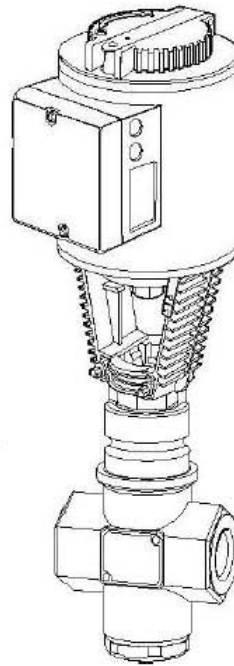


SIEMENS

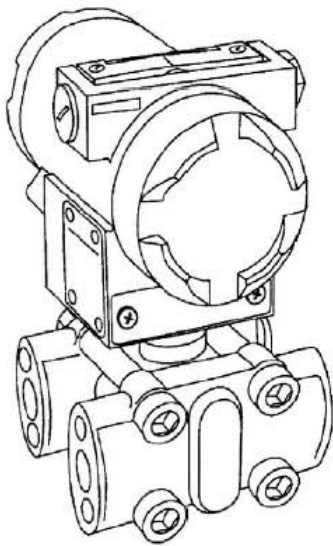
April 2, 2014



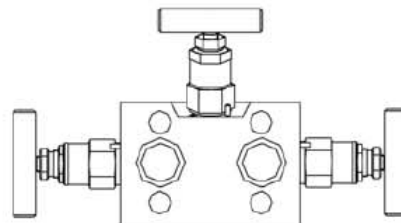
SIEMENS
Flowrite VF 599 Series
Two-Way Valves



SIEMENS
Flowrite
SKB/C/D
Valve Actuator



SIEMENS
Differential Pressure Transmitter
with Three-Valve Manifold



RWF5x Modulating Feedwater Control Valve Application Guide

Typical Feedwater Application Overview

This RWF5x Modulating Feedwater Control Valve Application Guide is intended for use by OEMs that integrate the RWF 5x controller into their products.

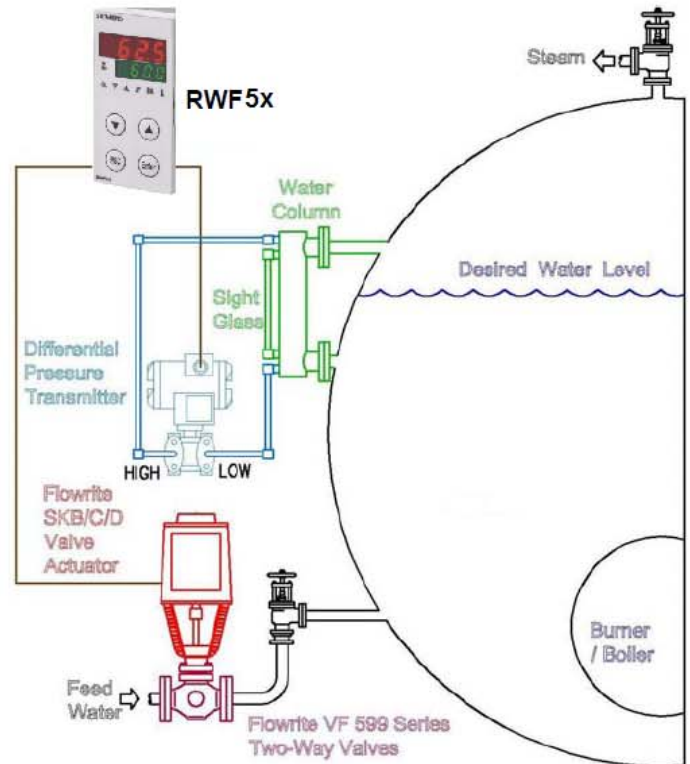
This application combines separate modular components to produce a modulating feedwater control.

The valves in this guide are typically applicable to steam boilers in the 200-2500 HP range.

The transmitter must be mounted below the minimum water level. Since the high and low pressure lines have equal and opposite forces below the minimum level, they will cancel each other out. This allows the transmitter to be mounted at *any* distance below minimum. The transmitter must be mounted in the vertical position.

The high pressure line is kept completely full of condensate and will be used as a reference.

Open or vented vessels require only a high pressure connection.



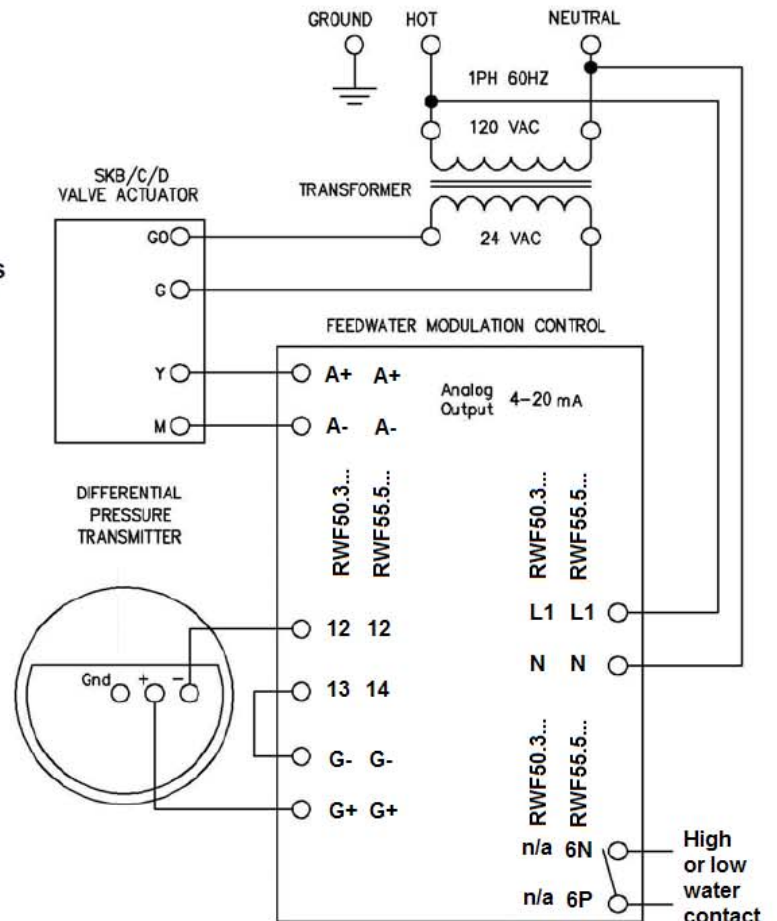
Typical Wiring Diagram

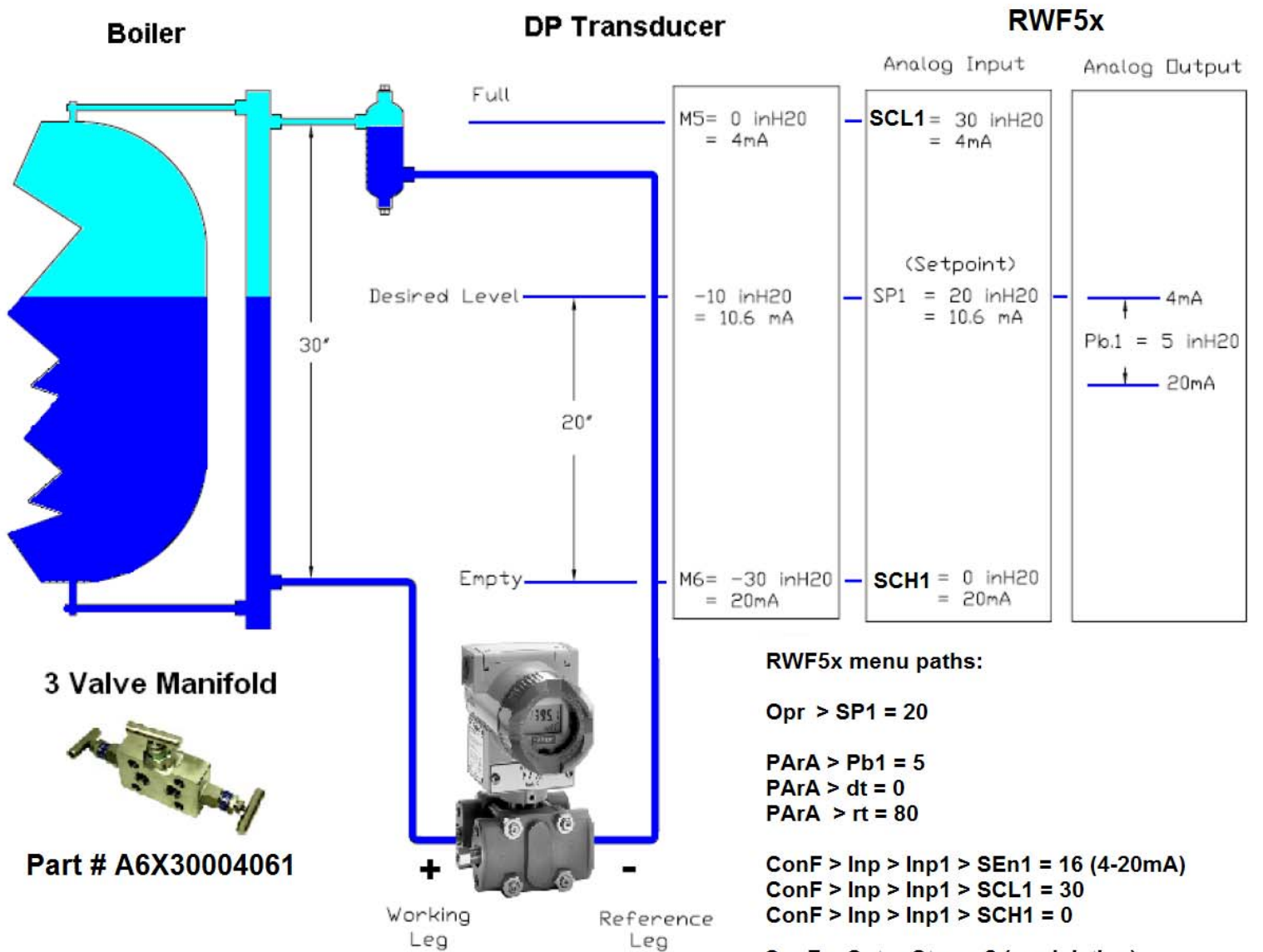
A typical wiring diagram is shown on the right using the components described in this document.

The supply power is a 120 VAC 1PH 60 Hz, utilizing a class 2 isolating step-down transformer with an earth ground, and a 24 VAC secondary.
(Do not use an autotransformer)

Dry relay contacts are available for High Water or Low Water.

It is recommended that these N.C. contacts be placed in the 'Operating Limit' circuit of the burner/boiler.
(vs the 'Lockout Circuit')





RWF5x menu paths:

Opr > SP1 = 20

PArA > Pb1 = 5

PArA > dt = 0

PArA > rt = 80

ConF > Inp > Inp1 > SEn1 = 16 (4-20mA)

ConF > Inp > Inp1 > SCL1 = 30

ConF > Inp > Inp1 > SCH1 = 0

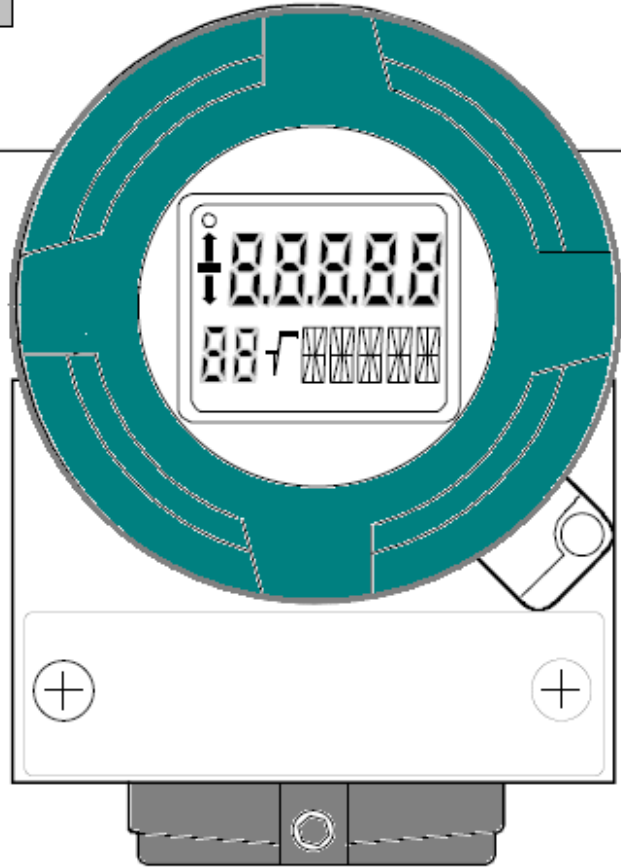
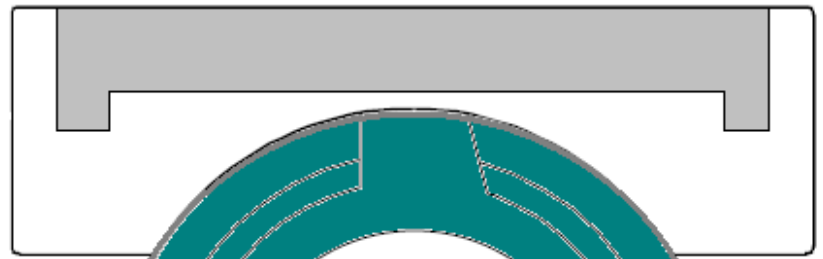
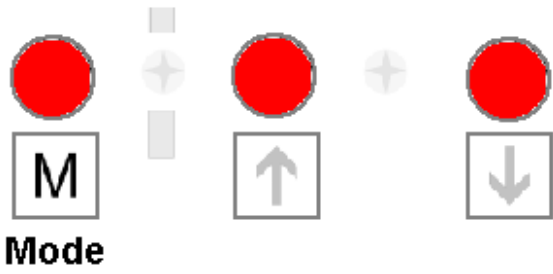
ConF > Cntr > Ctyp = 2 (modulating)

ConF > Cntr > CACt = 1 (heating)

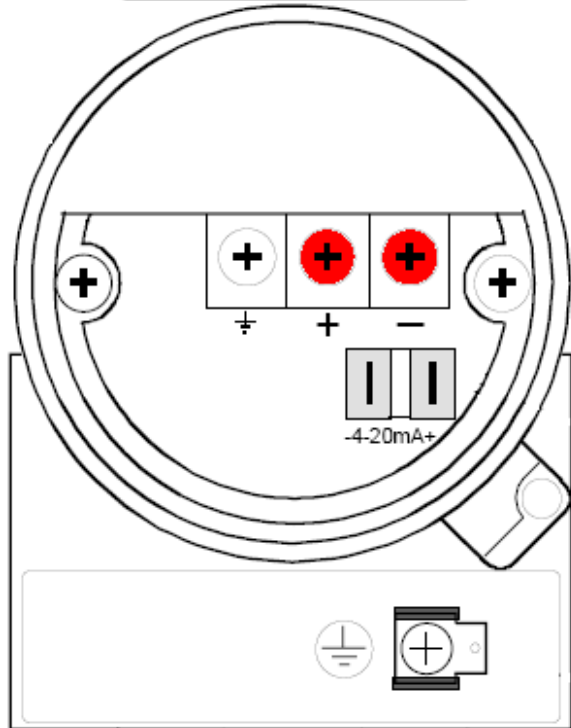
ConF > OutP > FnCt = 4 (modulating controller)

ConF > OutP > SiGn = 1 (4-20mA)


DP Transducer




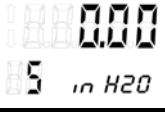
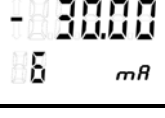

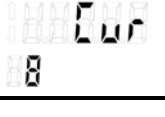



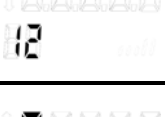
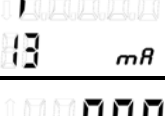
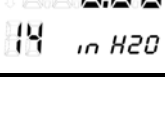


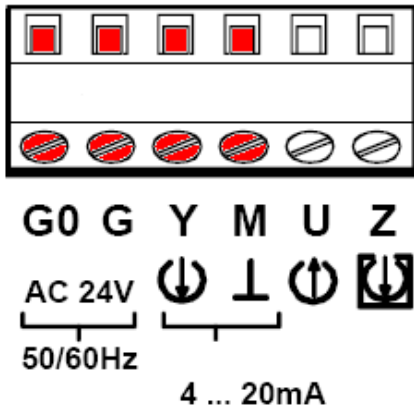
Front View



Back View

| | |
|--|---|
|  | <p>DP returns to this display after 30 seconds, if no keys are pressed.</p> <p>Units are determined by Mode 14.</p> |
|--|---|

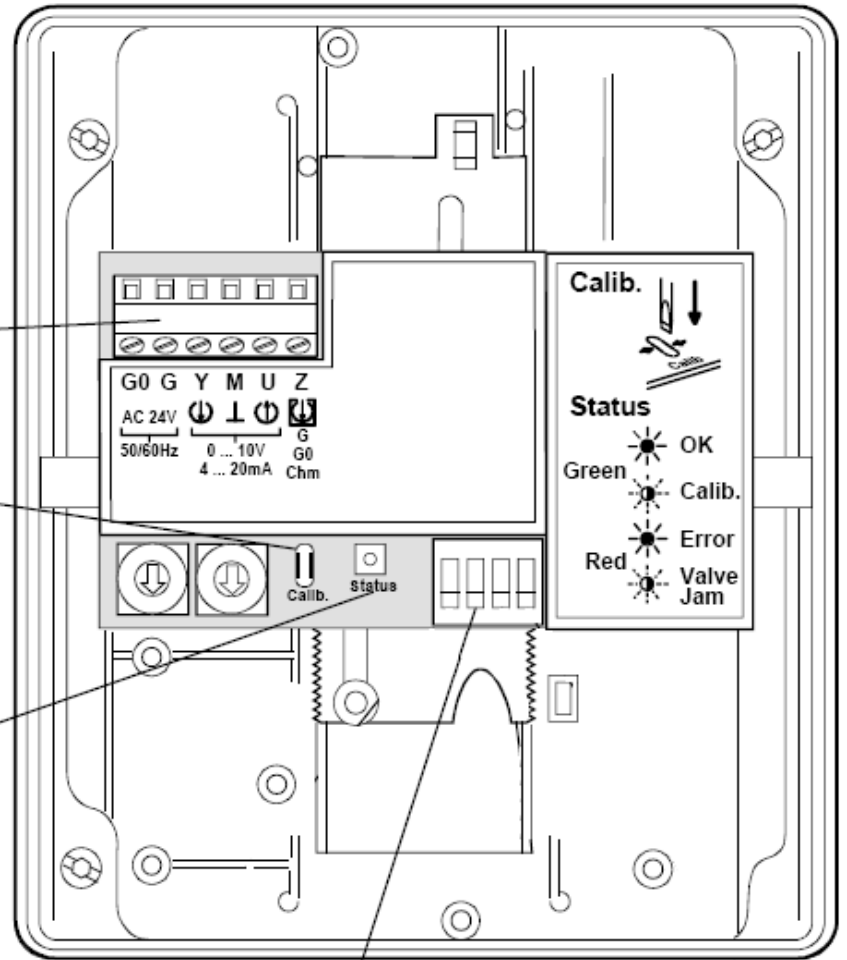
| Mode | Recommended | Function | Comment | Notes |
|---|---|-----------------------------------|--|--|
|  | Not used Don't care | "Live setting" Start of Scale | Not recommended Value will be overwritten by Mode 5 | Apply Live press to DP, Hold both ^ and v keys to set to 4 mA |
|  | Not used Don't care | "Live setting" Full Scale | Not recommended Value will be overwritten by Mode 6 | Apply Live press to DP, Hold both ^ and v keys to set to 20 mA |
|  | 0.0 | Electronic damping | Set to 0 (Time in seconds) (Factory default) | Hold both ^ and v keys to set to zero |
|  | 0.00 in H2O | "Blind setting" Start of Scale | Set to 0.00 (inH2O) | Full tank = Min differential = 4 mA output |
|  | - 30.00 (see example) in H2O | "Blind setting" Full Scale | Set to x.xx (inH2O) | Empty tank = Max differential = 20 mA output (actual measurement) |
|  | 0.00 | Zero adjustment | Using the 3 Valve Manifold, Close both isolation valves, Open bypass valve, Hold both ^ and v keys to set to zero, Re-close bypass, Re-open isolations | Hold both ^ and v keys to set to zero |
|  | Cur | Current transmitter | (Cur) Displays the current differential pressure | Hold both ^ and v keys to force an output of 3.6, 4.0, 12.0, 20.0, 22.8 mA M key brings you back to Current Value |
|  | 3.6 | Output if error occurs | If an error occurs, you can choose the output | Choices are 3.6 mA or 22.8 mA |
|  | 0 | Keys enable/disable Set to 0 | Choices are 0, LA, LO, L5, L | Hold M key for 5 sec to set to zero |
|  | Lin | Characteristic | Lin means the 4-20 mA output is Linear | Linear is recommended |
|  | (N/A) | Characteristic Sq Root | N/A (normally not shown) | ONLY used/displayed if Mode 11 is Sq Rt |
|  | mA | Displayed Measured Value | 3 choices (Mode 14 Unit) , %, mA | mA is recommended |
|  | in H2O | Display Unit | Many choices... | inH2O is recommended |



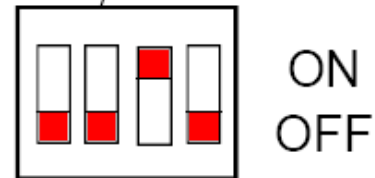
Connection Terminals

Stroke Calibration

LED Status Indication



SKx Actuator



DIP Switches

| | 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 | Direct-acting | Stroke limit control | 0 to 10 Vdc | Default |

RWF50 Menu Options

| Parameters | | Parameter Name | Value Range | Factory Setting | Your Setting | Notes | Page Number | |
|------------|--------------------|----------------------------------|---------------------------|-------------------------------------|-----------------|--|--|----|
| Opr | SP1 | Setpoint 1 | SPL...SPH | 60 | | | 34 | |
| | SP2 | Setpoint 2 | SPL...SPH | 0 | | Only if bin1 = 1 | | |
| | dSP | Setpoint shift | SPL...SPH | 0 | | Only if bin1 = 2 | | |
| | InP1 | Analog input 1 | N/A | - | | Cannot be edited here (just a display) | | |
| | Y | Angular positioning | N/A | - | | Cannot be edited here (just a display) | | |
| PARA | Pb1 | Proportional band | 1...9999 | 10 | | | 40 | |
| | dt | Derivative time | 0...9999 sec | 80 | | | | |
| | rt | Integral time | 0...9999 sec | 350 | | | | |
| | db | Dead band | 0.0...999.9 | 1 | | RWF 50.2 only | | |
| | tt | Controlling element running time | 10...3000 sec | 15 | | RWF 50.2 only | | |
| | HYS1 | Switch-on threshold | -1999...0.0 | -5 | | Only if CACT = 1 | | |
| | HYS2 | Switch-off threshold (stage II) | 0.0...HYS3 | 3 | | Only if CACT = 1 | | |
| | HYS3 | Switch-off threshold | 0.0...9999 | 5 | | Only if CACT = 1 | | |
| | HYS4 | Switch-on threshold | 0.0...9999 | 5 | | Only if CACT = 0 | | |
| | HYS5 | Switch-off threshold (stage II) | HYS6...0.0 | -3 | | Only if CACT = 0 | | |
| | HYS6 | Switch-off threshold | -1999...0.0 | -5 | | Only if CACT = 0 | | |
| q | Response threshold | 0.0...999.9 | 0 | | | 28 | | |
| ConF | InP | InP1 | SEn1 | Analog input 1 sensor type | 1...19 → | 1 | 1 = Pt-100 3-wire, 2 = Pt100 2-wire, 3 = Pt1000 3-wire, 4 = Pt1000 2-wire, 5 = Ni1000 3-wire, 6 = Ni1000 2-wire, 7 = 0-135 Ohm, 15 = 0-20 mA, 16 = 4-20 mA, 17 = DC 0-10 V, 18 = DC 0-5 V, 19 = DC 1-5 V | 42 |
| | | | OFF1 | Analog input 1 correction (offset) | -1999...9999 | 0 | | |
| | | | SCL1 | Analog input 1 scale low level | -1999...9999 | 0 | | |
| | | | SCH1 | Analog input 1 scale high level | -1999...9999 | 100 | | |
| | | | dF1 | Analog input 1 filter time constant | 0.0...100.0 sec | 0.6 | | |
| | | | Unit | Temperature units | 1, 2 | 1 | | |
| | Cntr | CtYP | Controller type | 1, 2 | N/A | | 1 = 3-position (50.2 only), 2 = modulating (50.3 only) | 43 |
| | | CACT | Operating action | 0, 1 | 1 | | 0 = cooling controller, 1 = heating controller | |
| | | SPL | Setpoint low limit | -1999...9999 | 0 | | | |
| | | SPH | Setpoint high limit | -1999...9999 | 100 | | | |
| | | oLLo | Lower working range limit | -1999...9999 | -1999 | | | |
| | rAFC | FnCt | Thermal shock function | 0, 1, 2 | 0 | | 0 = disconnected, 1 = Kelvin/min, 2 = Kelvin/hour | 44 |
| | | rASL | Ramp slope | 0.0...999.9 | 0 | | Only appears if FnCt ≠ 0 | |
| | | toLP | Tolerance band ramp | 2* HYS1 ...9999 | 0 | | Only appears if FnCt ≠ 0 | |
| | | rAL | Ramp limit value | 0...250 | 0 | | Only appears if FnCt ≠ 0 | |
| OutP | FnCt | Analog output function | 0, 1, 4 | 4 | | 0 = no function, 1 = analog input 1, 4 = controller angular position | 45 | |
| | SiGn | Analog output signal type | 0, 1, 2 | 0 | | 0 = 0-20 mA, 1 = 4-20 mA, 2 = DC 0-10 V | | |
| | rOut | Value when input is out of range | 0...101 % | 0 | | Output percentage | | |
| | OPnt | Re-transmit scale low | -1999...9999 | 0 | | Only if FnCt = 1 | | |
| | End | Re-transmit scale high | -1999...9999 | 100 | | Only if FnCt = 1 | | |
| binF | bin1 | Binary input 1 function | 0, 1, 2, 4 | 0 | | 0 = no function, 1 = setpoint changeover, 2 = setpoint shift, 4 = operating mode changeover | 46 | |
| diSP | diSU | Upper display | 0, 1, 4, 6, 7 | 1 | | 0 = disconnected, 1 = analog input 1, 4 = controller angular position, 6 = setpoint, 7 = thermal shock end value | 47 | |
| | diSL | Lower display | 0, 1, 4, 6, 7 | 6 | | 0 = disconnected, 1 = analog input 1, 4 = controller angular position, 6 = setpoint, 7 = thermal shock end value | | |
| | tout | Timeout | 0...255 sec | 180 | | | | |
| | dECP | Decimal places | 0, 1, 2 | 0 | | 0 = no decimal place, 1 = one decimal, 2 = two decimals | | |
| | Code | Locking of levels | 0, 1, 2, 3 | 0 | | 0 = no lockout, 1 = configuration level, 2 = parameter and configuration level, 3 = keyboard lockout | | |

| RWF55 Menu Options | | | | | | | |
|--------------------|-----------------------------|-------------------------------------|-------------------------------------|------------------|--|--|----|
| Parameters | Parameter Name | Value Range | Factory Setting | Your Setting | Notes | Page Number | |
| Opr | SP1 | Setpoint 1 | SPL...SPH | 60 | | | 41 |
| | SP2 | Setpoint 2 | SPL...SPH | 0 | | Only if bin1 = 1 | |
| | dSP | Setpoint | SPL...SPH | 0 | | Only if bin1 = 2 | |
| | InP1 | Analog Input 1 | N/A | - | | Cannot be edited here (just a display) | |
| | InP2 | Analog input 2 | N/A | - | | Cannot be edited here (just a display) | |
| | InP3 | Analog input 3 | N/A | - | | Cannot be edited here (just a display) | |
| | SPE | External setpoint | N/A | - | | Cannot be edited here (just a display) | |
| Y | Angular positioning | N/A | - | | Cannot be edited here (just a display) | | |
| PArA | Pb1 | Proportional band | 1...9999 | 10 | | | 47 |
| | dt | Derivative time | 0...9999 sec | 80 | | | |
| | rt | Integral time | 0...9999 sec | 350 | | | |
| | db | Dead band | 0.0...999.9 | 1 | | Only if CTYP = 1 | |
| | tt | Controlling element running time | 10...3000 sec | 15 | | Only if CTYP = 1 | |
| | HYS1 | Switch-on threshold | -1999...0.0 | -5 | | Only if CACT = 1 | |
| | HYS2 | Switch-off threshold (stage II) | 0.0...HYS3 | 3 | | Only if CACT = 1 | |
| | HYS3 | Switch-off threshold | 0.0...9999 | 5 | | Only if CACT = 1 | |
| | HYS4 | Switch-on threshold | 0.0...9999 | 5 | | Only if CACT = 0 | |
| | HYS5 | Switch-off threshold (stage II) | HYS6...0.0 | -3 | | Only if CACT = 0 | |
| | HYS6 | Switch-off threshold | -1999...0.0 | -5 | | Only if CACT = 0 | |
| | q | Response threshold | 0.0...999.9 | 0 | | | |
| At1 | Outside temp. curve point 1 | -40...120 | -10 | | Only if FnC3 = 1 | 48 | |
| Ht1 | Boiler temp. curve point 1 | SPL...SPH | 60 | | Only if FnC3 = 1 | | |
| At2 | Outside temp. curve point 2 | -40...120 | 20 | | Only if FnC3 = 1 | | |
| Ht2 | Boiler temp. curve point 2 | SPL...SPH | 50 | | Only if FnC3 = 1 | | |
| Inp | Inp1 | SEn1 | Analog input 1 sensor type | 1, 19 → | 1 | 1 = Pt-100 3-wire, 2 = Pt100 2-wire, 3 = Pt1000 3-wire, 4 = Pt1000 2-wire, 5 = Ni1000 3-wire, 6 = Ni1000 2-wire, 7 = 0-135 Ohm, 8 = T, 9 = J, 10 = K, 11 = N, 12 = S, 13 = R, 14 = B, 15 = 0-20 mA, 16 = 4-20 mA, 17 = DC 0-10 V, 18 = DC 0-5 V, 19 = DC 1-5 V | 50 |
| | | OFF1 | Analog input 1 correction (offset) | -1999...9999 | 0 | | |
| | | SCL1 | Analog input 1 scale low level | -1999...9999 | 0 | | |
| | | SCH1 | Analog input 1 scale high level | -1999...9999 | 100 | | |
| | | dF1 | Analog input 1 filter time constant | 0.0...100.0 sec | 0.6 | | |
| | | Unit | Temperature unit | 1, 2 | 1 | | |
| | Inp2 | FnC2 | Analog input 2 function | 0, 1, 2, 3 | 0 | 0 = no function, 1 = external setpoint, 2 = setpoint shifting, 3 = angular position feedback | 52 |
| | | SEn2 | Analog input 2 sensor type | 1, 2, 3, 4, 5, 6 | 1 | 1 = 0-20 mA, 2 = 4-20 mA, 3 = DC 0-10 V, 4 = DC 0-5 V, 5 = DC 0-1 V, 6 = resistance potentiometer (only if FnC2 ≠ 0) | |
| | | OFF2 | Analog input 2 correction (offset) | -1999...9999 | 0 | Only if FnC2 ≠ 0 | |
| | | SCL2 | Analog input 2 scale low level | -1999...9999 | 0 | Only if FnC2 ≠ 0 | |
| | | SCH2 | Analog input 2 scale high level | -1999...9999 | 100 | Only if FnC2 ≠ 0 | |
| | | dF2 | Analog input 2 filter time constant | 0.0...100.0 sec | 2 | Only if FnC2 ≠ 0 | |
| | Inp3 | SEn3 | Analog input 3 sensor type | 0, 1, 2 | 0 | 0 = switched-off, 1 = Pt1000 2-wire, 2 = LG-Ni1000 2-wire | 53 |
| | | FnC3 | Analog input 3 function | 0, 1 | 0 | 0 = no function, 1 = weather-compensated setpoint (only if SEn3 ≠ 0) | |
| | | OFF3 | Analog input 3 correction (offset) | -1999...1999 | 0 | Only if SEn3 ≠ 0 | |
| dF3 | | Analog input 3 filter time constant | 0.0...1500 sec | 1278 | Only if SEn3 ≠ 0 | | |
| Cntr | CTYP | Controller type | 1, 2 | 1 | 1 = 3-position, 2 = modulating | 54 | |
| | CACT | Operating action | 0, 1 | 1 | 0 = cooling, 1 = heating | | |
| | SPL | Setpoint low limit | -1999...9999 | 0 | | | |
| | SPH | Setpoint high limit | -1999...9999 | 100 | | | |
| | oLlo | Lower working range limit | -1999...9999 | -1999 | | | |
| | oLHi | Upper working range limit | -1999...9999 | 9999 | | | |
| rAFC | FnCt | Thermal shock function | 0, 1, 2 | 0 | 0 = switched off, 1 = Kelvin/min, 2 = Kelvin/hour | 37, 55 | |
| | rASL | Ramp slope | 0.0...999.9 | 0 | Only if FnCt ≠ 0 | | |
| | toLP | Tolerance band ramp | 2* HYS1 ...9999 | 0 | Only if FnCt ≠ 0 | | |
| | rAL | Ramp limit value | 0...250 | 0 | Only if FnCt ≠ 0 | | |
| AF | FnCt | Alarm limit function | 0...12 | 0 | 0 = no function, 1 = lk1 input 1, 2 = lk2 input 1, 3 = lk3 input 1, 4 = lk4 input 1, 5 = lk5 input 1, 6 = lk6 input 1, 7 = lk7 input 1, 8 = lk8 input 1, 9 = lk7 input 2, 10 = lk8 input 2, 11 = lk7 input 3, 12 = lk8 input 3 | 56-57 | |
| | AL | Alarm limit value | -1999...9999 | 0 | Only if FnCt ≠ 0 | | |
| | HYS1 | Switching difference (hysteresis) | 0...9999 | 1 | Only if FnCt ≠ 0 | | |
| | ACrA | Out of range response | 0, 1 | 0 | 0 = switched off, 1 = on (only if Fnct ≠ 0) | | |
| OutP | FnCt | Analog output function | 0, 1, 2, 3, 4 | 4 | 0 = no function, 1 = analog input 1, 2 = analog input 2, 3 = analog input 3, 4 = controller angular position | 58 | |
| | SiGn | Analog output signal type | 0, 1, 2 | 0 | 0 = 0-20 mA, 1 = 4-20 mA, 2 = DC 0-10 V | | |
| | rOut | Value when out of range | 0...101 | 0 | | | |
| | OPnt | Re-transmit scale low | -1999...9999 | 0 | | | |
| | End | Re-transmit scale high | -1999...9999 | 100 | | | |
| binF | bin1 | Binary input 1 function | 0, 1, 2, 3 | 0 | 0 = no function, 1 = setpoint changeover, 2 = setpoint shift, 3 = alarm input | 59 | |
| | bin2 | Binary input 2 | 4 | 4 | 4 = operating mode changeover | | |
| diSP | diSU | Upper display | 0, 1, 2, 3, 4, 6, 7 | 1 | 0 = disconnected, 1 = analog input 1, 2 = analog input 2, 3 = analog input 3, 4 = controller angular position, 6 = setpoint, 7 = thermal shock end value | 60 | |
| | diSL | Lower display | 0, 1, 2, 3, 4, 6, 7 | 6 | 0 = disconnected, 1 = analog input 1, 2 = analog input 2, 3 = analog input 3, 4 = controller angular position, 6 = setpoint, 7 = thermal shock end value | | |
| | tout | Timeout | 0...255 sec | 180 | | | |
| | dECP | Decimal places | 0, 1, 2 | 0 | 0 = no decimal place, 1 = one decimal, 2 = two decimals | | |
| | CodE | Locking of levels | 0, 1, 2, 3 | 0 | 0 = no lockout, 1 = config level, 2 = parameter and config level, 3 = keyboard lockout | | |
| IntF | bdrt | Baud rate | 0, 1, 2, 3 | 1 | 0 = 4800 Baud, 1 = 9600 Baud, 2 = 19200 Baud, 3 = 38400 Baud | 61 | |
| | Adr | Modbus address | 0...254 | 1 | | | |
| | dP | Profibus address | 0...125 | 125 | | | |
| | dtT | Remote detection timer | 0...7200 sec | 30 | Only RWF55.6 | | |

Valve Selection

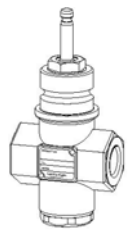
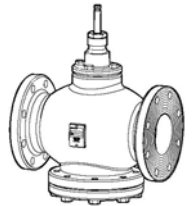
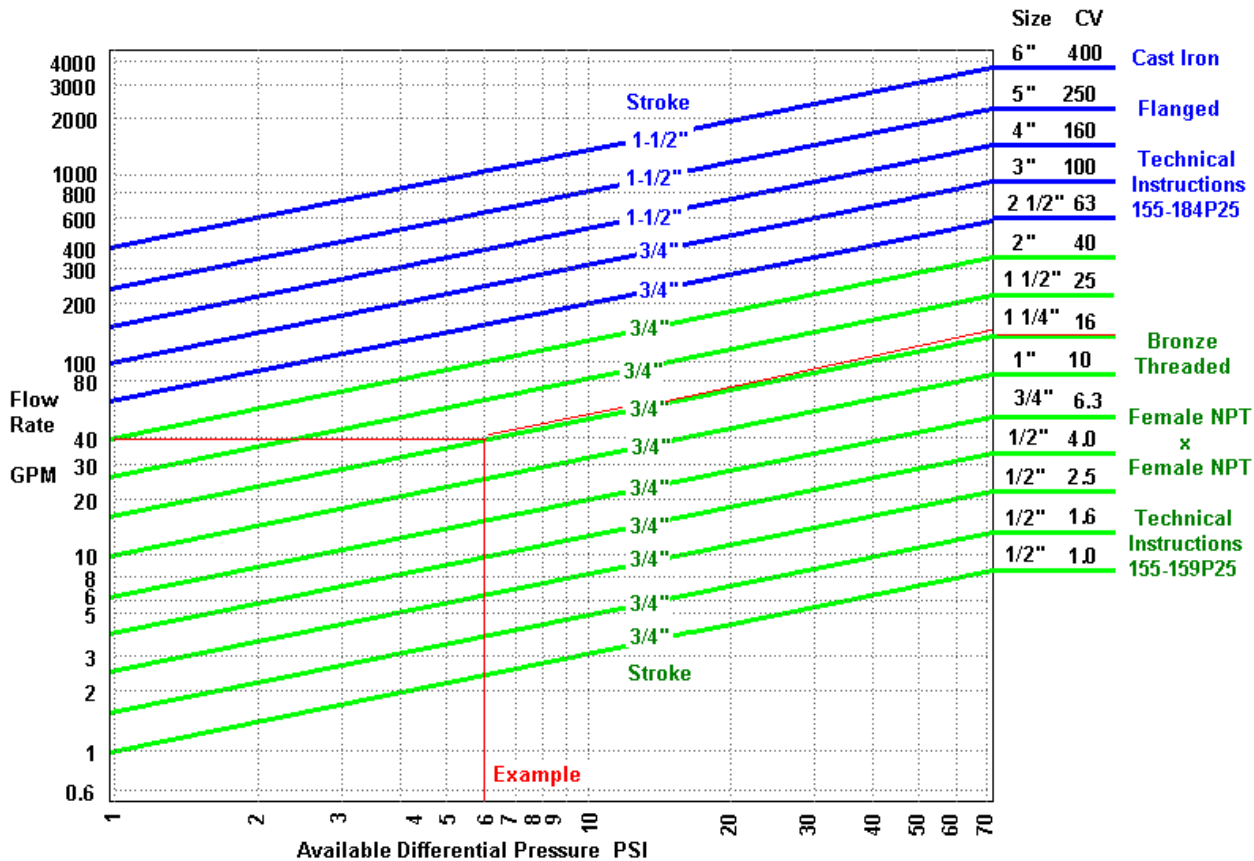
The recommended valve for a feedwater application is a Siemens Flowrite VF 599 series, two-way, normally closed, high-temperature, with an ANSI class pressure rating of 250 lbs. This is a Class IV valve, which means it has an allowable leakage rate of .01% of rated flow at installed dP. A Valve is typically sized for two requirements; flow rate in GPM (usually 1.1 to 1.5 times the maximum flow rate to the boiler) and the available differential pressure in PSI.

Example:

A 40 GPM flow rate with a differential pressure of 6 PSI, suggests a 1-1/4" bronze valve with a CV of 16, and 3/4" stroke.

The system must be designed so that the maximum pump pressure on start up, (no pressure in boiler) when the valve is closed does not exceed the maximum rated close off differential pressure rating of the valve body.

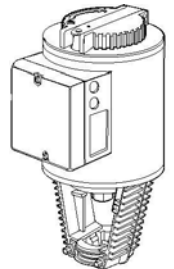
Please see Technical Instructions for maximum pressure rating vs. temperature, and capacity graph.



Electric Actuators Selection

The valve selected above can then be combined with a Siemens Flowrite EA 599 series, 24VAC, Electronic Proportional Control actuator. The actuator housings are all rated NEMA 1, all accept 4-20 mA inputs, and can be configured for normal or reverse acting. Refer to the chart below for actuator, order number, stroke, force, and run time.

| Order Number | Stroke | | Force | Run time | Technical Instructions | Installation Instructions |
|--------------|--------|------|----------|----------|------------------------|---------------------------|
| SKD 62UA | 3/4" | 20mm | 225 lbs. | 30 sec | 155-717 | 129-369 |
| SKC 62UA | 1-1/2" | 40mm | 640 lbs. | 120 sec | | 129-368 |
| | 3/4" | 20mm | | 60 sec | | |
| SKB 62UA | 3/4" | 20mm | 640 lbs. | 120 sec | | |

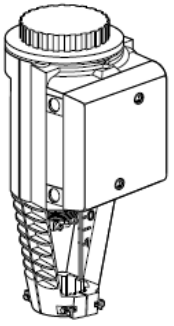
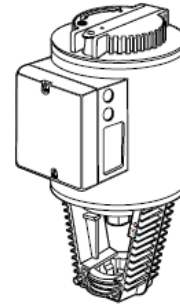
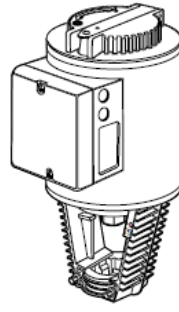


NOTE:

The SKx is selected based on:
 1 close-off pressure
 2 599 stroke

An SKC with a 40mm stroke
 can be used on a 20mm 599
 valve

- advantage is opening
 time of 60s vs 120s



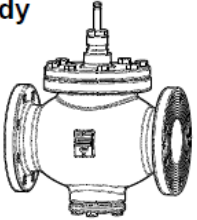
Running time
 Opening:

120 sec

120 sec

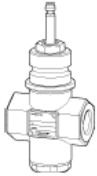
30 sec

**Two-Way Valves
 2-1/2 to 6-inch Flanged Iron
 Body**



| | | | |
|-----------------------------|--------------------------------------|--|--------------------------------------|
| Actuator Stroke | SKB 3/4-inch (20 mm) | SKC 1-1/2 inch (40 mm) | SKD 3/4-inch (20 mm) |
| Stem travel (stroke) | 2-1/2 and 3 inch 3/4-inch (20 mm) | 4, 5, and 6 inch 1-1/2 inch (40 mm) | 2-1/2 and 3 inch 3/4-inch (20 mm) |

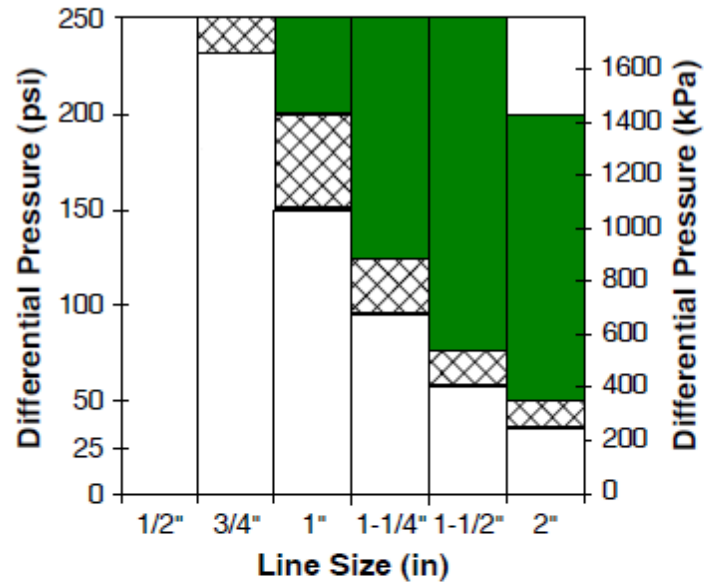
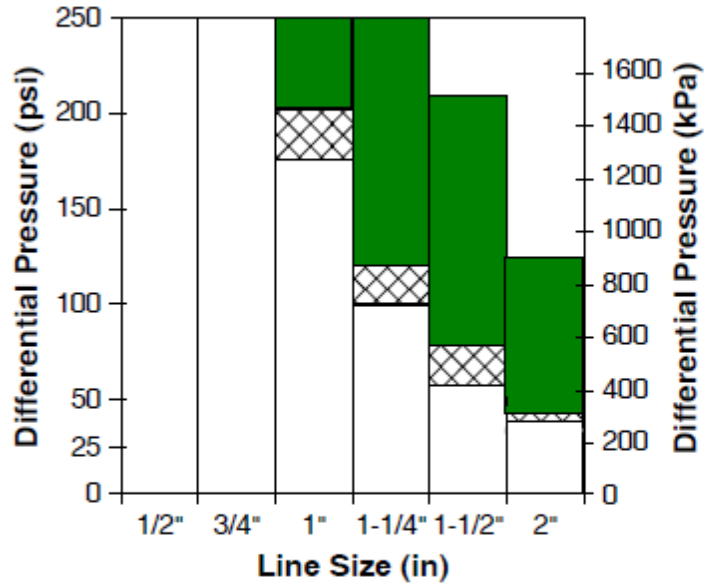
**Two-Way Valves
 1/2 to 2-inch Bronze Body**



Stem travel
 (stroke)

| | | | |
|-------------------------------------|---|--------------------|------------------|
| Stem travel (stroke) | 3/4-inch (20 mm) | 3/4-inch (20 mm) | 3/4-inch (20 mm) |
| Valve Stem Travel Indication | <p>ACTUATOR PRESSURE CYLINDER</p> <p>3/4" 20mm</p> | <p>1 1/2" 40mm</p> | <p>3/4" 20mm</p> |
| Position force | <p>SKB and SKC have the same close-off capacity</p> <p>2800N</p> | | 1000N |

Close-off Pressures



 SKD

 SKB \ SKC

ELECTRONIC

RWF5x Modulating Feedwater Control Valve Application Guide