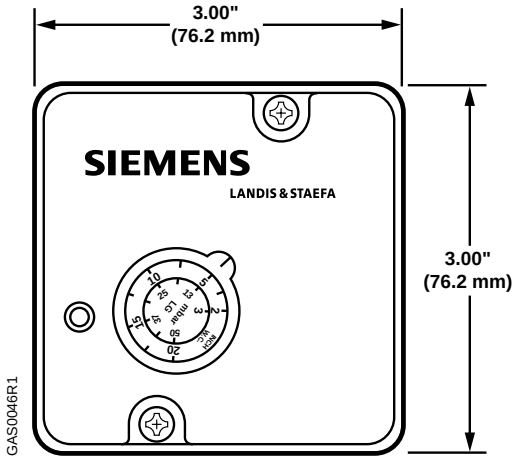


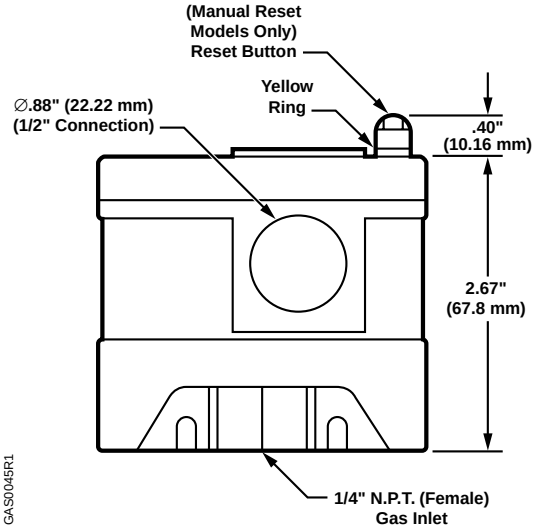
Figure 2. Typical Wiring for High Pressure Models.

Mounting

- All switches can be mounted in either a horizontal or vertical position.
- All models have a 1/4-inch NPT female pressure connection on the metal base.
- Check connections for leakage after installation.

Dimensions





Information in this publication is based on current specifications. The company reserves the right to make changes in specifications and models as design improvements are introduced. Other product or company names mentioned herein may be the trademarks of their respective owners.
© 2002 Siemens Building Technologies, Inc.

SIEMENS

Technical Instructions

Document No. 155-751
SKP15…U..
June 17, 2010

SKP Series

SKP15…U.. Gas Valve Actuator with Safety Shutoff Function



ISO 9001 and 14000 REGISTERED FIRM
GAS0001R2
LISTED
APPROVED

Only when assembled to Series VG… Gas valves

Description

SKP15… electro-hydraulic actuators are used in combination with VG… series gas valves to provide safety shut-off control for industrial and commercial burner applications.

The compact SKP15… actuator opens slowly and closes immediately when power is interrupted. The modular design allows the SKP15… to be used in combination with all VG… series gas valves bodies from 1/2-inch to 6 inches in size. The actuator is easily mounted on the square flange of any VG… valve with four pre-mounted screws. A visible position indicator on the front of the actuator displays the entire stroke of the valve. A light indicates when the actuator is powered.

Features

- UL listed, FM approved, CSA certified for USA and Canada, IRI approvable, and ISO 9001 certified. European, Australian and Japanese approved versions available.
- Proof of Closure with Over Travel (POC) versions are available.
- Optional NEMA 4 protection.
- Visual position indication.
- "Power on" indication light
- Quick connect wiring terminals
- Optional adjustable auxiliary switch available.
- Modular design with 360^{o} actuator rotation for easy field wiring and installation.
- Low, 13.5 VA power consumption.

Application

SKP15… series actuators are combined with 1/2-inch to 6-inch VG… series gas valve bodies. VG… series gas valves must be ordered separately (See *VG…U... Technical Instructions*, P/N 155-512P25).

Product Numbers

Table 1.

Product Number[1]	Operating Voltage	Proof of Closure Switch [2]	Auxiliary Switch [2]	Type of Switch
SKP15.013U1	110 to 120 Vac	–	–	–
SKP15.012U1		X	X	SPDT SPDT
SKP15.011U1		X	–	SPDT
SKP15.013U2	220 to 240 Vac	–	–	–
SKP15.012U2		X	X	SPDT SPDT

Note:

1. European, CE certified models are available (see *data sheet 7643*)
2. Proof of closure and auxiliary switches cannot be field installed.

Accessories

AGA66 Sealing gasket to provide NEMA 3, 3R, and 4 protection (for VGG…/VGD…valves)

Specifications		
Agency approvals	As safety shut-off valve	UL/429, FM/7400, ANSI Z21.21/CGA6.5 C/I Agency marks apply only for SKPxx.xxxU actuators with VGxxx.xxxU series gas valve bodies.
Power supply	Operating voltage	110 to 120 Vac + 10% to -15% 220 to 240 Vac + 10% to -15%
	Operating frequency	50 to 60 Hz ± 6%
	Power consumption	13.5 VA
	Duty cycle	continuous
Operating environment	Ambient operating temperature	5°F to 140°F (–15°C to 60°C)
	Mounting position	Any position except upside down
Physical characteristics	Weight	2.4 lb (1.1 kg)
	Enclosure	NEMA 1, 2, 5, and 12 for indoor use NEMA 3, 3R, and 4 with optional AGA66 gasket
	Dimensions	See Figure 3
	Specification for valve bodies	See *gas valve Technical Instructions,* P/N 155-512P25
	Conduit connection	Two 1/2-inch NPSM threaded knock-outs
	Electrical connection	Spring loaded terminals for 14 AWG wires
Operating characteristics	Output force	100 lb (450 N)
	Maximum stroke	1 inch (26 mm)
	Opening time for maximum stroke	Varies with valve size, 14 seconds for max. stroke
	Closing time	<0.8 seconds
Auxiliary features	Proof of closure switch	Non-adjustable
	Setting range of auxiliary switch	40% to 100% of stroke
	Switch rating	6A/250 Vac resistive; 3A/120 Vac pilot duty

Operation

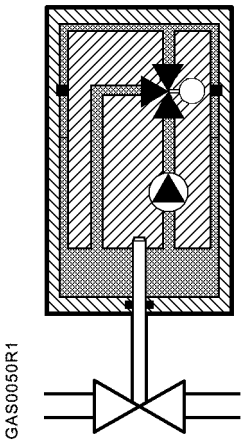


Figure 1. SKP15… Operation.

The electro-hydraulic actuator consists of a cylinder filled with oil, a piston containing an electric oscillating pump, and a relief system. When power is supplied to the actuator, the relief system closes, and the pump moves oil from the reservoir into the pressure chamber. This action causes the piston to move downward in the cylinder, opening the gas valve. When power to the actuator is interrupted, the relief system opens and the gas valve closes in less than 0.8 seconds.

A position indicator, visible through the transparent portion of the terminal cover, shows the entire stroke range of the actuator. A light, which is visible through the lower left transparent portion of the terminal cover, indicates when the actuator receives power. An optional, non-adjustable SPDT proof of closure over travel switch signals the closed position after the gas valve has closed. An optional SPDT auxiliary switch is adjustable between 40% and 100% of the stroke. The adjustment screw and scale are located on the right side in the terminal box, and are visible through the transparent portion of the terminal cover.

Installation

WARNING:

- Personal injury or loss of life may occur if procedures are not followed as specified.
- All installations must be performed by qualified personnel only.
- Do not pull the actuator shaft.
- The AGA66 gasket must be installed between the actuator and the gas valve body to provide NEMA 3, 3R, and 4 protection rating for VGG… and VGD… valves.

- The SKP15… actuator is directly coupled to the VG… series valve body by four pre-mounted 4 mm Allen key screws.
- The square mounting flange can be rotated in steps of 90^{o} to provide four different mounting positions. The SKP15… actuator can be mounted in any position except upside down.
- The actuator can be mounted or replaced while the valve body is under pressure.
- The SKP15… actuator has two knock-outs for the installation of 1/2”-14 NPSM conduit connections.
- When conduit routing is connected, flexible conduit must be used.
- Liquid tight conduit must be used in combination with AGA66 to provide NEMA 3, 3R, and 4 protection.
- The terminal marked GND, located above the wiring terminals, must be connected to the electrical ground.

Installation, Continued

NOTE: Wiring must meet all relevant electrical codes.

Wiring and Switch Adjustment

(See *Terminal Designations*)

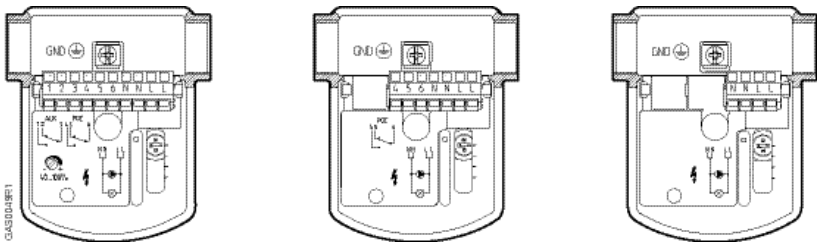
- The actuator is equipped with spring-loaded terminals for 14 AWG wires.
- The actuator has two line and two neutral terminals.
- Insert one wire into the opening of the terminal while pressing the lever downward with a screwdriver or hard object. Make sure that all strands insert into the opening.
- Adjust the auxiliary switch (if provided) according to the wiring diagram on the label below the terminals (see Figure 2). The adjustment screw and scale are located on the right side of the terminal box, and are visible through the transparent portion of the terminal cover.

NOTES:
1. The auxiliary switch is adjustable between 40% and 100% of the stroke. The factory setting is at 40%.
2. The auxiliary switch must not be used for proof of closure detection or other safety interlock functions.
3. The Proof of Closure Switch is non-adjustable.

Service

There are no serviceable parts on the SKP15… series actuators. If inoperative, replace the entire actuator. Tag wires before servicing.

Terminal Designations



SKP15.012U… SKP15.011U… SKP15.013U…

Figure 2. Terminal Designations.

Dimensions

(Dimensions in inches; millimeters in parentheses)

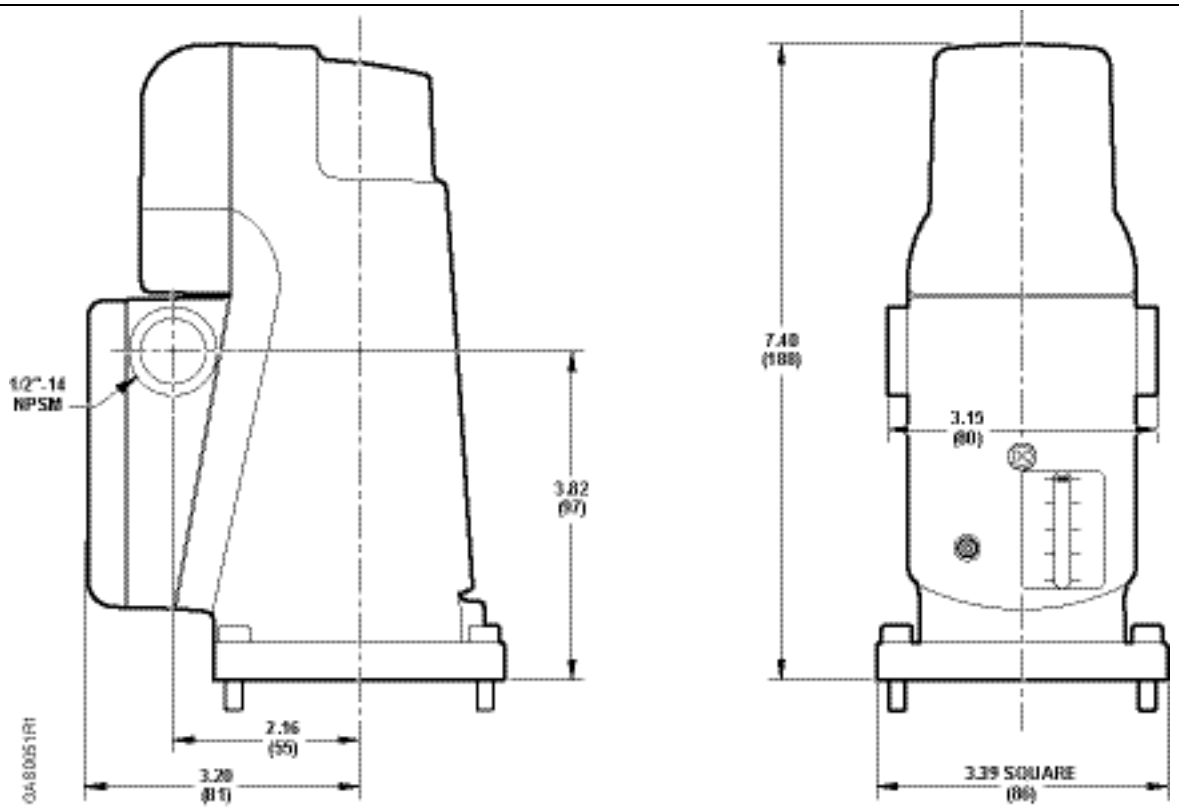


Figure 3. SKP15…U.. Dimensions.

SIEMENS

Technical Instructions
Document No. 155-752
SKP25…U..
June 17, 2010

SKP Series

SKP25…U.. Pressure Regulating Gas Valve Actuator with Safety Shut-off Function



ISO 9001 and 14000 REGISTERED FIRM
GAS0001 R2
LISTED
APPROVED

Only when assembled to Series VG… Gas valves

Description

SKP25… pressure regulating electro-hydraulic actuators are used in combination with VG… series gas valve bodies to provide safety shut-off and gas pressure regulation for industrial and commercial burners. The SKP25… can also be applied as a 1:1 air/gas proportionator or zero governor.

Since a single valve performs two or more functions, fewer gas train components and fittings are required. This significantly reduces both the size and weight of the gas train. In addition, smaller diameter gas valves can be used.

The compact SKP25… actuator opens slowly and closes immediately when power is interrupted. The modular design allows the SKP25… to be used in combination with all VG… series gas valve bodies from 1/2-inch to 6-inch in size. The actuator is easily mounted on the square flange of any VG… valve with four pre-mounted screws. A visible position indicator on the front of the actuator displays the entire stroke of the valve. A light indicates when the actuator is powered.

Features

- UL listed, FM approved, CSA certified for USA and Canada, IRI approvable, ISO 9001 certified. European, Australian and Japanese approved versions available.
- Certified as a ventless pressure regulator.
- Safety shut-off function and pressure regulating function in one compact unit.
- Proof of Closure with Over Travel (POC) versions are available.
- Optional NEMA 4 protection.
- Visual position indication.
- "Power on" indication light
- Quick connect wiring terminals
- Optional adjustable auxiliary switch available.
- Applicable as 1:1 air/gas proportionator or zero governor.
- Accurate pressure control characteristics, and zero offset (droop).
- Modular design with 360^{o} actuator rotation for easy field wiring and installation.
- Low, 13.5 VA power consumption.

Application

SKP25… series actuators are combined with 1/2-inch to 6-inch VG… series gas valve bodies. VG… series gas valves must be ordered separately (See *VG…U...Technical Instructions*, P/N 155-512P25).

Product Numbers

Table 1.

Product Number[1]	Operating Voltage	Proof of Closure Switch [4]	Auxiliary Switch [4]	Type of Switch
SKP25.011U1	110 to 120 Vac	x	–	SPDT
SKP25.012U1		x	x	SPDT SPDT
SKP25.013U1		–	–	–
SKP25.411U1 [2]		x	–	SPDT
SKP25.611U1 [3]		x	–	SPDT
SKP25.012U2	220 to 240 Vac	x	x	SPDT SPDT
SKP25.013U2		–	–	–

NOTES:
1. European, CE certified models are available (see *data sheet 7643*)
2. High outlet pressure model for 1.5 to 20 psi outlet pressure regulation
3. High bias model for proportionator function with 0" to – 4" WC bias.
4. Proof of closure and auxiliary switches cannot be field installed.

Accessories

Table 2.

Product Number	Description
AGA22	Yellow setpoint spring for 6” to 48” WC (1.5 to 10 psi for SKP25.411U1)
AGA23	Red setpoint spring for 40” to 100” WC (8.5 to 20 psi for SKP25.411U1)
AGA25	Damping orifice for mounting into vent connection of SKP25.0…models
AGA28	Black bias spring to install if SKP25.0… is used as proportionator or zero governor
AGA29	Unpainted setpoint spring for 0” to 8.5” WC (included in SKP25.0… as standard)
AGA66	Sealing gasket to provide NEMA 3, 3R, and 4 protection (for VGG…/VGD…valves)

Specifications

Agency approvals	As a safety shut-off valve	UL/429, FM/7400, ANSI Z21.21/CSA 6.5 C/I Agency marks apply only for SKPxx.xxxU actuators assembled with VGxxx.xxxU series gas valve bodies.
	As a pressure regulator	ANSI Z21.18/CSA 6.3
Power supply	Operating voltage	110 to 120 Vac + 10% to -15% 220 to 240 Vac + 10% to -15%
	Operating frequency	50 to 60 Hz ±6%
	Power consumption	13.5 VA
	Duty cycle	continuous
Operating environment	Ambient operating temperature	5°F to 140°F (-15°C to 60°C)
	Mounting position	Any position except upside down
	Maximum inlet gas pressure	Same as VG… series

Specifications, Continued

Physical characteristics	Weight	3.5 lb (1.6 kg)
	Enclosure	NEMA 1, 2, 5 and 12 for indoor use NEMA 3, 3R, and 4 with optional AGA66 gasket
	Dimensions	See Figure 3
	Specification for valve bodies	See *gas valve Technical Instructions,* P/N 155-512P25
Connections	Conduit connection	Two 1/2-inch NPSM threaded knock-outs
	Electrical connection	Spring loaded terminals for 14 AWG wires
	Gas connection	1/4” NPT
	Air connection Gas pressure test connection	1/4” NPT Hose barb with close-off screw
Operating characteristics	Output force	100 lb (450 N)
	Maximum stroke	1 inch (26 mm)
	Opening time for maximum stroke	Varies with valve size, 14 seconds for max. stroke
	Closing time	< 0.8 seconds
Operation/installation	Outlet pressure spring range for SKP25.0… models	0" to 8.5" WC (standard, unpainted spring, AGA29) 6" to 48" WC (yellow spring, AGA22) 40" to 100" WC (red spring, AGA23)
	for SKP25.411U1 models	1.5 to 10 psi (standard, yellow spring, AGA22) 8.5 to 20 psi (red spring, AGA23)
	With air pressure loading for SKP25.4…	± 0.6" WC bias (black spring AGA28)
	models or zero governor	
	or for SKP25.611U1	0" to – 4" WC bias (white spring)
	Maximum sensing line pressure	20 psi
	Maximum sensing line vacuum	3 psi for SKP25.0… models
	Minimum sensing line diameter	1/4" inside diameter
	Minimum distance between sensing line and gas valve outlet	5 times the pipe diameter
	Minimum time required for high to low fire load changes	5 seconds
Auxiliary features	Proof of closure switch	Non-adjustable
	Setting range of auxiliary switch	40% to 100% of stroke
	Switch rating	6A/250 Vac resistive; 3A/120 Vac pilot duty

Operation

(See Figure 1)

Safety Shut-off Function

The electro-hydraulic actuator consists of a cylinder filled with oil, a piston containing an electric oscillating pump, and a relief system. When power is supplied to the actuator, the relief system closes, and the pump moves oil from the reservoir into the pressure chamber. This action causes the piston to move downward in the cylinder, opening the gas valve. When power to the actuator is interrupted, the relief system opens and the gas valve closes in less than 0.8 seconds.

A position indicator, visible through the transparent portion of the terminal cover, shows the entire stroke range of the actuator. A light, which is visible through the lower left transparent portion of the terminal cover, indicates when the actuator receives power. An optional, non-adjustable SPDT proof of closure over travel switch signals the closed position after the gas valve has closed. An optional SPDT auxiliary switch is adjustable between 40% and 100% of the stroke. The adjustment screw and scale are located on the right side in the terminal box, and are visible through the transparent portion of the terminal cover.

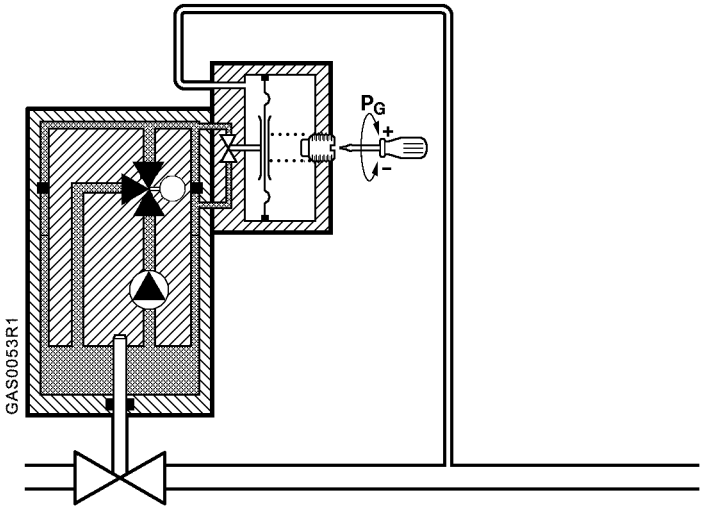


Figure 1. SKP25… Operation.

Regulating Function

The outlet gas pressure sensing line is connected to the pressure regulator housing. The outlet pressure acts on the regulator diaphragm. The diaphragm is opposed by an adjustable setpoint spring force, which represents the desired gas pressure value. The movement of the diaphragm modulates a hydraulic bypass valve connecting the pressure chamber to the hydraulic fluid reservoir. When the outlet gas pressure is lower than the desired value, the bypass valve is closed by the movement of the diaphragm, causing the actuator piston to open the gas valve. The opposite occurs when the outlet gas pressure is higher than the desired value; the diaphragm moves to open the bypass causing the actuator piston to close the gas valve. The movement of the actuator piston stops once the outlet gas pressure is equal to the setpoint. In this position the bypass valve is partially open so that the oil flow supplied by the pump is identical to the return flow. Unlike the conventional direct acting regulators, the SKP25… servo operated regulating system displays virtually zero droop (offset) across the turndown range.

Regulating Function, Continued

The SKP25.0… models may be applied as a 1:1 air/gas proportionator or as a zero governor. For either application, the standard spring has to be replaced with AGA28 spring, which allows sdjusting the bias between + 0.6" to –0.6" WC.

For proportionator operation, the air pressure sensing line must be connected to the port marked “AIR".

High bias model SKP25.611U1 is a 1:1 air/gas proportionator with a factory installed spring for 0” to -4.0” WC bias.

NOTES: 1. To avoid oscillation, do not oversize the VG… valve body. (See *Technical Instructions,* P/N 155-512P25.)

2. SKP25.4… models must not be used as proportionators.

Installation



WARNING:

- Personal injury or loss of life may occur if procedures are not followed as specified.
- All installations must be performed by qualified personnel only.
- Do not pull the actuator shaft.
- If minimum gas pressure detection is required, the pressure switch must be mounted upstream of the regulating gas valve to ensure sufficient gas pressure before starting the burner. If maximum gas pressure detection is required the pressure switch must be mounted downstream.
- The AGA66 gasket must be installed between the actuator and the gas valve body to provide NEMA 3, 3R, and 4 protection rating for VGG… and VGD… valves.
- The gas pressure sensing line must be at least 1/4-inch inside diameter.
- The gas pressure sensing line connection must be flush with the inner wall of the gas pipe in order to sense turbulence free pressure. The gas sensing line connection should be located at least five pipe diameters downstream of the valve, elbow, coupling, or other flow disturbing fitting. **Do not use the taps on the valve body for the gas sensing line connection since these locations typically have strong turbulence.** The pressure connection pipe should be as short as possible to allow the regulator to react to sudden changes.

Installation, Continued

- The SKP25… actuator is directly coupled to the VG… series valve body by four pre-mounted 4 mm Allen key screws.
- The square mounting flange can be rotated in steps of 90^{o} to provide four different mounting positions. The SKP25… actuator can be mounted in any position with the diaphragm vertical, except upside down.
- The actuator can be mounted or replaced while the valve body is under pressure.
- The SKP25… actuator has two knock-outs for the installation of 1/2”-14 NPSM conduit connections.
- When conduit routing is connected, flexible conduit must be used.
- Liquid tight conduit must be used in combination with AGA66 to provide NEMA 3, 3R, and 4 protection.
- The terminal marked GND, located above the wiring terminals, must be connected to the electrical ground.

NOTE: Wiring must meet all relevant electrical codes.

Start-up

Regulator

The gas outlet pressure setpoint adjustment screw is located in the center of the regulator cover. The SKP25.0… models are available with three interchangeable setpoint springs for an adjustable range of 0” to 100” WC The SKP25.411U… models are available with two interchangeable setpoint springs for an adjustable range of 1.5 to 20 psi. The bias for the SKP25.611U1 model is adjustable from 0 to 4.0" WC (See *Specifications* and Table 2). Clockwise rotation of the setpoint adjustment screw increases the outlet gas pressure. The hexagonal cap must be tightened after the setpoint screw has been adjusted and may be sealed from tampering by means of a wire and lead seal.

WARNING:

When firing at maximum burner capacity, ensure that the SKP25… /VG… is not in the fully open position. If this is the case, either the gas valve is sized too small or the gas supply pressure is too low.

Wiring and Switch Adjustment

(See *Terminal Designations*)

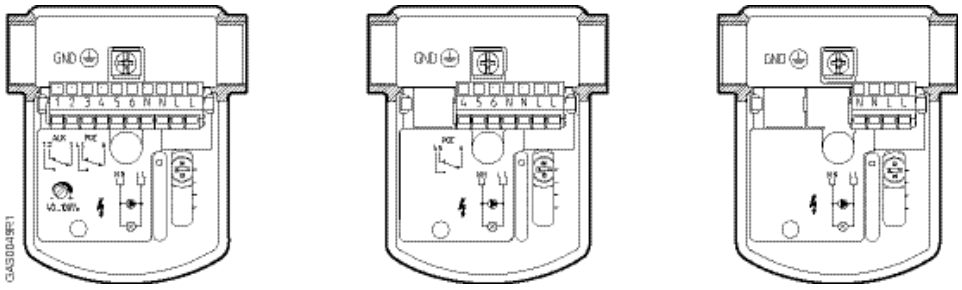
- The actuator is equipped with spring-loaded terminals for 14 AWG wires.
- The actuator has two line and two neutral terminals.
- Insert one wire into the opening of the terminal while pressing the lever downward with a screwdriver or hard object. Make sure that all strands insert into the opening.
- Adjust the auxiliary switch (if provided) according to the wiring diagram on the label below the terminals (see Figure 2). The adjustment screw and scale are located on the right side of the terminal box, and are visible through the transparent portion of the terminal cover.

NOTES:
1. The auxiliary switch is adjustable between 40% and 100% of the stroke. The factory setting is at 40%.
2. The auxiliary switch must not be used for proof of closure detection or other safety interlock functions.
3. The Proof of Closure Switch is non-adjustable.

Service

There are no serviceable parts on the SKP25… series actuators. If inoperative, replace the actuator. Tag wires before servicing.

Terminal Designations



SKP25.012U.. SKP25.011U.. SKP25.013U..

Figure 2. Terminal Designations.

Dimensions

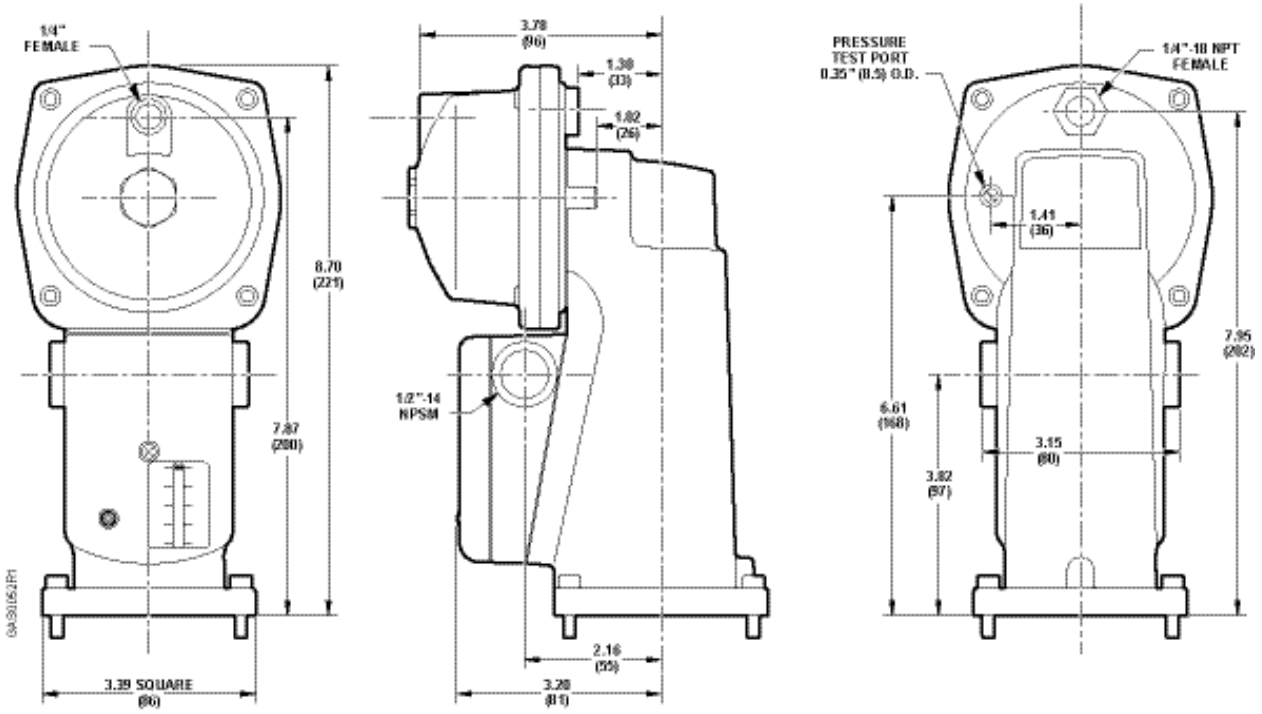


Figure 3. SKP25…U.. Dimensions in Inches, Millimeters in Parentheses.

SCC Inc.

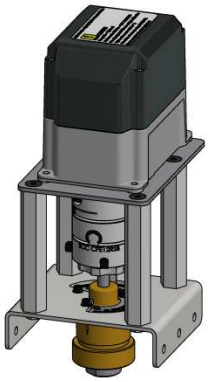
Technical Instructions

Document No. VA-4000

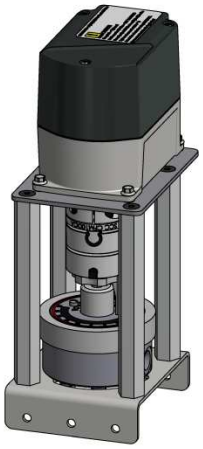
August 4, 2014

VA Series

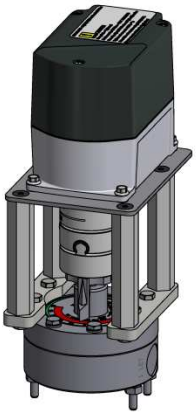
VA… Valve Actuator Assemblies with Hauck Oil Valves



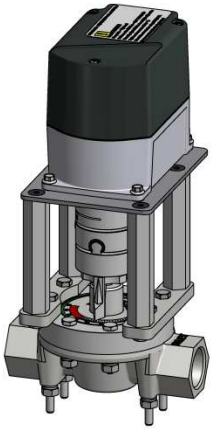
S Series



AS Series



B & F Series



G & K Series

Description

VA… valve actuator assemblies include a Siemens SQM… actuator reliably mounted to a Hauck oil valve.

Features

- Engineered for precise shaft alignment with less actuator wear
- Valve assemblies with S, AS, B, F, G, and K series Hauck valves available
- Valve assembly includes Siemens SQM33, SQM45, or SQM48 actuator
- Rigid and robust design

Application

VA… valve actuator assemblies mount an SQM33, SQM45, or SQM48 actuator to a Hauck oil valve. A variety of Hauck oil valves are available to accommodate a wide range of flow rates and applications. The Hauck oil valve and SQM… actuator are rigidly mounted with Siemens engineered brackets and couplings to ensure precise shaft alignment.

Product Part Numbers

Table 1 lists available VA… assembly part numbers including an SQM33 actuator. Technical instructions (N7813) for SQM33 actuators are available at www.scccombustion.com.

Table 1: Available VA… Assemblies Using an SQM33 Actuator

Part Number	Description
VA33-S33	SQM33.550A9 to S-3-3 Hauck oil valve
VA33-S35	SQM33.550A9 to S-3-5 Hauck oil valve
VA33-S37	SQM33.550A9 to S-3-7 Hauck oil valve
VA33-S39	SQM33.550A9 to S-3-9 Hauck oil valve
VA33-S311	SQM33.550A9 to S-3-11 Hauck oil valve
VA33-S313	SQM33.550A9 to S-3-13 Hauck oil valve
VA33-S31610	SQM33.550A9 to S-3-1610 Hauck oil valve
VA33-AS33	SQM33.550A9 to AS-3-3 Hauck oil valve
VA33-AS35	SQM33.550A9 to AS-3-5 Hauck oil valve
VA33-AS37	SQM33.550A9 to AS-3-7 Hauck oil valve
VA33-AS39	SQM33.550A9 to AS-3-9 Hauck oil valve
VA33-AS311	SQM33.550A9 to AS-3-11 Hauck oil valve

Table 2 lists available VA… assembly part numbers including an SQM45 actuator. Technical instructions (N7814) for SQM45 actuators are available at www.scccombustion.com.

Table 2: Available VA… Assemblies Using an SQM45 Actuator

Part Number	Description
VA45.2-S33	SQM45.295A9 to S-3-3 Hauck oil valve
VA45.2-S35	SQM45.295A9 to S-3-5 Hauck oil valve
VA45.2-S37	SQM45.295A9 to S-3-7 Hauck oil valve
VA45.2-S39	SQM45.295A9 to S-3-9 Hauck oil valve
VA45.2-S311	SQM45.295A9 to S-3-11 Hauck oil valve
VA45.2-S313	SQM45.295A9 to S-3-13 Hauck oil valve
VA45.2-S31610	SQM45.295A9 to S-3-1610 Hauck oil valve
VA45.2-AS33	SQM45.295A9 to AS-3-3 Hauck oil valve
VA45.2-AS35	SQM45.295A9 to AS-3-5 Hauck oil valve
VA45.2-AS37	SQM45.295A9 to AS-3-7 Hauck oil valve
VA45.2-AS39	SQM45.295A9 to AS-3-9 Hauck oil valve
VA45.2-AS311	SQM45.295A9 to AS-3-11 Hauck oil valve

Product Part Numbers (continued)

Table 3 lists available VA… assembly part numbers including an SQM48 actuator. Technical instructions (N7814) for SQM48 actuators are available at www.scccombustion.com.

Table 3: Available VA… Assemblies Using an SQM48 Actuator

Part Number	Description
VA48.4-S33	SQM48.497A9 to S-3-3 Hauck oil valve
VA48.4-S35	SQM48.497A9 to S-3-5 Hauck oil valve
VA48.4-S37	SQM48.497A9 to S-3-7 Hauck oil valve
VA48.4-S39	SQM48.497A9 to S-3-9 Hauck oil valve
VA48.4-S311	SQM48.497A9 to S-3-11 Hauck oil valve
VA48.4-S313	SQM48.497A9 to S-3-13 Hauck oil valve
VA48.4-S31610	SQM48.497A9 to S-3-1610 Hauck oil valve
VA48.4-AS33	SQM48.497A9 to AS-3-3 Hauck oil valve
VA48.4-AS35	SQM48.497A9 to AS-3-5 Hauck oil valve
VA48.4-AS37	SQM48.497A9 to AS-3-7 Hauck oil valve
VA48.4-AS39	SQM48.497A9 to AS-3-9 Hauck oil valve
VA48.4-AS311	SQM48.497A9 to AS-3-11 Hauck oil valve
VA48.4-B.5-12	SQM48.497A9 to B-1/2-12 Hauck oil valve
VA48.4-B.5-16	SQM48.497A9 to B-1/2-16 Hauck oil valve
VA48.4-B.5-18	SQM48.497A9 to B-1/2-18 Hauck oil valve
VA48.4-B.5-20	SQM48.497A9 to B-1/2-20 Hauck oil valve
VA48.4-B.5-24	SQM48.497A9 to B-1/2-24 Hauck oil valve
VA48.4-F.5-16	SQM48.497A9 to F-1/2-16 Hauck oil valve
VA48.4-F.5-18	SQM48.497A9 to F-1/2-18 Hauck oil valve
VA48.4-F.5-20	SQM48.497A9 to F-1/2-20 Hauck oil valve
VA48.4-F.5-24	SQM48.497A9 to F-1/2-24 Hauck oil valve
VA48.4-G-1.0-29	SQM48.497A9 to G-1-29 Hauck oil valve
VA48.4-K-1.0-29	SQM48.497A9 to K-1-29 Hauck oil valve
VA48.4-K-1.0-38	SQM48.497A9 to K-1-38 Hauck oil valve

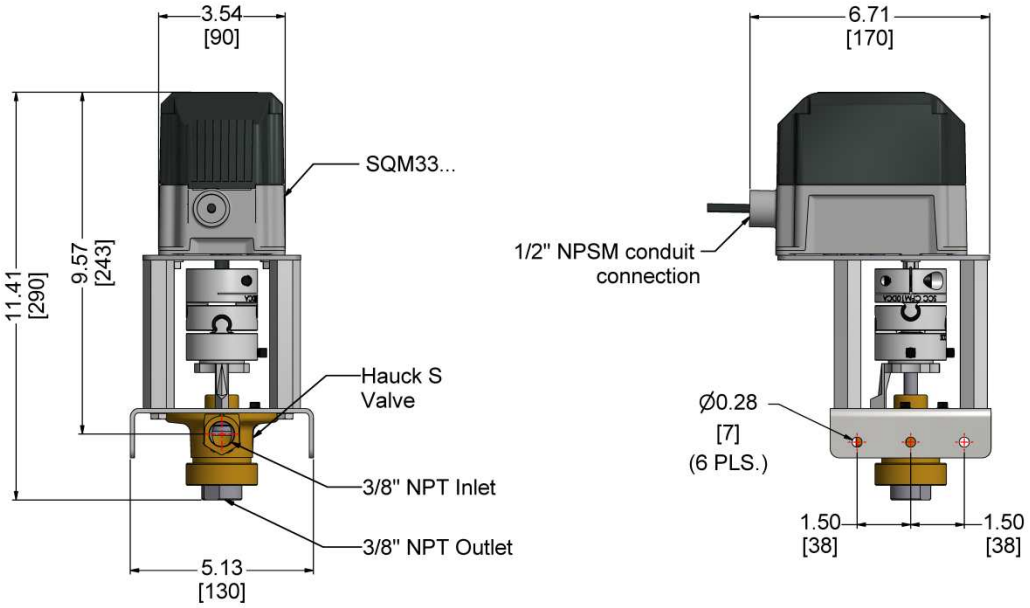
Installation

- Assembly may be mounted in any position except upside down.
- Valve position indicator shows valve position after installation.
- Assembly ships with the set screws on the coupling loose. Once light off position has been established, tighten the set screws to 160 in-lb.

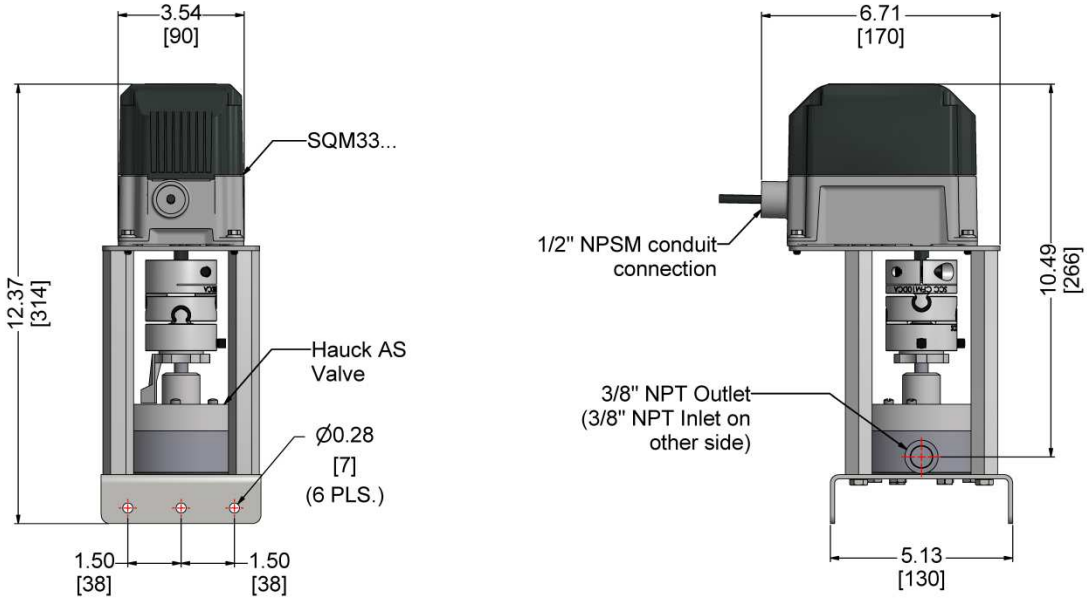
Dimensions

Dimensions in inches; millimeters in brackets

VA33… Assemblies Including a Hauck S Series Valve



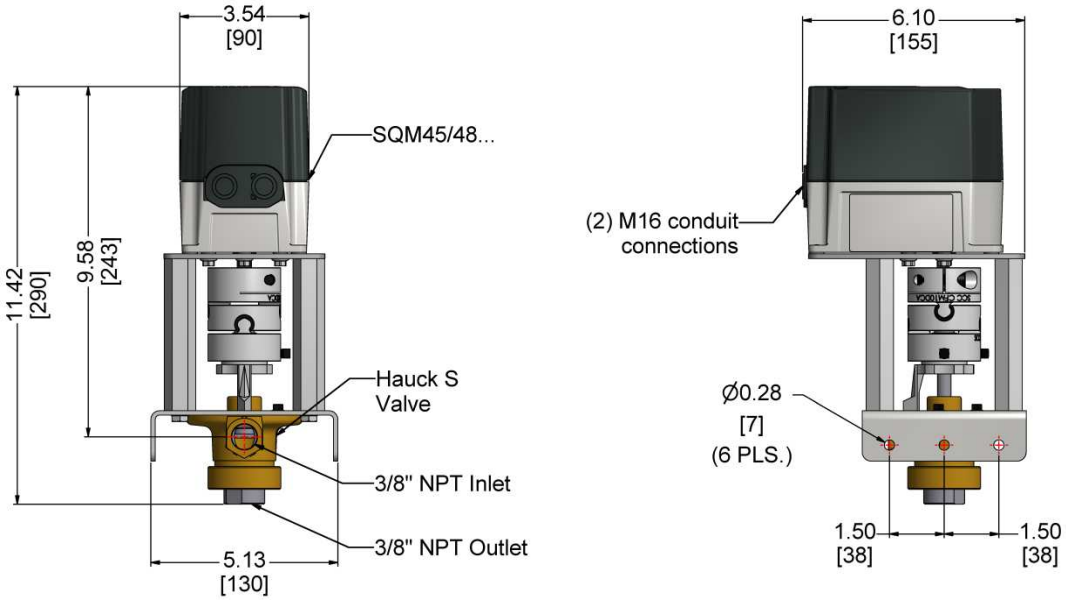
VA33… Assemblies Including a Hauck AS Series Valve



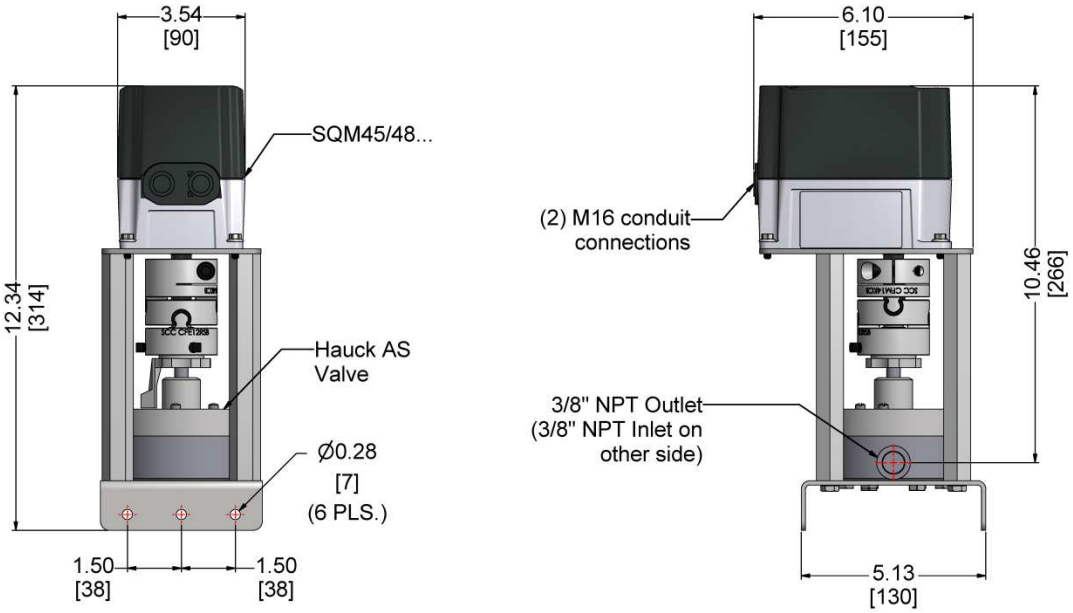
Dimensions (continued)

Dimensions in inches; millimeters in brackets

VA45… and VA48… Assemblies Including a Hauck S Series Valve



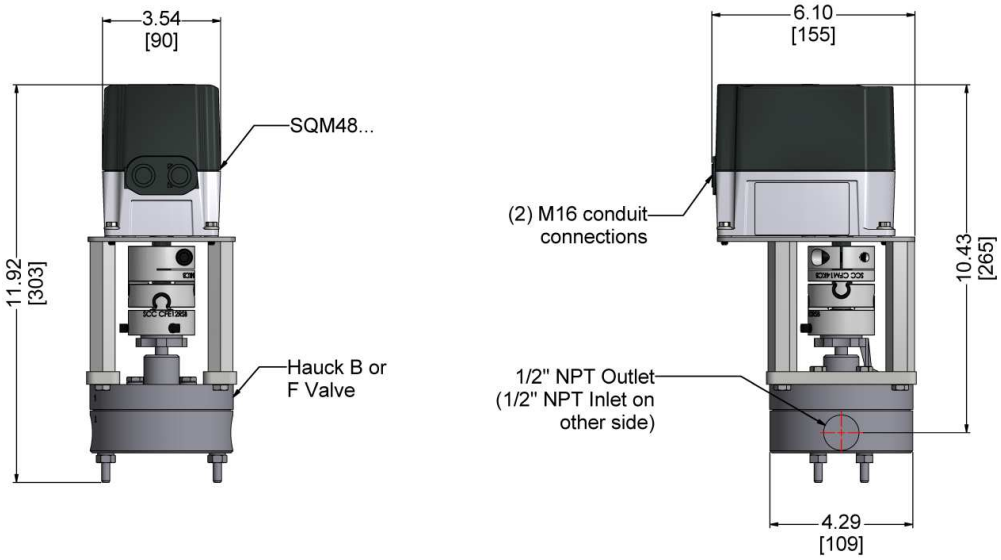
VA45… and VA48… Assemblies Including a Hauck AS Series Valve



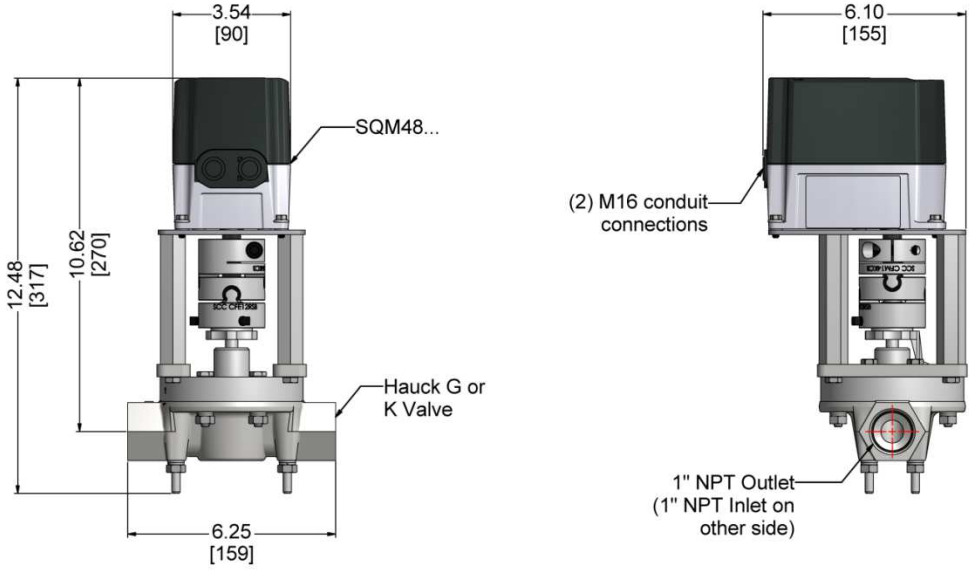
Dimensions (continued)

Dimensions in inches; millimeters in brackets

VA48… Assemblies Including a Hauck B or F Series Valve



VA48… Assemblies Including a Hauck G or K Series Valve



Information in this publication is based on current specifications. The company reserves the right to make changes in specifications and models as design improvements are introduced. Product or company names mentioned herein may be the trademarks of their respective owners. © 2009 SCC Inc.

SCC Inc.

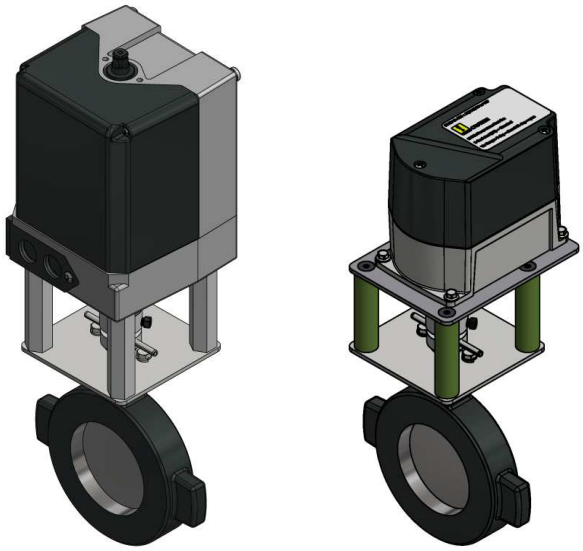
Technical Instructions

Document No. VA-3000

May 20, 2014

VA Series

VA…VKF Valve Actuator Assemblies with VKF Butterfly Valves



Description

VA…VKF valve actuator assemblies include a Siemens SQM… actuator reliably mounted to a VKF… butterfly valve.

Features

- Engineered for precise shaft alignment with less actuator wear
- High temperature VA…HT versions for FGR or hot air up to 550°F
- Biogas VA…B versions for corrosive gases such as biogas
- Rigid and robust design
- VKF valve sizes from 1-1/2” to 8”
- Includes Siemens SQM33, SQM40, SQM45, SQM48, or SQM5 actuator

Application

VA…VKF valve actuator assemblies mount an SQM33, SQM40, SQM45, SQM48, or SQM5 actuator to a VKF… butterfly valve. The VKF… valve and SQM… actuator are rigidly mounted with Siemens engineered brackets and couplings to ensure precise shaft alignment. VKF technical instructions (CVLV-1000) provide sizing and additional valve information.

Product Part Numbers

The following chart provides VA…VKF assembly part number identification including an SQM33, SQM40, SQM45, or SQM48 actuator. Technical instructions for SQM33 (N7813), SQM40 (N7817), or SQM45/48 (N7814) actuators are available at www.scccombustion.com.

VA 48.4 - 2.0 VKF - HT

Valve Actuator Assembly

Actuator

33	= SQM33.550A9 (stepper, for use with LMV3…)
40.1	= SQM40.145... (15sec, modulating)
40.16	= SQM40.165... (15sec, 3-position)
40.2	= SQM40.245… (30sec, modulating)
40.26	= SQM40.265… (30sec, 3-position)
45.2	= SQM45.295A9 (stepper, for use with LMV5…)
48.4	= SQM48.497A9 (stepper, for use with LMV5…)
48.6	= SQM48.697A9 (stepper, for use with LMV5…)

Voltage

Blank	= 120 Vac SQM40 or standard SQM33, SQM45, or SQM48
(220)	= 220 Vac (not available for SQM33, SQM45, or SQM48 actuators)

Valve Size

1.5	= 1-1/2" VKF41.40…
2.0	= 2" VKF41.50…
2.5	= 2-1/2" VKF41.65…
3.0	= 3" VKF41.80…
4.0	= 4" VKF41.100…
6.0	= 6" VKF41.150…
8.0	= 8" VKF41.200…

VKF Valve

Valve Type

Blank	= Standard VKF…C
B	= Biogas VKF…B
HT	= High-temp VKF…H

Product Part Numbers (continued)

The following chart provides VA…VKF assembly part number identification including an SQM50 actuator. Technical instructions for SQM5 (155-517) actuators are available at www.scccombustion.com.

VA 50 . 4 Z 7 - 4.0 VKF - - N4

Valve Actuator Assembly

Actuator

50 = SQM50
53 = SQM53
56 = SQM56

Torque / Timing

2 = 10Nm & 8sec for 90° stroke (SQM50 only)
3 = 15Nm & 12sec for 90° stroke (SQM50 only)
4 = 15Nm (SQM50) or 20Nm (SQM53) & 25sec for 90° stroke
5 = 30Nm & 37sec for 90° stroke (SQM56 only)
6 = 40Nm & 50sec for 90° stroke (SQM56 only)

Control Board

Blank = AGA56.41A... (4-20 mA input)
A = AGA56.1A97 (position proportional control)
H = AGA56.42A... (0-135 Ω input)
K = AGA56.43A... (0-10 Vdc input)
Z = AGA56.9... (all inputs/outputs)

Potentiometer

Blank = ASZ12.30 (1000Ω, 90°) on "G", "H", "K", or "Z" board; none on "A" board
3 = ASZ12.30 (1000Ω, 90°) on "A" board only
7 = ASZ22.30 (1000Ω/1000Ω, 90°)

Voltage

Blank = 120 Vac
(220) = 220 Vac

Valve Size

1.5 = 1-1/2" VKF41.40…
2.0 = 2" VKF41.50…
2.5 = 2-1/2" VKF41.65…
3.0 = 3" VKF41.80…
4.0 = 4" VKF41.100…
6.0 = 6" VKF41.150…
8.0 = 8" VKF41.200…

VKF Valve

Valve Type

Blank = Standard VKF…C
B = Biogas VKF…B
HT = High-temp VKF…H

Actuator NEMA Rating

Blank = NEMA 12
N4 = NEMA 4

Installation

- VKF… valves can accommodate flow in either direction. The VA…VKF assembly may be mounted in either direction for actuator wiring convenience.
- Assembly may be mounted in any position except upside down.
- Valve position indicator shows valve position after installation.

Dimensions

Dimensions in inches; millimeters in brackets

VA33…VKF Valve Actuator Assemblies

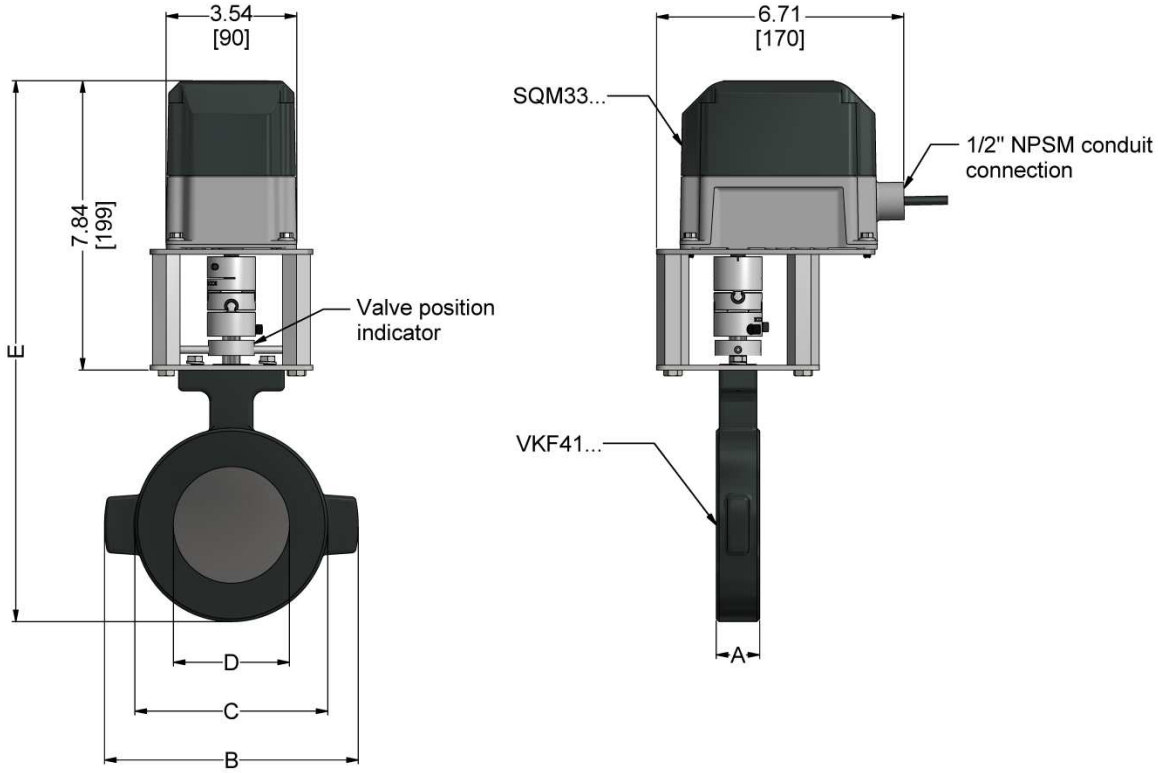


Table 1: VA33…VKF Dimensions

Valve Size	A	B	C	D	E
1-1/2”	1.18 [30]	5.12 [130]	3.43 [87]	1.57 [40]	12.97 [329]
2”	1.18 [30]	5.51 [140]	3.82 [97]	1.97 [50]	13.37 [340]
2-1/2”	1.18 [30]	6.30 [160]	4.61 [117]	2.56 [65]	14.06 [357]
3”	1.18 [30]	6.89 [175]	5.24 [133]	3.15 [80]	14.67 [373]
4”	1.18 [30]	7.68 [195]	6.02 [153]	3.94 [100]	15.45 [393]
6”	1.57 [40]	10.04 [255]	8.19 [208]	5.91 [150]	17.83 [453]
8”	1.57 [40]	12.20 [310]	10.35 [263]	7.87 [200]	19.90 [506]

Dimensions (continued)

Dimensions in inches; millimeters in brackets

VA40…VKF Valve Actuator Assemblies

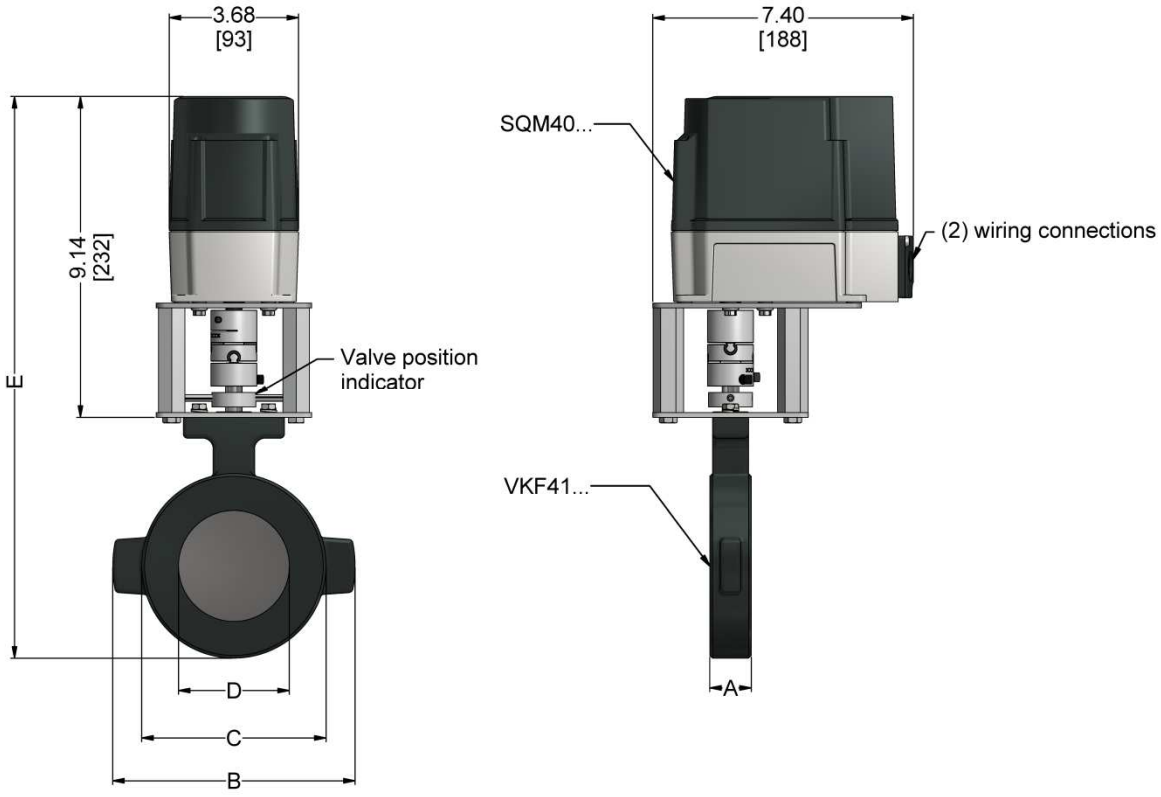


Table 2: VA40…VKF Dimensions

Valve Size	A	B	C	D	E
1-1/2”	1.18 [30]	5.12 [130]	3.43 [87]	1.57 [40]	14.27 [362]
2”	1.18 [30]	5.51 [140]	3.82 [97]	1.97 [50]	14.67 [373]
2-1/2”	1.18 [30]	6.30 [160]	4.61 [117]	2.56 [65]	15.36 [390]
3”	1.18 [30]	6.89 [175]	5.24 [133]	3.15 [80]	15.97 [406]
4”	1.18 [30]	7.68 [195]	6.02 [153]	3.94 [100]	16.75 [425]
6”	1.57 [40]	10.04 [255]	8.19 [208]	5.91 [150]	19.13 [486]
8”	1.57 [40]	12.20 [310]	10.35 [263]	7.87 [200]	21.20 [538]

Dimensions (continued)

Dimensions in inches; millimeters in brackets

VA45…VKF Valve Actuator Assemblies

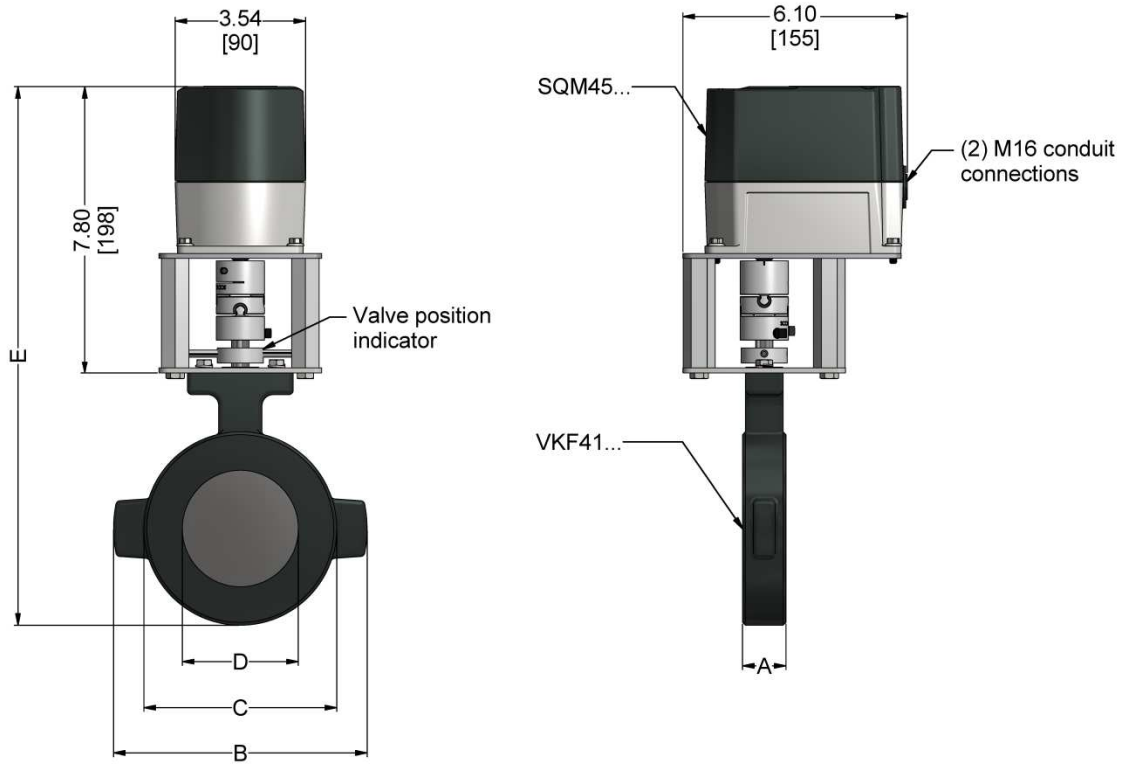


Table 3: VA45…VKF Dimensions

Valve Size	A	B	C	D	E
1-1/2”	1.18 [30]	5.12 [130]	3.43 [87]	1.57 [40]	12.93 [328]
2”	1.18 [30]	5.51 [140]	3.82 [97]	1.97 [50]	13.33 [339]
2-1/2”	1.18 [30]	6.30 [160]	4.61 [117]	2.56 [65]	14.02 [356]
3”	1.18 [30]	6.89 [175]	5.24 [133]	3.15 [80]	14.63 [372]
4”	1.18 [30]	7.68 [195]	6.02 [153]	3.94 [100]	15.41 [391]
6”	1.57 [40]	10.04 [255]	8.19 [208]	5.91 [150]	17.79 [452]
8”	1.57 [40]	12.20 [310]	10.35 [263]	7.87 [200]	19.86 [504]

Dimensions (continued)

Dimensions in inches; millimeters in brackets

VA48…VKF Valve Actuator Assemblies

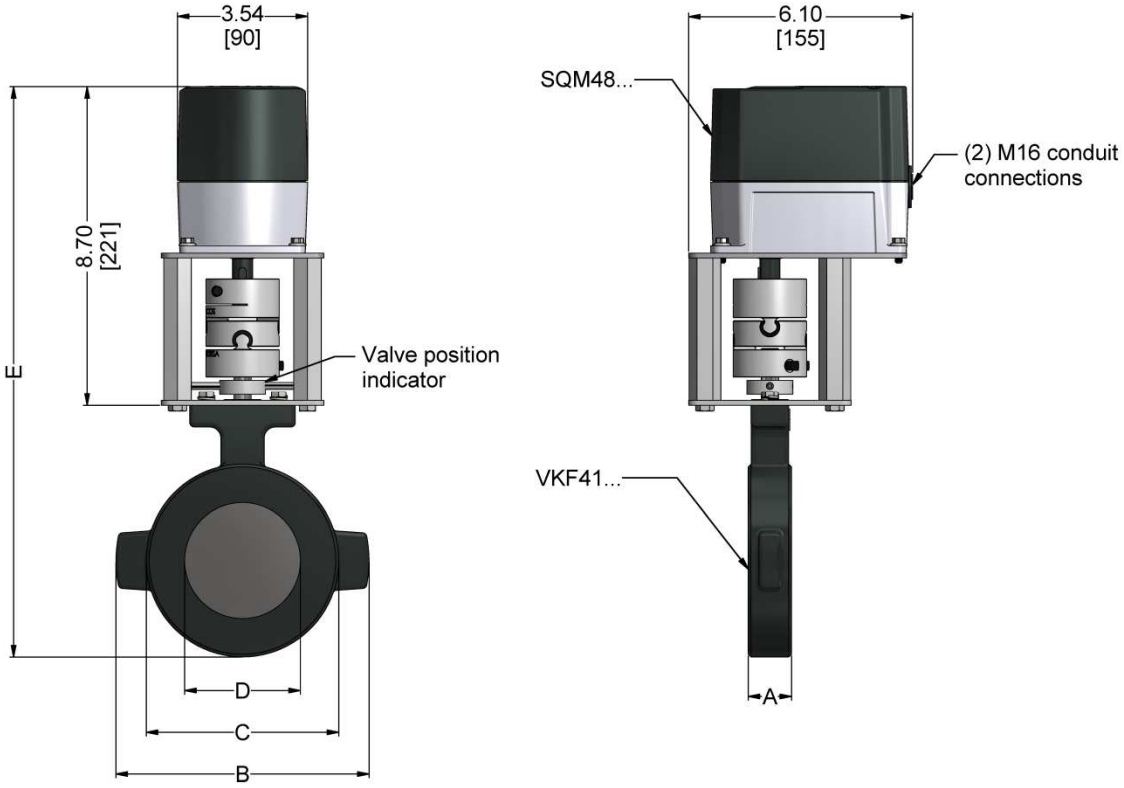


Table 4: VA48…VKF Dimensions

Valve Size	A	B	C	D	E
1-1/2”	1.18 [30]	5.12 [130]	3.43 [87]	1.57 [40]	13.83 [351]
2”	1.18 [30]	5.51 [140]	3.82 [97]	1.97 [50]	14.23 [361]
2-1/2”	1.18 [30]	6.30 [160]	4.61 [117]	2.56 [65]	14.92 [379]
3”	1.18 [30]	6.89 [175]	5.24 [133]	3.15 [80]	15.53 [394]
4”	1.18 [30]	7.68 [195]	6.02 [153]	3.94 [100]	16.31 [414]
6”	1.57 [40]	10.04 [255]	8.19 [208]	5.91 [150]	18.69 [475]
8”	1.57 [40]	12.20 [310]	10.35 [263]	7.87 [200]	20.76 [527]

Dimensions (continued)

Dimensions in inches; millimeters in brackets

VA50…VKF Valve Actuator Assemblies

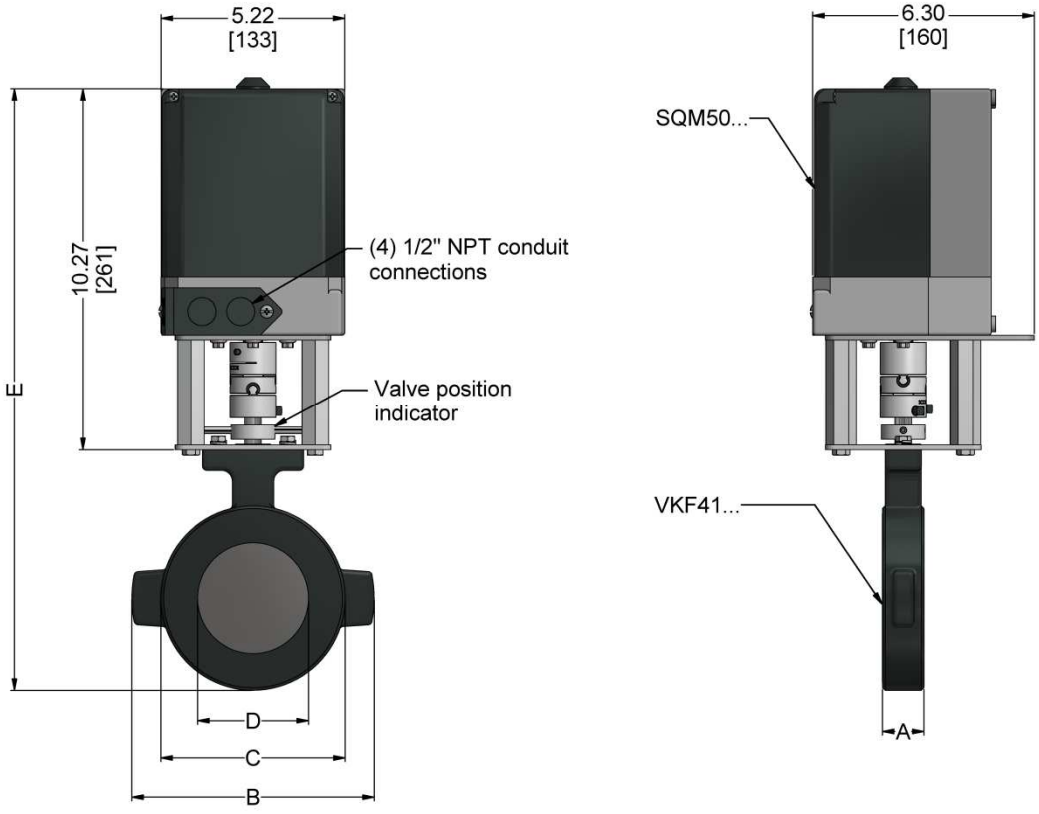


Table 5: VA50…VKF Dimensions

Valve Size	A	B	C	D	E
1-1/2”	1.18 [30]	5.12 [130]	3.43 [87]	1.57 [40]	15.40 [391]
2”	1.18 [30]	5.51 [140]	3.82 [97]	1.97 [50]	15.80 [401]
2-1/2”	1.18 [30]	6.30 [160]	4.61 [117]	2.56 [65]	16.49 [419]
3”	1.18 [30]	6.89 [175]	5.24 [133]	3.15 [80]	17.10 [434]
4”	1.18 [30]	7.68 [195]	6.02 [153]	3.94 [100]	17.88 [454]
6”	1.57 [40]	10.04 [255]	8.19 [208]	5.91 [150]	20.26 [515]
8”	1.57 [40]	12.20 [310]	10.35 [263]	7.87 [200]	22.33 [567]

Dimensions (continued)

Dimensions in inches; millimeters in brackets

VA53…VKF and VA56…VKF Valve Actuator Assemblies

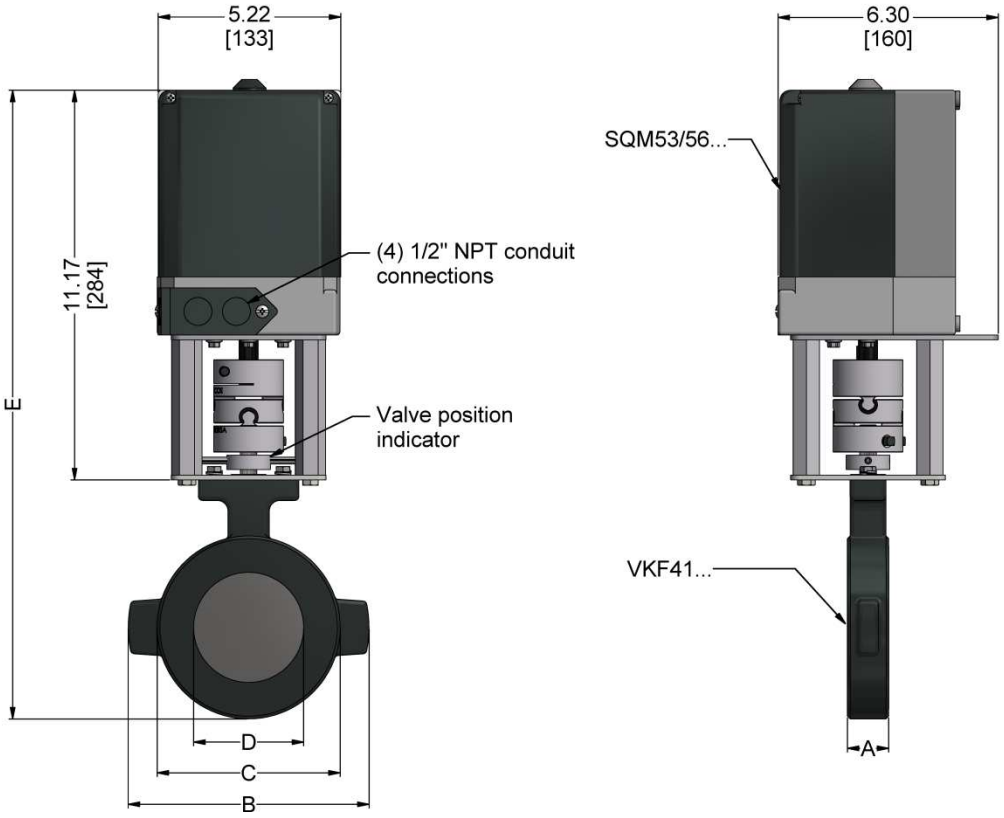


Table 6: VA53…VKF and VA56…VKF Dimensions

Valve Size	A	B	C	D	E
1-1/2”	1.18 [30]	5.12 [130]	3.43 [87]	1.57 [40]	16.30 [414]
2”	1.18 [30]	5.51 [140]	3.82 [97]	1.97 [50]	16.70 [424]
2-1/2”	1.18 [30]	6.30 [160]	4.61 [117]	2.56 [65]	17.39 [442]
3”	1.18 [30]	6.89 [175]	5.24 [133]	3.15 [80]	18.00 [457]
4”	1.18 [30]	7.68 [195]	6.02 [153]	3.94 [100]	18.78 [477]
6”	1.57 [40]	10.04 [255]	8.19 [208]	5.91 [150]	21.16 [537]
8”	1.57 [40]	12.20 [310]	10.35 [263]	7.87 [200]	23.23 [590]

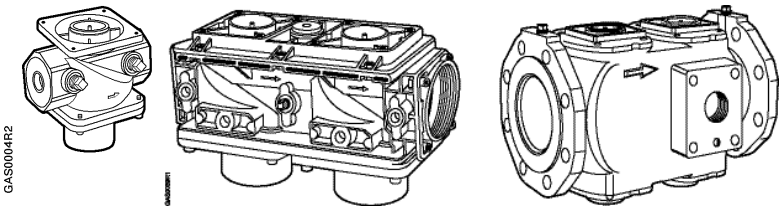
Information in this publication is based on current specifications. The company reserves the right to make changes in specifications and models as design improvements are introduced. Product or company names mentioned herein may be the trademarks of their respective owners. © 2009 SCC Inc.

SIEMENS

Technical Instructions
Document No. 155-512P25
VG…
August 1, 2012

VG Series

VGG… and VGD… Gas Valves for use with SKP… Electro-hydraulic Actuators



VGG… **VGD20…** **VGD40…**

GAS0001R2

ISO 9000 and 14000
REGISTERED FIRM

LISTED

APPROVED

Only when assembled to Series SKP… actuators

Description

The normally closed VG… Series of modular single and double-body gas valves combined with SKP… Series electro-hydraulic actuators provide safety shut-off, gas pressure regulation and air/gas ratio control for commercial and industrial gas burners.

Table 1. Legend.

Model Numbers	Body Style	Connection
VGG…	Single	NPT Threaded
VGD…	Double	NPT Threaded or ANSI Flanged

Features

All Models

- UL listed, FM approved, CSA certified, IRI approvable, ISO 9001 and 14000 certified. European, Australian and Japanese approved versions available.
- Stainless steel mesh inlet filter protects the valve seat(s) as well as downstream components.
- 1/4-inch NPT pressure taps on the inlet and outlet. (See Table 2 for details).
- Dual stem guides ensure precise disc alignment and tight shut-off.

VGG… Models

- Contoured valve disc provides smooth release of gas and stable regulating control.
- 3/4-inch NPT port for pilot or vent line connection on 2-1/2 and 3-inch VGG…valves.

VGD20… Models

- Compact VGD20… double-valve bodies consist of two safety shut-off valves in series. The first (inlet) valve has a flat valve disc applicable for safety shut-off function only. The second (outlet) valve has a contoured valve disc for use with pressure regulating actuators (SKP2…, SKP5…, SKP7…).
- A 1-inch NPT vent connection between the valves.
- Each VGD20… double-valve requires two threaded mounting flanges (AGAxxU). Each flange includes the necessary installation hardware (bolts, nuts and O-ring). Each mounting flange has a 1/4-inch NPT pressure tap. The flanges can be pre-mounted onto the pipe, and then bolted onto the VGD20… gas valve body. This feature eliminates the use of pipe unions and permits the gas valve assembly to be easily removed from a gas train.
- The overall dimensions of both the 1-1/2-inch and 2-inch AGAxxU flanges are identical. This permits a 1-1/2-inch flange to be mounted on a 2-inch valve body or vice versa.

NOTE: VGD20… valves and AGAxxU threaded flanges must be ordered as separate items (See Table 2).

VGD40… Models

- Compact VGD40… double-valve bodies consist of two safety shut-off valves in series.
- Each individual safety shut-off valve has double seats to achieve high flow.
- Patented seat construction with individual closing spring for each seat to assure reliable shut-off and high close-off pressure rating.
- Full port vent line connection plates are available.

NOTE: VGD40… valves and AGA… vent connection plates must be ordered as separate items (See Table 2).

Application

All VG… valves can be combined with any SKP… Series actuator. The actuator can be mounted while the valve is installed and under pressure.

SKP… regulating actuators are applicable for both low and high supply gas pressure applications, eliminating excessive regulator inventories. Maximum pressure ratings vary with valve size (See Table 2).

All VG… valves perform these functions in combination with each of the following actuators:

SKP15…	Safety shut-off
SKP25…	Safety shut-off and constant pressure regulation or zero governor.
SKP55…	Safety shut-off, pressure regulation and differential pressure air/gas ratio control.
SKP75…	Safety shut-off, pressure regulation and adjustable air/gas ratio control.

Since more than one function can be performed by a single valve, fewer components and fittings are required to assemble a gas train - significantly reducing both the size and weight of the gas train. In addition, smaller diameter gas valves can be used. For details on valve sizing see the Flow Charts (Figures 5 and 6).



CAUTION:

Do not oversize valves equipped with a regulating SKP… actuator. Oversizing may limit turndown and could cause oscillations.

Ordering Information

Gas valves and actuators are ordered separately. For additional SKP… actuator information, see the following Technical Instructions:

SKP15…	155-751P25
SKP25…	155-752P25
SKP55…	155-753P25
SKP75…	155-754P25

Accessories

Manual adjusting throttle attachment AGA61 permits VG… series valves to be used as adjustable limiting orifice valves. Once adjusted, the AGA61 has a provision to be sealed from tampering (See Table 3).

Adapter plate AGA60 permits VG… series valves to be used for modulating flow control when fitted with an SQX… series modulating actuator (See Table 3).

NOTE: The VG… /SQX… valve/actuator combination is designed strictly for modulating flow control and does not provide safety shut-off function.

Table 2. Product Numbers.

Product Number	Product Number (with stroke limiter)	Size	Maximum Operating Pressure psi	Close-off Pressure psi	Capacity CFH Natural Gas at ΔP=1" W.C.	Number of Test Points, 1/4" NPT		Valve Body Material
						Inlet	Outlet	
VGG10.154U	VGG10.1541U	1/2" NPT	20	75	327/242◆	2	2	Aluminum
VGG10.204U	VGG10.2041U	3/4" NPT	20	75	614/442◆	2	2	Aluminum
VGG10.254U	VGG10.2541U	1" NPT	20	75	914/686◆	2	2	Aluminum
VGG10.404U	VGG10.4041U	1-1/2" NPT	20	75	2,047/1,643◆	2	2	Aluminum
VGG10.504U	VGG10.5041U	2" NPT	15	75	3,511	2	2	Aluminum
VGG10.654U	VGG10.6541U	2-1/2" NPT	10	25	5,085	1	1	Cast Iron
VGG10.804U	VGG10.8041U	3" NPT	10	25	6,158	1	1	Cast Iron
*VGD20.403U		1-1/2"	20	30	1,890	Two 1/4-inch and one 1-inch port between valves		Aluminum
*VGD20.503U		2"	15	30	2,300			Aluminum
*AGA41U	Single 1-1/2" connecting flange with 1/4-inch port for VGD 20.403U							Two (2) needed per valve. Order separately
*AGA51U	Single 2" connecting flange with 1/4-inch port for VGD 20.503U							
VGD40.065U		2-1/2" NPT	10	75	3,880	1	1	Aluminum
VGD40.080U		3" NPT	10	75	5,370	1	1	Aluminum
VGD40.100U		4" Flanged	10	30	9,680	1	1	Aluminum
VGD40.150U		6" Flanged	10	30	17,490	1	1	Aluminum

* VGD20… double valves require 2 AGAxxU threaded flanges for installation.

◆ VGG… valves, 1/2- through 1-1/2 inch have reduced flow when used with AGA66 (NEMA 4 kit). Capacities shown are without/with NEMA 4 kit (See Figure 4a).

Table 3. Accessories.

Part Number	Description	Notes
AGA40.6580U	Vent connection plate with 1-1/4" NPT vent connection and 1/4" NPT test port	Order separately. For use with VGD40… only.
AGA40.0100U	Vent connection plate with 2" NPT vent connection and 1/4" NPT test port	
AGA40.0150U	Vent connection plate with 2-1/2" NPT vent connection and 1/4" NPT test port	
AGA60	Adapter for use with SQX… actuators	
AGA61	Manual operation kit, allows VG… valves to be used as adjustable limiting orifice valve.	
AGA66	Sealing gasket to provide NEMA 3, NEMA 3R, and NEMA 4 protection.	

Specifications

Approvals	Agency approvals/standards	UL/429, FM/7400, CSA/AINSI Z21.21/CGA 6.5 Commercial/Industrial IRI approvable Agency marks apply only for VGxxx.xxxU series gas valve bodies assembled with SKPxx.xxxU actuators.
Operating Environment	Maximum operating pressure	See Table 2
	Maximum back pressure (differential)	2.5 psi (150 mbar)
	Close-off pressure	See Table 2
	Permissible gases	Natural gas, propane, butane, air, and other non-corrosive gases.
	Permissible gas temperature	5°F to 140°F (-15°C to 60°C)
	Permissible operating temperature	5°F to 140°F (-15°C to 60°C)
	Mounting	Any position except upside down
Physical Characteristics	Body materials	See Table 2
	Weight	See Tables 4 through 7
Connections	Pipe connections	NPT or ANSI Class 150 flange (See Table 2)
	Pressure and vent taps	See Table 2

Operation

All VG… gas valves are normally closed, two-way valves. The valves have a standard, integral, stainless steel mesh filter (0.8 mm) in the inlet to protect the downstream components against contamination.

VGG… series gas valves have a contoured valve disc for stable regulating control and smooth release of gas (see Figure 1). VGG10.xx41U series gas valves have a stroke limiter.

VGD20… double valves consist of two valves in series. The first (inlet) valve has a flat valve disc suitable for the safety shut-off function only. The second (outlet) valve has a contoured valve disc for stable regulating control and smooth release of gas (see Figure 2).

VGD40… double valves consist of two valves in series. Each valve has a double seat to achieve high flow (see Figure 3).

All valves have 1/4-inch NPT ports for pressure test connection. The 2-1/2-inch and 3-inch VGG… valves have an additional 3/4-inch NPT port for a pilot connection. The VGD20… valves have a 1-inch NPT port for a vent line connection. The VGD40… valves can be equipped with a full size vent connection plate.

See Table 1 for details on ports and vent connection plates.

Operation, Continued

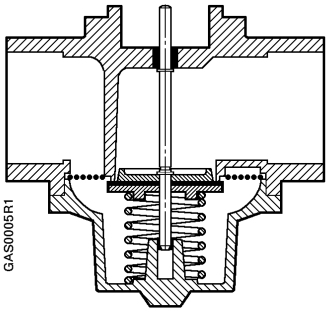


Figure 1. VGG… Models.

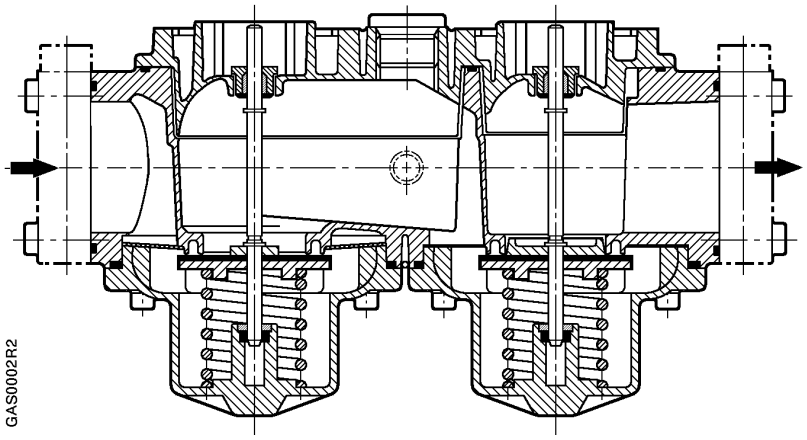


Figure 2. VGD20… Models.

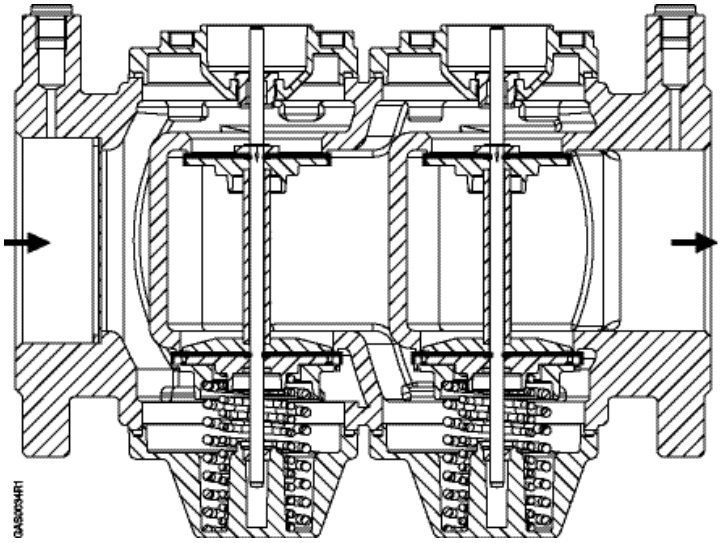


Figure 3. VGD40… Models.

Gas Flow Charts

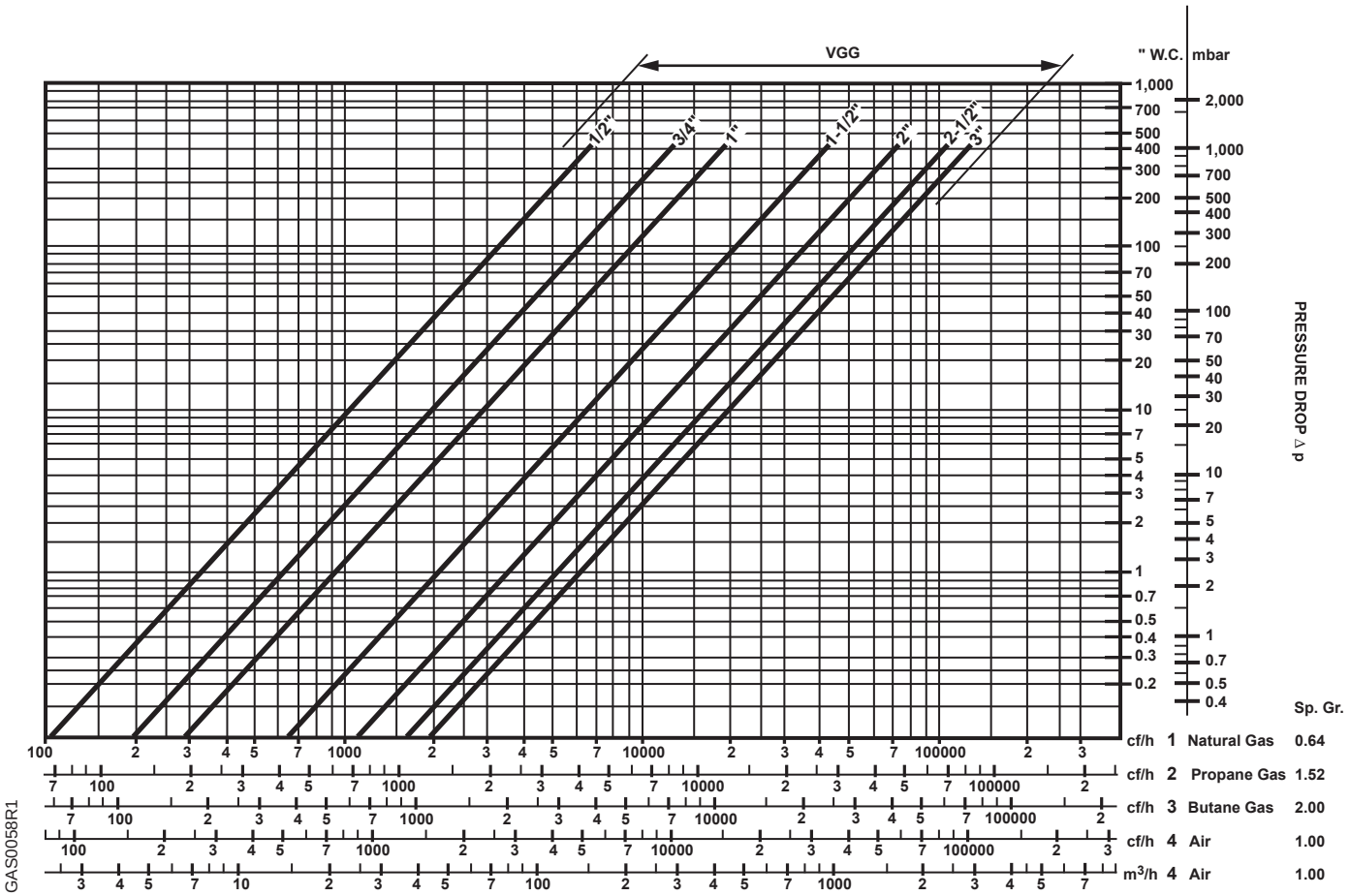


Figure 4. Sizing Single Valves Without NEMA 4 Kit.

NOTE: Pressure drop is for one valve when using an SKPx5…actuator without a NEMA 4 kit (AGA66).

CAUTION:

Do not oversize valves equipped with regulating actuators SKP2…, SKP5… or SKP7… Oversizing may limit turndown and could cause oscillations.

Gas Flow Charts, Continued

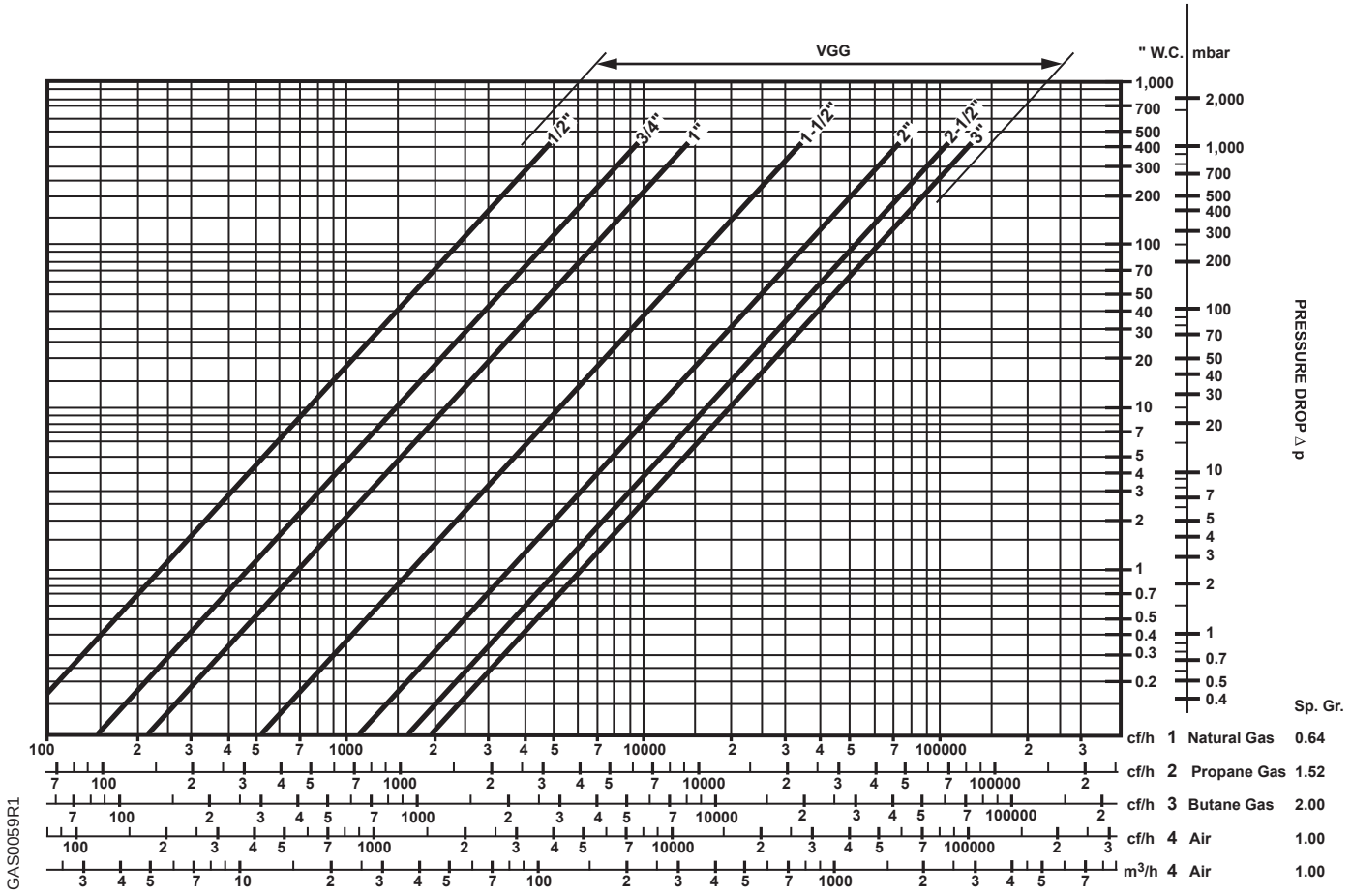


Figure 4a. Sizing Single Valves With a NEMA 4 Kit.

NOTE: Pressure drop is for one valve when using an SKPx5…actuator and a NEMA 4 kit (AGA66).

CAUTION:

Do not oversize valves equipped with regulating actuators SKP2…, SKP5… or SKP7… Oversizing may limit turndown and could cause oscillations.

Gas Flow Charts, Continued

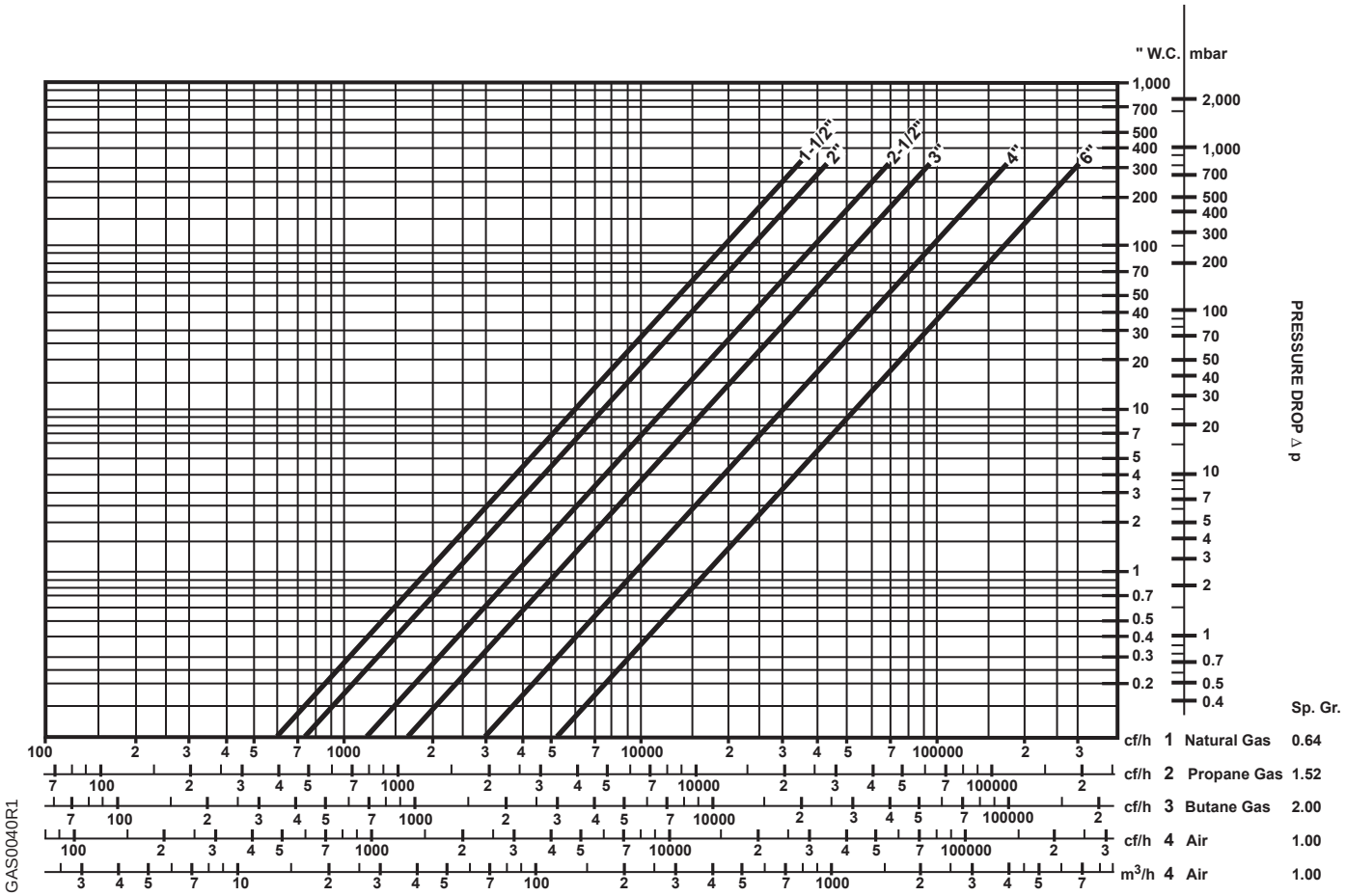


Figure 5. Sizing Double Valves.

NOTE: Pressure drop is total drop across both valves when using an SKPx5… actuator, with or without an AGA66.

CAUTION:

Do not oversize valves equipped with regulating actuators SKP2…, SKP5… or SKP7… Oversizing may limit turndown and could cause oscillations.

Dimensions

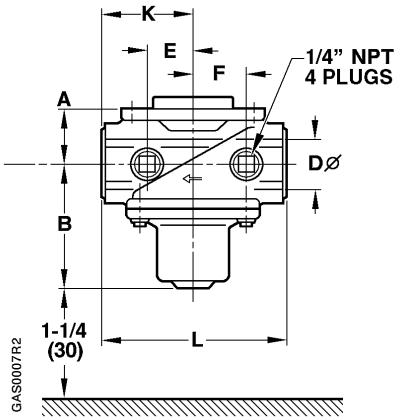


Table 4. VGG… Models.

Valve Model	Nominal Size D Inches	A Inches (mm)	B Inches (mm)	E Inches (mm)	F Inches (mm)	K Inches (mm)	L Inches (mm)	Weight Pounds (kg)
VGG…	1/2	1-1/4 (32)	3-1/8 (79)	1-1/8 (28)	1-7/32 (31)	2-3/16 (55)	4-3/8 (110)	1.65 (0.75)
	3/4	1-1/4 (32)	3-1/8 (79)	1-1/8 (28)	1-7/32 (31)	2-3/16 (55)	4-3/8 (110)	1.65 (0.75)
	1	1-1/4 (32)	3-18 (79)	1-1/8 (28)	1-7/32 (31)	2-3/16 (55)	4-3/8 (110)	1.5 (0.7)
	1-1/2	1-5/8 (41)	4 (102)	1-5/16 (34)	1-5/16 (34)	3 (75)	5-15/16 (150)	3.3 (1.5)
	2	2 (50)	4-1/4 (107)	1-5/16 (34)	1-5/16) (34)	3-3/8 (85)	6-3/4 (170)	4.0 (1.8)
	2-1/2	3-5/8 (92)	6-7/16 (163)	—	2-7/16 (62)	5-11/16 (145)	11-7/16 (290)	32.5 (14.8)
	3	3-15/16 (100)	6-7/16 (163)	—	2-7/16 (62)	6-1/16 (155)	12-3/16 (310)	34 (15.5)

Dimensions, Continued

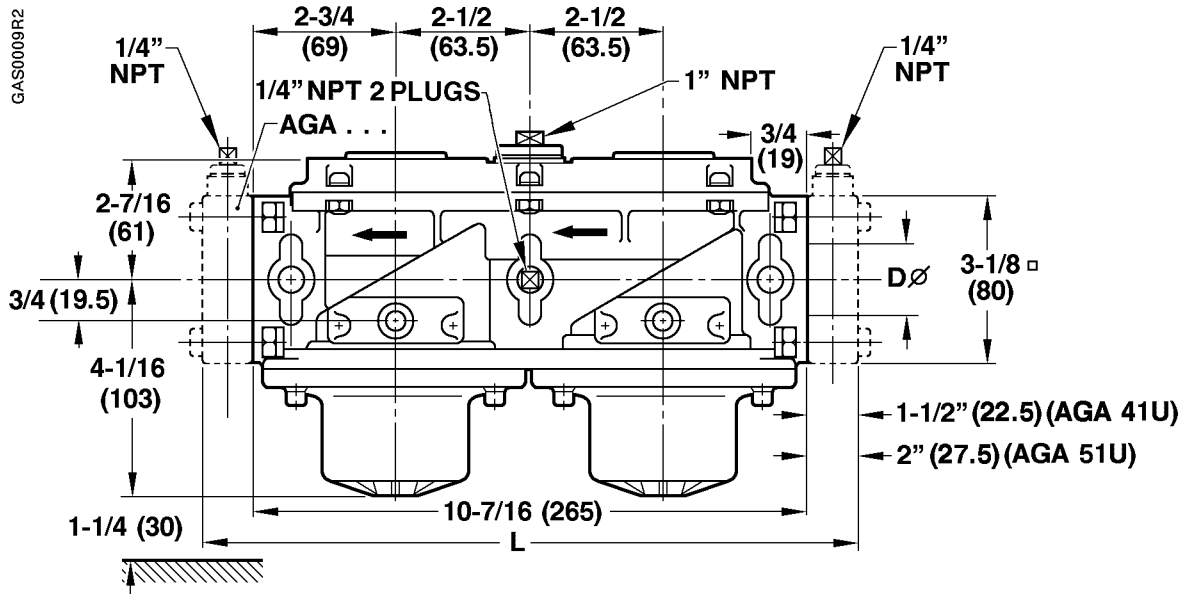


Table 5. VGD20... Models.

Valve Model	Nominal Size D Inches	L Inches (mm)	Weight Pounds (kg)
VGD20...	1-1/2	12-3/16 (310)	7 (3.2)
	2	12-5/8 (320)	6 (3.15)

Dimensions, Continued

Dimensions in Inches (mm)

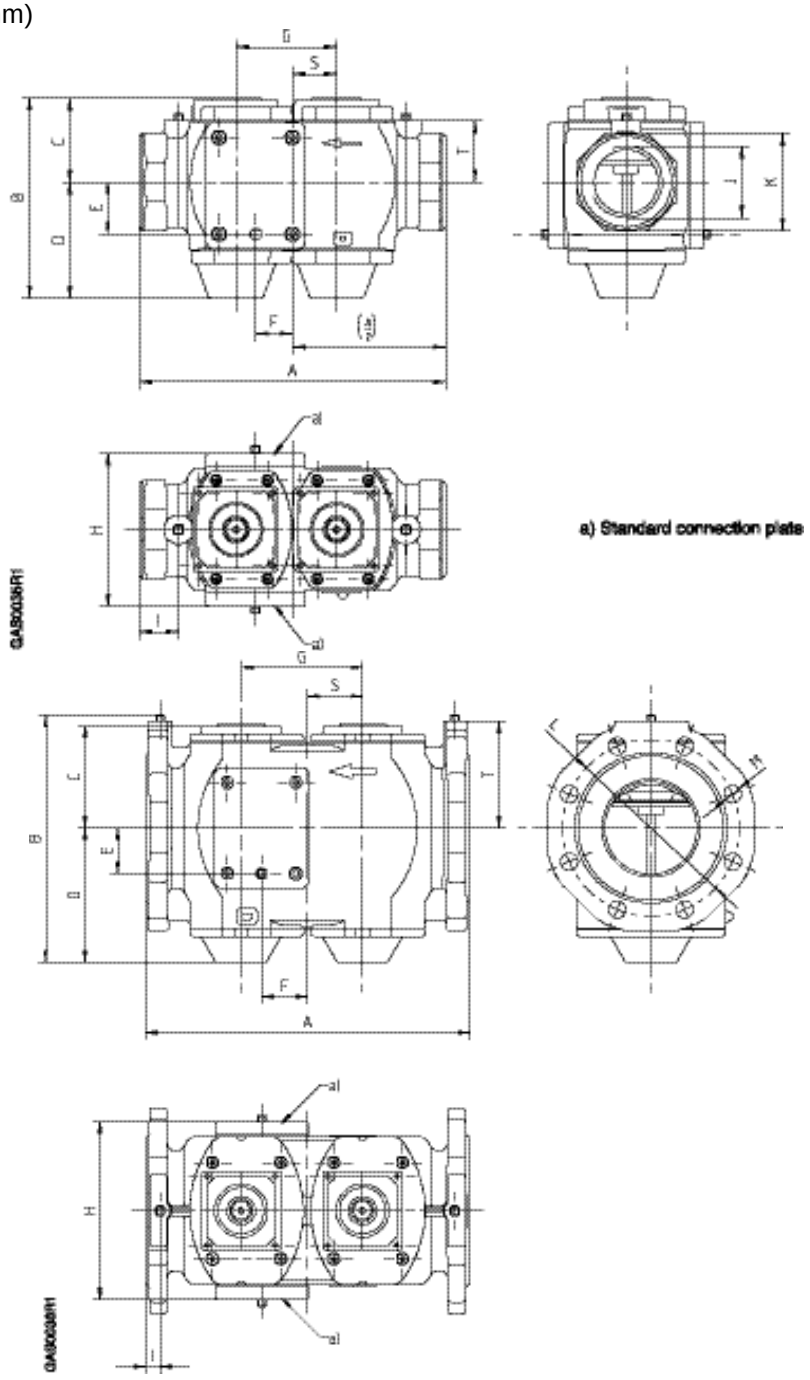


Table 6. VGD40… Models.

Valve Model	A	B	C	D	E	F	G	H	I	J	K *	L	M	S	T
VGD40.065U	12.09 (307)	7.00 (203)	3.25 (83)	4.63 (118)	2.09 (53)	1.46 (37)	4.02 (102)	6.14 (156)	1.57 (40)	2-1/2" NPT	SW 100	—	—	1.77 (45)	2.44 (62)
VGD40.080U	12.87 (327)	8.94 (227)	3.64 (93)	5.18 (132)	1.85 (47)	0.79 (20)	4.21 (107)	6.30 (160)	1.85 (47)	3" NPT	SW 120	—	—	2.34 (60)	2.83 (72)
VGD40.100U	13.78 (350)	10.50 (267)	4.33 (110)	5.70 (145)	1.93 (49)	1.95 (50)	5.16 (131)	7.56 (192)	0.63 (16)	—	—	d=7.50 (191)	d=0.75 (19)	2.34 (60)	4.55 (116)
VGD40.150U	18.90 (480)	13.29 (338)	5.71 (145)	7.40 (188)	2.09 (53)	2.30 (59)	6.61 (168)	10.31 (262)	0.63 (16)	—	—	d=9.49 (241)	d=0.91 (23)	3.54 (90)	5.61 (143)

* Spanner width in millimeters

Dimensions, Continued

Option a) Connection plate with 1/4" NPT plugged pressure test port
b) Vent connection plate with vent line connection and 1/4" NPT plugged pressure test port

Note: Plates a) and b) are interchangeable

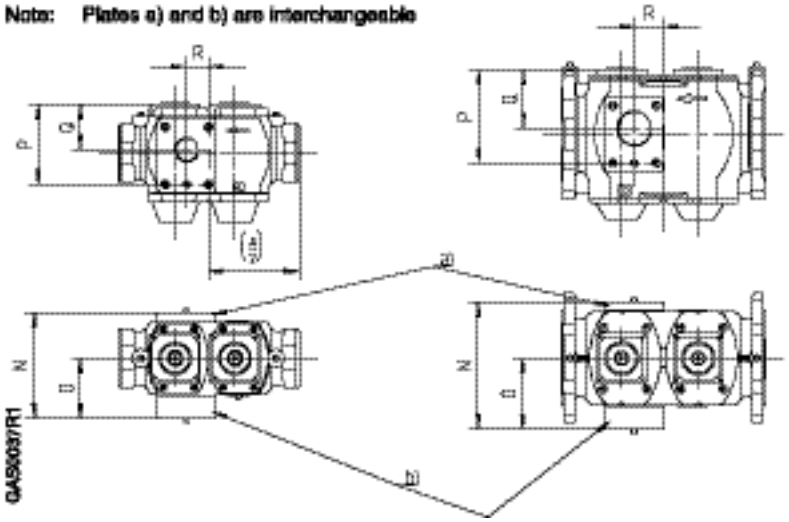
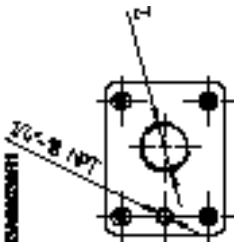


Table 7. VGD40… Dimensions in Inches (Millimeters).

Valve Model	N	O	P	Q	R	Weight Pounds (kg)
VGD40.065U	7.13 (181)	4.06 (103)	5.34 (136)	3.02 (77)	1.46 (37)	16 (7)
VGD40.080U	7.28 (185)	4.13 (105)	5.49 (140)	3.17 (81)	0.79 (20)	19 (8)
VGD40.100U	8.54 (217)	4.76 (121)	6.26 (159)	3.94 (100)	1.95 (50)	29 (13)
VGD40.150U	11.30 (287)	6.14 (156)	7.80 (198)	5.47 (139)	2.30 (59)	53 (24)

Table 8. Vent Connection Plate Dimensions.



	VGD40.065U	VGD40.080U	VGD40.100U	VGD40.150U	Thread Vent Connection Size
AGA40.6580U	X	X			1-1/4" NPT
AGA40.0100U			X		2" NPT
AGA40.0150U				X	2-1/2" NPT

SCC Inc.

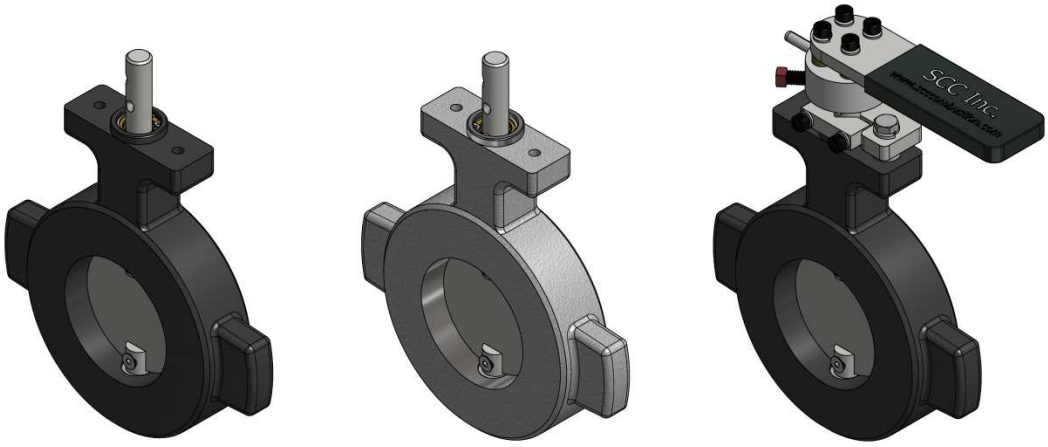
Technical Instructions

Document No. CVLV-1000

May 23, 2014

VKF… Series

VKF41… Butterfly Valves for Flow Control of Gases



Description

VKF… series butterfly valves are designed to control the flow of many common gases.

Features

- Standard VKF…C versions for air, natural gas, or propane
- High-temperature VKF…H versions for FGR or hot air up to 550°F
- Biogas VKF…B versions for corrosive gases such as biogas
- DN40 (1½”) through DN200 (8”)
- Accommodates flow in either direction
- Locking manual handle with valve position indicator

Application

VKF… series butterfly valves are used to throttle gases such as air, natural gas, or propane. These valves are wafer type, and mount between ANSI or DIN pipe flanges. Additional versions of the VKF… series butterfly valves are available for high-temperature or corrosive gas applications.

Product Part Numbers

Table 1: VKF41… Butterfly Valve Part Numbers

Size	Product Part Number		
	Standard	High-temperature	Biogas
1.5”	VKF41.40C	VKF41.40H	VKF41.40B
2”	VKF41.50C	VKF41.50H	VKF41.50B
2.5”	VKF41.65C	VKF41.65H	VKF41.65B
3”	VKF41.80C	VKF41.80H	VKF41.80B
4”	VKF41.100C	VKF41.100H	VKF41.100B
6”	VKF41.150C	VKF41.150H	VKF41.150B
8”	VKF41.200C	VKF41.200H	VKF41.200B

*Contact SCC Inc. if a valve larger than 8” is necessary.

Accessories

VKF41-MH



A manual handle kit can be added to any VKF41… butterfly valve for use as a manual flow restrictor. The kit includes position indicator and a handle with clamping pieces to lock the valve in any position. Add “-MH” to the end of any VKF41… valve part number to have the valve shipped with the manual handle kit attached.

VKF41-LH



A linkage kit for any VKF41… butterfly valve including position indicator. Holes in the handle allow users to connect a linkage (by others) to control valve position. Add “-LH” to the end of any VKF41… valve part number to have the valve assembled with the linkage handle.

VA… Valve Actuator Assemblies



Valve-actuator assemblies ensure proper shaft alignment and engagement. Assemblies include the valve, actuator, coupling, bracket, and position indicator which are configured, tested, and shipped as an assembly. Contact SCC Inc. for more information.

VKF41-RPI

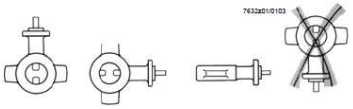


Optional position indicator for any VKF41… butterfly valve. Once installed, two pins line up parallel to the valve disc to show valve position. See “Installation” for more information.

VKF41…C Butterfly Valves

VKF41…C standard butterfly valves control ambient temperature inert gases such as air, natural gas, or propane.

Specifications

Physical characteristics	Materials	
	-Valve body	Cast iron
	-Shaft and disk	Stainless steel
	-Shaft seal	Buna-N O-rings
	-Bearings	Bronze
	-Centering spacers	Plastic
	Weight	See Table 7 on page 9
	Angular rotation	85° (beveled disc)
Operating environment	Type of gases	Air, natural gas, propane
	Operating pressure	-5 to 20 psig [-35 to 140 kPa]
	Flowing temperature	0 to 140°F [-18 to 60°C]
	Mounting positions	
	Humidity	< 95% relative humidity

Leakage rate

Table 2: VKF41…C Butterfly Valve Leakage Rates for Air* in SCFH**

Valve Size	Differential Pressure Across Valve				
	1” w.c.	2” w.c.	4” w.c.	8” w.c.	16” w.c.
1.5”	2.3	3.3	5.0	8.0	13.2
2”	2.4	4.1	7.7	13.4	21.2
2.5”	4.3	6.6	10.2	15.4	25.1
3”	6.4	10.2	18.0	30.4	54.3
4”	8.3	13.5	21.6	35.5	58.3
6”	9.7	15.2	26.6	54.3	82.4
8”	10.7	17.2	31.0	64.5	123.7

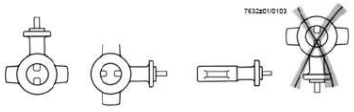
*For different gases, multiply leakage rate by correction factors from Table 6 on page 7

**Accuracy of leakage rates is ±5%

VKF41…H High-Temperature Butterfly Valves

VKF41…H high-temperature butterfly valves are typically used for FGR or hot air up to 550°F.

Specifications

Physical characteristics	Materials	
	-Valve body	Cast iron
	-Shaft and disk	Stainless steel
	-Shaft seal	PTFE
	-Bearings	PTFE
	-Centering spacers	Aluminum
	Weight	See Table 7 on page 9
	Angular rotation	360° (swing-through)
Operating environment	Type of gases	Air, FGR
	Operating pressure	-10 in w.c. to 5 psig [-2.5 to 35 kPa]
	Flowing temperature	0 to 550°F [-18 to 288°C]
	Mounting positions	
	Humidity	< 95% relative humidity

Leakage rate

Table 3: VKF41…H Butterfly Valve Leakage Rates for Air* in SCFH**

Valve Size	Differential Pressure Across Valve				
	1” w.c.	2” w.c.	4” w.c.	8” w.c.	16” w.c.
1.5”	168	242	330	451	607
2”	200	279	434	633	913
2.5”	329	482	661	922	1320
3”	345	493	706	1052	1513
4”	462	664	975	1423	2007
6”	711	974	1420	2138	3027
8”	950	1430	2053	2880	4274

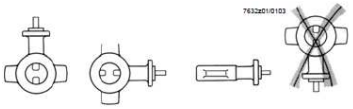
*For different gases, multiply leakage rate by correction factors from Table 6 on page 7

**Accuracy of leakage rates is ±5%

VKF41…B Biogas Butterfly Valves

VKF41…B biogas butterfly valves are typically used with corrosive gases such as digester gas. These valve bodies are electro-less nickel plated to prevent corrosion and wear caused by aggressive components of biogas such as hydrogen sulfide and ammonia.

Specifications

Physical characteristics	Materials	
	-Valve body	Nickel-plated cast iron
	-Shaft and disk	Stainless steel
	-Shaft seal	Buna-N O-rings
	-Bearings	PTFE
	-Centering spacers	Plastic
	Weight	See Table 7 on page 9
	Angular rotation	360° (swing-through)
Operating environment	Type of gases	Air, natural gas, propane, digester gas
	Operating pressure	-5 to 20 psig [-35 to 140 kPa]
	Flowing temperature	0 to 140°F [-18 to 60°C]
	Mounting positions	
	Humidity	< 95% relative humidity

Leakage rate

Table 4: VKF41…B Butterfly Valve Leakage Rates for Air* in SCFH**

Valve Size	Differential Pressure Across Valve				
	1” w.c.	2” w.c.	4” w.c.	8” w.c.	16” w.c.
1.5”	168	242	330	451	607
2”	200	279	434	633	913
2.5”	329	482	661	922	1320
3”	345	493	706	1052	1513
4”	462	664	975	1423	2007
6”	711	974	1420	2138	3027
8”	950	1430	2053	2880	4274

*For different gases, multiply leakage rate by correction factors from Table 6 on page 7

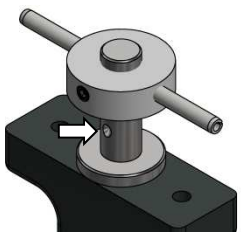
**Accuracy of leakage rates is ±5%

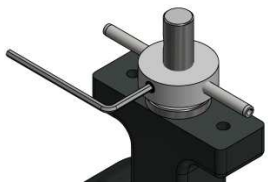
Installation

- Do not interfere with or modify the butterfly valves.
- All activities (mounting, installation, service work, etc.) must be performed by qualified staff.
- Fall or shock can adversely affect the safety functions of these valves. Such valves must not be put into operation, even if they do not exhibit any damage.
- No special tools are required.
- Use flange gaskets that are suited for the type of gas the valve will control.
- Ensure that the installation complies with relevant local and national codes.
- VKF41… butterfly valves do not require maintenance.
- For VKF…C versions, disk turns clockwise to increase flow and counterclockwise to decrease flow as viewed from shaft end. For VKF…H and VKF…B versions, disk may turn either direction to increase flow.
- VKF… valves come with four spacers to center the valve between flanges.
- To install the optional position indicator VKF41-RPI on any VKF… valve, follow the three steps below:

1. Slide position indicator over the valve shaft.
2. Line up set screw with the smaller notch in the valve shaft.
3. Tighten set screw using a 2.5mm hex key.







Flow Data

Flows through the valve body can be estimated using the equation below. Input data for this equation can be found in Tables 5 and 6.

$$Q = 1360 \times C_v \times \left(\sqrt{\frac{P_1 + P_2}{GT_f}}\right) \times \left(\sqrt{\frac{P_1 - P_2}{2}}\right)$$

Where:

C_v = Flow coefficient (see Table 5)
G = Specific gravity of gas (see Table 6)
P_1 = Inlet pressure in PSIA (PSIG + 14.7 psi)
P_2 = Outlet pressure in PSIA (PSIG + 14.7 psi)
Q = Flow rate in SCFH
T_f = Flowing temperature in degrees Rankine (°F + 460°)

Table 5: Flow Coefficients (C_v)

Valve	C_v
VKF41.40x	58
VKF41.50x	92
VKF41.65x	231
VKF41.80x	462
VKF41.100x	879
VKF41.150x	2428
VKF41.200x	4624

Table 6: Specific Gravities (G) and Correction Factors for Applicable Gases

Type of Gas	Specific Gravity	Correction Factor
Air	1.00	1.00
Natural Gas	0.61	1.28
Propane	1.56	0.80
Digester Gas	0.86	1.08

Flow Data (continued)

Approximate pressure drops for a given valve size and flow rate may be determined using the chart below. When pressure drop is more than 50% of the inlet pressure (P_1), choked flow occurs and chart is no longer accurate.

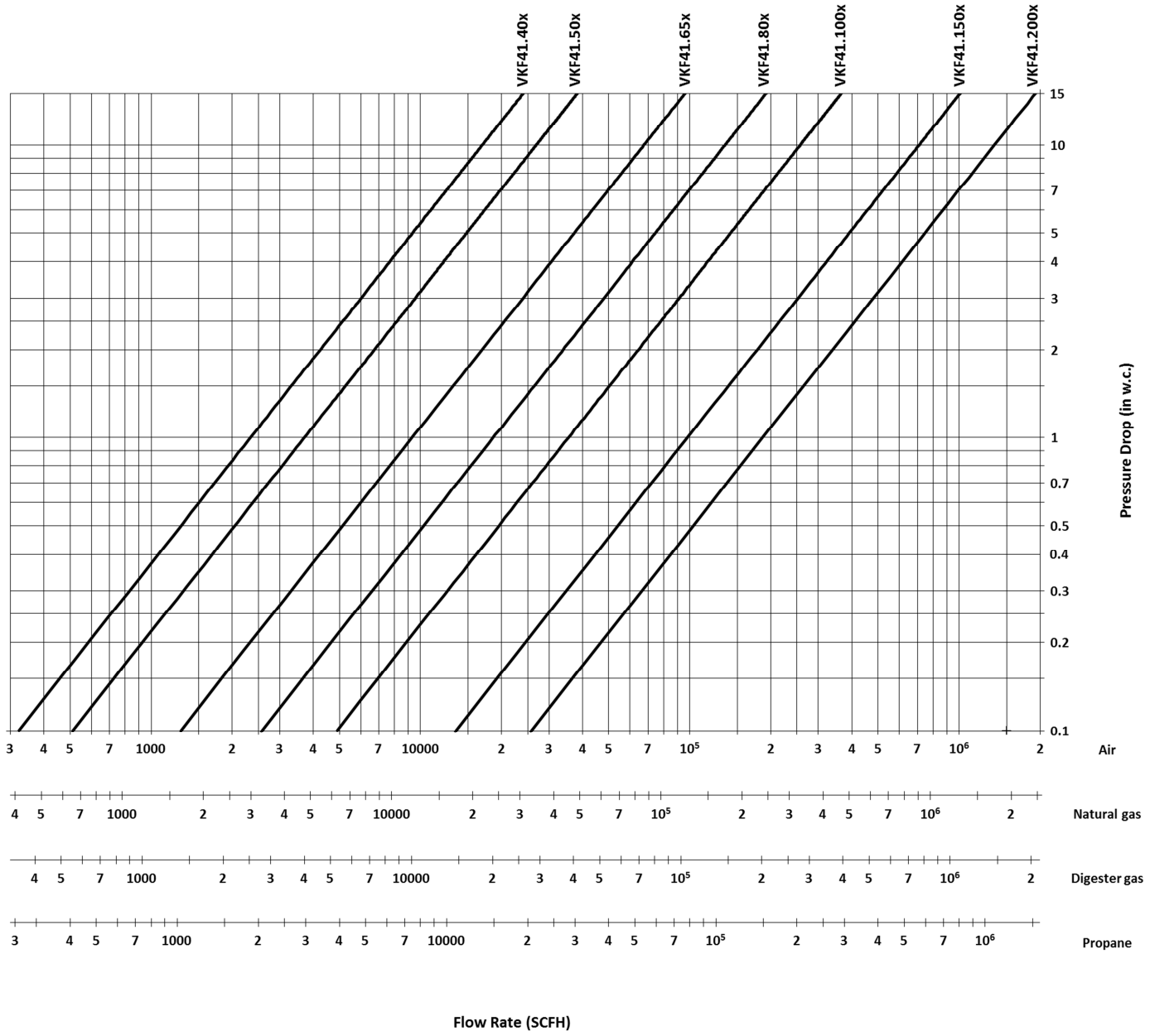


Figure 1: Capacities for Full Open VKF41… Butterfly Valves at 1 PSI Inlet

Dimensions

Dimensions in inches; millimeters in brackets

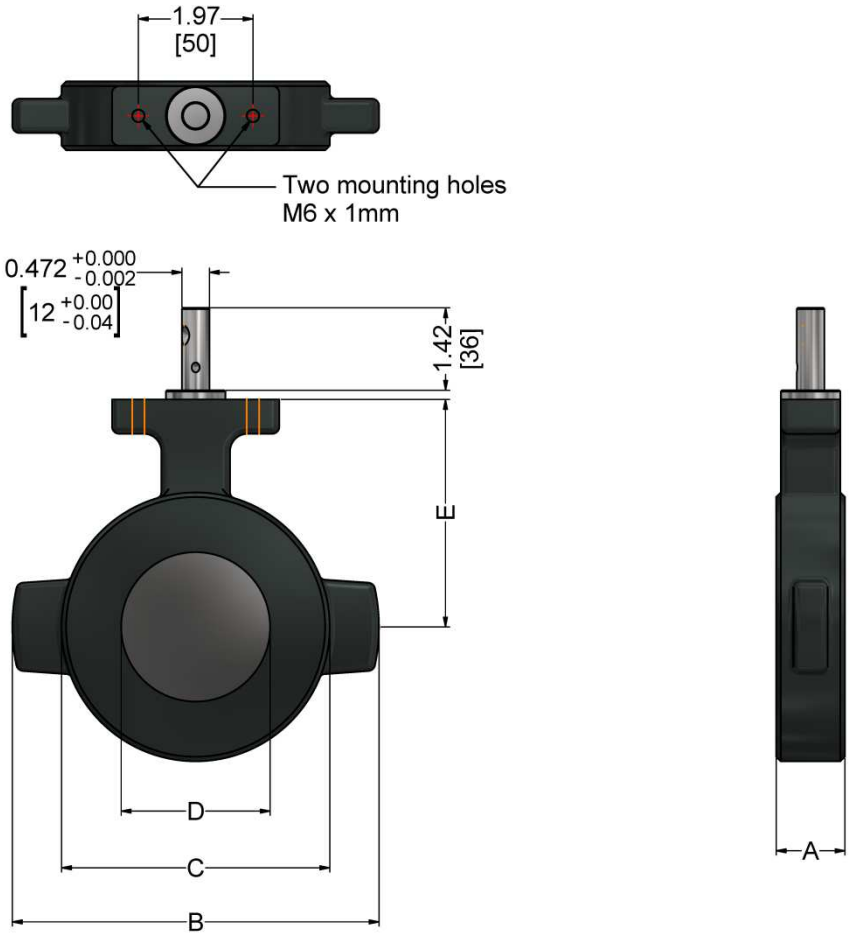


Table 7: VKF41… Valve Dimensions

Part Number	A	B	C	D	E	Weight – lb [kg]
VKF41.40x	1.18 [30]	5.12 [130]	3.43 [87]	1.57 [40]	3.43 [87]	3.79 [1.72]
VKF41.50x	1.18 [30]	5.51 [140]	3.82 [97]	1.97 [50]	3.62 [92]	4.30 [1.94]
VKF41.65x	1.18 [30]	6.30 [160]	4.61 [117]	2.56 [65]	3.92 [99.5]	5.22 [2.37]
VKF41.80x	1.18 [30]	6.89 [175]	5.24 [133]	3.15 [80]	4.21 [107]	5.80 [2.63]
VKF41.100x	1.18 [30]	7.68 [195]	6.02 [153]	3.94 [100]	4.61 [117]	6.44 [2.92]
VKF41.125x	1.57 [40]	8.86 [225]	7.20 [183]	4.92 [125]	5.41 [137.5]	11.57 [5.25]
VKF41.150x	1.57 [40]	10.04 [255]	8.19 [208]	5.91 [150]	5.91 [150]	13.87 [6.29]
VKF41.200x	1.57 [40]	12.20 [310]	10.35 [263]	7.87 [200]	6.89 [175]	18.61 [8.44]

Dimensions (continued)

Dimensions in inches; millimeters in brackets

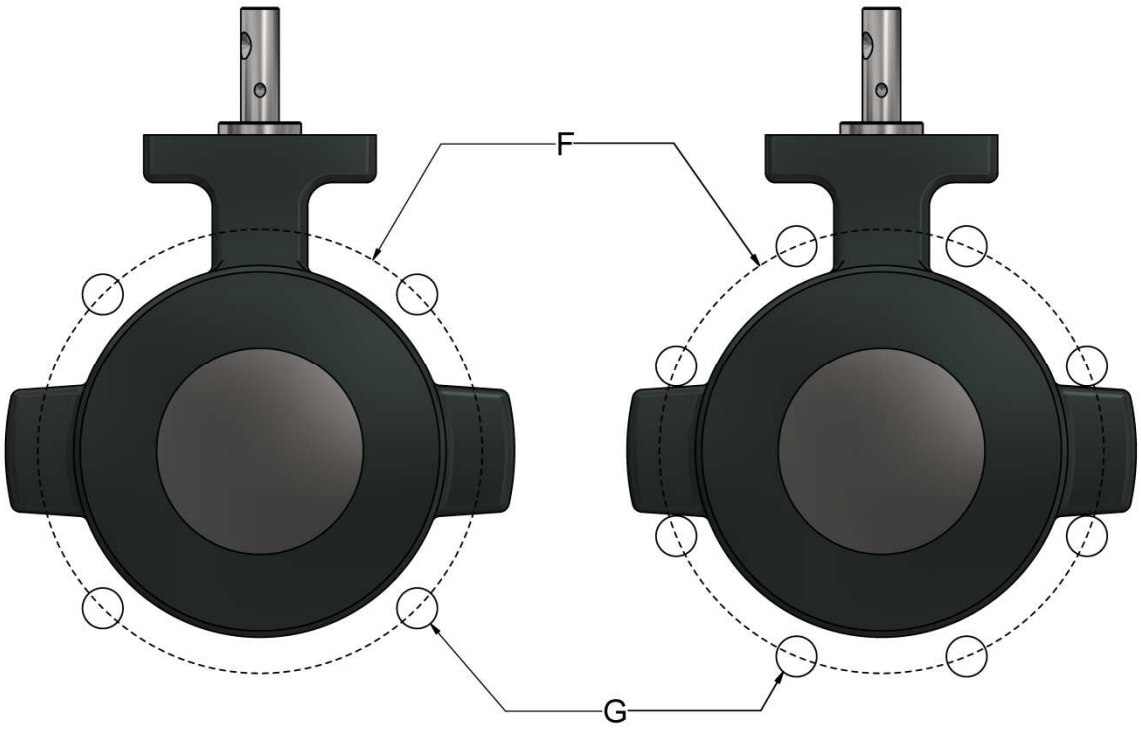


Table 8: Flange Mounting Dimensions

Valve	ANSI Flange		DIN Flange	
	Bolt Circle (F)	Mounting Screws (G)	Bolt Circle (F)	Mounting Screws (G)
VKF41.40x	See below*		4.33 [110]	M16 (4x)
VKF41.50x	4.75 [121]	5/8” (4x)	4.92 [125]	M16 (4x)
VKF41.65x	5.50 [140]	5/8” (4x)	5.71 [145]	M16 (4x)
VKF41.80x	6.00 [152]	5/8” (4x)	6.30 [160]	M16 (8x)
VKF41.100x	7.50 [191]	5/8” (8x)	7.09 [180]	M16 (8x)
VKF41.150x	9.50 [241]	3/4” (8x)	9.45 [240]	M20 (8x)
VKF41.200x	11.75 [298]	3/4” (8x)	11.61 [295]	M20 (8x)

*VKF41.40x butterfly valves must be mounted with either 2” ANSI flanges or 1½” DIN flanges.

Information in this publication is based on current specifications. The company reserves the right to make changes in specifications and models as design improvements are introduced. Product or company names mentioned herein may be the trademarks of their respective owners. © 2009 SCC Inc.

SIEMENS

Installation Instructions

Document No. 129-464
VOG15
July 6, 2010

VOG Series

VOG15.01xU1 Oil Safety Shut-off Valves with Proof of Closure (POC)



Oil Safety Shutoff Valve

Description

The VOG15 is an electro-hydraulically actuated three-way oil valve designed to provide safety shut-off control for industrial and commercial burner applications. The normally closed port on the valve is rated for safety shut-off function and the normally open port located on the bottom of the valve is typically used for recirculation of heavier oils. A 3/4-inch NPT pipe plug (provided) must be used in the bottom port for two-way applications.

The compact VOG15 actuator opens slowly when power is applied and closes in less than a second when power is interrupted. A visible position indicator on the front of the actuator displays position, and a light indicates when the actuator is powered.

Features

- UL listed, FM approved, CSA certified, ISO 9001 and ISO 14001 certified.
- Proof of Closure (POC) with Over Travel
- UL listed as watertight in the vertical position
- Visual position indication
- "Power on" indication light
- Quick connect wiring terminals
- Optional auxiliary switch available
- Actuator can be rotated 360^{o} with respect to valve for easy field wiring and installation.
- Low, 20 VA power consumption.

Application

The VOG15 is designed to be used as a two- or three-way valve on industrial and commercial burners firing No. 2 to No. 6 fuel oil having a maximum viscosity of 5,000 SSU.

Product Numbers

Table 1.

Product Number	Operating Voltage (VAC)	Proof of Closure Switch	Auxiliary Switch [1]	Type of Switch
VOG15.012U1	110/120	x	x	SPDT, SPDT
VOG15.011U1		x	–	SPDT

1. Switches cannot be field installed.

Specifications

Agency approvals	As a safety shut-off valve	UL 429, FM 7400, CSA C22.2 No.139
Power supply	Operating voltage	110/120 VAC
	Operating frequency	50/60 Hz
	Power consumption	20 VA Max
	Duty cycle	Continuous
Operating Environment	Ambient operating temperature	15°F to 140°F
	Maximum Oil Temperature	300°F
	Maximum Oil Pressure	300 PSIG
	Maximum Differential Pressure	300 PSID
	Maximum Oil Viscosity	5000 SSU (1087 cST)
	Mounting Position	Any position except upside down *
	* Watertight in Vertical Position Only	
Physical Characteristics	Actuator	Aluminum, Plastic
	Valve	
	Body	Forged brass
	Stem and Seat	Stainless steel
	Seal	PTFE
	Packing	Viton + PTFE
	Thermal Barrier	High temperature glass reinforced plastic
	Assembly Weight	4.5 lb
Connections	Piping Connections	3/4” NPT (3/4” × 1/2” NPT bushings provided)
	Conduit connections	Two 1/2-inch NPSM (for flexible conduit only)
	Electrical connection	Spring loaded terminals for up to 14 AWG wires
Operating characteristics	Stroke	0.26 inch
	Opening time (full open)	< 7 seconds *
	Closing time (full closed)	< 1 second
	Flow characteristics	
	With common Fuel Oils	See Table 2a, 2b ,3a, 3b
	Cv (single valve)	4.4
	Cv (two valves piped in series)	3.1
	* Opening times will increase at actuator temperatures below 35 °F	
Auxiliary features	Proof of closure switch	Non-adjustable
	Auxiliary switch	Non-adjustable, changes state at > 80% stroke
	Switch rating (POC and Aux)	6A/250 Vac resistive

Operation

The electro-hydraulic actuator consists of a cylinder filled with oil, a piston containing an electric oscillating pump, and a relief system. When power is supplied to the actuator, the relief system closes, and the pump moves the piston downward in the cylinder, opening the oil valve. When power to the actuator is interrupted, the relief system opens and the oil valve closes in less than one second.

A position indicator, visible through the transparent portion of the terminal cover, shows the entire stroke range of the actuator. The oil valve only uses about 1/4-inch of the actuator's stroke. A light, which is visible through the lower left transparent portion of the terminal cover, indicates when the actuator receives power. A non-adjustable SPDT POC over travel switch signals the valve closed position after the oil valve has closed. If equipped, an SPDT auxiliary switch changes state when the oil valve is more than 80% open.

Installation



WARNING:

- Personal injury or loss of life may occur if you do not follow procedures as specified.
- All installations must be performed by qualified personnel only.

- **DO NOT** use the actuator as a wrench when piping the oil valve. If a large enough force is applied to the actuator, the thermal barrier can be broken. **ALWAYS** use a wrench on the provided valve body wrench flats when piping the oil valve.
- The actuator meets NEMA 4 requirements when mounted in the vertical position and liquid tight conduit is used.
- The actuator has two knock-outs for the installation of 1/2"-14 NPSM conduit connectors.
- Flexible conduit must be used. Hard conduit (EMT or Rigid Type) is not permitted.
- The VOG15 is shipped with three 3/4" NPT to 1/2" NPT bushings and one 3/4" NPT plug. The bushings are included to adapt the valve ports to 1/2" NPT if necessary, and the 3/4" NPT plug must be installed in the oil valve's bottom port for two-way operation.
- Use suitable pipe thread sealant on all piping connections.

Wiring and Switches

(See *Terminal Designations*)

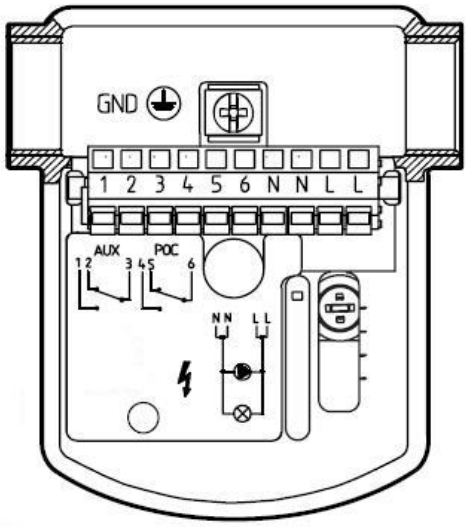
- The actuator is equipped with spring-loaded terminals for 14 AWG wires.
- The terminal marked GND, located above the wiring terminals, must be connected to the electrical ground.
- The two "L" terminals are interconnected and the two "N" terminals are interconnected. The second "L" terminal and the second "N" terminal are intended as a convenient wiring point for a second oil valve.
- Insert one wire into the opening of the terminal while pressing the lever downward with a screwdriver or hard object. Make sure that all strands insert into the opening.
- Wiring must meet all relevant electrical codes.

NOTES:
1. The Auxiliary Switch is not adjustable. This switch changes state when the oil valve is > 80% open.
2. The Auxiliary Switch must not be used for proof of closure detection or other safety interlock functions.
3. The Proof of Closure Switch is non-adjustable.

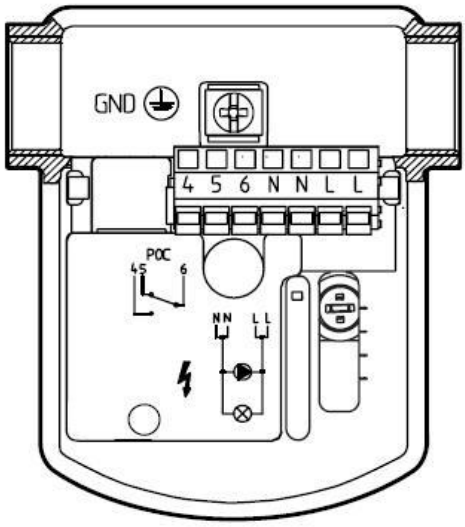
Service

There are no serviceable parts on the VOG15.01xU1 series oil valves. If damaged or inoperative, replace the entire oil valve assembly. Tag wires before replacing VOG15.

Terminal Designations



VOG15.012U1



VOG15.011U1

Terminals:

1. Auxiliary switch NO
2. Auxiliary switch NC
3. Auxiliary switch Common
4. Proof of closure switch NO
5. Proof of closure switch NC
6. Proof of closure switch Common

L = Line (terminals internally connected)

N = Neutral (terminals internally connected)

Figure 1. Terminal Designations.

Table 2a. Sizing a Single Oil Valve for No. 2 Oil.

Approximate flow of No. 2 oil (Degrees API = 34, Specific Gravity @ 60°F = 0.86, Heating Value = 141,000 BTU/GAL)													
Temp (°F)		20		40		60		80		100		120	
Viscosity (SSU)		57		47		40		38		34		33	
Specific Gravity		0.87		0.86		0.86		0.85		0.84		0.83	
		GPH	BTU/HR × 10^6	GPH	BTU/HR x 10^6	GPH	BTU/HR x 10^6	GPH	BTU/HR x 10^6	GPH	BTU/HR x 10^6	GPH	BTU/HR x 10^6
DP Across 1 Oil Valve - PSID Valve Cv = 4.4	**2**	363.4	51.2	375.5	52.9	388.2	54.7	394.0	55.5	407.8	57.5	409.8	57.8
	4	513.9	72.5	531.0	74.9	549.0	77.4	557.1	78.6	576.7	81.3	579.5	81.7
	6	629.4	88.7	650.3	91.7	672.4	94.8	682.4	96.2	706.3	99.6	709.8	100.1
	8	726.7	102.5	750.9	105.9	776.5	109.5	787.9	111.1	815.6	115.0	819.6	115.6
	10	812.5	114.6	839.5	118.4	868.1	122.4	880.9	124.2	911.8	128.6	916.3	129.2
	15	995.1	140.3	1028.2	145.0	1063.2	149.9	1078.9	152.1	1116.8	157.5	1122.2	158.2
	20	1149.1	162.0	1187.3	167.4	1227.7	173.1	1245.8	175.7	1289.5	181.8	1295.8	182.7
	25	1284.7	181.1	1327.4	187.2	1372.6	193.5	1392.9	196.4	1441.7	203.3	1448.8	204.3
	30	1407.3	198.4	1454.1	205.0	1503.6	212.0	1525.8	215.1	1579.3	222.7	1587.1	223.8
	35	1520.1	214.3	1570.7	221.5	1624.1	229.0	1648.0	232.4	1705.9	240.5	1714.2	241.7
	40	1625.0	229.1	1679.1	236.8	1736.2	244.8	1761.8	248.4	1823.7	257.1	1832.6	258.4
	45	1723.6	243.0	1781.0	251.1	1841.6	259.7	1868.7	263.5	1934.3	272.7	1943.7	274.1
	50	1816.8	256.2	1877.3	264.7	1941.2	273.7	1969.8	277.7	2038.9	287.5	2048.9	288.9

Table 2b. Sizing a Single Oil Valve for No. 6 Oil.

Approximate flow of No. 6 oil (Degrees API = 15, Specific Gravity @ 60°F = 0.96, Heating Value = 151,000 BTU/GAL)													
Temp (F)		200		220		240		260		280		300	
Viscosity (SSU)		125		90		79		60		56		46	
Specific Gravity		0.92		0.91		0.90		0.89		0.89		0.88	
		GPH	BTU/HR x 10^6	GPH	BTU/HR x 10^6	GPH	BTU/HR x 10^6	GPH	BTU/HR x 10^6	GPH	BTU/HR x 10^6	GPH	BTU/HR x 10^6
DP Across 1 Oil Valve - PSID Valve Cv = 4.4	**2**	316.6	47.8	328.8	49.6	336.0	50.7	352.6	53.2	360.7	54.5	372.5	56.2
	4	447.7	67.6	464.9	70.2	475.1	71.7	498.6	75.3	510.0	77.0	526.7	79.5
	6	548.3	82.8	569.4	86.0	581.9	87.9	610.7	92.2	624.7	94.3	645.1	97.4
	8	633.1	95.6	657.5	99.3	671.9	101.5	705.2	106.5	721.3	108.9	744.9	112.5
	10	707.9	106.9	735.1	111.0	751.2	113.4	788.4	119.1	806.5	121.8	832.9	125.8
	15	866.9	130.9	900.3	136.0	920.0	138.9	965.6	145.8	987.7	149.1	1020.0	154.0
	20	1001.1	151.2	1039.6	157.0	1062.4	160.4	1115.0	168.4	1140.5	172.2	1177.8	177.9
	25	1119.2	169.0	1162.3	175.5	1187.8	179.4	1246.6	188.2	1275.1	192.5	1316.9	198.8
	30	1226.1	185.1	1273.3	192.3	1301.1	196.5	1365.6	206.2	1396.8	210.9	1442.6	217.8
	35	1324.3	200.0	1375.3	207.7	1405.4	212.2	1475.0	222.7	1508.7	227.8	1558.1	235.3
	40	1415.7	213.8	1470.3	222.0	1502.4	226.9	1576.8	238.1	1612.9	243.5	1665.7	251.5
	45	1501.6	226.7	1559.4	235.5	1593.6	240.6	1672.5	252.5	1710.7	258.3	1766.8	266.8
	50	1582.8	239.0	1643.8	248.2	1679.8	253.6	1762.9	266.2	1803.3	272.3	1862.3	281.2

Table 3a. Sizing Two Oil Valves for No. 2 Oil – Valves Piped in Series.

Approximate flow of No. 2 oil (Degrees API = 34 , Specific Gravity @ 60°F = 0.86, Heating Value = 141,000 BTU/GAL)													
Temp (°F)		20		40		60		80		100		120	
Viscosity (SSU)		57		47		40		38		34		33	
Specific Gravity		0.87		0.86		0.86		0.85		0.84		0.83	
		GPH	BTU/HR x 10^6	GPH	BTU/HR x 10^6	GPH	BTU/HR x 10^6	GPH	BTU/HR x 10^6	GPH	BTU/HR x 10^6	GPH	BTU/HR x 10^6
DP Across 2 Oil Valves - PSID Cv of two valves (in series) = 3.1	**2**	256.0	36.1	264.5	37.3	273.5	38.6	277.6	39.1	287.3	40.5	288.7	40.7
	4	362.1	51.0	374.1	52.7	386.8	54.5	392.5	55.3	406.3	57.3	408.3	57.6
	6	443.4	62.5	458.2	64.6	473.8	66.8	480.8	67.8	497.6	70.2	500.1	70.5
	8	512.0	72.2	529.1	74.6	547.1	77.1	555.1	78.3	574.6	81.0	577.4	81.4
	10	572.5	80.7	591.5	83.4	611.6	86.2	620.6	87.5	642.4	90.6	645.6	91.0
	15	701.1	98.9	724.4	102.1	749.1	105.6	760.1	107.2	786.8	110.9	790.7	111.5
	20	809.6	114.1	836.5	117.9	865.0	122.0	877.7	123.8	908.5	128.1	913.0	128.7
	25	905.1	127.6	935.2	131.9	967.1	136.4	981.3	138.4	1015.8	143.2	1020.7	143.9
	30	991.5	139.8	1024.5	144.5	1059.4	149.4	1075.0	151.6	1112.7	156.9	1118.2	157.7
	35	1071.0	151.0	1106.6	156.0	1144.3	161.3	1161.1	163.7	1201.9	169.5	1207.7	170.3
	40	1144.9	161.4	1183.0	166.8	1223.3	172.5	1241.3	175.0	1284.8	181.2	1291.1	182.0
	45	1214.4	171.2	1254.8	176.9	1297.5	182.9	1316.6	185.6	1362.8	192.2	1369.4	193.1
	50	1280.0	180.5	1322.6	186.5	1367.6	192.8	1387.8	195.7	1436.5	202.5	1443.5	203.5

Table 3b. Sizing Two Oil Valves for No. 6 Oil – Valves Piped in Series.

Approximate flow of No. 6 oil (Degrees API = 15 , Specific Gravity @ 60°F = 0.96, Heating Value = 151,000 BTU/GAL)													
Temp (F)		200		220		240		260		280		300	
Viscosity (SSU)		125		90		79		60		56		46	
Specific Gravity		0.92		0.91		0.90		0.89		0.89		0.88	
		GPH	BTU/HR x 10^6	GPH	BTU/HR x 10^6	GPH	BTU/HR x 10^6	GPH	BTU/HR x 10^6	GPH	BTU/HR x 10^6	GPH	BTU/HR x 10^6
DP Across 2 Oil Valves - PSID Cv of two valves (in series) = 3.1	**2**	223.0	33.7	231.6	35.0	236.7	35.7	248.4	37.5	254.1	38.4	262.4	39.6
	4	315.4	47.6	327.6	49.5	334.7	50.5	351.3	53.0	359.4	54.3	371.1	56.0
	6	386.3	58.3	401.2	60.6	410.0	61.9	430.3	65.0	440.1	66.5	454.5	68.6
	8	446.1	67.4	463.3	70.0	473.4	71.5	496.8	75.0	508.2	76.7	524.8	79.3
	10	498.7	75.3	517.9	78.2	529.3	79.9	555.5	83.9	568.2	85.8	586.8	88.6
	15	610.8	92.2	634.3	95.8	648.2	97.9	680.3	102.7	695.9	105.1	718.7	108.5
	20	705.3	106.5	732.5	110.6	748.5	113.0	785.6	118.6	803.5	121.3	829.8	125.3
	25	788.5	119.1	818.9	123.7	836.8	126.4	878.3	132.6	898.4	135.7	927.8	140.1
	30	863.8	130.4	897.1	135.5	916.7	138.4	962.1	145.3	984.1	148.6	1016.3	153.5
	35	933.0	140.9	969.0	146.3	990.2	149.5	1039.2	156.9	1063.0	160.5	1097.8	165.8
	40	997.4	150.6	1035.9	156.4	1058.5	159.8	1110.9	167.8	1136.4	171.6	1173.6	177.2
	45	1057.9	159.7	1098.7	165.9	1122.7	169.5	1178.3	177.9	1205.3	182.0	1244.8	188.0
	50	1115.2	168.4	1158.1	174.9	1183.5	178.7	1242.1	187.6	1270.5	191.8	1312.1	198.1

NOTE: Calculations for two valves piped in series are based on a Cv = 3.1. This Cv was experimentally determined by using a 5” long 3/4” schedule 40 pipe nipple between the two shut-off valves.

Dimensions

(Dimensions in inches)

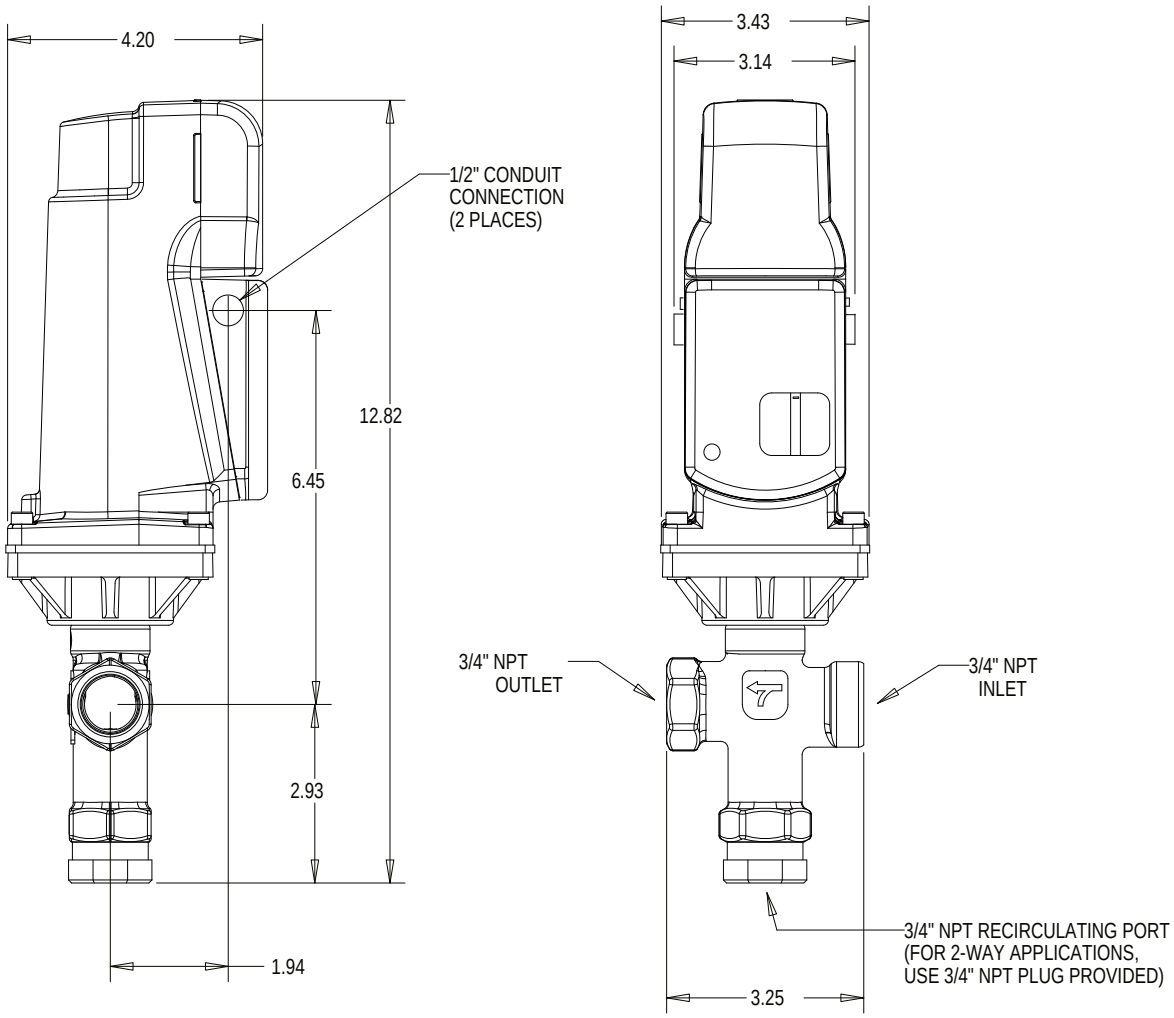


Figure 3. VOG15.01xU1 Dimensions.

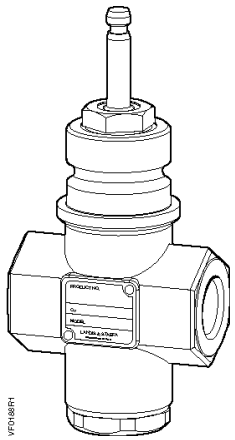
Information in this publication is based on current specifications. The company reserves the right to make changes in specifications and models as design improvements are introduced. Product or company names mentioned herein may be the trademarks of their respective owners. © 2009 Siemens Building Technologies, Inc.

SIEMENS

Technical Instructions
Document No. 155-184P25
VF 599-3
July 23, 2008

Flowrite™ 599 Series

Two-Way Valves
1/2 to 2-inch Bronze Body



Description	The Flowrite 599 Series two-way valves are designed to work with either a pneumatic or electronic actuator with a 3/4-inch (20 mm) stroke. They are available in ANSI Class 250 for normally closed or normally open action.
Features	• Direct coupled universal bonnet • Choice of two flow characteristics • Choice of brass or stainless steel trim • ANSI Leakage Class IV (0.01% of Cv) • Cartridge type packing
Application	Flowrite valves are generally recommended for water, steam, and glycol solutions to 50%.
Product Numbers	See Tables 1 and 2.
Ordering a Valve Plus Actuator Assembly	To order a complete valve plus actuator assembly from the factory, combine the actuator prefix code with the suffix of the valve assembly product number. See *TB 249 Flowrite 599 Series Valve and Actuator Assembly Selection Technical Bulletin* (155-304P25) for selection procedure and ordering codes. Valve assemblies can be ordered using the numbers in Tables 1 and 2.

Specifications

Material

	Line size	1/2 to 2 inches (15 to 50 mm)
	Capacity	See Tables 3 through 6 and Figure 3
	Body style	Globe style control valve with four connection options See Tables 1 and 2
	Seat style	Single seat, metal-to-metal
	Action	Normally Closed (NC) Normally Open (NO)
	Stem travel (stroke)	3/4-inch (20 mm)
	Valve body rating	ANSI Class 250; see Table 7
	Body	UNS CA 844 bronze
	Body trim	See Tables 1 and 2
	Stem	Stainless steel ASTM A582 Type 303
	Packing	
	Normal duty packing	EPDM O-ring
	Steam packing	Teflon® V-ring
Operating	Controlled medium	Saturated steam, water, glycol solutions to 50%
	Medium temperature range	
	Normal duty packing	20°F to 250°F (–7°C to 120°C)
	Steam packing	337°F (170°C) maximum
	Maximum inlet pressure	
	Water	See Table 7
	Steam	100 psig (690 kPa)

Maximum recommended differential pressure for modulating service

	Brass trim	Stainless steel trim
Liquid	25 psi (173 kPa)	50 psi (345 kPa)
Steam	15 psi (103 kPa)	50 psi (345 kPa)

	Rangeability	>100:1
	Close-off pressures	See Tables 8 and 9 and Figure 4
	Close-off ratings	According to ANSI/FCI 70-2
	Leakage rate	Class IV (0.01% of Cv)
	Flow characteristics	See Tables 1 and 2
	Mounting location	NEMA 1 (interior only)
Miscellaneous	Canadian Registration Numbers	0H7645.5 0C0838.9
	Dimensions	See Tables 12 and 13 and Figure 6
	Valve Weight	See Table 14

Accessories

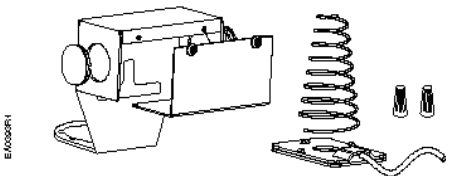


Figure 1. Packing Heating Element For Use with SKD and SQX Actuators.

599-00417 Packing heating element.

The heater allows the stem to move freely in valves that control fluids at temperatures below 32°F (0°C). It reduces ice crystal formation on the stem, which can damage the packing.

Operating Voltage	24 Vac
Heating Output	20 W

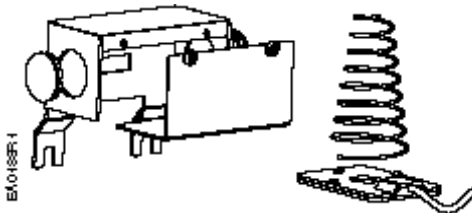


Figure 2. Packing Heating Element For Use with SKB/C and 8-inch Actuators.

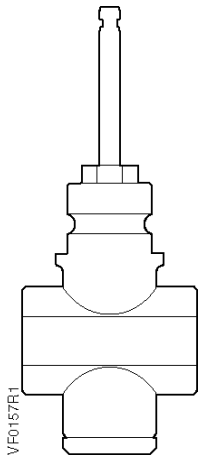
599-00418: Packing heating element.

The element allows the stem to move freely in valves that control fluids at temperatures below 32°F (0°C). It prevents ice crystal formation on the stem, which can damage the packing.

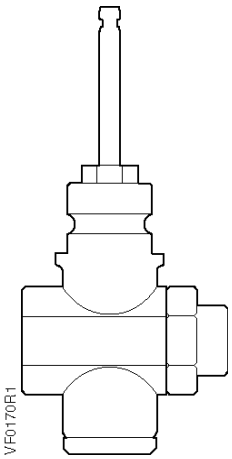
Operating Voltage	24 Vac
Heating Output	20 W

Service Kits

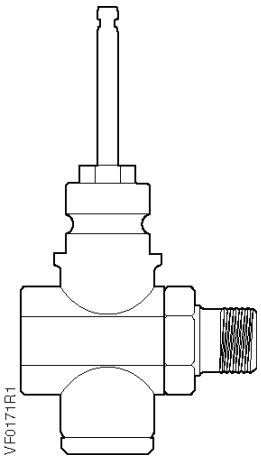
Valve packing kit	
Normal duty packing	599-03390
Steam packing	599-03391
Rebuild/repack kits	See Table 14
Sealing rings for union valves (package of 25)	
1/2-inch (15 mm)	599-03394
3/4-inch (20 mm)	599-03395
1 inch (25 mm)	599-03396
1-1/4 inch (32 mm)	599-03397
1-1/2 inch (40 mm)	599-03398
2 inch (50 mm)	599-03399
Union Tailpiece kit (one tailpiece, one union nut, one gasket.)	
1/2-inch (15 mm) male	599-09181
3/4-inch (20 mm) male	599-09182
1 inch (25 mm) male	599-09183
1-1/4 inch (32 mm) male	599-09184
1/2-inch (40 mm) female	599-09185
3/4-inch (20 mm) female	599-09186
1 inch (25 mm) female	599-09187
1-1/4 inch (32 mm) female	599-09188
1-1/2 inch (40 mm) female	599-09189
2 inch (50 mm) female	599-09190



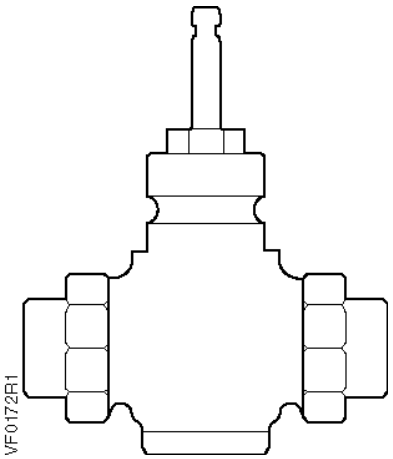
Female NPT x Female NPT FxF



Female NPT x Union Female FxUF



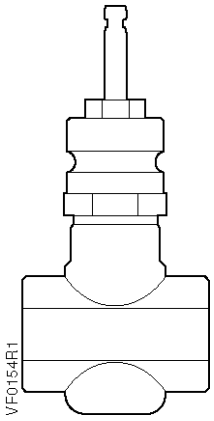
Female NPT x Union Male FxUM



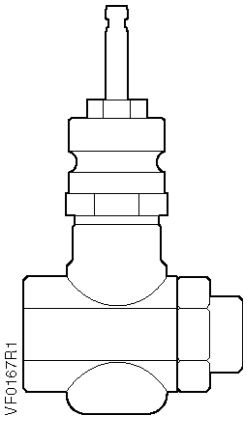
Union Female x Union Female UFxUF

Table 1. Normally Closed Valves.

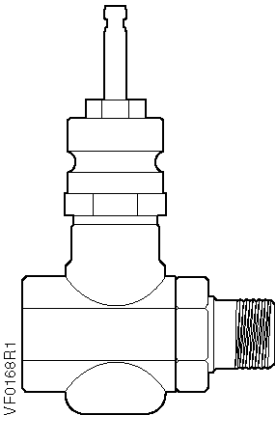
Flow Rate		Nominal Line Size		Connection	Equal Percentage		Linear	
					Stl. Steel Trim	Brass Trim	Stainless Steel Trim	
Cv	(Kvs)	Inch	(mm)		Normal Duty Packing		Normal Duty Packing	Steam Packing
1	(0.85)	1/2	(15)	FxF	599-03126	599-03180	599-03018	599-03072
				FxUF	599-03135	599-03189	599-03027	599-03081
				FxUM	599-03261	599-03279	599-03225	599-03243
1.6	(1.37)	1/2	(15)	FxF	599-03127	599-03181	599-03019	599-03073
				FxUF	599-03136	599-03190	599-03028	599-03082
				FxUM	599-03262	599-03280	599-03226	599-03244
2.5	(2.15)	1/2	(15)	FxF	599-03128	599-03182	599-03020	599-03074
				FxUF	599-03137	599-03191	599-03029	599-03083
				FxUM	599-03263	599-03281	599-03227	599-03245
4	(3.44)	1/2	(15)	FxF	599-03129	599-03183	599-03021	599-03075
				FxUF	599-03138	599-03192	599-03030	599-03084
				FxUM	599-03264	599-03282	599-03228	599-03246
6.3	(5.43)	3/4	(20)	FxF	599-03130	599-03184	599-03022	599-03076
				FxUF	599-03139	599-03193	599-03031	599-03085
				FxUM	599-03265	599-03283	599-03229	599-03247
10	(8.6)	1	(25)	FxF	599-03131	599-03185	599-03023	599-03077
				FxUF	599-03140	599-03194	599-03032	599-03086
				FxUM	599-03266	599-03284	599-03230	599-03248
16	(13.8)	1-1/4	(32)	FxF	599-03132	599-03186	599-03024	599-03078
				UFxUF	599-03141	599-03195	599-03033	599-03087
25	(21.5)	1-1/2	(40)	FxF	599-03133	599-03187	599-03025	599-03079
				UFxUF	599-03142	599-03196	599-03034	599-03088
40	(34.4)	2	(50)	FxF	599-03134	599-03188	599-03026	599-03080
				UFxUF	599-03143	599-03197	599-03035	599-03089



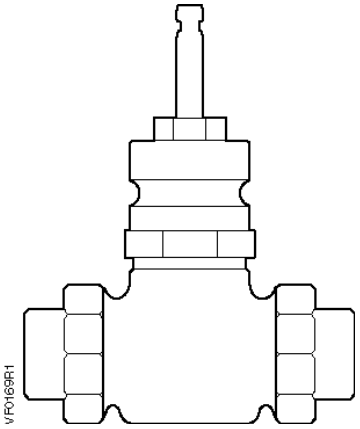
Female NPT x Female NPT FxF



Female NPT x Union Female FxUF



Female NPT x Union Male FxUM



Union Female x Union Female UFxUF

Table 2. Normally Open Valves.

Flow Rate		Nominal Line Size		Connection	Equal Percentage		Linear	
					Stainless Steel Trim	Brass Trim	Stainless Steel Trim	
C_v	(K_{vs})	inch	(mm)		Normal Duty Packing		Normal Duty Packing	Steam Packing
1	(0.85)	1/2	(15)	FxF	599-03108	599-03162	599-03000	599-03054
				FxUF	599-03117	599-03171	599-03009	599-03063
				FxUM	599-03252	599-03270	599-03216	599-03234
1.6	(1.37)	1/2	(15)	FxF	599-03109	599-03163	599-03001	599-03055
				FxUF	599-03118	599-03172	599-03010	599-03064
				FxUM	599-03253	599-03271	599-03217	599-03235
2.5	(2.15)	1/2	(15)	FxF	599-03110	599-03164	599-03002	599-03056
				FxUF	599-03119	599-03173	599-03001	599-03065
				FxUM	599-03254	599-03272	599-03218	599-03236
4	(3.44)	1/2	(15)	FxF	599-03111	599-03165	599-03003	599-03057
				FxUF	599-03120	599-03174	599-03012	599-03066
				FxUM	599-03255	599-03273	599-03219	599-03237
6.3	(5.43)	3/4	(20)	FxF	599-03112	599-03166	599-03004	599-03058
				FxUF	599-03121	599-03175	599-03013	599-03067
				FxUM	599-03256	599-03274	599-03220	599-03238
10	(8.6)	1	(25)	FxF	599-03113	599-03167	599-03005	599-03059
				FxUF	599-03122	599-03176	599-03014	599-03068
				FxUM	599-03257	599-03275	599-03221	599-03239
16	(13.8)	1-1/4	(32)	FxF	599-03114	599-03168	599-03006	599-03060
				UFxUF	599-03123	599-03177	599-03015	599-03069
				FxUM	—	599-03276	—	—
25	(21.5)	1-1/2	(40)	FxF	599-03115	599-03169	599-03007	599-03061
				UFxUF	599-03124	599-03178	599-03016	599-03070
40	(34.4)	2	(50)	FxF	599-03116	599-03170	599-03008	599-03062
				UFxUF	599-03125	599-03179	599-03017	599-03071

Table 3. Maximum Water Capacity - U.S. Gallons per Minute.

Valve Size in inches	Pressure Differential - psi															
	Cv\1	2	3	4	5	6	8	10	15	20	25	30	40	50	60	75
1/2	1.0	1.4	1.7	2.0	2.2	2.5	2.8	3.2	3.9	4.5	5.0	5.5	6.3	7.1	7.8	8.7
	1.6	2.3	2.8	3.2	3.6	3.9	4.5	5.1	6.2	7.2	8.0	8.8	10.1	11.3	12.4	13.9
	2.5	3.5	4.3	5.0	5.6	6.1	7.1	7.9	97	11.2	12.5	13.7	15.8	17.7	19.4	22
	4	5.7	7	8.0	8.9	10	11.3	12.6	15.5	17.9	20.0	21.9	25	28	31	35
3/4	6	8.9	10.9	12.6	14.1	15.4	17.8	20	24	28	32	35	40	45	49	55
1	10	14.1	17.3	20	22	24	28	32	39	45	50	55	63	71	77	87
1-1/4	16	23	28	32	36	39	45	51	62	72	80	88	101	113	124	139
1-1/2	25	35	43	50	56	61	71	79	97	112	125	137	158	177	194	217
2	40	57	69	80	89	98	113	126	155	179	200	219	253	283	310	346

Table 4. Maximum Water Capacity - Cubic Meters per Hour (m^3/hr).

Valve Size inches mm	Pressure Differential - kPa													
	1	10	20	30	40	50	60	80	Kvs/ 100	150	200	300	400	500
15	0.09	0.3	0.4	0.5	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.5	1.7	1.9
	0.14	0.4	0.6	0.8	0.9	1.0	1.1	1.2	1.4	1.7	1.9	2.4	2.7	3.1
	0.2	0.7	1.0	1.2	1.4	1.5	1.7	1.9	2.2	2.6	3.0	3.7	4.3	4.8
	0.3	1.1	1.5	1.9	2.2	2.4	2.7	3.1	3.4	4.2	4.9	6.0	6.9	7.7
20	0.5	1.7	2.4	3.0	3.4	3.8	4.2	4.9	5.4	6.7	7.7	9.4	10.9	12.1
25	0.9	2.7	3.8	4.7	5.4	6.1	6.7	7.7	8.6	10.5	12.2	14.9	17.2	19.2
32	1.4	4.4	6.2	7.6	8.7	9.8	10.7	12.3	13.8	16.9	19.5	23.9	27.6	30.9
40	2.2	6.8	9.6	11.8	13.6	15.2	16.7	19.2	22	26	30	37	43	48
50	3.4	10.9	15.4	18.8	22	24	27	31	34	42	49	60	69	77

Table 5. Steam Capacity - Pounds per Hour.

Line Size inches	Inlet Pressure - psig																								
	2		5			10			15			25			50			75				100			
	Pressure Differential - psi																								
	1	2	3	4	5	6	8	10	9	12	15	5	15	20	15	30	32.5	20	30	40	45	30	40	50	57.5
1/2	12.0	16.6	22	25	28	34	38	42	45	50	54	41	65	72	87	115	118	119	141	157	163	162	183	199	209
	19.1	27	35	40	44	54	61	67	72	80	86	65	104	116	139	183	188	109	225	251	261	260	292	318	334
	30	42	55	62	69	85	96	104	112	125	135	101	163	181	217	287	294	296	351	392	408	406	457	497	522
	48	67	88	100	110	136	153	167	179	200	216	162	261	289	348	459	471	474	562	627	653	650	731	796	835
3/4	75	105	138	157	174	213	241	263	282	316	341	255	411	455	548	722	742	747	886	988	1029	1023	1152	1253	1315
1	120	166	219	250	275	339	382	417	447	501	541	405	653	723	870	1147	1178	1186	1406	1568	1633	1624	1828	1989	2088
1-1/4	191	266	351	400	441	542	611	667	716	801	865	648	1044	1156	1392	1835	1884	1897	2249	2509	2612	2599	2925	3182	3340
1-1/2	299	416	549	625	689	847	955	1042	1118	1252	1351	1013	1632	1806	2175	2867	2944	2964	3515	3920	4081	4061	4570	4972	5219
2	478	666	878	1000	1102	1356	1529	1667	1789	2003	2162	1620	2611	2890	3480	4587	4710	4743	5624	6272	6530	6497	7311	7956	8350

Table 6. Steam Capacity - Kilograms per Hour.

Line Size mm	Inlet Pressure - kPa											
	100			150			200			500		
	Pressure Differential - kPa											
	10	20	50	15	30	75	20	40	100	50	100	250
15	6.04	8.54	13.50	9.07	12.8	20.2	12.11	17.13	27.08	30.3	42.9	67.8
	9.66	13.6	21.61	14.5	20.5	32.4	19.37	27.40	43.32	48.51	68.60	108.47
	15	21	34	23	32	51	30	43	68	76	107	169
	24	34	54	36	51	81	48	69	108	121	172	271
20	38	54	85	57	81	128	76	108	171	191	270	427
25	60	85	135	91	128	203	121	171	271	303	429	678
32	97	137	216	145	205	325	194	274	433	485	686	1085
40	151	214	338	227	321	507	303	428	677	758	1072	1695
50	242	342	540	363	513	812	484	685	1083	1213	1715	2712

Table 7. Body Temperature-Pressure Rating.

Valve Body	Temperature °F	°C	Pressure psig (kPa)
			ANSI Class 250
Bronze	–20 to +150	(–30 to 66)	400 (2758)
	+200	(93)	385 (2655)
	+250	(121)	365 (2586)
	+300	(149)	335 (2300)
	+350	(177)	300 (2068)

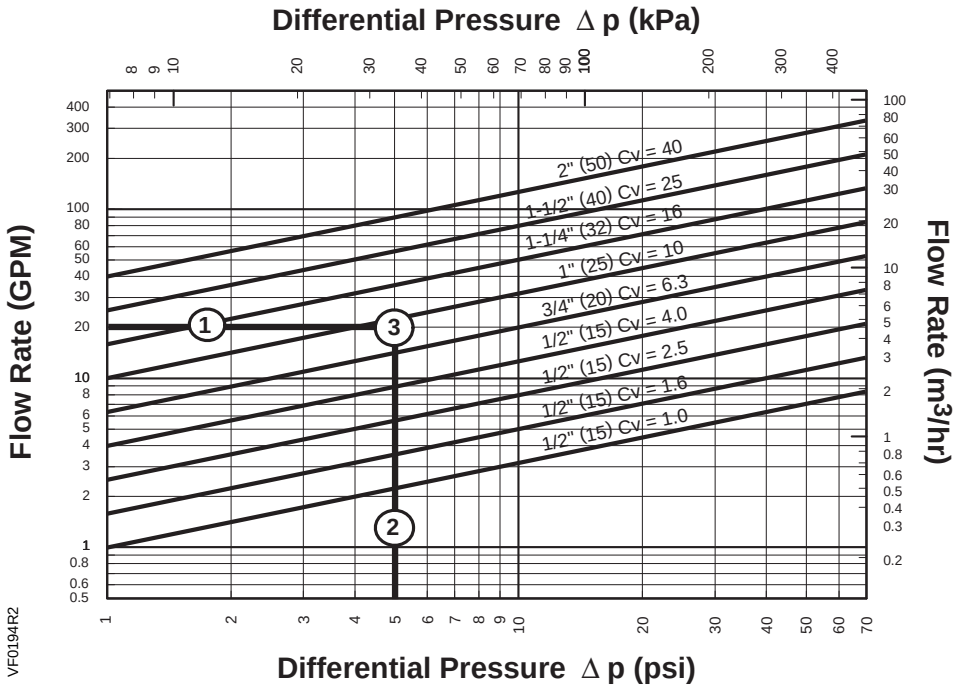


Figure 3. Water Capacity Graph.

Selection Example

Select a valve given:

1. Required flow = 20 gpm.
2. Desired pressure drop = 5 psi.
3. Select a 1-inch (25 mm) valve, Cv 10.

Table 8. Maximum Available Close-off Pressures for Pneumatic Actuators, Action, Upper Port.

	Valve Size Inch (mm)	10 to 15 psi (69 to 103 kPa) spring range		
		4-inch Actuator	8-inch Actuator	12-inch Actuator
		0 psi (0 kPa)	0 psi (0 kPa)	0 psi (0 kPa)
NC (Upper port)	1/2 (15)	236 (1627)	250 (1724)	—
	3/4 (20)	155 (1069)	250 (1724)	—
	1 (25)	91 (627)	250 (1724)	250 (1724)
	1-1/4 (32)	52 (359)	148 (1020)	250 (1724)
	1-1/2 (40)	32 (331)	92 (634)	250 (1724)
	2 (50)	20 (138)	55 (379)	185 (1275)

Table 9. Maximum Available Close-off Pressures for Pneumatic Actuators, Action, Bottom Port.

	Valve Size Inch (mm)	3 to 8 psi (21 to 55 kPa) spring range				
		4-inch Actuator	8-inch Actuator		12-inch Actuator	
		15 psi (103 kPa)	15 psi (103 kPa)	30 psi (207 kPa)	15 psi (103 kPa)	30 psI(207kPa)
NO (Bottom Port)	1/2 (15)	142 (979)	250 (1724)	250 (1724)	—	—
	3/4 (20)	80 (552)	231 (1593)	250 (1724)	—	—
	1 (25)	52 (359)	150 (1034)	250 (1724)	250 (1724)	250 (1724)
	1-1/4 (32)	32 (221)	93 (641)	250 (1724)	250 (1724)	250 (1724)
	1-1/2 (40)	20 (138)	60 (414)	198 (1365)	205 (1413)	250 (1724)
	2 (50)	12 (83)	37 (255)	123 (848)	130 (896)	250 (1724)

Table 10. Close-off Pressures for Electronic Actuators.

Action	Valve Size Inches (mm)	SKB	SKD	SQX	El/Mech Low Force	Rack & Pinion Valve
		psi (kPa)	psi (kPa)	psi (kPa)	psi (kPa)	psi (kPa)
NC	.50 (15)	250 (1724)	250 (1724)	250 (1724)	250 (1724)	250 (1724)
	.75 (20)	250 (1724)	250 (1724)	221 (1524)	238 (1640)	250 (1724)
	1.0 (25)	250 (1724)	203 (1400)	130 (896)	140 (965)	173 (1193)
	1.25 (32)	250 (1724)	117 (807)	75 (517)	81 (558)	100 (690)
	1.50 (40)	208 (1334)	73 (503)	46 (317)	50 (345)	61 (421)
	2.0 (50)	126 (869)	44 (303)	28 (193)	31 (214)	37 (255)
NO	.50 (15)	250 (1724)	250 (1724)	250 (1724)	250 (1724)	250 (1724)
	.75 (20)	250 (1724)	250 (1724)	173 (1193)	186 (1282)	231 (1593)
	1.0 (25)	250 (1724)	201 (1386)	112 (772)	121 (834)	149 (1028)
	1.25 (32)	250 (1724)	124 (855)	69 (476)	75 (517)	92 (634)
	1.50 (40)	250 (1724)	80 (552)	44 (303)	48 (331)	59 (407)
	2.0 (50)	201 (1386)	49 (338)	27 (186)	30 (207)	36 (248)

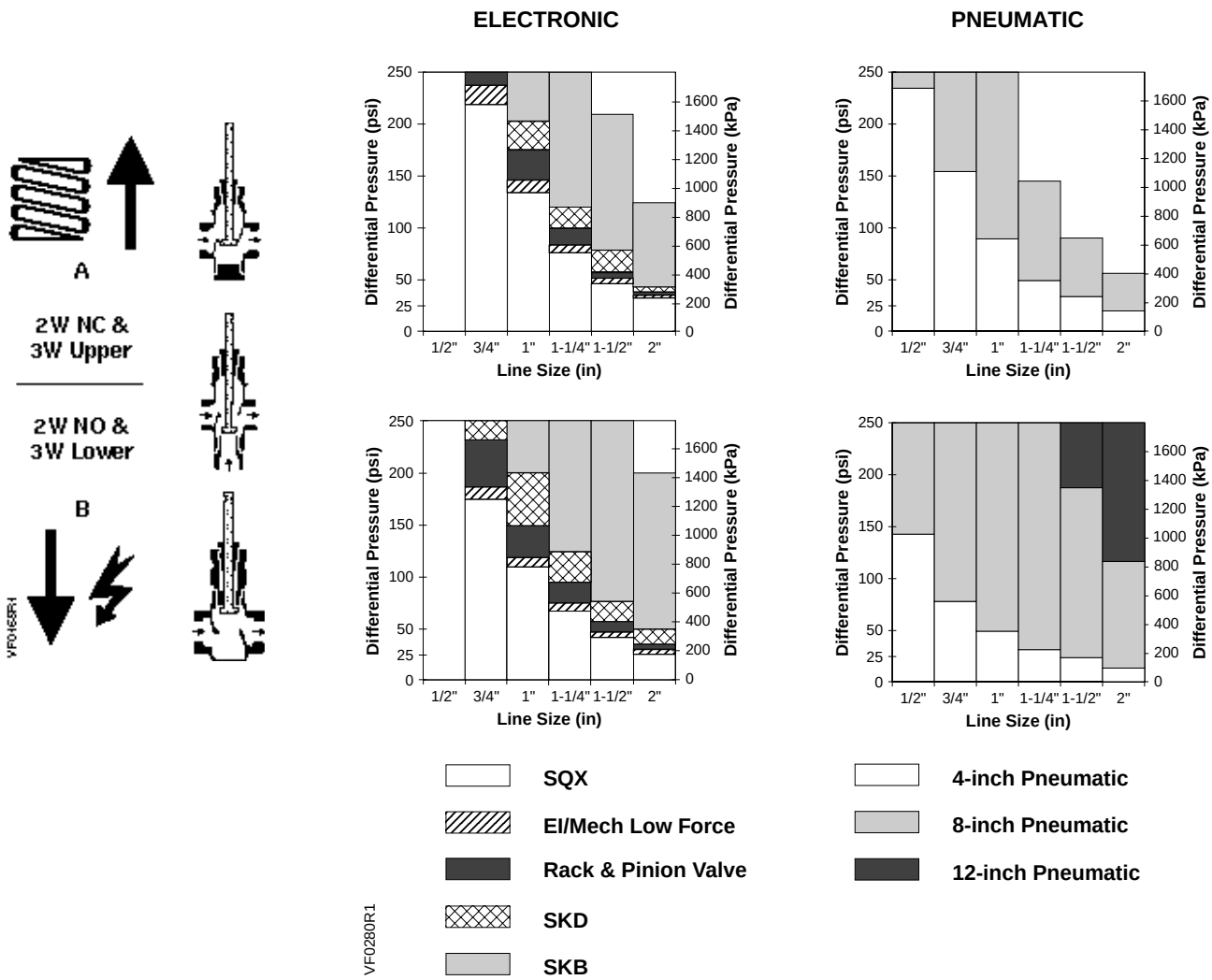


Figure 4. Close-off Pressures.

Operation

Figure 5 shows the normally open valve in the open or full flow position and the normally closed valve in the closed or zero flow position. The actuator spring provides the necessary force to hold the stem in the raised or normal position.

In the event of power failure, a spring return actuator returns the valve to its normal position. Non-spring return actuators will hold the last commanded position. See the *Technical Instructions* of the various actuators for additional information.

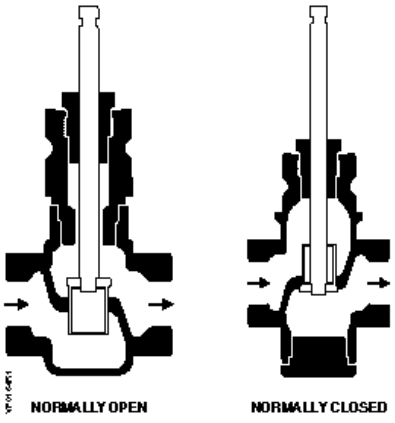


Figure 5.

Sizing

The sizing of a valve is important for correct system operation. An undersized valve will not have sufficient capacity at maximum load. An oversized valve can initiate cycling and the seat and throttling plug can be damaged because of the restricted opening. Correct sizing of the control valve for *actual expected conditions* is considered essential for good control.

The following variables must be determined:

- The medium to be controlled, such as steam, water, etc.
- The maximum inlet temperature and pressure of the medium at the valve.
- The pressure differential that will exist across the valve under maximum load demand.
- The maximum capacity the valve must deliver.
- The maximum line pressure differential the valve actuator must close against.
- See the *Control Valve Selection and Sizing (AB-1*) section *of HVAC Systems/Controls Reference Data* (125-1853) for further recommendations.
- See Tables 3 through 6 for valve capacities.

Mounting and Installation

- Install the valve so that the flow follows the direction of the arrow indicated on the valve body.
- For best performance, install the valve assembly with the actuator above the valve body. The valve and actuator can be installed in any position between vertical and horizontal. Siemens Building Technologies does not recommend installing the valve assembly so that the actuator is below horizontal or upside down.
- Allow sufficient space for servicing the valve and actuator. See Table 11 for valve body dimensions. See Figure 6 and Table 10 for dimensions of the service envelope recommended around the actuator.

NOTE: Instructions for field mounting an actuator, wiring diagrams, and start-up are covered in the Technical Instructions and Installation Instructions for each actuator.

Dimensions

The letters in Figure 6 refer to actuator and service envelope dimensions in Table 11. See Table 12 for valve body dimensions.

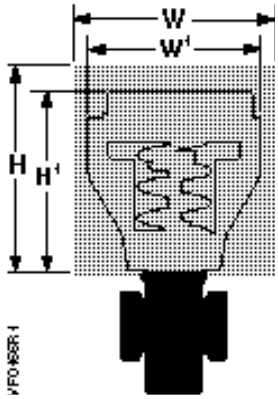
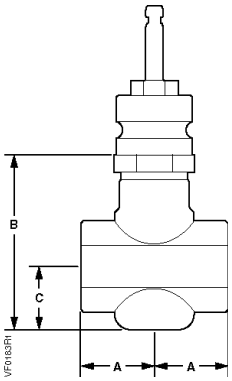


Figure 6. Dimensions.

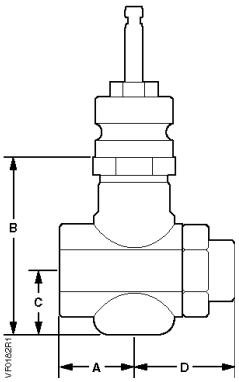
Table 11. Dimensions of the Actuator and Recommended Service Envelope. Dimensions in Inches (Millimeters).

Actuator	Actuator Prefix Code	Actual Height of Actuator H1	Service Height H	Actual Width or Diameter of Actuator W1	Service Width W
4-inch Pneumatic	268, 269 270	5-3/4 (146)	14 (350)	5-1/2 (137) diameter	18 (450)
8-inch Pneumatic	277, 278 283, 284	14-1/8 (359)	26 (660)	8-3/4 (222) diameter	21 (533)
12-inch Pneumatic	279, 285	17-7/8 (454)	30 (762)	15-1/8 (384) diameter	27 (686)
SKB	289, 291	14-3/4 (375)	22-3/4 (578)	14×9 (335 ×228)	25 (635)
SKD	274, 275 276, 279	11-13/16 (300)	19-3/4 (500)	5 (127) Width 6-5/8 (169) Depth	14-1/2 (360)
SQX	271, 272 273	8-7/8 (226)	17 (430)	5-17/32 (140) Width 4-3/8 (111) Depth	13-1/2 (340)
El/Mech with linkage	295, 296 297	11 (280)	22 (559)	5-3/4 (144) Width 8-7/8 (225) Depth	25-3/4 (654)
Rack and Pinion	298, 299	14-1/2 (368)	24 (622)	5 (127) width* 5-1/8 (131) depth	13-1/2 (334)

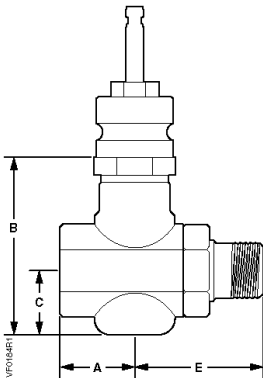
Dimensions, Continued



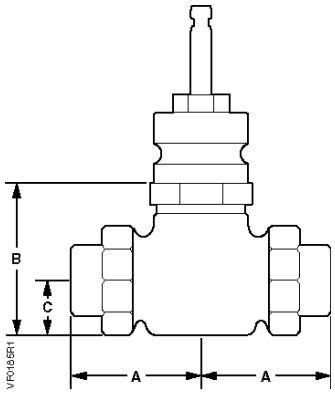
Female NPT by Female NPT FxF



Female NPT x Union Female FxUF



Female NPT x Union Male FxUM



Union Female x Union Female UFxUF

Table 12. 2-Way Valve Dimensions in Inches (Millimeters).

Valve Action	Valve Size	A		B	C	D FxUF	E FxUM
		FxF, FxUF, and FxUM	UFxUF				
Normally Closed	1/2 (15)	1-7/16 (36)	—	3-13/16 (97)	2-3/16 (55)	2-5/16 (59)	2-7/8 (73)
	3/4 (20)	1-11/16 (43)	—	3-13/16 (97)	2-3/16 (55)	2-5/8 (67)	3-3/16 (81)
	1 (25)	2 (50)	—	3-13/16 (97)	2-3/16 (55)	3 (76)	3-1/2 (89)
	1-1/4 (32)	2-1/2* (62)*	3-3/4 (95)	3-13/16 (97)	2-3/16 (55)	—	—
	1-1/2 (40)	2-9/16* (65)*	3-15/16 (99)	3-7/8 (99)	2-1/4 (58)	—	—
	2 (50)	3-1/8* (79)*	4-9/16 (115)	4-1/2 (114)	2-9/16 (65)	—	—
Normally Open	1/2 (15)	1-7/16 (36)	—	2-15/16 (74)	1-1/4 (31)	2-5/16 (59)	2-7/8 (73)
	3/4 (20)	1-11/16 (43)	—	3-15/16 (99)	1-7/16 (36)	2-5/8 (67)	3-3/16 (81)
	1 (25)	2 (50)	—	3-3/4 (96)	1-1/4 (32)	3 (76)	3-1/2 (89)
	1-1/4 (32)	2-1/2* (62)*	3-3/4 (95)	4-1/4** (108) **	2** (51) **	—	4-3/8 (111)
	1-1/2 (40)	2-9/16* (65)*	3-15/16 (99)	4-1/4** (108)**	2** (51)**	—	—
	2 (50)	3-1/8* (79)*	4-9/16 (115)	4-9/16** (116)**	2-1/4** (57)**	—	—

* FxUF is not available as standard in 1-1/4, 1-1/2, and 2-inch valves.
FxUM is not available as standard in 1-1/2, and 2-inch-valves.
** This dimension is determined by the union nut.

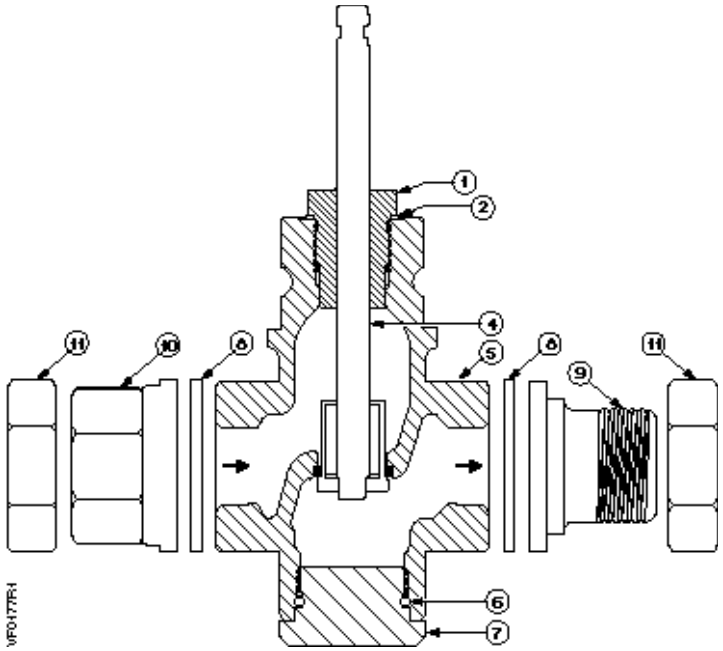
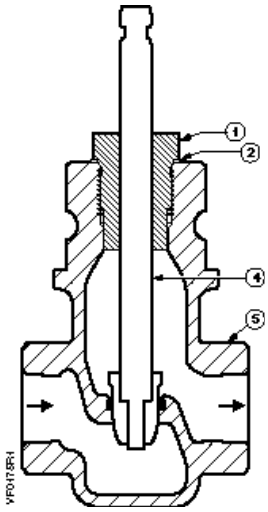
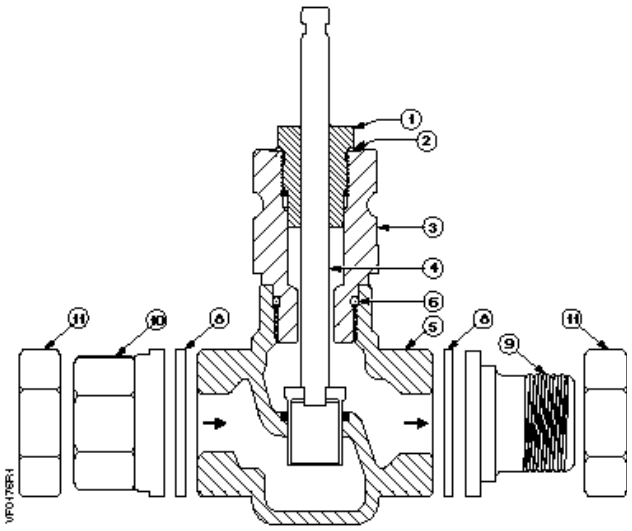


Figure 7. Normally Closed
1/2-inch to 2-inch (15 to 50 mm) Line Size Valve.



1/2-inch (15 mm) Line Size Valve



3/4-inch to 2-inch (20 to 50 mm) Line Size Valve

Figure 8. Normally Open.

Parts List

Table 13. Parts List for 2-Way Bronze Valves. See Figures 7 and 8.

Item	Part Name	Part Number	Quantity				Material
			FxF	FxUF	FxUM	UFxUF	
1	Packing Cartridge Assembly	—	1	1	1	1	—
2	Gasket	—	1	1		1	Copper
3	Normally Open 3/4-inch to 2-inch Bonnet	—	1	1	1	1	Brass
4	Stem and Plug Assembly	—	1	1	1	1	Bronze or Stainless Steel
5	Valve Body	—	1	1	1	1	Bronze
6	O-ring		1	1	1	1	EPDM
7	Normally closed Cap	—	1	1	1	1	Brass
8	Gasket	—	—	1	1	2	Fiber
9	NPT Male union tail piece	—	—	—	1	—	Brass
10	Female tail piece	—	—	1	—	2	Brass
11	Union Nut	—	—	1	1	2	Brass
—	Packing Kit Normal Duty Service Steam Service	 599-03390 599-03391	—	—	—	—	Items 1 and 2
—	Rebuild/Repack Kit Normally Closed	See Table 14	—	—	—	—	Items 1, 2, 4, and 6
—	Rebuild/Repack Kit Normally Open	See Table 14	—	—	—	–	Items 1, 2, 4, and 6

Valve Assembly Weight

Table 14. Weight in Pounds (Kilograms).

Line Size	Normally Closed				Normally Open			
	FxF	FxUF	FxUM	UFxUF	FxF	FxUF	FxUM	UFxUF
.50 (15)	3 (1.4)	4 (1.8)	4 (1.8)	— —	3 (1.4)	3 (1.4)	3 (1.4)	— —
.75 (20)	4 (1.8)	4 (1.8)	5 (2.3)	— —	4 (1.8)	4 (1.8)	5 (2.3)	— —
1.0 (25)	5 (2.3)	5 (2.3)	5 (2.3)	— —	5 (2.3)	6 (2.7)	6 (2.7)	— —
1.25 (32)	7 (3.2)	— —	— —	9 (4.1)	7 (3.2)	— —	8 (3.6)	9 (4.1)
1.50 (40)	8 (3.6)	— —	— —	11 (5)	9 (4.1)	— —	— —	11 (5)
2.0 (50)	16 (7.3)	— —	— —	16 (7.3)	13 (5.9)	— —	— —	16 (7.3)

Service Kit

NOTE: To select the service kit, know your valve body assembly number, model number and the type of connection. Read down the *Connection* column until you find the valve body assembly number and then read to the far right to identify the correct kit. The valve body assembly number and model number are stamped on the tag on the valve body.

Table 15. Rebuild/Repack Service Kits Part Numbers. See Table 12 for Items in Kit.

Connection				Valve	Model 1	Model 2
FxF	FxUF	UFxUF	FxUM	Description	Kit No.	Kit No.
599-03000	599-03009	—	599-03216	NO 1/2" Linear SS 1.0 Cv O-ring	599-03300	—
599-03001	599-03010	—	599-03217	NO 1/2" Linear SS 1.6 Cv O-ring	599-03301	—
599-03002	599-03011	—	599-03218	NO 1/2" Linear SS 2.5 Cv O-ring	599-03302	—
599-03003	599-03012	—	599-03219	NO 1/2" Linear SS 4.0 Cv O-ring	599-03303	—
599-03004	599-03013	—	599-03220	NO 3/4" Linear SS O-ring	599-03304	—
599-03005	599-03014	—	599-03221	NO 1" Linear SS O-ring	599-03305	—
599-03006	—	599-03015	—	NO 1-1/4" Linear SS O-ring	599-03306	599-09201
599-03007	—	599-03016	—	NO1-1/2" Linear SS O-ring	599-03307	599-09202
599-03008	—	599-03017	—	NO 2" Linear SS O-ring	599-03308	599-09203
599-03018	599-03027	—	599-03225	NC 1/2" Linear SS 1.0 Cv O-ring	599-03309	—
599-03019	599-03028	—	599-03226	NC 1/2" Linear SS 1.6 Cv O-ring	599-03310	—
599-03020	599-03029	—	599-03227	NC 1/2" Linear SS 2.5 Cv O-ring	599-03311	—
599-03021	599-03030	—	599-03228	NC 1/2" Linear SS 4.0 Cv O-ring	599-03312	—
599-03022	599-03031	—	599-03229	NC 3/4" Linear SS O-ring	599-03313	—
599-03023	599-03032	—	599-03230	NC 1" Linear SS O-ring	599-03314	—
599-03024	—	599-03033	—	NC 1-1/4" Linear SS O-ring	599-03315	599-09213
599-03025	—	599-03034	—	NC 1-1/2" Linear SS O-ring	599-03316	599-09214
599-03026	—	599-03035	—	NC 2" Linear SS O-ring	599-03317	599-09215
599-03054	599-03063	—	599-03234	NO 1/2" Linear SS 1.0 Cv Steam	599-03318	—
599-03055	599-03064	—	599-03235	NO 1/2" Linear SS 1.6 Cv Steam	599-03319	—
599-03056	599-03065	—	599-03236	NO 1/2" Linear SS 2.5 Cv Steam	599-03320	—
599-03057	599-03066	—	599-03237	NO 1/2" Linear SS 4.0 Cv Steam	599-03321	—
599-03058	599-03067	—	599-03238	NO 3/4" Linear SS Steam	599-03322	—
599-03059	599-03068	—	599-03239	NO 1" Linear SS Steam	599-03323	—
599-03060	—	599-03069	—	NO 1-1/4" Linear SS Steam	599-03324	599-09204
599-03061	—	599-03070	—	NO 1-1/2" Linear SS Steam	599-03325	599-09205
599-03062	—	599-03071	—	NO 2" Linear SS Steam	599-03326	599-09206
599-03072	599-03081	—	599-03243	NC 1/2" Linear SS 1.0 Cv Steam	599-03327	—
599-03073	599-03082	—	599-03244	NC 1/2" Linear SS 1.6 Cv Steam	599-03328	—
599-03074	599-03083	—	599-03245	NC 1/2" Linear SS 2.5 Cv Steam	599-03329	—
599-03075	599-03084	—	599-03246	NC 1/2" Linear SS 4.0 Cv Steam	599-03330	—
599-03076	599-03085	—	599-03247	NC 3/4" Linear SS Steam	599-03331	—
599-03077	599-03086	—	599-03248	NC 1" Linear SS Steam	599-03332	—
599-03078	—	599-03087	—	NC 1-1/4" Linear SS Steam	599-03333	599-09216
599-03079	—	599-03088	—	NC 1-1/2" Linear SS Steam	599-03334	599-09217
599-03080	—	599-03089	—	NC 2" Linear SS Steam	599-03335	599-09218

Service Kits, Continued

Table 16. Rebuild/Repack Service Kits Part Numbers Continued. See Table 13 for Items in Kit.

Connection				Valve Description	Model 1 Kit No.	Model 2 Kit No.
FxF	FxUF	UFxUF	FxUM			
599-03108	599-03117	—	599-03252	NO 1/2" =% SS 1.0 Cv O-ring	599-03336	—
599-03109	599-03118	—	599-03253	NO 1/2" =% SS 1.6 Cv O-ring	599-03337	—
599-03110	599-03119	—	599-03254	NO 1/2" =% SS 2.5 Cv O-ring	599-03338	—
599-03111	599-03120	—	599-03255	NO 1/2" =% SS 4.0 Cv O-ring	599-03339	—
599-03112	599-03121	—	599-03256	NO 3/4" =% SS O-ring	599-03340	—
599-03113	599-03122	—	599-03257	NO 1" =% SS O-ring	599-03341	—
599-03114	—	599-03123	—	NO 1-1/4" =% SS O-ring	599-03342	599-09207
599-03115	—	599-03124	—	NO 1-1/2" =% SS O-ring	599-03343	599-09208
599-03116	—	599-03125	—	NO 2" =% SS O-ring	599-03344	599-09209
599-03126	599-03135	—	599-03261	NC 1/2" =% SS 1.0 Cv O-ring	599-03345	—
599-03127	599-03136	—	599-03262	NC 1/2" =% SS 1.6 Cv O-ring	599-03346	—
599-03128	599-03137	—	599-03263	NC 1/2" =% SS 2.5 Cv O-ring	599-03347	—
599-03129	599-03138	—	599-03264	NC 1/2" =% SS 4.0 Cv O-ring	599-03348	—
599-03130	599-03139	—	599-03265	NC 3/4" =% SS O-ring	599-03349	—
599-03131	599-03140	—	599-03266	NC 1" =% SS O-ring	599-03350	—
599-03132	—	599-03141	—	NC 1-1/4" =% SS O-ring	599-03351	599-09219
599-03133	—	599-03142	—	NC 1-1/2" =% SS O-ring	599-03352	599-09220
599-03134	—	599-03143	—	NC 2" =% SS O-ring	599-03353	599-09221
599-03162	599-03171	—	599-03270	NO 1/2" =% BZ 1.0 Cv O-ring	599-03354	—
599-03163	599-03172	—	599-03271	NO 1/2" =% BZ 1.6 Cv O-ring	599-03355	—
599-03164	599-03173	—	599-03272	NO 1/2" =% BZ 2.5 Cv O-ring	599-03356	—
599-03165	599-03174	—	599-03273	NO 1/2" =% BZ 4.0 Cv O-ring	599-03357	—
599-03166	599-03175	—	599-03274	NO 3/4" =% BZ O-ring	599-03358	—
599-03167	599-03176	—	599-03275	NO 1" =% BZ O-ring	599-03359	—
599-03168	—	599-03177	599-03276	NO 1-1/4" =% BZ O-ring	599-03360	599-09210
599-03169	—	599-03178	—	NO 1-1/2" =% BZ O-ring	599-03361	599-09211
599-03170	—	599-03179	—	NO 2" =% BZ O-ring	599-03362	599-09212
599-03180	599-03189	—	599-03279	NC 1/2" =% BZ 1.0 Cv O-ring	599-03363	—
599-03181	599-03190	—	599-03280	NC 1/2" =% BZ 1.6 Cv O-ring	599-03364	—
599-03182	599-03191	—	599-03281	NC 1/2" =% BZ 2.5 Cv O-ring	599-03365	—
599-03183	599-03192	—	599-03282	NC 1/2" =% BZ 4.0 Cv O-ring	599-03366	—
599-03184	599-03193	—	599-03283	NC 3/4" =% BZ O-ring	599-03367	—
599-03185	599-03194	—	599-03284	NC 1" =% BZ O-ring	599-03368	—
599-03186	—	599-03195	—	NC 1-1/4" =% BZ O-ring	599-03369	599-09222
599-03187	—	599-03196	—	NC 1-1/2" =% BZ O-ring	599-03370	599-09223
599-03188	—	599-03197	—	NC 2" =% BZ O-ring	599-03371	599-09224

Information in this publication is based on current specifications. The company reserves the right to make changes in specifications and models as design improvements are introduced. Flowrite is a registered trademark of Siemens Building Technologies, Inc. Product or company names mentioned herein may be the trademarks of their respective owners. © 2008 Siemens Building Technologies, Inc.

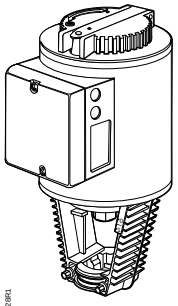
SIEMENS

Technical Instructions
Document No. 155-717
EA-599-18
April 30, 2004

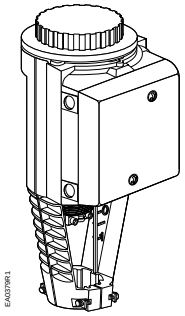
Flowrite™ EA 599 Series

SKB/C/D 62UA Series
Electronic Valve Actuator 24 Vac
Proportional Control
Advanced Features

c UL us LISTED



SKB/C



SKD

Description

The Flowrite EA 599 Series SKB/C/D62UA Electronic Valve Actuator requires a 24 Vac supply and receives a 0 to 10 Vdc or a 4 to 20 mA control signal to proportionally control a valve. This actuator is designed to work with Flowrite VF 599 Series valves and Siemens Building Technologies, Inc. standard valves with a 3/4-inch (20 mm) stroke.

Features

- Direct-coupled installation requires no special tools or adjustments
- Visual and electronic stroke indication
- Die-cast aluminum housing
- Manual override
- Spring return to fail-safe position
- Automatic stroke calibration
- Direct or reverse acting
- Adjustable start and span
- Stroke limit control
- Selectable operation direction (direct-acting/reverse acting)
- Choice of linear or equal-percentage flow characteristic
- Maintenance-free

Application

These electronic actuators are designed to be used with Flowrite VF 599 Series valves with either 3/4-inch (20 mm) stroke (SKB/D) or a 1-1/2 inch (40 mm) stroke (SKC) in liquid service and steam service applications; or other manufacturer's valves with appropriate Universal Valve Linkage Kit.

Product Numbers

Table 1. Product Numbers

Actuator Stroke	Order Number
3/4-inch (20 mm)	SKB62UA
	SKD62UA

1-1/2 inch (40 mm)	SKC62UA

Warning/Caution Notations

WARNING:		Personal injury/loss of life may occur if a procedure is not performed as specified.
CAUTION:		Equipment damage, or loss of data may occur if the user does not follow a procedure as specified.

Specifications

Power Supply

Operating voltage (SELV,PELV)		24 Vac ± 20%
Frequency		50 or 60 Hz
Power consumption		
	SKB62UA	17 VA/ 12W
	SKC62UA	28 VA/ 20W
	SKD62UA	17 VA/ 12W

Operating

Type of control (proportional)		0 to 10 Vdc; 4 to 20 mA; or 0 to 1000 ohm	
Running time		Opening:	Closing:
	SKB62UA	120 sec	15 sec
	SKC62UA	120 sec	20 sec
	SKD62UA	30 sec	15 sec
Spring-return time	Closing:		
	SKB62UA	15 sec	
	SKC62UA	20 sec	
	SKD62UA	15 sec	
Nominal stroke			
	SKB62UA	3/4-inch (20 mm)	
	SKC62UA	1-1/2-inch (40 mm)	
	SKD62UA	3/4-inch (20 mm)	
Position force			
	SKB/C 62UA	2800N	
	SKD62UA	1000N	

Signal Inputs

Terminal Y	
Voltage	0 to 10 Vdc
Input impendence	100K ohm
Current	4 to 20 mA
Input impedance	240 ohm
Signal resolution	<1%
Hysteresis	<1%

	Terminal Z	
	Resistance	0 to 1000 ohm
	Override control functions	
	Z not connected	No function (priority at Terminal Y)
	Z connected directly to G	Maximum stroke 100%
	Z connected directly to G0	Minimum stroke 0%
	Z connected to M via 0 to 1000 ohm	Linear or equal percentage
Signal Inputs, continued	Terminal U	
	Voltage	0 to 9.8 Vdc ± 2%
	Load impedance	>500 ohm
	Current	4 to 19.6 mA ± 2%
	Load impedance	<500 ohms
Ambient Conditions	Maximum admissible temperature of medium in the connected valve:	≤284°F (140°C)
	Ambient temperature	5°F to 130°F (-15°C to 55°C)
	Media temperature	14°F to 300°F (-10°C to 150°C)
	Operation	To IEC 721-3-3
	Environmental conditions	Class 3K5
	Temperature	5°F to 122°F (-15°C to 50°C)
	Humidity	5% to 95% rh
	Transport	To IEC 721-2-1
	Environmental conditions	Class 3K5
	Temperature	22°F to 149°F (-5°C to 65°C)
	Humidity	<95% rh
	Storage	To IEC 721-3-1
	Environmental conditions	Class 1K3
	Temperature	5°F to 122°F (-15°C to 50°C)
	Humidity	5% to 95% rh
Agency Certification		UL listed to UL873 C-UL certified to Canadian standard C22.2 No. 24-93
	Meet CE requirements:	
	EMC Directive	89/336/EEC
	C-tick	N474
	Protection standard	IP54 to EN 60 529
	Protection Class	III to EN 60 730
Miscellaneous	Materials	
	Actuator housing and bracket	Die-cast aluminum
	Housing box and manual adjustor	Plastic
	Conduit opening	1/2-inch NPSM
	Dimensions	See Figures 25 and 26
	Weight	
	SKB62UA	18.9 lbs (8,60 kg)
	SKC62UA	22.5 lbs (10,00 kg)
	SKD62UA	8.5 lbs (3,85 kg)
Housing	NEMA Rating	NEMA 1 (Interior only) See *Accessories*

Advanced Features

Direction of Operation	
Direct acting / reverse acting	0 to 10 Vdc; 10 to 0 Vdc 4 20 mA; 20 to 4 mA 0 to 1000 ohm / 1000 to 0 ohm
Stroke Limit Control	
Range of lower limit	0% to 45% adjustable
Range of upper limit	100% to 55% adjustable
Sequence Control	
Starting Point of Sequence (Start)	0 to 15V adjustable
Operating Range of Sequence (Span)	3 to 15V adjustable

Accessories

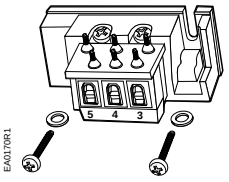


Figure 1. Auxiliary Switch.

ASC1.6 Auxiliary switch

- Sends a signal to indicate that the valve is in the 0% stroke position.
- The switching point is fixed at the 0% stroke position.

Switching capacity	24 Vac 4A resistive, 2A inductive
Lowest recommended current	10 mA

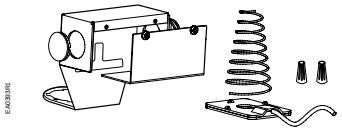


Figure 2. Packing Heating Element.

599-00417 Packing heating element for SKD
599-00418 Packing heating element for SKB/C

This heater allows the stem to move freely in valves that control fluids at temperatures below 32°F (0°C). It reduces ice crystal formation on the stem which may damage the packing.

Operating Voltage	24 Vac
Heating Output	20 W

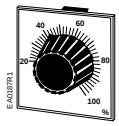


Figure 3. Remote Setting Unit.

FZA21.11 Remote setting unit.

Potentiometer is used for manual control or remote setting of minimum positions of controlled devices. Suitable for flush panel mounting only.

Control Input	0 to 1000 ohms

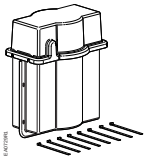


Figure 4. SKB/C Weather Shield.

599-10065 The SKB/C actuator is UL listed to meet NEMA Type 3R requirements (a degree of protection against rain, sleet, and damage from external ice formation) when installed with this weather shield and outdoor-rated conduit fittings in the vertical position. See *Service Kits* for replacement Ultraviolet resistant cable ties.

Accessories, continued

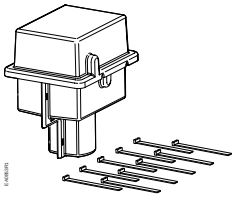


Figure 5. SKD Weather Shield.

599-10071 The SKD actuator is UL listed to meet NEMA TYPE 3R requirements (a degree of protection against rain, sleet, and damage from external ice formation) when installed with this weather shield and outdoor-rated conduit fittings in the vertical position. See *Service Kits* for replacement UV resistant cable ties.

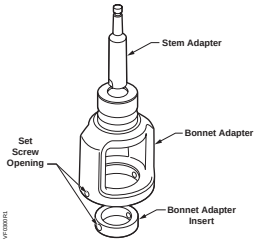


Figure 6. Valve Retrofit Kit.

Universal Retrofit Kit

Kit contains the parts needed to adapt a valve to the following Siemens 599 Series Flowrite actuators: SKB, SKC, SKD, SQX. Selected valves from the following manufacturers can also be accommodated: Honeywell, Johnson Controls and Siebe. See your local Siemens representative for details.

Service Kits

Circuit board replacement	4 668 5751 8
Manual override kit	4268 5510 8
Plastic wiring compartment cover	4 104 5582 8
Stem retainer kit	
Contains one stem nut (Figure 7, Item 6) and one stem retainer clip.	
2-1/2 and 3-inch valves	599-10048
4, 5, and 6-inch valves	599-10049
Retainer clamp kit	599-10200
Ultraviolet (UV) resistant cable ties (pkg. of 8)	538-994

WARNING:
This product contains a spring under high compression. Do not attempt to disassemble the actuator.

Valve Details

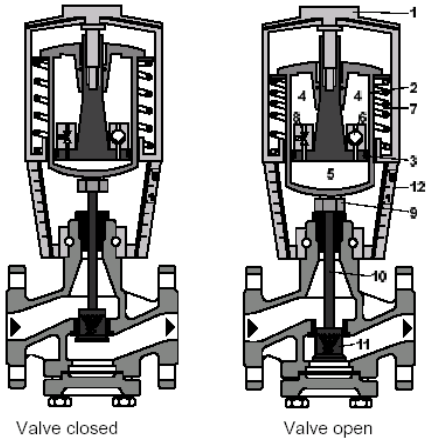
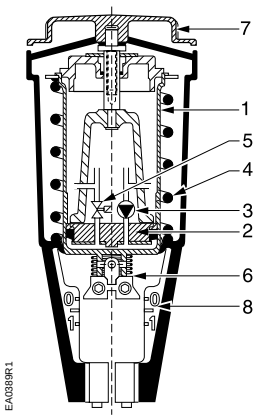


Figure 7. SKB/C Valve Parts.

1. Manual Adjuster
2. Pressure Cylinder
3. Piston
4. Reservoir
5. Pressure Chamber
6. Pump
7. Return Spring
8. Bypass Valve
9. Coupling
10. Valve Stem
11. Inner Valve
12. Position Indicator (0 to 1)

Valve Details, continued



1. Pressure cylinder
2. Piston
3. Oscillating pump
4. Return spring
5. Bypass valve
6. Valve stem retainer
7. Manual override knob
8. Position indicator

Figure 8. SKD Valve Parts.

Standard Operation

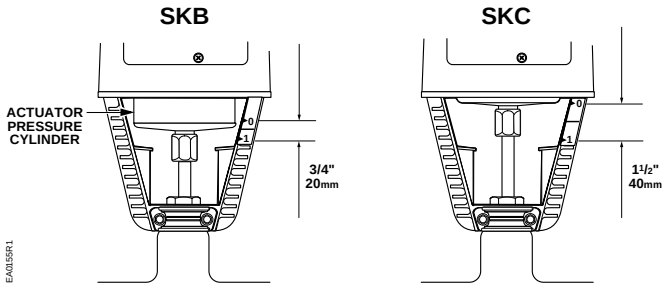


Figure 9. SKB\C Valve Stem Travel Indication.

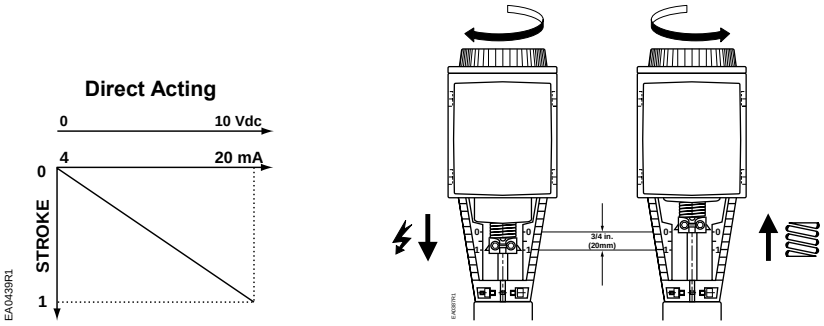


Figure 10. SKD Valve Stem Travel Indication.

The actuator accepts a 0 to 10 Vdc or a 4 to 20 mA control signal. The actuator mounted on a valve produces a stroke proportional to the input signal. When power is turned off or in the event of a power failure, the actuator spring returns the valve to its normal position.

Mounting and Installation

The vertical position is the recommended position for mounting and the only position for NEMA Type 3R rating with the Weather Shield. Acceptable mounting positions are shown in Figure 11.

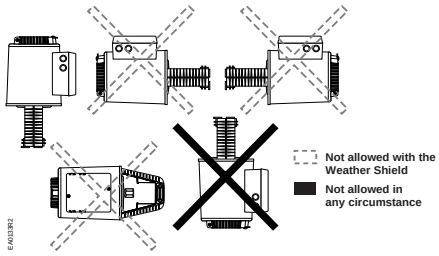


Figure 11. Acceptable Mounting Positions.

Allow four inches (100 mm) around the sides and back of the actuator and eight inches (200 mm) above and to the front of the actuator.

See dimensions in Figure 25and Figure 26.

Detailed installation instructions for field mounting are shipped with the actuator.

CAUTION:

When removing the knockout do not damage the circuit board. Use the top knockout position, if possible.

Start-up

Check the wiring for proper connections.

NOTE: The valve body assembly determines the complete assembly action.

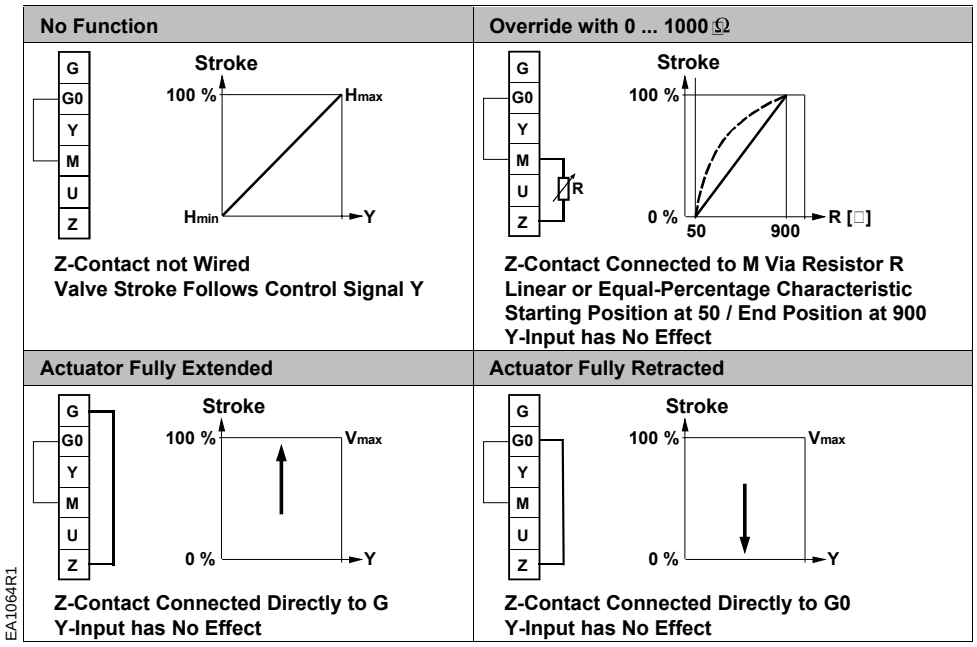
Spring Return Function

All SKB/C/D62UA actuators are factory-fitted with a spring-return function. If the control signal or power supply fails, the actuator will return to the 0% stroke position (stem fully retracted).

Start-up continued

Override Control

The override control input (Z) has three modes of operation:



NOTE: The Z-modes have a "direct acting" factory setting.

Stroke Calibration

To determine the stroke positions 0% and 100% in the valve, calibration is required when the valve/actuator are commissioned for the first time. The actuator must be mechanically connected to a valve and must have a supply voltage of 24 Vac. The calibration procedure can be repeated as often as necessary

CAUTION:

Before starting calibration, be sure that the manual adjuster is set to **Automatic** for the actual values to register.

There is a slot on the printed circuit boards for the actuators. To initiate the calibration procedure, the contacts inside this slot must be short-circuited (possibly with a screwdriver). See Figure 12.

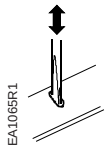


Figure 12.

Automatic calibration proceeds as follows (See Figure 13):

- Actuator runs to the 0% stroke position (1), the green LED flashes.
- Actuator then runs to the 100% stroke position (2), the green LED flashes.
- Measured values are stored in the EPROM.
- The actuator now moves to the position defined by control signal Y or Z (3), and the green LED now glows steady (normal operation).
- Throughout this procedure, output U is inactive, meaning the values only represent actual positions when the green LED stops flashing and remains on continuously.

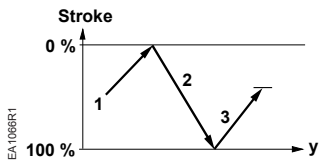


Figure 13.
Automatic Calibration.

Start-up continued

Table 2. LED Status.

LED	Display	Function	Action
Green	ON	Normal Operation	Automatic operation
	Flashing	Stroke calibration In Progress	Wait for calibration to be completed (LED stops flashing)
Red	ON	Faulty stroke calibration Internal Error	- Check mounting - Restart stroke calibration (by short-circuiting calibration slot) - Replace electronics
	Flashing	Valve plug jammed	Check the valve
	OFF	• No power supply • Faulty electronics	- Check mains - Replace electronics

Advanced Features

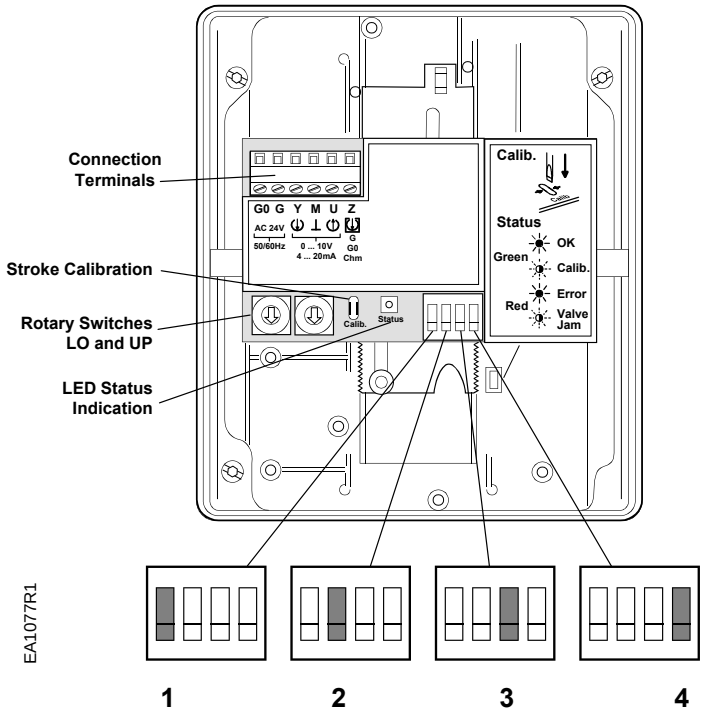


Figure 14. DIP Switches.

DIP Switches (From Left to Right)	1 Select Direction of Operation	2 Sequence Control or Stroke Limit Control	3 Selection of Control Signal	4 Selection of Flow Characteristic
ON	Reverse-acting	Sequence control	4 to 20 mA	Modified*
OFF (Factory Settings)	Direct-acting	Stroke limit control	0 to 10 Vdc	Default

*Changing the default setting will modify an equal percentage valve to a linear flow characteristic. When set to default, the flow characteristic is determined by the valve body.

Start-Up, continued

Selecting the Direction of Operation

- With normally-closed valves, "direct-acting" means that with a 0 Vdc signal input, the valve is closed.
- With Normally-open valves, "direct-acting" means that with a 0 Vdc signal input, the valve is open.

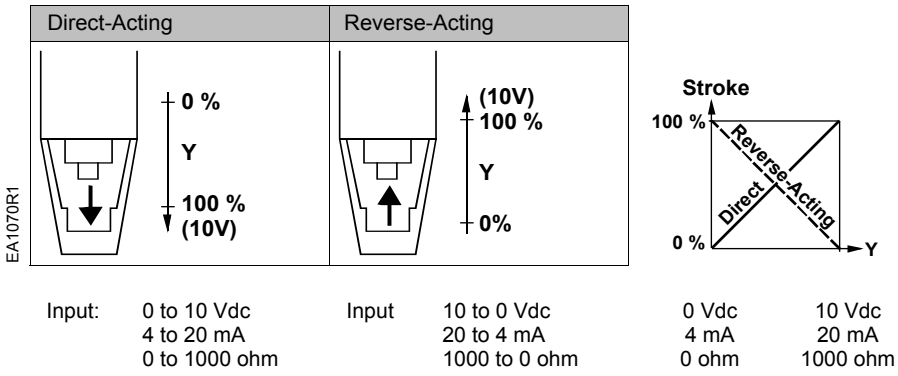


Figure 15. Direction of Operation.

Sequence Control or Stroke Limit Control

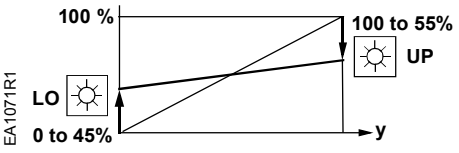
Check the wiring for proper connections.

NOTE: The valve body assembly determines the complete assembly action.

Table 3.

Setting the Stroke Limit Control

The rotary switches LO and UP can be used to apply an upper and lower limit to the stroke in increments of 3% up to a maximum of 45%.

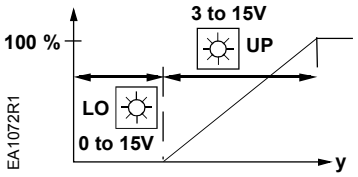


Position of LO	Lower Stroke Limit	Position of UP	Upper Stroke Limit
0	0%	0	100%
1	3%	1	97%
2	6%	2	94%
3	9%	3	91%
4	12%	4	88%
5	15%	5	85%
6	18%	6	82%
7	21%	7	79%
8	24%	8	76%
9	27%	9	73%
A	30%	A	70%
B	33%	B	67%
C	36%	C	64%
D	39%	D	61%
E	42%	E	58%
F	45%	F	55%

Table 4.

Setting the Sequence Control

The rotary switches LO and UP can be used to determine the starting point (Start) or the operating range of a sequence (Span).



Position of LO	Starting Point for Sequence Control	Position of UP	Operating Range of Sequence Control
0	0V	0	10V
1	1V	1	10V*
2	2V	2	10V*
3	3V	3	3V*
4	4V	4	4V
5	5V	5	5V
6	6V	6	6V
7	7V	7	7V
8	8V	8	8V
9	9V	9	9V
A	10V	A	10V
B	11V	B	11V
C	12V	C	12V
D	13V	D	13V
E	14V	E	14V
F	15V	F	15V

*The smallest adjustment is 3 Vdc; Control with 0 to 3 Vdc is possible only via Y.

Start-up, continued

Normally Closed Valve

When actuator pressure cylinder:
Moves outward (0 to 1): Valve opens.
Moves inward (1 to 0): Valve closes.

Normally Open Valve

When actuator pressure cylinder:
Moves outward (0 to 1): Valve closes.
Moves inward (1 to 0): Valve opens.

Three Way Valve

When actuator pressure cylinder:
Moves outward (0 to 1): Valve opens between port NC and C.
Moves inward (1 to 0): Valve opens between ports NO and C.

The measuring voltage at terminal U provides valve stem position feedback to an indicating instrument or building automation system.

Manual operation

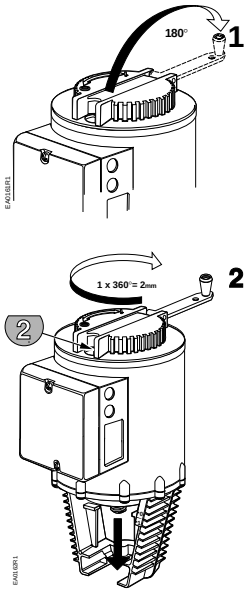


Figure 16. SKB/C Manual Operation.

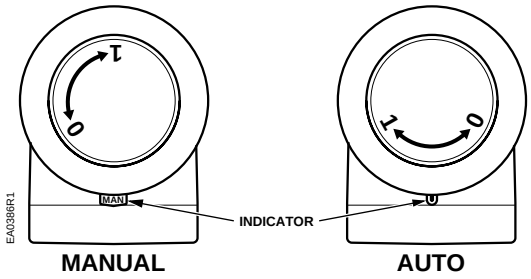


Figure 17. SKD Manual Operation.

Turn the manual setting knob clockwise for manual operation. As you begin to turn, a red indicator becomes visible. Each complete revolution (360°) is equal to 3/32-inch (2.5 mm) stroke.

NOTE: If a signal is sent to the actuator while it is in manual operation, the actuator will move, but the control will not be accurate. The valve cannot be commanded to its 0% position while in manual operation.

Start-up continued

Automatic Operation

When returning to automatic control, you must turn the crank arm of the manual setting knob counterclockwise until the red numbers disappear. It is essential that the window is clear and the crank arm is snapped into position. See Figure 18.

SKB/C

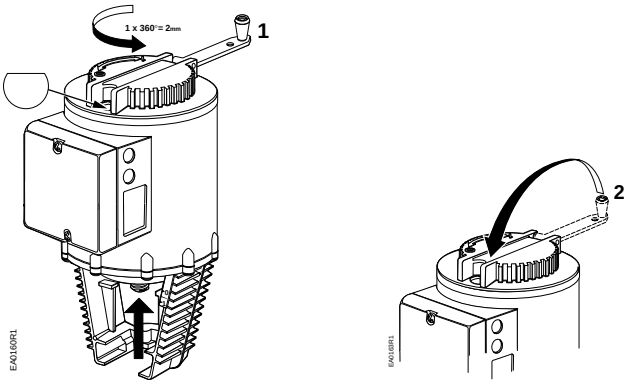


Figure 18. SKB/C Automatic Operation.

SKD

For automatic operation, the manual override knob must be in the fully closed position. Turn the manual override knob counterclockwise until the red indicator disappears.

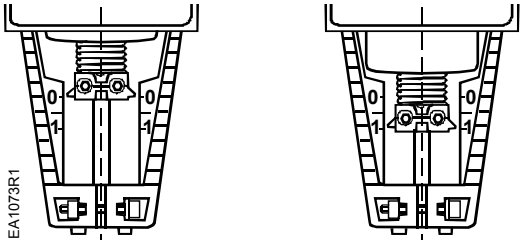


Figure 19.

Fully Retracted Coupling
► Stroke = 0%

Fully Extended Coupling
► Stroke = 100%

CAUTION:
The manual adjuster must be rotated counterclockwise to the end stop until the red indicator marked MAN is no longer visible.

Wiring

Do not use auto-transformers. Use earth ground isolating step-down Class II power supplies.

Determine supply transformer rating by summing total VA of all actuators used.

Determine the rating for Class 2 step-down transformer is 100 VA and consider the following requirements:
SKB62A = 17 VA SKC62UA = 28 VA SKD62UA = 17 VA;

A maximum of four actuators can be powered by one transformer (80% of transformer VA). Operating more than four SK series actuators requires additional transformers or separate 100 VA power supplies.

The position output signal U will switch from 0 to 10 Vdc to 4 to 20 mA when a 4 to 20 mA input signal is selected and used on the Y terminal.

Wiring Diagrams

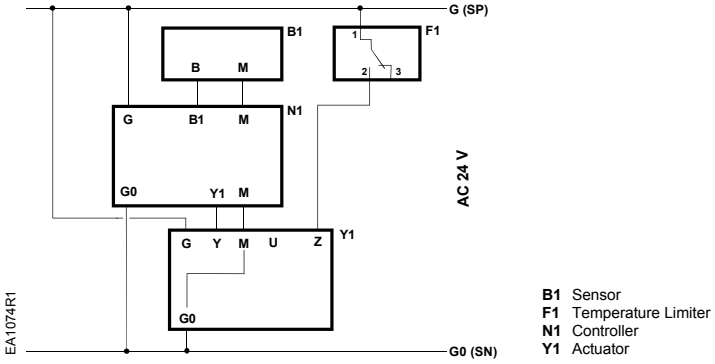


Figure 20. Terminal Connections.

24 Vac	
G	System potential (SP)
G0	System neutral (SN)
Y	Control input signal 0 to 10 (30) Vdc or 4 to 20 mA
M	Measuring neutral
U	Position indication 0 to 10 Vdc or 4 to 20 mA (see Table 1)
Z	Override input.

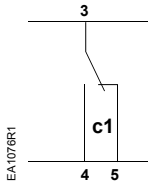


Figure 21. Auxiliary Switches.

Table 1. Actuator Output Signal U.

Actuator input signal	Receiving Impedance	
	low (<500 ohm)	high (>10K ohm)
0 to 10 Vdc	0 to 20 mA	0 to10 Vdc
4 to 20 mA	4 to 20 mA	2 to 10 Vdc

Wiring Diagrams, continued

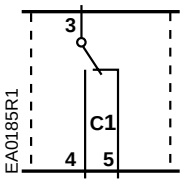


Figure 22. Auxiliary Switch ASC1.6.

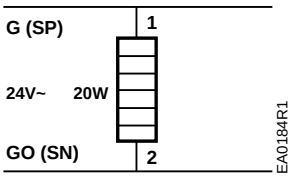


Figure 23. Packing Heating Element 599-00418.

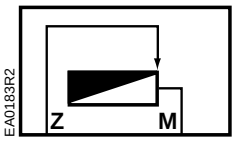


Figure 24. Remote Setting Unit FZA21.11.

Dimensions

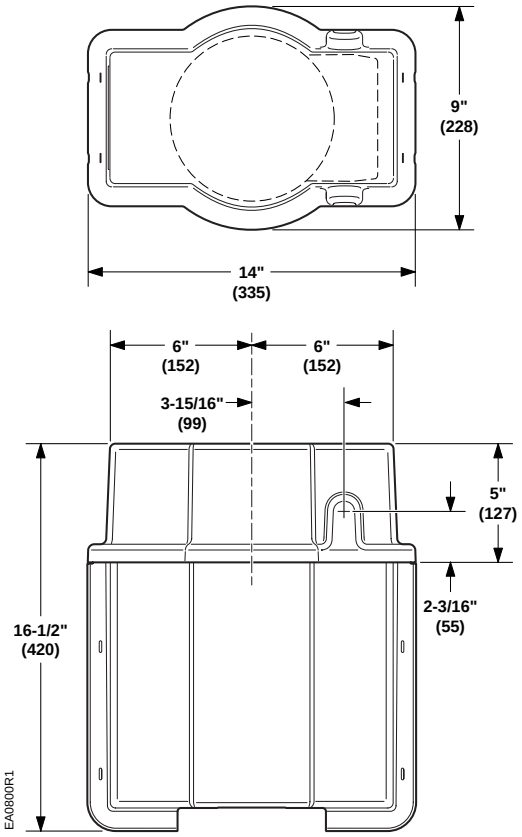


Figure 25. Dimensions of 599-10065 SKB\C Weather Shield in Inches (Millimeters).

Dimensions, continued

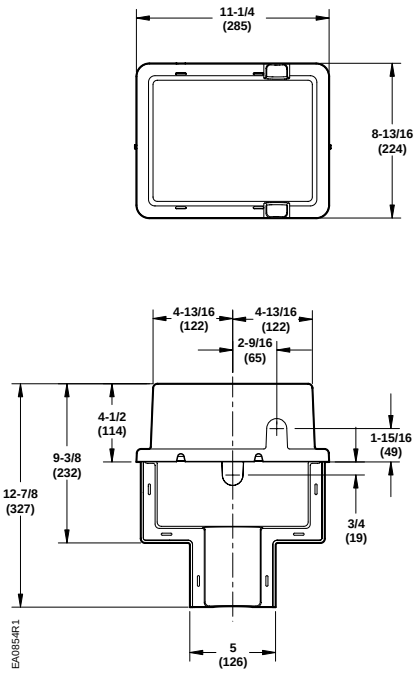


Figure 26. Dimensions of 599-10071 SKD Weather Shield in Inches (Millimeters).

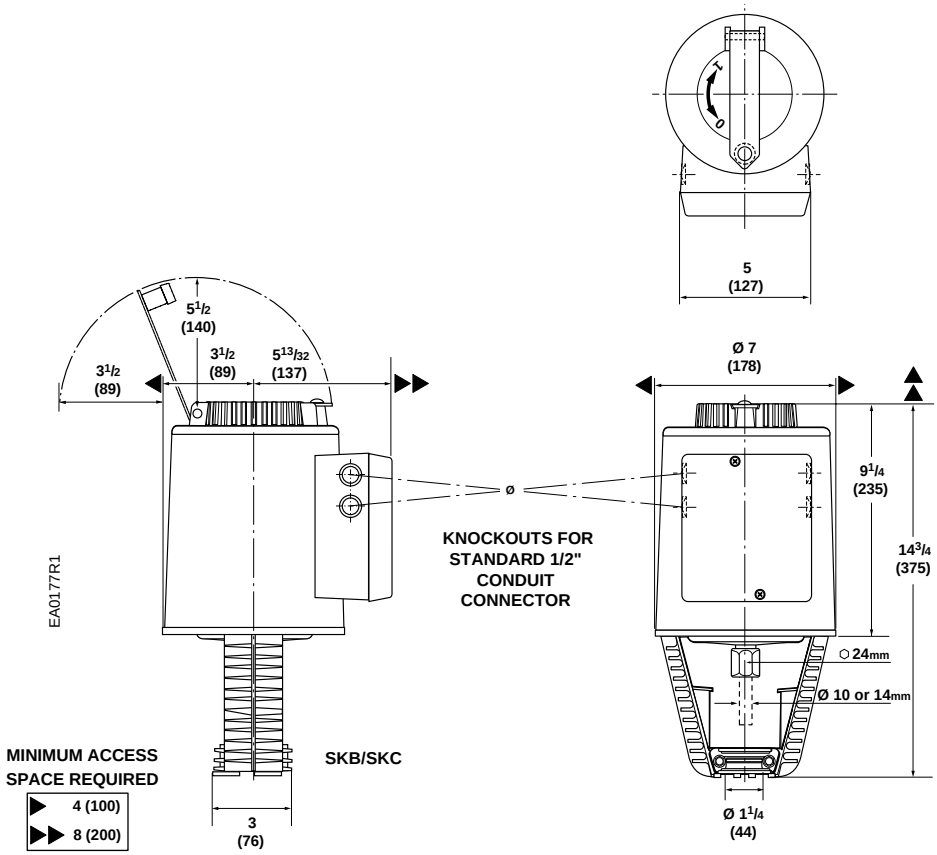


Figure 27. SKB/C Weather Shield, 599-10071 in Inches (Millimeters).

Dimensions, continued

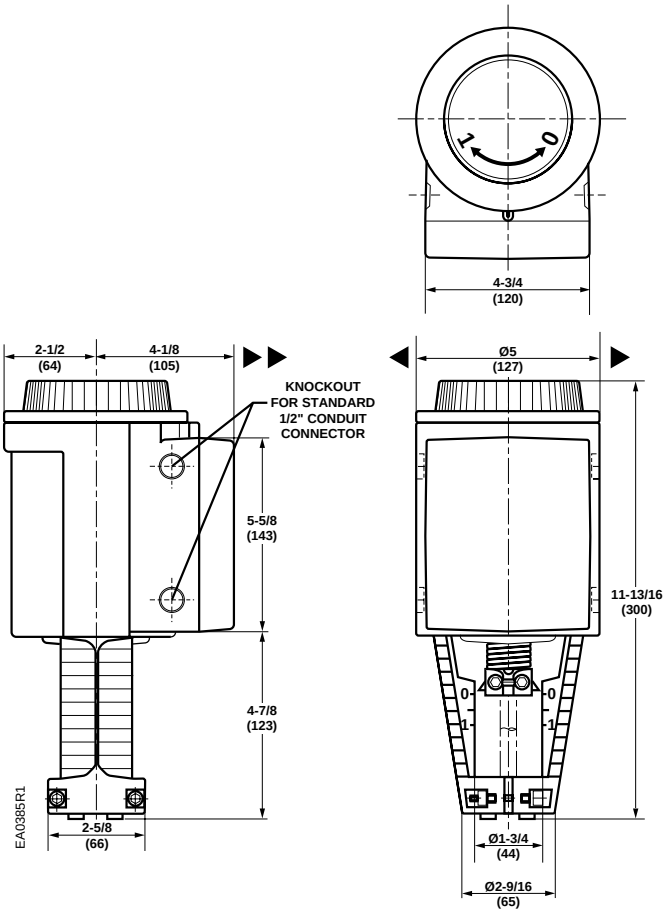


Figure 28. Dimensions of SKD Actuator in Inches (Millimeters).

Information in this publication is based on current specifications. The company reserves the right to make changes in specifications and models as design improvements are introduced. Flowrite is a trademark of Siemens Building Technologies, Inc. Other product or company names mentioned herein may be the trademarks of their respective owners. © 2004 Siemens Building Technologies, Inc.

SCC Inc.

Technical Instructions

Document No. LV5-4000

September 3, 2014

FLMTR Series

Natural Gas Flow Meter Kits for Boiler Commissioning or Flow Totalization



Product Description

The Natural Gas Flow Meter Kits reliably measure and display the instantaneous flow of natural gas. A commissioning kit is available to display the current gas flow in SCFH for accurate commissioning of a boiler. Two flow totalization kits are available to measure gas flow and transmit the information to either an LMV52 controller or a PLC.

Features

- Measures and displays the instantaneous flow of natural gas
- Automatically compensates for temperature and pressure of the gas
- Mounts on pipe sizes ranging from 1” to 6”

Product Part Numbers

Table 1: Available Natural Gas Flow Meter Kits

Part Number	Description
FLMTR-0.75-6.0KIT	Natural gas flow meter kit for boiler commissioning
KT-LMV52-PIK-100	Natural gas flow meter kit for measurement and totalization of flow through a 1” pipe on an LMV52 controller
KT-LMV52-PIK-125	Natural gas flow meter kit for measurement and totalization of flow through a 1-1/4” pipe on an LMV52 controller
KT-LMV52-PIK-150	Natural gas flow meter kit for measurement and totalization of flow through a 1-1/2” pipe on an LMV52 controller
KT-LMV52-PIK-200	Natural gas flow meter kit for measurement and totalization of flow through a 2” pipe on an LMV52 controller
KT-LMV52-PIK-250	Natural gas flow meter kit for measurement and totalization of flow through a 2-1/2” pipe on an LMV52 controller
KT-LMV52-PIK-300	Natural gas flow meter kit for measurement and totalization of flow through a 3” pipe on an LMV52 controller
KT-LMV52-PIK-400	Natural gas flow meter kit for measurement and totalization of flow through a 4” pipe on an LMV52 controller
KT-LMV52-PIK-500	Natural gas flow meter kit for measurement and totalization of flow through a 5” pipe on an LMV52 controller
KT-LMV52-PIK-600	Natural gas flow meter kit for measurement and totalization of flow through a 6” pipe on an LMV52 controller
KT-BMK-PLC-100	Natural gas flow meter kit for measurement and totalization of flow through a 1” pipe on a PLC
KT-BMK-PLC-125	Natural gas flow meter kit for measurement and totalization of flow through a 1-1/4” pipe on a PLC
KT-BMK-PLC-150	Natural gas flow meter kit for measurement and totalization of flow through a 1-1/2” pipe on a PLC
KT-BMK-PLC-200	Natural gas flow meter kit for measurement and totalization of flow through a 2” pipe on a PLC
KT-BMK-PLC-250	Natural gas flow meter kit for measurement and totalization of flow through a 2-1/2” pipe on a PLC
KT-BMK-PLC-300	Natural gas flow meter kit for measurement and totalization of flow through a 3” pipe on a PLC
KT-BMK-PLC-400	Natural gas flow meter kit for measurement and totalization of flow through a 4” pipe on a PLC
KT-BMK-PLC-500	Natural gas flow meter kit for measurement and totalization of flow through a 5” pipe on a PLC
KT-BMK-PLC-600	Natural gas flow meter kit for measurement and totalization of flow through a 6” pipe on a PLC

Specifications

Operating characteristics	Media to be measured	Natural gas
	Units for flow	SCFH
	Maximum flow	See Table 2
	Calibrated operating gas pressure	5 psig [0.3 bar][1]
	Calibrated operating gas temperature	55°F [13°C][1]
	Ambient temperature	-40 to 120°F [-40 to 49°C]
	Gas pressure operating range	0 to 120 psig [0 to 8.3 bar]
	Accuracy	±1% of full scale plus 3% of reading (correlation)
	Repeatability	±0.24% of full scale

Table 2: Pipe Size vs. Maximum Flow Rate

Pipe Size	Max Flow (SCFH)	Approx. Boiler Horsepower at Max Flow (BHP)[2]
1”	3601	91
1-1/4”	6232	158
1-1/2”	8483	215
2”	13982	355
2-1/2”	19949	507
3”	30803	782
4”	53042	1347
5”	83358	2117
6”	120376[3]	3057[3]

Notes:

1. Meter automatically compensates for temperature and pressure of the gas
2. Boiler Horsepower numbers assume a natural gas heating value of 1000 BTU / SCFH and a boiler efficiency of 85%.
3. When using commissioning kit FLMTR-0.75-6.0KIT on a 6” pipe, max flow is 99912 SCFH which is approximately 2537 BHP.

Components

Figure 1 shows the components included with the FLMTR-0.75-6.0KIT commissioning kit. See Installation Instructions LV5-4050 for more information.



Figure 1: Components Included in the FLMTR-0.75-6.0KIT Commissioning Kit

1. Enclosure with remote display and convenience outlet
2. Natural gas flow meter
3. Interconnecting cable, 25 feet long
4. Brass packing gland for 3/8” tube, ½”NPT connection, with O-rings and washers installed
5. Spare O-rings, Dash 204 (qty 4)
6. 120 VAC power cord, 10 feet long, 10A max

Components (continued)

Figure 2 shows the components included with a KT-LMV52-PIK… totalization kit. See Installation Instructions LV5-4150 for more information.



Figure 2: Components Included in a KT-LMV52-PIK… Totalization Kit

1. Natural gas flow meter with ½" NPT conduit connection
2. Milliamp-to-pulse converter
3. 115 / 230 VAC to 15 VDC power supply
4. 100 / 240 VAC to 24 VDC power supply
5. 4 pin plug for LMV52 connection
6. Stainless steel tubing adapter for 3/8" tube, ½" NPT connection, with stainless steel ferrule installed

Components (continued)

Figure 3 shows the components included with a KT-BMK-PLC… totalization kit. See Installation Instructions LV5-4250 for more information.



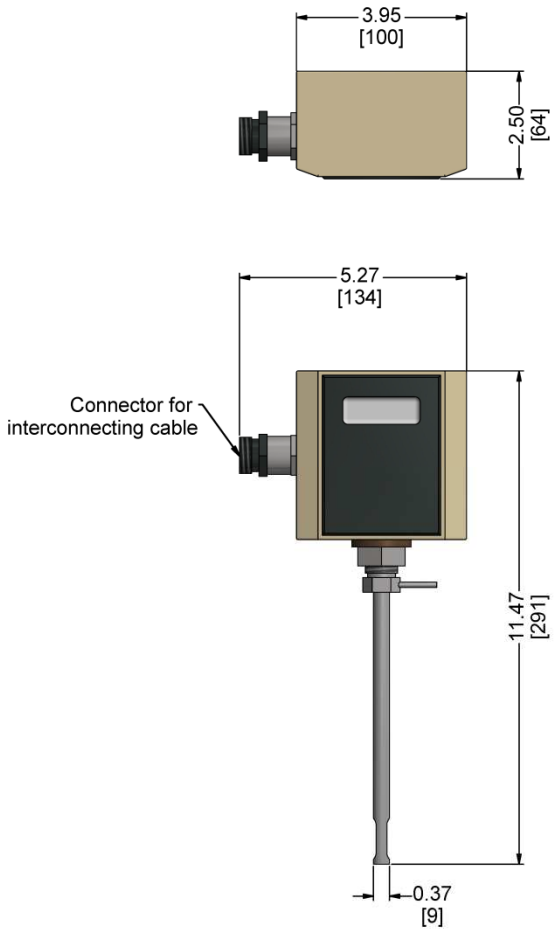
Figure 3: Components Included in a KT-BMK-PLC… Totalization Kit

1. Natural gas flow meter with ½" NPT conduit connection
2. 115 / 230 VAC to 15 VDC power supply
3. Stainless steel tubing adapter for 3/8" tube, ½" NPT connection, with stainless steel ferrule installed

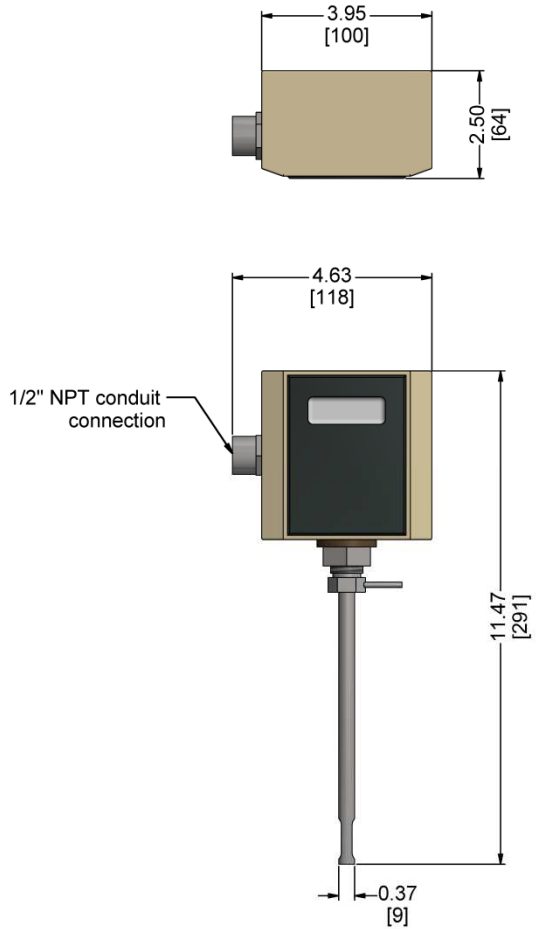
Dimensions

Dimensions in inches; millimeters in brackets

FLMTR-0.75-6.0KIT



KT-LMV52-PIK…, KT-BMK-PLC…



Information in this publication is based on current specifications. The company reserves the right to make changes in specifications and models as design improvements are introduced. Product or company names mentioned herein may be the trademarks of their respective owners. © 2009 SCC Inc.

SCC Inc.

Installation Instructions

Document No. LV5-4050

September 19, 2014

FLMTR Series

FLMTR-0.75-6.0KIT Natural Gas Flow Meter Kit



Product Information

The Natural Gas Flow Meter Kit measures and displays the instantaneous flow of natural gas in standard cubic feet per hour (SCFH).

Recommended Installation Tools

1. PTFE tape
2. Tape measure
3. 1” open end wrench or 8” crescent wrench

Components Supplied

Figure 1 shows all of the components that are supplied with the Natural Gas Flow Meter Kit.



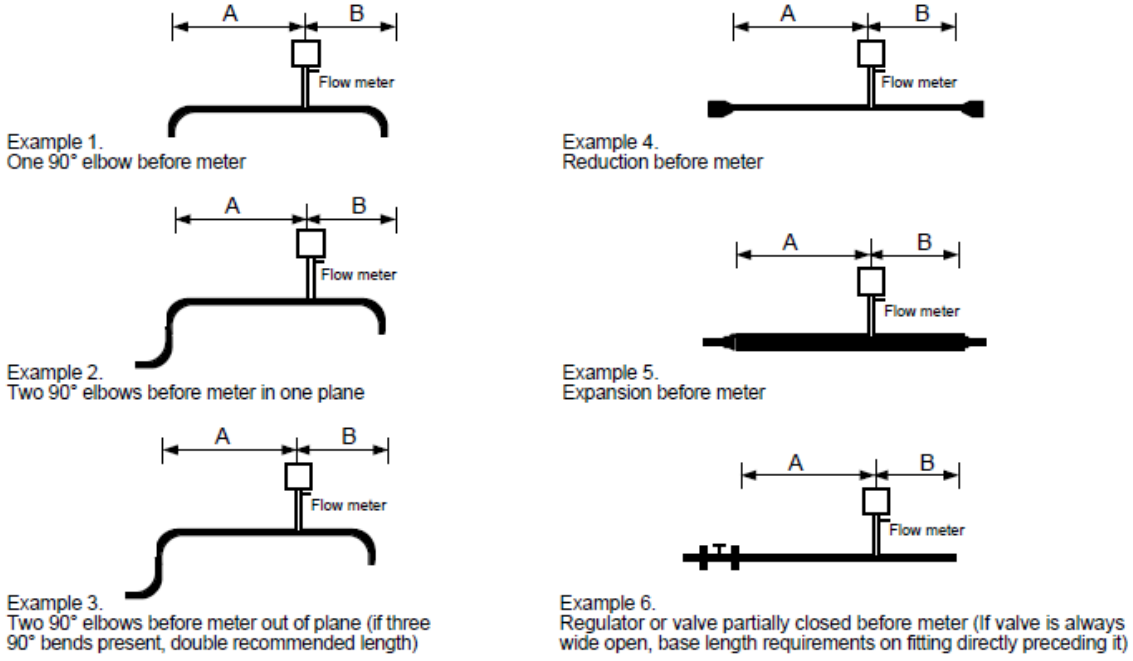
Figure 1: Components Included in the Natural Gas Flow Meter Kit

1. Enclosure with remote display and 110V convenience outlet
2. Natural gas flow meter
3. Interconnecting cable, 25 feet long
4. Brass packing gland for 3/8” tube, 1/2”NPT connection, with O-rings and washers installed
5. Spare O-rings , Dash 204 (qty 4)
6. 120 VAC power cord, 10 feet long, 10A max

Installation Procedure

1. The natural gas flow meter may be mounted in horizontal or vertical piping. The flow meter must be mounted at least 10 pipe diameters downstream of disturbances (elbows, reducers, etc.) and at least 5 pipe diameters upstream of disturbances. Longer distances of straight pipe may be necessary depending on the piping arrangement. See Figure 2 below for the necessary distance of straight pipe upstream and downstream of the meter. If the meter is not mounted per the requirements below, unstable flow readings may result.

   Note: Proper upstream and downstream pipe diameters are critical to achieve accurate and stable flow readings.



Example 1.
One 90° elbow before meter

Example 2.
Two 90° elbows before meter in one plane

Example 3.
Two 90° elbows before meter out of plane (if three 90° bends present, double recommended length)

Example 4.
Reduction before meter

Example 5.
Expansion before meter

Example 6.
Regulator or valve partially closed before meter (If valve is always wide open, base length requirements on fitting directly preceding it)

Example	A Upstream(1) Requirements	B Downstream(2) Requirements
1	10 D	5 D
2	15 D	5 D
3	25 D	10 D
4	10 D	5 D
5	20 D	5 D
6	25 D	10 D

(1) Number of diameters (D) of straight pipe required between upstream disturbance and the flow meter.
(2) Number of diameters (D) of straight pipe required downstream of the flow meter.

Figure 2: Necessary Amount of Straight Pipe for Mounting Flow Meter

Installation Procedure (continued)

2. Once a suitable location has been found, identify the pipe size and if possible, the pipe schedule. With this information, use Tables 4 and 5 in Appendix A to verify that the gas velocity through the pipe in this location is less than 166 ft/sec for 1" thru 5" pipe or 138 ft/sec for 6" pipe when the burner is at high fire.

3. Verify that the static pressure in the pipe is less than 50 PSIG and the natural gas temperature (when flowing) is between 20 and 120°F.

4. Verify that the natural gas piping into which the meter is going to be inserted is depressurized. If not, close the upstream gas valve and bleed off any residual trapped gas.

5. If a ½" NPT or larger half coupling is not available in a suitable location, one will need to be welded onto the pipe with a ½" or larger hole drilled through the pipe wall in the center of the coupling. After this is completed, the assembly should look like Figure 3.

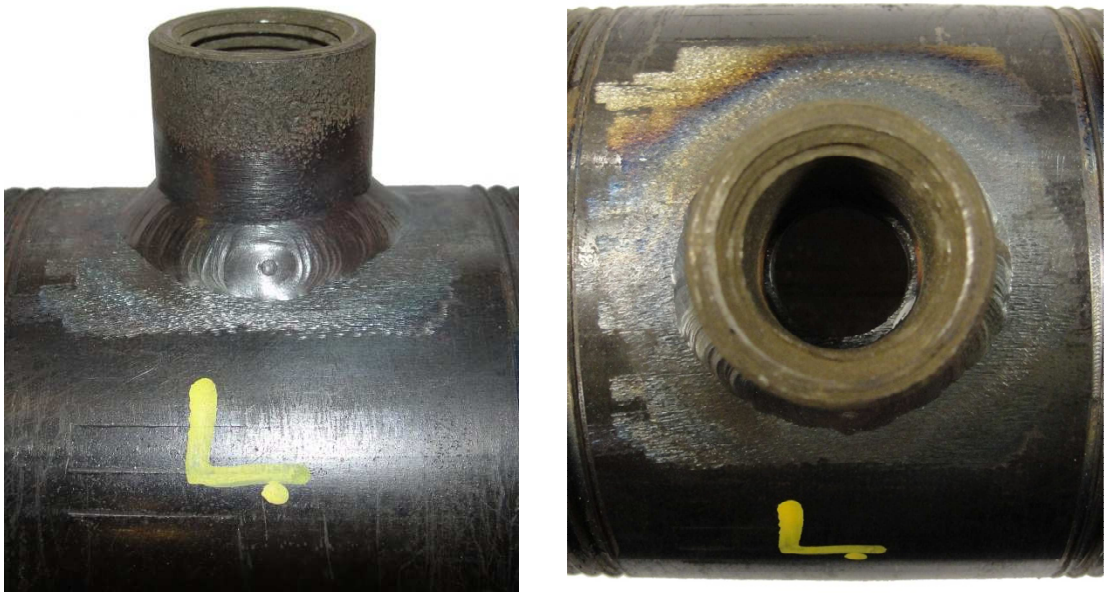


Figure 3: ½" NPT Half Coupling Welded to Pipe with ½" Hole Drilled Through Center

Installation Procedure (continued)

6. Screw the packing gland into the ½" NPT half coupling. PTFE tape should be used to seal the NPT threads of the packing gland. O-rings and washers must be installed in the packing gland as shown in Figure 4.

   Note: The O-rings will wear over time. Inspect the O-rings before each use and replace the O-rings if any wear is evident.

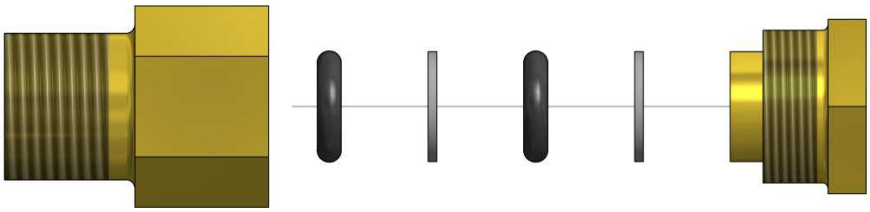


Figure 4: Proper Installation of Washers and O-rings in the Packing Gland

7. Insert the meter sensing tube into the packing gland. Using Table 1 and Figure 5, center the meter's sensing element in the pipe by setting distance "X" (distance from the outer diameter of the pipe to the bottom of the pointer). This can be done carefully with a tape measure. Ensure that the pointer on the flow meter is pointing in the direction of flow.

Pipe Size	Distance "X"
1"	5.34"
1-1/4"	5.17"
1-1/2"	5.05"
2"	4.81"
2-1/2"	4.56"
3"	4.25"
4"	3.75"
5"	3.22"
6"	2.69"

Table 1: Meter Insertion Distance



Figure 5: Meter Inserted into Pipe

Installation Procedure (continued)

8. After the meter is inserted to the correct depth with the pointer in the direction of flow, tighten the packing gland nut with the 1” open end wrench (or crescent wrench). This will cause the O-rings to compress around the meter’s sensing tube.

9. Connect the interconnecting cable to the flow meter and to the enclosure. The male end of the cable connects to the enclosure and the female end connects to the flow meter.

10. Plug the power cord into the side of the enclosure and then into a 120 VAC receptacle. The meter and the remote display should power up. After this step, the meter and enclosure should look like Figure 6.



Figure 6: Flow Meter Connected and Powered

Installation Procedure (continued)

11. Scale the remote display for the pipe size that the meter is installed in. For Schedule 40 pipe, use the table provided on the front of the enclosure or Table 2 in Appendix A to obtain the correct scaling value for parameter “dSP.2”. For Schedule 80 pipe, use Table 3 in Appendix A. Once the correct scaling value has been obtained, the following steps are necessary to change the scaling of the remote display:
    a. Press and hold down the button labeled LEVEL. The display will blink and “Cn-t” will appear on the display. Release the LEVEL button after “Cn-t” appears.
    b. Press the button labeled MODE four times until “dSP.2” appears on the display.
    c. Press the button labeled SHIFT. The current setting for parameter “dSP.2” should appear.
    d. Press the SHIFT button again. Note that as the SHIFT button is tapped more times, different digits in the setting blink. Press the SHIFT button until the digit to be changed is blinking.
    e. Change the blinking digit by pressing the UP key until the correct value for the digit is displayed.
    f. Repeat steps “d” and “e” as required to change the setting of “dSP.2” to the correct value.
    g. After all of the digits in the setting are changed and verified to be correct for the pipe size, press the MODE button. The display should then show “dP”.
    h. Press and hold the LEVEL button. The entire display should light up as if the display is re-booting. Release the button after this. The current flow rate should then be shown on the remote display.

12. If the gas meter is being inserted into 6” pipe, the gas meter itself will need to be re-scaled to 8300 SFPM. This can be done by removing the cover of the flow meter and using the three red buttons. See the “User Full Scale Adjustment” section of the Sierra 620 manual which is provided for how to re-scale the flow meter. When commissioning is complete, set the meter back to 10,000 SFPM for 1” through 5” pipe sizes. See Tables 2 and 3 in Appendix A for more information.

13. The gas meter and remote display should now be ready for use. The enclosure with the remote display should be hung in a location where the remote display can be easily read. A convenience outlet is provided on the side of the enclosure for 120 VAC devices up to 7A.

Installation Procedure (continued)

14. After use, remove all power from the enclosure prior to de-pressurizing the gas piping and removing the flow meter and packing gland. Plug the half coupling where the meter was inserted. Place the flow meter and accessories back into the plastic case. When all components are put back into the case, the flow meter kit will appear as shown in Figure 7.



Figure 7: Flow Meter Kit Packaged in Case

Appendix A

Table 2: Display Scaling for Schedule 40 Pipe

Pipe Size	Setting of "dSP.2"	Meter Full Scale (SFPM)*
1"	3601	10000
1-1/4"	6232	10000
1-1/2"	8483	10000
2"	13982	10000
2-1/2"	19949	10000
3"	30803	10000
4"	53043	10000
5"	83358	10000
6"	99912	8300

Table 3: Display Scaling for Schedule 80 Pipe

Pipe Size	Setting of "dSP.2"	Meter Full Scale (SFPM)*
1"	2997	10000
1 1/4"	5345	10000
1 1/2"	7363	10000
2	12304	10000
2 1/2"	17659	10000
3"	27522	10000
4"	47904	10000
5"	75807	10000
6"	90116	8300

***Note:** Re-scale the meter if inserting it into a 6" gas pipe.

Appendix A (continued)

Table 4: Schedule 40 Pipe Velocities and Flows

Standard Velocity			1"		1- 1/4"		1 -1/2"		2"		2 -1/2"	
			Flow		Flow		Flow		Flow		Flow	
STD ft/sec	STD ft/min	STD ft/hr	SCFH	BHP	SCFH	BHP	SCFH	BHP	SCFH	BHP	SCFH	BHP
0.0	**0**	0	0	0	0	0	0	0	0	0	0	0
6.7	**400**	24000	144	4	249	6	339	9	559	14	798	20
13.3	**800**	48000	288	7	499	13	679	17	1119	28	1596	41
20.0	**1200**	72000	432	11	748	19	1018	26	1678	43	2394	61
26.7	**1600**	96000	576	15	997	25	1357	34	2237	57	3192	81
33.3	**2000**	120000	720	18	1246	32	1697	43	2796	71	3990	101
40.0	**2400**	144000	864	22	1496	38	2036	52	3356	85	4788	122
46.7	**2800**	168000	1008	26	1745	44	2375	60	3915	99	5586	142
53.3	**3200**	192000	1152	29	1994	51	2714	69	4474	114	6384	162
60.0	**3600**	216000	1296	33	2244	57	3054	78	5033	128	7182	182
66.7	**4000**	240000	1440	37	2493	63	3393	86	5593	142	7980	203
73.3	**4400**	264000	1584	40	2742	70	3732	95	6152	156	8778	223
80.0	**4800**	288000	1729	44	2991	76	4072	103	6711	170	9576	243
86.7	**5200**	312000	1873	48	3241	82	4411	112	7270	185	10373	263
93.3	**5600**	336000	2017	51	3490	89	4750	121	7830	199	11171	284
100.0	**6000**	360000	2161	55	3739	95	5090	129	8389	213	11969	304
106.7	**6400**	384000	2305	59	3989	101	5429	138	8948	227	12767	324
113.3	**6800**	408000	2449	62	4238	108	5768	146	9508	241	13565	344
120.0	**7200**	432000	2593	66	4487	114	6107	155	10067	256	14363	365
126.7	**7600**	456000	2737	69	4736	120	6447	164	10626	270	15161	385
133.3	**8000**	480000	2881	73	4986	127	6786	172	11185	284	15959	405
140.0	**8400**	504000	3025	77	5235	133	7125	181	11745	298	16757	425
146.7	**8800**	528000	3169	80	5484	139	7465	190	12304	312	17555	446
153.3	**9200**	552000	3313	84	5734	146	7804	198	12863	327	18353	466
160.0	**9600**	576000	3457	88	5983	152	8143	207	13422	341	19151	486
166.7	**10000**	600000	3601	91	6232	158	8483	215	13982	355	19949	507

Note:

Boiler Horsepower numbers assume a natural gas heating value of 1000 BTU / SCFH and a boiler efficiency of 85%.

Appendix A (continued)

Table 4: Schedule 40 Pipe Velocities and Flows (continued)

Standard Velocity			3"		4"		5"		6"	
			Flow		Flow		Flow		Flow	
STD ft/sec	STD ft/min	STD ft/hr	SCFH	BHP	SCFH	BHP	SCFH	BHP	SCFH	BHP
0.0	**0**	0	0	0	0	0	0	0	0	0
6.7	**400**	24000	1232	31	2122	54	3334	85	4815	122
13.3	**800**	48000	2464	63	4243	108	6669	169	9630	245
20.0	**1200**	72000	3696	94	6365	162	10003	254	14445	367
26.7	**1600**	96000	4928	125	8487	215	13337	339	19260	489
33.3	**2000**	120000	6161	156	10609	269	16672	423	24075	611
40.0	**2400**	144000	7393	188	12730	323	20006	508	28890	734
46.7	**2800**	168000	8625	219	14852	377	23340	593	33705	856
53.3	**3200**	192000	9857	250	16974	431	26674	677	38520	978
60.0	**3600**	216000	11089	282	19095	485	30009	762	43335	1100
66.7	**4000**	240000	12321	313	21217	539	33343	847	48150	1223
73.3	**4400**	264000	13553	344	23339	593	36677	931	52965	1345
80.0	**4800**	288000	14785	375	25461	646	40012	1016	57781	1467
86.7	**5200**	312000	16017	407	27582	700	43346	1101	62596	1589
93.3	**5600**	336000	17250	438	29704	754	46680	1185	67411	1712
100.0	**6000**	360000	18482	469	31826	808	50015	1270	72226	1834
106.7	**6400**	384000	19714	501	33947	862	53349	1355	77041	1956
113.3	**6800**	408000	20946	532	36069	916	56683	1439	81856	2078
120.0	**7200**	432000	22178	563	38191	970	60017	1524	86671	2201
126.7	**7600**	456000	23410	594	40313	1024	63352	1609	91486	2323
133.3	**8000**	480000	24642	626	42434	1077	66686	1693	96301	2445
140.0	**8400**	504000	25874	657	44556	1131	70020	1778	-	-
146.7	**8800**	528000	27106	688	46678	1185	73355	1863	-	-
153.3	**9200**	552000	28339	720	48799	1239	76689	1947	-	-
160.0	**9600**	576000	29571	751	50921	1293	80023	2032	-	-
166.7	**10000**	600000	30803	782	53043	1347	83358	2117	-	-

Note:

Boiler Horsepower numbers assume a natural gas heating value of 1000 BTU / SCFH and a boiler efficiency of 85%.

Appendix A (continued)

Table 5: Schedule 80 Pipe Velocities and Flows

Standard Velocity			1"		1- 1/4"		1 -1/2"		2"		2 -1/2"	
			Flow		Flow		Flow		Flow		Flow	
STD ft/sec	STD ft/min	STD ft/hr	SCFH	BHP	SCFH	BHP	SCFH	BHP	SCFH	BHP	SCFH	BHP
0.0	**0**	0	0	0	0	0	0	0	0	0	0	0
6.7	**400**	24000	120	3	214	5	295	7	492	12	706	18
13.3	**800**	48000	240	6	428	11	589	15	984	25	1413	36
20.0	**1200**	72000	360	9	641	16	884	22	1476	37	2119	54
26.7	**1600**	96000	480	12	855	22	1178	30	1969	50	2826	72
33.3	**2000**	120000	599	15	1069	27	1473	37	2461	62	3532	90
40.0	**2400**	144000	719	18	1283	33	1767	45	2953	75	4238	108
46.7	**2800**	168000	839	21	1497	38	2062	52	3445	87	4945	126
53.3	**3200**	192000	959	24	1710	43	2356	60	3937	100	5651	143
60.0	**3600**	216000	1079	27	1924	49	2651	67	4429	112	6357	161
66.7	**4000**	240000	1199	30	2138	54	2945	75	4921	125	7064	179
73.3	**4400**	264000	1319	33	2352	60	3240	82	5414	137	7770	197
80.0	**4800**	288000	1439	37	2566	65	3534	90	5906	150	8477	215
86.7	**5200**	312000	1558	40	2779	71	3829	97	6398	162	9183	233
93.3	**5600**	336000	1678	43	2993	76	4123	105	6890	175	9889	251
100.0	**6000**	360000	1798	46	3207	81	4418	112	7382	187	10596	269
106.7	**6400**	384000	1918	49	3421	87	4712	120	7874	200	11302	287
113.3	**6800**	408000	2038	52	3635	92	5007	127	8366	212	12008	305
120.0	**7200**	432000	2158	55	3848	98	5301	135	8859	225	12715	323
126.7	**7600**	456000	2278	58	4062	103	5596	142	9351	237	13421	341
133.3	**8000**	480000	2398	61	4276	109	5890	150	9843	250	14128	359
140.0	**8400**	504000	2518	64	4490	114	6185	157	10335	262	14834	377
146.7	**8800**	528000	2637	67	4704	119	6480	165	10827	275	15540	395
153.3	**9200**	552000	2757	70	4917	125	6774	172	11319	287	16247	413
160.0	**9600**	576000	2877	73	5131	130	7069	179	11812	300	16953	430
166.7	**10000**	600000	2997	76	5345	136	7363	187	12304	312	17659	448

Note:

Boiler Horsepower numbers assume a natural gas heating value of 1000 BTU / SCFH and a boiler efficiency of 85%.

Appendix A (continued)

Table 5: Schedule 80 Pipe Velocities and Flows (continued)

Standard Velocity			3"		4"		5"		6"	
			Flow		Flow		Flow		Flow	
STD ft/sec	STD ft/min	STD ft/hr	SCFH	BHP	SCFH	BHP	SCFH	BHP	SCFH	BHP
0.0	**0**	0	0	0	0	0	0	0	0	0
6.7	**400**	24000	1101	28	1916	49	3032	77	4343	110
13.3	**800**	48000	2202	56	3832	97	6065	154	8686	221
20.0	**1200**	72000	3303	84	5748	146	9097	231	13029	331
26.7	**1600**	96000	4403	112	7665	195	12129	308	17372	441
33.3	**2000**	120000	5504	140	9581	243	15161	385	21715	551
40.0	**2400**	144000	6605	168	11497	292	18194	462	26058	662
46.7	**2800**	168000	7706	196	13413	341	21226	539	30401	772
53.3	**3200**	192000	8807	224	15329	389	24258	616	34744	882
60.0	**3600**	216000	9908	252	17245	438	27291	693	39086	992
66.7	**4000**	240000	11009	280	19161	487	30323	770	43429	1103
73.3	**4400**	264000	12110	307	21078	535	33355	847	47772	1213
80.0	**4800**	288000	13210	335	22994	584	36387	924	52115	1323
86.7	**5200**	312000	14311	363	24910	633	39420	1001	56458	1434
93.3	**5600**	336000	15412	391	26826	681	42452	1078	60801	1544
100.0	**6000**	360000	16513	419	28742	730	45484	1155	65144	1654
106.7	**6400**	384000	17614	447	30658	778	48517	1232	69487	1764
113.3	**6800**	408000	18715	475	32574	827	51549	1309	73830	1875
120.0	**7200**	432000	19816	503	34491	876	54581	1386	78173	1985
126.7	**7600**	456000	20916	531	36407	924	57613	1463	82516	2095
133.3	**8000**	480000	22017	559	38323	973	60646	1540	86859	2206
140.0	**8400**	504000	23118	587	40239	1022	63678	1617	-	-
146.7	**8800**	528000	24219	615	42155	1070	66710	1694	-	-
153.3	**9200**	552000	25320	643	44071	1119	69743	1771	-	-
160.0	**9600**	576000	26421	671	45988	1168	72775	1848	-	-
166.7	**10000**	600000	27522	699	47904	1216	75807	1925	-	-

Note:
Boiler Horsepower numbers assume a natural gas heating value of 1000 BTU / SCFH and a boiler efficiency of 85%.

Information in this publication is based on current specifications. The company reserves the right to make changes in specifications and models as design improvements are introduced. Product or company names mentioned herein may be the trademarks of their respective owners. © 2009 SCC Inc.

SCC Inc.

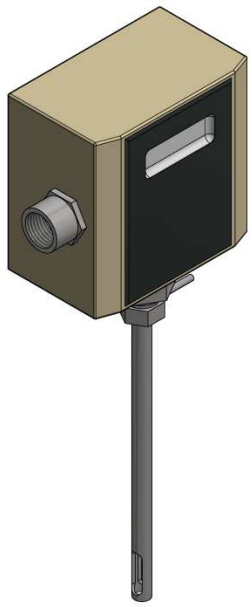
Installation Instructions

Document No. LV5-4250

July 24, 2014

FLMTR Series

KT-BMK-PLC… Gas Flow Meter Kits for Flow Totalization



Product Information

The Gas Flow Meter Kit for Flow Totalization measures and displays the instantaneous flow of natural gas and relays the information to a PLC.

Recommended Installation Tools

1. NPT thread sealant
2. Tape measure
3. 11/16” and 7/8” open end wrenches

Components Supplied

Figure 1 shows all of the components that are supplied with a KT-BMK-PLC… totalization kit.

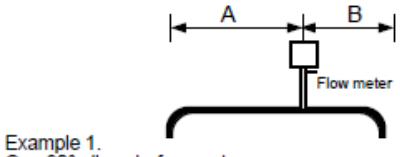


Figure 1: Components Included in a KT-BMK-PLC… Totalization Kit

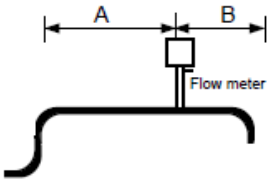
1. Natural gas flow meter with 1/2” NPT conduit connection
2. 115 / 230 VAC to 15 VDC power supply
3. Stainless steel tubing adapter for 3/8” tube, 1/2” NPT connection, with stainless steel ferrule installed

Installation Procedure

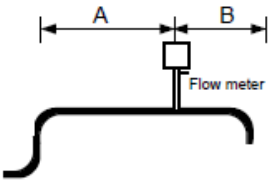
1. The natural gas flow meter may be mounted in horizontal or vertical piping. The flow meter must be mounted at least 10 pipe diameters downstream of disturbances (elbows, reducers, etc.) and at least 5 pipe diameters upstream of disturbances. Longer distances of straight pipe may be necessary depending on the piping arrangement. See Figure 2 below for the necessary distance of straight pipe upstream and downstream of the meter. If the meter is not mounted per the requirements below, unstable flow readings may result.



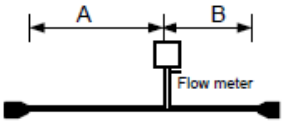
Example 1.
One 90° elbow before meter



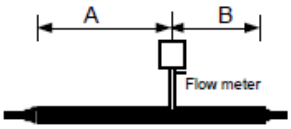
Example 2.
Two 90° elbows before meter in one plane



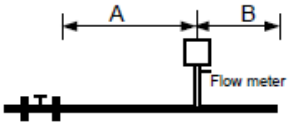
Example 3.
Two 90° elbows before meter out of plane (if three 90° bends present, double recommended length)



Example 4.
Reduction before meter



Example 5.
Expansion before meter



Example 6.
Regulator or valve partially closed before meter (If valve is always wide open, base length requirements on fitting directly preceding it)

Example	A Upstream(1) Requirements	B Downstream(2) Requirements
1	10 D	5 D
2	15 D	5 D
3	25 D	10 D
4	10 D	5 D
5	20 D	5 D
6	25 D	10 D

(1) Number of diameters (D) of straight pipe required between upstream disturbance and the flow meter.
(2) Number of diameters (D) of straight pipe required downstream of the flow meter.

Figure 2: Necessary Amount of Straight Pipe for Mounting Flow Meter

Installation Procedure (continued)

2. Once a suitable location has been found, identify the pipe size. Then, use Table 2 in Appendix A to verify that the gas velocity through the pipe in this location is less than 166 ft/sec when the burner is at high fire.

3. Verify that the static pressure in the pipe is less than 50 PSIG and the natural gas temperature (when flowing) is between 20 and 120°F.

4. Verify that the natural gas piping into which the meter is going to be inserted is depressurized. If not, close the upstream gas valve and bleed off any residual trapped gas.

5. If a ½" NPT or larger half coupling is not available in a suitable location, one will need to be welded onto the pipe with a ½" or larger hole drilled through the pipe wall in the center of the coupling. After this is completed, the assembly should look like Figure 3.

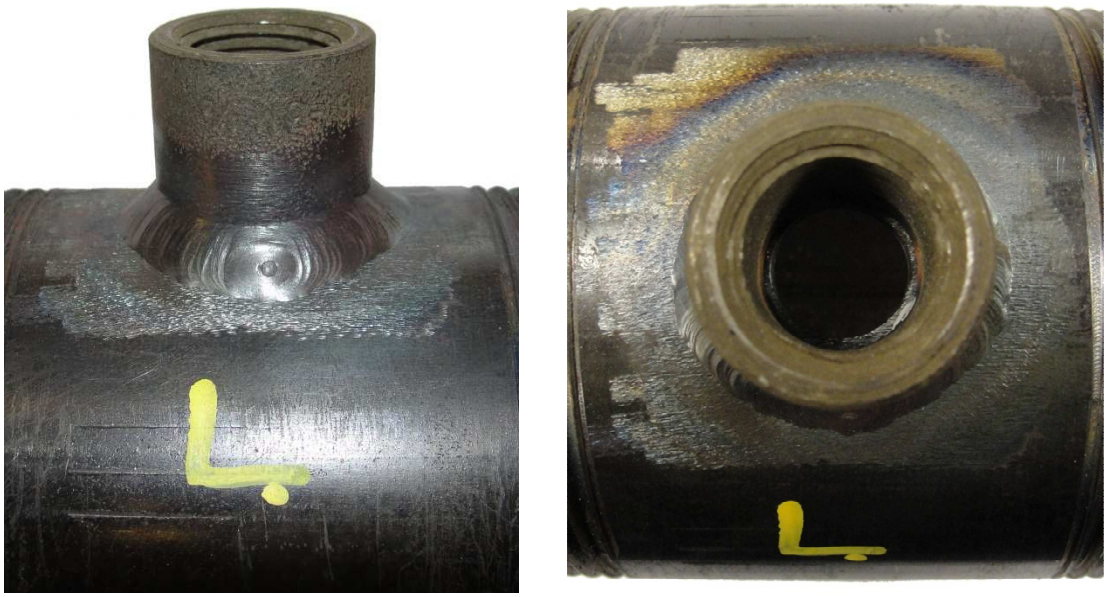


Figure 3: ½" NPT Half Coupling Welded to Pipe with ½" Hole Drilled Through Center

Installation Procedure (continued)

6. Screw the tubing adapter into the ½" NPT half coupling using the 7/8" open end wrench. Thread sealant should be used to seal the NPT threads of the tubing adapter.

7. Insert the meter sensing tube into the tubing adapter. Using Table 1 and Figure 4, center the meter's sensing element in the pipe by setting distance "X" (distance from the outer diameter of the pipe to the bottom of the pointer). This can be done carefully with a tape measure. Ensure that the pointer on the flow meter is pointing in the direction of flow.

Pipe Size	Distance "X"
1"	5.34"
1-1/4"	5.17"
1-1/2"	5.05"
2"	4.81"
2-1/2"	4.56"
3"	4.25"
4"	3.75"
5"	3.22"
6"	2.69"

Table 1: Meter Insertion Distance

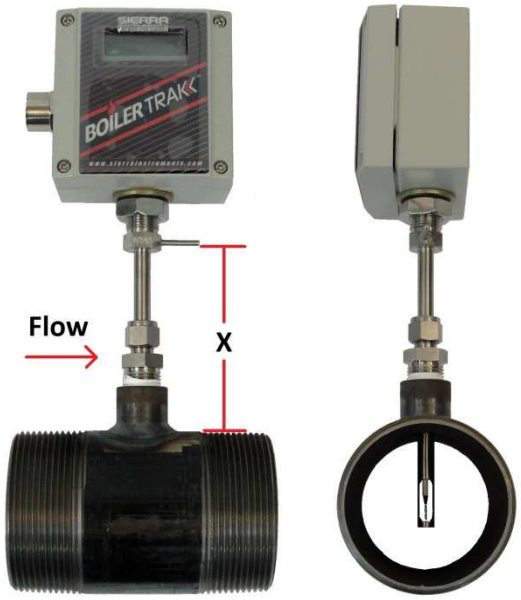


Figure 4: Meter Inserted into Pipe

8. After the meter is inserted to the correct depth with the pointer in the direction of flow, tighten the tube adapter nut with the 11/16" open end wrench.

   Note: Make sure that the meter is at the correct depth in the pipe before tightening the tube adapter nut. Tightening this nut will cause the stainless steel ferrule to bite (swage) into the tube of the meter. The location of the ferrule is permanent after it is swaged onto the tube!

Installation Procedure (continued)

9. Wire the flow meter, 15 VDC power supply, and PLC as shown in Figure 5.

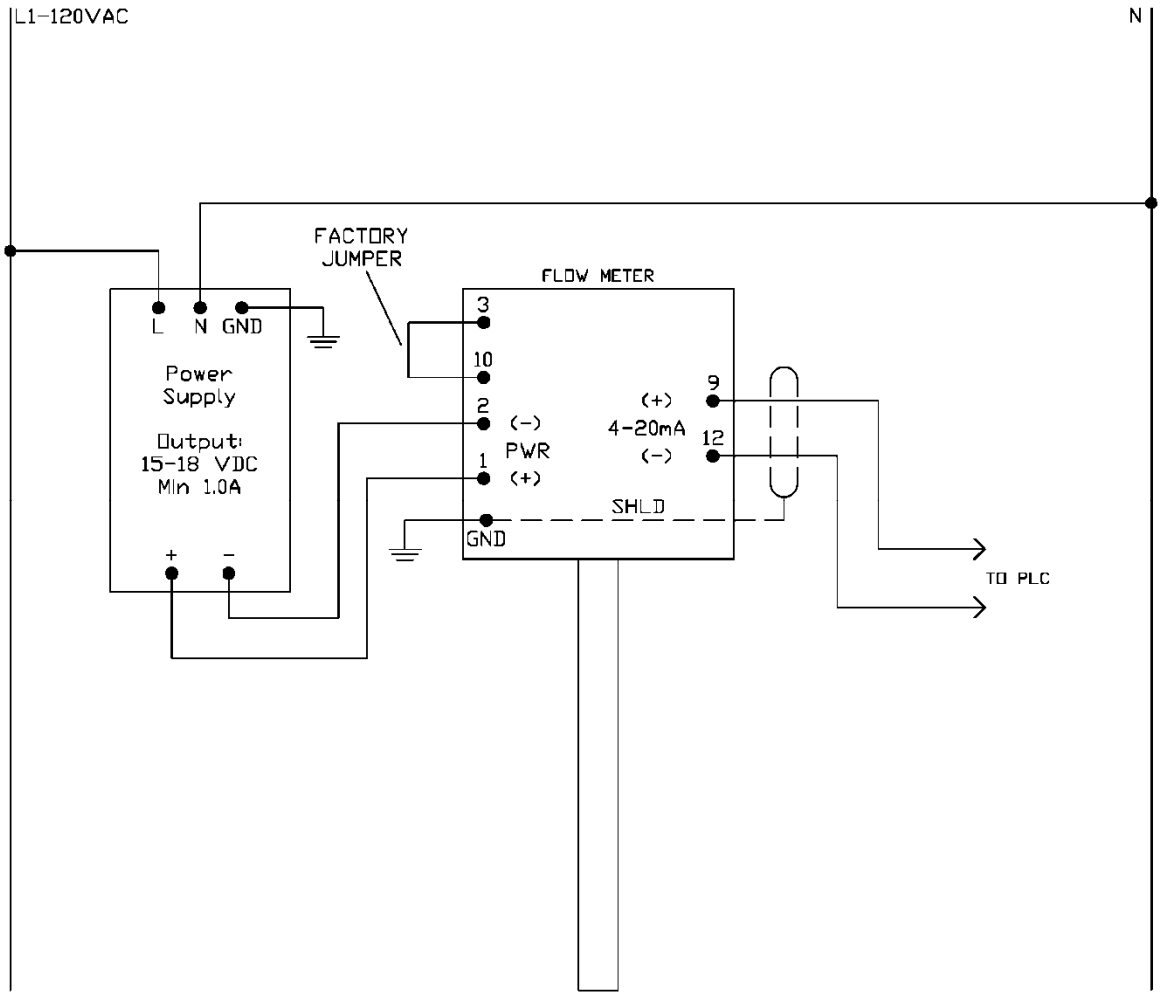


Figure 5: Flow Meter Kit Wiring

10. Scale the PLC accordingly. The flow meter will send 4 mA when there is 0 SCFH and 20 mA when there is maximum flow (see Table 2 in Appendix A).

11. With the main fuel valves closed, the local display on the gas meter should read 0 SCFH. If this is not the case, the "Current Zero Adjustment" of the gas flow meter may need to be changed slightly. To change the "Current Zero Adjustment" of the gas flow meter, refer to Section 3 in the gas flow meter instruction manual. Note that this should only be changed very slightly, if at all.

Appendix A

Table 2: Schedule 40 Pipe Velocities and Flows

SCC Part Number	Pipe Size	Maximum Flow (SCFH)	Maximum Capacity (BHP)
KT-BMK-PLC-100	1"	3601	91
KT- BMK-PLC-125	1-1/4"	6232	158
KT- BMK-PLC-150	1-1/2"	8483	215
KT- BMK-PLC-200	2"	13982	355
KT- BMK-PLC-250	2-1/2"	19949	507
KT- BMK-PLC-300	3"	30803	782
KT- BMK-PLC-400	4"	53042	1347
KT- BMK-PLC-500	5"	83358	2117
KT- BMK-PLC-600	6"	120376	3057

Note:

Boiler Horsepower numbers assume a natural gas heating value of 1000 BTU / SCFH and a boiler efficiency of 85%.

Information in this publication is based on current specifications. The company reserves the right to make changes in specifications and models as design improvements are introduced. Product or company names mentioned herein may be the trademarks of their respective owners. © 2009 SCC Inc.

SCC Inc.

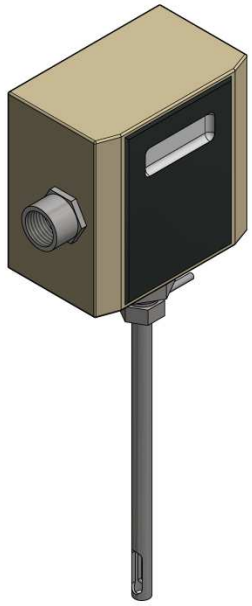
Installation Instructions

Document No. LV5-4150

July 24, 2014

FLMTR Series

KT-LMV52-PIK… Gas Flow Meter Kits for Flow Totalization



Product Information

The Gas Flow Meter Kit for Flow Totalization measures and displays the instantaneous flow of natural gas and relays the information to an LMV52 linkageless controller.

Recommended Installation Tools

1. NPT thread sealant
2. Tape measure
3. 11/16” and 7/8” open end wrenches

Components Supplied

Figure 1 shows all of the components that are supplied with a KT-LMV52-PIK… totalization kit.

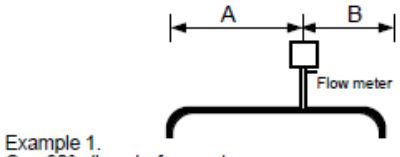


Figure 1: Components Included in a KT-LMV52-PIK… Totalization Kit

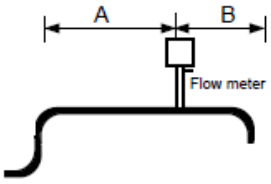
1. Natural gas flow meter with 1/2” NPT conduit connection
2. Milliamp-to-pulse converter
3. 115 / 230 VAC to 15 VDC power supply
4. 100 / 240 VAC to 24 VDC power supply
5. 4 pin plug for LMV52 connection
6. Stainless steel tubing adapter for 3/8” tube, 1/2” NPT connection, with stainless steel ferrule installed

Installation Procedure

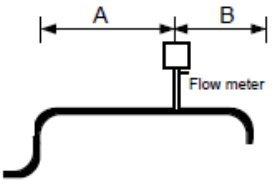
1. The natural gas flow meter may be mounted in horizontal or vertical piping. The flow meter must be mounted at least 10 pipe diameters downstream of disturbances (elbows, reducers, etc.) and at least 5 pipe diameters upstream of disturbances. Longer distances of straight pipe may be necessary depending on the piping arrangement. See Figure 2 below for the necessary distance of straight pipe upstream and downstream of the meter. If the meter is not mounted per the requirements below, unstable flow readings may result.



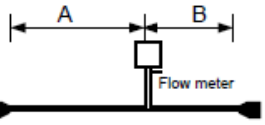
Example 1.
One 90° elbow before meter



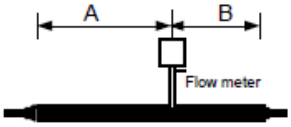
Example 2.
Two 90° elbows before meter in one plane



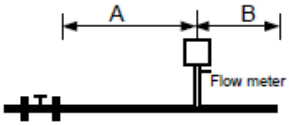
Example 3.
Two 90° elbows before meter out of plane (if three 90° bends present, double recommended length)



Example 4.
Reduction before meter



Example 5.
Expansion before meter



Example 6.
Regulator or valve partially closed before meter (If valve is always wide open, base length requirements on fitting directly preceding it)

Example	A Upstream(1) Requirements	B Downstream(2) Requirements
1	10 D	5 D
2	15 D	5 D
3	25 D	10 D
4	10 D	5 D
5	20 D	5 D
6	25 D	10 D

(1) Number of diameters (D) of straight pipe required between upstream disturbance and the flow meter.
(2) Number of diameters (D) of straight pipe required downstream of the flow meter.

Figure 2: Necessary Amount of Straight Pipe for Mounting Flow Meter

Installation Procedure (continued)

2. Once a suitable location has been found, identify the pipe size. Then, use Table 2 in Appendix A to verify that the gas velocity through the pipe in this location is less than 166 ft/sec when the burner is at high fire.

3. Verify that the static pressure in the pipe is less than 50 PSIG and the natural gas temperature (when flowing) is between 20 and 120°F.

4. Verify that the natural gas piping into which the meter is going to be inserted is depressurized. If not, close the upstream gas valve and bleed off any residual trapped gas.

5. If a ½" NPT or larger half coupling is not available in a suitable location, one will need to be welded onto the pipe with a ½" or larger hole drilled through the pipe wall in the center of the coupling. After this is completed, the assembly should look like Figure 3.

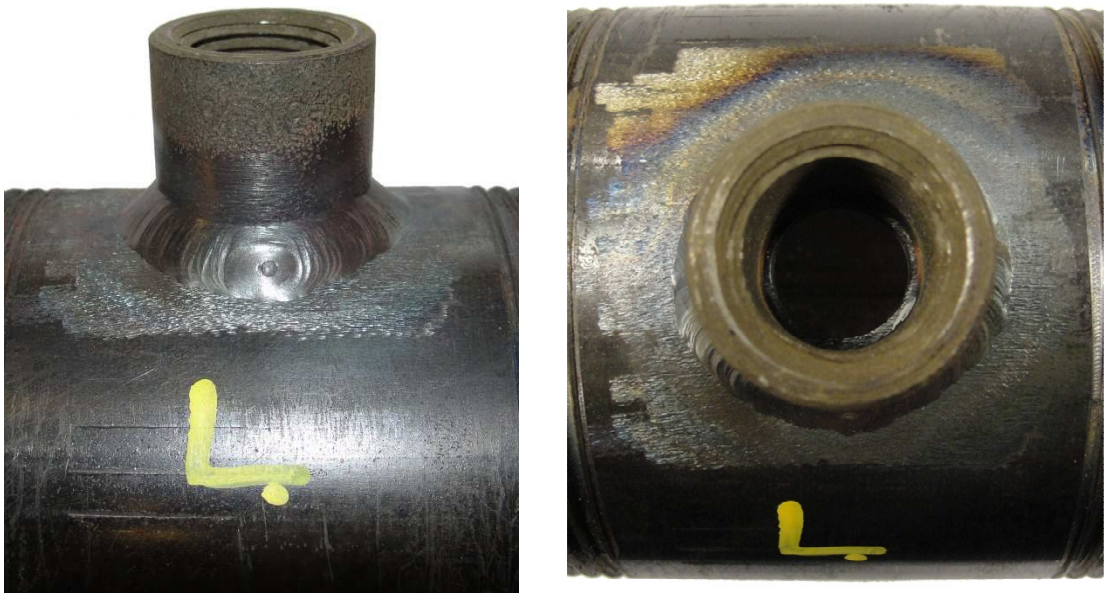


Figure 3: ½" NPT Half Coupling Welded to Pipe with ½" Hole Drilled Through Center

Installation Procedure (continued)

6. Screw the tubing adapter into the ½" NPT half coupling using the 7/8" open end wrench. Thread sealant should be used to seal the NPT threads of the tubing adapter.

7. Insert the meter sensing tube into the tubing adapter. Using Table 1 and Figure 4, center the meter's sensing element in the pipe by setting distance "X" (distance from the outer diameter of the pipe to the bottom of the pointer). This can be done carefully with a tape measure. Ensure that the pointer on the flow meter is pointing in the direction of flow.

Pipe Size	Distance "X"
1"	5.34"
1-1/4"	5.17"
1-1/2"	5.05"
2"	4.81"
2-1/2"	4.56"
3"	4.25"
4"	3.75"
5"	3.22"
6"	2.69"

Table 1: Meter Insertion Distance

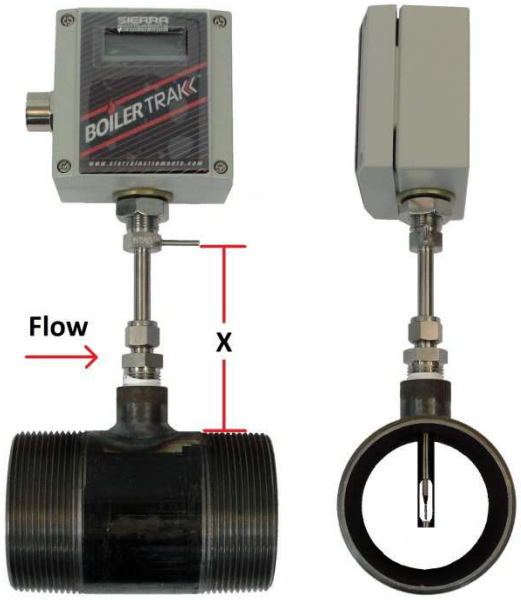


Figure 4: Meter Inserted into Pipe

8. After the meter is inserted to the correct depth with the pointer in the direction of flow, tighten the tube adapter nut with the 11/16" open end wrench.

   Note: Make sure that the meter is at the correct depth in the pipe before tightening the tube adapter nut. Tightening this nut will cause the stainless steel ferrule to bite (swage) into the tube of the meter. The location of the ferrule is permanent after it is swaged onto the tube!

Installation Procedure (continued)

9. Wire the flow meter, 15 VDC power supply, 24 VDC power supply, LMV52, and milliamp-to-pulse converter as shown in Figure 5. Also, set the dip switches exactly as they are shown in Figure 5.

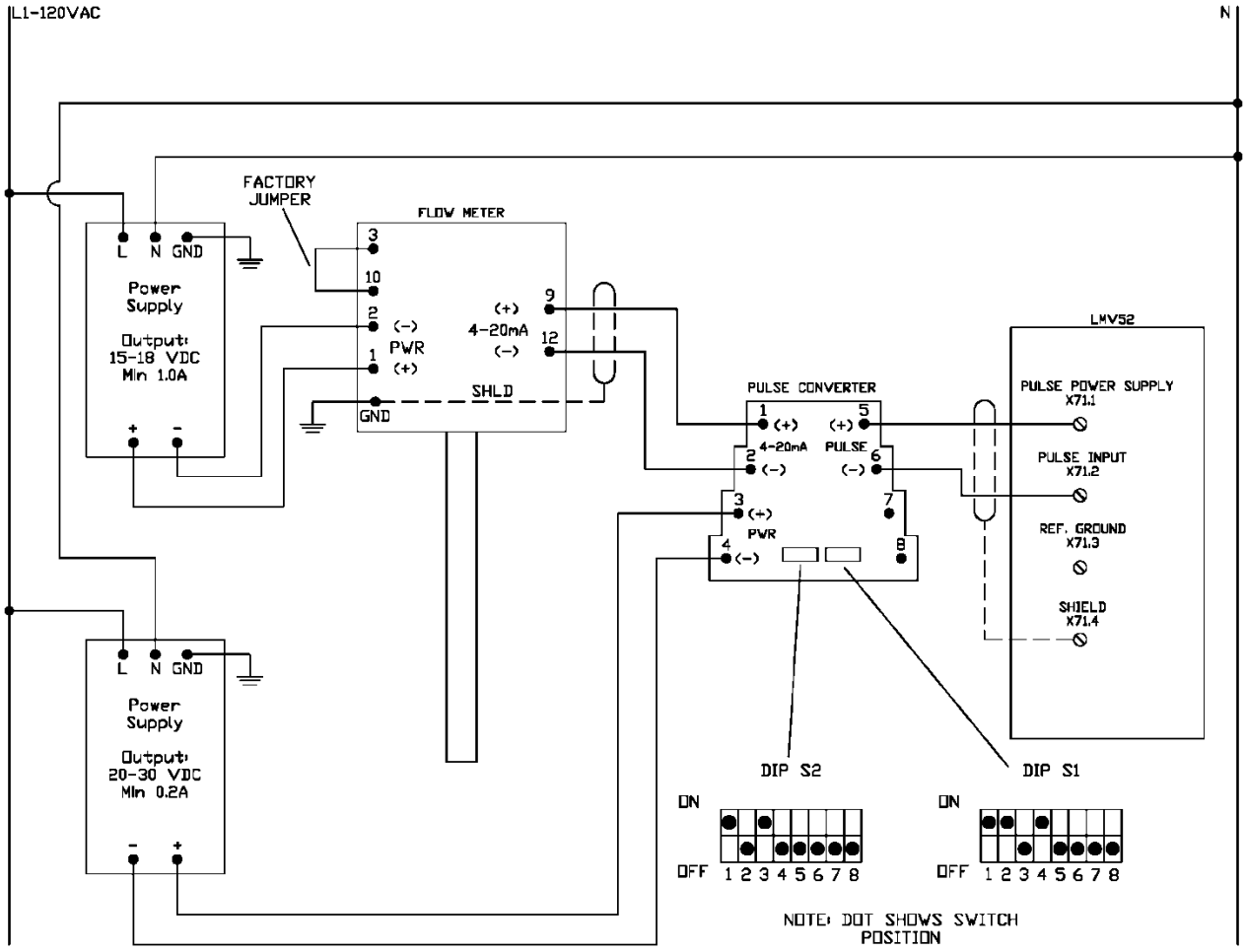


Figure 5: Wiring and Dip Switch Settings for Flow Meter Kit

Installation Procedure (continued)

10. Calculate the scaling factor for the LMV52. This is done by using the following equation:

$$F_s = \frac{900{,}000}{F_m}$$

F_s = Scaling factor in pulses per cubic foot

F_m = Meter full scale from Table 2 in Appendix A

11. To scale the LMV52 for the gas flow meter, log in to the LMV52 at the service or OEM password level. Access parameter "PulseValueGas" by using the following menu path in the LMV52:

    Params & Display > VSD Module > Configuration > Fuel Meter > PulseValueGas

    Set the units for "$1ft^3$" and set the pulse value to the scaling factor found in step 10.

12. With the main fuel valves closed, the local display on the gas meter should read 0 SCFH. If this is not the case, the "Current Zero Adjustment" of the gas flow meter may need to be changed slightly. To change the "Current Zero Adjustment" of the gas flow meter, refer to Section 3 in the gas flow meter instruction manual. Note that this should only be changed very slightly, if at all.

13. When it is safe to do so, turn on the burner. Access parameter "Curr Flow Rate" by using the following menu path in the LMV52:

    Operation > Fuel Meter > Curr Flow Rate

    Verify that the display on the gas flow meter matches the value of "Curr Flow Rate" on the LMV52 within +/- 0.25%.

Appendix A

Table 2: Schedule 40 Pipe Velocities and Flows

SCC Part Number	Pipe Size	Maximum Flow (SCFH)	Maximum Capacity (BHP)
KT-LMV52-PIK-100	1"	3601	91
KT-LMV52-PIK-125	1-1/4"	6232	158
KT-LMV52-PIK-150	1-1/2"	8483	215
KT-LMV52-PIK-200	2"	13982	355
KT-LMV52-PIK-250	2-1/2"	19949	507
KT-LMV52-PIK-300	3"	30803	782
KT-LMV52-PIK-400	4"	53042	1347
KT-LMV52-PIK-500	5"	83358	2117
KT-LMV52-PIK-600	6"	120376	3057

Note:

Boiler Horsepower numbers assume a natural gas heating value of 1000 BTU / SCFH and a boiler efficiency of 85%.

Information in this publication is based on current specifications. The company reserves the right to make changes in specifications and models as design improvements are introduced. Product or company names mentioned herein may be the trademarks of their respective owners. © 2009 SCC Inc.