Appendix B

Building Automation System (BAS) Specifications Listing

1 Purpose and Instructions

The purpose of this document is to represent the capacities and characteristics of Components used in a Building Automation System Installation. The products listed in this document are approved for the use in BAS system installations for Penn State University Park and Commonwealth Campuses. the spec editor must use this document to represent products requested by the owner as a base of design. Additional products required above and beyond what is encompassed in this document to be listed in Section 2.7.

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ZS2_CS

PennState
Physical Plant

Air Flow Measuring Stations (AFMS)

(This page is hyperlinked to the TOC)

Cutsheets to be inserted after this header document to create the section.

EBTRON®
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Advantage IV

o d Series
GTx116e-PC

OVERVIEW

Airflow and Temperature Measurement Device with Integral Relative Humidity Sensor (with /H option)

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- S ew Point Monitorin

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SPECIFICATIONS: GTx116e-PC

General

- Probe and Sensor Node Configurations (max.)
  - 2 probes x 8 sensor nodes/probe
  - 4 probes x 4 sensor nodes/probe
- Installed Airflow Accuracy
  - Ducts/Plenums: ±3% of reading
  - Non-ducted OA Intakes: better than or equal to ±5% of reading
- PC Sensor Density: Refer to the PC sensor density table.
- Sensor Node Averaging Method
  - Airflow: Independent, arithmetic average
  - Temperature: Independent, velocity weighted average
- Listings & Compliance
  - UL: UL 60730-1; CAN/CSA-E60730-1-15
  - CE: Yes
  - BACnet International: BTL Listed (GTC116e and GTM116e transmitters)
  - FCC: This device complies with Part 15 of the FCC rules
  - RoHS: This device is RoHS2 compliant
- Environmental Limits
  - Temperature:
    - Probes: -20 to 160 ºF [-28.9 to 71.1 ºC]
    - Transmitter: -20 to 120 ºF [-28.9 to 48.9 ºC]
  - Humidity: (non-condensing)
    - Probes: 0 to 100%
    - Transmitter: 5 to 95%

Individual Sensing Nodes

- Sensing Node Sensors
  - Self-heated sensor: Precision, hermetically sealed, bead-in-glass thermistor probe
  - Temperature sensor: Precision, hermetically sealed, bead-in-glass thermistor probe
- Sensing Node Housing
  - Material: Glass-filled Polypropylene (Kynar® with /SS option)
  - Sensor Potting Materials: Waterproof marine epoxy
- Sensing Node Internal Wiring
  - Type: Kynar® coated copper
- Airflow Measurement
  - Accuracy: ±2% of reading to NIST-traceable airflow standards (includes transmitter uncertainty)
  - Calibrated Range: 0 to 5,000 fpm [25.4 m/s]
  - Calibration Points: 16
- Temperature Measurement
  - Type: Velocity-weighted average
  - Accuracy: ±0.15ºF [0.08 ºC] to NIST-traceable temperature standards (includes transmitter uncertainty)
  - Calibrated Range: -20 to 160 ºF [-28.9 to 71.1 ºC]

Optional Relative Humidity Sensor (/H Option)

- Type: Ruggedized capacitive polymer RH sensor
- Accuracy @ 77 ºF [25 ºC]
  - 20 to 80 %RH: ±2% RH
  - 0 to 20 and 80 to 100 %RH: ±3.5% RH
- Temperature Coefficient: 0.07%/ºF [0.13%/ºC]
- Long Term Drift: 0.5% RH/year
- Calculated Measurements: Velocity weighted relative humidity, velocity-weighted enthalpy and dew point using measured RH, velocity-weighted temperature and on-board barometric pressure sensor.

Sensor Probe Assembly

- Tube
  - Material: Gold anodized 6063 aluminum (316 stainless steel with /SS option)
- Mounting Brackets
  - Material: 304 stainless steel
- Mounting Options & Size Limits
  - Insertion: 6 to 191in. [152.4 to 4851 mm]
  - Stand-off: 6 to 190 in. [152.4 to 4826 mm]
  - Internal: 10 to 194 in. [254.0 to 4928 mm]
  - Note: The /H option is only available on probes >18 in.[457.2 mm]
- Probe to Transmitter Cables
  - Type: FEP jacket, plenum rated CMP/CL2P, UL/cUL listed, -67 to 302 ºF [-55 to 150 ºC], UV tolerant
  - Standard Lengths: 10, 15, 20, 25, 30, 40 and 50 ft. [3.1, 4.6, 6.1, 7.6, 9.1, 12.2, and 15.2 m]
  - Connecting Plug: 13/16" [20.63 mm] nominal diameter with gold-plated connector pins

Transmitter

- Power Requirement: 24 VAC (22.8 to 26.4 under load) @20V-A max.
- Connector Receptacle Pins and PCB Connections: Gold-plated receptacle pins, PCB interconnects, PCB edge fingers, and test points
- User Interface: 2 line x16-character backlit LCD display and 4 button interface
- B.A.S. Connectivity Options
  - All Transmitters: Three field selectable (0-5/0-10 VDC or 4-20mA), scalable and isolated analog output signals (AO1=airflow, AO2=temperature or alarm, AO3=%RH, enthalpy or dew point when /H option is provided).
  - GTA116e Transmitter: No additional connectivity to B.A.S.
  - GTC116e Transmitter: One additional field selectable (BACnet MS/TP or Modbus RTU) and isolated RS-485 network connection - Individual sensor node airflow rates and temperatures are available via the network
  - GTM116e Transmitter: One additional isolated Ethernet (simultaneously supported BACnet Ethernet or BACnet IP, Modbus TCP and TCP/IP) network connection - Individual sensor node airflow rates and temperatures are available via the network
  - GTF116e Transmitter: One additional isolated Lonworks Free Topology network connection
  - GTU116e Transmitter: One additional USB connection for thumb drive data-logging of sensor node airflow rates and temperatures
- Airflow Alarm
  - Type: Low and/or high user defined setpoint alarm
  - Tolerance: User defined % of setpoint
  - Delay: User defined
  - Zero Disable: Alarm can be disabled when the airflow rate falls below the low limit cutoff value (unoccupied periods)
  - Reset Method: Manual or automatic
  - Visual Indication: Yes, LCD display
  - Analog Signal Indication: Yes, on AO2 assignment
- System Status Alarm
  - Type: Sensor diagnostic system trouble indication
  - Visual Indication: Yes, LCD display
  - Analog Signal Indication: Yes, on AO2 assignment
- *EB-Link* Bluetooth® low energy Interface for Android® and iPhone®: Display real-time airflow, velocity-weighted temperature, humidity, enthalpy, dew point, individual sensor node airflow/temperature data, settings and diagnostics.

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Air Pressure Transducers and Accessories

(This page is hyperlinked to the TOC)

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Pressure Probe Assemblies

Overview

The Static Pressure Probe and Total Pressure Probe Assemblies connect to the BAPI Zone Pressure Sensor to provide duct static pressure or duct air velocity. The angled total probe faces into the airflow to sense the moving air's total pressure while the static probe senses static pressure.

Both probe assemblies include a tube and rubber hose with built in surge damper to smooth out variations in airflow for a more stable reading. The Static Pressure Probe is available individually while the Pitot Pressure Probe Assemby includes the total probe and the static probe assemblies.

ORDERING INFORMATION

ZPS-ACC07... Static Pressure Probe Assembly, 6" long

ZPS-ACC08... Aluminum static Tube Only (6") w/ Circular Foam

ZPS-ACC09... Rubber Hoses w/ Surge Damper (includes a bulk head fitting)

ZPS-ACC11... Pitot Pressure Probe Assembly, 3.5" long (includes the Static & Total Probe Assemblies)

ZPS-ACC12... Pitot Pressure Probe Assembly, 6" long (includes the Static & Total Probe Assemblies)

ZPS-ACC13... Total Tube Only (3.5") with Circular Foam (doesn't include hoses & damper)

ZPS-ACC14... Total Tube Only (6") with Circular Foam (doesn't include hoses & damper)

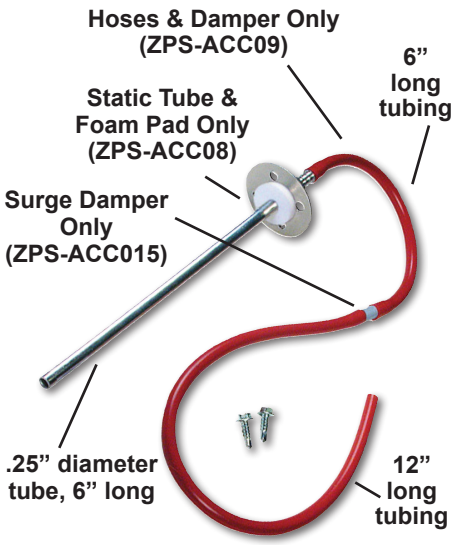
ZPS-ACC15... Surge Damper Only, 5 micron

ZPS-ACC17... Static Tube Only (0.5") with Circular Foam (doesn't include hoses & damper)

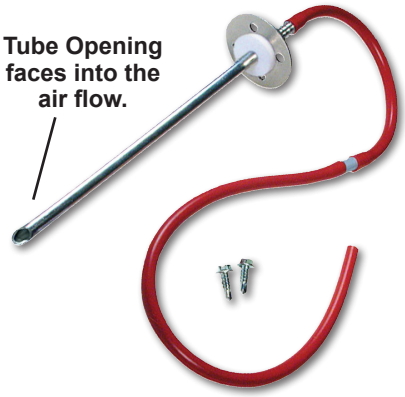
ZPS-ACC18... 2 Static Pressure Tube Assemblies, 6" Long

ZPS-ACC21... Stainless Steel Static Tube Only (6") with Circular Foam and Mounting Screws (doesn't include hoses & damper)

ZPS-ACC22... Static Tube Only, Zero Length, with Circular Foam and Mounting Screws



Static Pressure Probe Assembly



Total Pressure Probe Assembly

Static Tube Only, Zero Depth

Silicone Rubber Tubing

Overview

Made from a material that's used for green house glazing, this synthetic rubber tubing maintains its flexibility and resiliency over time.

Specifications:

ID: 1/8 inch • **OD:** 1/4 inch • **Bend Radius:** 1/4 inch

Hardness: 50 durometer • **Tensile Strength:** 1100 psi

Application Temperature: -94 to 392°F (-70 to 200°C)

Material: Silicone Rubber

ORDERING INFORMATION

ZPS-SIL-250-125-50 ..... 50 foot roll of silicone rubber tubing

Silicone Rubber Tubing

Pressure Multi-Sensor, Standard, Low & High Ranges

Zone Pressure Multi-Sensors (ZPM)

Rev. 04/07/17

Features & Options

- 10 Field Selectable Pressure Ranges and 5 Field Selectable Outputs
- Optional Display Shows Pressure Over the Entire Operational Range Regardless of Which Pressure Range is Selected
- Standard, Low and High Range Units
- Ranges and Outputs Can Be Set Without Power
- Free NIST Certificate Included with Each Unit

ZPM Pressure Multi-Sensor

BAPI's Zone Pressure Multi-Sensor is the most flexible pressure sensor on the market. Output, range, units, directionality, and response time are quickly set in the field with no tools, no power and no small components.

The optional LCD display helps with troubleshooting because it displays the actual differential pressure over the entire operational range regardless of which individual pressure range is selected for output to the system controller. Three LEDs on the face of the unit indicate when the pressure is "Out of Range Low", "In Range" or "Out of Range High".

Specifications

Power:
7 to 40 VDC (4 to 20 mA Output)
7 to 40 VDC or 18 to 32 VAC (0 to 5 or 1 to 5 V Output)
13 to 40 VDC or 18 to 32 VAC (0 to 10 or 2 to 10 V Output)

Power Consumption:
20 mA max, DC only at 4 to 20 mA Output
4.9 mA max DC at 0 to 5 VDC or 0 to 10 VDC Output
0.12 VA max AC at 0 to 5 VDC or 0 to 10 VDC Output

Load Resistance:
4 to 20 mA Output 850 Ω Maximum @ 24 VDC
0 to 5 V or 0 to 10 V output 6K to 10KΩ minimum

Accuracy for Standard Pressure Ranges at 72°F:
±0.25% of range

Accuracy for Low Pressure Ranges at 72°F:
±0.5% of range for the three lowest unidirectional and bidirectional ranges, ±0.25% of range all other ranges

Accuracy for High Pressure Ranges at 72ºF:
±0.25% on all ranges

Stability: ±0.25% F.S. per year

Environmental Op. Range: -4 to 140°F (-20 to 60°C)

Storage Temperature: -40 to 203°F (-40 to 95°C)

Temperature Error Low Range:
0.04% FS/°F (0.07% FS/°C)
(±1.0" W.C @-4 to 140ºF (-20 to 60°C)

Temperature Error Standard Range:
0.01% FS/°F (0.02% FS/°C)
(±5.0" W.C @-4 to 140ºF (-20 to 60°C)

Temperature Error High Range:
0.015% FS/°F (0.025% FS/°C)
(0 to 30" W.C @-4 to 140ºF (-20 to 60°C)

Overpressure:
Proof: 300.1 WC (10.83 PSI)
Burst: 512.6 WC (18.5 PSI)

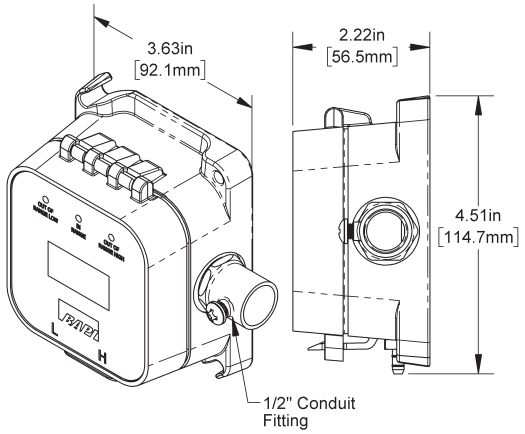
Wiring:
2 wires (4 to 20mA Current loop)*
3 wires (AC or DC powered, Voltage out)*

Humidity: 0 to 95% RH, non-condensing

Port Size: 1/4" tubing (1/8" to 3/16" I.D.)

Encl. Material: UV-resistant Polycarb., UL94, V-0

Enclosure Rating: IP44, NEMA 2



*__BAPI__ recommends that you do not run wiring for the pressure transmitter in the same conduit as line voltage wiring or with wiring used to supply highly inductive loads such as motors, generators and coils.

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Ordering Information

STANDARD RANGE UNITS

PART NUMBER	DESCRIPTION
BA/ZPM-SR-NT-D	ZPM Standard Range Unit, No Tube or Probe included, with Display
BA/ZPM-SR-ST-D	ZPM Standard Range Unit, with Static Pressure Tube, with Display
BA/ZPM-SR-AT-D	ZPM Standard Range Unit, with Attached Static Tube, with Display
BA/ZPM-SR-NT-ND	ZPM Standard Range Unit, No Tube or Probe included, No Display
BA/ZPM-SR-ST-ND	ZPM Standard Range Unit, with Static Pressure Tube, No Display
BA/ZPM-SR-AT-ND	ZPM Standard Range Unit, with Attached Static Tube, No Display

LOW RANGE UNITS

BA/ZPM-LR-NT-D	ZPM Low Range Unit, No Tube or Probe included, with Display
BA/ZPM-LR-ST-D	ZPM Low Range Unit, with Static Pressure Tube, with Display
BA/ZPM-LR-AT-D	ZPM Low Range Unit, with Attached Static Tube, with Display
BA/ZPM-LR-NT-ND	ZPM Low Range Unit, No Tube or Probe included, No Display
BA/ZPM-LR-ST-ND	ZPM Low Range Unit, with Static Pressure Tube, No Display
BA/ZPM-LR-AT-ND	ZPM Low Range Unit, with Attached Static Tube, No Display

HIGH RANGE UNITS

BA/ZPM-HR-NT-D	ZPM High Range Unit, No Tube or Probe included, with Display
BA/ZPM-HR-ST-D	ZPM High Range Unit, with Static Pressure Tube, with Display
BA/ZPM-HR-AT-D	ZPM High Range Unit, with Attached Static Tube, with Display
BA/ZPM-HR-NT-ND	ZPM High Range Unit, No Tube or Probe included, No Display
BA/ZPM-HR-ST-ND	ZPM High Range Unit, with Static Pressure Tube, No Display
BA/ZPM-HR-AT-ND	ZPM High Range Unit, with Attached Static Tube, No Display

Pressure Range, Output Range and Inches of Water Column or Pascal Operation will be selected in the field for these units. Ranges and Outputs shown below:

Custom Ranges are also available. Contact your BAPI representative for ordering information.

Your Number: BA/ZPM-

Field Selectable Ranges and Outputs

STANDARD RANGE UNITS

Inches WC	Pascals
0 to 1.00	0 to 250
0 to 2.00	0 to 300
0 to 2.50	0 to 500
0 to 3.00	0 to 1,000
0 to 5.00	0 to 1,250
-1.00 to 1.00	-250 to 250
-2.00 to 2.00	-300 to 300
-2.50 to 2.50	-500 to 500
-3.00 to 3.00	-1,000 to 1,000
-5.00 to 5.00	-1,250 to 1,250

LOW RANGE UNITS

Inches WC	Pascals
0 to 0.10	0 to 30
0 to 0.25	0 to 50
0 to 0.50	0 to 100
0 to 0.75	0 to 175
0 to 1.00	0 to 250
-0.10 to 0.10	-30 to 30
-0.25 to 0.25	-50 to 50
-0.50 to 0.50	-100 to 100
-0.75 to 0.75	-175 to 175
-1.00 to 1.00	-250 to 250

HIGH RANGE UNITS

Inches WC	Pascals
0 to 5	0 to 1,250
0 to 10	0 to 2,500
0 to 15	0 to 4,000
0 to 25	0 to 6,000
0 to 30	0 to 7,400

OUTPUTS AVAILABLE

4 to 20 mA
0 to 5 V
0 to 10 V
2 to 10 V
1 to 5 V

PennState
Physical Plant

Air Temperature Sensors

(This page is hyperlinked to the TOC)

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Duct Averaging Units

Temperature Sensors

Rev. 07/08/20

Features & Options

- Averaging Lengths: 8’, 12’ and 24’
- Three Enclosure Styles

BAPI Duct Averaging Units feature closed cell foam to seal the probe insertion hole and absorb vibration. Mounting tabs allow for easy installation to the duct. All units have etched Teflon leadwires and encapsulated sensors to create a watertight package that can perform under real world conditions.

Averaging probes should be used wherever there is a chance for stratified layers of hot and cold air. Averaging probes are made of bendable aluminum tubing and measure temperature along their entire length. Nylon tie straps are provided for mounting.

Duct Averaging Units come standard with a 2”x4” steel J-Box but are also available with no box or the new BAPI-Box Crossover enclosure.

Flexible Probe Bracket for Mounting Averaging Sensors

The Flexible Probe Bracket (FPB) is used to mount averaging sensors, low limit thermostats, or liquid fill thermostats.

The bracket is used to reverse the direction of the flexible probe with a smooth arc to eliminate the risk of kinking the sensor and damaging the probe. A fixed 1/4” probe may also be mounted as part of the bracket design using the scored break-off.

(See the Accessories Section for more information.)

Specifications

Environmental Operation Range:
Temperature:
BAPI-Box Crossover: -40 to 85 °C
Other Enclosures: -40 to 100 °C
Humidity: 0 to 95%, non-condensing

Sensing Element:
Thermistor or RTD (See Sensors Section for Specs.)

Probe Material:
Bendable Aluminum, 3/16” diameter

Enclosure Material:
Junction Box: Galvanized Steel
BAPI-Box Crossover:
UV-resistant polycarbonate, UL94, V-0

Enclosure Rating:
Junction Box: IP20, NEMA 1
BAPI-Box Crossover (BBX):
IP10, NEMA 1
IP44 with knockout plug in open port

Encl. Dimensions: H x W x D
BAPI-Box Crossover:
3.1 x 2.2 x 1.9” (79 x 56 x 49mm)
Junction Box
4.2 x 3.9 x 1.94” (106 x 98.4 x 49mm)

(For enclosure dimension drawings, see the end of the section.)

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Use the Option Selection Guide below to create your custom part number. Replace the number and parenthesis with the designator for each selection. Skip the designator and dashes for optional selections that are not required in your configuration.

Duct Averaging Sensor Option Selection Guide

BA/ (**#1**) - (**#2**) - (**#3**) - (**#4**)

#1: Temperature Sensor (required)

1.8K	1.8K Thermistor
3K	3K Thermistor
10K-2	10K-2 Thermistor
10K-3	10K-3 Thermistor
10K-3[11K]	10K-3[11K] Thermistor
20K	20K Thermistor
1K[375]	1K Platinum RTD (375 curve)
1K[NI]	1K Ω Nickel RTD
1K	1K Platinum RTD (385 curve)

Transmitters below require a BAPI-Box Crossover Enclosure

T1K[32 TO 212F]	1K Plat. RTD Transmitter, 4 to 20 mA Output, 32 to 212°F Range
T1K[20 TO 120F]	1K Plat. RTD Transmitter, 4 to 20 mA Output, 20 to 120°F Range
T1K[0 TO 100F]	1K Plat. RTD Transmitter, 4 to 20 mA Output, 0 to 100°F Range
T1K[0 TO 100C]	1K Plat. RTD Transmitter, 4 to 20 mA Output, 0 to 100°C Range
T1K[-7 TO 49C]	1K Plat. RTD Transmitter, 4 to 20 mA Output, -7 to 49°C Range
T1K[-18 TO 38C]	1K Plat. RTD Transmitter, 4 to 20 mA Output, -18 to 38°C Range

Matched Transmitters are also available. Contact your BAPI representative for ordering.

#2: Probe Type and Length (required)

A-8’	Flexible Averaging, 8’ (2.4m) length
A-12’	Flexible Averaging 12’ (3.7m) length
A-24’	Flexible Averaging 24’ (7.3m) length

#3: Enclosure and Lead Length (optional, J-Box comes standard)

BBX	BAPI-Box Crossover (IP10, NEMA 1)
NB	No Box (comes with 6” Etched Teflon Leads)

#4: Test & Balance or Terminal Strip (optional, requires a BAPI-Box Crossover Enclosure)

TB	Test & Balance Switch
TS	Terminal Strip Connection

Additional options are available for these units but not shown in the configurator above. Contact your BAPI representative for the complete list of options.

Example Number: BA/ (**10K-2**) - (**A-8’**) - (**BBX**) - ( )

Actual Number (with parenthesis removed): BA/10K-2-A-8’-BBX

Description: 10K-2 Thermistor, Duct Averaging Sensor, BAPI-Box Crossover Enclosure

Your Number: BA/

Gray shaded items follow the Buy and Resale Multiplier.

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Outside Air Units

Temperature Sensors

Rev. 09/01/17

Features & Options

- Quick-Response Sensor
- IP66/NEMA 4 BAPI-Box 2 Enclosure Style
- Well-Vented Sensor Guard

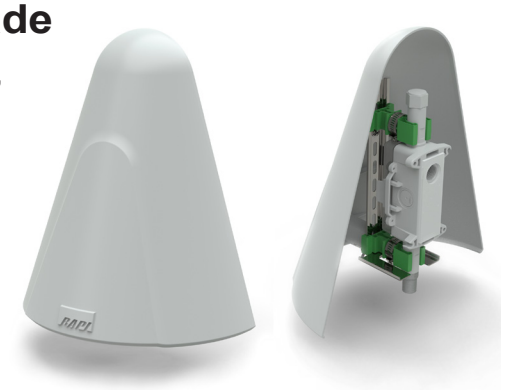
Outside Air Units are designed to be mounted outdoors. The UV-resistant plastic shield keeps the sensor out of the sunlight and allows for excellent air circulation. The units are available in a BAPI-Box 2 polycarbonate enclosure which carries an IP66/ NEMA 4 rating.

All Outside Air Units have etched Teflon leadwires and can withstand high humidity and condensation and perform under real world conditions. This is especially important in an outside air application which can be exposed to rain, snow and large temperature swings.

Outside Air Temperature Sensor in a BAPI-Box 2 Enclosure

Weather Shade

External temperature, humidity and air quality sensors can be affected by solar heat gain. The BAPI Weather Shade effectively blocks the solar heat gain, improving the accuracy of the sensor.



(See Accessories for more info.)

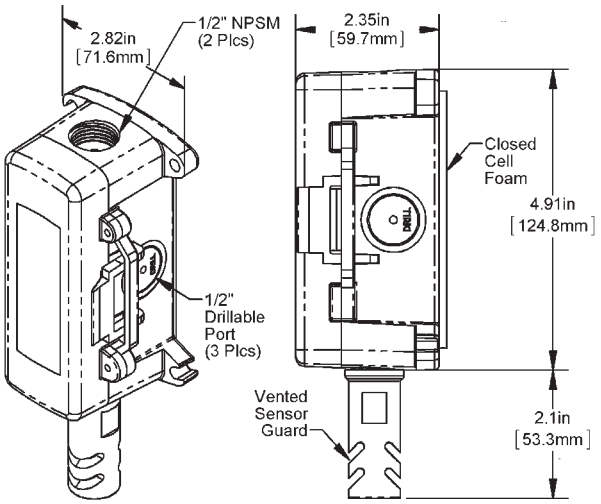
Specifications

Environmental Operation Range:
Temperature Sensor: -40 to 85 ºC
Temperature Transmitter: -20 to 70 ºC
Humidity: 0 to 100%, non-condensing

Sensing Element:
Thermistor or RTD
(See Sensors Section for Specs.)

Enclosure Rating: IP66, NEMA 4

Enclosure Material:
UV-resistant polycarbonate, UL94, V-0



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Use the Option Selection Guide below to create your custom part number. Replace the number and parenthesis with the designator for each selection. Skip the designator and dashes for optional selections that are not required in your configuration.

Outside Air Temperature Option Selection Guide

BA/ (**#1**) - (**#2**) - (**#3**) - (**#4**)

#1: Temperature Sensor (required)
1.8K .....1.8K Thermistor
3K .....3K Thermistor
10K-2 .....10K-2 Thermistor
10K-3 .....10K-3 Thermistor
10K-3[11K] .....10K-3[11K] Thermistor
20K .....20K Thermistor

1K[375] .....1K Platinum RTD (375 curve)
1K[NI] .....1K Ω Nickel RTD
1K .....1K Platinum RTD (385 curve)

Transmitters below require a BAPI-Box 2 Enclosure
T1K[32 TO 212F] .....1K Plat. RTD Transmitter, 4 to 20 mA Output, 32 to 212°F Range
T1K[20 TO 120F] .....1K Plat. RTD Transmitter, 4 to 20 mA Output, 20 to 120°F Range
T1K[0 TO 100F] .....1K Plat. RTD Transmitter, 4 to 20 mA Output, 0 to 100°F Range

T1K[0 TO 100C] .....1K Plat. RTD Transmitter, 4 to 20 mA Output, 0 to 100°C Range
T1K[-7 TO 49C] .....1K Plat. RTD Transmitter, 4 to 20 mA Output, -7 to 49°C Range
T1K[-18 TO 38C] .....1K Plat. RTD Transmitter, 4 to 20 mA Output, -18 to 38°C Range

Matched Transmitters are also available. Contact your BAPI representative for ordering.

#2: Outside Air Unit (required)
O .....Outside Air Unit

#3: Enclosure and Lead Length (required)
BB2 .....BAPI-Box 2 Polycarbonate Enclosure (IP66, NEMA 4)

#4: Test & Balance or Terminal Strip (optional)
TB .....Test & Balance Switch
TS .....Terminal Strip Connection

Additional options are available for these units but not shown in this Selection Guide. Contact your BAPI representative for the complete list of options. Submittal sheets without List Prices can be downloaded from our website at www.bapihvac.com

Example Number: BA/(**10K-2**) - (**O**) - (**BB2**) - ( )

Actual Number (with parenthesis removed): BA/10K-2-O-BB2

Description: 10K-2 Thermistor, Outside Air Temperature Sensor, BAPI-Box 2 Enclosure, No Test and Balance or Terminal Strip.

Your Number: BA/

Duct Units

Temperature Sensors

Rev. 03/15/18

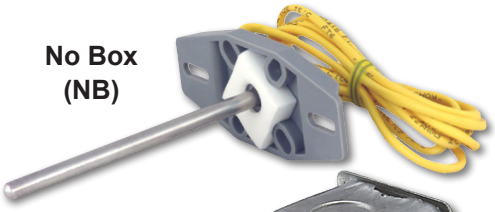
Features & Options

- Series 304 Stainless Steel Probes: 2, 4, 8, 12 and 18”
- Three Enclosure Styles
- Double Encapsulated Sensors & Etched Teflon Leads
- Limited Lifetime Warranty
- Wide Selection of Temperature Sensing Elements

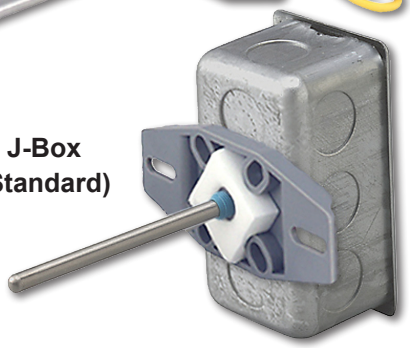
Single Point Duct Units feature closed cell foam to seal the probe insertion hole and to absorb vibration. Mounting tabs allow for easy installation directly to the wall of the duct.

All Duct Units have etched Teflon leadwires and double encapsulated sensors to create a watertight package that can withstand high humidity and condensation and perform under real world conditions. Duct Units have probe lengths from 2” to 18” to accommodate most duct shapes and sizes. Custom probe lengths are also available.

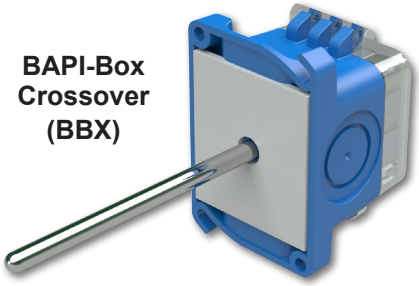
Duct Units come standard with a 2”x4” steel J-Box but are also available with no box or the new BAPI-Box Crossover enclosure.



No Box (NB)



J-Box (Standard)



BAPI-Box Crossover (BBX)

The New BAPI-Box Crossover Enclosure

The new BAPI-Box Crossover features a hinged cover with thumb latch for easy termination. A pierceable knockout plug is available for the open port. See the Accessories section for more info.

(Units shown with knockplug plug sold separately.)

Specifications

Environmental Operation Range:
Temperature:
BAPI-Box Crossover: -40 to 85 °C
Other Enclosures: -40 to 105 °C
Humidity: 0 to 100%, non-condensing

Sensing Element:
Thermistor or RTD (See Sensors Section for Specs.)

Probe Material:
Stainless Steel, 1/4” diameter

Enclosure Material:
Junction Box: Galvanized Steel
BAPI-Box Crossover:
UV-resistant polycarbonate, UL94, V-0

Enclosure Rating:
Junction Box: IP20, NEMA 1
BAPI-Box Crossover (BBX):
IP10, NEMA 1
IP44 with knockout plug in open port

Enclosure Dimensions: H x W x D
BAPI-Box Crossover:
3.1 x 2.2 x 1.9” (79 x 56 x 49mm)
Junction Box
4.2 x 3.9 x 1.94” (106 x 98.4 x 49mm)

(For enclosure dimension drawings, see the end of the section.)

Use the Option Selection Guide below to create your custom part number. Replace the number and parenthesis with the designator for each selection. Skip the designator and dashes for optional selections that are not required in your configuration.

Duct Temperature Option Selection Guide

BA/ (**#1**) - (**#2**) - (**#3**) - (**#4**)

#1: Temperature Sensor (required)
1.8K ..... 1.8K Thermistor
3K ..... 3K Thermistor
10K-2 ..... 10K-2 Thermistor
10K-3 ..... 10K-3 Thermistor
10K-3[11K] ..... 10K-3[11K] Thermistor
20K ..... 20K Thermistor

1K[375] ..... 1K Platinum RTD (375 curve)
1K[NI] ..... 1K Ω Nickel RTD
1K ..... 1K Platinum RTD (385 curve)

Transmitters below require a BAPI-Box Crossover Enclosure
T1K[32 TO 212F] ..... 1K Plat. RTD Transmitter, 4 to 20 mA Output, 32 to 212°F Range
T1K[20 TO 120F] ..... 1K Plat. RTD Transmitter, 4 to 20 mA Output, 20 to 120°F Range
T1K[0 TO 100F] ..... 1K Plat. RTD Transmitter, 4 to 20 mA Output, 0 to 100°F Range

T1K[0 TO 100C] ..... 1K Plat. RTD Transmitter, 4 to 20 mA Output, 0 to 100°C Range
T1K[-7 TO 49C] ..... 1K Plat. RTD Transmitter, 4 to 20 mA Output, -7 to 49°C Range
T1K[-18 TO 38C] ..... 1K Plat. RTD Transmitter, 4 to 20 mA Output, -18 to 38°C Rang

Matched Transmitters are also available. Contact your BAPI representative for ordering.

#2: Probe Type and Length (required)
D-2” ..... Duct, 2” (51mm) length
D-4” ..... Duct, 4” (102mm) length
D-8” ..... Duct, 8” (203mm) length
D-12” ..... Duct, 12” (305mm) length
D-18” ..... Duct, 18” (457mm) length

#3: Enclosure and Lead Length (optional, J-Box comes standard)
BBX ..... BAPI-Box Crossover (IP10, NEMA 1)
NB-18” ..... No Box, 18” Leads
NB-5’ ..... No Box, 5’ Leads
NB-10’ ..... No Box, 10’ Leads
NB-15’ ..... No Box, 15’ Leads

#4: Test & Balance or Terminal Strip (optional, requires a BAPI-Box Crossover Enclosure)
TB ..... Test & Balance Switch
TS ..... Terminal Strip Connection

Additional options are available for these units but not shown in this Selection Guide. Contact your BAPI representative for the complete list of options.

Example Number: BA/(**10K-2**) - (**D-8”**) - (**NB-5’**) - ( )

Actual Number (with parenthesis removed): BA/10K-2-D-8”-NB-5’

Description: 10K-2 Thermistor, Duct Temperature Sensor, No Box Enclosure with 5’ Leads.

Your Number: BA/

Control Valves

(This page is hyperlinked to the TOC)

Cutsheets to be inserted after this header document to create the section.

BELIMO

Stainless Steel Ball and Stem

Technical data sheet B210

5-year warranty

Technical data

Functional data	Valve Size	0.5" [15]
	Fluid	chilled or hot water, up to 60% glycol
	Fluid Temp Range (water)	0...250°F [-18...120°C]
	Body Pressure Rating	600 psi
	Close-off pressure Δps	200 psi
	Servicing	maintenance-free
	Flow Pattern	2-way
	Leakage rate	0% for A – AB
	Controllable flow range	75°
	Cv	1.2
	Body pressure rating note	600 psi
	Cv Flow Rating	A-port: as stated in chart B-port: 70% of A – AB Cv
Materials	Seat	PTFE
	End fitting	NPT female ends
	O-ring	EPDM (lubricated)
	Ball	stainless steel
Suitable actuators	Non-Spring	TR LRB(X) NR

Safety notes

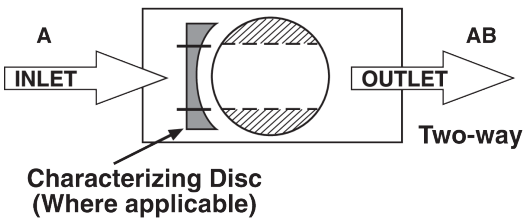
- WARNING: This product can expose you to lead which is known to the State of California to cause cancer and reproductive harm. For more information go to www.p65warnings.ca.gov

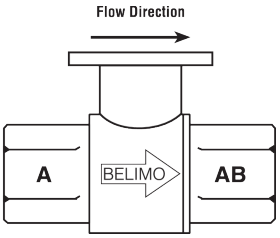
Product features

Application

This valve is typically used in air handling units on heating or cooling coils, and fan coil unit heating or cooling coils. Some other common applications include Unit Ventilators, VAV box re-heat coils and bypass loops. This valve is suitable for use in a hydronic system with variable flow.

Flow/Mounting details

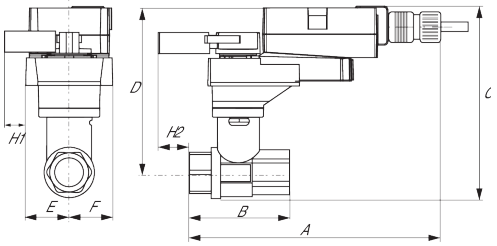




Dimensions

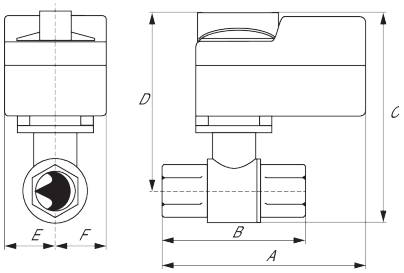
Dimensional drawings

LRB, LRX



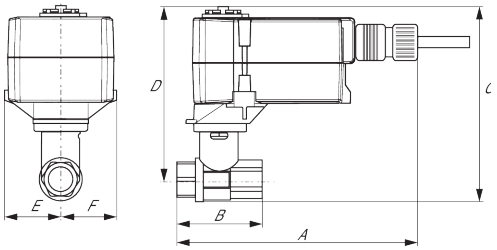
A	B	C	D	E	F	H1	H2
9.4" [239]	2.4" [60]	5.2" [132]	4.6" [117]	1.3" [33]	1.3" [33]	1.2" [30]	1.1" [28]

TR



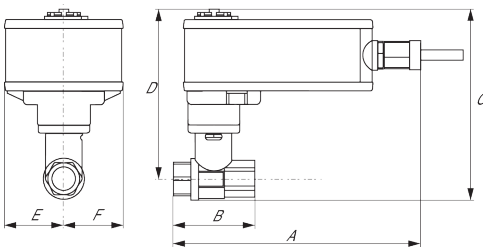
A	B	C	D	E	F
3.7" [95]	2.4" [60]	4.8" [122]	4.2" [107]	1.3" [33]	1.3" [33]

TFRB, TFRX



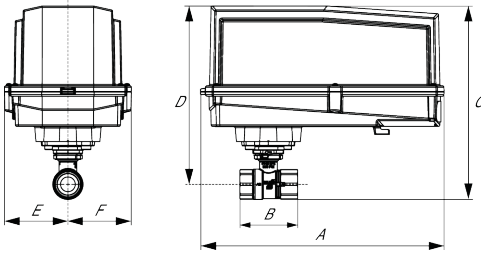
A	B	C	D	E	F
6.6" [167]	2.4" [60]	4.9" [124]	4.3" [110]	1.5" [39]	1.5" [39]

LF



A	B	C	D	E	F
7.9" [200]	2.4" [60]	5.7" [146]	5.1" [129]	1.8" [46]	1.8" [46]

ARB N4, ARX N4, NRB N4, NRX N4

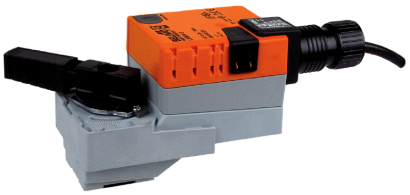


A	B	C	D	E	F
11.4" [289]	2.4" [60]	7.7" [196]	7.0" [179]	3.1" [80]	3.1" [80]

BELIMO

On/Off, Floating Point, Non-Spring Return, 24 V

Technical data sheet LRB24-3



5-year warranty

Technical data

Electrical data	Nominal voltage	AC/DC 24 V
	Nominal voltage frequency	50/60 Hz
	Power consumption in operation	1.5 W
	Power consumption in rest position	0.2 W
	Transformer sizing	2.5 VA (class 2 power source)
	Electrical Connection	18 GA plenum cable, 3 ft [1 m], with 1/2" conduit connector
	Overload Protection	electronic thoughout 0...90° rotation
Functional data	Input Impedance	600 Ω
	Direction of motion motor	selectable with switch 0/1
	Manual override	external push button
	Angle of rotation	90°
	Angle of rotation note	adjustable with mechanical stop
	Running Time (Motor)	90 s
	Noise level, motor	35 dB(A)
	Position indication	Mechanically, pluggable
Safety data	Degree of protection IEC/EN	IP54
	Degree of protection NEMA/UL	NEMA 2
	Enclosure	UL Enclosure Type 2
	Agency Listing	cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2014/30/EU
	Quality Standard	ISO 9001
	Ambient temperature	-22...122°F [-30...50°C]
	Storage temperature	-40...176°F [-40...80°C]
	Ambient humidity	max. 95% r.H., non-condensing
	Servicing	maintenance-free
Weight	Weight	1.1 lb [0.50 kg]

Electrical installation

INSTALLATION NOTES

1 Provide overload protection and disconnect as required.

2 Actuators may be connected in parallel. Power consumption and input impedance must be observed.

3 Actuators may also be powered by 24 VDC.

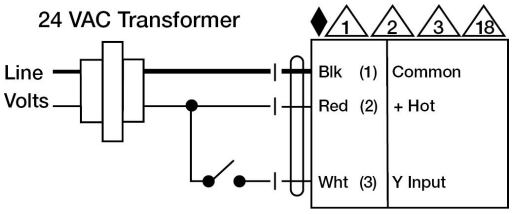
6 Actuators Hot wire must be connected to the control board common. Only connect common to neg. (-) leg of control circuits. Terminal models (-T) have no-feedback.

18 Actuators with plenum cable do not have numbers; use color codes instead.

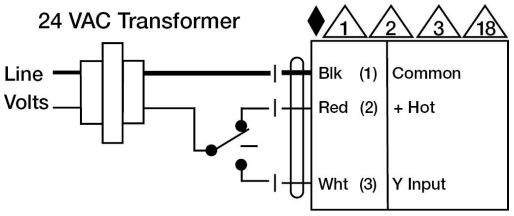
Meets cULus requirements without the need of an electrical ground connection.

Warning! Live Electrical Components!

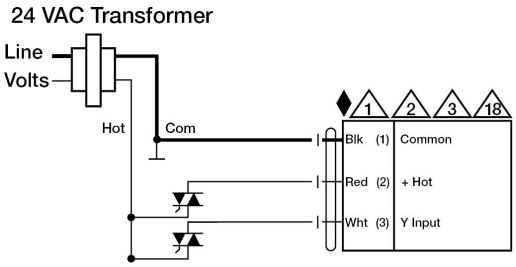
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

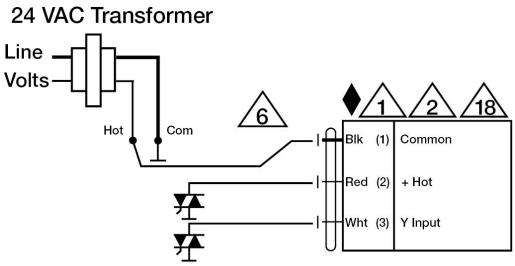


On/Off



Floating Point





Floating Point - Triac Sink

F6 Series 2-Way, ANSI Class 150 Butterfly Valve
Reinforced Teflon Seat, 316 Stainless Disc

BELIMO

- **Bubble tight shut-off to ANSI Class 150 Standards**
- **Long stem design allows for 2" insulation minimum**
- **Valve Face-to-face dimensions comply with API 609 & MSS-SP-68**
- **Designed to be installed between ASME/ANSI B16.5 Flanges**
- **Completely assembled and tested, ready for installation**

Application

These valves are designed to meet the needs of HVAC and Commercial applications requiring positive shut-off for liquids at higher pressures and temperatures. Typical applications include chiller isolation, cooling tower isolation, change-over systems, large air handler coil control, bypass and process control applications. The large C_v values provide for an economical control valve solution for larger flow applications.

Dead End Service

Utilizes larger retainer ring set screws to allow the valve to be placed at the end of the line without a down stream flange in either flow direction while still holding full pressure.

Technical Data	
Service	chilled, hot water, 60% glycol, steam to 50 psi
Flow characteristic	modified equal percentage, unidirectional
Controllable flow range	82°
Sizes	2" to 24"
Type of end fitting	for use with ASME/class 125/150 flange
Materials	
Body	carbon steel full lug
Disc	316 stainless steel
Seat	RPTFE
Shaft	17-4 PH stainless
Gland seal	PTFE
Bushings	glass backed PTFE
Media temperature range	-20°F to 400°F [-30°C to 204°C]
Body pressure rating	ANSI Class 150
Close-off pressure	285 psi
Rangeability	100:1 (for 30 deg to 70 deg range)
Maximum velocity	32 FPS
Leakage	bubble tight

		2-way Valves		Suitable Actuators					
		Valve Nominal Size	Type	Non Fail-Safe		Fail-Safe			
						Spring Return		Electronic	
C_V 90°	C_V 60°	Inches	ANSI 150 2-way	150	300	150	300	150	300
102	56	2	F650-150SHP	GM Series	GM Series	AF Series	AF Series	GK Series	GK Series
146	80	2½	F665-150SHP						
228	125	3	F680-150SHP						
451	248	4	F6100-150SHP	PR Series	PR Series			PKR	PKR
714	392	5	F6125-150SHP						
1103	607	6	F6150-150SHP						
2064	1135	8	F6200-150SHP	SY Series (2 Year Warranty)	SY (2 Year Warranty)				
3517	1934	10	F6250-150SHP						
4837	2660	12	F6300-150SHP						
6857	3592	14*	F6350-150SHP						
9287	4865	16*	F6400-150SHP						
11400	6270	18*	F6450-150SHP						
14420	7590	20*	F6500-150SHP						
22050	11550	24*	F6600-150SHP						

							MOD			ON/OFF
Valve	Size	C_v	10°	20°	30°	40°	50°	60°	70°	80°	90°
F650-150SHP	2"	102	1.50	6.10	14	26	39	56	77	99	102
F665-150SHP	2½"	146	2.20	8.80	20	37	55	80	110	142	146
F680-150SHP	3"	228	3.40	14	32	57	87	125	171	221	228
F6100-150SHP	4"	451	6.80	27	63	114	171	248	338	437	451
F6125-150SHP	5"	714	11	43	100	180	271	393	536	693	714
F6150-150SHP	6"	1103	17	66	154	278	419	607	827	1070	1103
F6200-150SHP	8"	2064	31	124	289	520	784	1135	1548	2002	2064
F6250-150SHP	10"	3517	53	211	492	886	1336	1934	2638	3411	3517
F6300-150SHP	12"	4837	73	290	677	1219	1838	2660	3628	4692	4837
F6350-150SHP	14"	6857	90	392	914	1646	2481	3592	4898	6530	6857
F6400-150SHP	16"	9287	132	531	1230	2229	3361	4865	6634	8845	9287
F6450-150SHP	18"	11400	171	684	1596	3873	4332	6270	8550	11270	11400
F6500-150SHP	20"	14420	207	828	1932	3478	5244	7590	10350	13800	14420
F6600-150SHP	24"	22050	315	1260	2940	5292	7890	11550	15750	21000	22050

Maximum Dimensions (Inches)

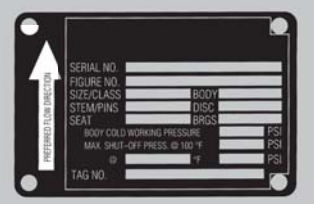
Valve	Size	C_v 90°	A	B	C	D(Max)	BHC	No. of Holes	Lug Bolt	Actuator	Close-Off (PSI)	
F650-150SHP	2"	102	1.75	9.00	9.00	19.50	4.75	4	5/8-11 UNC	2*AF	150	Spring Return
F665-150SHP	2½"	146	1.88	9.00	9.00	20.00	5.50	4	5/8-11 UNC		150	
F680-150SHP	3"	228	1.92	9.00	9.00	20.50	6.00	4	5/8-11 UNC		150	
F6100-150SHP	4"	451	2.13	9.00	9.00	21.00	7.50	8	5/8-11 UNC		150	
F650-150SHP	2"	102	1.75	9.00	9.00	19.50	4.75	4	5/8-11 UNC	GK	285	Electronic Fail-Safe
F665-150SHP	2½"	146	1.88	9.00	9.00	20.00	5.50	4	5/8-11 UNC		285	
F680-150SHP	3"	228	1.92	9.00	9.00	20.50	6.00	4	5/8-11 UNC		285	
F6100-150SHP	4"	451	2.13	9.00	9.00	21.00	7.50	8	5/8-11 UNC		150	
F6100-150SHP	4"	451	2.13	9.00	9.00	21.00	7.50	8	5/8-11 UNC	2*GK	285	
F650-150SHP	2"	102	1.75	9.00	9.00	19.50	4.75	4	5/8-11 UNC	GM	285	Non-Spring Return Electronic Fail-Safe (K)
F665-150SHP	2½"	146	1.88	9.00	9.00	20.00	5.50	4	5/8-11 UNC		285	
F680-150SHP	3"	228	1.92	9.00	9.00	20.50	6.00	4	5/8-11 UNC		285	
F6100-150SHP	4"	451	2.13	9.00	9.00	21.00	7.50	8	5/8-11 UNC		150	
F6100-150SHP	4"	451	2.13	9.00	9.00	21.00	7.50	8	5/8-11 UNC	2*GM	285	
F650-150SHP	2"	102	1.75	10.00	15.00	14.00	4.75	4	5/8-11 UNC	PR/PK	285	
F665-150SHP	2½"	146	1.88	10.00	16.00	14.00	5.50	4	5/8-11 UNC		285	
F680-150SHP	3"	228	1.92	10.00	17.00	15.00	6.00	4	5/8-11 UNC		285	
F6100-150SHP	4"	451	2.13	10.00	18.00	16.00	7.50	8	5/8-11 UNC		285	
F6125-150SHP	5"	714	2.25	10.00	19.00	16.00	8.50	8	3/4-10 UNC		285	
F6150-150SHP	6"	1103	2.29	10.00	20.00	17.00	9.50	8	3/4-10 UNC		285	
F6200-150SHP	8"	2064	2.50	12.00	12.00	32.00	11.75	8	3/4-10 UNC	SY4…	285	
F6250-150SHP	10"	3517	2.81	12.00	12.00	33.00	14.25	12	7/8-9 UNC	SY4…	285	
F6300-150SHP	12"	4837	3.23	12.00	12.00	35.00	17.00	12	7/8-9 UNC	SY4…	150	
										SY5…	285	
F6350-150SHP	14"	6857	3.62	14.00	14.00	36.00	18.75	12	1-8 UNC	SY5…	150	
										SY7…	285	
											150	
F6400-150SHP	16"	9287	4.00	14.00	14.00	37.50	21.25	16	1-8 UNC	SY8…	285	
F6450-150SHP	18"	11400	4.50	14.00	14.00	42.25	22.75	16	1 1/8-8 UNC	SY7…	150	
										SY8…	285	
F6500-150SHP	20"	14420	5.00	14.00	14.00	49.50	25.00	20	1 1/8-8 UNC	SY8…	150	
										SY10…	285	
F6600-150SHP	24"	22050	6.06	14.00	14.00	56.25	29.50	20	1 1/4-8 UNC	SY10…	150	

Dimension "A" does not include flange gaskets. (2 required per valve)

Application Notes

1. Valves are rated at 285 psi differential pressure in the closed position @ 100°F media temperature.
2. Valves are furnished with lugs tapped for use between ANSI Class 125/150 flanges conforming to ANSI B16.5 Standards.
3. 2-way assemblies are furnished assembled, calibrated and tested, ready for installation.
4. Dimension "D" allows for actuator(s) removal without the need to remove the valve from the pipe.
5. Weather shields are available, dimensional data furnished upon request.
6. Flange gaskets (2 required, not provided with valve) MUST be used between valve and ANSI flange.
7. Flange bolts are not included with the valve. These are furnished by others.

SHP series valves have a preferred flow direction.



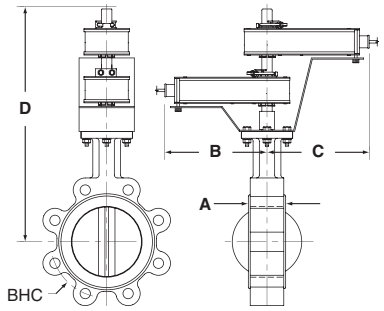
PreferredFlowrate

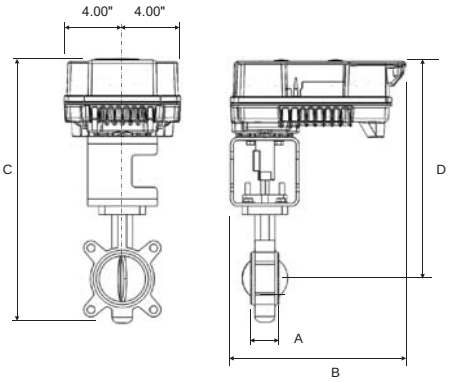
Safety Notes

WARNING: This product can expose you to lead which is known to the State of California to cause cancer and reproductive harm. For more information go to www.P65Warnings.ca.gov

Dimensions

D102





F7 Series 3-Way, ANSI Class 150 Butterfly Valve
Reinforced Teflon Seat, 316 Stainless Disc

- **Bubble tight shut-off to ANSI Class 150 Standards**
- **Long stem design allows for 2" insulation minimum**
- **Valve Face-to-face dimensions comply with API 609 & MSS-SP-68**
- **Designed to be installed between ASME/ANSI B16.5 Flanges**
- **Completely assembled and tested, ready for installation**
- **Tees comply with ASME/ANSI B16.1 Class 125 Flanges**

Application

These valves are designed to meet the needs of HVAC and Commercial applications requiring positive shut-off for liquids at higher pressures and temperatures. Typical applications include chiller isolation, cooling tower isolation, change-over systems, large air handler coil control, bypass and process control applications. The large C_V values provide for an economical control valve solution for larger flow applications.

Dead End Service

Utilizes larger retainer ring set screws to allow the valve to be placed at the end of the line without a down stream flange in either flow direction while still holding full pressure.

Technical Data	
Service	chilled, hot water, 60% glycol, steam to 50 psi
Flow characteristic	modified equal percentage, unidirectional
Controllable flow range	82°
Sizes	2" to 18"
Type of end fitting	for use with ASME/class 125/150 flanges
Materials	
Body	carbon steel full lug
Disc	316 stainless steel
Seat	RPTFE
Shaft	17-4 PH stainless
Gland seal	PTFE
Bushings	glass backed PTFE
Media temperature range	-20°F to 400°F [-30°C to 204°C]
Body pressure rating	ANSI Class 150
Close-off pressure	285 psi
Rangeability	100:1 (for 30 deg to 70 deg range)
Maximum velocity	32 FPS
Leakage	bubble tight

		3-way Valves		Suitable Actuators					
		Valve Nominal Size	Type	Non Fail-Safe				Electronic Fail-Safe	
C_V 90°	C_V 60°	Inches	ANSI 150 3-way	150		300		150	300
102	56	2	F750-150SHP	GM Series	PR Series	GM Series	PR Series	GK Series	GK Series
146	80	2½	F765-150SHP						PKR
228	125	3	F780-150SHP						
451	248	4	F7100-150SHP						
714	393	5	F7125-150SHP		SY Series (2 Year Warranty)		SY Series (2 Year Warranty)		
1103	607	6	F7150-150SHP						
2064	1135	8	F7200-150SHP						
3517	1934	10	F7250-150SHP						
4837	2660	12	F7300-150SHP						
6857	3592	14*	F7350-150SHP						
9287	4865	16*	F7400-150SHP						
11400	6270	18*	F7450-150SHP						

							MOD				ON/OFF
Valve	Size	C_V	10°	20°	30°	40°	50°	60°	70°	80°	90°
F750-150SHP	2"	102	1.50	6.10	14	26	39	56	77	99	102
F765-150SHP	2½"	146	2.20	8.80	20	37	55	80	110	142	146
F780-150SHP	3"	228	3.40	14	32	57	87	125	171	221	228
F7100-150SHP	4"	451	6.80	27	63	114	171	248	338	437	451
F7125-150SHP	5"	714	11	43	100	180	271	393	536	693	714
F7150-150SHP	6"	1103	17	66	154	278	419	607	827	1070	1103
F7200-150SHP	8"	2064	31	124	289	520	784	1135	1548	2002	2064
F7250-150SHP	10"	3517	53	211	492	886	1336	1934	2638	3411	3517
F7300-150SHP	12"	4837	73	290	677	1219	1838	2660	3628	4692	4837
F7350-150SHP	14"	6857	103	411	960	1728	2606	3592	5143	6651	6857
F7400-150SHP	16"	9287	139	557	1300	2340	3529	4865	6965	9008	9287
F7450-150SHP	18"	11400	171	684	1596	2873	4332	6270	8550	11058	11400

Maximum Dimensions (Inches)

Valve	Size	C_v 90°	A	B	C	D(Max)	BHC	No. of Holes	Lug Bolt	Actuator	Close-Off (PSI)	
F750-150SHP	2"	102	4.50	6.38	6.38	16.50	4.75	4	5/8-11 UNC	GK	150	Electronic Fail-Safe
F765-150SHP	2½"	146	5.00	6.88	6.88	17.00	5.50	4	5/8-11 UNC		150	
F780-150SHP	3"	228	5.50	7.56	7.56	17.50	6.00	4	5/8-11 UNC		150	
F750-150SHP	2"	102	4.50	6.38	6.38	16.50	4.75	4	5/8-11 UNC	2*GK	285	
F765-150SHP	2½"	146	5.00	6.88	6.88	17.00	5.50	4	5/8-11 UNC		285	
F780-150SHP	3"	228	5.50	7.56	7.56	17.50	6.00	4	5/8-11 UNC		285	
F750-150SHP	2"	102	4.50	6.38	6.38	16.50	4.75	4	5/8-11 UNC	GM	150	Non-Spring Return Electronic Fail-Safe (K)
F765-150SHP	2½"	146	5.00	6.88	6.88	17.00	5.50	4	5/8-11 UNC		150	
F780-150SHP	3"	228	5.50	7.56	7.56	17.50	6.00	4	5/8-11 UNC		150	
F7100-150SHP	4"	451	6.50	8.63	8.63	18.00	7.50	8	5/8-11 UNC		150	
F750-150SHP	2"	102	4.50	6.38	6.38	16.50	4.75	4	5/8-11 UNC	2*GM	285	
F765-150SHP	2½"	146	5.00	6.88	6.88	17.00	5.50	4	5/8-11 UNC		285	
F780-150SHP	3"	228	5.50	7.56	7.56	17.50	6.00	4	5/8-11 UNC		285	
F750-150SHP	2"	102	4.50	6.38	6.38	14.00	4.75	4	5/8-11 UNC	PR/PK	285	
F765-150SHP	2½"	146	5.00	6.88	6.88	14.50	5.50	4	5/8-11 UNC		285	
F780-150SHP	3"	228	5.50	7.56	7.56	15.00	6.00	4	5/8-11 UNC		285	
F7100-150SHP	4"	451	6.50	8.63	8.63	16.00	7.50	8	5/8-11 UNC		285	
F7125-150SHP	5"	714	7.50	9.75	9.75	24.25	8.50	8	3/4-10 UNC	SY4…	285	
F7150-150SHP	6"	1103	8.00	10.25	10.25	24.75	9.50	8	3/4-10 UNC		285	
F7200-150SHP	8"	2064	9.00	11.50	11.50	32.00	11.75	8	3/4-10 UNC	SY4…	150	
F7250-150SHP	10"	3517	11.00	13.81	13.81	33.00	14.25	12	7/8-9 UNC	SY4…	150	
										SY5…	285	
F7300-150SHP	12"	4837	12.00	15.81	15.81	35.00	17.00	12	7/8-9 UNC	SY5…	150	
										SY7…	285	
F7350-150SHP	14"	6857	14.00	17.62	17.62	36.00	18.75	12	1-8 UNC	SY7…	285	
F7400-150SHP	16"	9287	15.00	19.00	19.00	37.50	21.25	16	1-8 UNC	SY7…	150	
										SY9…	285	
F7450-150SHP	18"	11400	16.50	21.00	21.00	42.25	22.75	16	1 1/8-8 UNC	SY8…	150	
										SY10…	285	

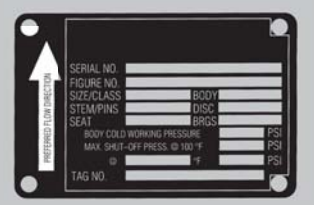
Dimensions "A, B and C" do not include flange gaskets. (3 required per valve)

Application Notes

1. Valves are rated at 285 psi differential pressure in the closed position @ 100°F media temperature.
2. Valves are furnished with lugs tapped for use between ANSI Class 125/150 flanges conforming to ANSI B16.5 Standards.
3. 3-way assemblies are furnished assembled with Tee, calibrated and tested, ready for installation. All 3-way assemblies require the customer to specify the 3-way configuration code prior to order entry to guarantee correct placement of valves and actuator(s) on the assembly.
4. Dimension "D" allows for actuator(s) removal without the need to remove the valve from the pipe.
5. Weather shields are available, dimensional data furnished upon request.
6. Dual actuated valves have single actuators mounted on each valve shaft.
7. Flange gaskets (3 required, not provided with valve) MUST be used between valve and ANSI flange.
8. Flange bolts are not included with the valve. These are furnished by others.

⚠ **Note:** For tee configuration, please refer to page 5.

SHP series valves have a preferred flow direction.



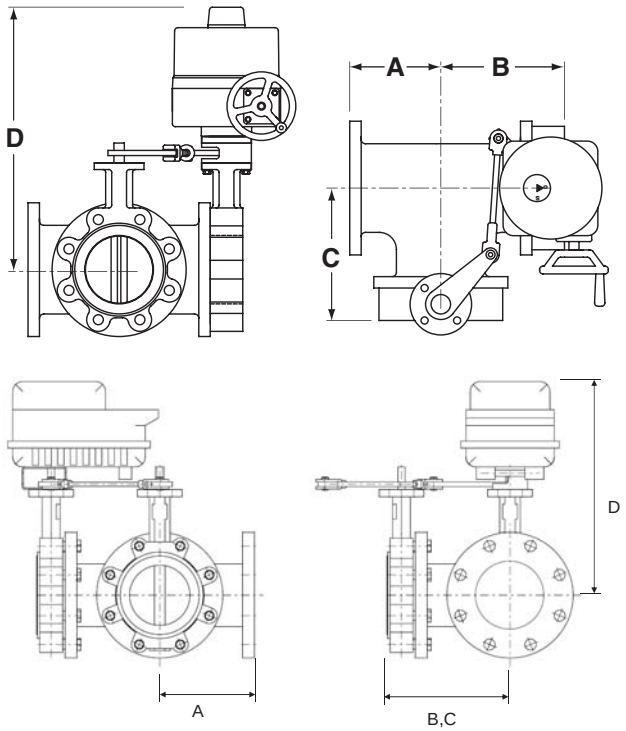
PreferredFlowrate

Safety Notes

WARNING: This product can expose you to lead which is known to the State of California to cause cancer and reproductive harm. For more information go to www.P65Warnings.ca.gov

Dimensions

D104



2 YEAR WARRANTY

Application:

The SY actuators are NEMA 4X rated and designed to meet the needs of HVAC and Commercial applications. Offered on Belimo standard and high performance valve series, these actuators are available for on/off and modulating applications.

Depending on the application, they are available in 24 VAC/ VDC, 120 VAC and 230 VAC.

Technical Data	
Electrical connection	½" conduit connector, screw terminals
Motor protection	H Class insulation (SY-1), F Class (SY-2…5)
Gear train	high alloy steel gear sets, self locking
Operating range	(SY…-24) on/off, floating point (SY...24MFT) 2-10 VDC, 4-20 mA, 0-10 VDC
Sensitivity	(SY…24MFT) 0.4 mA/200mV
Reversal hysteresis	(SY…24MFT)1.0 mA/500mV
Feedback	(SY…24MFT) 2-10 VDC
Angle of rotation	90°
Direction of rotation	reversible
Position indication	top mounted domed indicator
Internal humidity control	resistive heating element
Auxiliary switches	factory set for 5° and 85° change of state SY1: (2) SPDT, min 1 mA, 24 VAC; max 3A, 250 VAC. SY4-12: (2) SPDT, min 1 mA, 24 VAC; max 5A, 250 VAC.
Ambient temperature	-22°F to +150°F [-30°C to +65°C]
Humidity range	up to 95%
Housing type	IP67, NEMA 4X
Housing material	die cast aluminum alloy
Agency listings	ISO, CE, cCSAus

Power Supply 24 VAC/VDC 50/60Hz, single phase

Model	Torque	Speed	Power Consumption	Duty Cycle		Override	Weight
				On/Off	MFT		
SY4-24(MFT)	400Nm/3560 in-lbs	16s	6.0A	30%	75%	Hand Wheel	22kg/48.5 lb.
SY5-24(MFT)	500Nm/4450 in-lbs	22s	6.5A	30%	75%	Hand Wheel	22kg/48.5 lb.

SY...120V Series Non-Spring Return Actuator
Technical Data - 120 VAC

2 YEAR WARRANTY

Application:

The SY actuators are NEMA 4X rated and designed to meet the needs of HVAC and Commercial applications. Offered on Belimo standard and high performance valve series, these actuators are available for on/off and modulating applications. Depending on the application, they are available in 24 VAC/ VDC, 120 VAC and 230 VAC.

Technical Data	
Electrical connection	½" conduit connector, screw terminals
Motor protection	H Class insulation (SY-1), F Class (SY-2…12)
Gear train	high alloy steel gear sets, self locking
Operating range	(SY…-110) on/off, floating point (SY...120MFT) 2-10 VDC, 4-20 mA, 0-10 VDC
Sensitivity	(SY…120MFT) 0.4 mA/200mV
Reversal hysteresis	(SY…120MFT) 1.0 mA/500mV
Feedback	(SY…120MFT) 2-10 VDC
Angle of rotation	90°
Direction of rotation	reversible
Position indication	top mounted domed indicator
Internal humidity control	resistive heating element
Auxiliary switches	factory set for 5° and 85° change of state SY1: (2) SPDT, min 1 mA, 24 VAC; max 3A, 250 VAC. SY4-12: (2) SPDT, min 1 mA, 24 VAC; max 5A, 250 VAC.
Ambient temperature	-22°F to +150°F [-30°C to +65°C]
Humidity range	up to 95%
Housing type	IP67, NEMA 4X
Housing material	die cast aluminum alloy
Agency listings	ISO, CE, cCSAus

Note: Leakage current is possible (<3.5 mA).
Connect ground before applying voltage.

Power Supply 120 VAC 50/60Hz, single phase

Model	Torque	Speed 60Hz	Speed 50Hz	Power Consumption	Duty Cycle		Override	Weight
					On/Off	Proportional		
SY4-120(MFT)	400Nm/3560 in-lbs	16s	18s	1.3A	30%	75%	Hand Wheel	22kg/48.5 lb.
SY5-120(MFT)	500Nm/4450 in-lbs	22s	25s	1.5A	30%	75%	Hand Wheel	22kg/48.5 lb.
SY6-120(MFT)	650Nm/5785 in-lbs	28s	31s	1.8A	30%	75%	Hand Wheel	22kg/48.5 lb.
SY7-120(MFT)	1000Nm/8900 in-lbs	46s	55s	3.2A	30%	75%	Hand Wheel	36kg/79.5 lb.
SY8-120(MFT)	1500Nm/13350 in-lbs	46s	55s	4.0A	30%	75%	Hand Wheel	36kg/79.5 lb.
SY9-120(MFT)	2000Nm/17800 in-lbs	58s	70s	3.2A	30%	50%	Hand Wheel	56kg/123.5 lb.
SY10-120(MFT)	2500Nm/22250 in-lbs	58s	70s	4.0A	30%	50%	Hand Wheel	56kg/123.5 lb.
SY11-120(MFT)	3000Nm/26700 in-lbs	58s	70s	3.0A	30%	50%	Hand Wheel	56kg/123.5 lb.
SY12-120(MFT)	3500Nm/31150 in-lbs	58s	70s	4.0A	30%	50%	Hand Wheel	56kg/123.5 lb.

2 YEAR WARRANTY

Application:

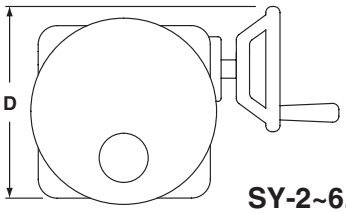
The SY actuators are NEMA 4X rated and designed to meet the needs of HVAC and Commercial applications. Offered on Belimo standard and high performance valve series, these actuators are available for on/off and modulating applications. Depending on the application, they are available in 24 VAC/ VDC, 120 VAC and 230 VAC.

Technical Data	
Electrical connection	½" conduit connector, screw terminals
Overload protection	thermally protected 135°C cut-out
Motor protection	H Class insulation (SY-1), F Class (SY-2…12)
Gear train	high alloy steel gear sets, self locking
Operating range	(SY…-220) on/off, floating point (SY...230MFT) 2-10 VDC, 4-20 mA, 0-10 VDC
Sensitivity	(SY…230MFT) 0.4 mA/200mV
Reversal hysteresis	(SY…230MFT) 1.0 mA/500mV
Feedback	(SY…230MFT) 2-10 VDC
Angle of rotation	90°
Direction of rotation	reversible
Position indication	top mounted domed indicator
Internal humidity control	resistive heating element
Auxiliary switches	factory set for 5° and 85° change of state SY1: (2) SPDT, min 1 mA, 24 VAC; max 3A, 250 VAC. SY4-12: (2) SPDT, min 1 mA, 24 VAC; max 5A, 250 VAC.
Ambient temperature	-22°F to +150°F [-30°C to +65°C]
Humidity range	up to 95%
Housing type	IP67, NEMA 4X
Housing material	die cast aluminum alloy
Agency listings	ISO, CE, cCSAus

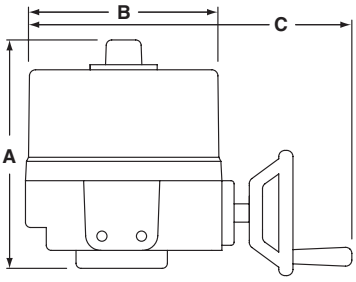
Power Supply 230 VAC 50/60Hz, single phase

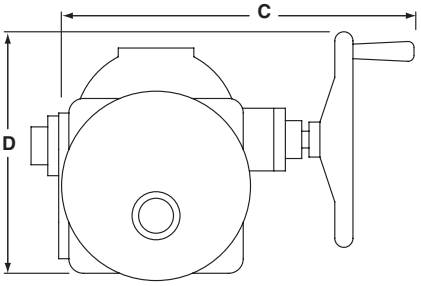
Model	Torque	Speed 60Hz	Speed 50Hz	Power Consumption	Duty Cycle		Override	Weight
					On/Off	MFT		
SY4-230(MFT)	400Nm/3560 in-lbs	16s	18s	0.6A	30%	75%	Hand Wheel	22kg/48.5 lb.
SY5-230(MFT)	500Nm/4450 in-lbs	22s	25s	0.7A	30%	75%	Hand Wheel	22kg/48.5 lb.
SY6-230(MFT)	650Nm/5785 in-lbs	28s	31s	0.8A	30%	75%	Hand Wheel	22kg/48.5 lb.
SY7-230(MFT)	1000Nm/8900 in-lbs	46s	55s	1.6A	30%	75%	Hand Wheel	36kg/79.5 lb.
SY8-230(MFT)	1500Nm/13350 in-lbs	46s	55s	2.0A	30%	75%	Hand Wheel	36kg/79.5 lb.
SY9-230(MFT)	2000Nm/17800 in-lbs	58s	70s	1.6A	30%	50%	Hand Wheel	56kg/123.5 lb.
SY10-230(MFT)	2500Nm/22250 in-lbs	58s	70s	2.0A	30%	50%	Hand Wheel	56kg/123.5 lb.
SY11-230(MFT)	3000Nm/26700 in-lbs	58s	70s	1.6A	30%	50%	Hand Wheel	56kg/123.5 lb.
SY12-230(MFT)	3500Nm/31150 in-lbs	58s	70s	2.2A	30%	50%	Hand Wheel	56kg/123.5 lb.

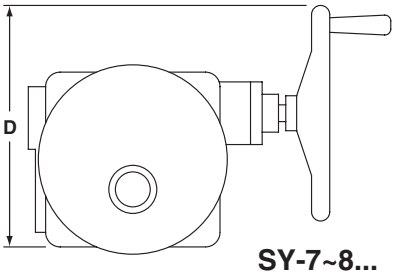
SY... Series Non-Spring Return Actuator Dimensions



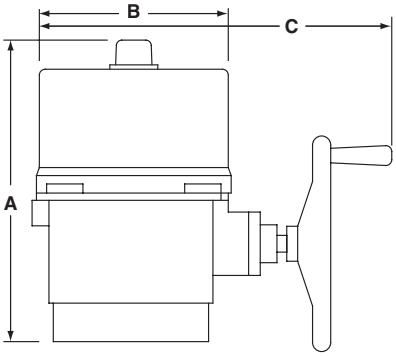
SY-2~6...

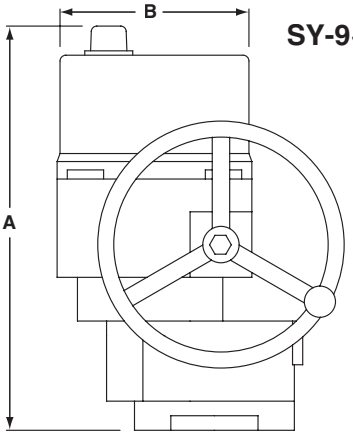






SY-7~8...





SY-9~12...

MODEL	DIM A (MAX)	Add to Dim A for cover removal	DIM B	DIM C (MAX)	DIM D
	Inches [mm]	Inches [mm]	Inches [mm]	Inches [mm]	Inches [mm]
SY4~6	12.40 [315]	8.86 [225]	9.21 [234]	14.96 [380]	11.81 [300]
SY7~8	16.54 [420]	8.86 [225]	9.21 [234]	17.72 [450]	13.39 [340]
SY9~12	23.23 [590]	8.86 [225]	10.24 [260]	18.50 [470]	13.78 [350]

Power Supply 24 VAC/VDC Single Phase

Model #	Torque	Speed 50 Hz/60 Hz	Current Draw (50 Hz)	Current Draw (60 Hz)	W (50 Hz)	W (60 Hz)	VA (50 Hz)	VA (60 Hz)	Override	Weight
PRBUP-3-T*	1400 in-lbs/ 160 Nm	35 seconds	0.8 A	0.8 A	20	20	20	20	Manual override crank	5.8 kg/12.8 lbs.
PRXUP-3-T*	1400 in-lbs/ 160 Nm	35, 30-120 seconds	0.8 A	0.8 A	20	20	20	20	Manual override crank	5.8 kg/12.8 lbs.
SY4-24	3540 in-lbs/ 400 Nm	30 seconds	9.5 A	9.5 A	208	212	228	228	Hand wheel	22 kg/48.5 lbs.
SY5-24	4430 in-lbs/ 500 Nm	35 seconds	9.3 A	9.4 A	178	168	223	227	Hand wheel	22 kg/48.5 lbs.

Power Supply 120 VAC Single Phase

Model #	Torque	Speed 50 Hz	Speed 60 Hz	Current Draw (50 Hz)	Current Draw (60 Hz)	W (50 Hz)	W (60 Hz)	VA (50 Hz)	VA (60 Hz)	Override	Weight
PRBUP-3-T*	1400 in-lbs/ 160 Nm	35 seconds	35 seconds	0.2 A	0.2 A	18	18	23	23	Manual override crank	5.8 kg/12.8 lbs.
PRXUP-3-T*	1400 in-lbs/ 160 Nm	35, 30-120 seconds	35, 30-120 seconds	0.2 A	0.2 A	18	18	23	23	Manual override crank	5.8 kg/12.8 lbs.
SY4-110	3540 in-lbs/ 400 Nm	21 seconds	18 seconds	2.2 A	1.8 A	240	196	264	216	Hand wheel	22 kg/48.5 lbs.
SY5-110	4430 in-lbs/ 500 Nm	29 seconds	25 seconds	2.2 A	1.8 A	242	193	264	216	Hand wheel	22 kg/48.5 lbs.
SY6-110	5750 in-lbs/ 650 Nm	37 seconds	32 seconds	2.2 A	1.8 A	247	198	264	216	Hand wheel	22 kg/48.5 lbs.
SY7-110	8850 in-lbs/ 1000 Nm	59 seconds	49 seconds	6.4 A	3.5 A	670	385	768	420	Hand wheel	36 kg/79.5 lbs.
SY8-110	13280 in-lbs/ 1500 Nm	60 seconds	50 seconds	8.2 A	4.8 A	847	514	984	576	Hand wheel	36 kg/79.5 lbs.
SY9-110	17700 in-lbs/ 2000 Nm	68 seconds	57 seconds	2.7 A	2.8 A	304	311	324	336	Hand wheel	72 kg/176.4 lbs.
SY10-110	22130 in-lbs/ 2500 Nm	75 seconds	62 seconds	2.8 A	2.9 A	318	335	336	348	Hand wheel	72 kg/176.4 lbs.
SY11-110	26550 in-lbs/ 3000 Nm	78 seconds	69 seconds	3.3 A	3.6 A	365	387	396	432	Hand wheel	72 kg/176.4 lbs.
SY12-110	30980 in-lbs/ 3500 Nm	72 seconds	60 seconds	3.7 A	3.8 A	415	422	444	456	Hand wheel	72 kg/176.4 lbs.

Power Supply 230 VAC Single Phase

Model #	Torque	Speed 50 Hz	Speed 60 Hz	Current Draw (50 Hz)	Current Draw (60 Hz)	W (50 Hz)	W (60 Hz)	VA (50 Hz)	VA (60 Hz)	Override	Weight
PRBUP-3-T*	1400 in-lbs/ 160 Nm	35 sec.	35 sec.	0.2 A	0.2 A	20	20	52	52	Manual override crank	5.8 kg/12.8 lbs.
PRXUP-3-T*	1400 in-lbs/ 160 Nm	35, 30-120 sec.	35, 30-120 sec.	0.2 A	0.2 A	20	20	52	52	Manual override crank	5.8 kg/12.8 lbs.
SY4-220	3540 in-lbs/ 400 Nm	21 seconds	18 seconds	1.1 A	0.9 A	221	180	253	207	Hand wheel	22 kg/48.5 lbs.
SY5-220	4430 in-lbs/ 500 Nm	29 seconds	25 seconds	1.1 A	0.9 A	216	179	253	207	Hand wheel	22 kg/48.5 lbs.
SY6-220	5750 in-lbs/ 650 Nm	38 seconds	31 seconds	1.0 A	0.9 A	193	177	230	207	Hand wheel	22 kg/48.5 lbs.
SY7-220	8850 in-lbs/ 1000 Nm	58 seconds	48 seconds	1.8 A	1.4 A	381	290	414	322	Hand wheel	36 kg/79.5 lbs.
SY8-220	13280 in-lbs/ 1500 Nm	59 seconds	49 seconds	1.9 A	1.4 A	428	294	437	322	Hand wheel	36 kg/79.5 lbs.
SY9-220	17700 in-lbs/ 2000 Nm	68 seconds	57 seconds	1.6 A	2.4 A	356	509	368	552	Hand wheel	72 kg/176.4 lbs.
SY10-220	22130 in-lbs/ 2500 Nm	73 seconds	62 seconds	1.7 A	2.5 A	377	531	391	579	Hand wheel	72 kg/176.4 lbs.
SY11-220	26550 in-lbs/ 3000 Nm	46 seconds	64 seconds	1.8 A	2.5 A	397	547	414	579	Hand wheel	72 kg/176.4 lbs.
SY12-220	30980 in-lbs/ 3500 Nm	74 seconds	61 seconds	1.8 A	2.4 A	409	505	414	552	Hand wheel	72 kg/176.4 lbs.

*-200 and -250 versions have the same ratings.

BELIMO

Power Supply 24 VAC/VDC Single Phase

Model #	Torque	Speed 50 Hz/60 Hz	Current Draw (50 Hz)	Current Draw (60 Hz)	W (50 Hz)	W (60 Hz)	VA (50 Hz)	VA (60 Hz)	Override	Weight
PRXUP-MFT-T*	1400 in-lbs/160 Nm	30-120 sec.	0.9 A	0.9 A	20	20	20	20	Manual override crank	5.8 kg/12.8 lbs.
PKRXUP-MFT-T*	1400 in-lbs/160 Nm	30-120 sec.	2.2 A	2.2 A	52	52	55	55	Manual override crank	6.4 kg/14.1 lbs.
SY4-24MFT	3540 in-lbs/ 400 Nm	23 seconds	11.0 A	11.0 A	254	251	264	264	Hand wheel	22 kg/48.5 lbs.
SY5-24MFT	4430 in-lbs/ 500 Nm	30 seconds	10.2 A	10.2 A	232	230	245	245	Hand wheel	22 kg/48.5 lbs.

Power Supply 120 VAC Single Phase

Model #	Torque	Speed 50 Hz	Speed 60 Hz	Current Draw (50 Hz)	Current Draw (60 Hz)	W (50 Hz)	W (60 Hz)	VA (50 Hz)	VA (60 Hz)	Override	Weight
PRXUP-MFT-T*	1400 in-lbs/160 Nm	30-120 sec.	30-120 sec.	0.2 A	0.2 A	18	18	23	23	Manual override crank	5.8 kg/12.8 lbs.
PKRXUP-MFT-T*	1400 in-lbs/160 Nm	30-120 sec.	30-120 sec.	0.3 A	0.3 A	40	40	43	43	Manual override crank	6.4 kg/14.1 lbs.
SY4-120MFT	3540 in-lbs/ 400 Nm	16 seconds	17 seconds	2.3 A	2.4 A	258	256	276	288	Hand wheel	22 kg/48.5 lbs.
SY5-120MFT	4430 in-lbs/ 500 Nm	21 seconds	21 seconds	2.3 A	2.3 A	216	208	276	276	Hand wheel	22 kg/48.5 lbs.
SY6-120MFT	5750 in-lbs/ 650 Nm	28 seconds	29 seconds	2.2 A	2.2 A	240	236	264	264	Hand wheel	22 kg/48.5 lbs.
SY7-120MFT	8850 in-lbs/ 1000 Nm	41 seconds	44 seconds	1.8 A	1.7 A	198	192	216	204	Hand wheel	36 kg/79.5 lbs.
SY8-120MFT	13280 in-lbs/ 1500 Nm	48 seconds	48 seconds	2.6 A	2.6 A	275	266	312	312	Hand wheel	36 kg/79.5 lbs.
SY9-120MFT	17700 in-lbs/ 2000 Nm	47 seconds	47 seconds	3.6 A	3.4 A	397	382	432	408	Hand wheel	72 kg/176.4 lbs.
SY10-120MFT	22130 in-lbs/ 2500 Nm	52 seconds	51 seconds	4.0 A	4.0 A	450	445	480	480	Hand wheel	72 kg/176.4 lbs.
SY11-120MFT	26550 in-lbs/ 3000 Nm	55 seconds	56 seconds	3.1 A	3.0 A	332	318	372	360	Hand wheel	72 kg/176.4 lbs.
SY12-120MFT	30980 in-lbs/ 3500 Nm	61 seconds	62 seconds	3.6 A	3.4 A	386	368	432	408	Hand wheel	72 kg/176.4 lbs.

Power Supply 230 VAC Single Phase

Model #	Torque	Speed 50 Hz	Speed 60 Hz	Current Draw (50 Hz)	Current Draw (60 Hz)	W (50 Hz)	W (60 Hz)	VA (50 Hz)	VA (60 Hz)	Override	Weight
PRXUP-MFT-T*	1400 in-lbs/160 Nm	30-120 sec.	30-120 sec.	0.1 A	0.1 A	20	20	52	52	Manual override crank	5.8 kg/12.8 lbs.
PKRXUP-MFT-T*	1400 in-lbs/160 Nm	30-120 sec.	30-120 sec.	0.2 A	0.2 A	40	40	68	68	Manual override crank	6.4 kg/14.1 lbs.
SY4-230MFT	3540 in-lbs/ 400 Nm	16 seconds	17 seconds	1.1 A	1.1 A	222	217	253	253	Hand wheel	22 kg/48.5 lbs.
SY5-230MFT	4430 in-lbs/ 500 Nm	22 seconds	22 seconds	1.1 A	1.0 A	211	200	253	230	Hand wheel	22 kg/48.5 lbs.
SY6-230MFT	5750 in-lbs/ 650 Nm	32 seconds	32 seconds	1.1 A	1.1 A	236	232	253	253	Hand wheel	22 kg/48.5 lbs.
SY7-230MFT	8850 in-lbs/ 1000 Nm	44 seconds	44 seconds	0.9 A	0.8 A	167	157	207	184	Hand wheel	36 kg/79.5 lbs.
SY8-230MFT	13280 in-lbs/ 1500 Nm	55 seconds	57 seconds	1.3 A	1.4 A	288	286	299	322	Hand wheel	36 kg/79.5 lbs.
SY9-230MFT	17700 in-lbs/ 2000 Nm	61 seconds	61 seconds	1.1 A	1.1 A	240	233	253	253	Hand wheel	72 kg/176.4 lbs.
SY10-230MFT	22130 in-lbs/ 2500 Nm	72 seconds	70 seconds	1.4 A	1.4 A	277	284	322	322	Hand wheel	72 kg/176.4 lbs.
SY11-230MFT	26550 in-lbs/ 3000 Nm	44 seconds	48 seconds	2.0 A	1.9 A	376	363	460	437	Hand wheel	72 kg/176.4 lbs.
SY12-230MFT	30980 in-lbs/ 3500 Nm	47 seconds	51 seconds	2.2 A	2.0 A	490	456	506	460	Hand wheel	72 kg/176.4 lbs.

*-200 and -250 versions have the same ratings.

W546_12

SY Actuator Wiring Diagram, SY1…5-24V – On/Off
SY1…12-120V or 230V On/Off

Hazard Identification

Warnings and Cautions appear at appropriate sections throughout this manual. Read these carefully.

CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

Indicates an action or condition that may cause irreversible damage to the actuator(s) or associated equipment.

Equipment damage!
Power consumption and input impedance must be observed.

INSTALLATION NOTES

Observe class 1 and class 2 wiring restrictions.

Transformer sizing = SY actuator draw X 1.25 (safety margin)
(Ex. SY2-24 requires 3.0A x 1.25 = 3.75A,
3.75A X 24 VAC = 90VA Transformer).

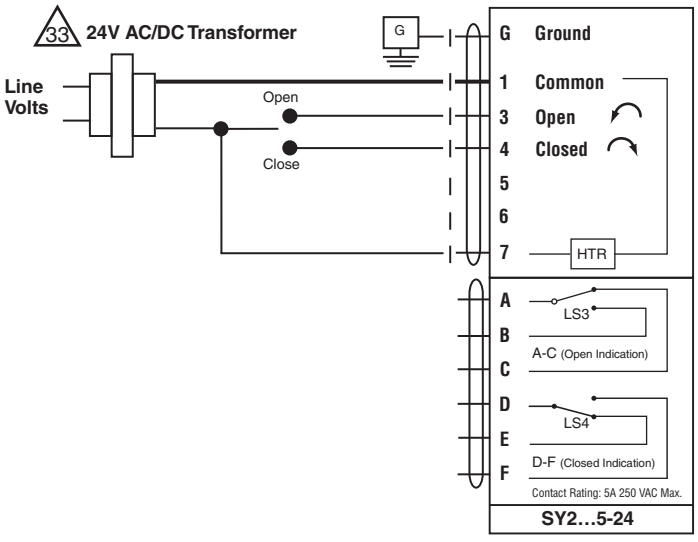
NOTES SY1…5-24

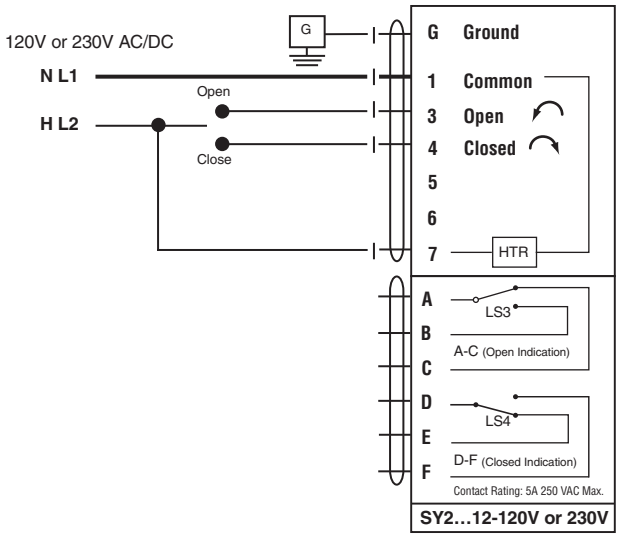
33 Each actuator should be powered by a single, isolated control transformer.

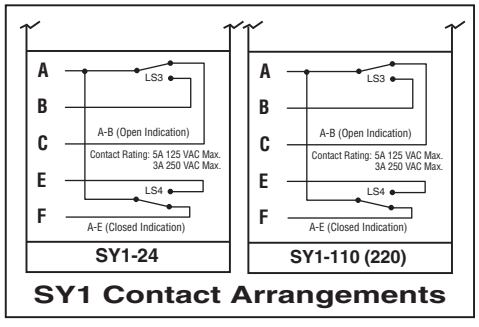
- Isolation relays must be used in parallel connection of multiple actuators using a common control signal input.
- "H" cannot be connected to terminal #3 and #4 simultaneously.

NOTES SY1…12-120V or 230V

- **Caution:** Power Supply Voltage
- Isolation relays must be used in parallel connection of multiple actuators using a common control signal input.
- "H" (L2) cannot be connected to terminal #3 and #4 simultaneously.







Wiring for Control Valves
Proportional, 24V, 120/230V

W547_2_11

Actuator: **SY2…5-24MFT** **SY2...12-120MFT** **SY2...12-230MFT**

Hazard Identification

Warnings and Cautions appear at appropriate sections throughout this manual. Read these carefully.

CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

Indicates an action or condition that may cause irreversible damage to the actuator(s) or associated equipment.

Equipment damage!
Power consumption and input impedance must be observed.

INSTALLATION NOTES

Observe Class 1 and Class 2 wiring restrictions.

Transformer sizing = SY actuator draw X 1.25 (safety margin)
(Ex. SY2-24 requires 3.0A x 1.25 = 3.75A, 3.75A X 24 VAC = 90VA Transformer)

APPLICATION NOTES

34 Ground shielded wire at control panel chassis.
Tape back ground at actuator.

36 Use of feedback is optional.

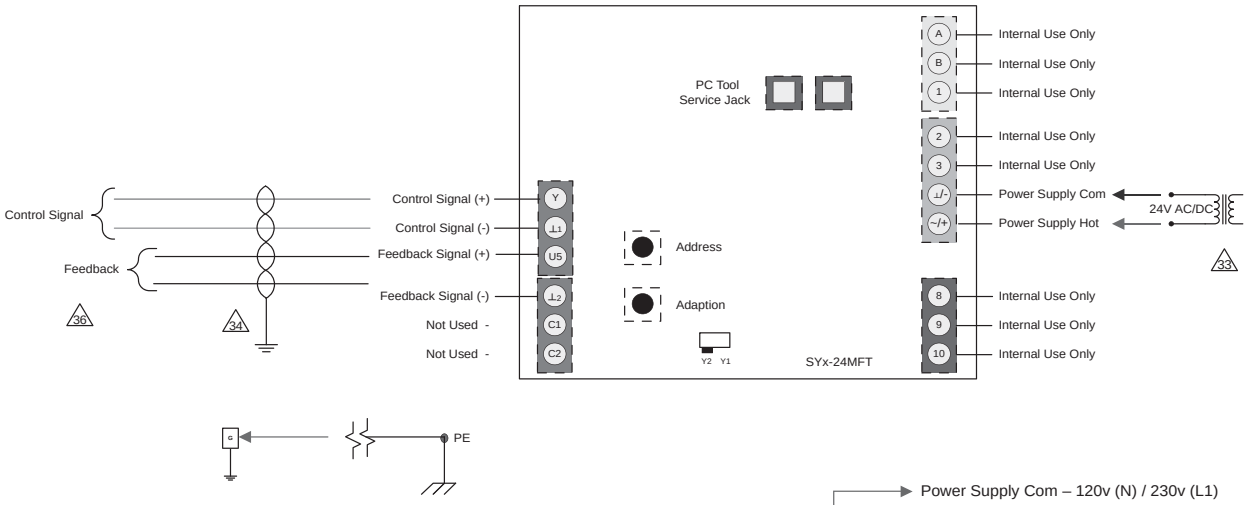
NOTES SY2...5-24MFT

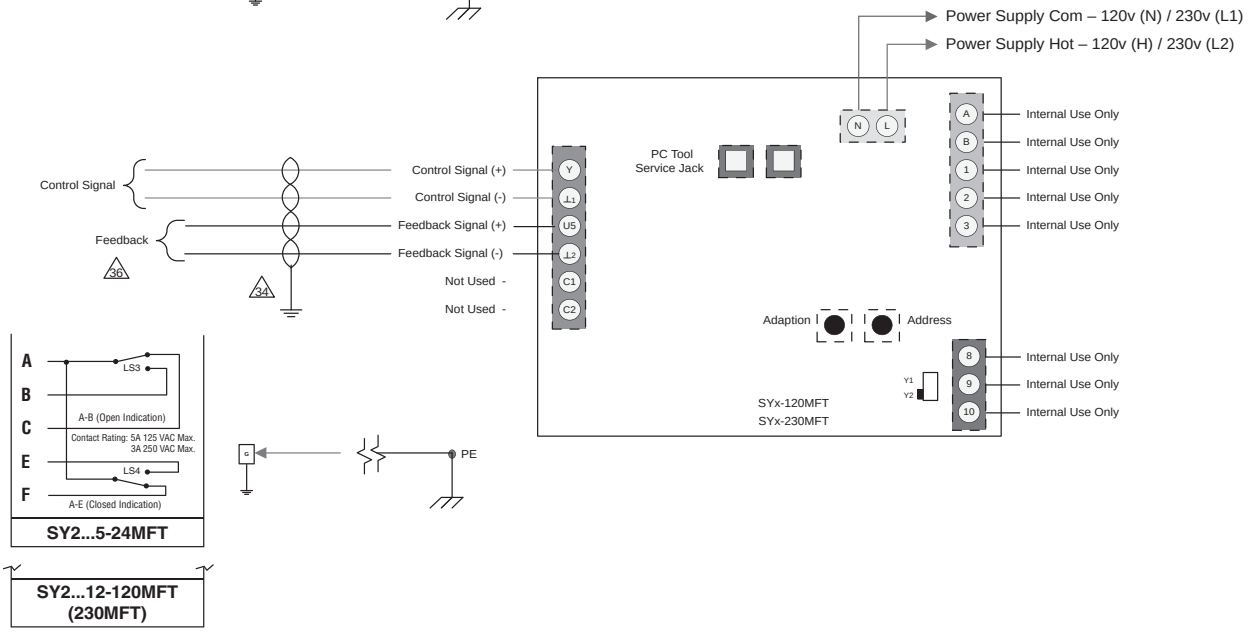
33 Each actuator should be powered by a single, isolated control transformer.

- Power supply Com/Neutral and Control Signal "–" wiring to a common is prohibited.

NOTES SY2...12-120MFT (230MFT)

- **Caution:** Power supply voltage.





W549_11

SY Actuator Wiring Diagram, SY1…5-24 – Multiple Wiring
SY1…12-110 (220) – Multiple Wiring

Hazard Identification

Warnings and Cautions appear at appropriate sections throughout this manual. Read these carefully.

CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

Indicates an action or condition that may cause irreversible damage to the actuator(s) or associated equipment.

Equipment damage!
Power consumption and input impedance must be observed.

Isolation relays are required in parallel applications.
The reason parallel applications need isolation relays is that the motor uses two sets of windings, one for each direction. When one is energized to turn the actuator in a specific direction a voltage is generated in the other due to the magnetic field created from the first. It's called back EMF.
This is OK with one actuator because the voltage generated in the second winding isn't connected to anything so there is no flow; it has no magnetic effect on the motor.
On parallel applications without isolation, this EMF voltage energizes the winding it is connected to on the other actuators in the system, the actuators are then trying to turn in both directions at once. The EMF voltage is always less than the supply voltage due to the resistance of the windings, so while the actuator still turns in the commanded direction, the drag from the other reduces the torque output and causes overheating.

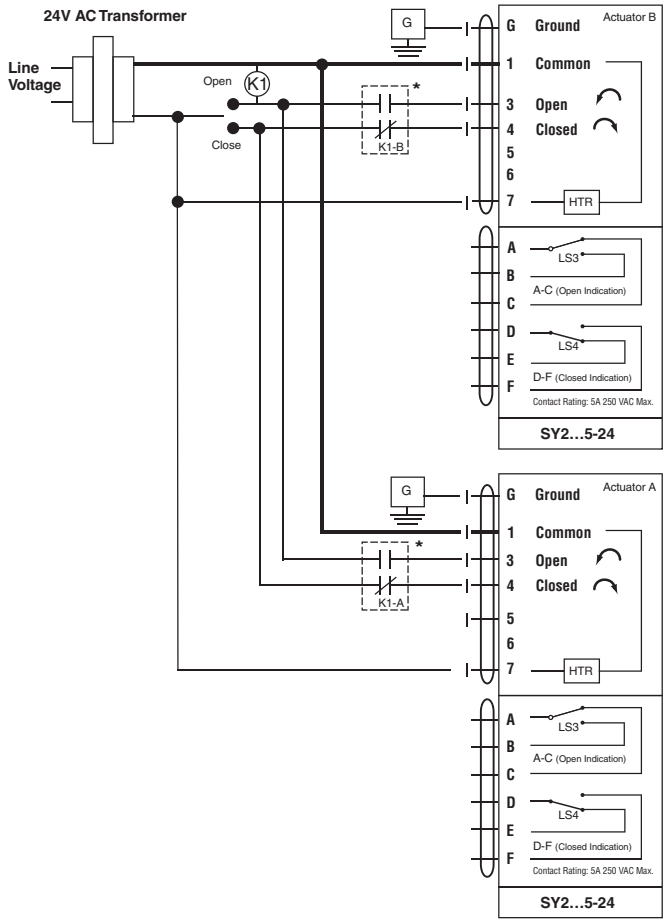
INSTALLATION NOTES

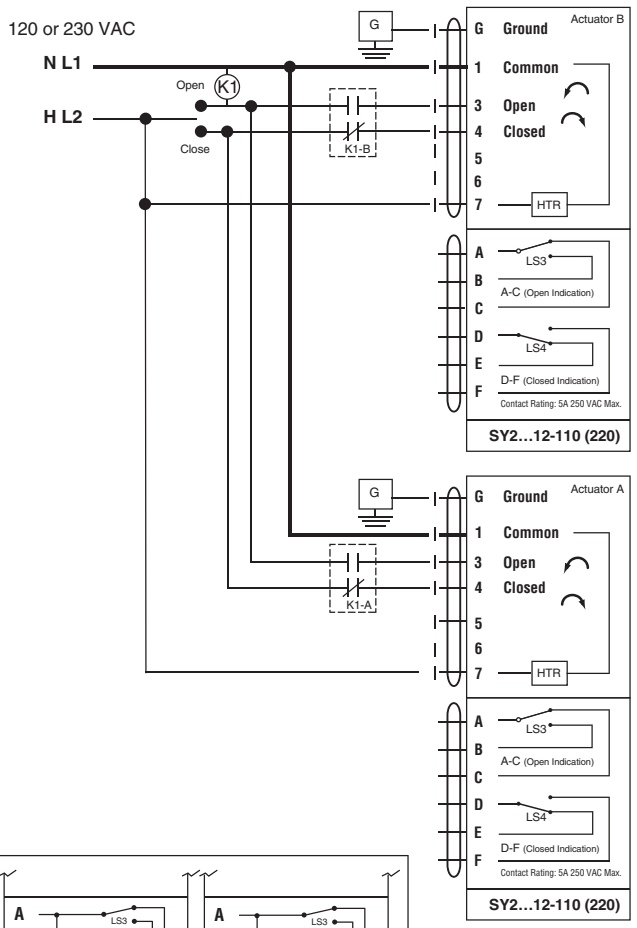
Observe class 1 and class 2 wiring restrictions.

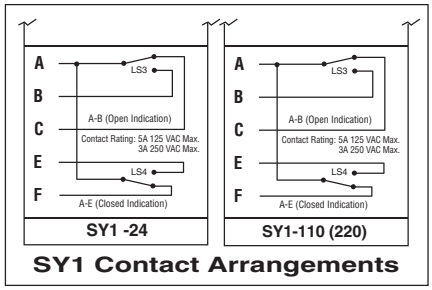
Transformer sizing = SY actuator draw X 1.25 (safety margin)
(Ex. SY2-24 requires 3.0A x 1.25 = 3.75A,
3.75A X 24 VAC = 90VA Transformer).

NOTES

- **Caution:** Power Supply Voltage.
- Isolation relays must be used in parallel connection of multiple actuators using a common control signal input. Should be DPDT.
- "H" (L2) cannot be connected to terminal #3 and #4 simultaneously.
- **Required:** Terminal #7 needs to be field wired to enable heater circuit.







W550_2_11

Actuators: SY2...5-24MFT

Hazard Identification

Warnings and Cautions appear at appropriate sections throughout this manual. Read these carefully.

CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

Indicates an action or condition that may cause irreversible damage to the actuator(s) or associated equipment.

Equipment damage!
Power consumption and input impedance must be observed.

Isolation relays are required in parallel applications.
The reason parallel applications need isolation relays is that the motor uses two sets of windings, one for each direction. When one is energized to turn the actuator in a specific direction a voltage is generated in the other due to the magnetic field created from the first. It's called back EMF.
This is OK with one actuator because the voltage generated in the second winding isn't connected to anything so there is no flow; it has no magnetic effect on the motor.
On parallel applications without isolation, this EMF voltage energizes the winding it is connected to on the other actuators in the system, the actuators are then trying to turn in both directions at once. The EMF voltage is always less than the supply voltage due to the resistance of the windings, so while the actuator still turns in the commanded direction, the drag from the other reduces the torque output and causes overheating.

INSTALLATION NOTES

Observe class 1 and class 2 wiring restrictions.

Transformer sizing = SY actuator draw X 1.25 (safety margin)
(Ex. SY2-24 requires 3.0A x 1.25 = 3.75A,
3.75A X 24 VAC = 90VA Transformer).

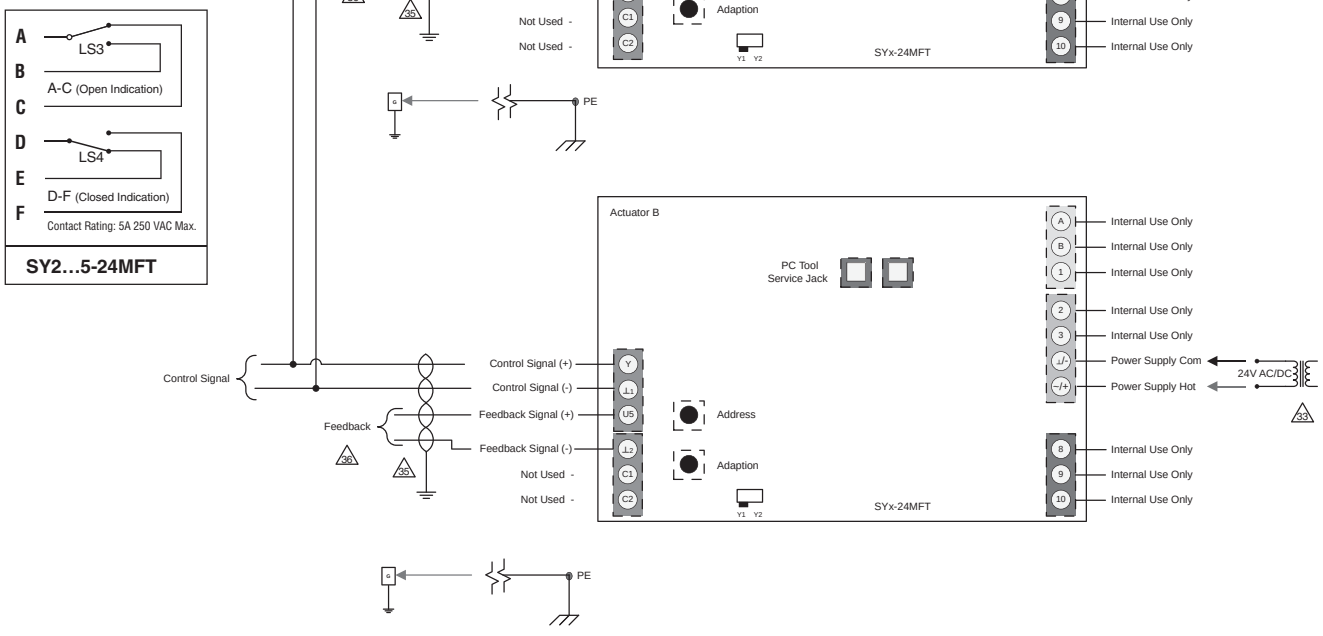
NOTES SY2...5-24MFT

33 Each actuator should be powered by a single, isolated control transformer.

APPLICATION NOTES

35 Recommended twisted shielded pair for control wiring.
Ground shielded wire at control panel chassis.
Tape back ground at actuator.

36 Use of feedback is optional.



W552_2

Actuators: SY2...12-120MFT SY2...12-230MFT

Hazard Identification

Warnings and Cautions appear at appropriate sections throughout this manual. Read these carefully.

CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

Indicates an action or condition that may cause irreversible damage to the actuator(s) or associated equipment.

Equipment damage!
Power consumption and input impedance must be observed.

Isolation relays are required in parallel applications.
The reason parallel applications need isolation relays is that the motor uses two sets of windings, one for each direction. When one is energized to turn the actuator in a specific direction a voltage is generated in the other due to the magnetic field created from the first. It's called back EMF.
This is OK with one actuator because the voltage generated in the second winding isn't connected to anything so there is no flow; it has no magnetic effect on the motor.
On parallel applications without isolation, this EMF voltage energizes the winding it is connected to on the other actuators in the system, the actuators are then trying to turn in both directions at once. The EMF voltage is always less than the supply voltage due to the resistance of the windings, so while the actuator still turns in the commanded direction, the drag from the other reduces the torque output and causes overheating.

INSTALLATION NOTES

Observe class 1 and class 2 wiring restrictions.

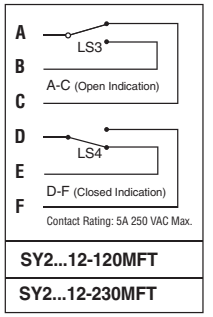
APPLICATION NOTES

35 Recommended twisted shielded pair for control wiring.
Ground shielded wire at control panel chassis.
Tape back ground at actuator.

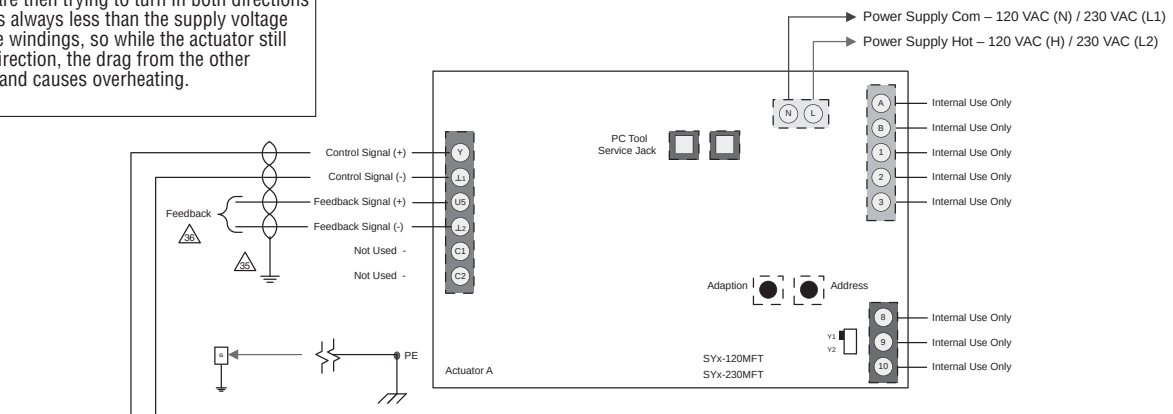
36 Use of feedback is optional.

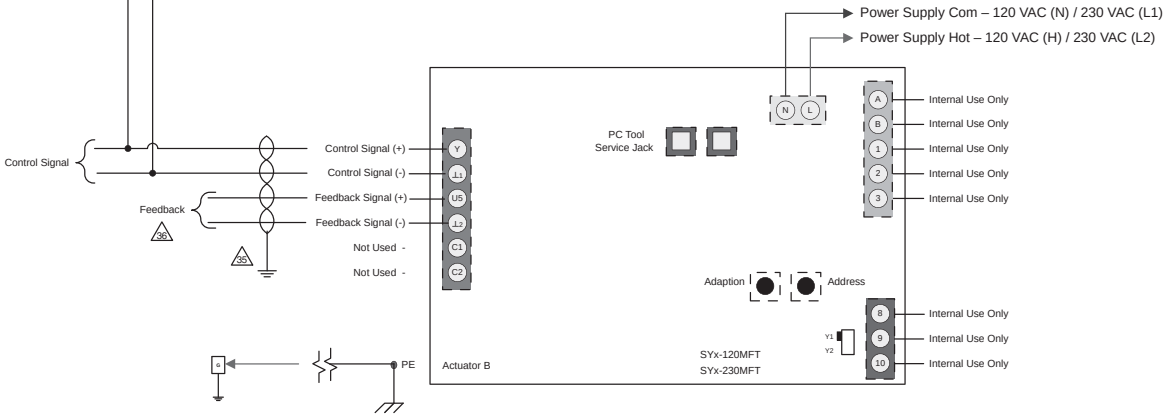
NOTES SY2...12-120MFT (230MFT)

- **Caution:** Power supply voltage.



SY2...12-120MFT
SY2...12-230MFT





AFBUP(-S)-X1, AFXUP(-S)-X1 Actuators, On/Off

Models

AFBUP-X1
AFBUP-S-X1
AFXUP-X1
AFXUP-S-X1

Technical Data		
Power supply		24...240 VAC -20% / +10%, 50/60 Hz 24...125 VDC ±10%
Power consumption	running	7 W
	holding	3.5 W
Transformer sizing		7 VA @ 24 VAC (class 2 power source) 8.5 VA @ 120 VAC 18 VA @ 240 VAC
Electrical connection		
AFBUP...		3 ft, 18 GA appliance cable, 1/2" conduit connector **-S models:** Two 3 ft, 18 gauge appliance cables with 1/2" conduit connectors
AFXUP...		3 ft [1m], 10 ft [3m] or 16 ft [5m] 18 GA appliance cable, with or without 1/2" conduit connector **-S models:** Two 3 ft [1m], 10 ft [3m] or 16 ft [5m] appliance cables with or without 1/2" conduit connectors
Overload protection		Electronic throughout 0 to 95° rotation
Control		On/Off
Torque		180 in-lb [20 Nm] minimum
Direction of rotation	spring	reversible with CW/CCW mounting
Mechanical angle of rotation		95° (adjustable with mechanical end stop, 35° to 95°)
Running time	motor	< 75 sec
	spring	20 sec @ -4°F to 122°F [-20°C to 50°C]; < 60 sec @ -22°F [-30°C]
Position indication		visual indicator, 0° to 95° (0° is full spring return position)
Manual override		5 mm hex crank (3/16" Allen), supplied
Humidity		max. 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		Nema 2, IP54, Enclosure Type2
Housing material		Zinc coated metal and plastic casing
Agency listings †		cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC & 2006/95/EC
Noise level		<50dB(A) motor @ 75 seconds ≤62dB(A) spring return
Servicing		maintenance free
Quality standard		ISO 9001
Weight		4.6 lbs (2.1 kg), 4.9 lbs (2.25 kg) with switches

† Rated Impulse Voltage 4kV, Type of action 1.AA (1.AA.B for -S version), Control Pollution Degree 3.

AFBUP-S-X1, AFXUP-S-X1	
Auxiliary switches	2 x SPDT 3A (0.5A) @ 250 VAC, UL Approved one set at +10°, one adjustable 10° to 90°

Wiring Diagrams

INSTALLATION NOTES

1 Provide overload protection and disconnect as required.

2 ***CAUTION** Equipment Damage!*
Actuators may be connected in parallel.
Power consumption and input impedance must be observed.

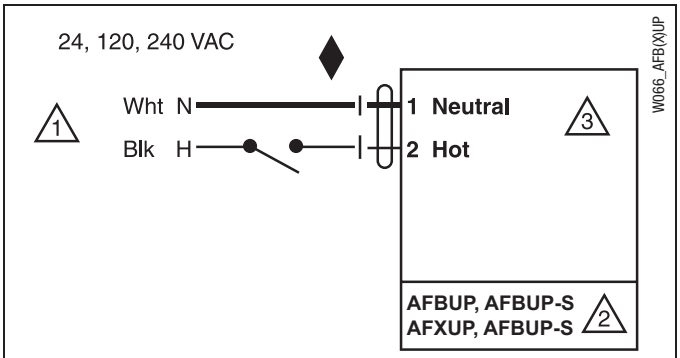
3 No ground connection is required.

4 For end position indication, interlock control, fan startup, etc., AFBUP-S-X1 and AFXUP-S-X1 incorporates two built-in auxiliary switches: 2 x SPDT, 3A (0.5A) @250 VAC, UL Approved, one switch is fixed at +10°, one is adjustable 10° to 90°.

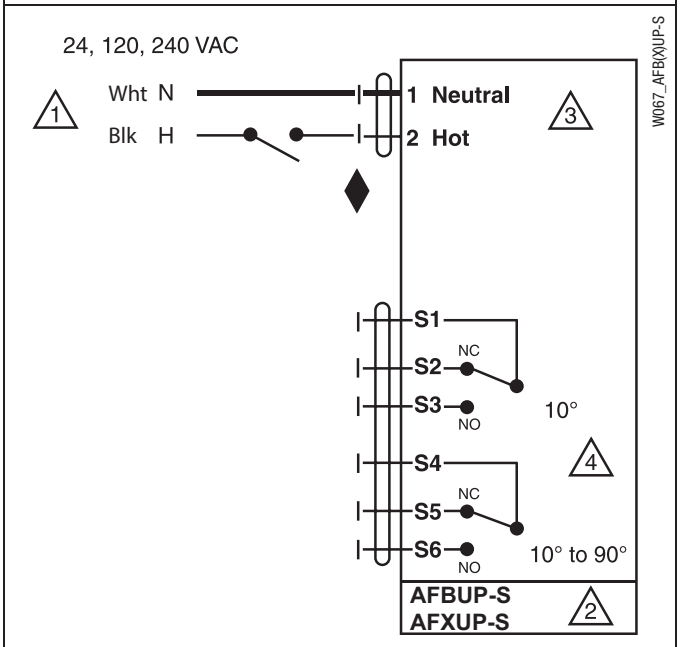
APPLICATION NOTES

Meets cULus requirements without the need of an electrical ground connection.

***WARNING** Live Electrical Components!*
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



On/Off wiring for AFBUP-X1, AFXUP-X1



Auxiliary Switches for AFBUP-S-X1, AFXUP-S-X1

AF Actuators, Multi-Function Technology

Models

AFX24-MFT-X1
AFX24-MFT-S-X1 w/built-in Aux. Switches
2*AFX24-MFT-X1
2*AFX24-MFT-S-X1

Technical Data	
Power supply	24 VAC, +/- 20%, 50/60 Hz 24 VDC, +20% / -10%
Power consumption♦ running	7.5 W
Power consumption♦ holding	3 W
Transformer sizing	10 VA (Class 2 power source)
Electrical connection AFX...	 3 ft [1m] default, 10 ft [3m] or 16 ft [5m] 18 GA appliance or plenum cables, with or without 1/2" conduit connector **-S models:** two 3 ft [1m] default, 10 ft [3m] or 16 ft [5m] appliance cables with or without 1/2" conduit connectors
Overload protection	electronic throughout 0 to 95° rotation
Operating range Y*	2 to 10 VDC, 4 to 20 mA (default) variable (VDC, PWM, floating point, on/off)
Input impedance	100 kΩ for 2 to 10 VDC (0.1 mA) 500 Ω for 4 to 20 mA 1500 Ω for PWM, floating point and on/off control
Feedback output U*	2 to 10 VDC, 0.5 mA max
Torque	minimum 180 in-lb (20 Nm)
Direction of rotation* spring	reversible with cw/ccw mounting
Direction of rotation* motor	reversible with built-in switch
Mechanical angle of rotation*	95° (adjustable with mechanical end stop, 35° to 95°)
Running time spring	<20 sec @ -4°F to 122°F [-20° C to 50° C]; <60 sec @ -22°F [-30° C]
Running time motor*	150 seconds (default), variable (70 to 220 seconds)
Angle of rotation adaptation	off (default)
Override control*	min position = 0% mid. position = 50% max. position = 100%
Position indication	visual indicator, 0° to 95° (0° is spring return position)
Manual override	5 mm hex crank (3/16" Allen), supplied
Humidity	max. 95% RH, non-condensing
Ambient temperature	-22 to 122° F (-30 to 50° C)
Storage temperature	-40 to 176° F (-40 to 80° C)
Housing	NEMA 2, IP54, Enclosure Type 2
Housing material	zinc coated metal and plastic casing
Noise level	≤40dB(A) motor @ 150 seconds, run time dependent ≤62dB(A) spring return
Agency listings †	cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC & 2006/95/EC
Quality standard	ISO 9001
Servicing	maintenance free
Weight	4.6 lbs. (1.9 kg), 4.9 lbs. (2 kg) with switch

* Variable when configured with MFT options

† Rated Impulse Voltage 800V, Type of action 1.AA (1.AA.B for -S version), Control Pollution Degree 3.

♦ Programmed for 70 sec motor run time. At 150 sec motor run time, transformer sizing is 8.5 VA and power consumption is 6 W running / 3 W holding.

AFX24-MFT-S-X1	
Auxiliary switches	2 x SPDT 3A (0.5A) @ 250 VAC, UL approved one set at +10°, one adjustable 10° to 90°

Wiring Diagrams

INSTALLATION NOTES

3 Actuators may also be powered by 24 VDC.

4 IN4004 or IN4007 diode (IN4007 supplied, Belimo part number 40155).

5 Triac A and B can also be contact closures.

6 Control signal may be pulsed from either the Hot (Source) or Common (Sink) 24 VAC line.

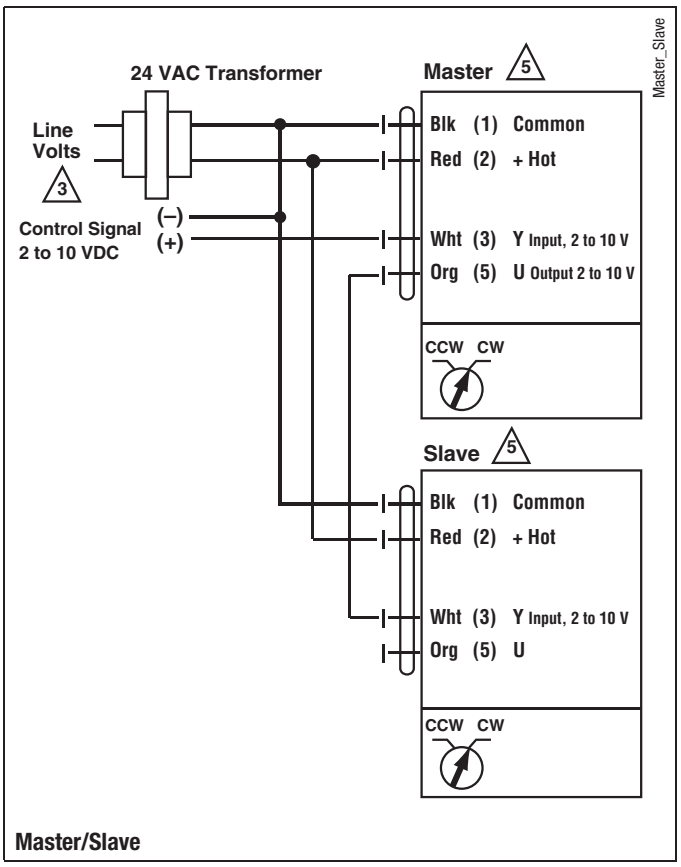
7 Position feedback cannot be used with Triac sink controller. The actuators internal common reference is not compatible.

APPLICATION NOTES

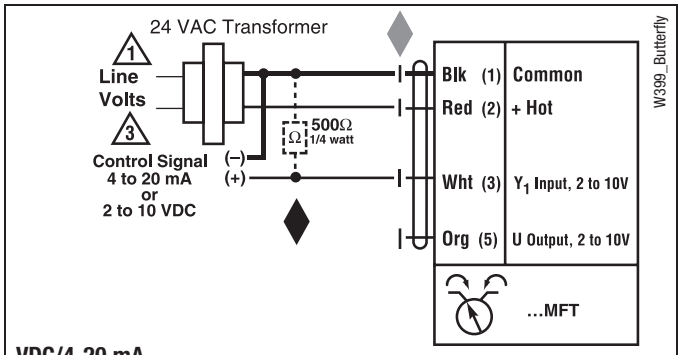
- The ZG-R01 500 Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC, up to 2 actuators may be connected in parallel.
- Meets cULus or UL and CSA requirements without the need of an electrical ground connection.

WARNING *Live Electrical Components!*

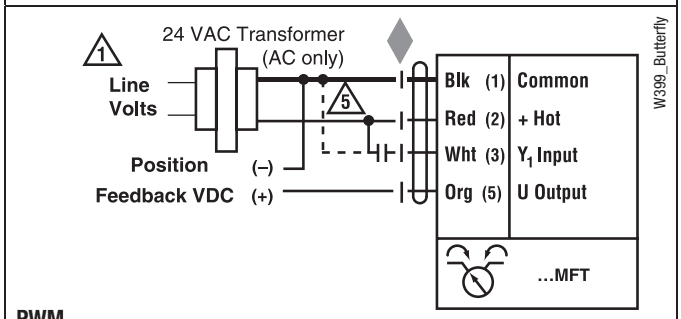
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



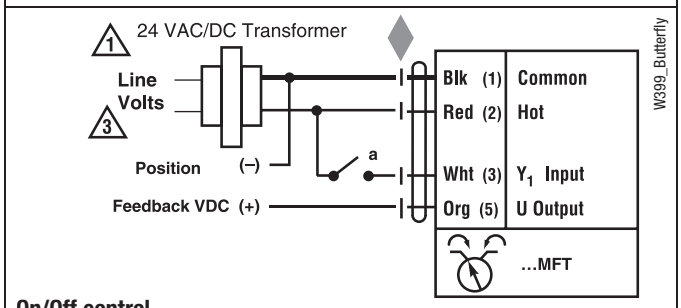
Master/Slave



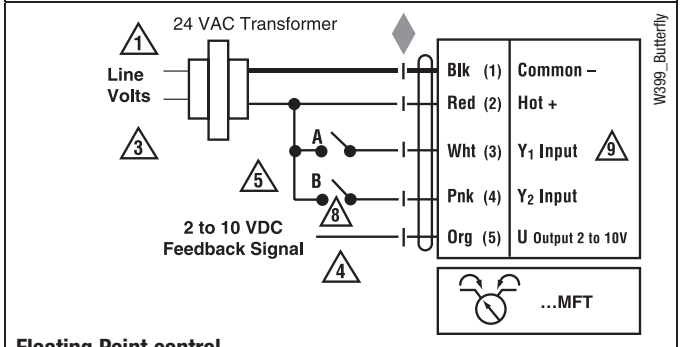
VDC/4-20 mA



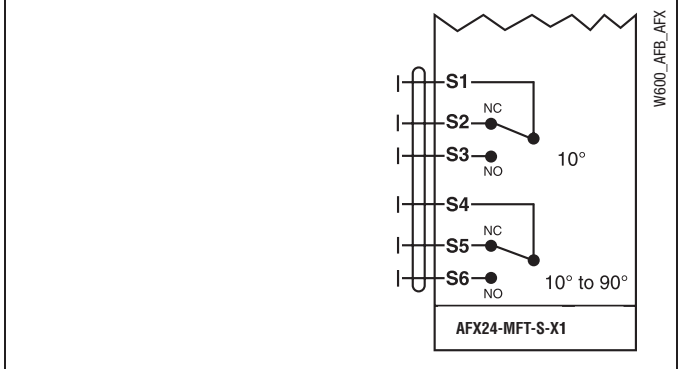
PWM



On/Off control



Floating Point control



Auxiliary Switches for AFX24-MFT-S-X1

DKRX24-3-T, DKRX(B)24-3-T N4(H)
NEMA 2/NEMA 4 Actuators, On/Off, Floating Point

Models

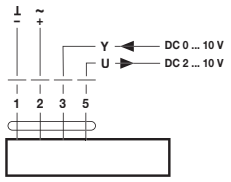
DKRX24-3-T	w/terminal block
DKRX24-3-T N4	w/terminal block
DKRB24-3-T N4H	w/heater

Technical Data		
Control		on/off, floating point
Power supply		24 VAC ± 20/-10% 50/60 Hz
Power consumption	running	12W / heater 33W
	holding	3W
Transformer sizing		21 VA (class 2 power source) / heater 36 VA
Electrical connection		screw terminal (for 22 to 12 AWG wire)
Overload protection		electronic throughout 0° to 90° rotation
Input impedance		100 Ω at control input 1500 Ω floating point
Angle of rotation		90°
Position indication		visual pointer (N4)
Manual override		internal push button (UL Type 4) external push buttom (UL Type 2)
Running time		150 seconds (default)
Fail-Safe		35 seconds
Humidity		5 to 100% RH (UL Type 4) 5 to 95% RH non condensation (UL Type 2)
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing type		UL Type 4/NEMA 4/IP66 UL Type 2/NEMA 2/IP54
Housing material		Polycarbonate
Agency listings		cULus according to UL 60730-1A, UL 60730-2-14 and CAN/CSA E60730-1; Certified to IEC/EN 60730-1 and IEC/EN 60730-2-14
EMC		CE according to 2004/108/EC
Quality standard		ISO 9001
Servicing		maintenance free

Electrical Installation

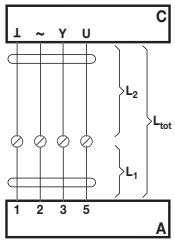
Wiring diagram

Note
- Connect via safety isolation transformer.
- Parallel connection of other actuators possible. Note performance data for supply.

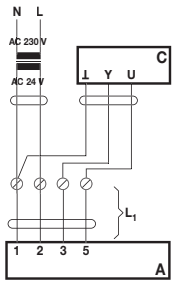


Cable lengths

Note
When several actuators are connected in parallel, the maximum cable length must be divided by the number of actuators.



Note
There are no special restrictions on installation if the supply and data cable are routed separately.



Cable colors:
1 = black
2 = red
3 = white
5 = orange

A = Actuator
C = Control unit
L_1 = Belimo connecting cable, 1 m (4 x 0.75 mm²)
L_2 = Customer cable
L_{tot} = Maximum cable length

Cross section L_2 ⊥ / ~	Max. cable length $L_{tot} = L_1 + L_2$ AC	DC	Example for DC
0.75 mm²	≤30 m	≤5 m	1 m (L_1) + 4 m (L_2)
1.00 mm²	≤40 m	≤8 m	1 m (L_1) + 7 m (L_2)
1.50 mm²	≤70 m	≤12 m	1 m (L_1) + 11 m (L_2)
2.50 mm²	≤100 m	≤20 m	1 m (L_1) + 19 m (L_2)

A = Actuator
C = Control unit
L_1 = Belimo connecting cable, 1 m (4 x 0.75 mm²)

Wiring Diagrams

INSTALLATION NOTES

1 Provide overload protection and disconnect as required.

2 ***CAUTION*** *Equipment Damage!*
Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.

4 Position feedback cannot be used with Triac sink controller. The actuator internal common reference is not compatible.

5 Control signal may be pulsed from either the Hot (source) or the Common (sink) 24 VAC line.

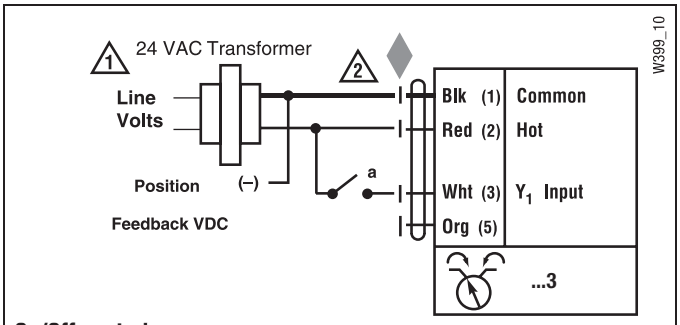
8 Contact closures A & B also can be triacs.
A & B should both be closed for triac source and open for triac sink.

9 For triac sink the common connection from the actuator must be connected to the hot connection of the controller.

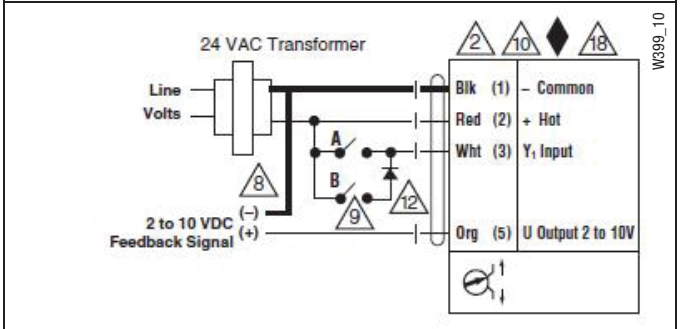
APPLICATION NOTES

Meets UL requirements without the need of an electrical ground connection.

WARNING *Live Electrical Components!*
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



On/Off control



Floating Point control

DKRX24-MFT-T, DKRX(B)24-MFT-T N4(H)
NEMA 2/NEMA 4 Actuators, Multi-Function Technology

MFT

Models

DKRX24-MFT-T	w/terminal block
DKRX24-MFT-T N4	w/terminal block
DKRB24-MFT-T N4H	w/heater

Technical Data	
Control	2 to 10 VDC, 4 to 20 mA (default) variable (VDC, floating point, on/off)
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption running	12 W / heater 33W
holding	3 W
Transformer sizing	21 VA (class 2 power source) / heater 36 VA
Electrical connection	screw terminal (for 22 to 12 AWG wire)
Overload protection	electronic throughout 0° to 90° rotation
Input impedance	100 kΩ (0.1 mA) 500 Ω 1500 Ω (floating point, on/off)
Angle of rotation	90° electronically variable
Position indication	visual pointer (N4)
Manual override	internal push button (UL Type 4) external push buttom (UL Type 2)
Running time	150 seconds (default) variable (75 to 290 seconds)
Fail-Safe	35 seconds
Humidity	5 to 100% RH (UL Type 4) 5 to 95% RH non condensation (UL Type 2)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing type	UL Type 4/NEMA 4/IP66 UL Type 2/NEMA 2/IP54
Housing material	Polycarbonate
Agency listings	cULus according to UL 60730-1A, UL 60730-2-14 and CAN/CSA E60730-1; Certified to IEC/EN 60730-1 and IEC/EN 60730-2-14
EMC	CE according to 2004/108/EC
Quality standard	ISO 9001
Servicing	maintenance free

Wiring Diagrams

INSTALLATION NOTES

△2 ***CAUTION** Equipment damage!*
Actuators may be connected in parallel.
Power consumption and input impedance must be observed.

△3 Actuators may also be powered by 24 VDC.

△5 Actuators with plenum rated cable do not have numbers on wires; use color codes instead. Actuators with appliance cables are numbered.

△8 Control signal may be pulsed from either the Hot (source) or the Common (sink) 24 VAC line.

△9 Contact closures A & B also can be triacs.
A& B should both be closed for triac source and open for triac sink.

△10 For triac sink the Common connection from the actuator must be connected to the Hot connection of the controller. Position feedback cannot be used with a Triac sink controller. The actuator internal common reference is not compatible.

△12 IN4004 or IN4007 diode. (IN4007 supplied, Belimo part number 40155).

APPLICATION NOTES

◆ The ZG-R01 500 Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC, up to 2 actuators may be connected in parallel.

***WARNING** Live Electrical Components!*
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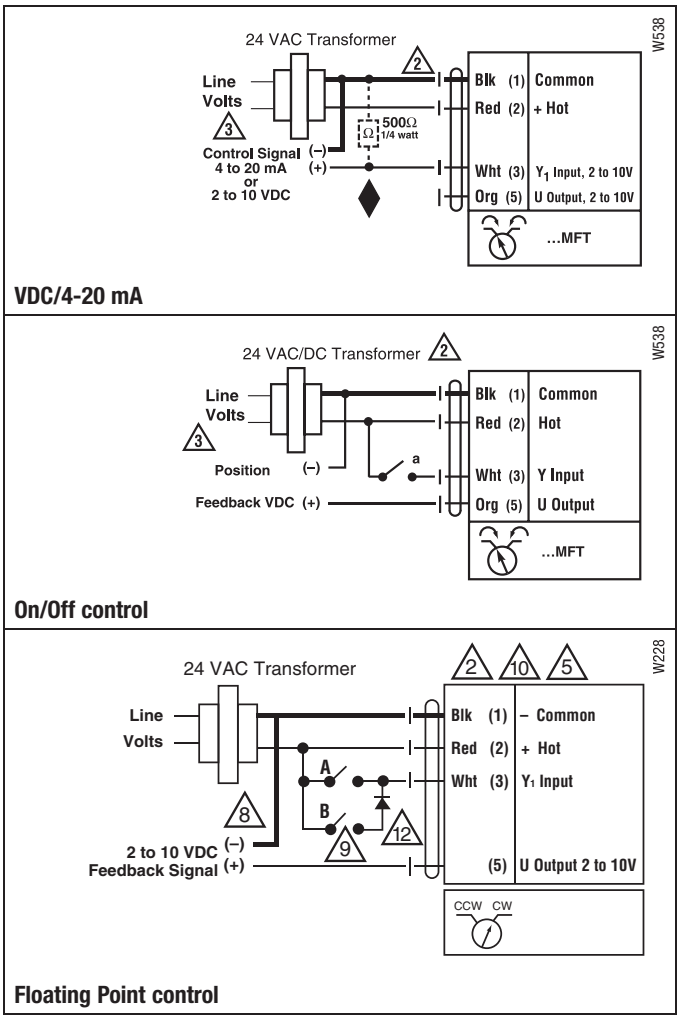


DRCX24-3-T, DRCX(B)24-3-T N4(H)
NEMA 2/NEMA 4 Actuators, On/Off, Floating Point

Models

DRCX24-3-T	w/terminal block
DRCX24-3-T N4	w/terminal block
DRCB24-3-T N4H	w/heater

Technical Data	
Control	on/off, floating point
Power supply	24 VAC ± 20/-10% 50/60 Hz 24 VDC ± 10%
Power consumption running	9W / heater 29W
holding	2W
Transformer sizing	12 VA (class 2 power source) / heater 27 VA
Electrical connection	screw terminal (for 22 to 12 AWG wire)
Overload protection	electronic throughout 0° to 90° rotation
Input impedance	1000 Ω at control input
Angle of rotation	90°
Position indication	visual pointer
Manual override	internal push button (UL Type 4) external push buttom (UL Type 2)
Running time	35 seconds (default)
Humidity	5 to 100% RH (UL Type 4) 5 to 95% RH non condensation (UL Type 2)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing type	UL Type 4/NEMA 4/IP66 UL Type 2/NEMA 2/IP54
Housing material	Polycarbonate
Agency listings	cULus according to UL 60730-1A, UL 60730-2-14 and CAN/CSA E60730-1; Certified to IEC/EN 60730-1 and IEC/EN 60730-2-14
EMC	CE according to 2004/108/EC
Quality standard	ISO 9001

Wiring Diagrams

INSTALLATION NOTES

△2 ***CAUTION** Equipment damage!*
Actuators may be connected in parallel.
Power consumption and input impedance must be observed.

△4 Actuators may also be powered by 24 VDC.

△5 Actuators with plenum rated cable do not have numbers on wires; use color codes instead. Actuators with appliance cables are numbered.

△8 Control signal may be pulsed from either the Hot (Source) or Common (Sink) 24 VAC line.

△9 Contact closures A & B also can be triacs. A & B should both be closed for triac source and open for triac sink.

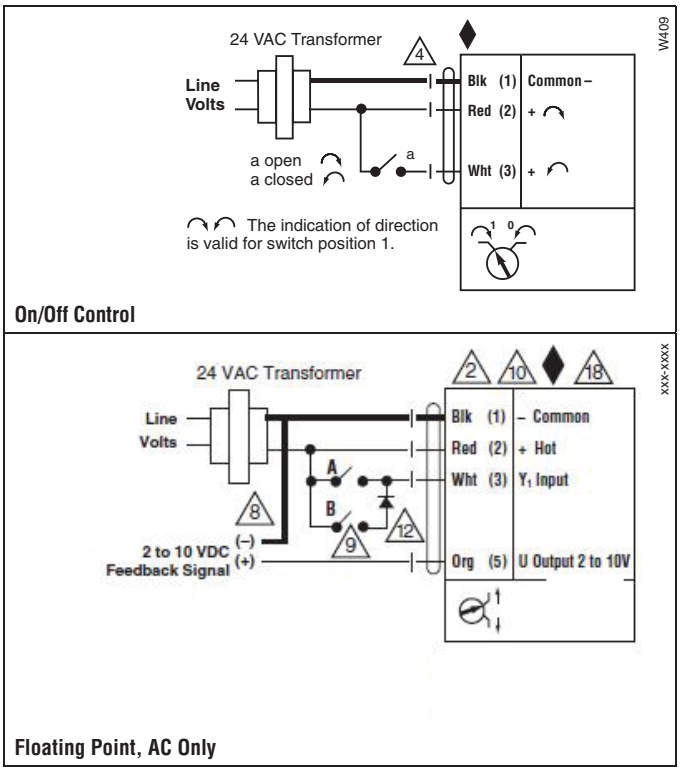
△10 For triac sink the Common connection from the actuator must be connected to the Hot connection of the controller. Position feedback cannot be used with a Triac sink controller. The actuator internal common reference is not compatible.

APPLICATION NOTES

♦ Meets cULus or UL and CSA requirements without the need of an electrical ground connection.

⚠ ***WARNING** Live Electrical Components!*
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

⚠ ***WARNING** Mechanical Precautions*
The mechanical end stops cannot be moved or repositioned. Doing so will adversely effect the operation of the valve.
The directional switch cannot be moved. Maintain Factory Settings



DRX24-MFT-T, DRX24-MFT-T N4, DRCX24-MFT-T, DRCX(B)24-MFT-T N4(H)
NEMA 2/NEMA 4 Actuators, Multi-Function Technology

MFT

Models

DRX24-MFT-T	w/terminal block
DRX24-MFT-T N4	w/terminal block
DRCX24-MFT-T	w/terminal block
DRCX24-MFT-T N4	w/terminal block
DRCB24-MFT-T N4H	w/heater

Technical Data		
Control		2 to 10 VDC, 4 to 20 mA (default) variable (VDC, floating point, on/off)
Power supply		24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	running	6.5 W / heater 27W
	holding	2.5 W
Transformer sizing		9.5 VA (class 2 power source) / heater 25 VA
Electrical connection		screw terminal (for 22 to 12 AWG wire)
Overload protection		electronic throughout 0° to 90° rotation
Input impedance		100 kΩ for 2 to 10 VDC (0.1 mA) 500 Ω for 4 to 20 mA 1000 Ω for floating point and on-off control
Angle of rotation		90° electronically variable
Position indication		visual pointer
Manual override		internal push button (UL Type 4) external push buttom (UL Type 2)
Running time		
DRX...		150 seconds
DRCX...		35 seconds
Humidity		5 to 100% RH (UL Type 4) 5 to 95% RH non condensation (UL Type 2)
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing type		UL Type 4/NEMA 4/IP66 UL Type 2/NEMA 2/IP54
Housing material		Polycarbonate
Agency listings		cULus according to UL 60730-1A, UL 60730-2-14 and CAN/CSA E60730-1; Certified to IEC/EN 60730-1 and IEC/EN 60730-2-14"
EMC		CE according to 2004/108/EC
Quality standard		ISO 9001

Wiring Diagrams

INSTALLATION NOTES

CAUTION *Equipment damage!*
Actuators may be connected in parallel.
Power consumption and input impedance must be observed.

3 Actuators may also be powered by 24 VDC.

5 Actuators with plenum rated cable do not have numbers on wires; use color codes instead. Actuators with appliance cables are numbered.

8 Control signal may be pulsed from either the Hot (source) or the Common (sink) 24 VAC line.

9 Contact closures A & B also can be triacs.
A& B should both be closed for triac source and open for triac sink.

10 For triac sink the Common connection from the actuator must be connected to the Hot connection of the controller. Position feedback cannot be used with a Triac sink controller. The actuator internal common reference is not compatible.

12 IN4004 or IN4007 diode. (IN4007 supplied, Belimo part number 40155).

APPLICATION NOTES

The ZG-R01 500 Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC, up to 2 actuators may be connected in parallel.

WARNING *Live Electrical Components!*
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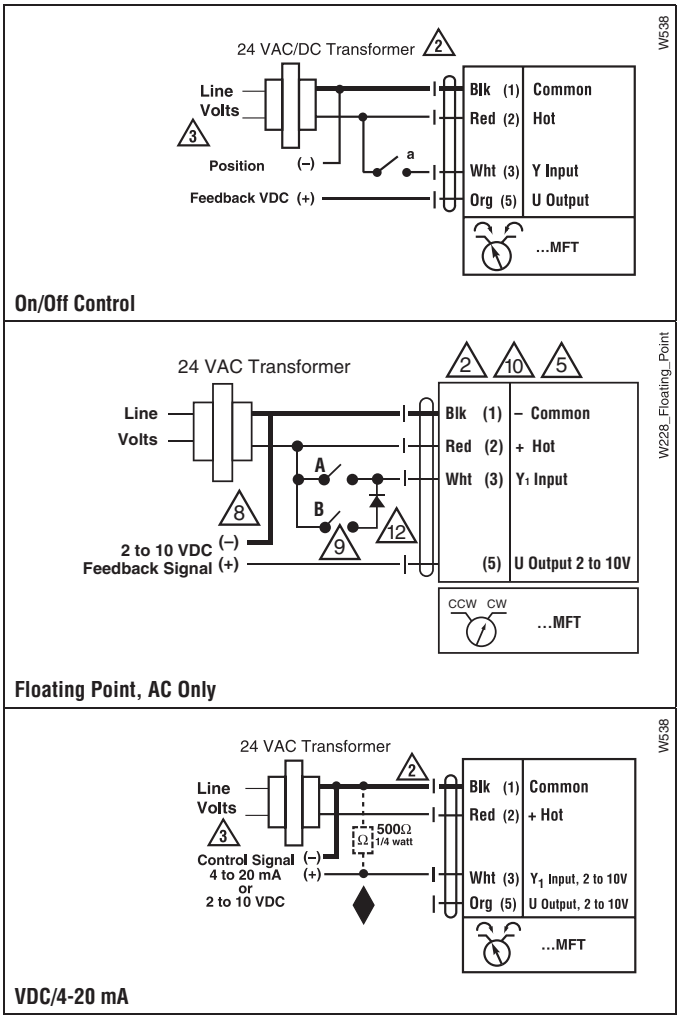
WARNING *Mechanical Precautions*
The mechanical end stops cannot be moved or repositioned. Doing so will adversely effect the operation of the valve.
The directional switch cannot be moved. Maintain Factory Settings



GK Actuators, On/Off, Floating Point

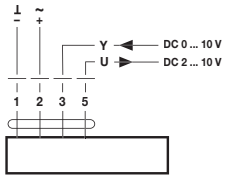
Models

GKRB24-3-X1
GKRB24-3-5
GKB24-3-X1

Technical Data	
Power supply	24VAC ±20% 50/60Hz
Power consumption	12W (3W)
Transformer sizing	21VA (class 2 power source)
Electrical connection	18 GA plenum rated cable ½" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout 0 to 95 rotation
Operation range Y	on/off, floating point
Input impedance	100kΩ (0.1 mA), 500Ω 1500Ω (floating point, on/off)
Feedback output U	2 to 10VDC, 0.5mA max, VDC variable
Angle of rotation	max. 95°, adjustable with mechanical stop electronically variable
Direction of rotation	reversible with ↷/↶ switch
Fail-safe position	adjustable with dial or tool 0 to 100% in 10% increments
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time normal operation fail-safe	 150 seconds (default), variable 90 to 150 seconds 35 seconds
Humidity	5 to 95% RH non-condensing (EN 60730-1)
Ambient temperature	-22°F to +122°F [-30°C to +50°C]
Storage temperature	-40°F to +176°F [-40°C to +80°C]
Housing	NEMA2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency list	cULus acc. to UL 60730-1A/-2-14 CAN/CSA E60730-1:02 CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	< 45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001

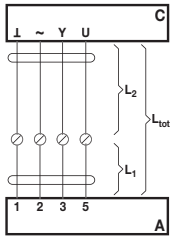
Electrical Installation

Wiring diagram

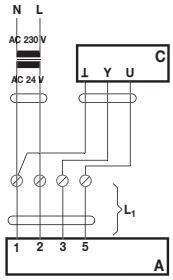


Note
- Connect via safety isolation transformer.
- Parallel connection of other actuators possible. Note performance data for supply.

Cable lengths



Note
When several actuators are connected in parallel, the maximum cable length must be divided by the number of actuators.



Note
There are no special restrictions on installation if the supply and data cable are routed separately.

Cable colors:
1 = black
2 = red
3 = white
5 = orange

A = Actuator
C = Control unit
L_1 = Belimo connecting cable, 1 m (4 x 0.75 mm²)
L_2 = Customer cable
L_{tot} = Maximum cable length

Cross section L_2 ⊥ / ~	Max. cable length $L_{tot} = L_1 + L_2$ AC	DC	Example for DC
0.75 mm²	≤30 m	≤5 m	1 m (L_1) + 4 m (L_2)
1.00 mm²	≤40 m	≤8 m	1 m (L_1) + 7 m (L_2)
1.50 mm²	≤70 m	≤12 m	1 m (L_1) + 11 m (L_2)
2.50 mm²	≤100 m	≤20 m	1 m (L_1) + 19 m (L_2)

A = Actuator
C = Control unit
L_1 = Belimo connecting cable, 1 m (4 x 0.75 mm²)

Wiring Diagrams

INSTALLATION NOTES

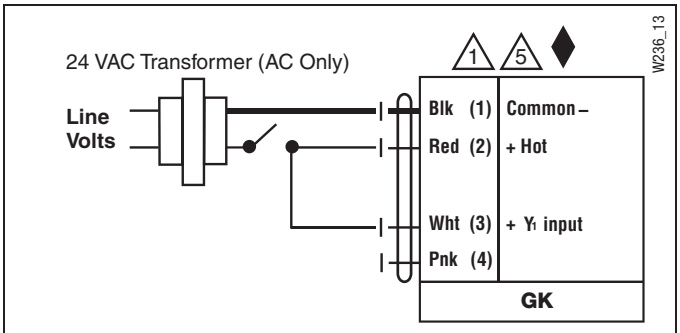
1. Provide overload protection and disconnect as required.
3. Actuators may also be powered by 24 VDC.
4. Position feedback cannot be used with Triac sink controller. The actuator internal common reference is not compatible.
5. Control signal may be pulsed from either the Hot (source) or the Common (sink) 24 VAC line.
8. Contact closures A & B also can be triacs. A & B should both be closed for triac source and open for triac sink.
9. For triac sink the common connection from the actuator must be connected to the hot connection of the controller.

APPLICATION NOTES

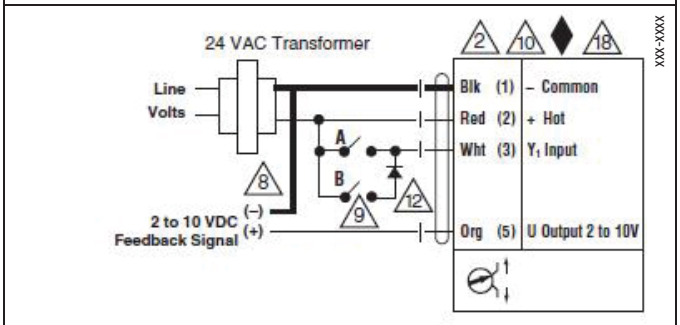
Meets UL requirements without the need of an electrical ground connection.

***WARNING** Live Electrical Components!*
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

NOTE: Wiring diagrams shown are for single actuator mounted solutions



On/Off control



Floating Point control

GK Actuators, Multi-Function Technology

MFT

Models

GKRX24-MFT-X1
GKX24-MFT-X1

Technical Data	GKX24-MFT-X1
Power supply	24VAC ±20% 50/60Hz 24VDC ±10%
Power consumption	12W (3W)
Transformer sizing	21VA (class 2 power source)
Electrical connection	18 GA plenum rated cable ½" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] 16 ft [5m]
Overload protection	electronic throughout 0 to 95 rotation
Operation range Y	2 to 10 VDC, 4 to 20mA (default) variable (VDC,PWM, floating point, on/off)
Input impedance	100 kΩ (0.1 mA), 500 Ω 1500 Ω (PWM, floating point, on/off)
Feedback output U	2 to 10VDC, 0.5mA max, VDC variable
Angle of rotation	max. 95°, adjustable with mechanical stop electronically variable
Direction of rotation	reversible with ↷/↶ switch
Fail-safe position	adjustable with dial or tool 0 to 100% in 10% increments
Position indication	reflective visual indicator (snap-on)
Manual override	external push button
Running time normal operation fail-safe	 95 seconds (default), variable 90 to 150 seconds 35 seconds
Humidity	5 to 95% RH non-condensing (EN 60730-1)
Ambient temperature	-22°F to +122°F [-30°C to +50°C]
Storage temperature	-40°F to +176°F [-40°C to +80°C]
Housing	NEMA2, IP54, UL enclosure type 2
Housing material	UL94-5VA
Agency list	cULus acc. to UL 60730-1A/-2-14 CAN/CSA E60730-1:02 CE acc. to 2004/108/EEC and 2006/95/EC
Noise level	< 45dB(A)
Servicing	maintenance free
Quality standard	ISO 9001

Note: GKR Actuators are on 2-way valves
GKX Actuators are on 3-way valves

Wiring Diagrams

INSTALLATION NOTES

1 Provide overload protection and disconnect as required.

3 Actuators may also be powered by 24 VDC.

4 Position feedback cannot be used with Triac sink controller.
The actuator internal common reference is not compatible.

5 Control signal may be pulsed from either the Hot (source)
or the Common (sink) 24 VAC line.

8 Contact closures A & B also can be triacs.
A & B should both be closed for triac source and open for triac sink.

9 For triac sink the common connection from the actuator
must be connected to the hot connection of the controller.

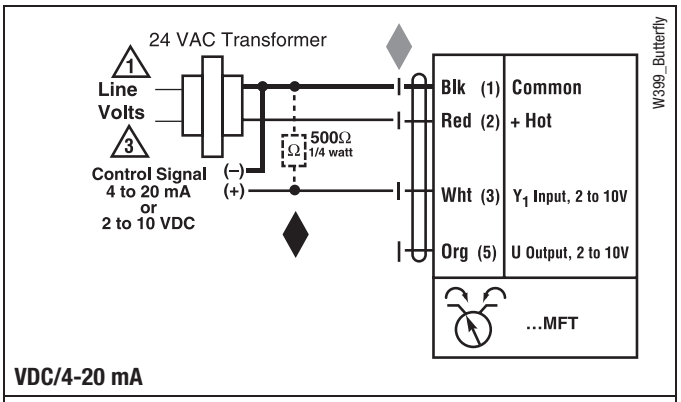
APPLICATION NOTES

◆ Meets UL requirements without the need of an electrical ground connection.

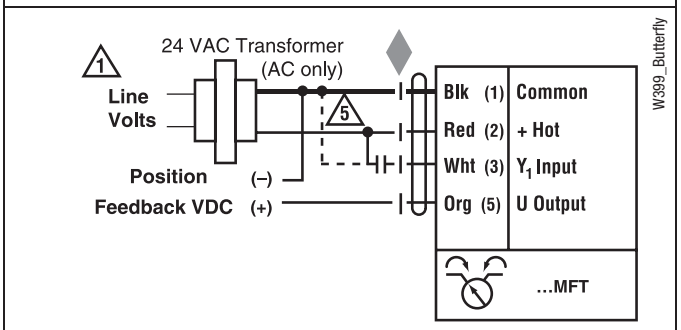
◆ The ZG-R01 500 Ω resistor may be used.

***WARNING** Live Electrical Components!*
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

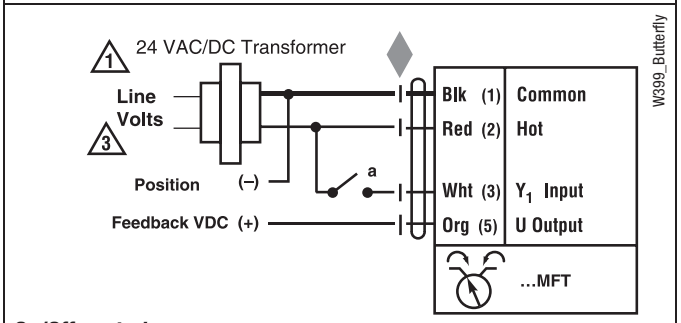
NOTE: Wiring diagrams shown are for single actuator mounted solutions



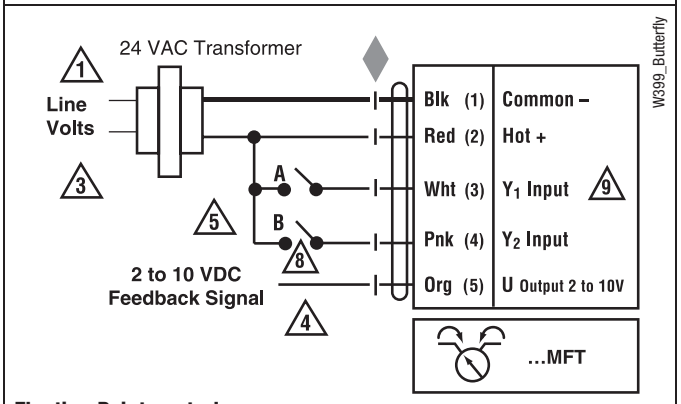
VDC/4-20 mA



PWM



On/Off control



Floating Point control

AM/AR Series Actuators, On/Off, Floating Point

Models

AMB24-3-X1
ARB24-3-X1
ARB24-3-5

Technical Data		
Power supply		24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	running	2.0 W
	holding	0.2 W
Transformer sizing		5.5 VA (class 2 power source)
Electrical connection		3 ft, 18 GA plenum rated cable ½" conduit connector
Overload protection		electronic throughout 0° to 95° rotation
Control		on/off, floating point
Input impedance		600 Ω
Angle of rotation		95°, adjustable with mechanical stop
Direction of rotation		reversible with protected ↷/↶ switch
Position indication		handle
Manual override		external push button
Running time		95 seconds
Humidity		5 to 95% RH non condensing (EN 60730-1)
Ambient temperature		-22°F to +122°F [-30°C to +50°C]
Storage temperature		-40°F to +176°F [-40°C to +80°C]
Housing		NEMA 2/IP54
Housing material		UL94-5VA
Agency listings†		cULus according to UL 60730-1A/-2-14, CAN/CSA E60730-1, CSA C22.2 No. 24-93, CE according to 89/336/EEC (and 2006/95/EC for line voltage and/or -S versions)
Noise level		<45dB(A)
Quality standard		ISO 9001

Note: AR Actuators are on 2-way valves
AM Actuators are on 3-way valves

Wiring Diagrams

INSTALLATION NOTES

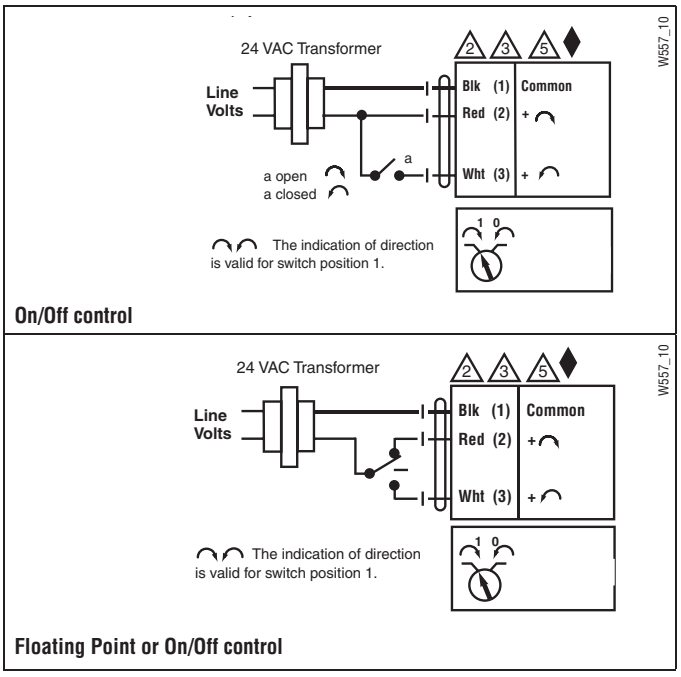
△2 ***CAUTION** Equipment damage!*
Actuators may be connected in parallel.
Power consumption and input impedance must be observed.

△4 Actuators may also be powered by 24 VDC.

APPLICATION NOTES

♦ Meets cULus or UL and CSA requirements without the need of an electrical ground connection.

⚠ ***WARNING** Live Electrical Components!*
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



On/Off control

Floating Point or On/Off control

AM/AR Series Actuators, Multi-Function Technology

Models

AMX24-MFT-X1
ARX24-MFT-X1
ARB24-MFT-5

Technical Data	
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption running	4 W
Power consumption holding	1.25 W
Transformer sizing	6 VA (class 2 power source)
Electrical connection	3 ft [1m], 10 ft [3m], 16 ft [5m] 18 GA plenum rated cable ½" conduit connector
Overload protection	electronic throughout 0° to 95° rotation
Operating range Y	2 to 10 VDC, 4 to 20 mA (default) variable (VDC, PWM, floating point, on/off)
Input impedance	100k Ω (0.1 mA), 500 Ω 1500 Ω (PWM, floating point, on/off)
Feedback output U	2 to 10 VDC, 0.5 mA max VDC variable
Angle of rotation	95° electronically variable
Direction of rotation	reversible with protected ↷/↶ switch
Position indication	handle
Manual override	external push button
Running time	150 seconds (default) variable (90 to 350 secs)
Humidity	5 to 95% RH non condensing (EN 60730-1)
Ambient temperature	-22°F to +122°F [-30°C to +50°C]
Storage temperature	-40°F to +176°F [-40°C to +80°C]
Housing	NEMA 2/IP54
Housing material	UL94-5VA
Agency listings†	cULus according to UL60730-1A/-2-14, CAN/CSA E60730-1, CSA C22.2 No. 24-93, CE according to 89/336/EEC
Noise level	<45dB(A)
Quality standard	ISO 9001

† Rated impulse voltage 4kV, Control pollution degree 3, Type of action 1

Wiring Diagrams

INSTALLATION NOTES

△3 Actuators may also be powered by 24 VDC.

△4 Position feedback cannot be used with Triac sink controller.
The actuator internal common reference is not compatible.

△6 Control signal may be pulsed from either the Hot (source)
or the Common (sink) 24 VAC line.

△8 Contact closures A & B also can be triacs.
A& B should both be closed for triac source and open for triac sink.

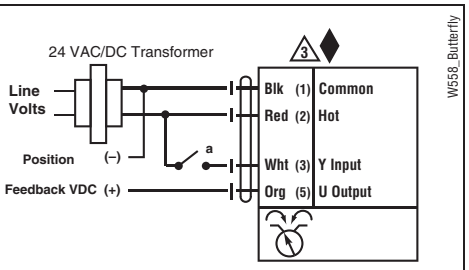
△9 For triac sink the common connection from the actuator
must be connected to the hot connection.

APPLICATION NOTES

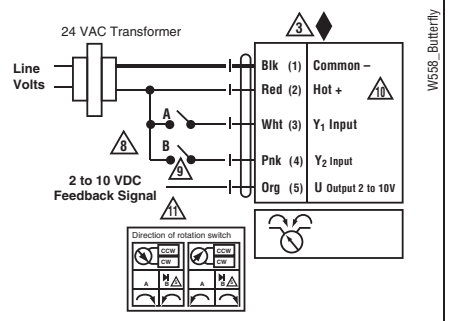
◆ The ZG-R01 500 Ω resistor converts the 4 to 10 mA control signal to 2 to 10 VDC, up to 2 actuators may be connected in parallel.

WARNING *Live Electrical Components!*

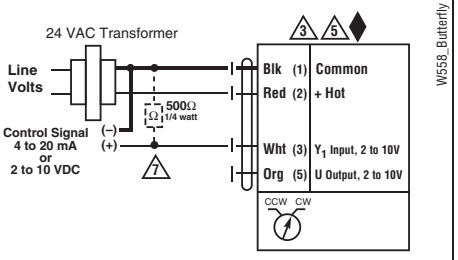
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



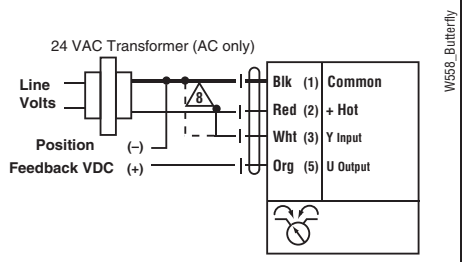
Two Position



Floating Point



VDC/4-20 mA



PWM

GM/GR Actuators, On/Off, Floating Point

Models

GMB24-3-X1
GRB24-3-X1
GRB24-3-5
GRB24-3-7

Technical Data		
Power supply		24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	running	4.0 W
	holding	2 W
Transformer sizing		6 VA (class 2 power source)
Electrical connection		3 ft, 18 GA appliance cable, 1/2" conduit connector
Overload protection		electronic throughout 0 to 95° rotation
Control signal		On/Off, Floating Point
Input impedance		600 Ω
Angle of rotation		mechanically limited to 95°
Direction of rotation		reversible with switch A/B
Position indication		0 to 1 and reversible indicator
Running time		150 sec.
Humidity		5 to 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		NEMA 2/IP54
Housing material		UL94-5VA (flammability rating)
Agency listings		cULus according to UL60730-1A/-2-14, CAN/CSA E60730-1, CSA C22.2 No.24-93, CE according to 89/336/EEC
Noise level		max. 45 dB (A)
Servicing		maintenance free
Quality standard		ISO 9001

Note: GR Actuators are on 2-way valves
GM Actuators are on 3-way valves

Wiring Diagrams

INSTALLATION NOTES

△2 ***CAUTION** Equipment damage!*
Actuators may be connected in parallel.
Power consumption and input impedance must be observed.

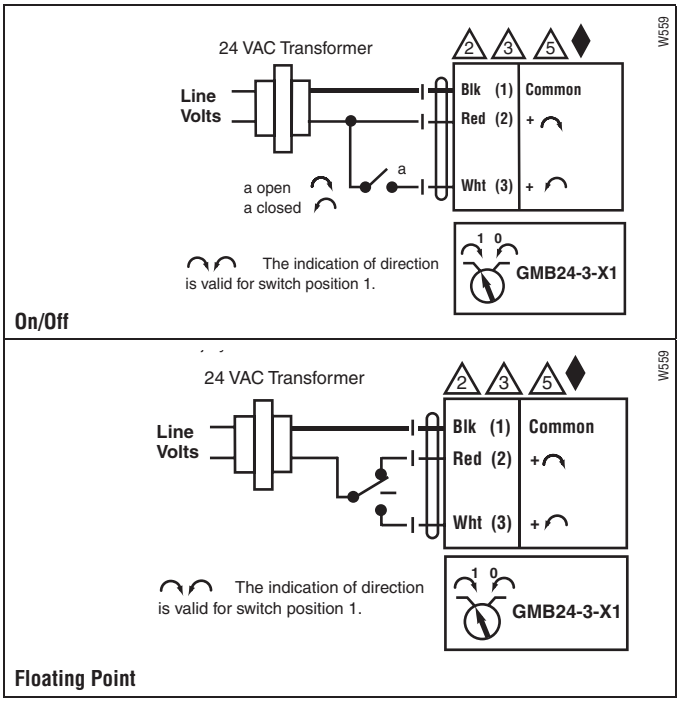
△3 Actuators may also be powered by 24 VDC.

△5 Actuators with plenum rated cable do not have numbers on wires; use color codes instead. Actuators with appliance cables are numbered.

APPLICATION NOTES

◆ Meets cULus or UL and CSA requirements without the need of an electrical ground connection.

⚠ ***WARNING** Live Electrical Components!*
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



BELIMO

5 YEAR WARRANTY

MFT CE LISTED 94 05 TEMP. IND. & REG. EQUIP. c UL us BRUSHLESS dc. motor

Models

GMX24-MFT-X1
GRX24-MFT-X1
GRB24-MFT-5
GRX24-MFT-7

Technical Data		
Power supply		24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	running	4.5 W
	holding	2 W
Transformer sizing		7 VA (class 2 power source)
Electrical connection		3 ft, 18 GA appliance cable, 1/2" conduit connector
Overload protection		electronic throughout 0 to 95° rotation
Control signal		2 to 10 VDC, 4 to 20 mA (with 500 Ω, 1/4 W resistor) ZG-R01
Input impedance		100 k Ω for 2 to 10 VDC (0.1 mA) 500 Ω for 4 to 20 mA 750 Ω for PWM 1500 Ω for on/off and floating point
Angle of rotation		mechanically limited to 95°
Direction of rotation		reversible with switch A/B
Position indication		0 to 1 and reversible indicator
Running time		150 seconds
Humidity		5 to 95% RH non-condensing
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing		NEMA 2/IP54
Housing material		UL94-5VA (flammability rating)
Agency listings		cULus according to UL60730-1A/-2-14, CAN/CSA E60730-1, CSA C22.2 No.24-93, CE according to 89/336/EEC
Noise level		max. 45 dB(A)
Servicing		maintenance free
Quality standard		ISO 9001

Wiring Diagrams

INSTALLATION NOTES

△3 Actuators may also be powered by 24 VDC.

△5 Actuators with plenum rated cable do not have numbers on wires; use color coded instead. Actuators with appliance rated cable use numbers.

△8 Control signal may be pulsed from either the Hot (Source) or Common (Sink) 24 VAC line.

△10 For triac sink the Common connection from the actuator must be connected to the Hot connection of the controller.

APPLICATION NOTES

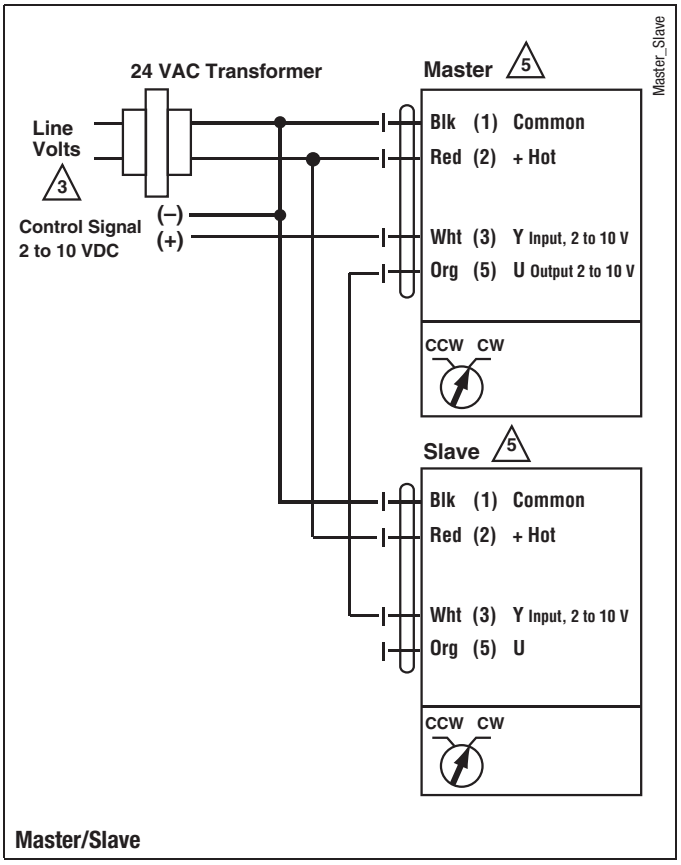
◆ Meets cULus or UL and CSA requirements without the need of an electrical ground connection.

△9 Contact closures A & B also can be triacs. A & B should both be closed for triac source and open for triac sink.

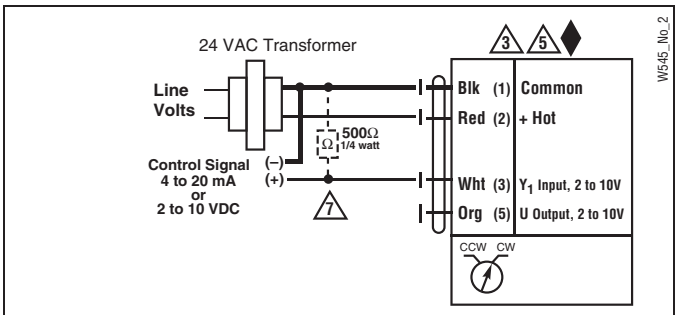
△11 Position feedback cannot be used with a Triac sink controller. The actuator internal common reference is not compatible.

⚠ *WARNING* *Live Electrical Components!*

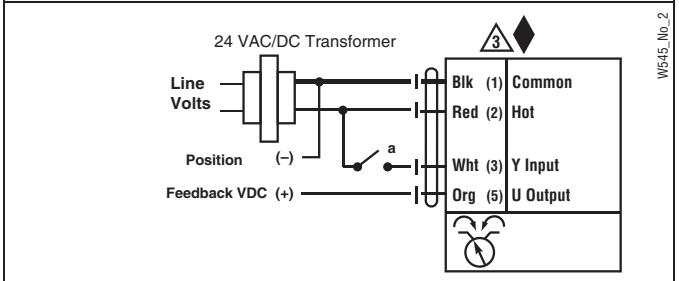
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



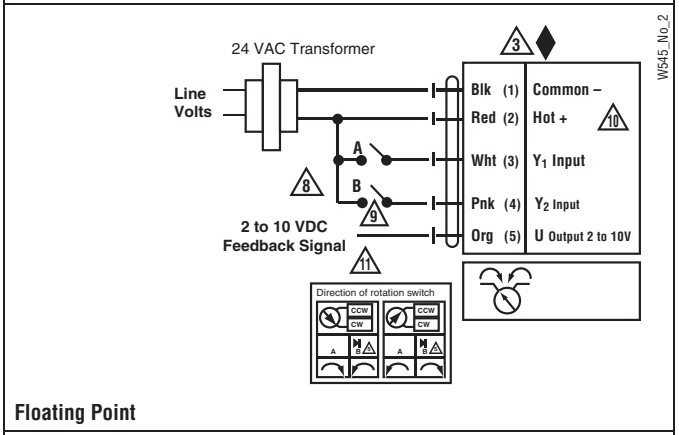
Master/Slave



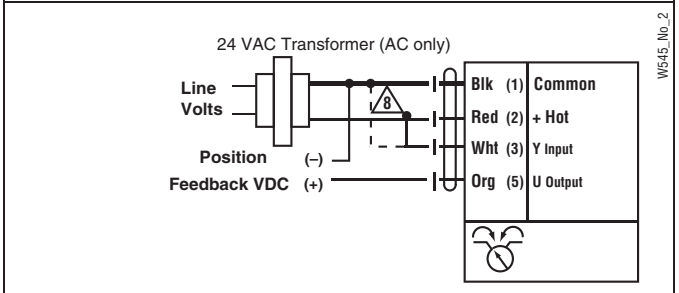
VDC/4-20 mA



Two Position



Floating Point



PWM

GRCX(B)24-3-T N4(H) NEMA 4 Actuators, On/Off, Floating Point

Models

GRCX24-3-T N4 w/terminal block
GRCB24-3-T N4H w/heater

Technical Data		
Control		on/off, floating point
Power supply		24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	running	8W / heater 29W
	holding	2.5W
Transformer sizing		11 VA (class 2 power source) / heater 26 VA
Electrical connection		screw terminal (for 22 to 12 AWG wire)
Overload protection		electronic throughout 0° to 90° rotation
Input impedance		1000 Ω at control input
Angle of rotation		90°, adjustable with mechanical stop
Position indication		visual pointer
Manual override		internal push button (UL Type 4)
Running time		35 seconds (default)
Humidity		5 to 100% RH (UL Type 4)
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing type		UL Type 4/NEMA 4/IP66
Housing material		Polycarbonate
Agency listings		cULus according to UL 60730-1A, UL 60730-2-14 and CAN/CSA E60730-1; Certified to IEC/EN 60730-1 and IEC/EN 60730-2-14
EMC		CE according to 2004/108/EC
Quality standard		ISO 9001

Wiring Diagrams

INSTALLATION NOTES

△2 ***CAUTION** Equipment damage!*
Actuators may be connected in parallel.
Power consumption and input impedance must be observed.

△4 Actuators may also be powered by 24 VDC.

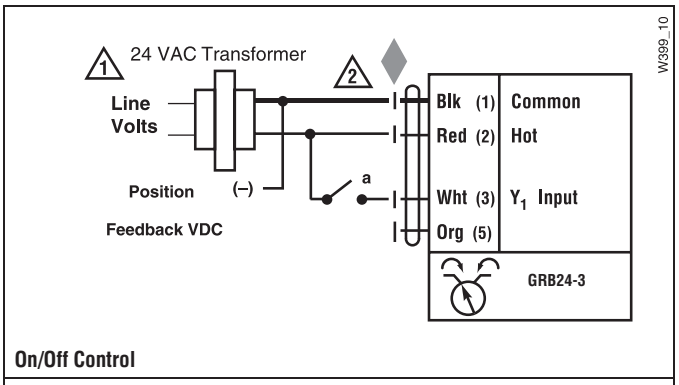
△5 Actuators with plenum rated cable do not have numbers on wires; use color codes instead. Actuators with appliance cables are numbered.

APPLICATION NOTES

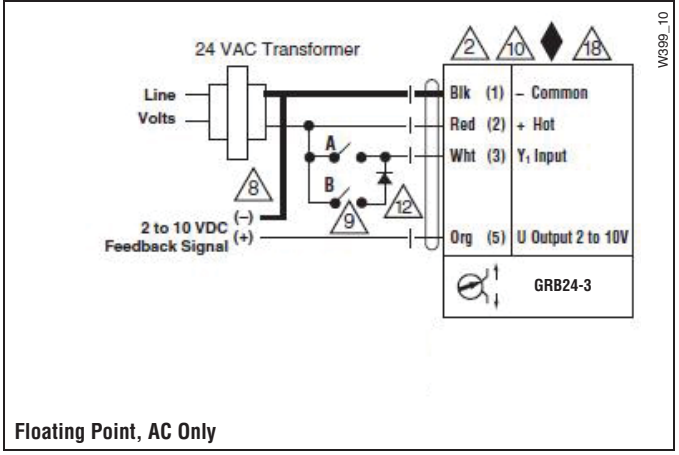
♦ Meets cULus or UL and CSA requirements without the need of an electrical ground connection. Use suitable flexible metallic conduit or its equivalent with the conduit fitting.

⚠ ***WARNING** Live Electrical Components!*
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

⚠ ***WARNING** Mechanical Precautions*
The mechanical end stops cannot be moved or repositioned. Doing so will adversely effect the operation of the valve.
The directional switch cannot be moved. Maintain Factory Settings



On/Off Control



Floating Point, AC Only

GRX(B)24-MFT-T N4(H) NEMA 4 Actuators, Multi-Function Technology

MFT

Models

GRX24-MFT-T N4 w/terminal block
GRB24-MFT-T N4H w/heater

Technical Data		
Control		2 to 10 VDC, 4 to 20 mA (default) variable (VDC, floating point, on/off)
Power supply		24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	running	8 W / heater 29W
	holding	2.5 W
Transformer sizing		11 VA (class 2 power source) / heater 24 VA
Electrical connection		screw terminal (for 22 to 12 AWG wire)
Overload protection		electronic throughout 0° to 90° rotation
Input impedance		100 kΩ for 2 to 10 VDC (0.1 mA) 500 Ω for 4 to 20 mA 1000 Ω for floating point and on-off control
Angle of rotation		90°, adjustable with mechanical stop electronically variable
Position indication		visual pointer
Manual override		internal push button (UL Type 4)
Running time		150 seconds (default) variable (75 to 290 seconds)
Humidity		5 to 100% RH (UL Type 4)
Ambient temperature		-22°F to 122°F [-30°C to 50°C]
Storage temperature		-40°F to 176°F [-40°C to 80°C]
Housing type		UL Type 4/NEMA 4/IP66
Housing material		Polycarbonate
Agency listings		cULus according to UL 60730-1A, UL 60730-2-14 and CAN/CSA E60730-1; Certified to IEC/EN 60730-1 and IEC/EN 60730-2-14
EMC		CE according to 2004/108/EC
Quality standard		ISO 9001

Wiring Diagrams

INSTALLATION NOTES

CAUTION *Equipment damage!*
Actuators may be connected in parallel.
Power consumption and input impedance must be observed.

3 Actuators may also be powered by 24 VDC.

5 Actuators with plenum rated cable do not have numbers on wires; use color codes instead. Actuators with appliance cables are numbered.

8 Control signal may be pulsed from either the Hot (source) or the Common (sink) 24 VAC line.

9 Contact closures A & B also can be triacs.
A& B should both be closed for triac source and open for triac sink.

10 For triac sink the Common connection from the actuator must be connected to the Hot connection of the controller. Position feedback cannot be used with a Triac sink controller. The actuator internal common reference is not compatible.

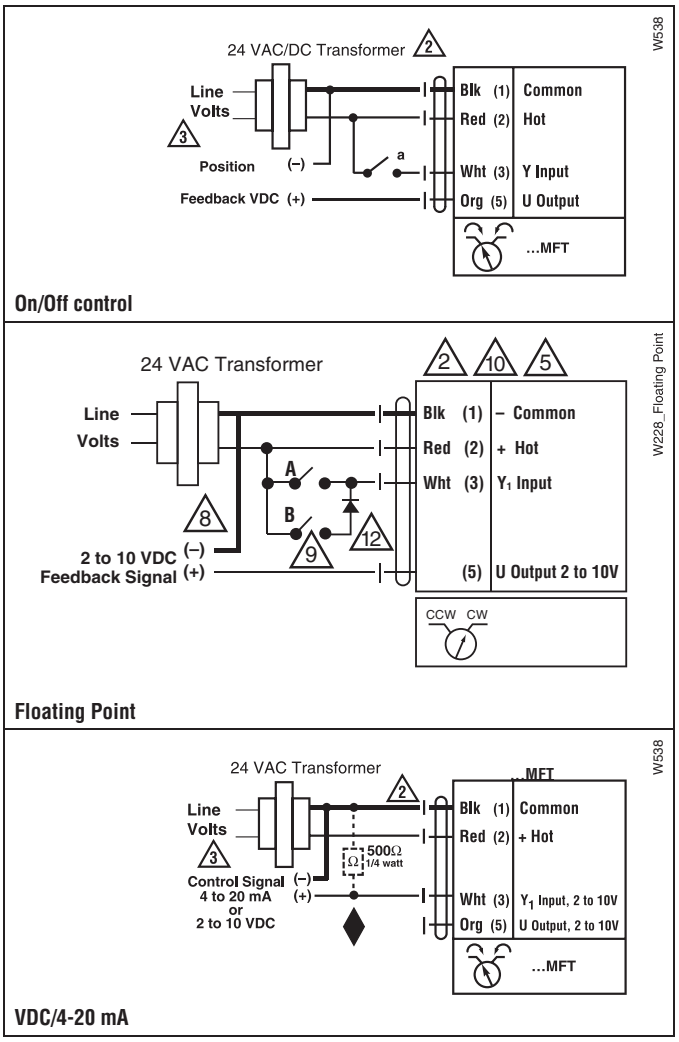
12 IN4004 or IN4007 diode. (IN4007 supplied, Belimo part number 40155).

APPLICATION NOTES

The ZG-R01 500 Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC, up to 2 actuators may be connected in parallel.

WARNING *Live Electrical Components!*
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

WARNING *Mechanical Precautions*
The mechanical end stops cannot be moved or repositioned. Doing so will adversely effect the operation of the valve.
The directional switch cannot be moved. Maintain Factory Settings



GMCX(B)24-3-T-X1 N4(H) NEMA 4 Actuators, On/Off, Floating Point

Models

GMCX24-3-T-X1 N4 w/terminal block
GMCB24-3-T-X1 N4H w/heater

Technical Data	
Control	on/off, floating point
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption running	8W / heater 28W
holding	2.5W
Transformer sizing	11 VA (class 2 power source) / heater 26 VA
Electrical connection	screw terminal (for 22 to 12 AWG wire)
Overload protection	electronic throughout 0° to 95° rotation
Input impedance	1000 Ω at control input
Angle of rotation	95°, adjustable with mechanical stop electronically variable
Direction of rotation	reversible with ↷/↶ switch
Position indication	visual pointer
Manual override	internal push button (UL Type 4)
Running time	35 seconds (default)
Humidity	5 to 100% RH (UL Type 4)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing type	UL Type 4/NEMA 4/IP66
Housing material	Polycarbonate
Agency listings	cULus according to UL 60730-1A, UL 60730-2-14 and CAN/CSA E60730-1; Certified to IEC/EN 60730-1 and IEC/EN 60730-2-14
EMC	CE according to 2004/108/EC
Quality standard	ISO 9001

Wiring Diagrams

INSTALLATION NOTES

2 ***CAUTION** Equipment damage!*
Actuators may be connected in parallel.
Power consumption and input impedance must be observed.

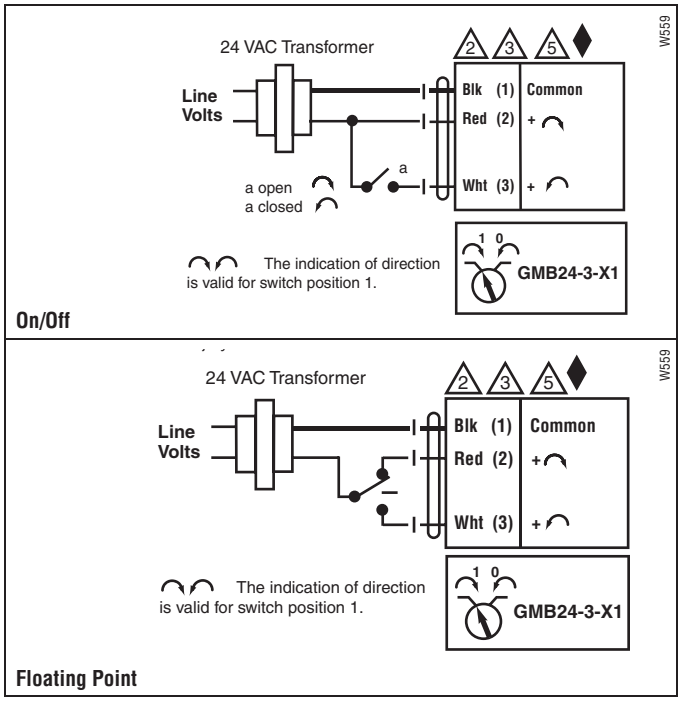
3 Actuators may also be powered by 24 VDC.

5 Actuators with plenum rated cable do not have numbers on wires; use color codes instead. Actuators with appliance cables are numbered.

APPLICATION NOTES

Meets cULus or UL and CSA requirements without the need of an electrical ground connection.

***WARNING** Live Electrical Components!*
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



GMX(B)24-MFT-T N4(H) NEMA 4 Actuators, Multi-Function Technology

MFT

5 YEAR WARRANTY

LISTED 94 D5 TEMP. IND. & REG. EQUIP. c UL us

BRUSHLESS dc. motor

Models

GMX24-MFT-T-X1 N4 w/terminal block
GMB24-MFT-T-X1 N4H w/heater

Technical Data	
Control	2 to 10 VDC, 4 to 20 mA (default) variable (VDC, floating point, on/off)
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption running	8 W / heater 29W
holding	2.5 W
Transformer sizing	11 VA (class 2 power source) / heater 26 VA
Electrical connection	screw terminal (for 22 to 12 AWG wire)
Overload protection	electronic throughout 0° to 95° rotation
Input impedance	100 kΩ for 2 to 10 VDC (0.1 mA) 500 Ω for 4 to 20 mA 1000 Ω for floating point and on-off control
Angle of rotation	95°, adjustable with mechanical stop electronically variable
Direction of rotation	reversible with ↷/↶ switch
Position indication	visual pointer
Manual override	internal push button (UL Type 4)
Running time	150 seconds (default) variable (75 to 290 seconds)
Humidity	5 to 100% RH (UL Type 4)
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing type	UL Type 4/NEMA 4/IP66
Housing material	Polycarbonate
Agency listings	cULus according to UL 60730-1A, UL 60730-2-14 and CAN/CSA E60730-1; Certified to IEC/EN 60730-1 and IEC/EN 60730-2-14
EMC	CE according to 2004/108/EC
Quality standard	ISO 9001

Wiring Diagrams

INSTALLATION NOTES

1. Provide overload protection and disconnect as required.
2. ***CAUTION*** *Equipment Damage!*
   Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.
3. Actuators may also be powered by 24 VDC.
4. Position feedback cannot be used with Triac sink controller.
   The actuator internal common reference is not compatible.
5. Control signal may be pulsed from either the Hot (source) or the Common (sink) 24 VAC line.
8. Contact closures A & B also can be triacs.
   A & B should both be closed for triac source and open for triac sink.
9. For triac sink the common connection from the actuator must be connected to the hot connection of the controller.

APPLICATION NOTES

- The ZG-R01 500 Ω resistor may be used.

WARNING *Live Electrical Components!*

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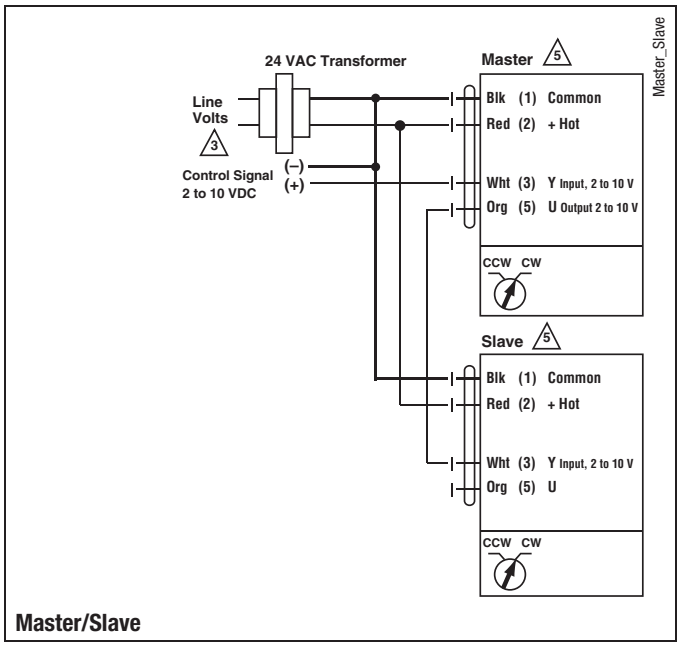
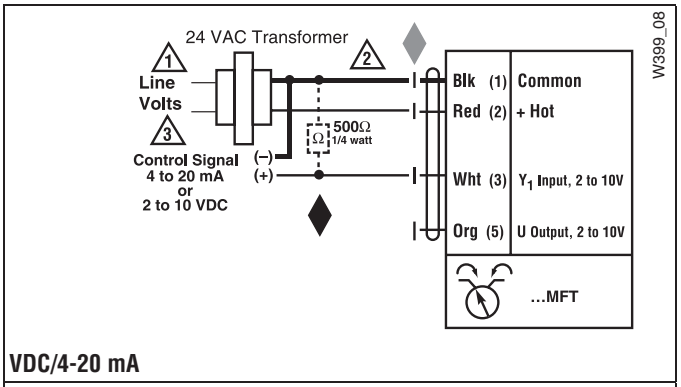
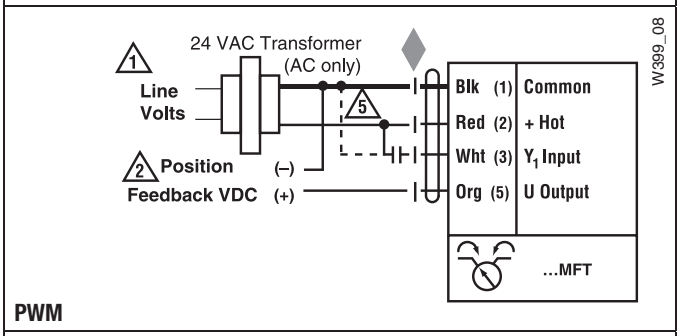


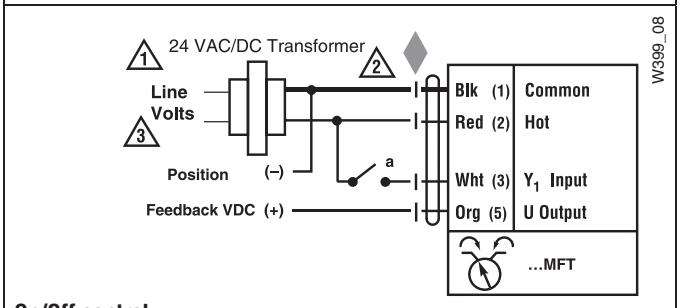
Master/Slave



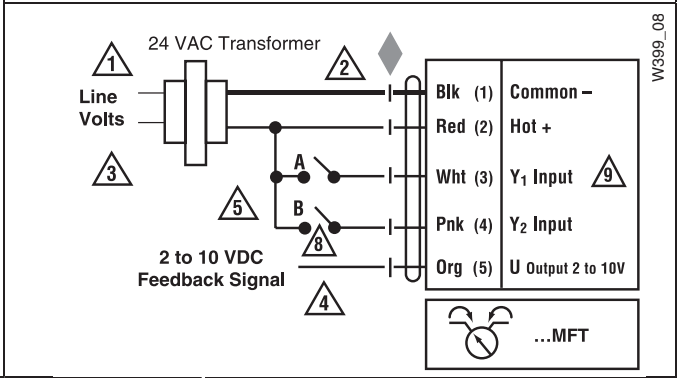
VDC/4-20 mA



PWM

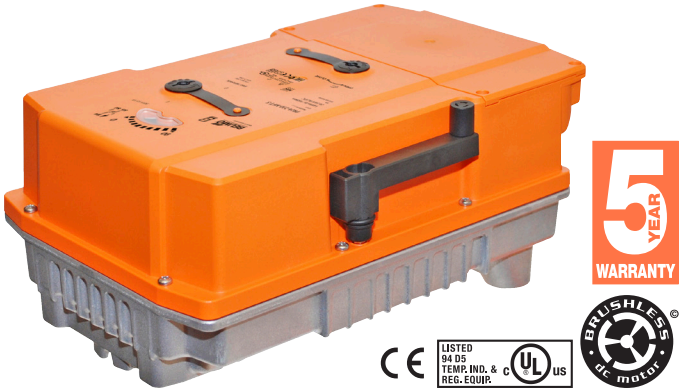


On/Off control



PRBUP-MFT-T

Modulating, Non-Spring Return, 24-240 V, NEMA 4X with BACnet



Technical Data	
Power Supply	24...240 VAC, -20% / +10%, 50/60 Hz, 24...125 VDC, -20% / +10%
Power Consumption Running	20 W @ 24 V, 18 W @ 120 V, 20 W @ 230 V
Power Consumption Holding	3.5 W @ 24 V, 4 W @ 120 V, 6 W @ 230 V
Transformer Sizing	20 VA @ 24 VAC/DC (class 2 power source), 23 VA @ 120 VAC/DC, 52 VA @ 230 VAC
Electrical Connection	terminal block
Overload Protection	electronic thoughout 0° to 90° rotation
Operating Range Y	2 to 10 VDC, 4 to 20 mA variable (VDC, floating point, on/off)
Input Impedance	100 k Ω for 2 to 10 VDC (0.1 mA), 500 Ω for 4 to 20 mA, 1500 Ω for On/Off
Feedback Output U	2 to 10 VDC, 0.5 mA max, VDC variable
Angle of Rotation	90°
Torque motor	Min. 1400 in-lbs [160 Nm]
Direction of Rotation (Motor)	reversible with app
Position Indication	integral pointer and bottom mounted reflective indicators
Manual Override	7 mm hex crank, supplied
Running Time (Motor)	35 sec
Ambient Humidity	5 to 100% RH (UL Type 4)
Ambient Temperature Range	-22°F to 122°F [-30°C to 50°C]
Storage Temperature Range	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 4X, IP66/67, UL Enclosure Type 4
Housing Material	Aluminum die cast and plastic casing
Agency Listings†	cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC and 2006/95/EC
Noise Level (Motor)	68 dB (A)
Servicing	maintenance free
Quality Standard	ISO 9001
Weight	12.8 lbs [5.8kg]
Auxiliary switch	2 x SPDT, 3A resistive (0.5A inductive) @ 250 VAC, one set at 10°, one adjustable 0° to 90°
Communication	BACnet MS/TP
Passive Sensor Inputs	2 (PT1000) (NI1000) (NTC)

Application

PR Series valve actuators are designed with an integrated linkage and visual position indicators. For outdoor applications, the installed valve must be mounted with the actuator at or above horizontal. For indoor applications the actuator can be in any location including directly under the valve.

Operation

The PR series actuator provides 90° of rotation and a visual indicator shows the position of the valve. The PR Series actuator uses a low power consumption brushless DC motor and is electronically protected against overload. A universal power supply is furnished to connect supply voltage in the range of 24-240 VAC and 24-125 VDC. Included is a smart heater with thermostat to eliminate condensation. Two auxiliary switches are provided; one set at 10° open and the other is field adjustable. Running time is field adjustable from 30-120 seconds by using the Near Field Communication (NFC) app and a smart phone.

†Use 60°C/75°C copper wire size range 12-28 AWG, stranded or solid. Use flexible metal conduit. Push the listed conduit fitting device over the actuator's cable to butt against the enclosure. Screw in conduit connector. Jacket the actuators input wiring with listed flexible conduit. Properly terminate the conduit in a suitable junction box. Rated impulse Voltage 4000V. Type of action 1. Control pollution degree 3.

PRBUP-MFT-T

Modulating, Non-Spring Return, 24-240 V, NEMA 4X with BACnet

Wiring Diagrams

Meets cULus requirements without the need of an electrical ground connection.

Universal Power Supply (UP) models can be supplied with 24 VAC up to 240 VAC, or 24 VDC up to 240 VDC.

Disconnect power.

1 Provide overload protection and disconnect as required.

4 Two built-in auxiliary switches (2x SPDT), for end position indication, interlock control, fan startup, etc.

5 Only connect common to negative (-) leg of control circuits.

46 Actuators may be controlled in parallel. Current draw and input impedance must be observed.

WARNING! LIVE ELECTRICAL COMPONENTS!

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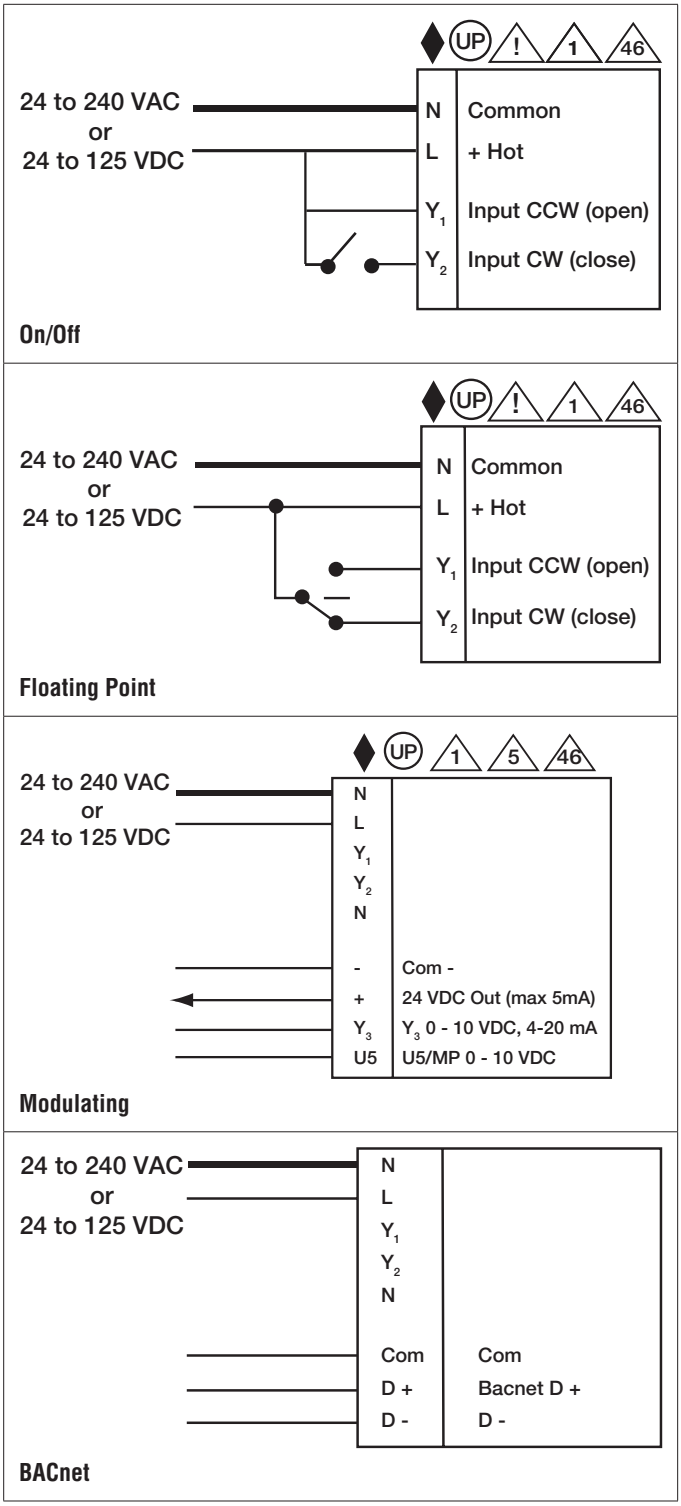
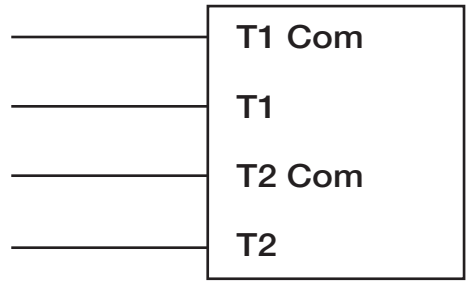
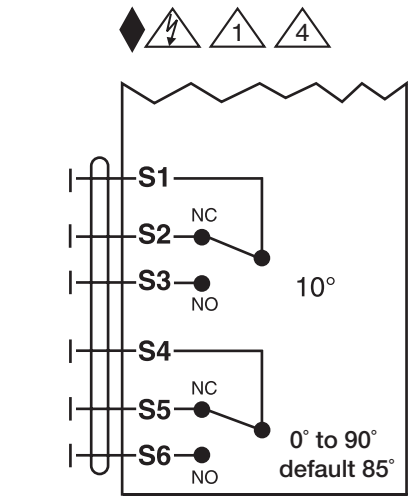




Temperature Sensors



Auxiliary Switches

PRXUP-3-T

On/Off, Floating Point, Non-Spring Return, 24-240 V, NEMA 4X

Technical Data	
Power Supply	24...240 VAC, -20% / +10%, 50/60 Hz, 24...125 VDC, -20% / +10%
Power Consumption Running	20 W @ 24 V, 18 W @ 120 V, 20 W @ 230 V
Power Consumption Holding	3.5 W @ 24 V, 4 W @ 120 V, 6 W @ 230 V
Transformer Sizing	20 VA @ 24 VAC/DC (class 2 power source), 23 VA @ 120 VAC/DC, 52 VA @ 230 VAC
Electrical Connection	terminal block
Overload Protection	electronic thoughout 0° to 90° rotation
Input Impedance	1000 Ω
Angle of Rotation	90°
Position Indication	integral pointer and bottom mounted reflective indicators
Manual Override	7 mm hex crank, supplied
Running Time (Motor)	35 sec
Ambient Humidity	5 to 100% RH (UL Type 4)
Ambient Temperature Range	-22°F to 122°F [-30°C to 50°C]
Housing	NEMA 4X, IP66/67, UL Enclosure Type 4X
Housing Material	aluminum die cast polycarbonate cover
Agency Listings†	cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC and 2006/95/EC
Noise Level (Motor)	68 dB (A)
Servicing	maintenance free
Quality Standard	ISO 9001
Weight	12.8 lbs [5.8kg]
Auxiliary switch	2 x SPDT, 3A resistive (0.5A inductive) @ 250 VAC, one set at 10°, one adjustable 0° to 90°

Application

PR Series valve actuators are designed with an integrated linkage and visual position indicators. For outdoor applications, the installed valve must be mounted with the actuator at or above horizontal. For indoor applications the actuator can be in any location including directly under the valve.

Operation

The PR series actuator provides 90° of rotation and a visual indicator shows the position of the valve. The PR Series actuator uses a low power consumption brushless DC motor and is electronically protected against overload. A universal power supply is furnished to connect supply voltage in the range of 24-240 VAC and 24-125 VDC. Included is a smart heater with thermostat to eliminate condensation. Two auxiliary switches are provided; one set at 10° open and the other is field adjustable. Running time is field adjustable from 30-120 seconds by using the Near Field Communication (NFC) app and a smart phone.

†Use 60°C/75°C copper wire size range 12-28 AWG, stranded or solid. Use flexible metal conduit. Push the listed conduit fitting device over the actuator's cable to butt against the enclosure. Screw in conduit connector. Jacket the actuators input wiring with listed flexible conduit. Properly terminate the conduit in a suitable junction box. Rated impulse Voltage 4000V. Type of action 1. Control pollution degree 3.

PRXUP-3-T

On/Off, Floating Point, Non-Spring Return, 24-240 V, NEMA 4X

Wiring Diagrams

◆ Meets cULus requirements without the need of an electrical ground connection.

UP Universal Power Supply (UP) models can be supplied with 24 VAC up to 240 VAC, or 24 VDC up to 125 VDC.

Disconnect power.

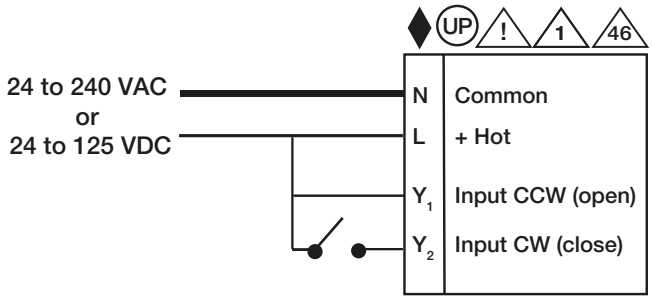
1 Provide overload protection and disconnect as required.

4 Two built-in auxiliary switches (2x SPDT), for end position indication, interlock control, fan startup, etc.

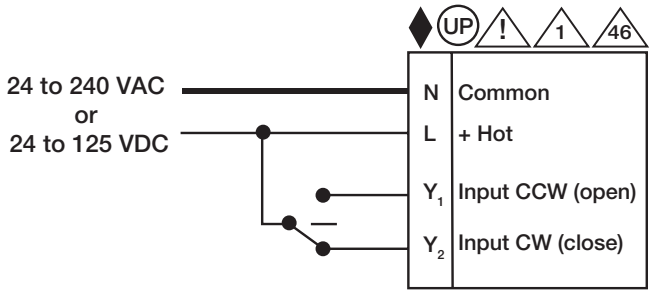
46 Actuators may be controlled in parallel. Current draw and input impedance must be observed.

! ***WARNING! LIVE ELECTRICAL COMPONENTS!***

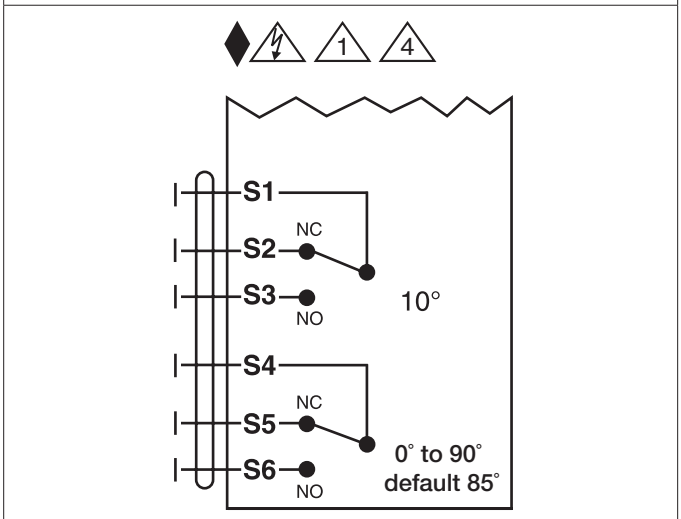
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



On/Off



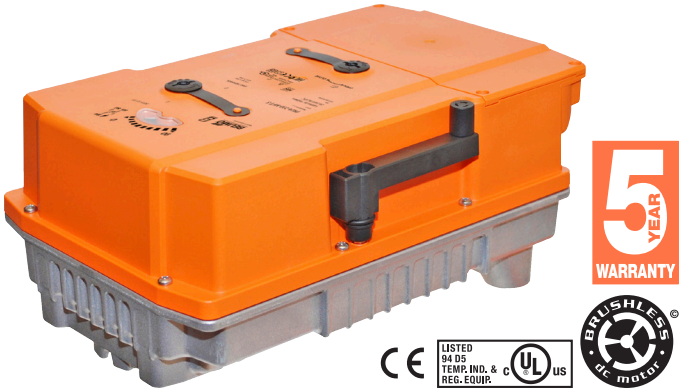
Floating Point



Auxiliary Switches

PRXUP-MFT-T

Modulating, Non-Spring Return, 24-240 V, NEMA 4X with BACnet



Technical Data	
Power Supply	24...240 VAC, -20% / +10%, 50/60 Hz, 24...125 VDC, -20% / +10%
Power Consumption Running	20 W @ 24 V, 18 W @ 120 V, 20 W @ 230 V
Power Consumption Holding	3.5 W @ 24 V, 4 W @ 120 V, 6 W @ 230 V
Transformer Sizing	20 VA @ 24 VAC/DC (class 2 power source), 23 VA @ 120 VAC/DC, 52 VA @ 230 VAC
Electrical Connection	terminal block
Overload Protection	electronic thoughout 0° to 90° rotation
Operating Range Y	2 to 10 VDC, 4 to 20 mA variable (VDC, floating point, on/off)
Input Impedance	100 k Ω for 2 to 10 VDC (0.1 mA), 500 Ω for 4 to 20 mA, 1500 Ω for On/Off
Feedback Output U	2 to 10 VDC, 0.5 mA max, VDC variable
Angle of Rotation	90°
Torque motor	Min. 1400 in-lbs [160 Nm]
Direction of Rotation (Motor)	reversible with app
Position Indication	integral pointer and bottom mounted reflective indicators
Manual Override	7 mm hex crank, supplied
Running Time (Motor)	35 sec
Ambient Humidity	5 to 100% RH (UL Type 4)
Ambient Temperature Range	-22°F to 122°F [-30°C to 50°C]
Storage Temperature Range	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 4X, IP66/67, UL Enclosure Type 4
Housing Material	Aluminum die cast and plastic casing
Agency Listings†	cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC and 2006/95/EC
Noise Level (Motor)	68 dB (A)
Servicing	maintenance free
Quality Standard	ISO 9001
Weight	12.8 lbs [5.8kg]
Auxiliary switch	2 x SPDT, 3A resistive (0.5A inductive) @ 250 VAC, one set at 10°, one adjustable 0° to 90°
Communication	BACnet MS/TP
Passive Sensor Inputs	2 (PT1000) (NI1000) (NTC)

Application

PR Series valve actuators are designed with an integrated linkage and visual position indicators. For outdoor applications, the installed valve must be mounted with the actuator at or above horizontal. For indoor applications the actuator can be in any location including directly under the valve.

Operation

The PR series actuator provides 90° of rotation and a visual indicator shows the position of the valve. The PR Series actuator uses a low power consumption brushless DC motor and is electronically protected against overload. A universal power supply is furnished to connect supply voltage in the range of 24-240 VAC and 24-125 VDC. Included is a smart heater with thermostat to eliminate condensation. Two auxiliary switches are provided; one set at 10° open and the other is field adjustable. Running time is field adjustable from 30-120 seconds by using the Near Field Communication (NFC) app and a smart phone.

†Use 60°C/75°C copper wire size range 12-28 AWG, stranded or solid. Use flexible metal conduit. Push the listed conduit fitting device over the actuator's cable to butt against the enclosure. Screw in conduit connector. Jacket the actuators input wiring with listed flexible conduit. Properly terminate the conduit in a suitable junction box. Rated impulse Voltage 4000V. Type of action 1. Control pollution degree 3.

PRXUP-MFT-T

Modulating, Non-Spring Return, 24-240 V, NEMA 4X with BACnet

Wiring Diagrams

Meets cULus requirements without the need of an electrical ground connection.

Universal Power Supply (UP) models can be supplied with 24 VAC up to 240 VAC, or 24 VDC up to 240 VDC.

Disconnect power.

1 Provide overload protection and disconnect as required.

4 Two built-in auxiliary switches (2x SPDT), for end position indication, interlock control, fan startup, etc.

5 Only connect common to negative (-) leg of control circuits.

46 Actuators may be controlled in parallel. Current draw and input impedance must be observed.

WARNING! LIVE ELECTRICAL COMPONENTS!

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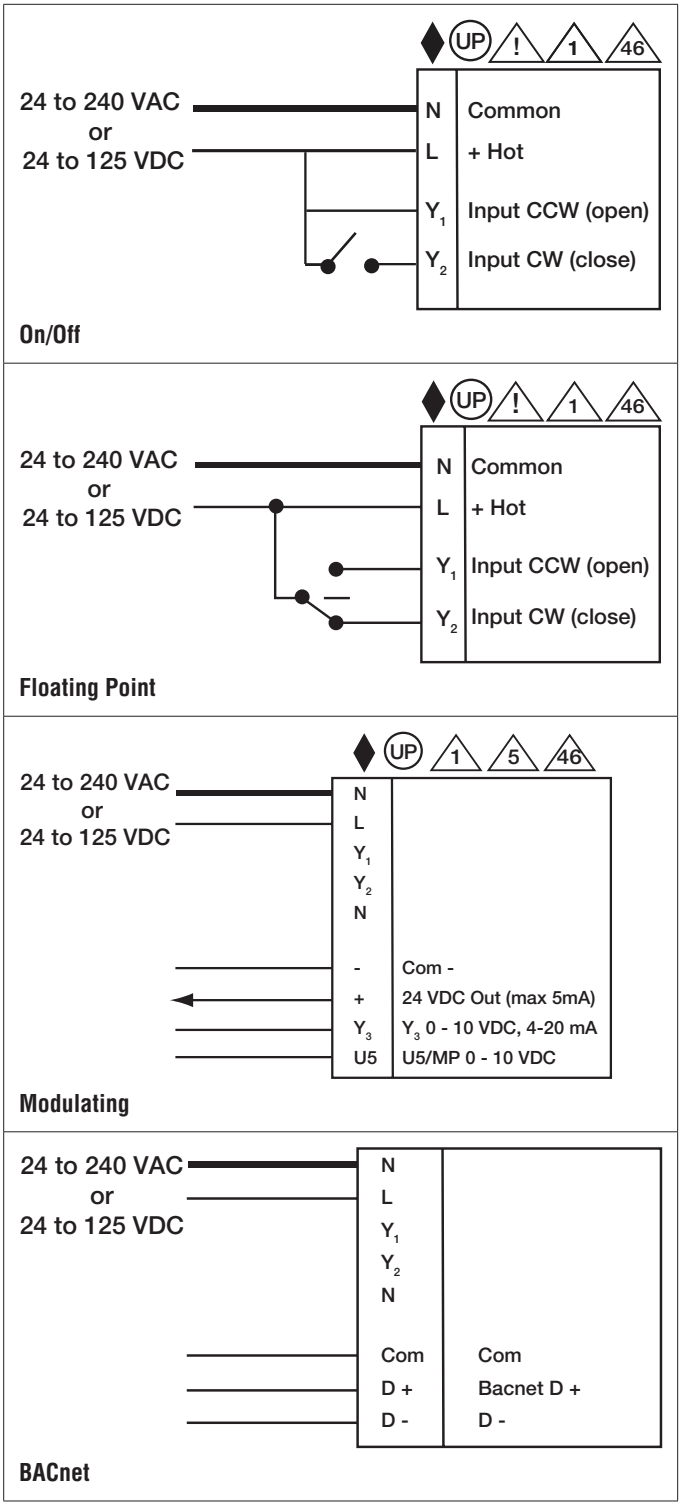
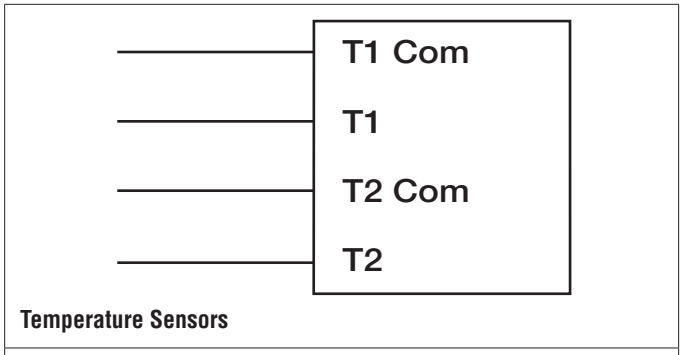
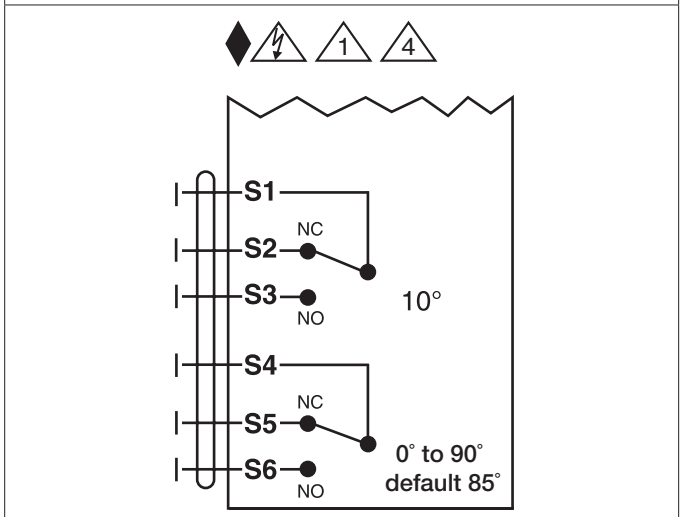


PRXUP-MFT-T

Modulating, Non-Spring Return, 24-240 V, NEMA 4X with BACnet



Temperature Sensors



Auxiliary Switches

PRBUP-3-T

On/Off, Floating Point, Non-Spring Return, 24-240 V, NEMA 4X

Technical Data	
Power Supply	24...240 VAC, -20% / +10%, 50/60 Hz, 24...125 VDC, -20% / +10%
Power Consumption Running	20 W @ 24 V, 18 W @ 120 V, 20 W @ 230 V
Power Consumption Holding	3.5 W @ 24 V, 4 W @ 120 V, 6 W @ 230 V
Transformer Sizing	20 VA @ 24 VAC/DC (class 2 power source), 23 VA @ 120 VAC/DC, 52 VA @ 230 VAC
Electrical Connection	terminal block
Overload Protection	electronic thoughout 0° to 90° rotation
Input Impedance	1000 Ω
Angle of Rotation	90°
Position Indication	integral pointer and bottom mounted reflective indicators
Manual Override	7 mm hex crank, supplied
Running Time (Motor)	35 sec
Ambient Humidity	5 to 100% RH (UL Type 4)
Ambient Temperature Range	-22°F to 122°F [-30°C to 50°C]
Housing	NEMA 4X, IP66/67, UL Enclosure Type 4X
Housing Material	aluminum die cast polycarbonate cover
Agency Listings†	cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC and 2006/95/EC
Noise Level (Motor)	68 dB (A)
Servicing	maintenance free
Quality Standard	ISO 9001
Weight	12.8 lbs [5.8kg]
Auxiliary switch	2 x SPDT, 3A resistive (0.5A inductive) @ 250 VAC, one set at 10°, one adjustable 0° to 90°

Application

PR Series valve actuators are designed with an integrated linkage and visual position indicators. For outdoor applications, the installed valve must be mounted with the actuator at or above horizontal. For indoor applications the actuator can be in any location including directly under the valve.

Operation

The PR series actuator provides 90° of rotation and a visual indicator shows the position of the valve. The PR Series actuator uses a low power consumption brushless DC motor and is electronically protected against overload. A universal power supply is furnished to connect supply voltage in the range of 24-240 VAC and 24-125 VDC. Included is a smart heater with thermostat to eliminate condensation. Two auxiliary switches are provided; one set at 10° open and the other is field adjustable. Running time is field adjustable from 30-120 seconds by using the Near Field Communication (NFC) app and a smart phone.

†Use 60°C/75°C copper wire size range 12-28 AWG, stranded or solid. Use flexible metal conduit. Push the listed conduit fitting device over the actuator's cable to butt against the enclosure. Screw in conduit connector. Jacket the actuators input wiring with listed flexible conduit. Properly terminate the conduit in a suitable junction box. Rated impulse Voltage 4000V. Type of action 1. Control pollution degree 3.

PRBUP-3-T

On/Off, Floating Point, Non-Spring Return, 24-240 V, NEMA 4X

Wiring Diagrams

◆ Meets cULus requirements without the need of an electrical ground connection.

(UP) Universal Power Supply (UP) models can be supplied with 24 VAC up to 240 VAC, or 24 VDC up to 125 VDC.

Disconnect power.

1 Provide overload protection and disconnect as required.

4 Two built-in auxiliary switches (2x SPDT), for end position indication, interlock control, fan startup, etc.

46 Actuators may be controlled in parallel. Current draw and input impedance must be observed.

! ***WARNING! LIVE ELECTRICAL COMPONENTS!***

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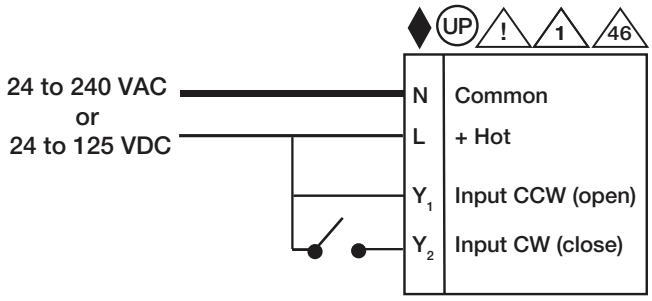
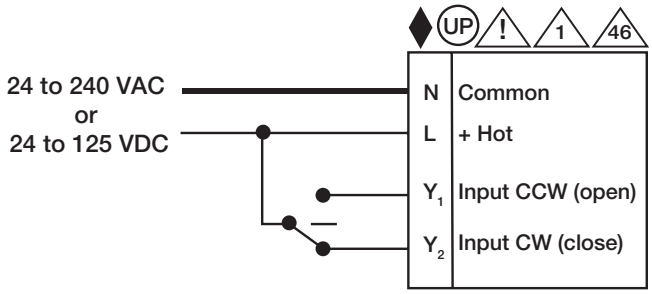
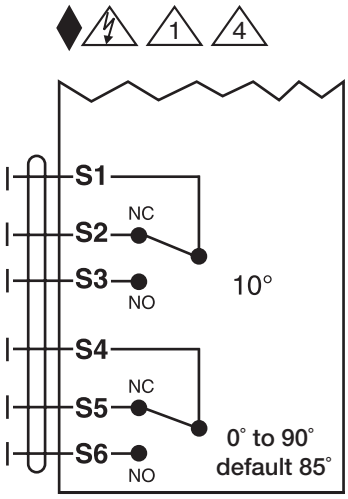


On/Off



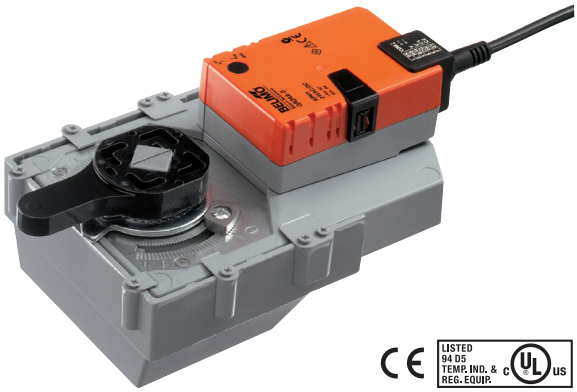
Floating Point



Auxiliary Switches

GRB120-3-5-14

On/Off Floating Point, Non-Spring Return, 110 V



Technical Data	
Power Supply	100-240 VAC ± 20%, 50/60 Hz
Power Consumption Running	4 W
Power Consumption Holding	2 W
Transformer Sizing	7 VA @ 24 VAC (class 2 power source)
Electrical Connection	18 GA applicance rated cable with 1/2" conduit connector protected NEMA 2 (IP54) 3 ft [1m] 10 ft [3m] and 16 ft [5m]
Overload Protection	electronic throughout 0° to 95° rotation
Input Impedance	600 Ω
Angle of Rotation	90°, adjustable with mechanical stop
Direction of Rotation (Motor)	reversible with built-in switch
Manual Override	external push button
Running Time (Motor)	150 sec
Humidity	5 to 95% RH non-condensing
Ambient Temperature Range	-22°F to +122°F [-30°C to +50°C]
Storage Temperature Range	-40°F to +176°F [-40°C to +80°C]
Housing	NEMA 2, IP42, UL enclosure type 2
Housing Material	UL94-5VA
Agency Listings†	cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC and 2006/95/EC
Noise Level (Motor)	<45 dB (A)
Servicing	maintenance free
Quality Standard	ISO 9001
Weight	3.5 lb [1.6 kg]

†Rated Impulse Voltage 800V, Type of action 1.AA, Control Pollution Degree 3

GRB120-3-5-14

On/Off Floating Point, Non-Spring Return, 110 V

Wiring Diagrams

INSTALLATION NOTES

(A) Actuators with appliance cables are numbered.

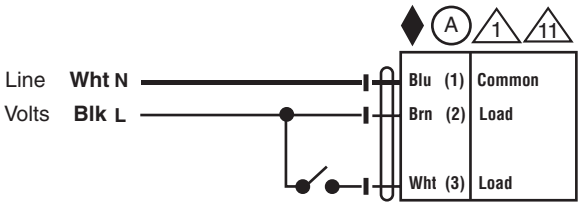
1 Provide overload protection and disconnect as required.

11 Actuators may be connected in parallel if not mechanically linked. Power consumption and input impedance must be observed.

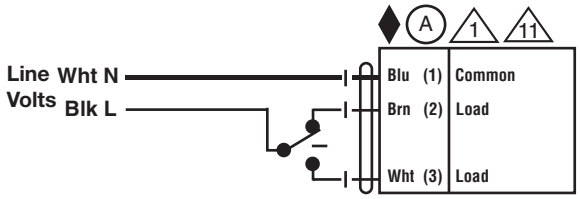
Meets cULus requirements without the need of an electrical ground connection.

WARNING! LIVE ELECTRICAL COMPONENTS!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



On/Off 100 to 240 VAC



Floating Point 100 to 240 VAC

BELIMO

Stainless Steel Ball and Stem

Technical data sheet B210

5-year warranty

Technical data

Functional data	Valve Size	0.5" [15]
	Fluid	chilled or hot water, up to 60% glycol
	Fluid Temp Range (water)	0...250°F [-18...120°C]
	Body Pressure Rating	600 psi
	Close-off pressure Δps	200 psi
	Servicing	maintenance-free
	Flow Pattern	2-way
	Leakage rate	0% for A – AB
	Controllable flow range	75°
	Cv	1.2
	Body pressure rating note	600 psi
	Cv Flow Rating	A-port: as stated in chart B-port: 70% of A – AB Cv
Materials	Seat	PTFE
	End fitting	NPT female ends
	O-ring	EPDM (lubricated)
	Ball	stainless steel
Suitable actuators	Non-Spring	TR LRB(X) NR

Safety notes

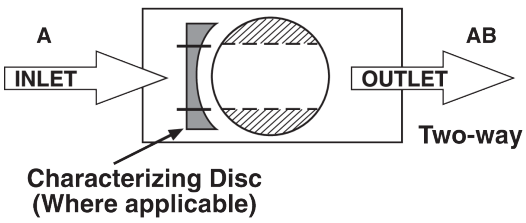
- WARNING: This product can expose you to lead which is known to the State of California to cause cancer and reproductive harm. For more information go to www.p65warnings.ca.gov

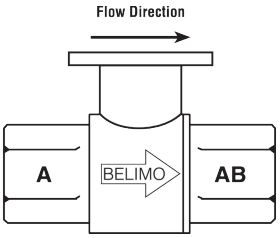
Product features

Application

This valve is typically used in air handling units on heating or cooling coils, and fan coil unit heating or cooling coils. Some other common applications include Unit Ventilators, VAV box re-heat coils and bypass loops. This valve is suitable for use in a hydronic system with variable flow.

Flow/Mounting details

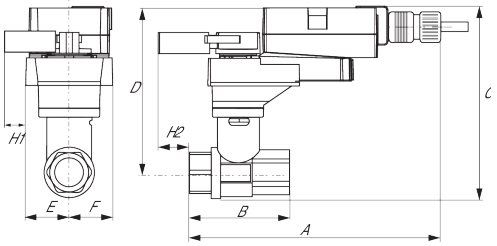




Dimensions

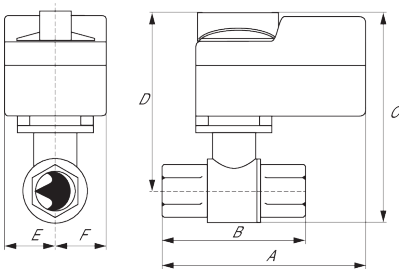
Dimensional drawings

LRB, LRX



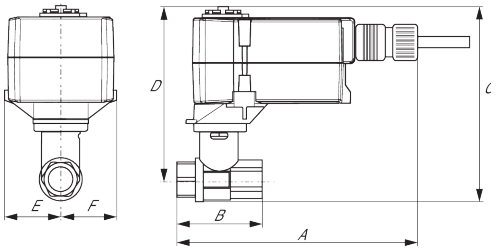
A	B	C	D	E	F	H1	H2
9.4" [239]	2.4" [60]	5.2" [132]	4.6" [117]	1.3" [33]	1.3" [33]	1.2" [30]	1.1" [28]

TR



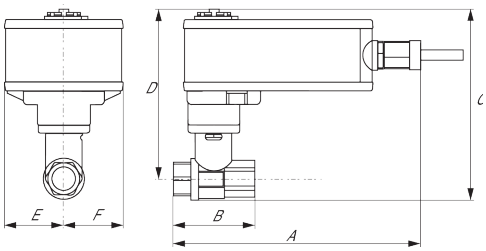
A	B	C	D	E	F
3.7" [95]	2.4" [60]	4.8" [122]	4.2" [107]	1.3" [33]	1.3" [33]

TFRB, TFRX



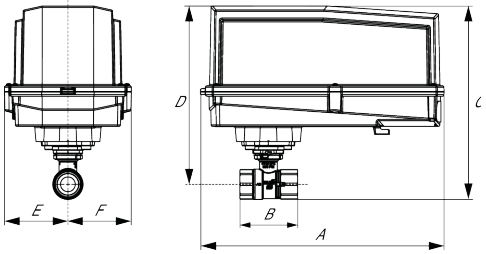
A	B	C	D	E	F
6.6" [167]	2.4" [60]	4.9" [124]	4.3" [110]	1.5" [39]	1.5" [39]

LF



A	B	C	D	E	F
7.9" [200]	2.4" [60]	5.7" [146]	5.1" [129]	1.8" [46]	1.8" [46]

ARB N4, ARX N4, NRB N4, NRX N4



A	B	C	D	E	F
11.4" [289]	2.4" [60]	7.7" [196]	7.0" [179]	3.1" [80]	3.1" [80]

BELIMO

Modulating, Spring Return, Multi-Function Technology®

Technical data sheet LF24-MFT US

5-year warranty

Technical data

Electrical data	Nominal voltage	AC/DC 24 V
	Nominal voltage frequency	50/60 Hz
	Power consumption in operation	2.5 W
	Power consumption in rest position	1 W
	Transformer sizing	5 VA (class 2 power source)
	Electrical Connection	18 GA appliance cable, 3 ft [1 m], with 1/2" conduit connector
	Overload Protection	electronic throughout 0...95° rotation
Functional data	Operating range Y	2...10 V
	Operating range Y note	4...20 mA w/ ZG-R01 (500 Ω, 1/4 W resistor)
	Input Impedance	100 kΩ for 2...10 V (0.1 mA), 500 Ω for 4...20 mA, 1500 Ω for PWM, On/Off and Floating point
	Operating range Y variable	Start point 0.5...30 V End point 2.5...32 V
	Options positioning signal	variable (VDC, on/off, floating point)
	Position feedback U	2...10 V
	Position Feedback	2...10 V, Max. 0.5 mA, VDC variable
	Position feedback U note	Max. 0.5 mA
	Position feedback U variable	VDC variable
	Direction of motion motor	selectable with switch 0/1
	Direction of motion fail-safe	reversible with cw/ccw mounting
	Angle of rotation	90°
	Running Time (Motor)	default 150 s, variable 75...300 s
	Running time motor variable	75...300 s
	Running time fail-safe	<25 s @ -4...122°F [-20...50°C], <60 s @ -22°F [-30°C]
	Running time fail-safe note	@ -4...122°F [-20...50°C], <60 s @ -22°F [-30°C]
	Noise level, motor	50 dB(A)
	Noise level, fail-safe	62 dB(A)
	Position indication	Mechanical
Safety data	Degree of protection IEC/EN	IP54
	Degree of protection NEMA/UL	NEMA 2
	Enclosure	UL Enclosure Type 2
	Agency Listing	cULus acc. To UL 873 and CAN/CSA C22.2 No. 24-93
	Quality Standard	ISO 9001
	Ambient temperature	-22...122°F [-30...50°C]
	Storage temperature	-40...176°F [-40...80°C]
	Ambient humidity	max. 95% r.H., non-condensing
	Servicing	maintenance-free
Weight	Weight	3.1 lbs (1.40 kg.)

Electrical installation

INSTALLATION NOTES

A Actuators with appliance cables are numbered.

1 Provide overload protection and disconnect as required.

2 Actuators may be connected in parallel. Power consumption and input impedance must be observed.

Apply only AC line voltage or only UL-Class 2 voltage to the terminals of auxiliary switches. Mixed or combined operation of line voltage/safety extra low voltage is not allowed.

3 Actuators may also be powered by 24 VDC.

4 Two built-in auxiliary switches (2x SPDT), for end position indication, interlock control, fan startup, etc.

5 Only connect common to negative (-) leg of control circuits.

7 A 500 Ω resistor (ZG-R01) converts the 4...20 mA control signal to 2...10 V.

8 Control signal may be pulsed from either the Hot (Source) or Common (Sink) 24 V line.

10 For triac sink the Common connection from the actuator must be connected to the Hot connection of the controller. Position feedback cannot be used with a triac sink controller; the actuator internal common reference is not compatible.

11 Actuators may be connected in parallel if not mechanically linked. Power consumption and input impedance must be observed.

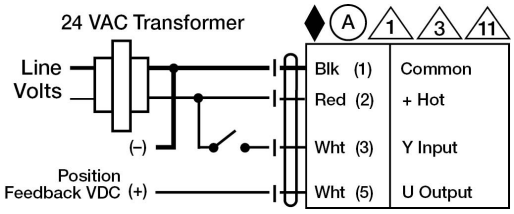
12 IN4004 or IN4007 diode. (IN4007 supplied, Belimo part number 40155).

Meets cULus requirements without the need of an electrical ground connection.

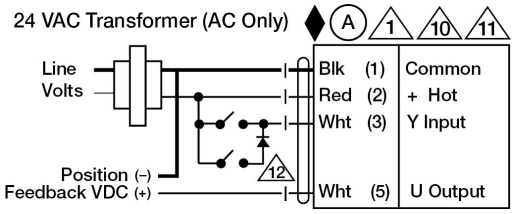
4 Actuators are provided with color coded wires. Wire numbers are provided for reference.

Warning! Live Electrical Components!

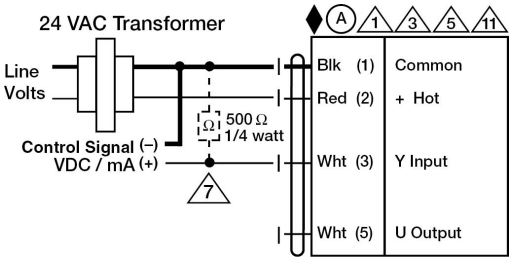
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



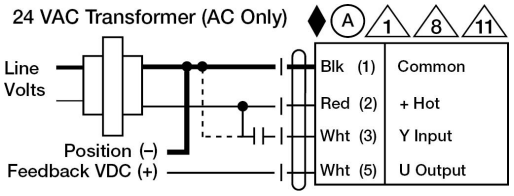
On/Off



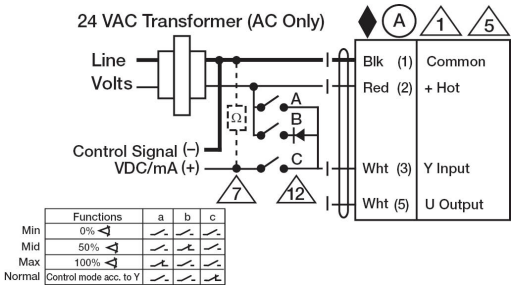
Floating Point



VDC/mA Control



PWM Control



Override Control

BELIMO

Stainless Steel Ball and Stem

Technical data sheet B210

5-year warranty

Technical data

Functional data	Valve Size	0.5" [15]
	Fluid	chilled or hot water, up to 60% glycol
	Fluid Temp Range (water)	0...250°F [-18...120°C]
	Body Pressure Rating	600 psi
	Close-off pressure Δps	200 psi
	Servicing	maintenance-free
	Flow Pattern	2-way
	Leakage rate	0% for A – AB
	Controllable flow range	75°
	Cv	1.2
	Body pressure rating note	600 psi
	Cv Flow Rating	A-port: as stated in chart B-port: 70% of A – AB Cv
Materials	Seat	PTFE
	End fitting	NPT female ends
	O-ring	EPDM (lubricated)
	Ball	stainless steel
Suitable actuators	Non-Spring	TR LRB(X) NR

Safety notes

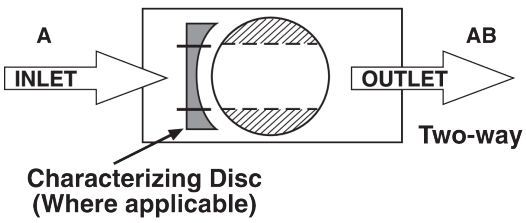
- WARNING: This product can expose you to lead which is known to the State of California to cause cancer and reproductive harm. For more information go to www.p65warnings.ca.gov

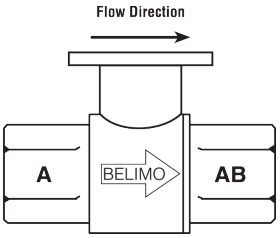
Product features

Application

This valve is typically used in air handling units on heating or cooling coils, and fan coil unit heating or cooling coils. Some other common applications include Unit Ventilators, VAV box re-heat coils and bypass loops. This valve is suitable for use in a hydronic system with variable flow.

Flow/Mounting details

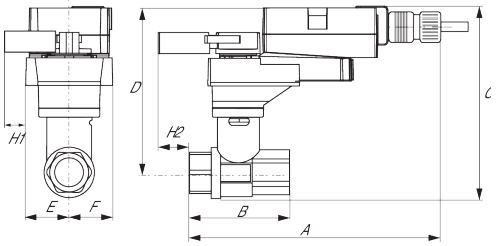




Dimensions

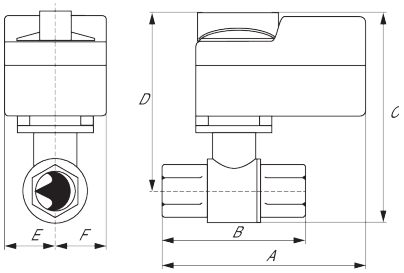
Dimensional drawings

LRB, LRX



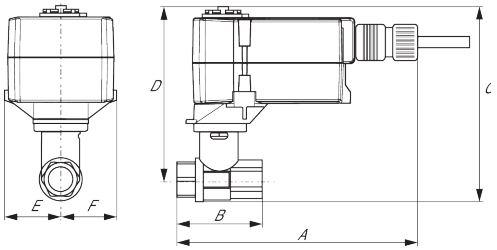
A	B	C	D	E	F	H1	H2
9.4" [239]	2.4" [60]	5.2" [132]	4.6" [117]	1.3" [33]	1.3" [33]	1.2" [30]	1.1" [28]

TR



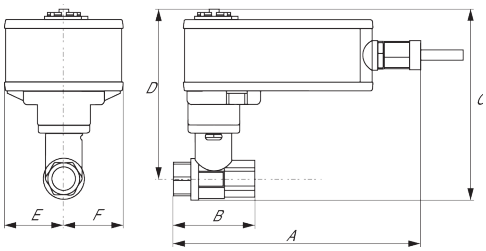
A	B	C	D	E	F
3.7" [95]	2.4" [60]	4.8" [122]	4.2" [107]	1.3" [33]	1.3" [33]

TFRB, TFRX



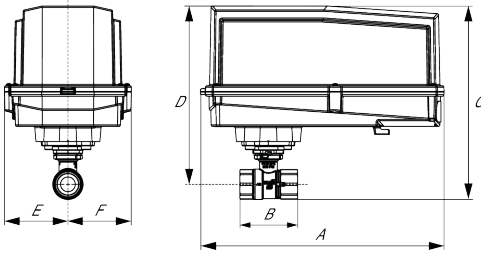
A	B	C	D	E	F
6.6" [167]	2.4" [60]	4.9" [124]	4.3" [110]	1.5" [39]	1.5" [39]

LF



A	B	C	D	E	F
7.9" [200]	2.4" [60]	5.7" [146]	5.1" [129]	1.8" [46]	1.8" [46]

ARB N4, ARX N4, NRB N4, NRX N4

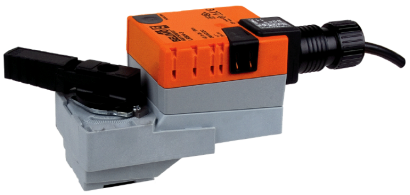


A	B	C	D	E	F
11.4" [289]	2.4" [60]	7.7" [196]	7.0" [179]	3.1" [80]	3.1" [80]

BELIMO

Modulating, Non-Spring Return, 24 V, for DC 2...10 V or 4...20 mA

Technical data sheet LRB24-SR



5-year warranty

Technical data

Electrical data	Nominal voltage	AC/DC 24 V
	Nominal voltage frequency	50/60 Hz
	Power consumption in operation	1.5 W
	Power consumption in rest position	0.4 W
	Transformer sizing	3 VA (class 2 power source)
	Electrical Connection	18 GA plenum cable, 3 ft [1 m], with 1/2" conduit connector
	Overload Protection	electronic thoughout 0...90° rotation
Functional data	Operating range Y	2...10 V
	Operating range Y note	4...20 mA w/ ZG-R01 (500 Ω, 1/4 W resistor)
	Input Impedance	100 kΩ for 2...10 V (0.1 mA), 500 Ω for 4...20 mA
	Position feedback U	2...10 V
	Position Feedback	2...10 V
	Direction of motion motor	selectable with switch 0/1
	Manual override	external push button
	Angle of rotation	90°
	Angle of rotation note	adjustable with mechanical stop
	Running Time (Motor)	90 s
	Noise level, motor	35 dB(A)
	Position indication	Mechanically, pluggable
Safety data	Degree of protection IEC/EN	IP54
	Degree of protection NEMA/UL	NEMA 2
	Enclosure	UL Enclosure Type 2
	Agency Listing	cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2014/30/EU
	Quality Standard	ISO 9001
	Ambient temperature	-22...122°F [-30...50°C]
	Storage temperature	-40...176°F [-40...80°C]
	Ambient humidity	max. 95% r.H., non-condensing
	Servicing	maintenance-free
Weight	Weight	1.1 lb [0.50 kg]

Electrical installation

INSTALLATION NOTES

1 Provide overload protection and disconnect as required.
2 Actuators may be connected in parallel. Power consumption and input impedance must be observed.
3 Actuators may also be powered by 24 VDC.
5 Only connect common to negative (-) leg of control circuits.

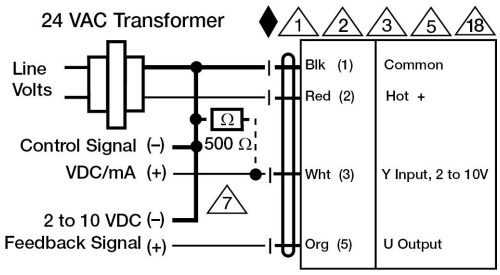
7 A 500 Ω resistor (ZG-R01) converts the 4...20 mA control signal to 2...10 V.

18 Actuators with plenum cable do not have numbers; use color codes instead.

Meets cULus requirements without the need of an electrical ground connection.

Warning! Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



2...10 V / 4...20 mA Control

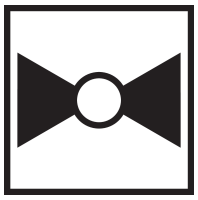
BELIMO

Carbon Steel Body, Hardened Chrome Plated, Stainless Steel Ball and Stem

Technical data sheet B6300VB-207

2

2-year warranty



Technical data

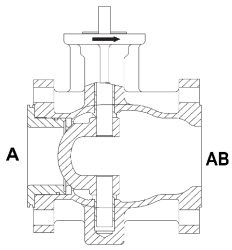
Functional data	Valve Size	3" [80]
	Fluid	chilled or hot water, up to 60% glycol, steam
	Fluid Temp Range (water)	-22...380°F [-30...193°C]
	Fluid Temp Range (steam)	-22...380°F [-30...193°C]
	Body Pressure Rating	ANSI Class 150
	Close-off pressure Δps	250 psi
	Servicing	repack/rebuild kits available
	Rangeability Sv	300:1
	Maximum differential pressure (water)	150 psi
	Max Differential Pressure (Steam)	100 psi
	Close-Off Pressure (Steam)	150 psi
	Flow Pattern	2-way
	Leakage rate	ANSI Class IV
	Controllable flow range	75°
	Cv	207
	Maximum Inlet Pressure (Steam)	200 psi
	ANSI Class	150
Materials	Housing	WCC grade carbon steel
	Seat	PTFE
	End fitting	125/150 lb flanged, ASME/ANSI b16.1/b16.5
	Ball	stainless steel
Suitable actuators	Non-Spring	SY1 AMB(X) PRB(X)
	Electronic fail-safe	GKB(X) PKRB(X)

Product features

Product features Fast quarter turn open or closed operation, stainless-steel ball and stem, positive isolation, two-piece body construction

Application This valve is typically used in air handling units on heating or cooling coils, and fan coil unit heating or cooling coils. Some other common applications include Unit Ventilators, VAV box re-heat coils and bypass loops. This valve is suitable for use in a hydronic system with variable flow.

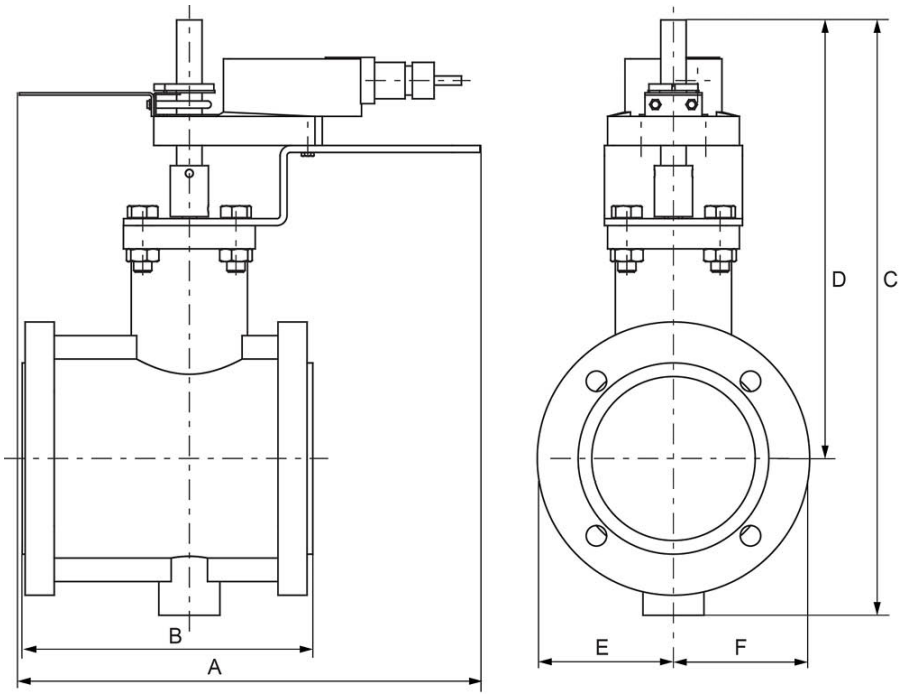
Flow/Mounting details



Dimensions

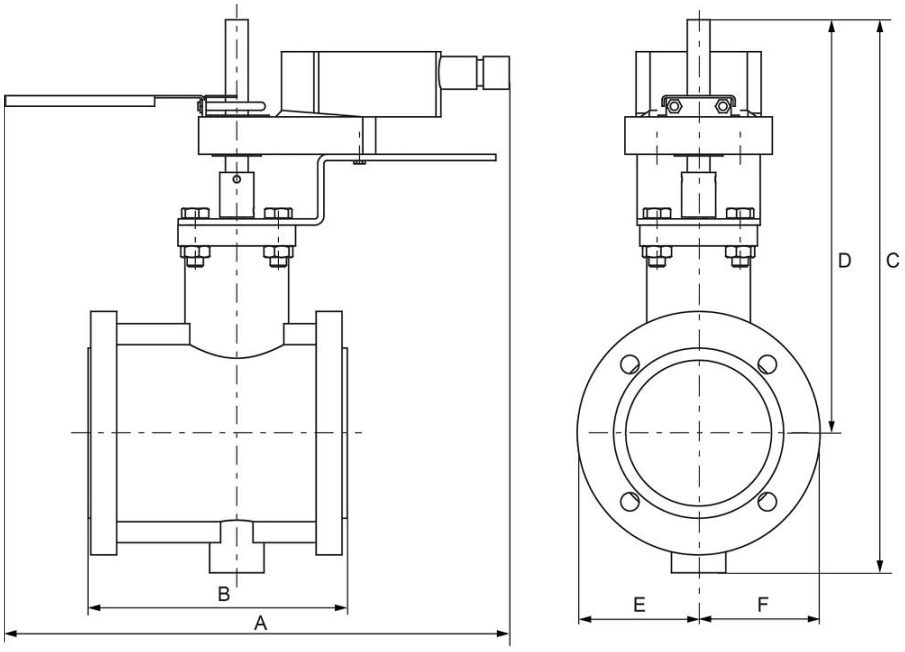
Dimensional drawings

B6VB-AM



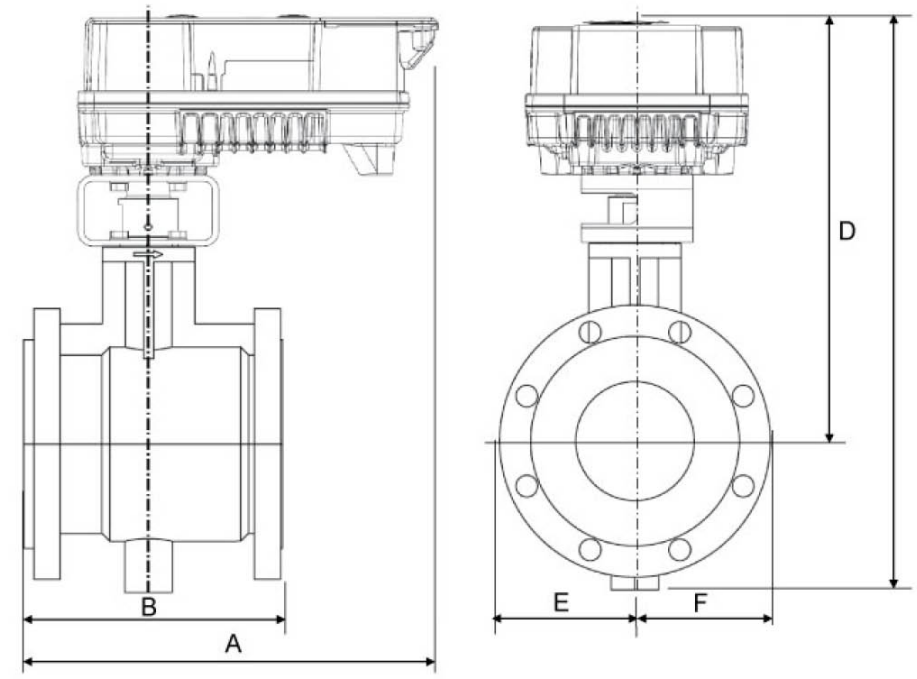
A	B	C	D	E	F
12.6" [320]	8.0" [203]	16.3" [415]	12.0" [306]	3.7" [95]	3.7" [95]

B6VB-GK



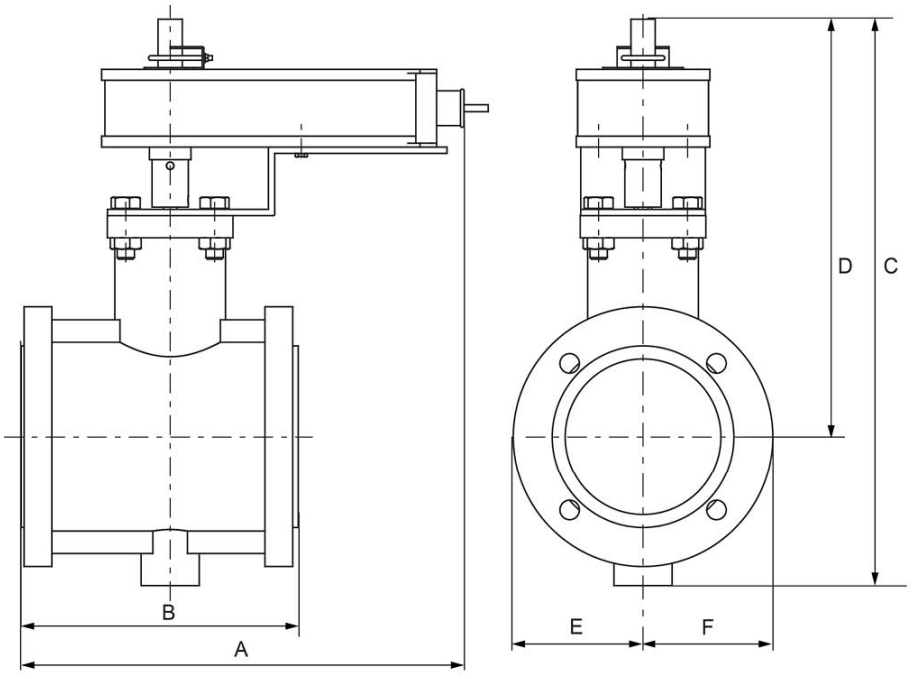
A	B	C	D	E	F
13.1" [332]	8.0" [203]	17.0" [433]	12.7" [323]	3.7" [95]	3.7" [95]

B6VB-PR



A	B	C	D	E	F
11.8" [299]	8.0" [203]	18.9" [480]	14.6" [371]	3.9" [100]	3.9" [100]

B6VB-AF



A	B	C	D	E	F
12.7" [323]	8.0" [203]	16.4" [416]	12.0" [306]	3.7" [95]	3.7" [95]

BELIMO

Modulating, Non-Spring Return, 24 V, Multi-Function Technology®

Technical data sheet AMX24-MFT-X1

5-year warranty

Technical data

Electrical data	Nominal voltage	AC/DC 24 V
	Nominal voltage frequency	50/60 Hz
	Power consumption in operation	3.5 W
	Power consumption in rest position	1.3 W
	Transformer sizing	6 VA
	Electrical Connection	18 GA plenum cable, 3 ft [1 m], with 1/2" conduit connector (10 ft [3 m] and 15 ft [5 m] available)
	Overload Protection	electronic throughout 0...95° rotation
Functional data	Operating range Y	2...10 V
	Operating range Y note	4...20 mA w/ ZG-R01 (500 Ω, 1/4 W resistor)
	Input Impedance	100 kΩ for 2...10 V (0.1 mA), 500 Ω for 4...20 mA, 1500 Ω for PWM, On/Off and Floating point
	Operating range Y variable	Start point 0.5...30 V End point 2.5...32 V
	Options positioning signal	variable (VDC, PWM, on/off, floating point)
	Position feedback U	2...10 V
	Position Feedback	2...10 V, Max. 0.5 mA, VDC variable
	Position feedback U note	Max. 0.5 mA
	Position feedback U variable	VDC variable
	Direction of motion motor	selectable with switch 0/1
	Manual override	external push button
	Angle of rotation	Max. 95°, adjustable with mechanical stop
	Angle of rotation note	adjustable with mechanical stop
	Running Time (Motor)	default 150 s, variable 90...350 s
	Running time motor variable	90...350 s
	Noise level, motor	45 dB(A)
	Position indication	Mechanically, integrated, two-section
Safety data	Degree of protection IEC/EN	IP54
	Degree of protection NEMA/UL	NEMA 2
	Enclosure	UL Enclosure Type 2
	Agency Listing	cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2014/30/EU and 2014/35/EU
	Quality Standard	ISO 9001
	Ambient temperature	-22...150°F [-30...65°C]
	Storage temperature	-40...176°F [-40...80°C]
	Ambient humidity	max. 95% r.H., non-condensing
	Servicing	maintenance-free
Weight	Weight	4.9 lb [2.0 kg]

Materials	Housing material	UL94-5VA

Electrical installation

INSTALLATION NOTES

A Actuators with appliance cables are numbered.

1 Provide overload protection and disconnect as required.

3 Actuators may also be powered by 24 VDC.

5 Only connect common to negative (-) leg of control circuits.

7 A 500 Ω resistor (ZG-R01) converts the 4...20 mA control signal to 2...10 V.

8 Control signal may be pulsed from either the Hot (Source) or Common (Sink) 24 V line.

10 For triac sink the Common connection from the actuator must be connected to the Hot connection of the controller. Position feedback cannot be used with a triac sink controller; the actuator internal common reference is not compatible.

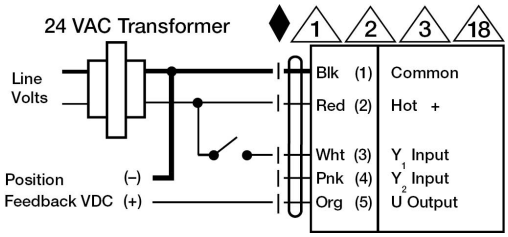
11 Actuators may be connected in parallel if not mechanically linked. Power consumption and input impedance must be observed.

12 IN4004 or IN4007 diode. (IN4007 supplied, Belimo part number 40155).

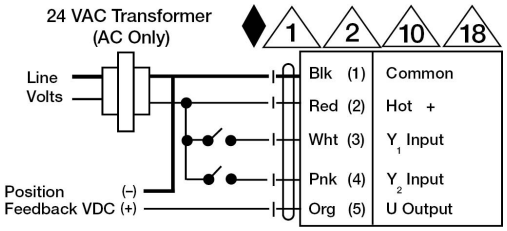
Meets cULus requirements without the need of an electrical ground connection.

Warning! Live Electrical Components!

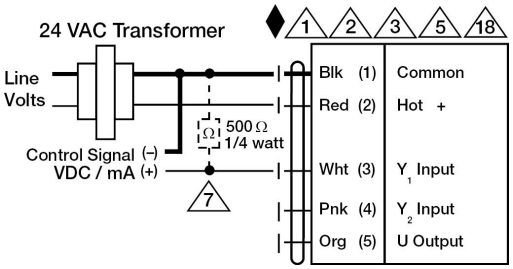
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



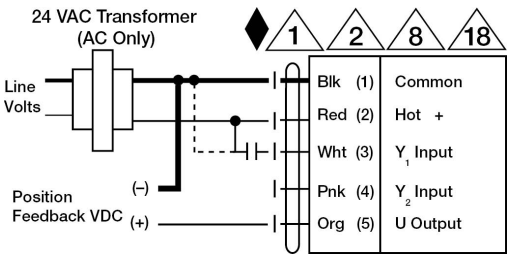
On/Off



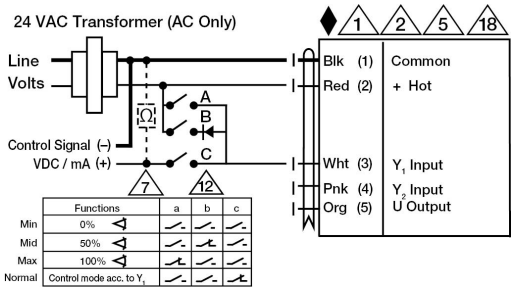
Floating Point



VDC/mA Control



PWM Control



Override Control

Control Wire

(This page is hyperlinked to the TOC)

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Multi-Conductor, Shielded, Plenum

NEC Type CMP and/or CL3P

PART NUMBER	NO. OF COND.	AWG. SIZE	COND. STRAND	NOM. INSUL. THICKNESS		NOM. JACKET WALL		NOMINAL O.D.	WEIGHT
				INCHES	MM	INCHES	MM	INCHES	POUNDS
22 AWG CONDUCTORS									
W221P-2044	2	22	7/30	0.008	0.20	0.015	0.38	0.128	13 lbs.
W223C-2144	3	22	7/30	0.008	0.20	0.015	0.38	0.131	16 lbs.
W224C-2020	4	22	7/30	0.008	0.20	0.015	0.38	0.147	19 lbs.
W226C-2077	6	22	7/30	0.008	0.20	0.015	0.38	0.173	24 lbs.
W228C-2032	8	22	7/30	0.008	0.20	0.015	0.38	0.184	28 lbs.
20 AWG CONDUCTORS									
W201P-2057	2	20	7/28	0.009	0.23	0.015	0.38	0.143	15 lbs.
W203C-2173	3	20	7/28	0.009	0.23	0.015	0.38	0.151	19 lbs.
W204C-2124	4	20	7/28	0.009	0.23	0.015	0.38	0.166	24 lbs.
18 AWG CONDUCTORS									
W181P-2040	2	18	7/26	0.008	0.20	0.015	0.38	0.164	21 lbs.
W183C-2058	3	18	7/26	0.008	0.20	0.015	0.38	0.169	28 lbs.
W184C-2059	4	18	7/26	0.008	0.20	0.015	0.38	0.185	36 lbs.
W186C-2055	6	18	7/26	0.009	0.23	0.015	0.38	0.231	51 lbs.
W188C-2030	8	18	7/26	0.009	0.23	0.015	0.38	0.252	60 lbs.
W1810C-2088	10	18	7/26	0.009	0.23	0.015	0.38	0.270	70 lbs.
W1812C-2145	12	18	7/26	0.009	0.23	0.015	0.38	0.279	85 lbs.
16 AWG CONDUCTORS									
W161P-2084	2	16	19/.0117	0.008	0.20	0.015	0.38	0.179	27 lbs.
W163C-2018	3	16	19/.0117	0.008	0.20	0.015	0.38	0.190	37 lbs.
W164C-2155	4	16	19/.0117	0.008	0.20	0.015	0.38	0.209	48 lbs.
14 AWG CONDUCTORS									
W141P-2087*	2	14	19/.0147	0.008	0.20	0.015	0.38	0.207	40 lbs.
W144C-2297*	4	14	19/.0147	0.008	0.20	0.015	0.38	0.260	75 lbs.
12 AWG CONDUCTORS									
W121P-2144*	2	12	19/.0185	0.008	0.20	0.015	0.38	0.244	55 lbs.
W124C-2273*	4	12	19/.0185	0.008	0.20	0.015	0.38	0.288	120 lbs.

** NEC CL3P only*

UL LISTED

Designed to Meet UL 910 Test For Flame Propagation & Smoke Density
Underwriters Laboratories Inc.

Color Code Chart

NO. OF COND.	COLOR
1	Black
2	White
3	Red
4	Green

NO. OF COND.	COLOR
5	Brown
6	Blue
7	Orange
8	Yellow

Product Construction

CONDUCTOR:
- Stranded bare copper per ASTM B-3, B-8 and B-286

INSULATION:
- Premium grade color coded Plenum Rated PVC

SHIELD:
- Overall Flexfoil® polyester supported aluminum foil
- Stranded tinned copper drain wire

JACKET:
- Premium grade Plenum Rated PVC
- Multiple jacket colors available – consult sales office
- Sequential footage markings to facilitate installation
- Suitable for use from -20°C to + 75°C
- Ripcord available – consult Customer Service for details

APPLICATIONS:
- Power limited control circuits
- Wiring of the following systems:
  - Intercom
  - Security
  - Audio
  - Background music
- Suggested voltage rating: 300 volts

COMPLIANCES:
- NEC Article 725 Type CL3P (UL: 75°C, 150V)
- NEC Article 800 Type CMP (UL: 75°C, 300V)

PACKAGING:
- 1000' (305m) Pull-Pac® Cartons
- 1000' (305m) Reels
- Other put-ups available– consult Customer Service

CONNECT AIR
GENUINE CABLE GROUP

PennState
Physical Plant

Control Enclosures and Perforated Panel

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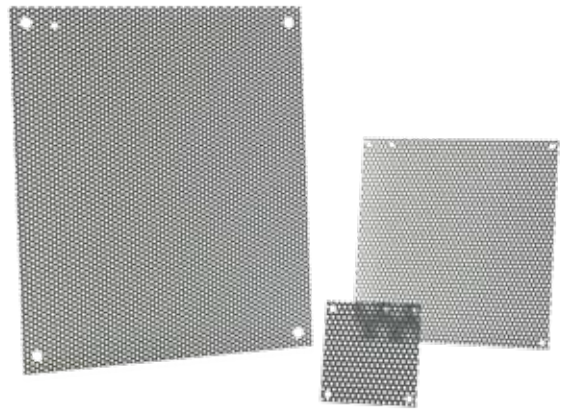
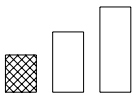
PERFORATED PANELS

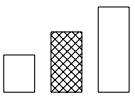


Perforated panels are 16 gauge steel and accept self-tapping screws and eliminate the need to measure, mark and drill when mounting components. Use for mounting lightweight control components.

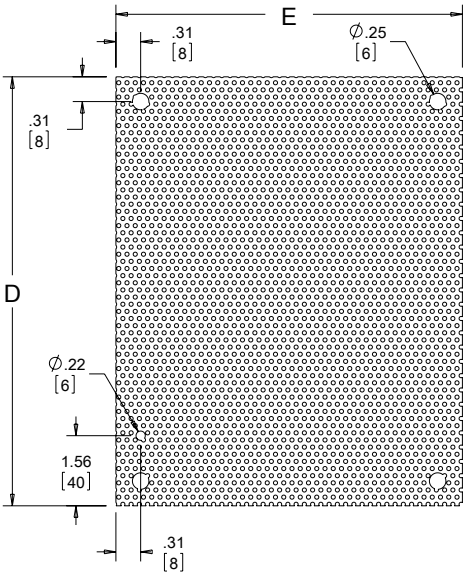
BULLETIN: PNLP

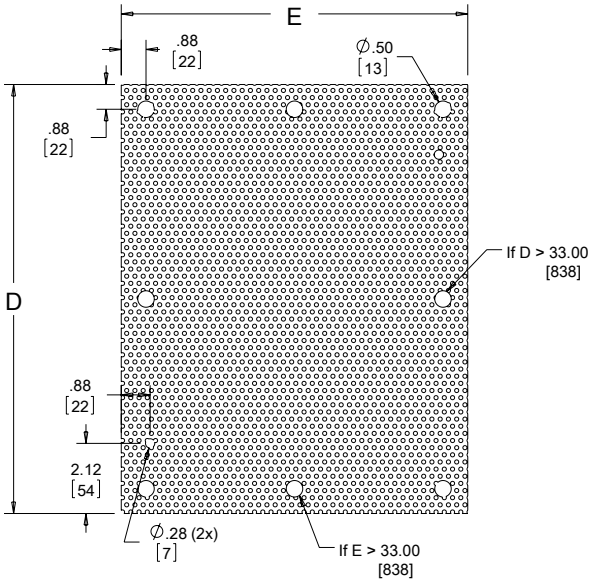
Catalog Number	Use in	Panel Size D x E (in.)	Panel Size D x E (mm)
A6N6PP	Small Type 1 Panel Enclosures and Small Type 3R Boxes	4.25 x 4.25	108 x 108
A8N6PP	Small Type 1 Panel Enclosures and Small Type 3R Boxes	6.25 x 4.25	159 x 108
A8N8PP	Small Type 1 Panel Enclosures and Small Type 3R Boxes	6.25 x 6.25	159 x 159
A10N8PP	Small Type 1 Panel Enclosures and Small Type 3R Boxes	8.25 x 6.25	210 x 159
A10N10PP	Small Type 1 Panel Enclosures and Small Type 3R Boxes	8.25 x 8.25	210 x 210
A12N10PP	Small Type 1 Panel Enclosures and Small Type 3R Boxes	10.25 x 8.25	260 x 210
A12N12PP	Small Type 1 Panel Enclosures and Small Type 3R Boxes	10.25 x 10.25	260 x 260
A14N12PP	Small Type 1 Panel Enclosures and Small Type 3R Boxes	12.25 x 10.25	311 x 260
A16N12PP	Small Type 1 Panel Enclosures and Small Type 3R Boxes	14.25 x 10.25	362 x 260
A20N12PP	Small Type 1 Panel Enclosures and Small Type 3R Boxes	18.25 x 10.25	464 x 260
A16N12MPP	Medium Type 1 Panel Enclosures	13.00 x 10.50	330 x 267
A16N16MPP	Medium Type 1 Panel Enclosures	13.00 x 14.50	330 x 368
A16N20MPP	Medium Type 1 Panel Enclosures	13.00 x 18.50	330 x 470
A18N18MPP	Medium Type 1 Panel Enclosures	15.00 x 16.50	381 x 419
A20N12MPP	Medium Type 1 Panel Enclosures	17.00 x 10.50	432 x 267
A20N16MPP	Medium Type 1 Panel Enclosures	17.00 x 14.50	432 x 368
A20N20MPP	Medium Type 1 Panel Enclosures	17.00 x 18.50	432 x 470
A24N16MPP	Medium Type 1 Panel Enclosures	21.00 x 14.50	533 x 368
A24N20MPP	Medium Type 1 Panel Enclosures	21.00 x 18.50	533 x 470
A24N24MPP	Medium Type 1 Panel Enclosures	21.00 x 22.50	533 x 572
A30N20MPP	Medium Type 1 Panel Enclosures	26.00 x 18.50	660 x 470
A30N24MPP	Medium Type 1 Panel Enclosures	26.00 x 22.50	660 x 572
A30N30MPP	Medium Type 1 Panel Enclosures	26.00 x 28.50	660 x 724
A36N24MPP	Medium Type 1 Panel Enclosures	32.00 x 22.50	813 x 572
A36N30MPP	Medium Type 1 Panel Enclosures	32.00 x 26.50	813 x 724
A16P12PP	Medium Type 3R Hinged-Cover Panel Enclosures	13.00 x 9.00	330 x 229
A16P16PP	Medium Type 3R Hinged-Cover Panel Enclosures	13.00 x 13.00	330 x 330
A20P16PP	Medium Type 3R Hinged-Cover Panel Enclosures	17.00 x 13.00	432 x 330
A18P18PP	Medium Type 3R Hinged-Cover Panel Enclosures	15.00 x 15.00	381 x 381
A20P20PP	Medium Type 3R Hinged-Cover Panel Enclosures	17.00 x 17.00	432 x 732
A24P20PP	Medium Type 3R Hinged-Cover Panel Enclosures	21.00 x 17.00	533 x 432
A24P24PP	Medium Type 3R Hinged-Cover Panel Enclosures	21.00 x 21.00	533 x 533
A30P24PP	Medium Type 3R Hinged-Cover Panel Enclosures	27.00 x 21.00	686 x 533
A36P24PP	Medium Type 3R Hinged-Cover Panel Enclosures	33.00 x 21.00	838 x 533
A30P30PP	Medium Type 3R Hinged-Cover Panel Enclosures	27.00 x 27.00	686 x 686
A36P30PP	Medium Type 3R Hinged-Cover Panel Enclosures	33.00 x 27.00	838 x 686
A36P36PP	Medium Type 3R Hinged-Cover Panel Enclosures	33.00 x 33.00	838 x 838

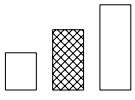




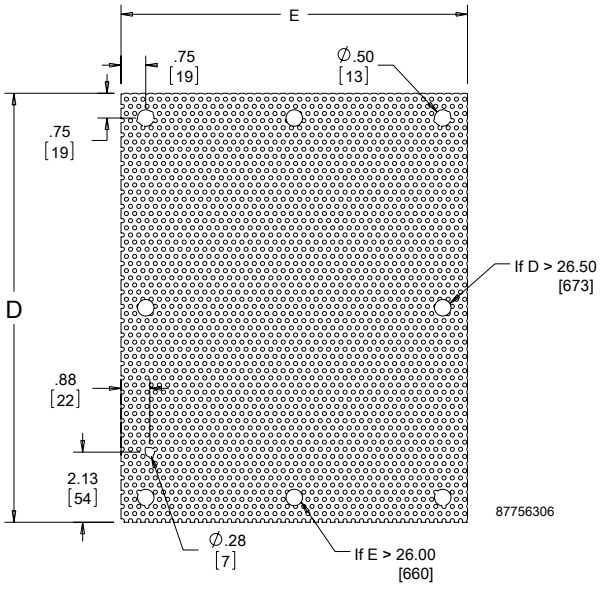
Type 3R

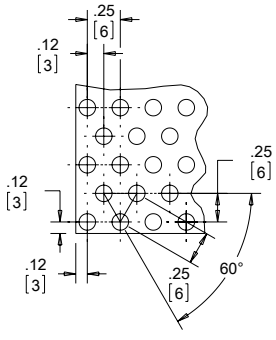






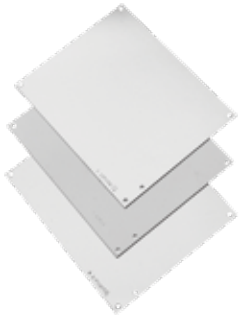
Type 1

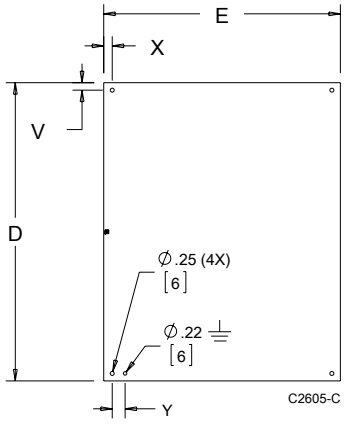




PANELS FOR JUNCTION BOXES

BULLETIN: PNLJ, PNLWM





Steel panels are 14 gauge, finished with white polyester powder paint or with a conductive, corrosion-resistant coating. Stainless steel panels are 14 gauge Type 304 and have a commercial #3 finish which is protected on one side with a plastic film. Aluminum panels are 5052-H32 aluminum alloy 0.080-in. (2-mm) thick and protected on one side with a plastic film. Panel mounting hardware is furnished with all enclosures which accept these panels.

Catalog Number	Material	Panel Size D x E (in.)	Panel Size D x E (mm)	V (in.)	V (mm)	X (in.)	X (mm)	Y (in.)	Y (mm)
A4P4G	Conductive	2.88 x 2.88	73 x 73	.31	8	.31	8	1.25	32
A6P4	Painted steel	4.88 x 2.88	124 x 73	.31	8	.31	8	1.25	32
A6P4G	Conductive steel	4.88 x 2.88	124 x 73	.31	8	.31	8	1.25	32
A6P4SS	Stainless Steel	4.88 x 2.88	124 x 73	.31	8	.31	8	1.25	32
A6P4AL	Aluminum	4.88 x 2.88	124 x 73	.31	8	.31	8	1.25	32
A6P6	Painted steel	4.88 x 4.88	124 x 124	.31	8	.31	8	1.25	32
A6P6G	Conductive steel	4.88 x 4.88	124 x 124	.31	8	.31	8	1.25	32
A6P6SS	Stainless Steel	4.88 x 4.88	124 x 124	.31	8	.31	8	1.25	32
A6P6AL	Aluminum	4.88 x 4.88	124 x 124	.31	8	.31	8	1.25	32
A7P7G	Conductive	5.88 x 5.88	149 x 149	.31	8	.31	8	1.25	32
A8P6	Painted steel	6.75 x 4.88	171 x 124	.25	6	.31	8	1.25	32
A8P6G	Conductive steel	6.75 x 4.88	171 x 124	.25	6	.31	8	1.25	32
A8P6SS	Stainless Steel	6.75 x 4.88	171 x 124	.25	6	.31	8	1.25	32
A8P6AL	Aluminum	6.75 x 4.88	171 x 124	.25	6	.31	8	1.25	32
A8P8	Painted steel	6.75 x 6.88	171 x 175	.25	6	.31	8	1.25	32
A8P8G	Conductive Steel	6.75 x 6.88	171 x 175	.25	6	.31	8	1.25	32
A8P8AL	Aluminum	6.75 x 6.88	171 x 175	.25	6	.31	8	1.25	32
A9P6G	Conductive	7.38 x 4.63	187 x 118	.31	8	.31	8	1.25	32
A10P8	Painted steel	8.75 x 6.88	222 x 175	.25	6	.31	8	1.25	32
A10P8G	Conductive steel	8.75 x 6.88	222 x 175	.25	6	.31	8	1.25	32
A10P8SS	Stainless Steel	8.75 x 6.88	222 x 175	.25	6	.31	8	1.25	32
A10P8AL	Aluminum	8.75 x 6.88	222 x 175	.25	6	.31	8	1.25	32
A10P10	Painted steel	8.75 x 8.88	222 x 226	.25	6	.31	8	1.25	32
A10P10G	Conductive steel	8.75 x 8.88	222 x 226	.25	6	.31	8	1.25	32
A10P10AL	Aluminum	8.75 x 8.88	222 x 226	.25	6	.31	8	1.25	32
A12P6	Painted steel	10.75 x 4.88	273 x 124	.25	6	.31	8	1.25	32
A12P6G	Conductive steel	10.75 x 4.88	273 x 124	.25	6	.31	8	1.25	32
A12P10	Painted steel	10.75 x 8.88	273 x 226	.25	6	.31	8	1.25	32
A12P10G	Conductive steel	10.75 x 8.88	273 x 226	.25	6	.31	8	1.25	32
A12P10SS	Stainless Steel	10.75 x 8.88	273 x 226	.25	6	.31	8	1.25	32
A12P10AL	Aluminum	10.75 x 8.88	273 x 226	.25	6	.31	8	1.25	32
A12P12	Painted steel	10.75 x 10.88	273 x 276	.25	6	.31	8	1.25	32
A12P12G	Conductive steel	10.75 x 10.88	273 x 276	.25	6	.31	8	1.25	32
A12P12SS	Stainless Steel	10.75 x 10.88	273 x 276	.25	6	.31	8	1.25	32
A14P8	Painted steel	12.75 x 6.88	324 x 175	.25	6	.31	8	1.25	32
A14P8G	Conductive steel	12.75 x 6.88	324 x 175	.25	6	.31	8	1.25	32
A14P12	Painted steel	12.75 x 10.88	324 x 276	.25	6	.31	8	1.25	32
A14P12G	Conductive steel	12.75 x 10.88	324 x 276	.25	6	.31	8	1.25	32
A14P12SS	Stainless Steel	12.75 x 10.88	324 x 276	.25	6	.31	8	1.25	32
A14P12AL	Aluminum	12.75 x 10.88	324 x 276	.25	6	.31	8	1.25	32
A16P10	Painted steel	14.75 x 8.88	375 x 226	.25	6	.31	8	1.25	32
A16P10G	Conductive steel	14.75 x 8.88	375 x 226	.25	6	.31	8	1.25	32
A16P14	Painted steel	14.75 x 12.88	375 x 327	.25	6	.31	8	1.25	32
A16P14G	Conductive steel	14.75 x 12.88	375 x 327	.25	6	.31	8	1.25	32
A16P14SS	Stainless Steel	14.75 x 12.88	375 x 327	.25	6	.31	8	1.25	32
A16P14AL	Aluminum	14.75 x 12.88	375 x 327	.25	6	.31	8	1.25	32
A18P16	Painted steel	16.75 x 14.88	425 x 378	.25	6	.31	8	1.25	32
A18P16G	Conductive steel	16.75 x 14.88	425 x 378	.25	6	.31	8	1.25	32
A18P16SS	Stainless Steel	16.75 x 14.88	425 x 378	.25	6	.31	8	1.25	32
A18P16AL	Aluminum	16.75 x 14.88	425 x 378	.25	6	.31	8	1.25	32
A20P16J	Painted	18.75 x 14.88	476 x 378	.47	12	.54	14	.81	21
A20P16JAL	Aluminum	18.75 x 14.88	476 x 378	.47	12	.54	14	.81	21

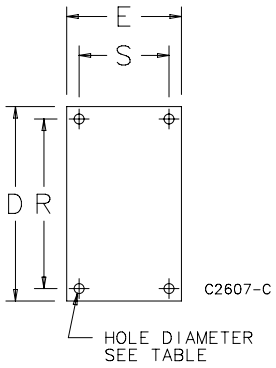
COMPOSITE PANELS FOR JUNCTION BOXES AND UL/NEMA WALL-MOUNT ENCLOSURES

Manufactured from light-brown, reinforced phenolic laminate sheet stock. This material has exceptional strength and chemical resistance, which makes it ideally suited for the most corrosive environments. Composite panels are intended for use in corrosion-resistant enclosures. Panel sizes are available for junction boxes and UL/NEMA size enclosures. Composite panels may be drilled and tapped but work equally as well with self-threading or thread-cutting screws. Refer to the table for recommended mounting specifications.

BULLETIN: PNLC

Standard Product

Catalog Number	Panel Size D x E in./mm	R in./mm	S in./mm	Hole Dia. in./mm	Panel Thickness in./mm
A6P4C	4.88 x 2.88 124 x 73	4.25 108	2.25 57	0.25 6	0.12 3
A6P6C	4.88 x 4.88 124 x 124	4.25 108	4.25 108	0.25 6	0.12 3
A8P6C	6.75 x 4.88 171 x 124	6.25 159	4.25 108	0.25 6	0.12 3
A10P8C	8.75 x 6.88 222 x 175	8.25 210	6.25 159	0.25 6	0.12 3
A12P10C	10.75 x 8.88 273 x 226	10.25 260	8.25 210	0.25 6	0.19 5
A14P12C	12.75 x 10.88 324 x 276	12.25 311	10.25 260	0.25 6	0.19 5
A16P14C	14.75 x 12.88 375 x 327	14.25 362	12.25 311	0.25 6	0.19 5
A18P16C	16.75 x 14.88 425 x 379	16.25 413	14.25 362	0.25 6	0.19 5
A20P16C	17.00 x 13.00 432 x 330	15.25 387	11.25 286	0.50 13	0.19 5
A20P20C	17.00 x 17.00 432 x 432	15.25 387	15.25 387	0.50 13	0.19 5
A24P20C	21.00 x 17.00 533 x 432	19.25 489	15.25 387	0.50 13	0.19 5
A24P24C	21.00 x 21.00 533 x 533	19.25 489	19.25 489	0.50 13	0.19 5
A30P24C	27.00 x 21.00 686 x 533	25.25 641	19.25 489	0.50 13	0.19 5



Composite Panel Mounting Recommendations

Screw Type	Screw Size	Hole Size in./mm	Max. Insertion Torque (lb.) in 0.12 in. Material	Max. Insertion Torque (lb.) in 0.19 in. Material	Max. Load (lb. per screw) in 0.12 in. Material	Max. Load (lb. per screw) in 0.19 in. Material
Machine (tapped hole)	8-32	.136 3	15	25	40	45
Machine (tapped hole)	10-32	.161 4	15	25	35	40
Machine (tapped hole)	1/4-20	.204 5	20	25	30	35
Thread Cutting Type T	8-32	.144 4	15	25	40	45
Thread Cutting Type T	10-32	.166 4	15	25	35	40
Thread Cutting Type T	1/4-20	.288 7	20	25	30	35
Sheet Metal A-B	8-32	.147 4	Not recommended	10	40	45
Sheet Metal A-B	10-32	.166 4	Not recommended	10	35	40
Sheet Metal A-B	1/4-20	.221 6	Not recommended	15	30	35

JUNCTION BOX AND WALL-MOUNT ENCLOSURE SWING-OUT PANEL KIT

Kits allow mounting standard Hoffman junction box and NEMA style panels (purchase separately) near the front of the enclosure for easy access to or reading of gauges, switches, pilot lights and other components. Kits consist of heavy-gauge brackets and hinges which are easily installed by drilling small holes in the sides of the enclosure and bolting the brackets in place. External screws are stainless steel; internal components are plated steel. All mounting hardware and instructions are provided. Sealing washers ensure the enclosure will meet original JIC or NEMA standards after installation.
Swing-Out Panel Kits do not fit single-door disconnect enclosures.

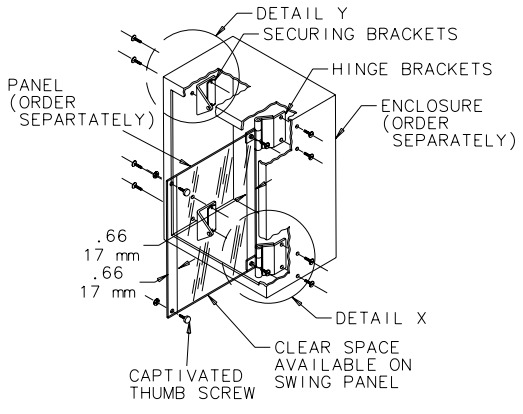
BULLETIN: A80

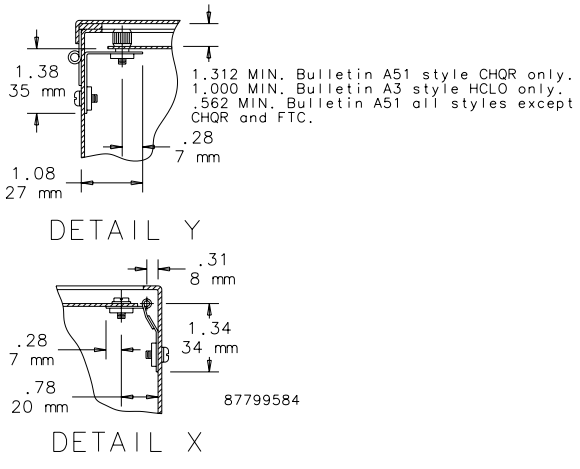
Catalog Number	Description	Maximum Load (lb.)	Maximum Load (kg)	Use In
AJCDFK	Junction Box Kit	25	11.3	- Junction boxes where A x B is 8.00 x 6.00 in. (203 x 152 mm) or larger - HCLO Type 3R enclosures where A x B is 16.00 x 12.00 in. (406 x 305 mm) or smaller
ANADFK	Wall-Mount Enclosure Kit	100	45.4	- One-door Type 4, 4X, 12 and 13 enclosures where A x B is 12.00 x 12.00 in. (305 x 305 mm) or larger - HCLO Type 3R enclosures where A x B is 16.00 x 16.00 in. (406 x 406 mm) or larger - HCR Type 3R enclosures where A x B is 16.00 x 12.00 (406 x 305 mm) or larger - Type 1 enclosures where A x B is 42.00 x 30.00 in. (1067 x 762 mm) or larger

Both kits maintain UL Type 4 and Type 4X rating when properly installed in a Hoffman enclosure.

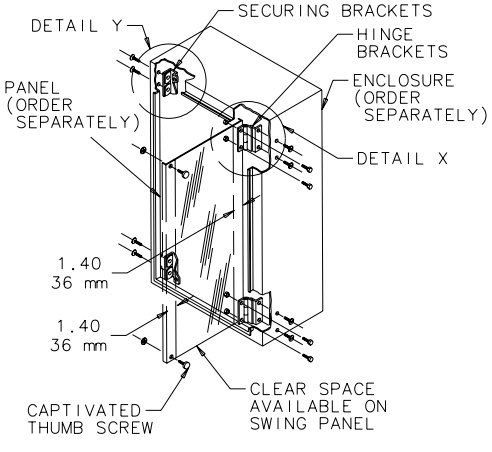
Maximum load includes the weight of the panel plus the weight of the components, with the weight of the components spread evenly over the panel.

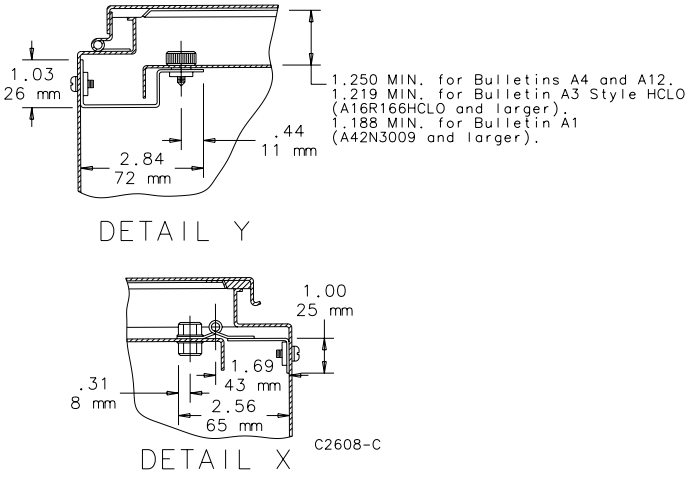
Junction Box Swing-Out Panel Kit





Wall-Mount Enclosure Swing-Out Panel Kit

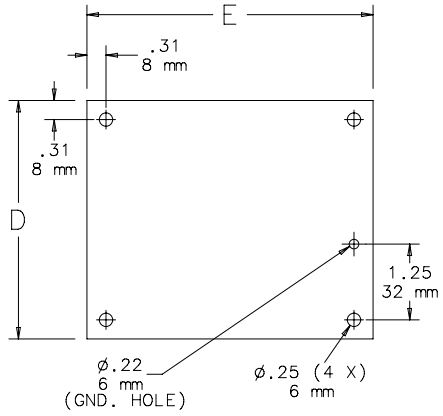




PANELS FOR TYPE 1 ENCLOSURES AND SMALL TYPE 3R ENCLOSURES

Steel panels are 14 gauge, finished with white polyester powder paint. Panel mounting hardware is furnished with enclosure.

BULLETIN: PNLT1



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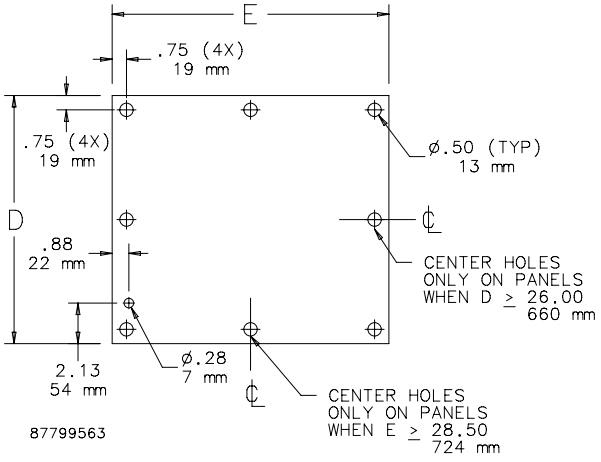
Catalog Number	Panel Size D x E (in.)	Panel Size D x E (mm)
A6N4P	4.25 x 2.25	108 x 57
A6N6P	4.25 x 4.25	108 x 108
A8N6P	6.25 x 4.25	159 x 108
A8N8P	6.25 x 6.25	159 x 159
A10N8P	8.25 x 6.25	210 x 159
A10N10P	8.25 x 8.25	210 x 210
A12N10P	10.25 x 8.25	260 x 210
A12N12P	10.25 x 10.25	260 x 260
A14N12P	12.25 x 10.25	311 x 260
A16N12P	14.25 x 10.25	362 x 260
A20N12P	18.25 x 10.25	464 x 260

PANELS FOR MEDIUM TYPE 1 ENCLOSURES

Steel panels are 14 or 12 gauge with a white polyester powder paint finish. Panel mounting hardware is furnished with enclosure.

BULLETIN: PNLT1

Catalog Number	Panel Thickness (ga.)	Panel Size D x E (in.)	Panel Size D x E (mm)
A16N12MP	14	13.00 x 10.50	330 x 267
A20N12MP	14	17.00 x 10.50	432 x 267
A16N16MP	14	13.00 x 14.50	330 x 368
A20N16MP	14	17.00 x 14.50	432 x 368
A24N16MP	14	21.00 x 14.50	533 x 368
A18N18MP	14	15.00 x 16.50	381 x 419
A16N20MP	14	13.00 x 18.50	330 x 470
A20N20MP	14	17.00 x 18.50	432 x 470
A24N20MP	14	21.00 x 18.50	533 x 470
A30N20MP	14	26.00 x 18.50	660 x 470
A24N24MP	12	21.00 x 22.50	533 x 571
A30N24MP	12	26.00 x 22.50	660 x 571
A36N24MP	12	32.00 x 22.50	813 x 571
A30N30MP	12	26.00 x 28.50	660 x 724
A36N30MP	12	32.00 x 28.50	813 x 724



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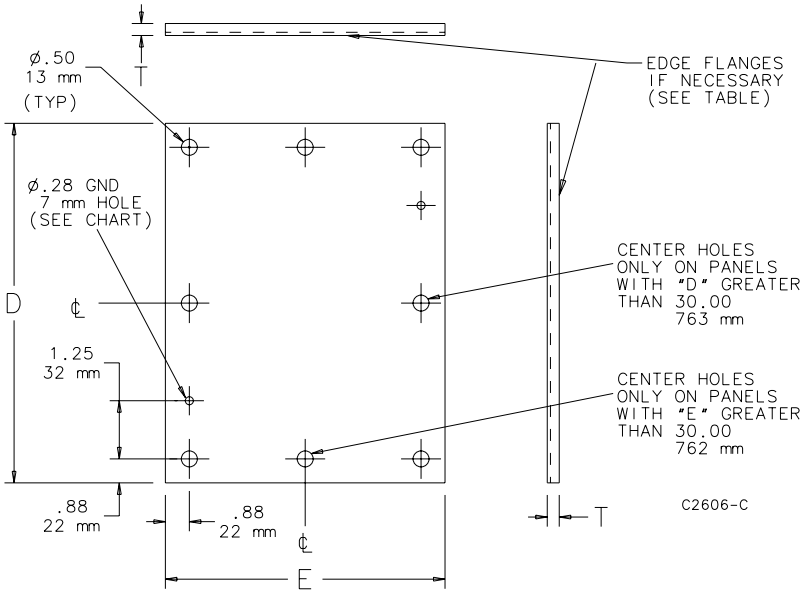
PANELS FOR TYPE 3R, 4, 4X, 12 AND 13 ENCLOSURES

Steel panels are 12 gauge, finished with white polyester powder paint or a conductive, corrosion-resistant coating. Larger panels have flanges on two or four sides. Some larger steel panels are 10 gauge and include extra holes for panel lifting. Aluminum panels are 5052-H32 aluminum alloy. Larger panels have flanges on four sides. Aluminum panels are protected on one side with a plastic film. Stainless steel panels are Type 316 stainless steel. Panel mounting hardware is furnished with all enclosures which accept these panels.

BULLETIN: PNLFS, PNLJ, PNLWM

Catalog Number	Material	Panel Size D x E (in.)	Panel Size D x E (mm)	Panel Gauge or Thickness	Edge Flanges	T (in.)	T (mm)	Number of Holes
A12P24	Painted steel	9.00 x 21.00	229 x 533	12 ga.	0	—	—	4
A12P24G	Conductive steel	9.00 x 21.00	229 x 533	12 ga.	0	—	—	4
A16P12	Painted steel	13.00 x 9.00	330 x 229	12 ga.	0	—	—	4
A16P12G	Conductive steel	13.00 x 9.00	330 x 229	12 ga.	0	—	—	4
A16P12SS6	Stainless Steel	13.00 x 9.00	330 x 229	12 ga.	0	—	—	4
A16P12AL	Aluminum	13.00 x 9.00	330 x 229	0.10 in./3 mm	0	—	—	4
A16P16	Painted steel	13.00 x 13.00	330 x 330	12 ga.	0	—	—	4
A16P16G	Conductive steel	13.00 x 13.00	330 x 330	12 ga.	0	—	—	4
A16P16SS6	Stainless Steel	13.00 x 13.00	330 x 330	12 ga.	0	—	—	4
A16P16AL	Aluminum	13.00 x 13.00	330 x 330	0.10 in./3 mm	0	—	—	4
A18P18	Painted steel	15.00 x 15.00	381 x 381	12 ga.	0	—	—	4
A18P18G	Conductive steel	15.00 x 15.00	381 x 381	12 ga.	0	—	—	4
A20P12	Painted steel	17.00 x 9.00	432 x 229	12 ga.	0	—	—	4
A20P12G	Conductive steel	17.00 x 9.00	432 x 229	12 ga.	0	—	—	4
A20P16	Painted steel	17.00 x 13.00	432 x 330	12 ga.	0	—	—	4
A20P16G	Conductive steel	17.00 x 13.00	432 x 330	12 ga.	0	—	—	4
A20P16SS6	Stainless Steel	17.00 x 13.00	432 x 330	12 ga.	0	—	—	4
A20P16AL	Aluminum	17.00 x 13.00	432 x 330	0.10 in./3 mm	0	—	—	4
A20P20	Painted steel	17.00 x 17.00	432 x 432	12 ga.	0	—	—	4
A20P20G	Conductive steel	17.00 x 17.00	432 x 432	12 ga.	0	—	—	4
A20P20SS6	Stainless steel	17.00 x 17.00	432 x 432	12 ga.	0	—	—	4
A20P20AL	Aluminum	17.00 x 17.00	432 x 432	0.10 in./3 mm	0	—	—	4
A24P16	Painted steel	21.00 x 13.00	533 x 330	12 ga.	0	—	—	4
A24P16G	Conductive steel	21.00 x 13.00	533 x 330	12 ga.	0	—	—	4
A24P16SS6	Stainless Steel	21.00 x 13.00	533 x 330	12 ga.	0	—	—	4
A24P20	Painted steel	21.00 x 17.00	533 x 432	12 ga.	2	0.75	19	4
A24P20G	Conductive steel	21.00 x 17.00	533 x 432	12 ga.	2	0.75	19	4
A24P20SS6	Stainless Steel	21.00 x 17.00	533 x 432	12 ga.	2	0.75	19	4
A24P20AL	Aluminum	21.00 x 17.00	533 x 432	0.10 in./3 mm	4	0.75	19	4
A24P24	Painted steel	21.00 x 21.00	533 x 533	12 ga.	2	0.75	19	4
A24P24G	Conductive steel	21.00 x 21.00	533 x 533	12 ga.	2	0.75	19	4
A24P24SS6	Stainless Steel	21.00 x 21.00	533 x 533	12 ga.	2	0.75	19	4
A24P24AL	Aluminum	21.00 x 21.00	533 x 533	0.10 in./3 mm	2	0.75	19	4
A30P16	Painted steel	27.00 x 13.00	686 x 330	12 ga.	2	0.75	19	4
A30P16G	Conductive steel	33.00 x 27.00	838 x 686	12 ga.	2	0.75	19	4
A30P20	Painted steel	27.00 x 17.00	686 x 432	12 ga.	2	0.75	19	4
A30P20G	Conductive steel	27.00 x 17.00	686 x 432	12 ga.	2	0.75	19	4
A30P20SS6	Stainless Steel	27.00 x 17.00	686 x 432	12 ga.	2	0.75	19	4
A30P24	Painted steel	27.00 x 21.00	686 x 533	12 ga.	2	0.75	19	4
A30P24G	Conductive steel	27.00 x 21.00	686 x 533	12 ga.	2	0.75	19	4
A30P24SS6	Stainless Steel	27.00 x 21.00	686 x 533	12 ga.	2	0.75	19	4
A30P24AL	Aluminum	27.00 x 21.00	686 x 533	0.10 in./3 mm	2	0.75	19	4
A30P30	Painted steel	27.00 x 27.00	686 x 686	12 ga.	4	0.75	19	4
A30P30G	Conductive steel	27.00 x 27.00	686 x 686	12 ga.	4	0.75	19	4
A30P30SS6	Stainless Steel	27.00 x 27.00	686 x 686	12 ga.	4	0.75	19	4
A36P16	Painted steel	33.00 X 13.00	838 X 330	12 ga.	2	0.75	19	4
A36P16G	Conductive steel	33.00 x 13.00	838 x 330	12 ga.	2	0.75	19	4
A36P24	Painted steel	33.00 x 21.00	838 x 533	12 ga.	2	0.75	19	6
A36P24G	Conductive steel	33.00 x 21.00	838 x 533	12 ga.	2	0.75	19	6
A36P24SS6	Stainless Steel	33.00 x 21.00	838 x 533	12 ga.	2	0.75	19	6
A36P24AL	Aluminum	33.00 x 21.00	838 x 533	0.10 in./3 mm	2	0.75	19	6
A36P30	Painted steel	33.00 x 27.00	838 x 686	12 ga.	4	0.75	19	6
A36P30G	Conductive steel	33.00 x 27.00	838 x 686	12 ga.	4	0.75	19	6
A36P30SS6	Stainless Steel	33.00 x 27.00	838 x 686	12 ga.	4	0.75	19	6
A36P30AL	Aluminum	33.00 x 27.00	838 x 686	0.10 in./3 mm	4	0.75	19	6
A36P36	Painted steel	33.00 x 33.00	838 x 838	12 ga.	4	0.75	19	8
A36P36G	Conductive steel	33.00 x 33.00	838 x 838	12 ga.	4	0.75	19	8
A36P36SS6	Stainless Steel	33.00 x 33.00	838 x 838	12 ga.	4	0.75	19	8
A40P24	Painted steel	37.00 x 21.00	940 x 533	12 ga.	4	0.75	19	6
A40P24G	Conductive steel	37.00 x 21.00	940 x 533	12 ga.	4	0.75	19	6
A40P30	Painted steel	37.00 x 29.00	940 x 737	12 ga.	4	0.75	19	4 (no D dim. center hole)
A40P30G	Conductive steel	37.00 x 29.00	940 x 737	12 ga.	4	0.75	19	4 (no D dim. center hole)
A42P24	Painted steel	39.00 x 21.00	991 x 533	12 ga.	2	0.75	19	6
A42P24G	Conductive steel	39.00 x 21.00	991 x 533	12 ga.	2	0.75	19	6
A42P30	Painted steel	39.00 x 27.00	991 x 686	12 ga.	4	0.75	19	6
A42P30G	Conductive steel	39.00 x 27.00	991 x 686	12 ga.	4	0.75	19	6
A42P30SS6	Stainless Steel	39.00 x 27.00	991 x 686	12 ga.	4	0.75	19	6
A42P36	Painted steel	39.00 x 33.00	991 x 838	12 ga.	4	0.75	19	8
A42P36G	Conductive steel	39.00 x 33.00	991 x 838	12 ga.	4	0.75	19	8
A42P36SS6	Stainless Steel	39.00 x 33.00	991 x 838	12 ga.	4	0.75	19	8
A42P42	Painted steel	39.00 x 39.00	991 x 991	12 ga.	4	0.75	19	8

Catalog Number	Material	Panel Size D x E (in.)	Panel Size D x E (mm)	Panel Gauge or Thickness	Edge Flanges	T (in.)	T (mm)	Number of Holes
A42P42G	Conductive steel	39.00 x 39.00	991 x 991	12 ga.	4	0.75	19	8
A48P24	Painted steel	45.00 x 21.00	1143 x 533	12 ga.	2	0.75	19	6
A48P24G	Conductive steel	45.00 x 21.00	1143 x 533	12 ga.	2	0.75	19	6
A48P30	Painted steel	45.00 x 27.00	1143 x 686	12 ga.	4	0.75	19	6
A48P30G	Conductive steel	45.00 x 27.00	1143 x 686	12 ga.	4	0.75	19	6
A48P36	Painted steel	45.00 x 33.00	1143 x 838	12 ga.	4	0.75	19	8
A48P36G	Conductive steel	45.00 x 33.00	1143 x 838	12 ga.	4	0.75	19	8
A48P36SS6	Stainless Steel	45.00 x 33.00	1143 x 838	12 ga.	4	0.75	19	8
A48P36AL	Aluminum	45.00 x 33.00	1143 x 838	0.10 in./3 mm	4	0.75	19	8
A48P42	Painted steel	45.00 x 39.00	1143 x 991	12 ga.	4	0.75	19	8
A48P42G	Conductive steel	45.00 x 39.00	1143 x 991	12 ga.	4	0.75	19	8
A48P48	Painted steel	44.00 x 44.00	1118 x 1118	10 ga.	4	0.88	22	8
A48P48G	Conductive steel	44.00 x 44.00	1118 x 1118	10 ga.	4	0.88	22	8
A54P42	Painted steel	50.00 x 38.00	1270 x 965	12 ga.	4	0.75	19	8
A54P42G	Conductive steel	50.00 x 38.00	1270 x 965	10 ga.	4	0.75	19	8
A60P24	Painted steel	57.00 x 21.00	1448 x 533	12 ga.	4	0.75	19	6
A60P24G	Conductive steel	57.00 x 21.00	1448 x 533	12 ga.	4	0.75	19	6
A60P30	Painted steel	57.00 x 27.00	1448 x 686	12 ga.	4	0.75	19	6
A60P30G	Conductive steel	57.00 x 27.00	1448 x 686	12 ga.	4	0.75	19	6
A60P36	Painted steel	57.00 x 33.00	1448 x 838	12 ga.	4	0.75	19	8
A60P36G	Conductive steel	57.00 x 33.00	1448 x 838	12 ga.	4	0.75	19	8
A60P36SS6	Stainless Steel	57.00 x 33.00	1448 x 838	12 ga.	4	0.75	19	8
A60P36AL	Aluminum	57.00 x 33.00	1448 x 838	0.10 in./3 mm	4	0.75	19	8
A60BFP42	Painted steel	56.00 x 38.00	1422 x 965	10 ga.	4	0.88	22	10
A60BFP42G	Conductive steel	56.00 x 38.00	1422 x 965	10 ga.	4	0.88	22	10
A60P48	Painted steel	56.00 x 44.00	1422 x 1118	10 ga.	4	0.88	22	12
A60P48G	Conductive steel	56.00 x 44.00	1422 x 1118	10 ga.	4	0.88	22	12
A60P60	Painted steel	56.00 x 56.00	1422 x 1422	10 ga.	4	0.88	22	10
A60P60G	Conductive steel	56.00 x 56.00	1422 x 1422	10 ga.	4	0.88	22	10
A72P36	Painted steel	69.00 x 33.00	1753 x 838	12 ga.	4	0.75	19	8
A72P36G	Conductive steel	69.00 x 33.00	1753 x 838	12 ga.	4	0.75	19	8
A72P60	Painted steel	68.00 x 56.00	1727 x 1422	10 ga.	4	0.88	22	12
A72P60G	Conductive steel	68.00 x 56.00	1727 x 1422	10 ga.	4	0.88	22	12
A72P72	Painted steel	68.00 x 68.00	1727 x 1727	10 ga.	4	0.88	22	10
A72P72G	Conductive steel	68.00 x 68.00	1727 x 1727	10 ga.	4	0.88	22	10

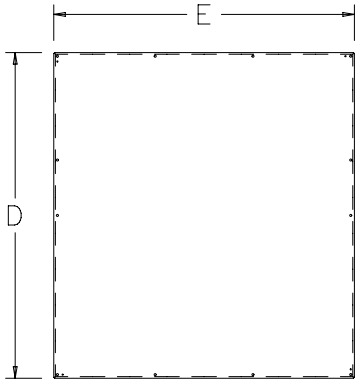


PANELS FOR LARGE BULLETIN A27, A28, A28S4 AND A34 MULTI-DOOR ENCLOSURES

Extra panels for large enclosures (Bulletins A27, A28, A28S4 and A34) can be ordered for panel assembly prior to receiving the enclosures (enclosures include panels). Panels are 10 gauge steel with .80-in. (20-mm) flanges on four sides. Finish is white polyester powder paint or a conductive, corrosion-resistant coating. Two extra holes are provided for lifting and installing panels. Mounting hardware included with enclosure.

BULLETIN: PNLFS

Catalog Number	Finish	Panel Size D x E (in.)	Panel Size D x E (mm)	Number of Holes	Fits Enclosure Height
A72PM28	Painted steel	60.00 x 21.75	1524 x 552	8	72 in.
A72PM28G	Conductive	60.00 x 21.75	1524 x 552	8	72 in.
A72PM34	Painted steel	60.00 x 27.75	1524 x 705	8	72 in.
A72PM34G	Conductive	60.00 x 27.75	1524 x 705	8	72 in.
A72PM40	Painted steel	60.00 x 33.75	1524 x 857	8	72 in.
A72PM40G	Conductive	60.00 x 33.75	1829 x 857	8	72 in.
A72PM54	Painted steel	60.00 x 48.00	1524 x 1219	10	72 in.
A72PM54G	Conductive	60.00 x 48.00	1524 x 1219	10	72 in.
A72PM66	Painted steel	60.00 x 60.00	1524 x 1524	10	72 in.
A72PM66G	Conductive	60.00 x 60.00	1524 x 1524	10	72 in.
A72PM78	Painted steel	60.00 x 72.00	1524 x 1829	12	72 in.
A72PM78G	Conductive	60.00 x 72.00	1524 x 1829	12	72 in.
A84PM40	Painted steel	72.00 x 33.75	1829 x 857	8	84 in.
A84PM40G	Conductive	72.00 x 33.75	1829 x 857	8	84 in.
A84PM78	Painted steel	72.00 x 72.00	1829 x 1829	12	84 in.
A84PM78G	Conductive	72.00 x 72.00	1829 x 1829	12	84 in.
A86PM37	Painted steel	78.00 x 34.00	1981 x 864	8	86 in.
A86PM37G	Conductive	78.00 x 34.00	1981 x 864	8	86 in.
A86PM75	Painted steel	78.00 x 70.00	1981 x 1778	12	86 in.
A86PM75G	Conductive	78.00 x 70.00	1981 x 1778	12	86 in.
A90PM40	Painted steel	78.00 x 33.75	1981 x 857	8	90 in.
A90PM40G	Conductive	78.00 x 33.75	1981 x 857	8	90 in.
A90PM78	Painted steel	78.00 x 72.00	1981 x 1829	12	90 in.
A90PM78G	Conductive	78.00 x 72.00	1981 x 1829	12	90 in.



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PANELS FOR FREE-STAND TYPE 1 LARGE ONE-DOOR ENCLOSURES

Panels for free-stand Type 1 large one-door standard and disconnect enclosures are 12 gauge steel. Panels have either polyester powder paint finish or a conductive, corrosion-resistant coating.

BULLETIN: A38P

Catalog Number	Finish	Panel Size D x E (in.)	Panel Size D x E (mm)
A37P21N	Painted steel	37.16 x 21.50	944 x 546
A37P21NG	Conductive	37.16 x 21.50	944 x 546
A49P21N	Painted steel	49.16 x 21.50	1249 x 546
A49P21NG	Conductive	49.16 x 21.50	1249 x 546
A61P21N	Painted steel	61.16 x 21.50	1553 x 546
A73P21N	Painted steel	73.16 x 21.50	1858 x 546
A73P21NG	Conductive	73.16 x 21.50	1858 x 546
A49P32N	Painted steel	49.16 x 32.00	1249 x 813
A49P32NG	Conductive	49.16 x 32.00	1249 x 813
A61P32N	Painted steel	61.16 x 32.00	1553 x 813
A61P32NG	Conductive	61.16 x 32.00	1553 x 813
A73P32N	Painted steel	73.16 x 32.00	1858 x 813
A73P32NG	Conductive	73.16 x 32.00	1858 x 813

PANELS FOR FREE-STAND TYPE 1 LARGE TWO-DOOR ENCLOSURES

Panels for free-stand Type 1 large two-door standard and disconnect enclosures are 10 gauge steel. Panels have either polyester powder paint finish or a conductive, corrosion-resistant coating.

BULLETIN: A38P

Catalog Number	Finish	Panel Size D x E (in.)	Panel Size D x E (mm)
A37P48N	Painted steel	37.16 x 48.00	944 x 1219
A37P48NG	Conductive	37.16 x 48.00	944 x 1219
A49P48N	Painted steel	49.16 x 48.00	1249 x 1219
A49P48NG	Conductive	49.16 x 48.00	1249 x 1219
A49P68N	Painted steel	49.16 x 68.00	1249 x 1727
A49P68NG	Conductive	49.16 x 68.00	1249 x 1727
A61P68N	Painted steel	61.16 x 68.00	1553 x 1727
A61P68NG	Conductive	61.16 x 68.00	1553 x 1727
A73P68N	Painted steel	73.16 x 68.00	1858 x 1727
A73P68NG	Conductive	73.16 x 68.00	1858 x 1727

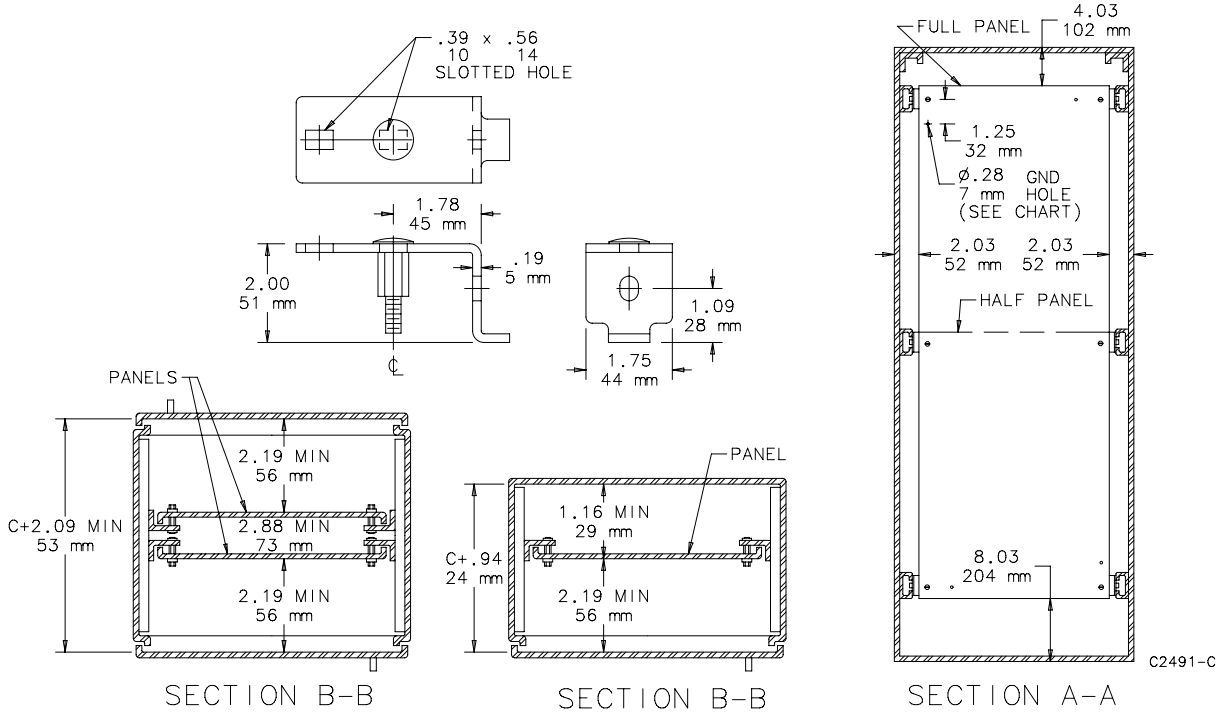
PANELS FOR FREE-STAND TYPE 4, 4X AND 12 SINGLE- AND DUAL-ACCESS ONE-DOOR ENCLOSURES WITH MOUNTING CHANNEL

Panels for one-door, single-access and one-door, dual-access Free-Stand Type 12 Enclosures, Free-Stand Type 4 Enclosures and One-Door Type 4X Free-Stand Fiberglass Enclosures. Panels are 12 gauge steel and can be positioned anywhere along horizontal mounting channels (see dimension drawing Sections B-B for limitations). Half-length panels can be located in the upper or lower portion of the enclosure. Panels are finished with white polyester powder paint or a conductive, corrosion-resistant coating and furnished with plated mounting hardware.

BULLETIN: PNL30, PNLFS

Catalog Number	Description	Finish	Panel Size (in.)	Panel Size (mm)	Fits Enclosure A x B (in.)	Fits Enclosure A x B (mm)
A60P24F1	Full Panel	Painted steel	48.00 x 20.00	1218 x 508	60.00 x 24.00	1524 x 610
A60P24F1G	Full Panel	Conductive	48.00 x 20.00	1218 x 508	60.00 x 24.00	1524 x 610
A60P24F2	Half Panel	Painted steel	24.88 x 20.00	632 x 508	60.00 x 24.00	1524 x 610
A60P24F2G	Half Panel	Conductive	24.88 x 20.00	632 x 508	60.00 x 24.00	1524 x 610
A72P24F1	Full Panel	Painted steel	60.00 x 20.00	1524 x 508	72.00 x 24.00	1829 x 610
A72P24F1G	Full Panel	Conductive	60.00 x 20.00	1524 x 508	72.00 x 24.00	1829 x 610
A72P24F2	Half Panel	Painted steel	30.88 x 20.00	784 x 508	72.00 x 24.00	1829 x 610
A72P24F2G	Half Panel	Conductive	30.88 x 20.00	784 x 508	72.00 x 24.00	1829 x 610
A90P24F1	Full Panel	Painted steel	78.00 x 20.00	1981 x 508	90.00 x 24.00	2286 x 610
A90P24F1G	Full Panel	Conductive	78.00 x 20.00	1981 x 508	90.00 x 24.00	2286 x 610
A90P24F2	Half Panel	Painted steel	39.88 x 20.00	1013 x 508	90.00 x 24.00	2286 x 610
A90P24F2G	Half Panel	Conductive	39.88 x 20.00	1013 x 508	90.00 x 24.00	2286 x 610
A72P30F1	Full Panel	Painted steel	60.00 x 26.00	1524 x 660	72.00 x 30.00	1829 x 762
A72P30F1G	Full Panel	Conductive	60.00 x 26.00	1524 x 660	72.00 x 30.00	1829 x 762
A72P30F2	Half Panel	Painted steel	30.88 x 26.00	784 x 660	72.00 x 30.00	1829 x 762
A72P30F2G	Half Panel	Conductive	30.88 x 26.00	784 x 660	72.00 x 30.00	1829 x 762
A60P36F1	Full Panel	Painted steel	48.00 x 32.00	1219 x 813	60.00 x 36.00	1524 x 914
A60P36F1G	Full Panel	Conductive	48.00 x 32.00	1219 x 813	60.00 x 36.00	1524 x 914
A60P36F2	Half Panel	Painted steel	24.88 x 32.00	632 x 813	60.00 x 36.00	1524 x 914
A60P36F2G	Half Panel	Conductive	24.88 x 32.00	632 x 813	60.00 x 36.00	1524 x 914
A72P36F1	Full Panel	Painted steel	60.00 x 32.00	1524 x 813	72.00 x 36.00	1829 x 914
A72P36F1G	Full Panel	Conductive	60.00 x 32.00	1524 x 813	72.00 x 36.00	1829 x 914
A72P36F2	Half Panel	Painted steel	30.88 x 32.00	784 x 813	72.00 x 36.00	1829 x 914
A72P36F2G	Half Panel	Conductive	30.88 x 32.00	784 x 813	72.00 x 36.00	1829 x 914
A90P36F1	Full Panel	Painted steel	78.00 x 32.00	1981 x 813	90.00 x 36.00	2286 x 914
A90P36F1G	Full Panel	Conductive	78.00 x 32.00	1981 x 813	90.00 x 36.00	2286 x 914
A90P36F2	Half Panel	Painted steel	39.88 x 32.00	1013 x 813	90.00 x 36.00	2286 x 914
A90P36F2G	Half Panel	Conductive	39.88 x 32.00	1013 x 813	90.00 x 36.00	2286 x 914

Use combinations of panels for 3-5 door A 28 enclosures.



PANELS FOR FREE-STAND TYPE 4, 4X AND 12 SINGLE- AND DUAL-ACCESS TWO-DOOR ENCLOSURES WITH MOUNTING CHANNEL

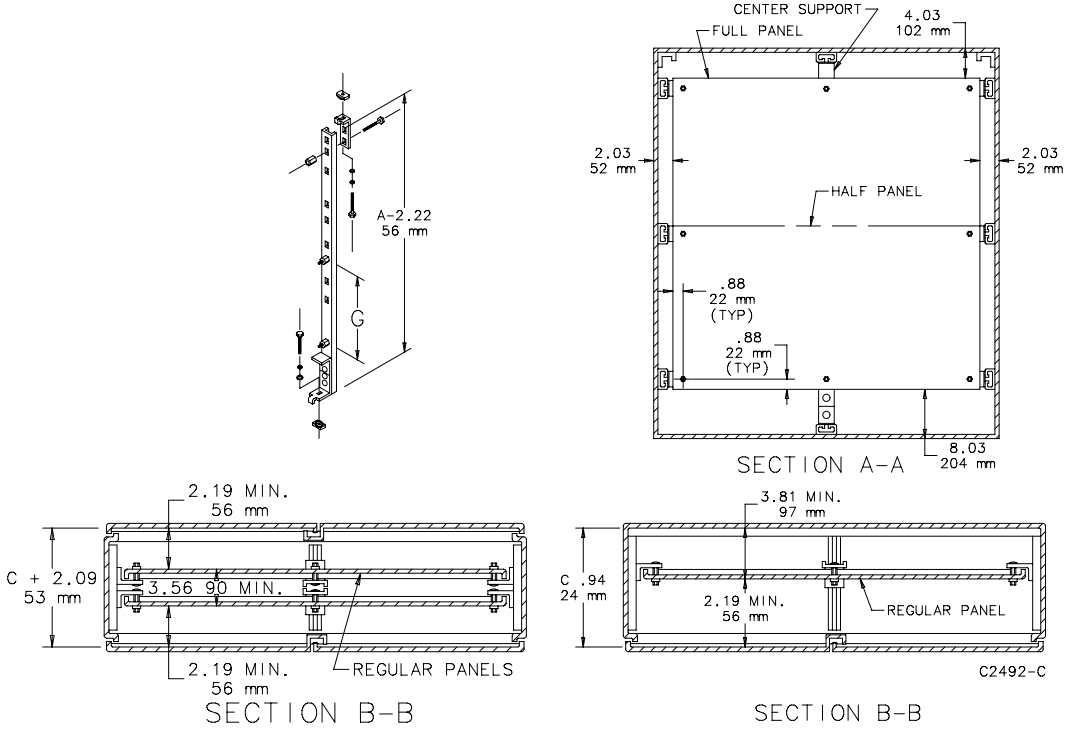
Panels for two-door single access and two-door dual access Free-Stand Type 4, 4X and 12 Enclosures with mounting channel are 10 gauge steel and can be positioned anywhere along horizontal mounting channels (see Sections B-B for limitations). Half-length panels can be located in the upper or lower portion of the enclosure. Some assembly is required.

Panels are finished with white polyester powder paint or a conductive, corrosion-resistant coating and furnished with plated mounting hardware.

Center support is furnished with each full panel or half panel for two-door enclosures. The center support attaches to the top and bottom mounting channels and can be positioned from front to back in the enclosure. The center support can be used with heavy duty panel supports to support panels of various heights.

BULLETIN: PNL30, PNLFS

Catalog Number	Description	Fits Enclosure A x B (in.)	Fits Enclosure A x B (mm)	Panel Size (in.)	Panel Size (mm)	G (in.)	G (mm)
A60P48F1	Full Panel	60.00 x 48.00	1524 x 1219	48.00 x 44.00	1219 x 1118	23.12	587
A60P48F1G	Full Panel	60.00 x 48.00	1524 x 1219	48.00 x 44.00	1219 x 1118	23.12	587
A72P48F1	Full Panel	72.00 x 48.00	1829 x 1219	60.00 x 44.00	1524 x 1118	29.12	740
A72P48F1G	Full Panel	72.00 x 48.00	1829 x 1219	60.00 x 44.00	1524 x 1118	29.12	740
A72P48F2	Half Panel	72.00 x 48.00	1829 x 1219	30.88 x 44.00	784 x 1118	29.12	740
A72P48F2G	Half Panel	72.00 x 48.00	1829 x 1219	30.88 x 44.00	784 x 1118	29.12	740
A90P48F1	Full Panel	90.00 x 48.00	2286 x 1219	78.00 x 44.00	1981 x 1118	38.12	968
A90P48F1G	Full Panel	90.00 x 48.00	2286 x 1219	78.00 x 44.00	1981 x 1118	38.12	968
A90P48F2	Half Panel	90.00 x 48.00	2286 x 1219	39.88 x 44.00	1013 x 1118	38.12	968
A90P48F2G	Half Panel	90.00 x 48.00	2286 x 1219	39.88 x 44.00	1013 x 1118	38.12	968
A72P60F1	Full Panel	72.00 x 60.00	1829 x 1524	60.00 x 56.00	1524 x 1422	29.12	740
A72P60F1G	Full Panel	72.00 x 60.00	1829 x 1524	60.00 x 56.00	1524 x 1422	29.12	740
A72P60F2	Half Panel	72.00 x 60.00	1829 x 1524	30.88 x 56.00	784 x 1422	29.12	740
A72P60F2G	Half Panel	72.00 x 60.00	1829 x 1524	30.88 x 56.00	784 x 1422	29.12	740
A72P72F1	Full Panel	72.00 x 72.00	1829 x 1829	60.00 x 68.00	1524 x 1727	29.12	740
A72P72F1G	Full Panel	72.00 x 72.00	1829 x 1829	60.00 x 68.00	1524 x 1727	29.12	740
A72P72F2	Half Panel	72.00 x 72.00	1829 x 1829	30.88 x 68.00	784 x 1727	29.12	740
A72P72F2G	Half Panel	72.00 x 72.00	1829 x 1829	30.88 x 68.00	784 x 1727	29.12	740
A90P72F1	Full Panel	90.00 x 72.00	2286 x 1829	78.00 x 68.00	1981 x 1727	38.12	968
A90P72F1G	Full Panel	90.00 x 72.00	2286 x 1829	78.00 x 68.00	1981 x 1727	38.12	968
A90P72F2	Half Panel	90.00 x 72.00	2286 x 1829	39.88 x 68.00	1013 x 1727	38.12	968
A90P72F2G	Half Panel	90.00 x 72.00	2286 x 1829	39.88 x 68.00	1013 x 1727	38.12	968



SIDE-MOUNTED PANELS

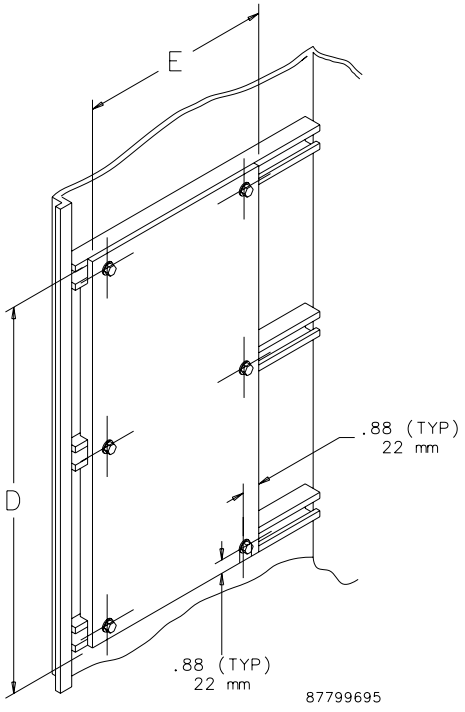
Panels provide extra mounting space on the sides of enclosures. 12 gauge steel side-mounting panels are painted white. Conductive panels are steel with a conductive, corrosion-resistant coating. Panels attach securely to mounting channels. Plated steel mounting hardware is furnished.

BULLETIN: PNL30, PNLFS

Catalog Number	Description	Panel Size D x E in./mm	Fits Enclosure A in./mm
A60SMP14	Painted steel	48.00 x 14.00 1219 x 356	60.00 1524
A60SMP14G	Conductive	48.00 x 14.00 1219 x 356	60.00 1524
A72SMP14	Painted steel	60.00 x 14.00 1524 x 356	72.00 1829
A72SMP14G	Conductive	60.00 x 14.00 1524 x 356	72.00 1829
A72SMP20	Painted steel	60.00 x 20.00 1524 x 508	72.00 1829
A72SMP20G	Conductive	60.00 x 20.00 1524 x 508	72.00 1829
A90SMP14	Painted steel	78.00 x 14.00 1981 x 356	90.00 2286
A90SMP14G	Conductive	78.00 x 14.00 1981 x 356	90.00 2286
A90SMP20	Painted steel	78.00 x 20.00 1981 x 508	90.00 2286
A90SMP20G	Conductive	78.00 x 20.00 1981 x 508	90.00 2286

A90SMP14 and A90SMP14G will not fit 18.06-in.deep two-door enclosures (FSD style) if regular panel is also installed.

A90SMP20 and A90SMP20G will not fit 20.12-in. deep enclosures. Will not fit 24.12-in. deep two-door enclosures (FSD style) if regular panel is also installed.

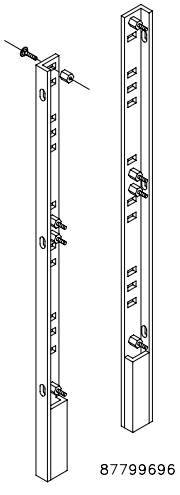


HEAVY DUTY PANEL SUPPORTS

Heavy Duty Panel Supports, sold in pairs, are used in place of the panel supports furnished with panels when heavy equipment will be installed on the panels. They extend to the bottom of the enclosure. Adjustable mounting studs allow mounting of different height panels or a combination of panels. Use mounting hardware furnished with panels.

BULLETIN: A80

Catalog Number	Fits Enclosure A in./mm	Support Length in./mm
A60FSHDPS	60.00 1524	57.25 1454
A72FSHDPS	72.00 1829	69.25 1759
A90FSHDPS	90.00 2286	87.25 2216



CENTER PANEL SUPPORTS

Center panel supports are used with Free-Stand Type 12 (Bulletin A30) two-door enclosures. They permit the installation of panels, swing-out panels and rack-mounting angles sized for one-door enclosures. The Center Panel Support can be positioned from front to back of the enclosure.

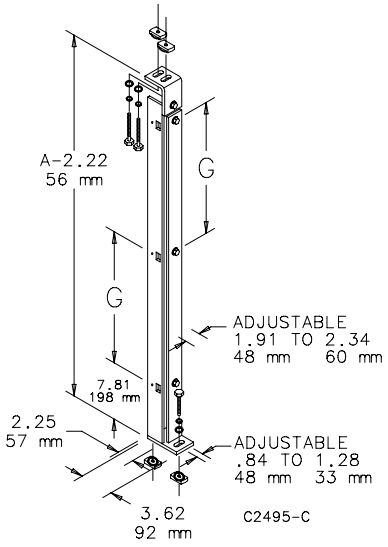
BULLETIN: A80

Standard Product **Panel Supports**

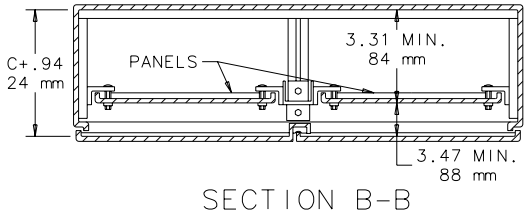
Catalog Number	Fits Enclosure A (in.)	Fits Enclosure A (mm)	G (in.)	G (mm)
A60FSCPS	60.00	1524	23.12	587
A72FSCPS	72.00	1829	29.12	740
A90FSCPS	90.00	2286	38.12	968

Accessory Width with Center Panel Supports

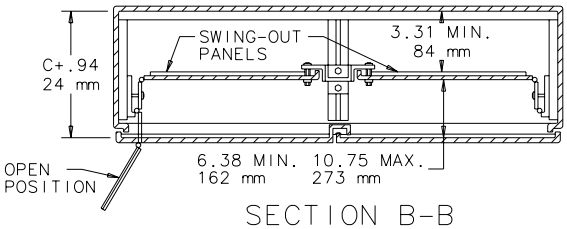
Two Door Enclosure Width (in.)	Two Door Enclosure Width (mm)	Accessory Width (in.)	Accessory Width (mm)
48.00	1219	24.00	610
60.00	1524	30.00	762
72.00	1829	36.00	914



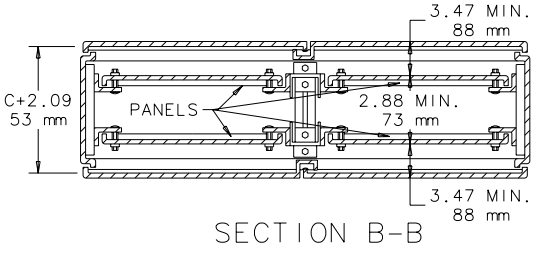
Center Panel Supports Enclosure Section Views



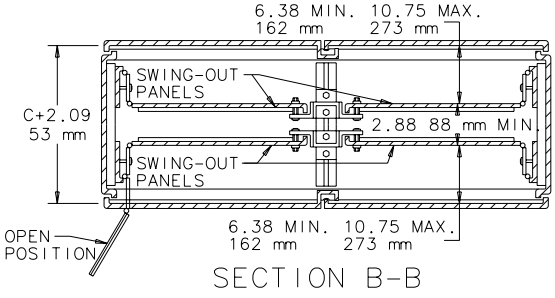
Showing two panels (for one-door enclosures)and center panel support mounted in two-door enclosure.



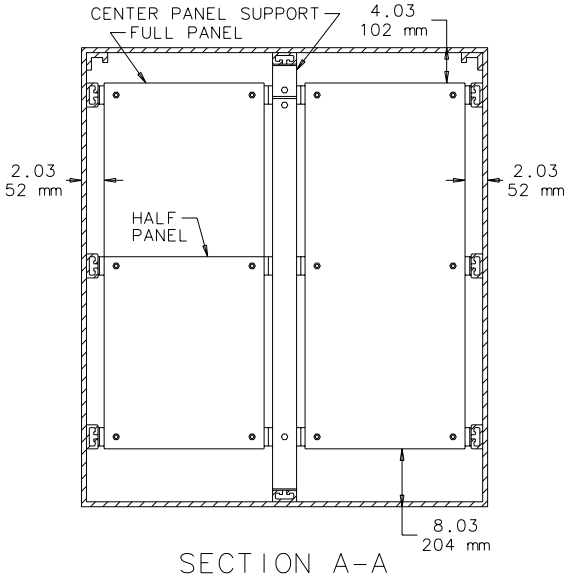
Showing four swing-out panels and center panel support mounted in two-door enclosure.



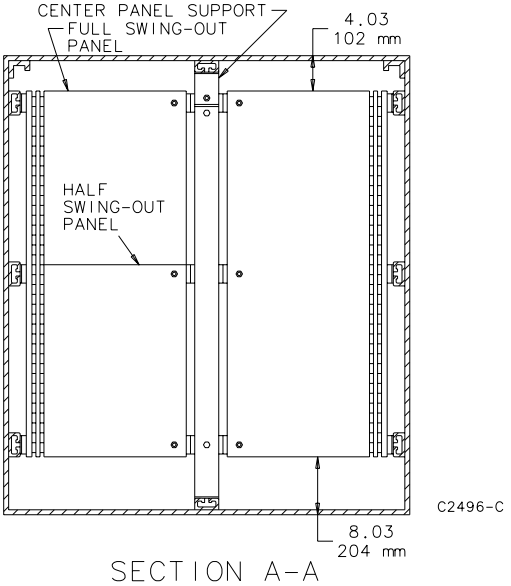
Showing four panels (for one-door enclosures) and two center panel supports mounted in two-door access enclosure.



Showing four swing-out panels and two center panel supports mounted in two-door dual access enclosure.



Panels shown are for one-door free-stand enclosures. Half panel fits in top or bottom half of enclosure.



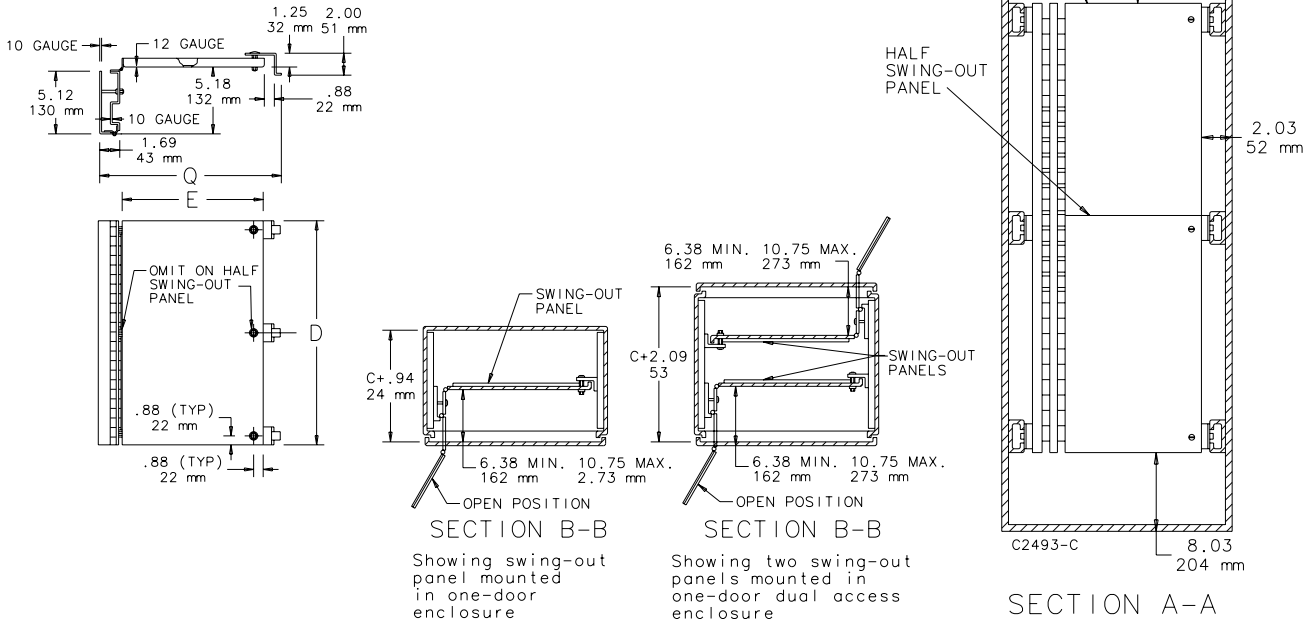
Showing swing-out panels installed in one-door enclosure.

SWING-OUT PANELS FOR FREE-STAND TYPE 4, 4X AND 12 ENCLOSURES WITH MOUNTING CHANNEL

Panels for Free-Stand Type 12 Enclosures, Free-Stand Type 4 Enclosures and One-Door Type 4X Free-Stand Fiberglass Enclosures. Full-length and half-length swing-out panels are available. Half-length panels can be located in the upper or lower portion of the enclosures. Swing-out panels have a 10 gauge steel support frame and two heavy-gauge continuous hinges which permit the panel to swing completely out of the enclosure if it is located within approximately 10.75 in. (273 mm) of the door. These panels are 12 gauge steel and can be mounted on either side of the enclosure. Panels are finished with white polyester powder paint and furnished with plated mounting hardware.

BULLETIN: PNL30

Catalog Number	Description	Panel Size D x E (in.)	Panel Size D x E (mm)	Fits Enclosure A x B (in.)	Fits Enclosure A x B (mm)	Q (in.)	Q (mm)
A72SP24F3	Full Panel	60.00 x 18.81	1524 x 478	72.00 x 24.00	1829 x 610	21.84	555
A72SP24F4	Half Panel	30.88 x 18.81	784 x 478	72.00 x 24.00	1829 x 610	21.84	555
A72SP30F3	Full Panel	60.00 x 24.81	1524 x 630	72.00 x 30.00	1829 x 762	27.84	707
A72SP30F4	Half Panel	30.88 x 24.81	784 x 630	72.00 x 30.00	1829 x 762	27.84	707
A72SP36F3	Full Panel	60.00 x 30.81	1524 x 783	72.00 x 36.00	1829 x 914	33.84	860
A72SP36F4	Half Panel	30.88 x 30.81	784 x 783	72.00 x 36.00	1829 x 914	33.84	860
A90SP36F3	Full Panel	78.00 x 30.81	1981 x 783	90.00 x 36.00	2286 x 914	33.84	860
A90SP36F4	Half Panel	39.88 x 30.81	1013 x 783	90.00 x 36.00	2286 x 914	33.84	860

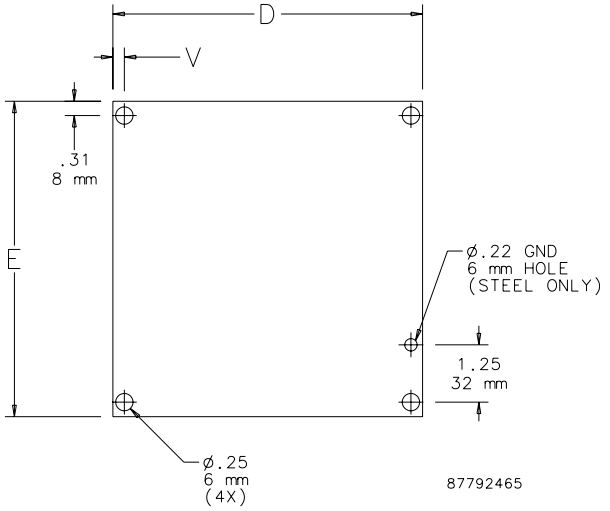


PANELS FOR WIFI CABINETS AND SMALL WALL-MOUNT ENCLOSURES

Panels are available in both steel and wood. Steel panels are 14 gauge steel with a white polyester powder paint finish. Wood panels are 3/4-in. plywood and are unfinished. Wood panels are supplied with Fiberglass Hinged-Cover and POLYPRO Type 4X WiFi Cabinets.

BULLETIN: DWS12, PNLJ, PNLWM

Catalog Number	Material	Panel Size D x E (in.)	Panel Size D x E (mm)	V (in.)	V (mm)
A6P6	Steel	4.88 x 4.88	124 x 124	0.31	8
A6P6WD	Wood	4.88 x 4.88	124 x 124	0.31	8
A16P14	Steel	14.75 x 12.88	375 x 327	0.25	6
A16P14WD	Wood	14.75 x 12.88	375 x 327	0.25	6
A18P16	Steel	16.75 x 14.88	425 x 378	0.25	6
A18P16WD	Wood	16.75 x 14.88	425 x 378	0.25	6



MEDIUM, TYPE 1

APPLICATION

These enclosures have a size range of 16 x 12 x 6-in. to 36 x 30 x 12-in. and meet basic functionality requirements for applications that do not require oil- or dust-tight enclosures.

FEATURES

- Doors have butt hinges
- Collar studs provided for mounting optional panel
- Slotted flush latches; optional latches available
- Mounting holes on back of enclosure

SPECIFICATIONS

- 14 or 12 gauge steel

FINISH

ANSI 61 gray polyester powder paint finish inside and out over pretreated surfaces. Optional solid panels are white and optional perforated panels are gray.

ACCESSORIES

See also Accessories.
T-Handle Latch and Keyed Cylinder Lock Kits
Electric Heater
Electrical Interlocks
Grounding Device
Panels for Medium Type 1 Enclosures
Rack Mounting Angles - U Style (Type RA)
Touch-Up Paint
Steel and Stainless Steel Window Kits

BULLETIN: A1M

INDUSTRY STANDARDS

UL 50, 50E Listed; Type 1; File No. E27567
cUL Listed per CSA C22.2 No 40; Type 1; File No. E27567

NEMA/EEMAC Type 1
CSA, File 42184: Type 1
IEC 60529, IP30

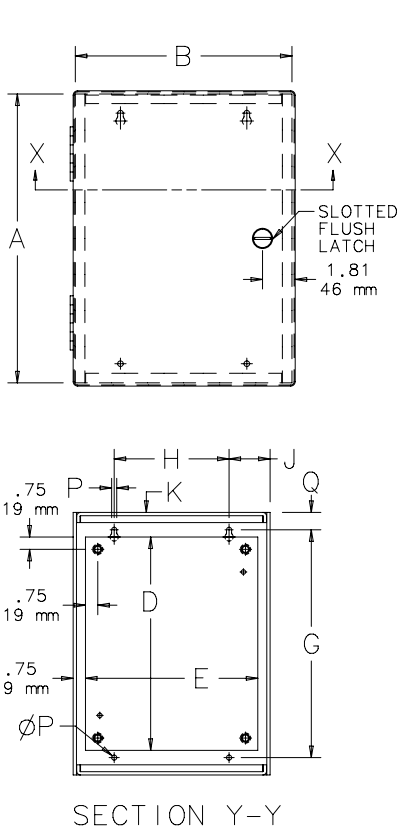
Standard Product

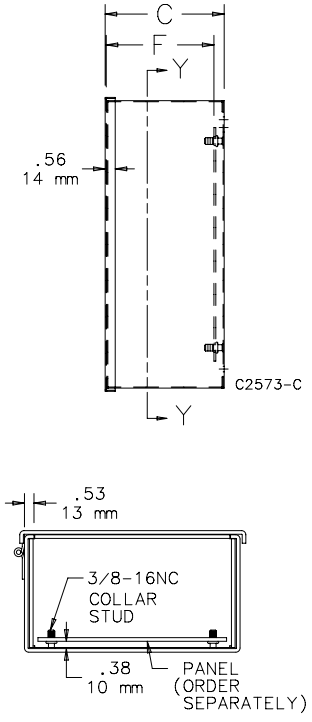
Catalog Number	AxBxC in./mm	Panel	Perforated Panel	Panel Size D x E in./mm	Panel Gauge	G in./mm	H in./mm	J in./mm	Q in./mm	P in./mm	F in./mm	K in./mm
A16N12ALP	16.00 x 12.00 x 6.62 406 x 305 x 168	A16N12MP	A16N12MPP	13.00 x 10.50 330 x 267	14	13.88 353	7.00 178	2.50 64	1.06 27	0.31 8	6.00 152	1.50 38
A16N16ALP	16.00 x 16.00 x 6.62 406 x 406 x 168	A16N16MP	A16N16MPP	13.00 x 14.50 330 x 368	14	13.88 353	11.00 279	2.50 64	1.06 27	0.31 8	6.00 152	1.50 38
A16N20ALP	16.00 x 20.00 x 6.62 406 x 508 x 168	A16N20MP	A16N20MPP	13.00 x 18.50 330 x 470	14	13.88 353	15.00 381	2.50 64	1.06 27	0.31 8	6.00 152	1.50 38
A20N16ALP	20.00 x 16.00 x 6.62 508 x 406 x 168	A20N16MP	A20N16MPP	17.00 x 14.50 432 x 368	14	17.88 454	11.00 279	2.50 64	1.06 27	0.31 8	6.00 152	1.50 38
A20N20ALP	20.00 x 20.00 x 6.62 508 x 508 x 168	A20N20MP	A20N20MPP	17.00 x 18.50 432 x 470	14	17.88 454	15.00 381	2.50 64	1.06 27	0.31 8	6.00 152	1.50 38
A24N16ALP	24.00 x 16.00 x 6.62 610 x 406 x 168	A24N16MP	A24N16MPP	21.00 x 14.50 533 x 368	14	21.88 556	11.00 279	2.50 64	1.06 27	0.31 8	6.00 152	1.50 38
A24N20ALP	24.00 x 20.00 x 6.62 610 x 508 x 168	A24N20MP	A24N20MPP	21.00 x 18.50 533 x 470	14	21.88 556	15.00 381	2.50 64	1.06 27	0.31 8	6.00 152	1.50 38
A24N24ALP	24.00 x 24.00 x 6.62 610 x 610 x 168	A24N24MP	A24N24MPP[a]	21.00 x 22.50 533 x 572	12	21.88 556	19.00 483	2.50 64	1.06 27	0.31 8	6.00 152	1.50 38
A30N24ALP	30.00 x 24.00 x 6.62 762 x 610 x 168	A30N24MP	A30N24MPP[a]	26.00 x 22.50 660 x 572	12	27.50 699	16.75 425	3.62 92	1.25 32	0.44 11	6.00 152	2.00 51
A36N24ALP	36.00 x 24.00 x 6.62 914 x 610 x 168	A36N24MP	A36N24MPP[a]	32.00 x 22.50 813 x 572	12	33.50 851	16.75 425	3.62 92	1.25 32	0.44 11	6.00 152	2.00 51
A36N30ALP	36.00 x 30.00 x 6.62 914 x 762 x 168	A36N30MP	A36N30MPP[a]	32.00 x 28.50 813 x 724	12	33.50 851	22.75 578	3.62 92	1.25 32	0.44 11	6.00 152	2.00 51
A16N12BLP	16.00 x 12.00 x 8.62 406 x 305 x 219	A16N12MP	A16N12MPP	13.00 x 10.50 330 x 267	14	13.88 353	7.00 178	2.50 64	1.06 27	0.31 8	8.00 203	1.50 38
A20N12BLP	20.00 x 12.00 x 8.62 508 x 305 x 219	A20N12MP	A20N12MPP	17.00 x 10.50 432 x 267	14	17.88 454	7.00 178	2.50 64	1.06 27	0.31 8	8.00 203	1.50 38
A20N16BLP	20.00 x 16.00 x 8.62 508 x 406 x 219	A20N16MP	A20N16MPP	17.00 x 14.50 432 x 368	14	17.88 454	11.00 279	2.50 64	1.06 27	0.31 8	8.00 203	1.50 38
A20N20BLP	20.00 x 20.00 x 8.62 508 x 508 x 219	A20N20MP	A20N20MPP	17.00 x 18.50 432 x 470	14	17.88 454	15.00 381	2.50 64	1.06 27	0.31 8	8.00 203	1.50 38
A24N20BLP	24.00 x 20.00 x 8.62 610 x 508 x 219	A24N20MP	A24N20MPP	21.00 x 18.50 533 x 470	14	21.88 556	15.00 381	2.50 64	1.06 27	0.31 8	8.00 203	1.50 38
A24N24BLP	24.00 x 24.00 x 8.62 610 x 610 x 219	A24N24MP	A24N24MPP[a]	21.00 x 22.50 533 x 572	12	21.88 556	19.00 483	2.50 64	1.06 27	0.31 8	8.00 203	1.50 38

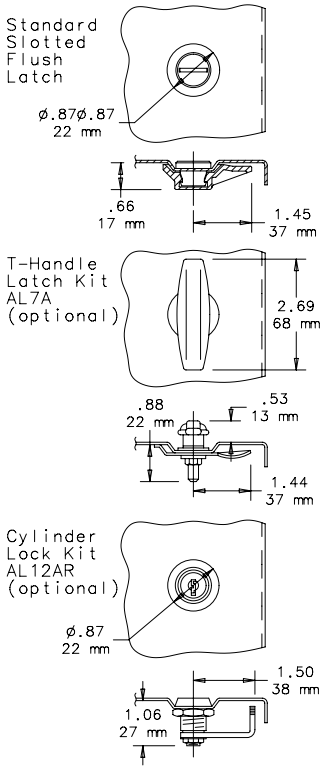
Catalog Number	AxBxC in./mm	Panel	Perforated Panel	Panel Size D x E in./mm	Panel Gauge	G in./mm	H in./mm	J in./mm	Q in./mm	P in./mm	F in./mm	K in./mm
A30N20BLP	30.00 x 20.00 x 8.62 762 x 508 x 219	A30N20MP	A30N20MPP[a]	26.00 x 18.50 660 x 470	12	27.50 699	15.00 381	2.50 64	1.25 32	0.44 11	8.00 203	2.00 51
A30N24BLP	30.00 x 24.00 x 8.62 762 x 610 x 219	A30N24MP	A30N24MPP[a]	26.00 x 22.50 660 x 572	12	27.50 699	16.75 425	3.62 92	1.25 32	0.44 11	8.00 203	2.00 51
A30N30BLP	30.00 x 30.00 x 8.62 762 x 762 x 219	A30N30MP	A30N30MPP[a]	26.00 x 28.50 660 x 724	12	27.50 699	22.75 578	3.62 92	1.25 32	0.44 11	8.00 203	2.00 51
A36N24BLP	36.00 x 24.00 x 8.62 914 x 610 x 219	A36N24MP	A36N24MPP[a]	32.00 x 22.50 813 x 572	12	33.50 851	16.75 425	3.62 92	1.25 32	0.44 11	8.00 203	2.00 51
A36N30BLP	36.00 x 30.00 x 8.62 914 x 762 x 219	A36N30MP	A36N30MPP[a]	32.00 x 28.50 813 x 724	12	33.50 851	22.75 578	3.62 92	1.25 32	0.44 11	8.00 203	2.00 51
A18N18CLP	18.00 x 18.00 x 10.62 457 x 457 x 270	A18N18MP	A18N18MPP	15.00 x 16.50 381 x 419	14	15.88 403	13.00 330	2.50 64	1.06 27	0.31 8	10.00 254	1.50 38
A24N20CLP	24.00 x 20.00 x 10.62 610 x 508 x 270	A24N20MP	A24N20MPP	21.00 x 18.50 533 x 470	14	21.88 556	15.00 381	2.50 64	1.06 27	0.31 8	10.00 254	1.50 38
A30N24CLP	30.00 x 24.00 x 10.62 762 x 610 x 270	A30N24MP	A30N24MPP[a]	21.00 x 22.50 533 x 572	12	27.50 699	16.75 425	3.62 92	1.25 32	0.44 11	10.00 254	2.00 51
A24N24DLP	24.00 x 24.00 x 12.62 610 x 610 x 321	A24N24MP	A24N24MPP[a]	21.00 x 22.50 533 x 572	12	21.88 556	19.00 483	2.50 64	1.06 27	0.31 8	12.00 305	1.50 38
A30N24DLP	30.00 x 24.00 x 12.62 762 x 610 x 321	A30N24MP	A30N24MPP[a]	26.00 x 22.50 660 x 724	12	27.50 699	16.75 425	3.62 92	1.25 32	0.44 11	12.00 305	2.00 51
A36N30DLP	36.00 x 30.00 x 12.62 914 x 762 x 321	A36N30MP	A36N30MPP[a]	32.00 x 28.50 813 x 724	12	33.50 851	22.75 578	3.62 92	1.25 32	0.44 11	12.00 305	2.00 51

Purchase panels separately.

[a]Flanged on all four sides







PennState
Physical Plant

Damper Actuators

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BELIMO

On/Off, Spring Return, AC/DC 24 V

Technical data sheet AFB24

5-year warranty

Technical data

Electrical data	Nominal voltage	AC/DC 24 V
	Nominal voltage frequency	50/60 Hz
	Power consumption in operation	5 W
	Power consumption in rest position	2.5 W
	Transformer sizing	7.5 VA (class 2 power source)
	Electrical Connection	18 GA appliance cable, 3 ft [1 m], with 1/2" conduit connector
	Overload Protection	electronic throughout 0...95° rotation
	Electrical Protection	actuators are double insulated
Functional data	Torque motor	180 in-lb [20 Nm]
	Direction of motion motor	selectable by ccw/cw mounting
	Direction of motion fail-safe	reversible with cw/ccw mounting
	Manual override	5 mm hex crank (3/16" Allen), supplied
	Angle of rotation	95°, adjustable with mechanical end stop, 35...95°
	Angle of rotation note	adjustable with mechanical end stop, 35...95°
	Running Time (Motor)	75 s
	Running time fail-safe	<20 s @ -4...122°F [-20...50°C], <60 s @ -22°F [-30°C]
	Running time fail-safe note	@ -4...122°F [-20...50°C], <60 s @ -22°F [-30°C]
	Noise level, motor	50 dB(A)
	Noise level, fail-safe	62 dB(A)
	Shaft Diameter	1/2...1.05" round, centers on 1/2" and 3/4" with insert, 1.05" without insert
	Position indication	Mechanical
Safety data	Degree of protection IEC/EN	IP54
	Degree of protection NEMA/UL	NEMA 2
	Enclosure	UL Enclosure Type 2
	Agency Listing	cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2014/30/EU and 2014/35/EU; Listed to UL 2043 - suitable for use in air plenums per Section 300.22(c) of the NEC and Section 602.2 of the IMC
	Quality Standard	ISO 9001
	Ambient temperature	-22...122°F [-30...50°C]
	Storage temperature	-40...176°F [-40...80°C]
	Ambient humidity	max. 95% r.H., non-condensing
	Servicing	maintenance-free
Weight	Weight	2.4 lb [2.4 kg]
Materials	Housing material	Galvanized steel and plastic housing

Product features

Application

For On/Off, fail-safe control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications. Control is On/Off from an auxiliary contact or a manual switch. The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft. Maximum of two AF's can be piggybacked for torque loads of up to 266 in-lbs. Minimum 3/4" diameter shaft and parallel wiring.

Operation

The AF..24 series actuators provide true spring return operation for reliable failsafe application and positive close off on air tight dampers. The spring return system provides constant torque to the damper with, and without, power applied to the actuator. The AF..24 series provides 95° of rotation and is provided with a graduated position indicator showing 0° to 95°. The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches. The AF..24 actuator is shipped at 5° (5° from full fail-safe) to provide automatic compression against damper gaskets for tight shut-off.

Typical specification

On/Off spring return damper actuators shall be direct coupled type which require no crank arm and linkage and be capable of direct mounting to a jackshaft up to a 1.05” diameter. The actuators must be designed so that they may be used for either clockwise or counter clockwise fail-safe operation. Actuators shall be protected from overload at all angles of rotation. If required, two SPDT auxiliary switch shall be provided having the capability of one being adjustable. Actuators with auxiliary switches must be constructed to meet the requirements for Double Insulation so an electrical ground is not required to meet agency listings. Actuators shall be cULus listed and have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

Accessories

Electrical accessories

Description	Type
Auxiliary switch, mercury-free, {	P475
Auxiliary switch, mercury-free, {	P475-1
Signal Siumlator, Power supply AC 230 V, {	PS-100
Cable Conduit Connector 1/2", {	TF-CC US
Transformer, AC 120 V to AC 24 V, 40 VA, {	ZG-X40

Mechanical accessories

Description	Type
Anti-rotation bracket AF/NF.	AF-P
Shaft extension 240 mm Ø20 mm for damper shaft Ø 8...22.7 mm	AV8-25
End stop indicator	IND-AFB
Shaft clamp reversible, for central mounting, for damper shafts Ø12.7 / 19.0 / 25.4 mm, {	K7-2
Ball joint suitable for damper crank arm KH8 / KH10	KG10A
Ball joint suitable for damper crank arm KH8	KG8
Actuator arm, for 3/4" shafts, clamping range Ø10...22 mm, Slot width 8.2 mm, {	KH-AFB
Damper crank arm Slot width 8.2 mm, clamping range Ø14...25 mm	KH10
Damper crank arm Slot width 8.2 mm, for Ø1.05"	KH12
Damper crank arm Slot width 8.2 mm, clamping range Ø10...18 mm	KH8
Push rod for KG10A ball joint (36” L, 3/8” diameter).	SH10
Push rod for KG6 & KG8 ball joints (36” L, 5/16” diameter).	SH8
TOOL-06 8mm-10mm Wrench	TOOL-06
Retrofit clip	Z-AF
Base plate extension	Z-SF
Univ. right angle bracket 17"x11-1/8"x6" (HxWxbase).	ZG-100
Univ. right angle bracket 13x11x7-7/16" (HxWxbase).	ZG-101
Dual actuator mounting bracket.	ZG-102
Right angle bracket for ZS-260.	ZG-109
Stand-off bracket for ZS-260.	ZG-110
AFB(X)/NFB(X) U bracket 5-7/8x5-1/2x2-19/32" (HxWxD).	ZG-118
Jackshaft mounting bracket.	ZG-120
Mounting kit for linkage operation for flat and side installation	ZG-AFB
Mounting kit for foot mount installation	ZG-AFB118
Damper clip for damper blade, 3.5” width.	ZG-DC1
Damper clip for damper blade, 6” width.	ZG-DC2
1" diameter jackshaft adaptor (11" L).	ZG-JSA-1
1-5/16" diameter jackshaft adaptor (12" L).	ZG-JSA-2
1.05" diameter jackshaft adaptor (12" L).	ZG-JSA-3

Weather shield 13x8x6" [330x203x152 mm] (LxWxH), {	ZS-100
Base Plate, for ZS-100	ZS-101
Weather shield 16x8-3/8x4" [406x213x102 mm] (LxWxH), {	ZS-150
Explosion Proof Housing 16x10x6.435" [406x254x164 mm] (LxWxH), UL and CSA, Class I, Zone 1&2, Groups B, C, D, (NEMA 7), Class III, Hazardous (classified) Locations, outdoor application NEMA 4, {	ZS-260
Weather shield 17-1/4x8-3/4x5-1/2" [438x222x140 mm] (LxWxH), NEMA 4X, with mounting brackets, {	ZS-300
Weather shield 17-1/4x8-3/4x5-1/2" [438x222x140 mm] (LxWxH), NEMA 4X, with mounting brackets, {	ZS-300-5
Shaft extension 1/2", {	ZS-300-C1
Shaft extension 3/4", {	ZS-300-C2
Shaft extension 1", {	ZS-300-C3

Electrical installation

Warning! Live Electrical Components!
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

Meets cULus requirements without the need of an electrical ground connection.

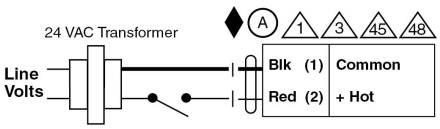
A Actuators with appliance cables are numbered.

1 Provide overload protection and disconnect as required.

3 Actuators may also be powered by 24 VDC.

45 Actuators may be powered in parallel. Power consumption must be observed.

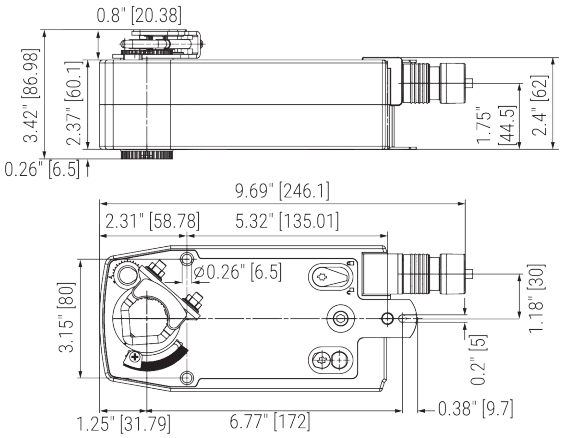
48 Parallel wiring required for piggy-back applications.



On/Off

Dimensions

Dimensional drawings



BELIMO

Modulating, Spring Return, AC 24 V/DC, for DC 2...10 V or 4...20 mA Control Signal

Technical data sheet LF24-SR US

5-year warranty

Technical data

Electrical data	Nominal voltage	AC/DC 24 V
	Nominal voltage frequency	50/60 Hz
	Power consumption in operation	2.5 W
	Power consumption in rest position	1 W
	Transformer sizing	5 VA (class 2 power source)
	Electrical Connection	18 GA plenum cable, 3 ft [1 m], with 1/2" conduit connector
	Overload Protection	electronic throughout 0...95° rotation
	Electrical Protection	actuators are double insulated
Functional data	Torque motor	35 in-lb [4 Nm]
	Operating range Y	2...10 V
	Operating range Y note	4...20 mA w/ ZG-R01 (500 Ω, 1/4 W resistor)
	Input Impedance	100 kΩ for 2...10 V (0.1 mA), 500 Ω for 4...20 mA
	Position feedback U	2...10 V
	Position Feedback	2...10 V, Max. 0.7 mA
	Position feedback U note	Max. 0.7 mA
	Direction of motion motor	selectable with switch 0/1
	Direction of motion fail-safe	reversible with cw/ccw mounting
	Angle of rotation	Max. 95°,
	Running Time (Motor)	150 s constant, independent of load
	Running time motor note	constant, independent of load
	Running time fail-safe	<25 s @ -4...122°F [-20...50°C], <60 s @ -22°F [-30°C]
	Running time fail-safe note	@ -4...122°F [-20...50°C], <60 s @ -22°F [-30°C]
	Noise level, motor	30 dB(A)
	Noise level, fail-safe	62 dB(A)
	Shaft Diameter	3/8...1/2" round, centers on 1/2"
	Position indication	Mechanical
Safety data	Degree of protection IEC/EN	IP54
	Degree of protection NEMA/UL	NEMA 2
	Enclosure	UL Enclosure Type 2
	Agency Listing	cULus acc. To UL 873 and CAN/CSA C22.2 No. 24-93
	Quality Standard	ISO 9001
	Ambient temperature	-22...122°F [-30...50°C]
	Storage temperature	-40...176°F [-40...80°C]
	Ambient humidity	max. 95% r.H., non-condensing
	Servicing	maintenance-free
Weight	Weight	3.4 lb [1.5 kg]
Materials	Housing material	galvanized steel

Product features

Application

For fail-safe, modulating control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications. The actuator is mounted directly to a damper shaft from 3/8" up to 1/2" in diameter by means of its universal clamp, 1/2" shaft centered at delivery. For shafts up to 3/4" use K6-1 accessory. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft. The actuator operates in response to a 2 to 10 VDC, or with the addition of a 500Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. A 2 to 10 VDC feedback signal is provided for position indication.

Operation

The LF series actuators provide true spring return operation for reliable fail-safe application and positive close-off on air tight dampers. The spring return system provides consistent torque to the damper with, and without, power applied to the actuator. The LF series provides 95° of rotation and is provided with a graduated position indicator showing 0 to 95°. The LF24-SR US uses a brushless DC motor which is controlled by an Application Specific Integrated Circuit (ASIC) and a microprocessor. The microprocessor provides the intelligence to the ASIC to provide a constant rotation rate and to know the actuator's exact fail-safe position. The ASIC monitors and controls the brushless DC motor's rotation and provides a digital rotation sensing function to prevent damage to the actuator in a stall condition. The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches. Power consumption is reduced in holding mode.

Typical specification

Spring return control damper actuators shall be direct coupled type which require no crank arm and linkage and be capable of direct mounting to a shaft up to a 3/4" diameter and center on a 1/2" shaft (default). Actuator shall deliver a minimum output torque of 35 in-lbs. The actuator must provide modulating damper control in response to a 2 to 10 VDC or, with the addition of a 500Ω resistor, a 4 to 20 mA control input from an electronic controller. Actuators shall use a brushless DC motor controlled by a microprocessor and be protected from overload at all angles of rotation. Run time shall be constant, and independent of torque. A 2 to 10 feedback signal shall be provided for position feedback. The actuator must be designed so that they may be used for either clockwise or counter clockwise failsafe operation. Actuators shall be cULus listed, have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

Accessories

Electrical accessories

Description	Type
	IRM-100
Auxiliary switch, mercury-free, {	P475
Auxiliary switch, mercury-free, {	P475-1
Signal Siumlator, Power supply AC 230 V, {	PS-100
	PTA-250
Positioner for wall mounting	SGA24
Positioner for front-panel mounting	SGF24
Resistor, 500 Ω, 1/4" wire resistor with 6" pigtail wires, {	ZG-R01
Resistor Kit, 50% voltage divider, {	ZG-R02
Mounting plate for SGF.	ZG-SGF
Transformer, AC 120 V to AC 24 V, 40 VA, {	ZG-X40

Mechanical accessories

Description	Type
Shaft extension 170 mm Ø10 mm for damper shaft Ø 6...16 mm	AV6-20
End stop indicator	IND-LF
Standard LF clamp (3/8" to 1/2").	K6 US
Shaft clamp reversible, clamping range Ø16...20 mm, {	K6-1
Ball joint suitable for damper crank arm KH8 / KH10	KG10A
Ball joint suitable for damper crank arm KH8	KG6
Ball joint suitable for damper crank arm KH8	KG8
Actuator arm, clamping range Ø8...16 mm, Slot width 8.2 mm, {	KH-LF
V-bolt Kit for KH-LF.	KH-LFV
Damper crank arm Slot width 8.2 mm, for Ø1.05"	KH12
Damper crank arm Slot width 6.2 mm, clamping range Ø10...18 mm	KH6
Damper crank arm Slot width 8.2 mm, clamping range Ø10...18 mm	KH8
Anti-rotation bracket LF.	LF-P
Push rod for KG10A ball joint (36" L, 3/8" diameter).	SH10
Push rod for KG6 & KG8 ball joints (36" L, 5/16" diameter).	SH8
TOOL-06 8mm-10mm Wrench	TOOL-06
Angle of rotation limiter, with end stop, {	ZDB-LF

Form fit adapter 8x8 mm, {	ZF8-LF
Right angle bracket for ZS-260.	ZG-109
Stand-off bracket for ZS-260.	ZG-110
LF right angle bracket 4-1/2x5-1/2x2-1/2" (HxWxD).	ZG-112
Damper clip for damper blade, 3.5" width.	ZG-DC1
Damper clip for damper blade, 6" width.	ZG-DC2
LF crankarm adaptor kit (includes ZG-112).	ZG-LF112
LF crankarm adaptor kit (T bracket included).	ZG-LF2
Shaft extension for 3/8" diameter shafts (4" L).	ZG-LMSA-1
Shaft extension for 1/2" diameter shafts (5" L).	ZG-LMSA-1/2-5
Weather shield 13x8x6" [330x203x152 mm] (LxWxH), {	ZS-100
Base Plate, for ZS-100	ZS-101
Weather shield 16x8-3/8x4" [406x213x102 mm] (LxWxH), {	ZS-150
Explosion Proof Housing 16x10x6.435" [406x254x164 mm] (LxWxH), UL and CSA, Class I, Zone 1&2, Groups B, C, D, (NEMA 7), Class III, Hazardous (classified) Locations, outdoor application NEMA 4, {	ZS-260
Weather shield 17-1/4x8-3/4x5-1/2" [438x222x140 mm] (LxWxH), NEMA 4X, with mounting brackets, {	ZS-300
Weather shield 17-1/4x8-3/4x5-1/2" [438x222x140 mm] (LxWxH), NEMA 4X, with mounting brackets, {	ZS-300-5
Shaft extension 1/2", {	ZS-300-C1
Shaft extension 3/4", {	ZS-300-C2
Shaft extension 1", {	ZS-300-C3

Electrical installation

Warning! Live Electrical Components!
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

◆ Meets cULus requirements without the need of an electrical ground connection.

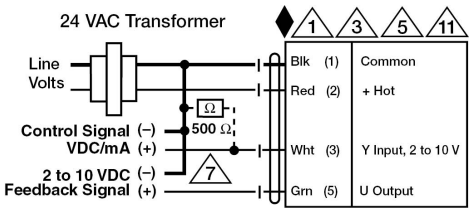
1 Provide overload protection and disconnect as required.

3 Actuators may also be powered by 24 VDC.

5 Only connect common to negative (-) leg of control circuits.

7 A 500 Ω resistor (ZG-R01) converts the 4...20 mA control signal to 2...10 V.

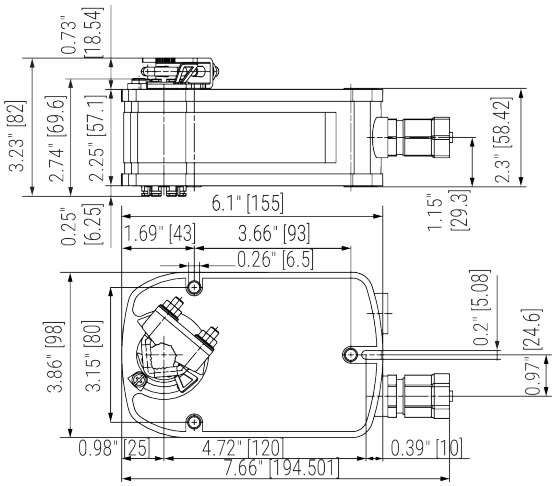
11 Actuators may be connected in parallel if not mechanically linked. Power consumption and input impedance must be observed.



2...10 V / 4...20 mA Control

Dimensions

Dimensional drawings



PennState
Physical Plant

Humidity Sensors

(This page is hyperlinked to the TOC)

Cutsheets to be inserted after this header document to create the section.

Duct Units

Humidity or Combination Temp/Humidity Sensors

Rev. 03/16/18

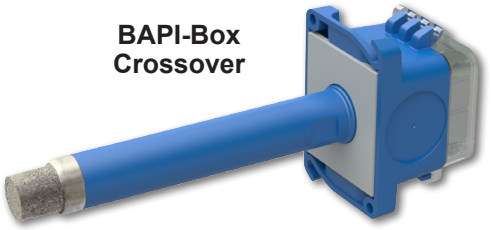
Features & Options

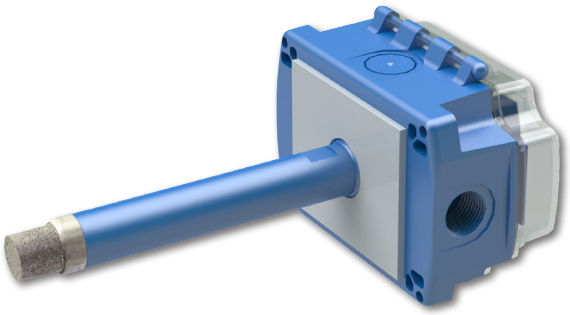
- 10 Points of Calibration from 10 to 90% RH
- Humidity Only or Temp./Humidity Combination
- Replaceable Stainless Steel Filter
- Green Power Indication LED on BAPI-Box Crossover Units
- 2% and 3% RH Accuracies

Humidity control is an important aspect of any climate control system. Therefore, humidity sensors must be both accurate and dependable. BAPI's humidity transmitters are calibrated at 10 points from 10 to 90% RH for accuracy, eliminating field calibration.

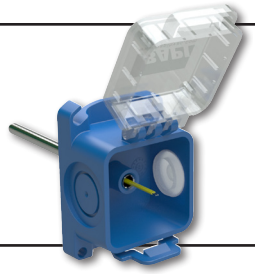
The Duct Units are also extremely dependable, featuring two of the most watertight enclosures available today. The BAPI-Box and BAPI-Box Crossover Enclosures are made of UV-resistant polycarbonate and carry an IP66 rating. The BAPI-Box is only available for units with a temperature transmitter and a humidity transmitter.

BAPI-Box Crossover





BAPI-Box
(only available for units with a temperature transmitter and a humidity transmitter)



The BAPI-Box Crossover Enclosure

The BAPI-Box Crossover features a hinged cover with thumb latch for easy termination. A pierceable knockout plug is available for the open port. See the Accessories section for more info.

(Unit shown with knockplug plug sold separately.)

Specifications

Power and Consumption:
10 to 35 VDC, 22 mA max. (for units with 0 to 5 VDC or 4 to 20 mA Humidity Outputs)
15 to 35 VDC, 6 mA max. (for units with 0 to 10 VDC Humidity Output)
12 to 27 VAC, 0.53 VA max. (for units with 0 to 5 VDC Humidity Outputs)
15 to 27 VAC, 0.14 VA max. (for units with 0 to 10 VDC Humidity Output)

Enclosure Dimensions: **H x W x D**
BAPI-Box Crossover:.....3.1 x 2.2 x 1.9" (79 x 56 x 49mm)
BAPI-Box.....5 x 4.1 x 2.5" (127 x 104 x 63.5mm)

(For enclosure dimension drawings, turn to the end of the section.)

Sensor:
Humidity:
Capacitive 2% or 3%RH
(10 to 90% RH @ 23°C)

Temperature:
Thermistor or RTD
(See Sensors section for specs)

Enclosure Rating:
BAPI-Box Crossover: IP10, NEMA 1
(IP44 with knockout plug)
BAPI-Box: IP66, NEMA 4X

Enclosure Material:
UV-res. Polycarbonate, UL 94, V-0

Environmental Operation Range:
Temp: -40 to 158°F (-40 to 70°C)
Humidity: 0% to 100% RH
Fully Temperature Compensated

Building Automation Products, Inc. • 750 North Royal Avenue, Gays Mills, WI 54631 USA
Tel: +1-608-735-4800 • Fax: +1-608-735-4804 • Email: sales@bapihvac.com • Web: www.bapihvac.com

Use the Option Selection Guide below to create your custom part number. Replace the number and parenthesis with the designator for each selection. Skip the designator and dashes for optional selections that are not required in your configuration.

Duct Humidity Sensor Option Selection Guide

BA/ (**#1**) - (**#2**) - (**#3**)

#1: Temperature Sensor or Transmitter (optional)

1.8K .....1.8K Thermistor
3K .....3K Thermistor
10K-2 .....10K-2 Thermistor
10K-3 .....10K-3 Thermistor
10K-3[11K].....10K-3[11K] Thermistor
20K .....20K Thermistor

1K[375] .....1K Platinum RTD (375 curve)
1K[NI].....1K Ω Nickel RTD
1K .....1K Platinum RTD (385 curve)

Temperature Transmitters below require a BAPI-Box Enclosure
T1K[32 TO 212F].....1K Plat. RTD Transmitter, 4 to 20 mA Output, 32 to 212°F Range
T1K[20 TO 120F].....1K Plat. RTD Transmitter, 4 to 20 mA Output, 20 to 120°F Range
T1K[0 TO 100F].....1K Plat. RTD Transmitter, 4 to 20 mA Output, 0 to 100°F Range

T1K[0 TO 100C] .....1K Plat. RTD Transmitter, 4 to 20 mA Output, 0 to 100°C Range
T1K[-7 TO 49C] .....1K Plat. RTD Transmitter, 4 to 20 mA Output, -7 to 49°C Range
T1K[-18 TO 38C] .....1K Plat. RTD Transmitter, 4 to 20 mA Output, -18 to 38°C Range

Matched Transmitters are also available. Contact your BAPI representative for ordering.

#2: Humidity Output (required)

H200 .....±2% Humidity Transmitter with Interchangeable Output of 0 to 5 V or 4 to 20 mA
H210 .....±2% Humidity Transmitter with 0 to 10 V Output
H212 .....±2% Humidity Transmitter with 2 to 10 V Output
H300 .....±3% Humidity Transmitter with Interchangeable Output of 0 to 5 V or 4 to 20 mA
H310 .....±3% Humidity Transmitter with 0 to 10 V Output
H312 .....±3% Humidity Transmitter with 2 to 10 V Output

#3: Enclosure Style (required)

D-BBX.....BAPI-Box Crossover (IP10, NEMA 1)
D-BB .....BAPI-Box (for units with a humidity and temperature transmitter only)

Additional options are available for these units but not shown in this Selection Guide. Contact your BAPI representative for the complete list of options. Submittal sheets without List Prices can be downloaded from our website at www.bapihvac.com

Example Number: BA/(**10K-2**) - (**H200**) - (**D-BBX**)

Actual Number (with parenthesis removed): BA/10K-2-H200-D-BBX

Description: 10K-2 Thermistor, 0 to 5V or 4 to 20mA Humidity Output, BAPI-Box Crossover IP10-rated Enclosure.

Your Number: BA/

PennState
Physical Plant

Hydronic Pressure Sensors

(This page is hyperlinked to the TOC)

Cutsheets to be inserted after this header document to create the section.

Model 231

Multi-Configurable, Wet-to-Wet Differential Pressure Transducer

Features

- Dual sensors
- Suitable for harsh environments
- 3 & 5 valve manifold assembly options
- 4 Field Selectable Outputs
- 8 Field Selectable Pressure Ranges
- Field Accessible Push-Button Zero & Remote Zero
- Hinged Cover
- Optional LCD Display
- NEMA 4 Rated Housing, All Cast Aluminum
- CE & RoHS Compliant

Applications

- Energy management systems
- Process control systems
- Flow measurement of various gases or liquids
- Liquid level measurement of pressurized vessels
- Pressure drop across filters

Setra's 231 is a multi-configurable, wet-to-wet differential pressure transducer offering the user an all-in-one device with field selectable pressure ranges and analog outputs. The device is offered with an optional 3 or 5 valve machined brass manifold for ease of installation and maintenance. The 231 has a robust, NEMA 4 enclosure with a hinged, captive cover allowing for easy access to switches for adjusting the range and output. An optional display is available that allows users to view high, low, and differential pressure readings on a simple rotating cycle.

Field selectable pressure ranges

The 231 offers 8 field selectable pressure ranges which can be changed using a slide switch, reducing risk of installing the wrong range unit. The multi-range functionality allows the user to hold less inventory and add additional flexibility in the field.

Quick and simple installation

The 231 provides the user with an optional 3 or 5 valve machined brass manifold which can save money on installation and maintenance. The single piece construction of the brass body has no internal process connections, eliminating the risk of internal leaks.

Robust enclosure for difficult applications

The 231 NEMA 4 housing offers an optional LCD display for instant indication of the high, low and differential pressure readings. A hinged enclosure makes it suitable for harsh environments and saves the hassle of misplacing it when completing a difficult installation.

1 YEAR WARRANTY

USA Made

RoHS

CE

Specifications

Electrical data (voltage)

Circuit	3-Wire
Excitation	15 to 30 VDC/18 to 30 VAC (Reverse Excitation Protected)
Output[1]	0 to 5 VDC, 0 to 10 VDC, 1 to 5 VDC
Output impedance	30 Ω
Circuit consumption	8 mA (typ.) at 5 VDC, 8 mA (typ) at 10 VDC, 40 mA (typ.) at 18-30 VAC

Electrical data (current)

Circuit	2-wire (reverse excitation protected)
Output[2]	4 to 20 mA
External load	0 to 250 Ω
Min. supply voltage	15 VDC + 0.02 x (resistance of receiver plus line)
Max. supply voltage	30 VDC + 0.004 x (resistance of receiver plus line)

Physical description

Case	Die cast aluminum, powder coated
Pressure fittings	1/8-18 NPT internal
Electrical connection	1/2 in. conduit
Size	4.0 x 6 x 2 in. (102 x 152 x 51 mm)
Weight	1.5 lb
Sensor vacity volume	0.2 cc

Environmental data

Operating[3] **temperature °F (°C)**	-4 to +185 (-20 to -85)
Storage temperature °F (°C)	-4 to +185 (-20 to +85)
Vibration	10g from 50Hz to 2000 Hz
Shock	200g

[1] Calibrated into a 50K ohm load, operable into a 5000 ohm load or greater.
[2] Calibrated at factory with a 24 VDC loop supply voltage and a 250 ohm load.
[3] Operating temperature limits of the electronics only. Pressure media temperatures may be considerably higher or lower.
[4] RSS of Non-Linearity, Hysteresis, and Non-Repeatability.
[5] Units calibrated at nominal 70°F. Maximum thermal error computed from this datum.

Specifications subject to change without notice.

Performance data

Accuracy RSS[4] **(at constant temp.)**	
Pressure ranges A, B, C:	±1.0% FS
Pressure ranges D:	±2.0% FS

Pressure ranges (PSID)

Range code	A	B	C	D	Max. line pressure
MS1	50	25	10	5	50
MS2	100	50	20	10	100
MS3	250	125	50	25	250

Pressure media

Liquids or Gases Compatible with 17-4 PH Stainless Steel
Note: Hydrogen not recommended for use with 17-4 PH stainless steel

Thermal effects[5]

Compensated range °F (°C)	+32 to +130 (0 to +54)
Zero/Span Shift %FS/100°F (50°C)	2.0 (1.8)
Warm-up shift	<0.12% FS
Surge damping	1 to 5 sec. (selectable)
Proof pressure	2 x Full Scale
Burst pressure	15 x Full Scale (50 PSI), 10 x Full Scale (75 x 150 PSI), 8 x Full Scale (250 PSI)

Ordering information

Example part number: 231GMS12FD;
Model 231, 5 PSID up to 50 PSID, 1/8" NPT Int. fitting, and LCD display:

2 3 1 G ☐ ☐ ☐ ☐ ☐ ☐
[1] [2] [3] [4]

[1]

Model	
231G	Model 231

[2]

Range specifications[1]		
	Unidirectional	Bidirectional
MS1	5, 10, 25, 50 PSID	±5, ±10, ±25, ±50 PSID
MS2	10, 20, 50, 100 PSID	±10, ±20, ±50, ±100 PSID
MS3	25, 50, 125, 250 PSID	±25, ±50, ±125, ±250 PSID

[3]

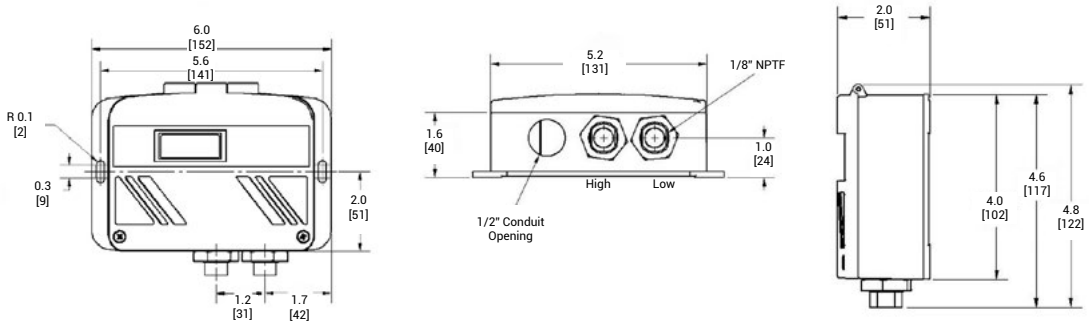
Pressure connection	
2F	1/8-18 NPT female (standard) sensor (conduit version)
3V	3-V manifold assembled w/ Model 231
5V	5-V manifold assembled w/ Model 231

[4]

Display	
N	No display
D	LCD display

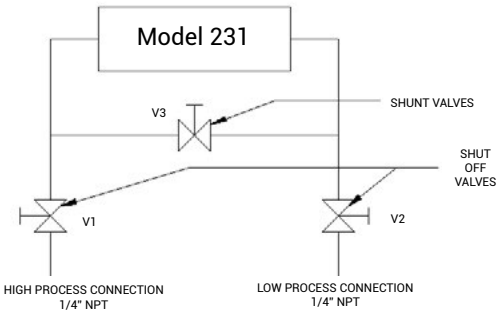
[1] Maximum line pressure is maximum range of pressure ordered.

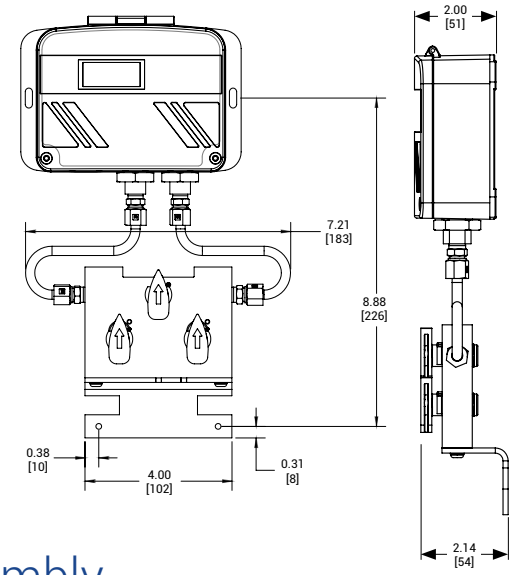
Dimensions



Dimensions - 3 valve manifold assembly

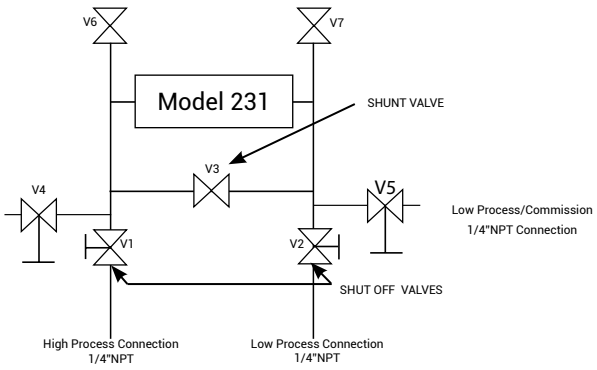
Manifold Block	Brass
Valves (3)	V1 for connection to +port V2 for connection to -port V3 for equalizing pressure
Valve type	90 Degree On/Off
Process Connections	1/4" -18 NPT Internal Thread

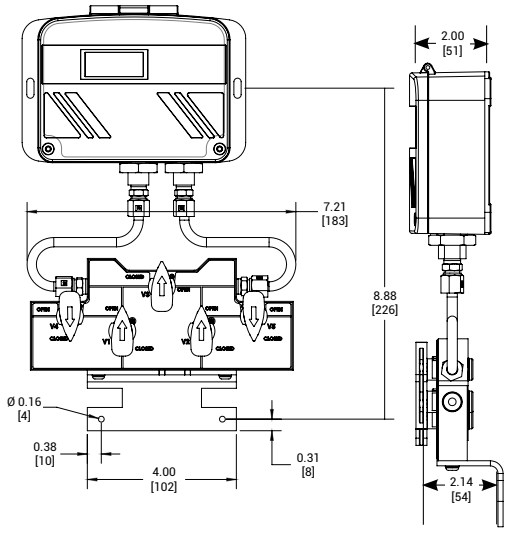




Dimensions - 5 valve manifold assembly

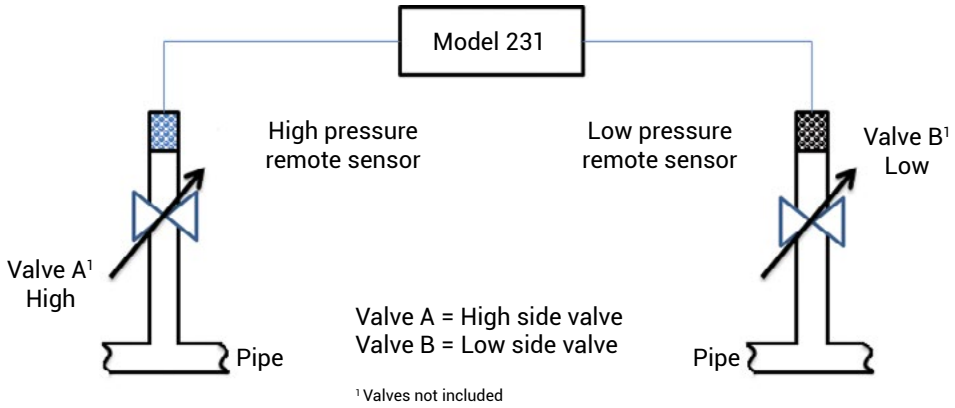
Manifold Block	Brass
Valves (5)	V1 for connection to ±port V2 for connection to -port V3 for equalizing pressure V4 for connection to external gauge or alternate plumbing configuration V5 for connection to external gauge or alternate plumbing configuration
Valve Type	90 Degree On/Off
Process Connection	1/4 "-18 NPT Internal Thread





inches (mm)

Installation



Pressure range code selector

NOTE: Please read before ordering.

1. Examine the pressure application and determine what is the Highest System Line Pressure.
2. Determine what is the Differential Pressure being measured.
3. Find the MAX. Line Pressure in the table on the right that is ≥ to your Highest System Line Pressure.
4. Verify that your DP falls within the selectable ranges in that row.
5. Follow that row to the left and select that range code.

Range Code	A	B	C	D	Max. Line Pressure
MS1	50	25	10	5	50
MS2	100	50	20	10	100
MS3	250	125	50	25	250

Example:

Highest system line pressure:	125 PSIG
Differential pressure measured:	50 PSID
"Max line pressure" ≥ to system line pressure:	250 PSID (50 PSID DP falls within ranges in this row)
Select range code:	MS3

SSP 231 Rev. L 04/2018

Model 209

OEM Pressure Transducer

The Model 209 pressure transducer is designed for Industrial and OEM customers who require high performance, reliability and versatility at an affordable price. It offers exceptional ±0.25% FS accuracy with pressure ranges from 1 PSI up to 10,000 PSI to meet a multitude of demanding applications. The 209 features all stainless steel wetted materials and offers many pressure and electrical connections to satisfy challenging installation requirements. The 209 features a patented overpressure stop to protect the sensor against unexpected spikes or in high pulsation applications.

True Low Range Sensor

The Model 209's capacitive transducer is designed for industrial applications with demanding price and performance requirements. The Model 209 offers exceptional reliability in typical industrial grade environments. The true low range sensor design offers high performance with no additional amplification required to meet range requirements down to 1 PSI.

Flexibility for Many Applications

The 209 transducer offers many pressure and electrical fittings covering many installation configurations. It minimizes additional engineering time to accommodate the sensor, allowing for earlier project completion and quicker time to market.

Robust Design & Construction for Reliable Service

The Model 209 is designed and built to withstand demanding applications. The industrial construction, with optional positive overpressure stop, enables the sensor to withstand overpressure conditions up to 16X the rated range.

- **Rugged For Demanding Applications**
- **Full Span Ranges Down to 1 PSI**
- **Highly Configurable Design**

Model 209 Features:

- High Overpressure Option Available on Select Ranges
- Operates Over a Wide Temperature Band
- Compatible w/ a Variety of Gases & Liquids
- Operates on Low Cost Unregulated DC Power
- Suitable For High Shock & Vibration Applications
- No Seals or O-Rings to Cause Leakage
- No Brazed Joints Susceptible to Corrosion Problems
- CE & RoHS Compliant

Applications:

- Industrial OEM Equipment
- Hydraulic Systems
- Compressor Control
- HVAC/R Equipment
- Industrial Engines

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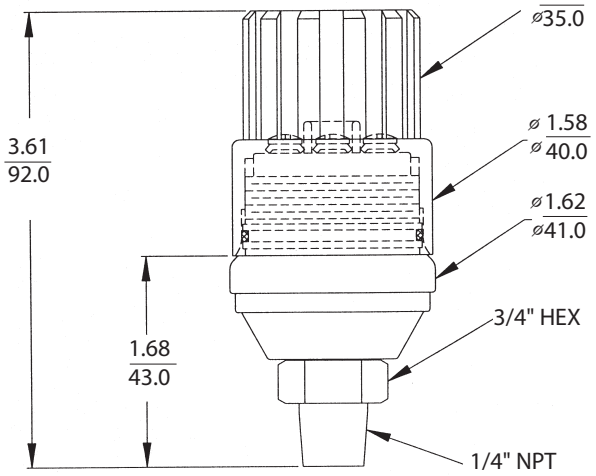
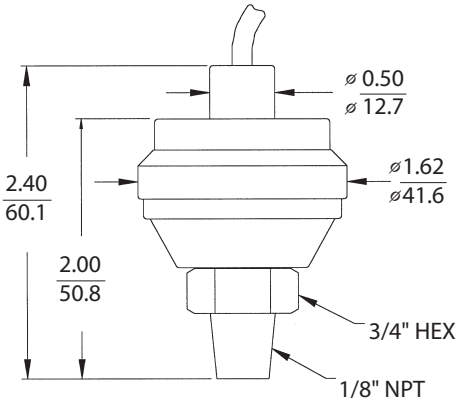
Model 209
OEM Pressure Transducer

DIMENSIONS

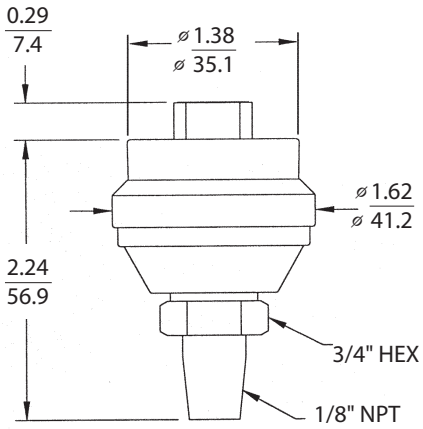
CONDUIT VERSION

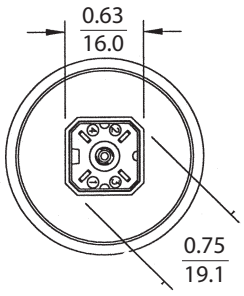


CABLE ANCHOR



OPTIONAL HIRSCHMANN CONNECTOR
Type: G4A1M #931807-106



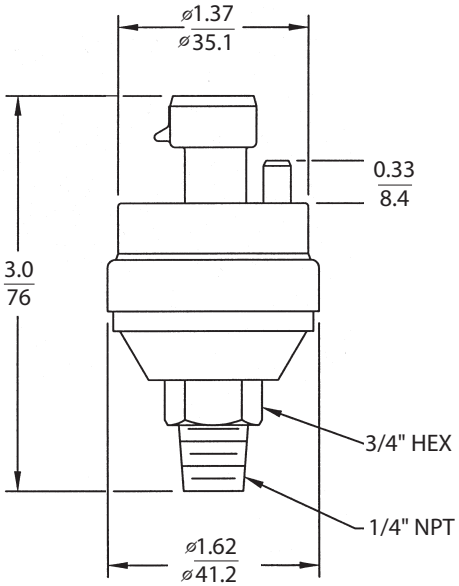


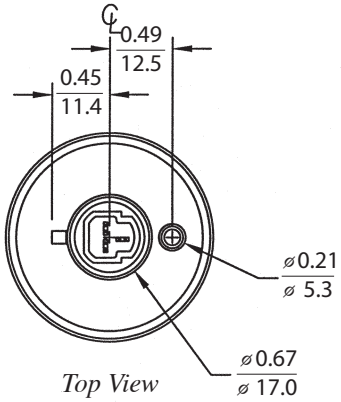
Top View

Mating Hirschmann Connector G4WIF available. See table below to order.

in.
mm

OPTIONAL 3-Pin PACKARD CONNECTOR
Type: P2S Series 150





Top View

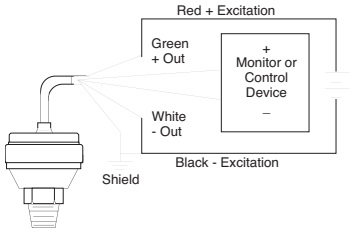
Mating Packard Connectors available. See table below to order.

Model 209
OEM Pressure Transducer

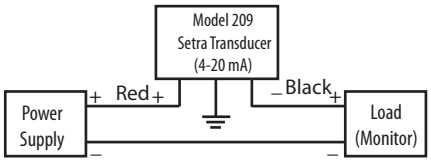
WIRING

CABLE ANCHOR

Voltage Output
The Model 209 voltage output is a 3-wire circuit. If the 209 is supplied with 2 feet of cable, the electrical connection is as follows:

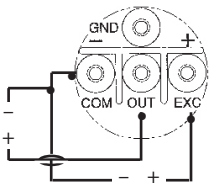


Current Output
The Model 209 True 2-wire device. If the 209 is supplied with 2 feet of cable, the electrical connection is as follows:

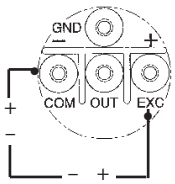


CONDUIT VERSION

Voltage

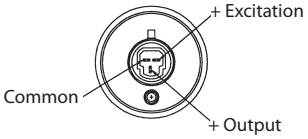


Current



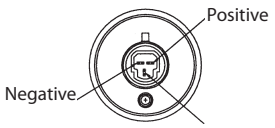
3-PIN PACKARD CONNECTOR

Voltage



Top View: 3-Pin Packard Connector
Type: P2S Series 150

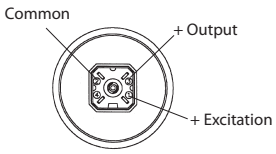
Current



Top View: 3-Pin Packard Connector
Type: P2S Series 150

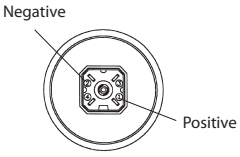
HIRSCHMANN CONNECTOR

Voltage



Top View: Hirschmann Connector
Type: G4A1M#931807-106

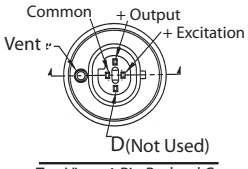
Current



Top View: Hirschmann Connector
Type: G4A1M#931807-106

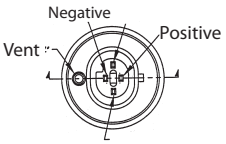
4-PIN PACKARD CONNECTOR

Voltage



Top View: 4-Pin Packard Connector
Type: Metri-Pack 150

Current



Top View: 4-Pin Packard Connector
Type: Metri-Pack 150

Model 209

OEM Pressure Transducer

ORDERING INFORMATION

2 0 9 1 – ☐☐☐☐ – ☐ – ☐☐ – ☐☐ – ☐☐ – ☐

Model	Range Code				Pressure Type		Pressure Fitting		Output[6]		Elec. Termination		Options	
2091 = Model 209	Range Code	PSI	Range Code	PSI	G	Gauge	2M	1/4" NPT Male	11	4-20 mA	XX	Cable length in feet	H	High Overpressure Capability (Only available on 25 PSI up to 1500 PSI Pressure Ranges)
	001P	0 to 1	500P	0 to 500	C	Compound	J7	7/16" SAE Male	24	0.5 to 5.5 VDC	P1	Packard (3-Pin)[2]		
	002P	0 to 2	10CP	0 to 1,000	S	Sealed[1]	1M	1/8" NPT Male	27	1 to 5 VDC	P3	Packard (4-Pin)[3]		
	005P	0 to 5	15CP	0 to 1,500	V	Vacuum	L4	1/4 Female SAE Internal 7/16-20 w/ Schrader Pin	28	1 to 6 VDC	H2	Hirschmann, ("Mini")[4]		
	010P	0 to 10	20CP	0 to 2,000			G4[5]	1/2" A Male	45	0.5 to 4.5 VDC	A1	Terminal Block w/ Conduit Cover		
	025P	0 to25	30CP	0 to 3,000			P1	1/8" NPT Female Bulkhead (Available on Ranges > 50 PSI)						
	050P	0 to 50	50CP	0 to 5,000										
	100P	0 to 100	10KP	0 to 10,000										
	200P	0 to 200	Z01P	0 to -14.7 PSI										
	250P	0 to 250												

[1] Sealed version available on 200 PSI ranges and above.
[2] Order Setra Part #577 for Mating Connector.
[3] Order Setra Part #857 for Mating Connector.
[4] Order Setra Part #590 for Mating Connector.
[5] Only available for pressure ranges below 25 PSI.
[6] Consult factory for other output options.

Ordering Example: 2091001PG2M1102 = Model 209, 0 to1 PSI Range, Gauge Pressure, 14" NPT Male Fitting, 4 to 20 mA Output, 2 ft. Cable.

ACCESSORIES

577	3-Pin Mating Packard Kit
581	Cable Assembly - Packard, 3-pin (3 ft.)
582	Cable Assembly - Packard, 3-pin (6 ft.)
590	Mating Hirschmann Kit
857	4-Pin Mating Packard Kit

PROOF PRESSURE

	Standard		Option	
Full Scale Range (PSI)	Proof Pressure (PSI)	Burst Pressure (PSI)	High Proof Pressure (PSI)	High Burst Pressure (PSI)
1	2	250	N/A	N/A
2	4	250	N/A	N/A
5	10	250	N/A	N/A
10	20	500	N/A	N/A
25	50	500	N/A	N/A
50	100	750	800	5,000
100	200	1,000	1,000	5,000
200	400	2,000	1,500	5,000
250	500	2,000	2,000	8,000
500	1,000	3,000	2,500	10,000
1,000	2,000	5,000	4,000	10,000
1,500	2,500	6,000	5,000	12,000
2,000	3,000	6,500	N/A	N/A
3,000	4,500	7,500	N/A	N/A
5,000	7,500	10,000	N/A	N/A
10,000	12,500	20,000	N/A	N/A
-14.7 (Vacuum)	10	15	N/A	N/A

GENERAL SPECIFICATIONS

Performance Data		**Environmental Data**	
Accuracy RSS[1] (at constant temp)	±0.25% FS	Operating[3] Temperature °F (°C)	-40 to + 185 (-40 to +85)
Non-Linearity, BFSL	±0.22% FS	Storage Temperature °F (°C)	-40 to + 185 (-40 to +85)
Hysteresis	0.10% FS	Shock[3]	200g operating
Non-Repeatability	0.05% FS	Acceleration	10 g Maximum[5]
Thermal Effects		Shock[3]	200g Operating
Compensated Range °F (°C)	-4 to +176 (-20 to +80)	Vibration[4]	20g
Zero Shift %FS/100°F (%FS/50°C)	±2.0 (±1.8)	Environmental Protection	Weather Resistant
Span Shift %FS/100°F (%FS/50°C)	±1.5 (±1.3)	**Electrical Data (Voltage)**	
Warm-up Shift	0.1% FS Total	Circuit	3-Wire (COM, OUT, EXC)
Response Time	5 milliseconds	Excitation	9 to 30 VDC
Long Term Stability	0.5% FS/1 YR	Output[6]	0.5 to 5.5 VDC[7]
Pressure Media		Output Impedance	10 ohms
Liquids and gases compatible with 17-4 PH Stainless Steel.[2]		**Electrical Data (Current)**	
Physical Description		Circuit	2-Wire
Case	Stainless Steel & Valox	Output[8]	4 to 20mA[9]
Wetted Material	17-4 PH Stainless Steel	External Load	0 to 800 ohms
Electrical Connection	2 ft. multiconductor cable	Minimum supply voltage (VDC)	9+ 0.02 x (Resistance of receiver plus line)
Pressure Fitting[5]	1/4" -18 NPT external, 17-4 PH Stainless Steel	Maximum supply voltage (VDC)	30+ 0.004 x (Resistance of receiver plus line).
Vent	Through cable		
Weight (approx.)	2.3 ounces (65 grams)		

[1] RSS of Non-Linearity, Hysteresis, and Non-Repeatability.
[2] Note: Hydrogen not recommended for use with 17-4 PH Stainless Steel.
[3] Mil-Std. 202, Method 213B, Cond. C
[4] Mil-Std. 202, Method 204, Cond. C
[5] See ordering information for other fittings available (minimum quantities apply).
[6] Calibrated into a 50K ohm load, operable into a 5000 ohm load or greater.
[7] Zero output factory set to within ±50mV. Span (Full Scale) output factory set to within ±50mV.
[8] Calibrated at factory with a 24 VDC loop supply voltage and a 250 ohm load.
[9] Zero output factory set to within ±0.16mA. Span (Full Scale) output factory set to within ±0.16mA.
Specifications subject to change without notice.

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PennState
Physical Plant

Hydronic Temperature Sensors and Wells

(This page is hyperlinked to the TOC)

Cutsheets to be inserted after this header document to create the section.

Immersion Probes w/ nylon fitting

Temperature Sensors

Rev. 03/15/18

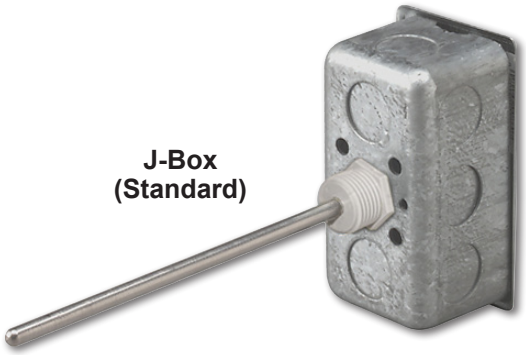
Features & Options

- Probe Lengths: 2”, 4” & 8” (fit standard BAPI Thermowell lengths)
- Series 304 Stainless Steel Probes and three Enclosure Styles
- Double Encapsulated Sensors & Etched Teflon Leadwires

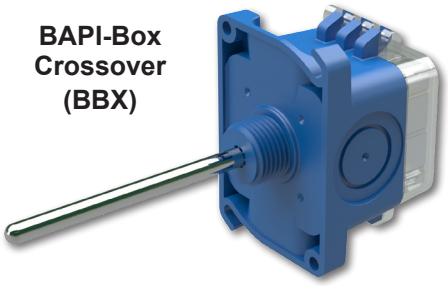
Immersion Units are available in 2”, 4” and 8” probe lengths. The sensor is potted inside a 1/4” stainless steel probe with thermally conductive compound.

All Immersion Units have etched Teflon leadwires and double encapsulated sensors to create a watertight package that can withstand high humidity and condensation.

Immersion Units come standard with a 2”x4” steel J-Box but are also available with the metal Weatherproof enclosure or the new BAPI-Box Crossover enclosure.



J-Box (Standard)



BAPI-Box Crossover (BBX)

The BAPI-Box Crossover

The new BAPI-Box Crossover enclosure features a hinged cover with thumb latch for easy termination. A pierceable knockout plug is available for the open port. See the Accessories section for more info.

(Shown with knockout plug sold separately.)

BAPI Thermowells

Immersion Unit Probes are designed to be inserted into a Thermowell. For more info on Thermowells, see page A40.

Specifications

Environmental Operation Range:
Temperature:
BAPI-Box Crossover: -40 to 85 °C
Other Enclosures: -40 to 100 °C
Humidity: 0 to 100%, non-condensing

Sensing Element:
Thermistor or RTD (See Sensors Section for Specs.)

Probe Material:
Stainless Steel, 1/4” diameter

Enclosure Material:
Junction Box: Galvanized Steel
BAPI-Box Crossover:
UV-resistant polycarbonate, UL94, V-0

Enclosure Rating:
Junction Box: IP20, NEMA 1
BAPI-Box Crossover (BBX):
IP10, NEMA 1
IP44 with knockout plug in open port

Encl. Dimensions: H x W x D
BAPI-Box Crossover:
3.1 x 2.2 x 1.9” (79 x 56 x 49mm)
Junction Box
4.2 x 3.9 x 1.94” (106 x 98.4 x 49mm)

(For enclosure dimension drawings, see the end of the section.)

Use the Option Selection Guide below to create your custom part number. Replace the number and parenthesis with the designator for each selection. Skip the designator and dashes for optional selections that are not required in your configuration.

Immersion Sensor Option Selection Guide

BA/ (**#1**) - (**#2**) - (**#3**) - (**#4**)

#1: Temperature Sensor (required)
1.8K .....1.8K Thermistor
3K .....3K Thermistor
10K-2 .....10K-2 Thermistor
10K-3 .....10K-3 Thermistor
10K-3[11K] .....10K-3[11K] Thermistor
20K .....20K Thermistor

1K[375] .....1K Platinum RTD (375 curve)
1K[NI] .....1K Ω Nickel RTD
1K .....1K Platinum RTD (385 curve)

Transmitters below require a BAPI-Box Crossover Enclosure
T1K[32 TO 212F] .....1K Plat. RTD Transmitter, 4 to 20 mA Output, 32 to 212°F Range
T1K[20 TO 120F] .....1K Plat. RTD Transmitter, 4 to 20 mA Output, 20 to 120°F Range
T1K[0 TO 100F] .....1K Plat. RTD Transmitter, 4 to 20 mA Output, 0 to 100°F Range

T1K[0 TO 100C] .....1K Plat. RTD Transmitter, 4 to 20 mA Output, 0 to 100°C Range
T1K[-7 TO 49C] .....1K Plat. RTD Transmitter, 4 to 20 mA Output, -7 to 49°C Range
T1K[-18 TO 38C] .....1K Plat. RTD Transmitter, 4 to 20 mA Output, -18 to 38°C Range

Matched Transmitters are also available. Contact your BAPI representative for ordering.

#2: Probe Type and Length (required)
I-2” .....Immersion, 2” (51mm) length
I-4” .....Immersion, 4” (102mm) length
I-8” .....Immersion, 8” (203mm) length

#3: Enclosure and Lead Length (optional, comes standard with Junction Box)
BBX ..... BAPI-Box Crossover (IP10, NEMA 1)

#4: Test & Balance or Terminal Strip (optional, requires a BAPI-Box Crossover Enclosure)
TB .....Test & Balance Switch
TS .....Terminal Strip Connection

Additional options are available for these units but not shown in this Selection Guide. Contact your BAPI representative for the complete list of options. Submittal sheets without List Prices can be downloaded from our website at www.bapihvac.com

Example Number: BA/ (**10K-2**) - (**I-2”**) - (**BBX**) - ( )

Actual Number (with parenthesis removed): BA/10K-2-I-2”-BBX

Description: 10K-2 Thermistor, Immersion Sensor, BAPI-Box Crossover, No Test and Balance or Terminal Strip.

Your Number: BA/

Thermowells

Temperature Sensors

Rev. 1/22/13

Features & Options

- Three Lengths: 2”, 4” and 8”
  (Fit standard Immersion Unit lengths)
- Stainless Steel (304 or 316) or Brass
- Two Part (Welded) or Machined Construction
- Other Lengths Available Upon Request
- Limited Lifetime Warranty

Machined Thermowell

Standard Thermowells available from BAPI include 304 stainless steel (machined), 316 stainless steel (machined), brass (machined), and two part* (welded) 304 stainless steel. These wells are offered in 2”, 4” and 8” lengths with 1/2” NPT external and 1/2” NPSM internal. Other lengths and thread diameters are available upon request.

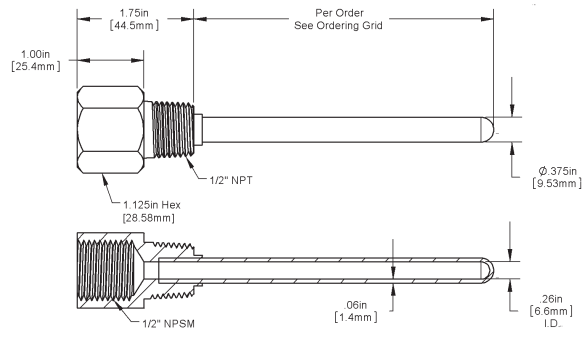
Two Part (welded) Thermowell

The Thermowell chosen for an installation is governed mainly by the corrosion conditions the well will face. The machined stainless steel wells all come with a mirror polish to provide maximum corrosion resistance.

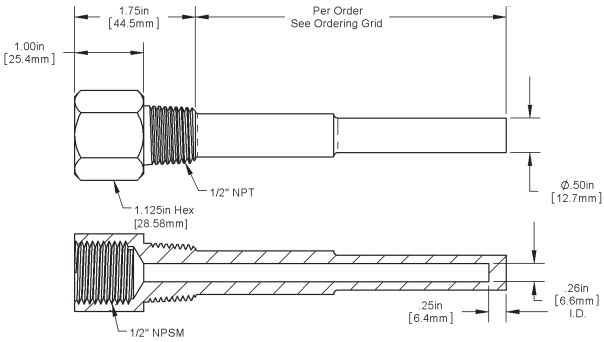
Occasionally, the material consideration is one of strength rather than corrosion. For example, a machined stainless steel well may be required for high pressure water service where otherwise a brass or two part stainless steel well would be satisfactory from a corrosion standpoint.

Note: The two part welded stainless steel thermowells are not intended for service in moving water. They may be used in catch basins, sumps or large storage tanks with small inlet and outlet pipes. Do not mount the two part welded stainless steel thermowells close to the inlet or outlet pipe of the tank.

Specifications



Two Part (Welded) Thermowell
304 Stainless Steel



Machined Thermowell
304 or 316 Stainless Steel or Brass

NPT= National Pipe Taper
NPSM=National Pipe Straight Mechanical (not tapered)

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Ordering Information		Thermowells
BA/		
	Unit Type	
	2"	Two Part (Welded) 304 Stainless Steel - 2"
	4"	Two Part (Welded) 304 Stainless Steel - 4"
	8"	Two Part (Welded) 304 Stainless Steel - 8"
	2"M304	Machined 304 Stainless Steel - 2"
	4"M304	Machined 304 Stainless Steel - 4"
	8"M304	Machined 304 Stainless Steel - 8"
	2"M316	Machined 316 Stainless Steel - 2"
	4"M316	Machined 316 Stainless Steel - 4"
	8"M316	Machined 316 Stainless Steel - 8"
	2"MB	Machined Brass - 2"
	4"MB	Machined Brass - 4"
	8"MB	Machined Brass - 8"
EXAMPLE		
BA/	**4"M304**	
Example Part Number: BA/4"M304 4" Machined 304 Stainless Steel Thermowell		
Your Part Number:		

Note: Standard thread size is ½" NPT external, and ½" NPSM internal.
2" wells have an insertion length of 2.5" (11.43 cm).
4" wells have an insertion length of 4.5" (11.43 cm).
8" wells have an insertion length of 7.5" (19.05 cm).

Gray shaded items follow the Buy and Resale Multiplier.

Comparing the Wake Frequency and the Resonant Frequency

Well failures, in most cases, are not due to the effects of pressure or temperature on the well. The calculations necessary to provide adequate strength, under given conditions, are familiar enough to permit proper choice of wall thickness and material. The values shown in Table 1 are conservative, and intended primarily as a guide. Less familiar, and more dangerous, are the **vibration effects** to which wells are subjected. Fluid, flowing by the well, forms a turbulent wake (called the Von Karman Trail) which has a definite frequency, based on the diameter of the well and the velocity of the fluid. It is important that the well have sufficient stiffness so that the wake frequency will never equal the resonant (natural) frequency of the well itself. If the resonant frequency of the well coincided with the wake frequency, the well would vibrate to destruction and break off in the piping. Wells are also safe if the resonant frequency is well **below** the wake frequency or if the fluid velocity is constantly fluctuating through the critical velocity point. Nevertheless, if the installation is not hampered by the use of a sufficiently stiff well, we recommend the values given in Table 2 not be exceeded.

Table 1: Pressure Rating versus Temperature

Thermowell Material	Temperature in Degrees Fahrenheit						
	70°F	200°F	400°F	600°F	800°F	1000°F	1200°F
	Pressure Rating (Pounds per Square Inch)						
Brass	5000	4200	1000	-	-	-	-
Welded 304 S.S.	982	820	675	604	550	510	299
304 S.S.	7000	6200	5600	5400	5200	4500	1650
316 S.S.	7000	7000	6400	6200	6100	5100	2500

Table 2: Maximum Fluid Velocity versus Insertion Length

Thermowell Material	Fluid Type	Insertion Length (inches)		
		I-2"	I-4"	I-8"
		Maximum Fluid Velocity (Feet per Second)		
Brass	Air/Steam	207	75.5	27.3
	Water	59.3	32.2	19.7
Welded 304 S.S.	Air/Steam	169	61	20
	Water	88	20	10
304 S.S. 316 S.S.	Air/Steam	300	109	39.5
	Water	148	82.2	-

The values shown in Table Two are based on operating temperatures of 350°F for brass and 1,000°F for stainless steel (S.S.). Slightly higher velocities are possible at lower temperatures.

PennState
Physical Plant

Leak Detectors

(This page is hyperlinked to the TOC)

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E10 Water Leak Detector

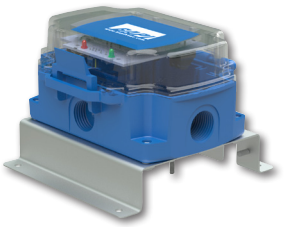
Accessories for HVAC/R

Rev. 04/28/17

Features & Options

- Detection Within 5 Seconds with Local LED Alarm Indication
- 5 Amp or 0.5 Amp Relays @ 30VAC/DC
- One Piece, Rope or Remote Sensor Design
- NEMA 4 Enclosure

The Water Leak Detector is designed to sense the presence of water and alert a central monitoring system of the potentially destructive situation. Upon water detection, the alarm relays change state, and a local red LED illuminates. The transmitter can be set for latching or non-latching alarm, and normally energized or normally de-energized operation.



Detector with Attached Sensor

Detector with Remote Sensor

Detector with Rope Sensor

Specifications

Power: 24VAC/VDC +/- 10%
5 Amp Relays: 4 Watt/ 4 VA max
0.5 Amp Relays: 2 Watt/ 2 VA max (not intended to switch a load)

Wiring: Flex Connector or Liquid Tight Fitting
Relays.....Up to 6 wires for Alarm Contacts
Transmitter .....2 wires for Power

Sensor:
Attached .....SS probe w/ adjustable depth screw from 0.063 to 0.84”
Remote.....Sensor w/ adjustable depth from 0.062 to 0.5”, Mounts to pan with industrial adhesive tape or 0.172” mounting holes
Rope.....Long Line Wire Sensor, Plenum Rated. Detects 1/8” of water over the full length.

Alarm Contacts:
LDT1:..... One SPST, 0.5A relay output, 10W max.
LDT2:..... Two SPST, 0.5A relay outputs, 10W max.
LDT3: ..... One SPDT, 5A relay output
LDT4:..... Two SPDT, 5A relay outputs

Indication: 1 Green Power LED, 1 Red Alarm LED

Reset Action: If latching, local pushbutton or power interrupt

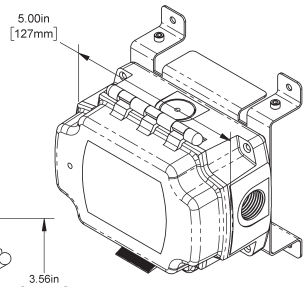
Termination: Terminal Strip, 12 to 24 AWG

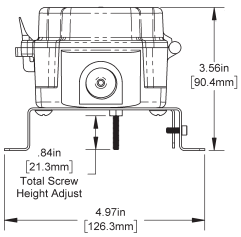
Latching and Supervised Relay Options:
Latching..... Relay stays in alarm until manually reset or power is cycled
Non-Latching.. Relay automatically resets after water is removed (default)
Unsupervised.. Relay energizes on water detection
Supervised..... Relay de-energizes on water detection (default)
Note: Relay de-energizes on loss of power

Enclosure Ratings:
Remote Sensor.. Submersible, with FEP plenum-rated, waterproof cable
Detector..... BAPI-Box, NEMA 4 Polycarbonate Enclosure

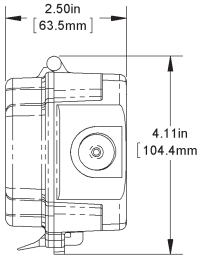
Ambient:
Remote Sensor..... -40 to 185ºF (-40 to 85ºC), 0 to 100%RH, Condensing
Rope Sensor..... 32 to 167ºF (0 to 75ºC), 0 to 95%RH, Non-condensing
Detector (BB)..... -40 to 185ºF (-40 to 85ºC), 0 to 95%RH, Non-condensing

Agency: RoHS, UL94V-0 , UV-rated in Enclosure

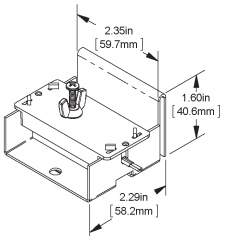




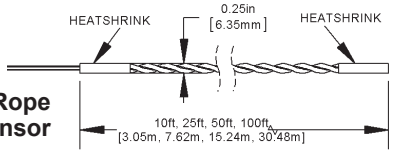
Unit with Attached Sensor



Unit with Remote or Rope Sensor



Remote Sensor



Rope Sensor

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Water Leak Detector Option Selection Guide

BA/ (**#1**) - (**#2**) - (**#3**)

#1: Leak Detector Transmitter (required)

LDT1 ..... Water leak detector transmitter w/ one 0.5A SPST contacts
LDT2 ..... Water leak detector transmitter w/ two 0.5A SPST contacts
LDT3 ..... Water leak detector transmitter w/ one SPDT 5A contacts
LDT4 ..... Water leak detector transmitter w/ two SPDT 5A contacts

#2: Probe Sensor (required)

PS ..... Probe Sensor built into the enclosure
RS5 ..... Remote Spot Sensor with 5 foot FEP cable
RS10 ..... Remote Spot Sensor with 10 foot FEP cable
RS25 ..... Remote Spot Sensor with 25 foot FEP cable
RR10 ..... Remote Rope Sensor with 10 foot Plenum Rated Sensor Cable
RR25 ..... Remote Rope Sensor with 25 foot Plenum Rated Sensor Cable
RR50 ..... Remote Rope Sensor with 50 foot Plenum Rated Sensor Cable
RR100 ..... Remote Rope Sensor with 100 foot Plenum Rated Sensor Cable

#3: Enclosure and Fitting Options (required)

BB ..... BAPI-Box enclosure, IP66 rated
BB-LTF ..... BAPI-Box enclosure, IP66 rated, w/ Liquid tight fitting
BB-GFF ..... BAPI-Box enclosure, IP66 rated, w/ flex connector

Submittal sheets without List Prices can be downloaded from our website at www.bapihvac.com

Example Number: BA/ (**LDT1**) - (**RR10**) - (**BB**)
Actual Number (with parenthesis removed): BA/LDT1-RR10-BB
Description: Detector with one 0.5A contact, 10' Remote Rope Sensor and BAPI-Box Enclosure

Your Number: BA/

Replacement Remote Spot or Remote Rope Sensors

For use as updates to existing systems or built-in (-PS) probe Sensors

	Sensor Type
BA/RS5	Remote Spot Water Sensor with 5 foot FEP cable
BA/RS10	Remote Spot Water Sensor with 10 foot FEP cable
BA/RS25	Remote Spot Water Sensor wtih 25 foot FEP cable
BA/RR10	Remote Rope Sensor with 10 foot Plenum Rated Sensor Cable
BA/RR25	Remote Rope Sensor with 25 foot Plenum Rated Sensor Cable
BA/RR50	Remote Rope Sensor with 50 foot Plenum Rated Sensor Cable
BA/RR100	Remote Rope Sensor with 100 foot Plenum Rated Sensor Cable

Your Number: BA/

On Duty 24/7 AquaGuard®

AG-1200+

AG-1200+

Float Switch System for Metal and Plastic Secondary Pans

The AG-1200+ has all of the features of the 1100+ plus an innovative two-piece clamp design which allows it to be mounted to a metal drain pan (without a lip) or inferior, non-AquaGuard plastic drain pan (with a lip) in 10 seconds or less, without the need for a drain hole in the pan.

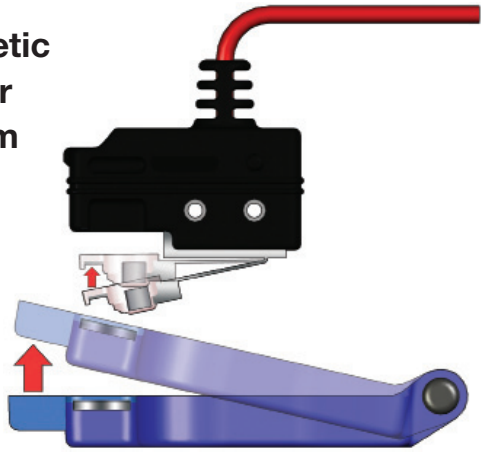
Key Features

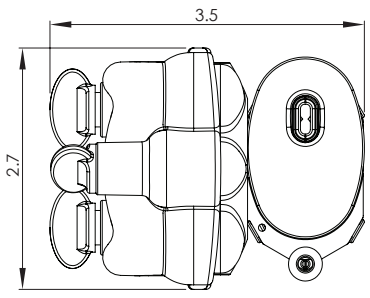
- **5 amp high-capacity sensor designed for metal and plastic pans**
- **The industry leading float switch for metal and plastic drain pans**
- **Easy, no-drill installation**
- **Protective housing keeps out insulation and debris**
- **NEW Open circuit wiring option**

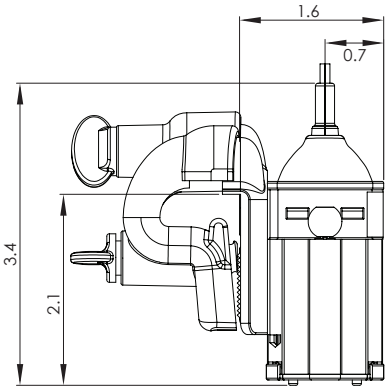
Product Specs

- UL LISTED (UL 508)
- NORMALLY CLOSED OR NORMALLY OPEN
- VERTICAL TRIGGER DEPTH OF 3/4 INCH
- VOLTAGE RATING: 24VAC, 5.0A

Magnetic Trigger System







RECTORSEAL

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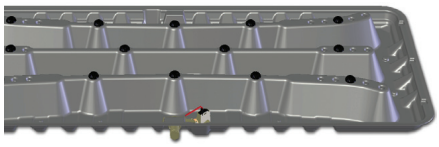
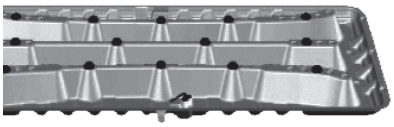
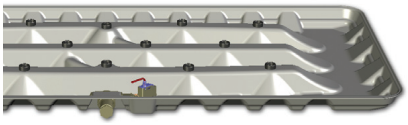
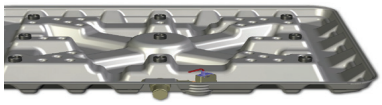
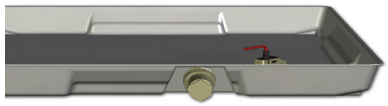
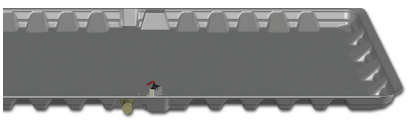
DRAIN PAN SELECTION CHART

Goliath | Titan | Goliath VALUE SERIES

Secondary Pan Model	Pan Size	External Pan Size			Max Unit Size		Recommended Application
Goliath Series		Width	Length	Height	Width	Length	
	30x50	30.25"	50.50"	4.00"	27.25"	47.50"	*Hangable* *When additional clearance is needed under air handler for drain.* *General Purpose for both furnace and air handler installation.*
	30x62	30.38"	63.00"	4.25"	27.38"	60.00"	
	28x57	28.38"	57.25"	5.25"	25.38"	54.25"	
	28x69	28.25"	69.13"	4.25"	26.00"	66.50"	
	30x66	30.25"	66.50"	4.00"	27.25"	64.00"	
Goliath Value Series		Width	Length	Height	Width	Length	
	30x50	30.25"	50.50"	4.00"	27.25"	47.5"	*Non-Hangable* *General purpose for air handler installation.*
	30x62	30.38"	63.00"	4.25"	27.38"	60.00"	
	30x66	30.25"	66.50"	4.00"	27.25"	64.00"	
Goliath Low Profile		Width	Length	Height	Width	Length	
	26x56	26.50"	56.63"	2.75"	23.50"	53.63"	*Hangable* *When space is at a minimum in a garage or attic.*
Goliath Furnace Series		Width	Length	Height	Width	Length	
	30x36	30.50"	37.50"	3.00"	27.50"	34.50"	*Non-Hangable* *For Vertical, upflow installation of furnace or air handler.*
Goliath Furnace Series		Width	Length	Height	Width	Length	
	34x64	34.13"	64.13"	7.50"	31.13"	61.13"	*Non-Hangable* *When greater clearance height is needed to accomodate piping under furnace.*
	34x79	33.75"	79.00"	7.50"	30.75"	76.00"	
Titan Flexible Series		Width	Length	Height	Width	Length	
	24x24	24.00"	24.00"	2.25"	20.00"	20.50"	*Non-Hangable* *Flexible and durable enough to bend and fit into tight spaces.*
	26x26	26.00"	26.00"	2.25"	22.00"	22.50"	
	30x30	30.00"	30.00"	2.25"	26.00"	26.50"	
	32x32	32.00"	32.00"	2.25"	28.00"	28.50"	
Titan Flexible Series		Width	Length	Height	Width	Length	
	30x50	30.25"	50.50"	2.50"	27.25"	47.50"	*Hangable* *Flexible and durable enough to bend and fit into tight spaces.*
	30x62	30.38"	63.00"	2.50"	27.38"	60.00"	

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PennState
Physical Plant

Peripherals and Accessories

(This page is hyperlinked to the TOC)

Cutsheets to be inserted after this header document to create the section.

Low Temperature Detection Sensor

For monitoring the temperatures of water/air heaters in ventilation and air conditioning systems to prevent frost damage to the cooling registers. Manual or automatic reset versions and adjustable setpoints. The frost alarm is provided with a 1-pole changeover switch.

5 YEAR WARRANTY

Type Overview

Type	Output signal temperature switch	Additional features	Probe length
01DTS-504	changeover	Auto reset	10 ft [3 m]
01DTS-504X	changeover	Manual reset	10 ft [3 m]
01DTS-505	changeover	Auto reset	20 ft [6 m]
01DTS-505X	changeover	Manual reset	20 ft [6 m]

Technical Data

Electrical Data	Cable entry	Cable gland cap nut with strain relief Ø6...8 mm
Functional Data	Output signal switch note	1x SPDT (4A @ AC/DC 24V)
	Application	air
Measuring Data	Measuring values	temperature
	Measuring range temperature	15...60°F [-10...15°C]
	Accuracy temperature active	±0.9°F [±0.5°C]
Materials	Cable gland	PA6, gray
	Housing	Base: ABS, gray seal: 0467 NBR70, black cover ABS, transparent
	Probe material	Copper/vapor filled R507
Safety Data	Ambient humidity	max. 95% r.H., non-condensing
	Ambient temperature	-30...160°F [-35...70°C]
	Fluid temperature	-30...120°F [-35...50°C]
	Protection class IEC/EN	III protective extra-low voltage (pelv)
	EU Conformity	CE Marking
	Certification IEC/EN	IEC/EN 60730-1
	Degree of protection IEC/EN	IP65
	Degree of protection NEMA/UL	NEMA 4
	Quality Standard	ISO 9001

Safety Notes

This device has been designed for use in stationary heating, ventilation and air-conditioning systems and must not be used outside the specified field of application. Unauthorised modifications are prohibited. The product must not be used in relation with any equipment that in case of a failure may threaten humans, animals or assets.
Ensure all power is disconnected before installing. Do not connect to live/operating equipment.

Only authorised specialists may carry out installation. All applicable legal or institutional installation regulations must be complied during installation.

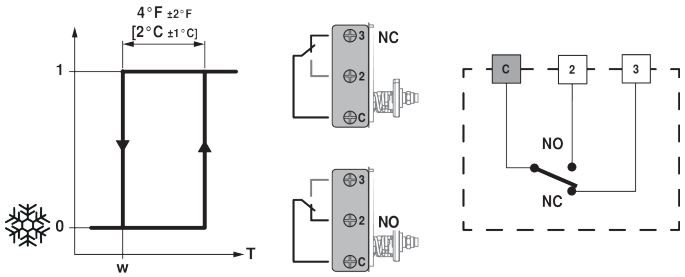
The device contains electrical and electronic components and must not be disposed of as household refuse. All locally valid regulations and requirements must be observed.

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

Scope of delivery

Scope of delivery	Description	Type
	Mounting kit, with mounting brackets	A-22D-A08

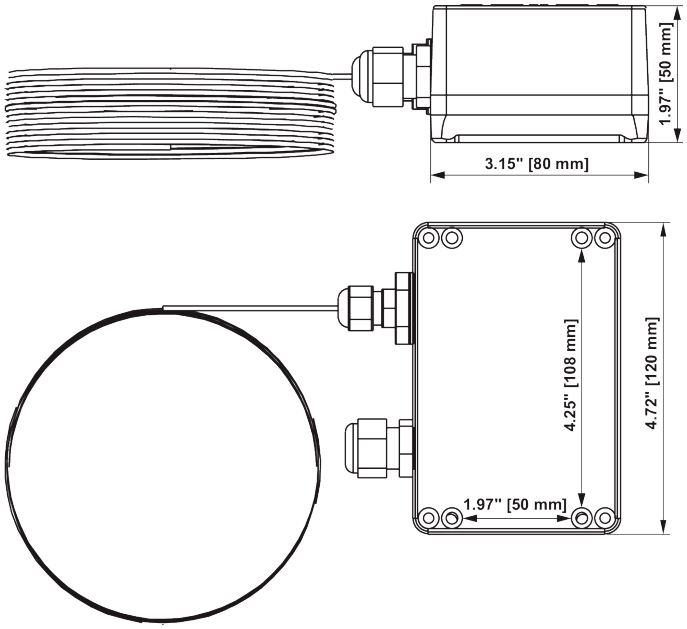
Wiring Diagram



set point range (factory setting 41°F [5°C])
If the capillary leaks, the switch changes to the frost position.

Dimensions

Dimensions



Type	Probe length	Weight
01DTS-504	10 ft [3 m]	0.89 lb [0.41 kg]
01DTS-504X	10 ft [3 m]	0.89 lb [0.41 kg]
01DTS-505	20 ft [6 m]	1.01 lb [0.46 kg]
01DTS-505X	20 ft [6 m]	1.01 lb [0.46 kg]

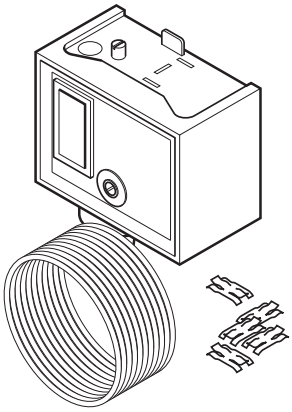
TC-5231 Series, TC-5232, & TC-5241 Series

Low Temperature Thermostats
General Instructions

Application

The TC-5231, TC-5232, and TC-5241 low temperature thermostats are used to control temperature in air conditioning or refrigeration systems. The low temperature thermostat measures the coldest one-foot section along the entire 20-foot sensing element.

The low temperature thermostats are applicable to various applications such as: low temperature control of steam coils; frost indication in storehouses or orchards; temperature control of freezer cabinets, display cases, beverage coolers, milk cooling tanks, and air conditioners.



Features

- 20 ft. (6.1 m) element senses temperature over a large area. Control responds to coldest one-foot section of the sensor.
- Adjustable setpoint from 35 to 60°F (1.7 to 15.5°C) with 5°F (3°C) fixed differential.
- SPDT and DPST versions.
- Rated for use at 17 full load amps (120/208/240 Vac), 24 non-inductive amps (120/208/240 Vac), and 16 non-inductive amps (24 Vac). Capable of controlling refrigeration equipment directly.
- UL and CSA approved.
- Capillary clips provided.

Applicable Literature

- Electric/Electronic Products Catalog, F-27382
- Environmental Controls Application Manual, F-21335

SPECIFICATIONS

Setpoint Dial Range: Dual marked 35 to 60°F (1.7 to 15.5°C).

Sensing Element: Vapor pressure type, copper construction.

Response: To lowest temperature sensed by any one-foot section of its element. Altitude causes the control to operate approximately 1°F colder per 1000 ft. of elevation.

Differential: 5°F (3°C) fixed.

Electrical Switch: Snap action SPDT or DPST. Refer to Table-1.
Ratings, Refer to Table-1 and Table-2.

Connections:
TC-52xx, Screw terminals.

Mounting: In any position on any surface not subject to excessive vibration.

Housing: Molded gray PVC plastic cover with a zinc-plated steel main enclosure with a 1/2 in. conduit opening.

Ambient Temperature Limits:
Shipping and Storage, -40 to 150°F (-40 to 66°C).
Operating, Must be 5°F (3°C) above setpoint to a maximum of 150°F (66°C) at case.
Thermal Sensing Element, 300°F (149°C).

Humidity:
Enclosure, 5 to 95% RH, non-condensing.
Thermal Sensing Element, 0 to 100% RH.

Enclosure Rating: NEMA Type 1.

Dimensions:
Case, 2.7 H x 3.44 W x 1.97 D in. (69 x 87 x 50 mm).
Element, 3/32 in. O.D. x 20 ft. length (2.4 mm x 6.1 m).

Agency Approvals: UL 873 Temperature-Indicating and -Regulating Equipment and CSA Certified.

Table-1 Model Chart.

Model Number	Device Type	Electrical Switch	Voltage Vac	Full Load Amps	Locked Rotor Amps	Pilot Duty (VA)	Non-Inductive Amps
TC-5231	Low temp auto reset	SPDT[e]	24[a]	—	—	100	16
			120	17	102	720	24
			208				
			240[c]				
			277	—	—	—	7.2
TC-5232	Low temp auto reset	DPST[d]	24[a]	—	—	100	16
			120[c]	24	144	125	24
			208[c]				
			240[c]				
			277	—	—	—	7.2
TC-5241	Low temp manual reset[b]	SPDT[e]	24[a]	—	—	100	16
			120	17	102	720	24
			208				
			240[c]				
			277	—	—	—	7.2

[a] Less than 0.5 Amp is not recommended.
[b] Reset cannot be accomplished until the sensed temperature is at least 5°F above setpoint.
[c] Full load and locked rotor ratings are suitable for hermetic compressors only.
[d] Limit two separate circuit loads with common return to < 5885 VA. Only one load may be a motor load.
[e] Do not exceed pilot duty rating on one side of switch.

Table-2 DC Ratings for TC-5232 Only.

Volts	FLA	LRA	NIA	PD VA
120	4.6	46	3	57.5
240	2.3	23	0.5	57.5
600	—	—	—	57.5

TYPICAL APPLICATIONS (wiring diagrams)

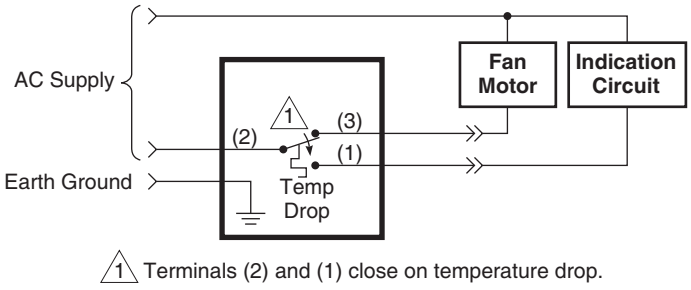
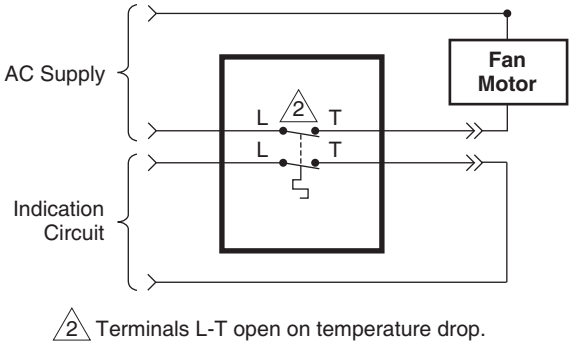


Figure-1 TC-5231 and TC-5241 Typical Application.



Note: Contacts are not rated for dry circuit applications. Less than 1 Amp is not recommended.

Figure-2 TC-5232 Typical Application.

INSTALLATION

Inspection

Inspect the package for damage. If damaged, notify the appropriate carrier immediately. If undamaged, open the package and inspect the device for obvious damage. Return damaged products.

Requirements

- Job wiring diagrams
- Tools (not provided):
  - Voltage meter/indicator
  - Appropriate drill and drill bit for mounting screws
  - Appropriate screwdrivers and wrenches
- Mounting screws, two (2) #10 maximum (not provided)
- Capillary mounting clips (5 provided)
- Training: Installer must be a qualified, experienced technician

WARNING

- The TC-5231 series, TC-5232, and TC-5241 series devices are designed for use *only* as operating controls. Where an operating control failure would result in personal injury and/or loss of property, it is the responsibility of the installer to add devices (safety, limit controls) that protect against, or systems (alarm, supervisory systems) that warn, of control failure.
- Disconnect the power supply (line power) before and during installation to prevent possible electrical shock and equipment damage.
- Make all connections in accordance with the wiring diagram and in accordance with the National and Local Electrical Code. *Use copper conductors only.*
- Do not restore electrical power until installation is complete.

CAUTION

- Do not exceed the electrical ratings indicated on the label inside the cover of the device.
- Avoid locations where excessive moisture, corrosive fumes, or vibration are present. Use only in locations suitable for NEMA Type 1 rated devices.

Mounting

CAUTION

- Do not kink the capillary or the thermostat will be damaged.
- To achieve optimum performance, do not mount the thermal element in a vertical pattern.

1. Select a location that permits proper capillary routing. It is important not to twist or strain the control body or shifting of the calibration may result.

NOTE

- Use only the mounting holes provided in the control frame. Make sure the mounting surface is flat. Mounting the device to an uneven surface may cause improper control operation.
- Do not let any part of the capillary touch any surface that is colder than the desired sensing area.
- Do not crush or deform the sensing element when clamping.
- Do not cut the capillary or bulb. Avoid sharp bends, kinks, strains, or pinch marks in the capillary. Never allow the capillary to rest against sharp edges or rub against metal surfaces.

2. Provide a drip loop in the capillary if the body is mounted in any position other than upright. The thermal element is usually located on the downstream side of the coil.
3. Allow slack so that the capillary is not taut. Install the thermal element securely in the controlled media for maximum sensing capability and minimum vibration damage.
4. Serpentine the element in a horizontal pattern so that it is exposed to all areas where low temperatures are possible. See Figure-3.
5. Secure the element into place using the five capillary clips provided.
6. Remove the cover. See Figure-4.
7. Mount the case with two screws (#10 maximum) in the screw slots in the back of the case. See Figure-6.
8. Connect the appropriate wiring. Follow the wiring instructions in the Wiring section.

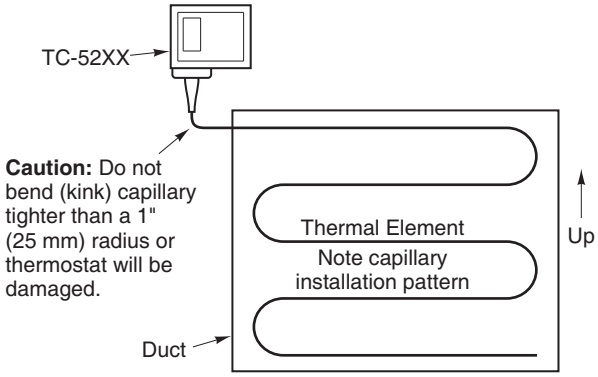


Figure-3 Thermal Element Location.

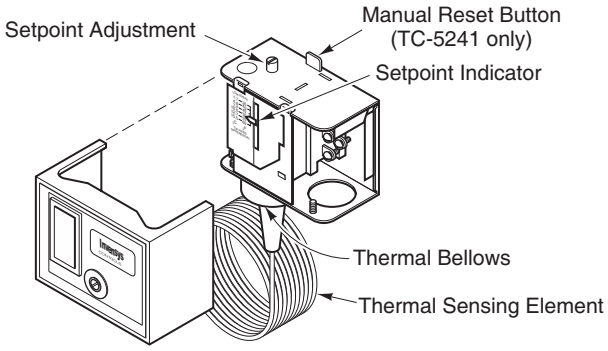


Figure-4 TC-52xx with Cover Removed.

Wiring

NOTE

Do not adjust the pointer beyond the highest and lowest marks on the scaleplate. The scaleplate is only for reference, and the final settings should be verified with a thermometer.

▼ ***CAUTION***

The terminals must not be bent, cut off, drilled, or retapped.

1. Provide a drip loop in the wiring to prevent water from reaching the thermostat.
2. Loosen the green grounding screw provided on the TC-52xx case to connect the unit to earth ground.
3. Loosen the terminal screws and make the appropriate power wiring connections to the numbered terminals. The TC-52xx case has an opening for a 1/2 in. conduit fitting. See Figure-1 and Figure-2 for TC-52xx models.
4. Replace the cover.
5. Adjust the setpoint by turning the setpoint screw until the scale pointer is properly positioned.
6. Check for proper operation of the device. Follow the instructions in the Checkout section.
7. At initial start-up of the equipment, observe the capillary for excessive vibration and make corrections as required.

CHECKOUT

▼ ***CAUTION***

The unit includes a mechanical stop to prevent adjustment below 35°F (2°C). Do not attempt to set below 35°F (2°C), or the device may be damaged.

1. If the ambient temperature at the thermal element is within the 35 to 55°F (2 to 13°C) setpoint range, turn the adjustment screw located in the top of the case until the setpoint exceeds the ambient temperature. Confirm that the snap acting switch has operated.
2. Turn the setpoint adjustment screw until the indicating pointer is at the desired setpoint temperature.
3. On the TC-5241 model, push the manual reset button to put the thermostat into service.

Manual Operation of Switch

▼ ***CAUTION***

- When the sensed temperature is below setpoint, the switch is open (terminals 2–3 on TC-52x1 and terminals L–T on TC-5232), and the tab at the end of the bellows lever is down. The switch can be momentarily closed by lifting the tab with a screwdriver. See Figure-5.
- Do not attempt to manually operate the thermostat in any other way as this can damage equipment and void the warranty.

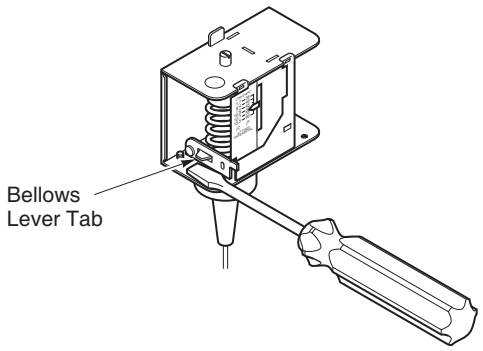


Figure-5 Manual Operation of Switch on TC-5231 and TC-5241.

CALIBRATION

All thermostats are precision calibrated at the factory.

REPAIR

This thermostat is not field repairable. Replace the device if necessary.

DIMENSIONAL DATA

Dimensions are shown in inches (millimeters).

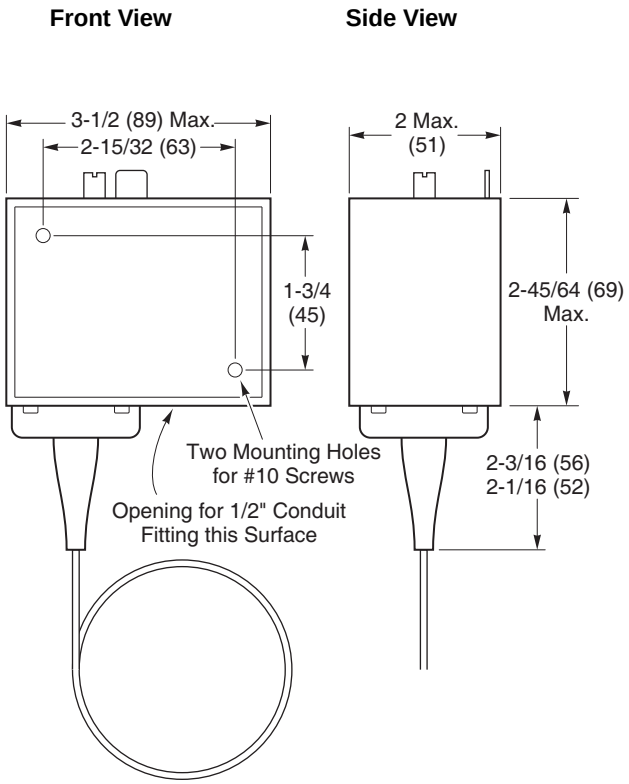


Figure-6 TC-52xx Mounting Dimensions.

On October 1st, 2009, TAC became the Buildings business of its parent company Schneider Electric. This document reflects the visual identity of Schneider Electric, however there remains references to TAC as a corporate brand in the body copy. As each document is updated, the body copy will be changed to reflect appropriate corporate brand changes.

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- Optional clear hinged cover
- Multiple depths available for different contact points
- 16 gauge steel or plastic construction
- Surface or flush mounted
- 600V rated insulation voltage
- 10 amp rated thermal current

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NFPA NEMA ISO 9001 REGISTERED COMPANY ADA

CONTACT BLOCKS (NOT INCLUDED WITH STATION)

Standard breakglass station box holds 2 max, plastic box holds 2 max, and metal box holds 4 max

Part #	Description
SAENOCB	Normally open contact block
SAENCCB	Normally closed contact block

EMERGENCY HVAC STATIONS

Part #	Label	Construction	Mount	NEMA Rating	Switch
HVAC120	HVAC SHUT-DOWN	Plastic	Surface	4 (Weatherproof)	Push/Pull
HVAC120-MT4	HVAC SHUT-DOWN	Deep Plastic	Surface	4 (Weatherproof)	Push/Pull
HVAC120-TWIL24R	HVAC SHUT-DOWN	Plastic	Surface	4 (Weatherproof)	24V LED Push/Turn
HVAC120F	HVAC SHUT-DOWN	Steel	Flush	4 (Weatherproof)	Push/Pull
HVAC120F-KR	HVAC SHUT-DOWN	Steel	Flush	4 (Weatherproof)	Push/Key
HVAC120F-MO-IL	HVAC SHUT-DOWN	Steel	Flush	4 (Weatherproof)	24V LED Push/Pull
HVAC120FN1	HVAC SHUT-DOWN	Steel	Flush	1 (Indoor)	Push/Pull
HVAC120FWB-KR	HVAC SHUT-DOWN	Steel	Flush	1 (Indoor)	Push/Key
HVAC120FWB-TW	HVAC SHUT-DOWN	Steel	Flush	1 (Indoor)	Push/Turn
HVAC120MT4IL24R	HVAC SHUT-DOWN	Deep Steel	Surface	4 (Weatherproof)	24V LED Push/Pull
HVAC120N1	HVAC SHUT-DOWN	Steel	Surface	1 (Indoor)	Push/Pull

BOILER SHUT DOWN STATIONS

Part #	Label	Construction	Mount	NEMA Rating	Switch
BSD120	BOILER SHUT-DOWN	Plastic	Surface	4 (Weatherproof)	Push/Pull
BSD120-KR	BOILER SHUT-DOWN	Plastic	Surface	4 (Weatherproof)	Push/Key
BSD120-MO	BOILER SHUT-DOWN	Plastic	Surface	4 (Weatherproof)	Push/Momentary
BSD120-TW	BOILER SHUT-DOWN	Plastic	Surface	4 (Weatherproof)	Push/Turn
BSD120FN1	BOILER SHUT-DOWN	Steel	Flush	1 (Indoor)	Push/Pull
BSD120N1	BOILER SHUT-DOWN	Steel	Surface	1 (Indoor)	Push/Pull
BSD120N1-MO	BOILER SHUT-DOWN	Steel	Surface	1 (Indoor)	Push/Momentary
BSD120N1-TW	BOILER SHUT-DOWN	Steel	Surface	1 (Indoor)	Push/Turn
BSD120N4	BOILER SHUT-DOWN	Steel	Surface	4 (Weatherproof)	Push/Pull

ESB
EMERGENCY SWITCH BOXES

FUEL SHUT OFF STATIONS

Part #	Label	Construction	Mount	NEMA Rating	Switch
FS120	FUEL SHUT-OFF	Plastic	Surface	4 (Weatherproof)	Push/Pull
FS120FN1	FUEL SHUT-OFF	Steel	Flush	1 (Indoor)	Push/Pull
FS120N1	FUEL SHUT-OFF	Steel	Surface	1 (Indoor)	Push/Pull

EMERGENCY ELECTRICAL DISCONNECT STATIONS

Part #	Label	Construction	Mount	NEMA Rating	Switch
ST120ES	EMERGENCY STOP	Plastic	Surface	4 (Weatherproof)	Push/Pull
ST120ES-TW	EMERGENCY STOP	Plastic	Surface	4 (Weatherproof)	Push/Turn
ST120ESFN1	EMERGENCY STOP	Steel	Flush	1 (Indoor)	Push/Pull
ST120ESFWB-KR	EMERGENCY STOP	Steel	Flush	1 (Indoor)	Push/Key
ST120ESFWB-TW	EMERGENCY STOP	Steel	Flush	1 (Indoor)	Push/Turn
ST120ESN1	EMERGENCY STOP	Steel	Surface	1 (Indoor)	Push/Pull
ST120ESN1-KR	EMERGENCY STOP	Steel	Surface	1 (Indoor)	Push/Key
ST120ESN1-TW	EMERGENCY STOP	Steel	Surface	1 (Indoor)	Push/Turn
ST120ESO	EMER SHUT-OFF	Plastic	Surface	4 (Weatherproof)	Push/Pull
ST120ESON1	EMER SHUT-OFF	Steel	Surface	1 (Indoor)	Push/Pull
ST120FN1	EMER ELEC DISC	Steel	Flush	1 (Indoor)	Break Glass
ST120FN1-BP2	EMER ELEC DISC	Steel	Flush	1 (Indoor)	Break Glass/Push
ST120FN1-SL-BSD	BOIL SHUT DOWN	Steel	Flush	1 (Indoor)	Break Glass
ST120FN1-SL-HSD	HVAC SHUT DOWN	Steel	Flush	1 (Indoor)	Break Glass
ST120FN1SLHSBP2	HVAC SHUT DOWN	Steel	Flush	1 (Indoor)	Break Glass/Push
ST120PB	EMER POWER OFF	Plastic	Surface	4 (Weatherproof)	Push/Pull
ST120PBFWB	HVAC POWER OFF	Steel	Flush	1 (Indoor)	Push/Pull
ST120SL-SL-BS	BOILER STOP	Plastic	Surface	4 (Weatherproof)	Push/Pull
ST120SL-SL-BSD	BOILER SHUT-DOWN	Plastic	Surface	4 (Weatherproof)	Push/Pull
ST120SL-SL-CSD	CHILLER SHUT-DOWN	Plastic	Surface	4 (Weatherproof)	Push/Pull
ST120SL-SL-EXH	EXH FAN SHT-DWN	Plastic	Surface	4 (Weatherproof)	Push/Pull
ST120SL-SL-EXH3	EXH FAN 3 SHTDWN	Plastic	Surface	4 (Weatherproof)	Push/Pull
ST120SL-SL-FAN	EMER EXHAUST FAN	Plastic	Surface	4 (Weatherproof)	Push/Pull
ST120SL-SL-HESO	HVAC EMER SHUT OFF	Plastic	Surface	4 (Weatherproof)	Push/Pull
ST120SL-SL-HSN	HVAC SHUT-DOWN	Plastic	Surface	4 (Weatherproof)	Push/Pull
ST120SL-SL-RPG	REFRIGERANT PURG	Plastic	Surface	4 (Weatherproof)	Push/Pull
ST120SL-SL-SO	EMER SHUT-OFF	Plastic	Surface	4 (Weatherproof)	Push/Pull
ST120SL-SL-VSTR	EMER VENTI START	Plastic	Surface	4 (Weatherproof)	Push/Pull

EMERGENCY ELECTRICAL DISCONNECT STATIONS (CONTINUED)

Part #	Label	Construction	Mount	NEMA Rating	Switch
ST120SLF-SL-BSD	BOIL SHUT-DOWN	Steel	Flush	4 (Weatherproof)	Push/Pull
ST120SLFN1SLBSD	BOIL SHUT-DOWN	Steel	Flush	1 (Indoor)	Push/Pull
ST120SLFN1SLCS	CHILLER STOP	Steel	Flush	1 (Indoor)	Push/Pull
ST120SLFN1SLESD	EMER SHUT-DOWN	Steel	Flush	1 (Indoor)	Push/Pull
ST120SSLFN1SLHSD	HVAC SHUT DOWN	Steel	Flush	1 (Indoor)	Push/Pull
ST120SLFN1SLODS	O/A DAM SHT-DWN	Steel	Flush	1 (Indoor)	Push/Pull
ST120SLFN1SLVS	VENTILATION STOP	Steel	Flush	1 (Indoor)	Push/Pull
ST120SLN1-SL-BD	BOIL SHUT DOWN	Steel	Surface	1 (Indoor)	Push/Pull
ST120SLN1-SL-BS	EMER BOIL STOP	Steel	Surface	1 (Indoor)	Push/Pull
ST120SLN1-SL-CS	CHILLER STOP	Steel	Surface	1 (Indoor)	Push/Pull
ST120SLN1-SL-FP	FLOOD PREVENTION	Steel	Surface	1 (Indoor)	Push/Pull
ST120SLN1-SL-FS	FUEL SHUT-OFF	Steel	Surface	1 (Indoor)	Push/Pull
ST120SLN1-SL-HR	EME HRC-1 STOP	Steel	Surface	1 (Indoor)	Push/Pull
ST120SLN1-SL-HS	HVAC SHUT DOWN	Steel	Surface	1 (Indoor)	Push/Pull
ST120SLN1-SL-IM	INFECT MODE	Steel	Surface	1 (Indoor)	Push/Pull
ST120SLN1-SL-SD	EMER SHUT DOWN	Steel	Surface	1 (Indoor)	Push/Pull
ST120SLN1-SL-SO	EMER SHUT-OFF	Steel	Surface	1 (Indoor)	Push/Pull
ST120SLN1-SL-ST	SMOKE TUNNEL STP	Steel	Surface	1 (Indoor)	Push/Pull
ST120SLN1-SL-VS	VENTILATE STOP	Steel	Surface	1 (Indoor)	Push/Pull
ST120SLN-SL-VT	VENTILAT START	Steel	Surface	1 (Indoor)	Push/Pull
ST120SN1	EMER ELEC DISC	Steel	Surface	1 (Indoor)	Break Glass
ST120SN1-BP1	EMER ELEC DISC	Steel	Surface	1 (Indoor)	Break Glass/Push
ST120SN1-BP2	EMER ELEC DISC	Steel	Surface	1 (Indoor)	Break Glass/Push
ST120SN1-MT1	EMER ELEC DISC	Deep Steel	Surface	1 (Indoor)	Break Glass
ST120SN1-SL-BDC	BOIL DISCONNECT	Steel	Surface	1 (Indoor)	Break Glass
ST120SN1-SL-BSD	BOIL SHUT DOWN	Steel	Surface	1 (Indoor)	Break Glass
ST120SN1-SL-CS	CHILLER STOP	Steel	Surface	1 (Indoor)	Break Glass
ST120SN-SL-CSD	CHILLER SHUT DW	Steel	Surface	1 (Indoor)	Break Glass
ST120SN1-SL-EF1	EF-1 HIGH SPED	Steel	Surface	1 (Indoor)	Break Glass
ST120SN1-SL-EF2	EF-2 HIGH SPED	Steel	Surface	1 (Indoor)	Break Glass
ST120SN1-SL-EVS	EMER VENT STAR	Steel	Surface	1 (Indoor)	Break Glass
ST120SN1-SL-FAN	EMER EXHST FAN	Steel	Surface	1 (Indoor)	Break Glass
ST120SN1-SL-VFS	VENT FAN START	Steel	Surface	1 (Indoor)	Break Glass
ST120SN1-SL-VSS	VENT SYS SHDWN	Steel	Surface	1 (Indoor)	Break Glass
ST120SN1SLBSDB1	BOIL SHUT DOWN	Steel	Surface	1 (Indoor)	Break Glass
ST120SN1SLBSBD2	BOIL SHUT DOWN	Steel	Surface	1 (Indoor)	Break Glass

EMERGENCY ELECTRICAL DISCONNECT STATIONS (CONTINUED 2)

Part #	Label	Construction	Mount	NEMA Rating	Switch
ST120SN1SLFANB1	EMER FAN SH DW	Steel	Surface	3R (Outdoor)	Break Glass
ST120SN1SHSDB1	HVAC SHUT DOWN	Steel	Surface	3R (Outdoor)	Break Glass
ST120SN1SLHSDB2	HVAC SHUT DOWN	Steel	Surface	4 (Weatherproof)	Break Glass/Push
ST120SN1SLSDBP2	EMER SHUT DOWN	Steel	Surface	4 (Weatherproof)	Break Glass/Push
ST120SN3-SL-BSD	BOIL SHUT DOWN	Steel	Surface	4 (Weatherproof)	Break Glass/Push
ST120SN3-SL-GSP	GENERATOR STOP	Steel	Surface	4 (Weatherproof)	Break Glass/Push
ST120SN3R	ELE DISCONNECT	Steel	Surface	4 (Weatherproof)	Break Glass
ST120SN3R-SLVSS	VENT SYS SHDWN	Steel	Surface	4 (Weatherproof)	Break Glass
ST120SN4-BP2	EMER ELEC DISC	Steel	Surface	1 (Indoor)	Break Glass/Push
ST120SN4-SL-CSD	CHIL SHUT DOWN	Steel	Surface	1 (Indoor)	Break Glass
ST120SN4-SL-HSD	HVAC SHUT DOWN	Steel	Surface	1 (Indoor)	Break Glass
ST120SN4SLFSDB1	FAN SHUT DOWN	Steel	Surface	1 (Indoor)	Break Glass/Push
ST120SN4SXSL-BSD	BOILER SHUT DN	Steel	Surface	3R (Outdoor)	Break Glass
ST120SN4XSL-RFL	REFRIGRT LEAK	Steel	Surface	3R (Outdoor)	Break Glass

GENERATOR STOP STATION

Part #	Label	Construction	Mount	NEMA Rating	Switch
GS120N1	GENERATOR STOP	Steel	Surface	1 (Indoor)	Push/Pull

ACCESSORIES

Part #	Description
SAECLHCOV1	Clear polycarbonate cover for steel enclosure
SAECLHCOV1-PVC	Clear polycarbonate cover for plastic enclosure
SAEENS	Spare break glass plate

iStation

Surface Mount Boxes

UL Plenum Rated ISB Surface Mount Box

Features

- Surface Mounting
- Accepts Standard Jacks, Fiber and AV Connections
- Delivers Connectivity to Plenum Areas
- UL Listed for Use in Air Handling Spaces With Jack Installed

Ordering Information

Description	Color	UPC Number	Catalog Number
iStation UL Plenum Rated ISB Surface Mount Box, 2-Port	Office White	662620246369	**ISB2OWP**

Listings

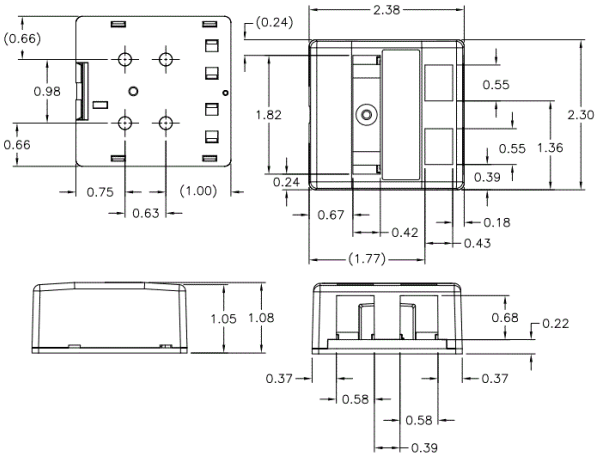
UL and cUL Listed 1863
ANSI/TIA/EIA-606A compliant
ADA compliant
RoHS Compliant

Specifications

Material	High-impact thermoplastic (UL 94V-0)

Applications

Open office environments
Compact surface mount environments
Retrofits to support data, voice, and multimedia applications
Accepts Hubbell HJ and HXJ jacks and audio/video keystone connectors



Online Resources

eCatalog

Dimensions in Inches (mm)

Wiring Device-Kellems

HX00 SERIES

On/Off Status Current Switches

H800

H900

H300

H600

CURRENT SENSING THE ULTIMATE PROOF OF FLOW

Maximize Reliability
Minimize Installed Cost

Reliable

More reliable for status than relays across auxiliary contacts

Installation flexibility

Removable mounting bracket provides installation flexibility

Ideal for direct-drive units

Ideal for direct-drive units, unit vents, fan coil units, exhaust fans, and other fixed loads

Flexibility

Bracket on H900 can be installed in three different configurations

Low setpoint

Minimum trip point as low as 0.5 A (H608)…avoids the need for multiple wraps of the conductor through the sensor even on loads as small as 1/5 HP

Quick installation

Split-core H300, H600 and H900 for fast retrofit installation

Hawkeye x00 on/off current switches provide a cost-effective solution for monitoring status on unit vents, exhaust fans, recirculation pumps, and other fixed loads where belt loss is not a concern.

Veris has applied new technology to the H300, H600, and H800 models to achieve impressive improvement in turn-on levels. The Hawkeye H300 and H600 have the lowest turn-on current in the industry at a mere 0.15 A!

APPLICATIONS

- Electrical load status
- Direct-drive units, exhaust fans, process motors, and other fixed loads
- Lighting run times and status
- VFD output On/Off status
- Direct-Drive units, unit vents, fan coil units, exhaust fans, and other fixed loads

SPECIFICATIONS

Sensor Power	N.O models: Induced from monitored current; H800NC: 5 to 30 Vdc, permanently connected
Insulation Class	600 Vac RMS (UL), 300 Vac RMS (CE*)
Frequency Range	50/60 Hz, On/Off status for Variable Frequency Drive (VFD) outputs at 12 to 115 Hz (a)
Temperature Range: H800NC, H300, H900 H600 H800, H800HV	 -15 to 60 °C (5 to 140 °F) -15 to 40 °C (5 to 104 °F) (to 200 A); -15 to 60 °C (5 to 140 °F) (to 150 A) -40 to 50 °C (-40 to 122 °F) (to 200 A); -40 to 75 °C (-40 to 167 °F) (to 100 A, and 0.25 A status output)
Humidity Range	10 to 90% RH non-condensing
Off State Leakage (H800NC Only)	34 µA @ 5 Vdc, 200 µA @ 30 Vdc
On State Voltage Drop (H800NC Only)	1.9 Vdc (max.) @ 0.1 A
Terminal Block Wire Size H600, H800, H900 H300	 24 to 14 AWG (0.2 to 2.1 mm^2); 22 to 16 AWG (0.3 to 1.3 mm^2)
Terminal Block Torque H600, H800, H900 H300	3.5 to 4.4 in-lbs (0.4 to 0.5 N-m); 7 in-lbs (0.8 N-m)
WARRANTY	
Limited Warranty	5 years
AGENCY APPROVALS	
Agency approvals	UL 508 open device listing; CE: EN61010-1, CAT III, Pollution Degree 2, basic insulation

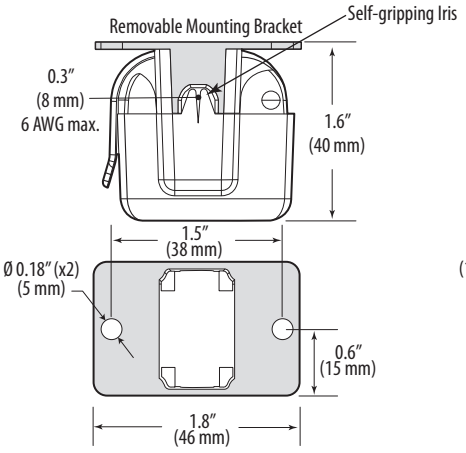
CE c UL us LISTED E150462

*The CE mark indicates RoHS2 compliance. Please refer to the CE Declaration of Conformity for additional details.

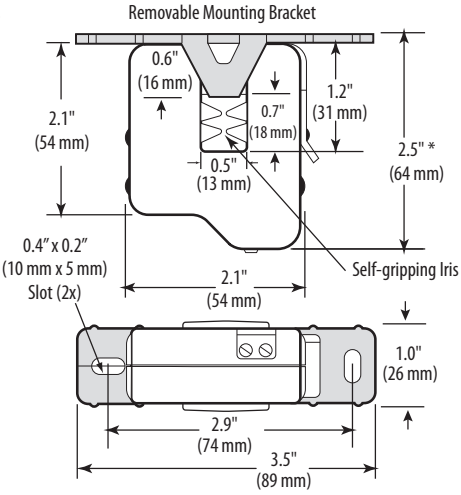
Note: Do not use the LED status indicators as evidence of applied voltage.

(a) VFD systems generate fields that can disrupt electrical devices. Ensure that these fields are minimized and are not affecting the sensor.

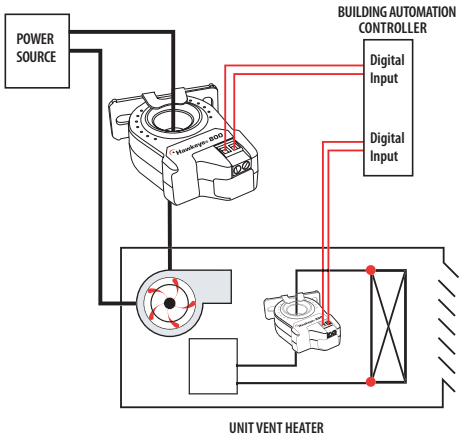
H300
Dimensional Drawing



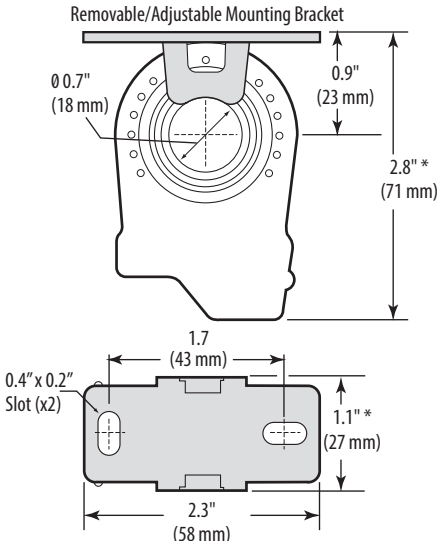
H600
Dimensional Drawing



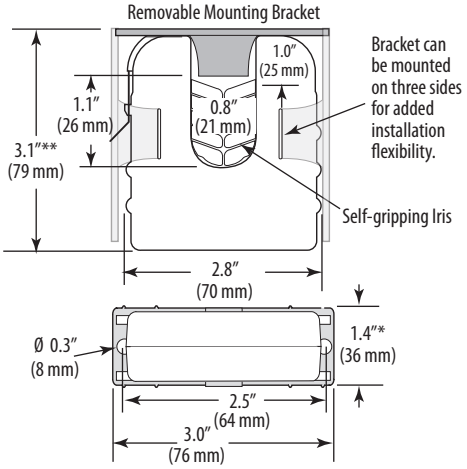
UNIT VENT HEATER CONTROL
Wiring Diagram



H800, H800HV, H800NC
Dimensional Drawing



H900
Dimensional Drawing



* Terminal block may extend up to 1/8″ over the height dimensions shown.
** Slide switch may extend up to 1/4″ over the height dimensions shown.

ORDERING INFORMATION

MODEL	AMPERAGE RANGE @ 50/60 HZ ONLY	STATUS OUTPUT (MAX.)	TRIP POINT	HOUSING	UL	CE	LEAD FREE
H300	0.15 to 60 A	N.O. 1.0 A @ 30 Vac/dc	0.15 A or less	Split-core	•[2]	•	
H600	0.15 to 200 A	N.O. 1.0 A @ 30 Vac/dc	0.15 A or less	Split-core	•[1]	•	
H800	0.25 to 200 A	N.O. 1.0 A @ 30 Vac/dc	0.25 A or less	Solid-core	•[1]	•	
H800NC	0.5 to 200 A	N.C. 0.1 A @ 30 Vdc	0.5 A or less	Solid-core	•[1]		•
H800HV	0.75 to 200 A	N.O. 0.5 A @ 250 Vac/dc	0.75 A or less	Solid-core	•[3]		
H900	1.5 to 200 A	N.O. 1.0 A @ 30 Vac/dc	1.5 A or less	Split-core	•	•	

1. Listed for use on 75°C insulated conductors.
2. Product provides functional insulation only.
3. Listed for use on 90°C insulated conductors.

HX22 SERIES

Load Trending with 0 to 5 Vdc Output

H722 LC

H922

H822

H622-xx

CURRENT SENSING THE ULTIMATE PROOF OF FLOW

Maximize Reliability
Minimize Installed Cost

Hawkeye™

Self-powered analog

Self-powered analog current sensor simplifies installation

New construction

Economical solid-core models feature adjustable bracket for easy alignment (H722xC)

No external power required

No external power required for sensor

Factory calibrated

Factory calibrated ranges for increased flexibility and resolution

Retrofit

Self-gripping, split-core design for fast retrofit installation…no need to remove conductor (H622-xx, H922)

No jumpers

No jumpers on unit…reduces installation error

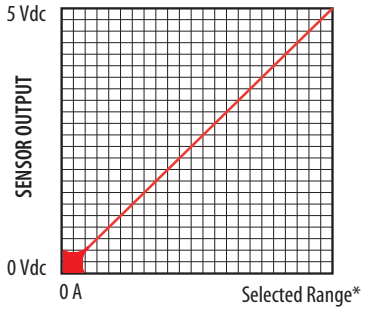
The Hawkeye 622-xx, 722, 822, and 922 provide accurate load trending information with a proportional 0 to 5 Vdc output signal. Slide-switches provide easy field selection of monitored amperage range without jumpers (available on some models).

APPLICATIONS

- Load trending
- Motor control
- Positive proof of flow

EXAMPLE LINEAR OUTPUT

Scale software as shown



SENSED AMPS

**Factory calibrated ranges selected with the amperage range switch*

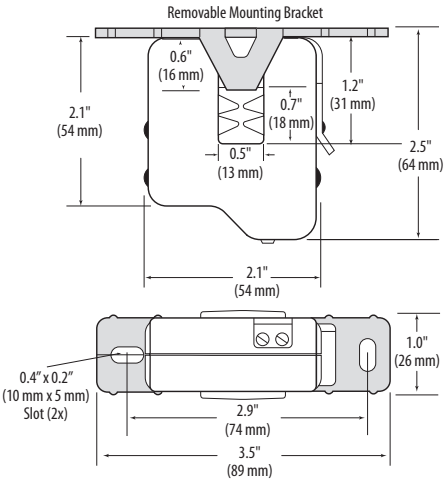
SPECIFICATIONS

Sensor Power	Induced from monitored conductor
Insulation Class	600 Vac RMS (UL), 300 Vac RMS (CE[1])
Frequency Range	50/60 Hz nominal
Temperature Range	-15 to 60 °C (5 to 140 °F)
Humidity Range	10 to 90% RH non-condensing
Accuracy	±2% F.S. from 10% to 100% (range)
Response Time	2 sec.
Terminal Block Wire Size	24 to 14 AWG (0.2 to 2.1 mm²)
Terminal Block Torque	3.5 to 4.4 in-lbs (0.4 to 0.5 N-m)
WARRANTY	
Limited Warranty	5 years
AGENCY APPROVALS	
Agency Approvals	UL 508 open device listing; CE: EN61010-1, CAT III, Pollution Degree 2, basic insulation

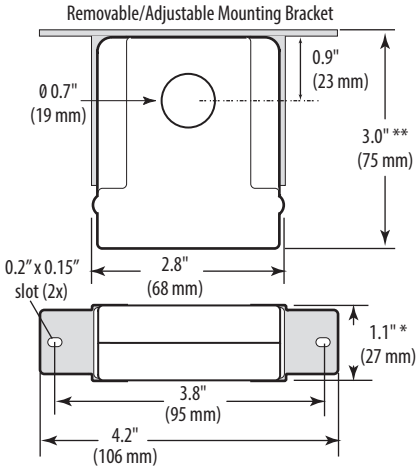
CE c UL us LISTED

1. The CE mark indicates RoHS2 compliance. Please refer to the CE Declaration of Conformity for additional details.

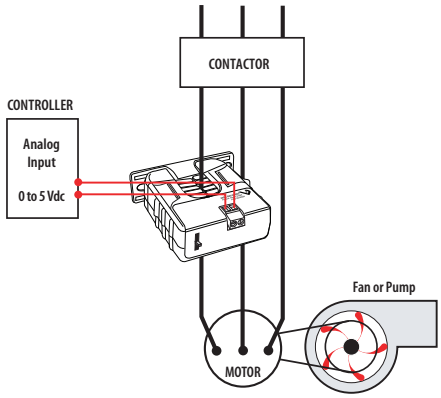
H622-XX
Dimensional Drawing



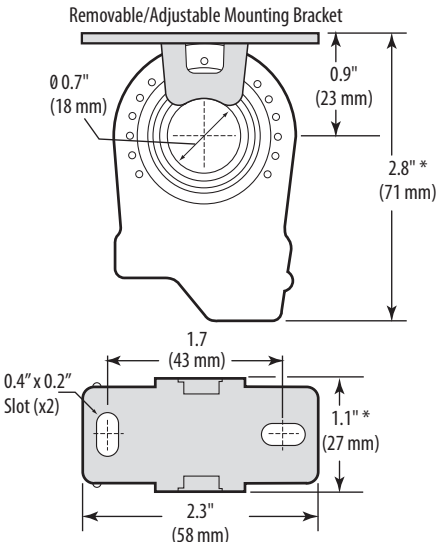
H722LC/H722HC
Dimensional Drawing



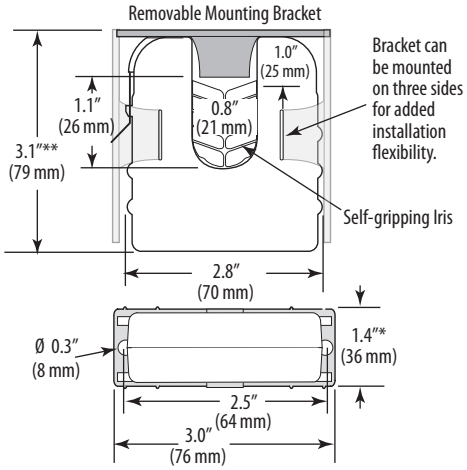
MONITORING FAN /PUMP MOTORS FOR POSITIVE PROOF OF FLOW
Wiring Diagram



H822/H822-20
Dimensional Drawing



H922
Dimensional Drawing



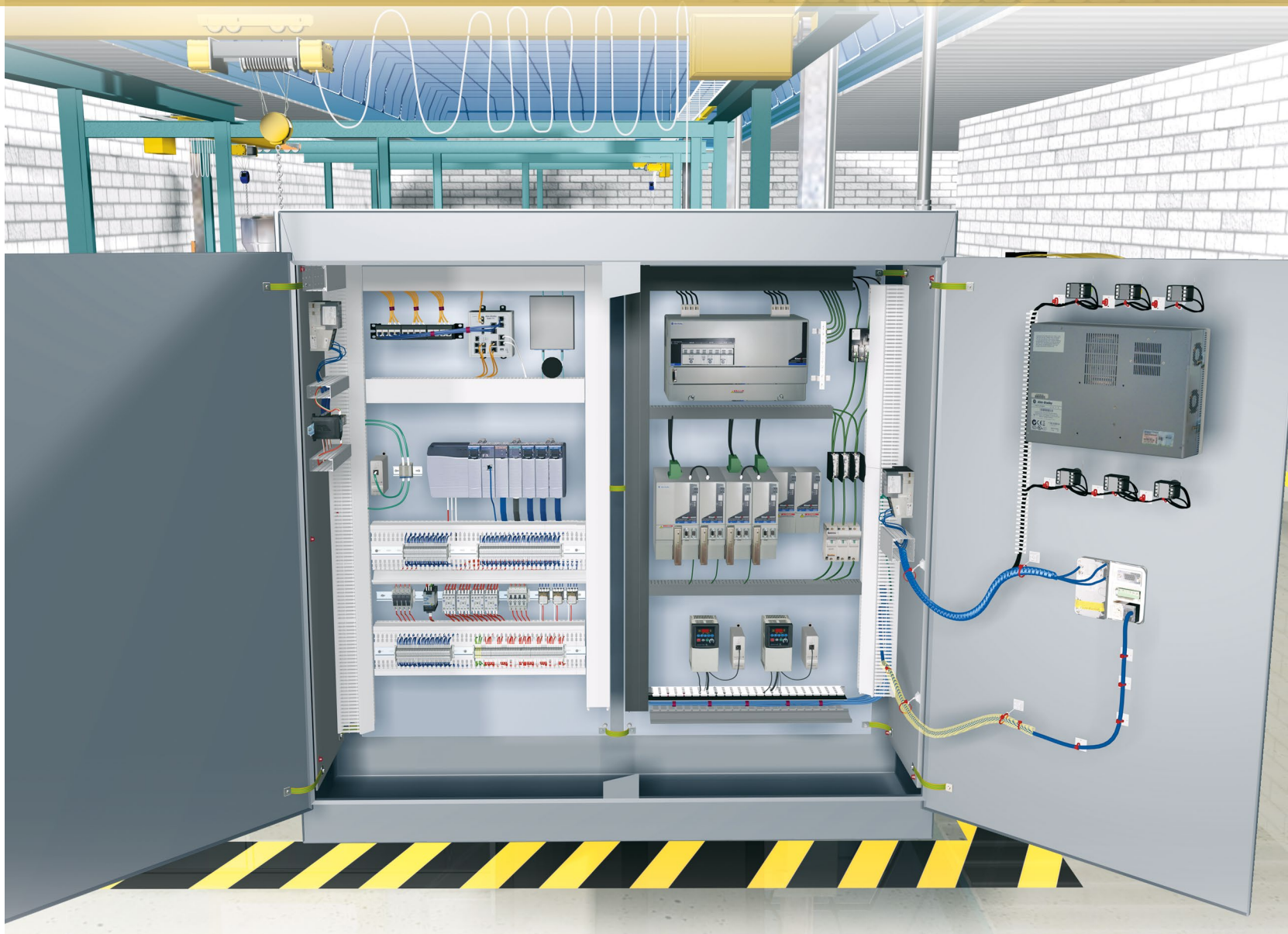
* Terminal block may extend up to 1/8" over the height dimensions shown.
** Slide switch may extend up to 1/4" over the height dimensions shown.

ORDERING INFORMATION

MODEL	AMPERAGE RANGE	SENSOR OUTPUT	HOUSING	UL	CE	LEAD FREE
H622-10	0 to 10 A	0 to 5 Vdc	Split-core	•	•	
H622-20	0 to 20 A		Split-core	•	•	
H722LC	0 to 10/20/40 A		Solid-core	•	•	
H722HC	0 to 50/100/200 A		Solid-core	•	•	
H822	0 to 10 A		Solid-core	•		•
H822-20	0 to 20 A		Solid-core	•		•
H922	0 to 30/60/120 A		Split-core	•[1]	•	
H922030A	0 to 30 A		Split-core		•	
H922060A	0 to 60 A		Split-core		•	
H922120A	0 to 120 A		Split-core		•	

1. Listed for use on 75°C insulated conductors.

800.354.8556 | +1 503.598.4564 | sales@veris.com | intl@veris.com | www.veris.com



Wiring Duct Product Selection Guide

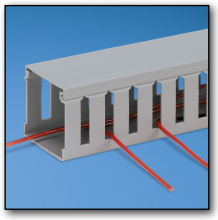
Organize • Connect • Protect

PANDUIT®

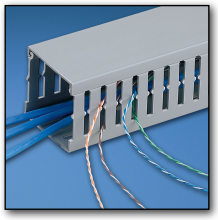
infrastructure for a connected world

Comprehensive Wiring Duct Solutions

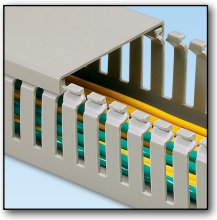
PVC Flush Cover Wiring Duct



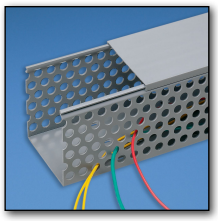
Type G, Wide Slots, Wide Fingers



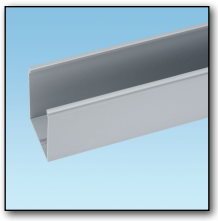
Type F, Narrow Slots, Narrow Fingers



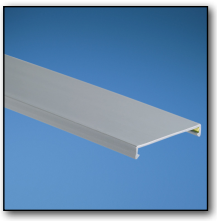
Type MC, Narrow Slots, Narrow Fingers, Metric



Type D, Round Holes

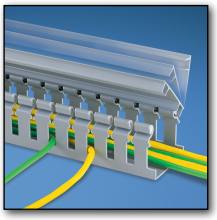


Type FS, Solid Wall

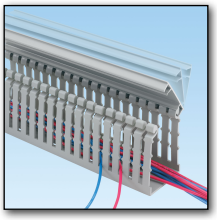


Type C Covers for Type F, G, D, FS, and MC Wiring Duct

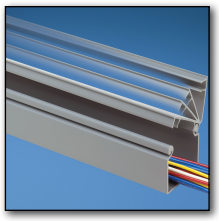
PVC Hinged Cover Wiring Duct



Type H, Hinged Cover, Wide Slots



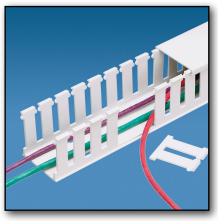
Type HN, Hinged Cover, Narrow Slots



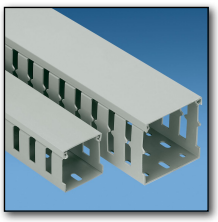
Type HS, Hinged Cover, Solid Wall

Type HC Covers for Type HN, H, and HS Wiring Duct

Halogen-Free Wiring Duct



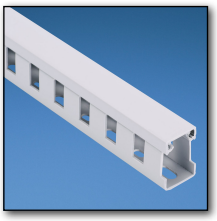
Type NE, Halogen-Free, Wide Slots



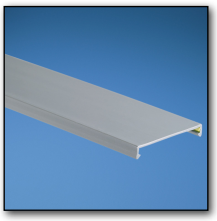
Type NNC, Halogen-Free, Wide Slots, Metric

Type NC Covers for Type NE and NNC Wiring Duct

Low-Smoke, Halogen-Free Wiring Duct

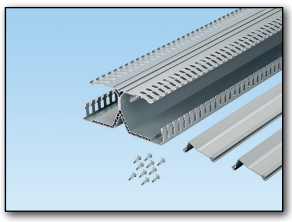


Type TNC, Low Smoke, Halogen-Free, Wide Slots, Metric

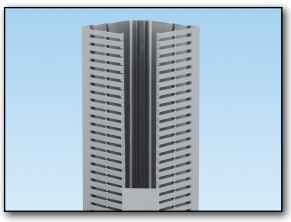


Type TNC Covers for Type TNC Wiring Duct

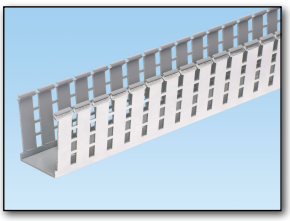
PanelMax™ Space Optimization and Noise Mitigation Products



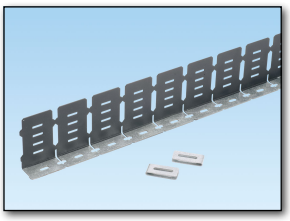
Type DRD, DIN Rail Wiring Duct*



Type CWD, Corner Wiring Duct (use 2" Type C Cover)



Shielded Wiring Duct



EMI Noise Shield

These wiring duct types are sold base and cover separately: G, F, D, FS, HN, H, HS, NE, CWD, and Shielded.
These wiring duct types are sold base and cover together: DRD, NNC, TNC, and MC.
*DIN Rail not included.

Wiring Duct Available Colors and Sizes

Duct Size W x H		LG Light Gray												WH White												BL Black						IB Intrs. Blue+		IG Intl. Gray
In.	mm																																	
.5 x .5	12 x 12	G	F	FS						FL				G	F	FS		NE																
.5 x 1		G	F	FS										G	F			NE																
.5 x 2		G												G																				
.75 x .75		G	F	FS										G	F																			
.75 x 1		G												G																				
.75 x 1.5		G	F											G	F																			
.75 x 2		G												G												G								
1 x 1	25 x 25	G	F	FS					NNC	FL				G	F	FS		NE				NNC				G	F	FS				G	F	MC
1 x 1.5	25 x 37	G	F	FS					NNC		TNC			G	F			NE				NNC				G	F					G	F	MC
1 x 2	25 x 50	G	F	FS	D				NNC					G	F			NE				NNC	MC			G	F		D			G	F	MC
1 x 2.5	25 x 62																						MC											MC
1 x 3	25 x 75	G	F	FS	D				NNC		TNC			G	F		D	NE				NNC	MC			G	F		D			G	F	MC
1 x 4	25 x 100	G	F	FS	D									G	F		D	NE								G	F		D			G	F	
1.5 x 1		G	F	FS										G	F	FS																		
1.5 x 1.5	37 x 37	G	F	FS					NNC		TNC			G	F	FS		NE				NNC	MC			G	F	FS				G	F	MC
1.5 x 2	37 x 50	G	F	FS	D	H	HN	HS	NNC					G	F			NE	H	HN	HS	NNC	MC			G	F		D	H	HS	G	F	MC
1.5 x 2.5	37 x 62																						MC											MC
1.5 x 3	37 x 75	G	F	FS	D	H	HN	HS	NNC		TNC			G	F		D	NE	H	HN	HS	NNC	MC			G	F		D	H	HS	G	F	MC
1.5 x 4		G	F		D									G	F		D	NE								G	F		D			G	F	
2 x 1		G	F	FS										G	F	FS		NE								G	F							
2 x 1.5		G	F	FS										G	F	FS																		
2 x 2	50 x 50	G	F	FS	D	H	HN	HS	NNC	FL	TNC			G	F	FS	D	NE	H	HN	HS	NNC	MC			G	F	FS	D	H	HS	G	F	MC
2 x 3	50 x 75	G	F	FS	D	H	HN	HS	NNC					G	F	FS	D	NE	H	HN	HS	NNC	MC			G	F		D	H	HS	G	F	MC
2 x 4	50 x 100	G	F	FS	D	H	HN	HS	NNC					G	F		D	NE	H	HN	HS	NNC	MC			G	F		D	H	HS	G	F	MC
2 x 5		G	F											G	F																	G		
2.5 x 2.5	62 x 62																						MC											MC
2.5 x 3		G	F		D									G	F											G								
3 x 1		G	F	FS										G	F	FS		NE																
3 x 2	75 x 50	G	F	FS	D									G	F	FS		NE					MC			G	F	FS				G		MC
3 x 2.5	75 x 62																						MC											MC
3 x 3	75 x 75	G	F	FS	D	H	HN	HS	NNC		TNC			G	F	FS	D	NE	H	HN	HS	NNC	MC			G	F	FS	D	H	HS	G	F	MC
3 x 4	75 x 100	G	F	FS	D	H	HN	HS						G	F	FS	D	NE	H	HN	HS		MC			G	F		D	H	HS	G	F	MC
3 x 5		G	F	FS										G	F	FS		NE								G	F					G		
4 x 1.5		G		FS										G																				
4 x 2	100 x 50	G	F	FS	D				NNC		TNC			G	F	FS		NE				NNC	MC			G	F		D			G		MC
4 x 3	100 x 75	G	F	FS	D				NNC		TNC			G	F	FS		NE				NNC	MC			G	F					G	F	MC
4 x 4	100 x 100	G	F	FS	D	H	HN	HS	NNC					G	F	FS	D	NE	H	HN	HS	NNC	MC			G	F	FS	D	H	HS	G	F	MC
4 x 5		G	F	FS										G	F			NE								G	F					G		
6 x 4		G	F	FS										G	F	FS																		
3.35 x 2.54*	85.0 x 64.4											CWD												CWD										
4.40 x 3.57*	111.8 x 90.7											CWD												CWD										
5.33 x 4.58*	135.3 x 115.7											CWD												CWD										
6.25 x 2.12**	156.7 x 54.0												DRD												DRD									
7.25 x 3.12**	184.1 x 79.4												DRD												DRD									
8.25 x 4.12**	209.5 x 104.8												DRD												DRD									

*Corner Duct Profile
**DIN Rail Duct Profile

+Intrinsic Blue Color –

Intrinsic Blue wiring duct is made from the same lead-free PVC material as our standard PVC duct. Intrinsic Blue is an Internationally recognized standard blue color that identifies the wiring duct as “incapable of releasing sufficient electrical or thermal energy under normal or abnormal conditions, to cause ignition of a specific hazardous atmospheric mixture in its most easily ignited concentrations."

+ISA-RD12.6 (Instrument Society of America)

Panduct® Type D, G, F and FS Wiring Duct – Wire Fill Capacity

Nominal Duct Size (W x H) In.	Nominal Area In.²	Electrical															Communication			
		8 AWG	10 AWG	12 AWG			14 AWG			16 AWG			18 AWG			22 AWG	23 AWG	23/24 AWG	24 AWG	Fiber Cable
		0.216	0.164	0.13	0.141	0.152	0.111	0.124	0.133	0.096	0.111	0.118	0.084	0.100	0.106	0.085	0.330	0.25	0.190	0.118
		THHN	THHN	THHN	MTW	MTW	THHN	MTW	MTW	TFFN	MTW	MTW	TFFN	MTW	MTW	MTW	Cat. 6A	Cat. 6	Cat. 5e	3.0 mm
0.50 x 0.50	0.250	3	5	8	7	6	11	9	8	15	11	10	20	14	12	19	1	2	3	10
0.50 x 1.00	0.500	6	10	16	14	12	23	18	16	31	23	20	40	28	25	39	2	4	7	20
0.50 x 2.00	1.000	12	21	33	28	24	46	37	32	62	46	41	80	57	50	79	5	9	15	40
0.75 x 0.75	0.563	6	11	19	16	13	26	20	18	34	26	23	45	32	28	44	2	5	8	23
0.75 x 1.00	0.750	9	15	25	21	18	34	27	24	46	34	30	60	42	38	59	3	6	11	30
0.75 x 1.50	1.125	13	23	38	32	27	52	41	36	69	52	46	91	64	57	88	5	10	17	46
0.75 x 2.00	1.500	18	31	50	43	37	69	55	48	93	69	61	121	85	76	118	7	13	23	61
1.00 x 1.00	1.000	12	21	33	28	24	46	37	32	62	46	41	80	57	50	79	5	9	15	40
1.00 x 1.50	1.500	18	31	50	43	37	69	55	48	93	69	61	121	85	76	118	7	13	23	61
1.00 x 2.00	2.000	24	42	67	57	49	92	74	64	124	92	82	161	114	101	158	10	18	31	81
1.00 x 3.00	3.000	36	63	101	86	74	139	111	96	186	139	123	242	171	152	237	15	27	47	122
1.00 x 4.00	4.000	48	84	135	114	98	185	148	129	248	185	164	323	228	203	316	20	36	63	163
1.50 x 1.00	1.500	18	31	50	43	37	69	55	48	93	69	61	121	85	76	118	7	13	23	61
1.50 x 1.50	2.250	27	47	76	64	55	104	83	72	139	104	92	182	128	114	177	11	20	35	92
1.50 x 2.00	3.000	36	63	101	86	74	139	111	96	186	139	123	242	171	152	237	15	27	47	122
1.50 x 3.00	4.500	55	95	152	129	111	208	167	145	279	208	184	364	257	228	355	23	41	71	184
1.50 x 4.00	6.000	73	127	202	172	148	278	222	193	372	278	246	485	342	305	474	31	54	94	245
2.00 x 1.00	2.000	24	42	67	57	49	92	74	64	124	92	82	161	114	101	158	10	18	31	81
2.00 x 1.50	3.000	36	63	101	86	74	139	111	96	186	139	123	242	171	152	237	15	27	47	122
2.00 x 2.00	4.000	48	84	135	114	98	185	148	129	248	185	164	323	228	203	316	20	36	63	163
2.00 x 3.00	6.000	73	127	202	172	148	278	222	193	372	278	246	485	342	305	474	31	54	94	245
2.00 x 4.00	8.000	97	169	270	229	197	371	297	258	496	371	328	647	457	406	632	41	73	126	327
2.00 x 5.00	10.000	122	212	338	287	247	463	371	323	620	463	410	809	571	508	790	52	91	158	409
2.50 x 3.00	7.500	91	159	253	215	185	347	278	242	465	347	307	607	428	381	593	39	68	118	307
3.00 x 1.00	3.000	36	63	101	86	74	139	111	96	186	139	123	242	171	152	237	15	27	47	122
3.00 x 2.00	6.000	73	127	202	172	148	278	222	193	372	278	246	485	342	305	474	31	54	94	245
3.00 x 3.00	9.000	110	191	304	258	222	417	334	290	558	417	369	728	514	457	711	47	82	142	368
3.00 x 4.00	12.000	146	254	405	344	296	556	445	387	744	556	492	971	685	610	949	62	109	189	491
3.00 x 5.00	15.000	183	318	507	431	370	695	557	484	930	695	615	1214	857	762	1186	78	137	237	614
4.00 x 1.50	6.000	73	127	202	172	148	278	222	193	372	278	246	485	342	305	474	31	54	94	245
4.00 x 2.00	8.000	97	169	270	229	197	371	297	258	496	371	328	647	457	406	632	41	73	126	327
4.00 x 3.00	12.000	146	254	405	344	296	556	445	387	744	556	492	971	685	610	949	62	109	189	491
4.00 x 4.00	16.000	195	339	540	459	395	742	594	516	992	742	656	1295	914	813	1265	83	146	253	655
4.00 x 5.00	20.000	244	424	676	574	494	927	743	646	1240	927	820	1619	1142	1017	1581	104	182	316	819
6.00 x 4.00	24.000	293	509	811	689	593	1113	891	775	1488	1113	984	1943	1371	1220	1898	125	219	379	983

General Formula

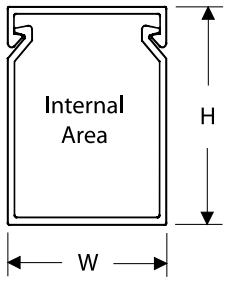
Panduit Wiring Duct wire fills are calculated using the following general formula:

$$50\%\ \text{Wire fill} = 50\%\ \text{of} \left(\frac{\text{Usable Duct Area}}{\text{Wire Area}}\right)$$

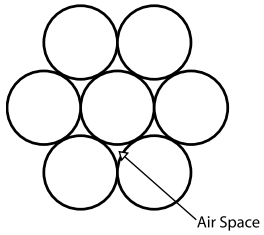
Why use a 50% Wire Fill?

As specified in NFPA79-2012 section 13.5.2, Percentage Fills of Raceways (Ducts), a 50% wire fill is given as the maximum wire fill capacity in all Panduit Wiring Ducts. This helps ensure general safe wiring practices are followed. In actual practice, a 50% wire fill is the maximum amount of wiring the duct can hold given the additional airspace created between cables by non-uniform cable shapes, cable interlacing, and cable packing factors.

Calculation of Internal Area



Air Space Allotment



What is the Usable Duct Area?

The usable area we define as the calculation of internal area that can be occupied by wires or cables. Accounting for thickness of material, 90% of the nominal area (WxH) is used in the formula.

Wire Area

The wire area formula is converted to allow calculation using the cable diameter:

$$A_{WIRE} = \pi r^2$$
$$A_{WIRE} = (\pi/4) \times D^2$$
$$A_{WIRE} = 0.785 \times D^2$$

Formula Derivation

Inserting the elements from above into the general formula results in the following:

$$50\%\ \text{Wire fill} = 0.50 \left(\frac{(W \times H) \times 0.90}{0.785 \times D^2}\right)$$

Simplifying this formula results in the formula used for wire fill calculation:

$$50\%\ \text{Wire fill} = \left(\frac{W \times H}{1.75 \times D^2}\right)$$

Note: When calculating wire fill capacity using the above formula, variables W, H, and D must be expressed in same units (i.e. mm or inches).

Part Numbering System for Panduct® Wiring Duct

G **2** X **2** **LG** — **6** **-A**

Type
G = Wide Slot
F = Narrow Slot
FL = Flexible Duct
FS = Solid Wall
H = Hinged Cover Wide Slot
HN = Hinged Cover, Narrow Slot
HS = Hinged Cover, Solid Wall
D = Round Hole
NNC = Halogen-Free, Metric
NE = Halogen-Free
MC = Narrow Slot, Metric
TNC = Low Smoke, Halogen-Free

Nominal Width
In. or mm

Nominal Height
In. or mm

Color
LG = Light Gray
WH = White
BL = Black
IB = Intrinsic Blue
IG = International Gray

Length
6 ft. or 2m

Options
-A = Adhesive backed
NM = No mounting holes
= Leave blank for no options

Part Numbering System for Panduct® PanelMax™ DIN Rail Wiring Duct

DRD **22** **LG** **6**

Type
DRD = DIN Rail Duct

Size
Capability Height
22 = 2" Height
33 = 3" Height
44 = 4" Height

Color
LG = Light Gray
WH = White

Length
6 ft.

Part Numbering System for Panduct® PanelMax™ Corner Wiring Duct

CWD **2** **LG** **6**

Type
CWD = Corner Wiring Duct

Size
Capability Height
2 = 2" Height
3 = 3" Height
4 = 4" Height

Color
LG = Light Gray
WH = White

Length
6 ft.

Part Numbering System for Panduct® Wiring Duct Covers

C **2** **LG** **6**

Type
C = Cover
HC = Hinged Cover
NC = Halogen-Free
TNC = Low Smoke, Halogen-Free
DRDC = DIN Rail Duct

Width
In. or mm

Color
LG = Light Gray
WH = White
BL = Black
IB = Intrinsic Blue
IG = International Gray

Length
6 ft. or 2m

Panduct® PanelMax™ Shielded Wiring Duct

Shielded wiring duct is a Type G style duct with bridges wrapped with an aluminum foil shield. Sold in 6 ft. lengths, available in three (3) sizes and uses Type C covers and uses standard cover part number C2LG6.

Part Number	Size (W x H)
G2X2LG6EMI	2" x 2"
G2X3LG6EMI	2" x 3"
G2X4LG6EMI	2" x 4"

Panduct® PanelMax™ Noise Shield

Noise shield is zinc-plated steel and black powder coated except at bonding locations. Each kit contains two (2) 3 ft. sections and four (4) bonding clips.*

Part Number	Size (H)
SD2EMI	2"
SD3EMI	3"
SD4EMI	4"

*Additional bonding clips available – SDCLIP (2 per package).

Wiring Duct Material Properties

Rigid Polyvinyl Chloride (PVC)

A general purpose lead-free material for indoor applications. It has a UL 94 flame class of V-0 with a UL recognized continuous-use temperature up to 50°C (122°F). Used in the manufacture of the following types of Panduit wiring duct and covers: G, F, D, FS, MC, H, HN, HS, CWD, DRD.

Halogen-Free, Polyphenylene Oxide (PPO)

A special purpose material for use in halogen-free or high-temperature applications. It has a UL 94 flame class of V-0 with a UL recognized continuous-use temperature up to 95°C (203°F) and is 20% lighter than PVC. Used in the manufacture of the following types of Panduit wiring duct and covers: NE and NNC.

Low-Smoke, Halogen-Free, Polyphenylene Ether + High Impact Polystyrene (PPE + HIPS)

A special purpose material for use in low-smoke, halogen-free, and high-temperature applications. It has a UL 94 flame class of V-0 with a UL recognized continuous-use temperature up to 105°C (221°F). Meets the regulatory requirements of the mass transit industry and other applications where fire and public safety are critical; such as in trains, buses, offshore oil and gas platforms, and other similar environments. Used in the manufacture of Type TNC wiring duct and covers.

Polypropylene (PP)

A flexible material with a UL 94 flame class of V-2 with a UL recognized continuous-use temperature up to 65°C (149°F). Used in the manufacture of Type FL flexible wiring duct.

Recommended Precaution when using Type NE, NS, NNC, and TNC Wiring Duct

Cleaning solvents and cutting fluids that contain any of the following chemical agents should not come into contact with these types of wiring duct or covers. These chemicals are the most commonly known to cause stress cracking.

- Hydrocarbons
- Phenols
- Ketones
- Amines
- Ethers
- Organic, inorganic, and oxidizing acids
- Petrol

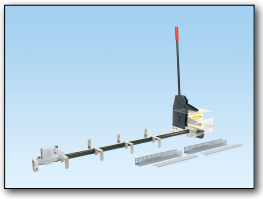
Refer to www.panduit.com for more information on chemical resistance.

Unmatched Expertise

Panduit continually invests in resources to solve your greatest business and technology challenges. Our network of sales, technical support, distribution, and manufacturing teams are readily accessible to help you with your project needs.

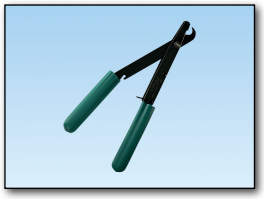
Complete Your Installation with Accessories and Installation Tools

Wire Duct Cutting Tools

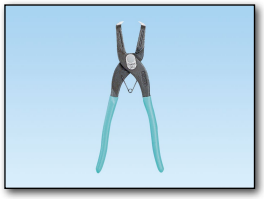


PBDCT –
Bench Mount Duct Cutting Tool

DCT –
Hand-Held Duct Cutting Tool



DNT-100 –
Duct Notching Tool



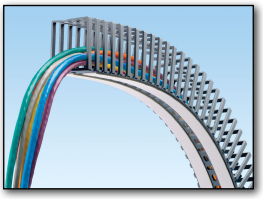
DFCT –
Duct Finger Cutting Tool

Wire Duct Installation Tools

TNR –
Nylon RIvet Installation Tool

Nylon Rivets:
NR1-C – 100 pcs.
NR1-M – 1000 pcs.

Accessories



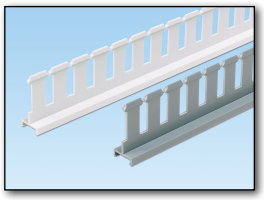
Type FL –
Flexible Wiring Duct; available in lengths of 500mm and in three sizes: 12mm x 12mm, 25mm x 25mm, 50mm x 50mm

Adhesive Tape –
Available in roll form or factory applied on select sizes

Divider Walls

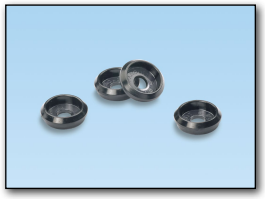
PVC Divider Walls:

Light Gray	White
D2H6 – 2"(H)	**D2HWH6 –** 2"
D3H6 – 3"	**D3HWH6 –** 3"
D4H6 – 4"	**D4HWH6 –** 4"

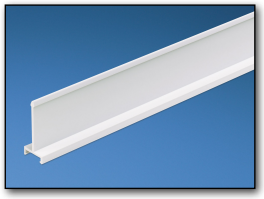


PVC Slotted Divider Walls:

Light Gray	White
SD2H6 – 2"(H)	**SD2HWH6 –** 2"
SD3H6 – 3"	**SD3HWH6 –** 3"
SD4H6 – 4"	**SD4HWH6 –** 4"

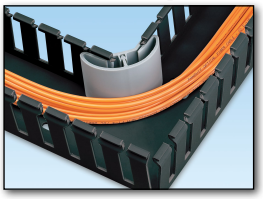


DB-C –
Divider Wall Base for mounting all types of divider walls; halogen-free

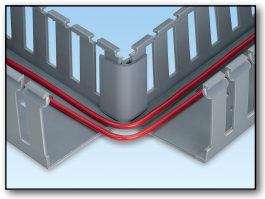


Halogen-Free Divider Walls:
NNC50DWH2 – 50mm (H)
NNC75DWH2 – 75mm
Low Smoke, Halogen-Free:
TNC50D2 – 50mm
TNC75D2 – 75mm

Corner Strips

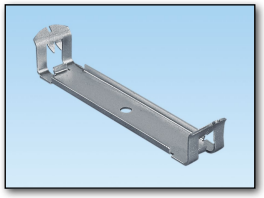


CSC1LG6 –
6 ft. length strip with bend radius control



CS1LG6 –
6 ft. length strip

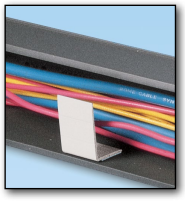
Snap-Clip Mounting Brackets

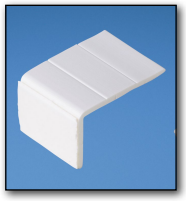


For Wiring Duct Types G, F, FS, and D:
S1F-C – 1" duct width
S1.5F-C – 1.5" duct width
S2F-C – 2" duct width
S3F-C – 3" duct width
S4F-C – 4" duct width

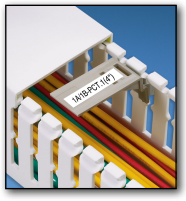
For Wiring Duct Type NE:
SNS.5-C – 0.5' duct width
SNS.75-C – 0.75' duct width
SNS1-C – 1" duct width
SNS1.5-C – 1.5" duct width
SNS2-C – 2" duct width
SNS3-C – 3" duct width

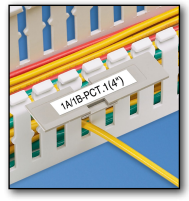
Wire Retainers



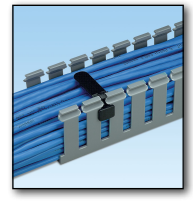


For Type FS and D Wiring Duct:
WRS-A-C10 – for 1" – 2" duct width





For Type F and HN Wiring Duct:
FWR-C – for 1.5" – 4" duct width
For Type MC Wiring Duct:
FMWR-C – for 1.5" – 4" duct width



For Type G and H Wiring
WR2-C – for 2" duct width
WR3-C – for 3" duct width
WR4-C – for 4" duct width
WR5-C – for 5" duct width
WR2H-C – for 2" hinged duct

Panduit Wiring Duct Approvals and Compliances

Agency Mark	Agency	Requirement	Classification/Performance	Wiring Duct Types/Products
	Underwriters Laboratories, Inc. File No. E147128	UL 1565	Material Flame Class V-0 Continuous-use temperature up to 50°C (122°F)	All wiring duct types and covers
c US		UL 1565 CSA C22.2 No. 18.5-13	Material Flame Class V-0 Continuous-use temperature up to 50°C (122°F)	Type H, HS, HN, and DRD
	Underwriters Laboratories, Inc.	UL 508 section 15	An insulating barrier material shall comply with the minimum material properties indicated in Table 15.1	PVC divider walls
		UL 508 sections 34 and 181	Qualifies as a metal barrier with required thickness as indicated in Table 6.1	SD*EMI metal barrier
	Canadian Standards Association File No. 016446	CSA C22.2 No. 18.5-13	Material Flame Class V-0 Continuous-use temperature up to 50°C (122°F)	All wiring duct types and covers (except H, HS, and HN)
CE	European Union	Low Voltage Directive 2006/95/EC	• CDS (cable ducting system for impact 2 J) • Minimum storage, transport, installation, and application temperature: -5°C (23°F) • Maximum application temperature: 60°C (140°F) • Non-flame propagating • Without electrical continuity • Cover removable without a tool	H, HS, G, F, D, MC, FS, NNC, NE, DRD, and TNC
		EN 50085-1 EN 50085-2-3		
	European Union	EN 45545-2	Type NNC and Type NE: Exterior (R23) - HL1 Type TNC: Interior (R22) - HL2 & Exterior (R23) - HL2	NNC and TNC
	DIN German Institute for Standardization	DIN 43659	• Specifies dimensions for slotted trunkings used in electrical switch-gear assemblies and that conform to DIN VDE 060 Part 506 • Channel mounting hole pattern, slot dimensions, pitch, and location • Distance from first to last like-size mounting hole • Minimum overall product length	MC, NNC, and TNC
		DIN 5510-2 DIN 54837	Burning Class: S4 Smoke Class: SR2 Dripping Class: ST2	TNC
	AFNOR French Association of Normalization	NF F 16-101 NF F 16-102	Type NNC Wiring Duct Classification = F3/I4 Type TNC Wiring Duct Classification = F1/I4	NNC and TNC
	UNIFER Italian Railway Standards	EN ISO 11925-2	Pass 30-second flame application	TNC
	FRA – Federal Railroad Administration	49 CFR Part 238	Surface Flammability: < 35 Smoke Density D_s (1.5) < 100 D_s (4.0) < 200	TNC
	NFPA – National Fire Protection Association	NFPA130		
	National Fire Protection Agency	NFPA 79-2015, Section 13.3.1 IEC 60332-1	Non-metallic duct shall be permitted (inside enclosures) only when they are made with a flame-retardant material; flame-retardant material is defined in the standard by the IEC 60332-1 test method	All wiring duct types and covers (except FL)
		NFPA 79-2015, Section 13.5.2	Panduit publishes a maximum percentage wire fill for common wire types equal to 50% of the interior cross-sectional area of the wiring duct	All wiring duct types and covers
		NFPA 79-2015, section 13.1.6.9	Panduit bend radius control accessories can be mounted at right angles and T junctions created using wiring duct in order to maintain cable bend radius control	Corner strip with 1" bend radius control
RoHS	European Union	European Directive 2011/65/EU	Meets the requirements on the Restriction of Hazardous Substances and is free of the six substances listed in the directive	All wiring duct products

PANDUIT®

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Visit us at www.panduit.com

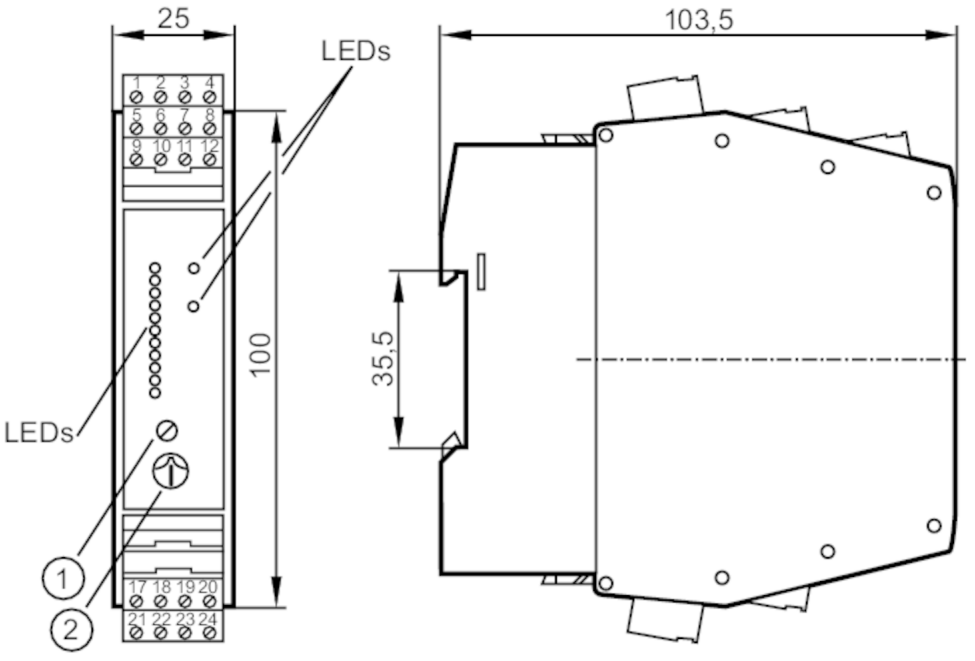
Contact Customer Service by email: cs@panduit.com
or by phone: 800.777.3300

WDSG03--SA-ENG
Replaces WDSG02--SA-ENG
3/2016

SR0150

Control monitor for flow sensors

VS3000/24VDC



1 potentiometer (switch point flow)
2 potentiometer (switch point temperature)

Application		
Application		Flow monitoring; Temperature monitoring; Wire monitoring
Electrical data		
Operating voltage tolerance	[%]	-20...10
Operating voltage	[V]	24 DC
Current consumption	[mA]	90
Protection class		III
Reverse polarity protection		no
Power-on delay time	[s]	10...80; (adjustable (fixed-value resistors terminals 22-23))
Number of channels		1
Outputs		
Performance in case of a fault		In case of undervoltage all relays are de-energised; the LED "LOW VOLTAGE/WIRE BREAK-RELAY" lights
Electrical design		relay
Contact rating		4 A (250 V AC / 30 V DC)
Switching function flow monitoring		relay energised when flow is present and during the power-on delay time
Switching function temperature monitoring		relay energised when temperature is exceeded
Switching function wire break monitoring		relay de-energised in case of wire break or short circuit
Short-circuit proof		no
Overload protection		no

SR0150

Control monitor for flow sensors

VS3000/24VDC

Response times			
Response time	[s]	< 3	
Software / programming			
Adjustment of the switch point		potentiometer	
Selection liquids / gases		wire bridge; on delivery: monitoring of liquids.; for monitoring of gases: link terminals 23 / 24.	
Switch point setting		potentiometer	
Temperature range	[°C]	0...80	
Repeatability of the set switch point	[K]	4	
Operating conditions			
Ambient temperature	[°C]	-20...60	
Note on ambient temperature		in case of sufficient free space for convection cooling	
Protection		IP 20	
Tests / approvals			
MTTF	[years]	263	
Mechanical data			
Weight	[g]	237.5	
Housing		housing for DIN rail mounting	
Dimensions	[mm]	100 x 25 x 103.5	
Materials		PBT	
Displays / operating elements			
Display		function	11 x LED
		switching status	LED, red
		switching status	LED, red
Electrical connection			
Required protection		miniature fuse to IEC60127-2 sheet 1; ≤ 5 A; fast acting	
Remarks			
Remarks		Recommendation Check the safe functioning of the unit after a short circuit.	
Pack quantity		1 pcs.	

SR0150

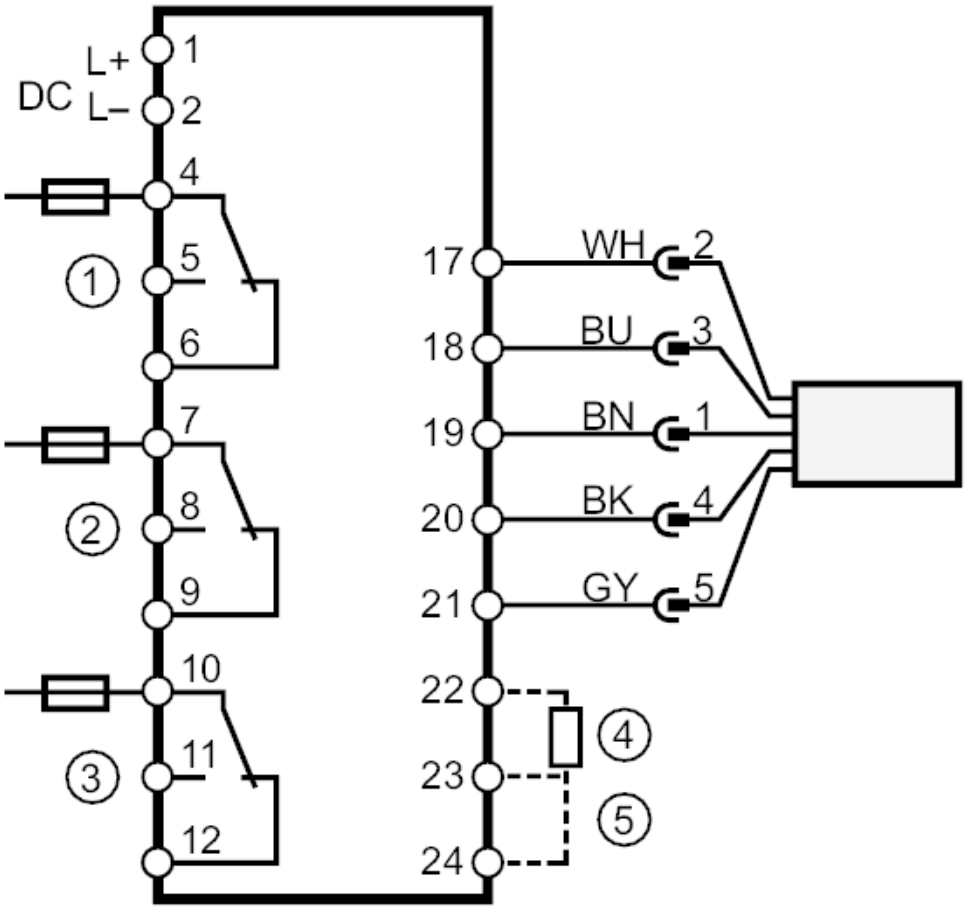
Control monitor for flow sensors

VS3000/24VDC

Electrical connection

COMBICON connector:

Connection

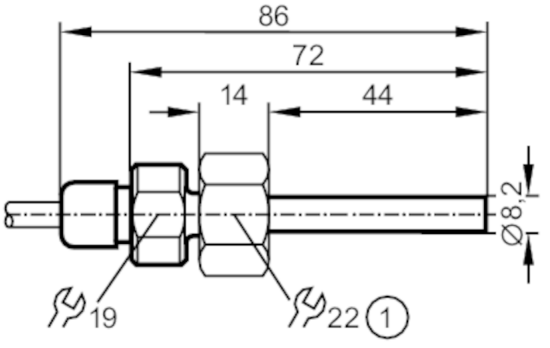


1 =	Flow monitoring
2 =	Wire monitoring
3 =	Temperature monitoring
4 =	external resistor to set the power-on delay time
5 =	link to monitor gaseous media
Note	miniature fuse to IEC60127-2 sheet 1 ≤ 5 A fast acting
	Core colours :
BN =	brown
BU =	blue
BK =	black
WH =	white
GY =	grey

SF5300

Flow sensor for connection to an evaluation unit

SFD10ZDB /6M



1 Internal thread M18 x 1;5

Product characteristics		
Probe length L	[mm]	45
Process connection		M18 x 1,5 Internal thread
Application		
Application		high temperature
Media		Liquids; Gases
Pressure rating	[bar]	300
Liquids		
Medium temperature	[°C]	0...120
Gases		
Medium temperature	[°C]	0...100
Electrical data		
Connection to control monitor		VS3000
Measuring/setting range		
Probe length L	[mm]	45
Liquids		
Setting range	[cm/s]	3...300
Greatest sensitivity	[cm/s]	3...60
Gases		
Setting range	[cm/s]	200...3000
Greatest sensitivity	[cm/s]	200...800
Accuracy / deviations		
Max. temperature gradient of medium	[K/min]	300
Reaction times		
Response time	[s]	1...10
Operating conditions		
Protection		IP 67

SF5300

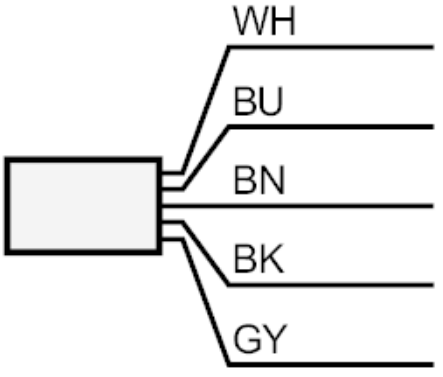
Flow sensor for connection to an evaluation unit

SFD10ZDB /6M

Tests / approvals			
Shock resistance		DIN IEC 68-2-27	40 g (11 ms)
Vibration resistance		DIN IEC 68-2-6	10 g (55...2000 Hz)
MTTF	[years]	8096	
Mechanical data			
Weight	[g]	454.5	
Housing		for adapter	
Dimensions	[mm]	M18 x 1.5	
Thread designation		M18 x 1.5	
Material		knurled nut: stainless steel; Cable gland: FKM; nut for cable gland: brass nickel-plated; Sleeve: brass nickel-plated	
Materials (wetted parts)		stainless steel (1.4404 / 316L); O-ring: FKM 80 Shore A	
Process connection		M18 x 1,5 Internal thread	
Remarks			
Pack quantity		1 pcs.	
Electrical connection			

Cable: 6 m, silicone; Maximum cable length: 100 m; 5 x 0.34 mm²

Connection

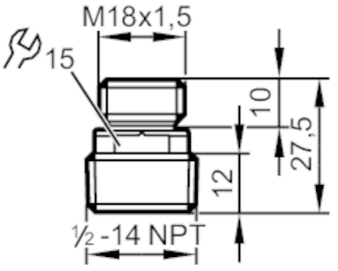


	Core colors :
BN =	brown
BU =	blue
BK =	black
WH =	white
GY =	grey

E40107

Screw-in adapter for process sensors

Adapter SI/1 - 1/2NPT



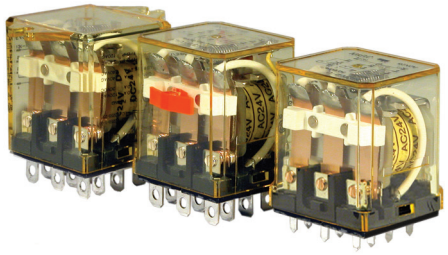
CRN

Application		
Application		for industrial applications
Media		liquids and gases
Pressure rating	[bar]	300
MAWP (for applications according to CRN)	[bar]	303
Tests / approvals		
Pressure Equipment Directive		A possible classification to PED depends on the application and has to be carried out by the user / operator.
Safety instructions		The compatibility between medium and product material has to be checked in all applications.
Mechanical data		
Weight	[g]	39
Materials		stainless steel (1.4404 / 316L)
Sensor connection		M18 x 1,5 internal thread
Process connection		threaded connection 1/2" NPT
Insertion depth	[mm]	23; (measuring probe SID, SFD, TN)
Remarks		
Pack quantity		1 pcs.

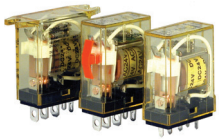
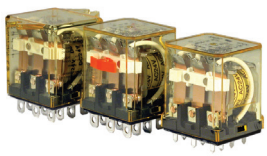
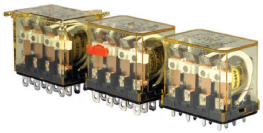
RH Series Compact Power Relays

Key features

- SPDT through 4PDT, 10A contacts
- Compact power type relays
- Miniature power relays with a large capacity
- 10A contact capacity
- Compact size saves space



Part Number Selection

Contact	Model	Part Number: Blade Terminal	Part Number: PCB Terminal	Coil Voltage Code (Standard Stock in bold)
SPDT 	Standard	RH1B-U ☐	RH1V2-U ☐	AC6V, AC12V, **AC24V**, AC110V, **AC120V**, AC220V, **AC240V** DC6V, **DC12V**, **DC24V**, DC48V, DC110V
	With Indicator	RH1B-UL ☐	—	
	With Check Button	RH1B-UC ☐	—	
	With Indicator and Check Button	RH1B-ULC ☐	—	
	Top Bracket Mounting	RH1B-UT ☐	—	
	With Diode (DC coil only)	RH1B-UD ☐	RH1V2-UD ☐	DC6V, **DC12V**, **DC24V**, DC48V, DC110V
	With Indicator and Diode (DC coil only)	RH1B-ULD ☐	—	**DC12V**, **DC24V**, DC48V, DC110V
DPDT 	Standard	RH2B-U ☐	RH2V2-U ☐	AC6V, AC12V, **AC24V**, **AC110-120V**, **AC220-240V** DC6V, **DC12V**, **DC24V**, DC48V, DC100-110V
	With Indicator	RH2B-UL ☐	RH2V2-UL ☐	
	With Check Button	RH2B-UC ☐	—	
	With Indicator and Check Button	RH2B-ULC ☐	—	
	Top Bracket Mounting	RH2B-UT ☐	—	
	With Diode (DC coil only)	RH2B-UD ☐	RH2V2-UD ☐	DC6V, **DC12V**, **DC24V**, DC48V, DC100-110V
	With Indicator and Diode (DC coil only)	RH2B-ULD ☐	RH2V2-ULD ☐	
3PDT 	Standard	RH3B-U ☐	RH3V2-U ☐	AC6V, AC12V, **AC24V**, AC110V, **AC120V**, AC220V, **AC240V** DC6V, **DC12V**, **DC24V**, DC48V, DC110V
	With Indicator	RH3B-UL ☐	RH3V2-UL ☐	
	With Check Button	RH3B-UC ☐	—	
	With Indicator and Check Button	RH3B-ULC ☐	—	
	Top Bracket Mounting	RH3B-UT ☐	—	
	With Diode (DC coil only)	RH3B-UD ☐	—	DC6V, DC12V, DC24V, DC48V, DC110V
	With Indicator and Diode (DC coil only)	RH3B-ULD ☐	—	
4PDT 	Standard	RH4B-U ☐	RH4V2-U ☐	AC6V, AC12V, **AC24V**, AC110V, **AC120V**, AC220V, **AC240V** DC6V, **DC12V**, **DC24V**, DC48V, DC110V
	With Indicator	RH4B-UL ☐	RH4V2-UL ☐	
	With Check Button	RH4B-UC ☐	—	
	With Indicator and Check Button	RH4B-ULC ☐	—	
	Top Bracket Mounting	RH4B-UT ☐	—	
	With Diode (DC coil only)	RH4B-UD ☐	RH4V2-UD ☐	DC6V, DC12V, DC24V, DC48V, DC110V
	With Indicator and Diode (DC coil only)	RH4B-ULD ☐	—	

PCB terminal relays are designed to mount directly to a circuit board without any socket.

Ordering Information
When ordering, specify the Part No. and coil voltage code:

(example) **RH3B-U** **AC120V**
Part No. — Coil Voltage Code

Sockets (for Blade Terminal Models)

Relays	Standard DIN Rail Mount [1]	Finger-safe DIN Rail Mount [1]	Through Panel Mount	PCB Mount
RH1B	SH1B-05	SH1B-05C	SH1B-51	SH1B-62
RH2B	SH2B-05	SH2B-05C	SH2B-51	SH2B-62
RH3B	SH3B-05	SH3B-05C	SH3B-51	SH3B-62
RH4B	SH4B-05	SH4B-05C	SH4B-51	SH4B-62
				

1. DIN Rail mount socket comes with two horseshoe clips. Do not use unless you plan to insert pullover wire spring. Replacement horseshoe clip part number is Y778-011.

Hold Down Springs & Clips

Appearance	Item	Relay	For DIN Mount Socket	For Through Panel & PCB Mount Socket
	Pullover Wire Spring	RH1B	SY2S-02F1 [2]	SY4S-51F1
		RH2B	SY4S-02F1 [2]	
		RH3B	SH3B-05F1 [2]	
		RH4B	SH4B-02F1 [2]	
	Leaf Spring (side latch)	RH1B, RH2B, RH3B, RH4B	SFA-202 [3]	SFA-302 [3]
	Leaf Spring (top latch)	RH1B, RH2B, RH3B, RH4B	SFA-101 [3]	SFA-301 [3]

2. Must use horseshoe clip when mounting in DIN mount socket. Replacement horseshoe clip part number is Y778-011.
3. Two required per relay.

AC Coil Ratings

Voltage (V)	Rated Current (mA) ±15% at 20°C								Coil Resistance (Ω) ±10% at 20°C				Operation Characteristics (against rated values at 20°C)		
	AC 50Hz				AC 60Hz										
	SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT	Max. Continuous Applied Voltage	Pickup Voltage	Dropout Voltage
6	170	240	330	387	150	200	280	330	18.8	9.4	6.4	5.4	110%	80% maximum	30% minimum
12	86	121	165	196	75	100	140	165	76.8	39.3	25.3	21.2			
24	42	60.5	81	98	37	50	70	83	300	153	103	84.5			
110	9.6	—	18.1	21.6	8.4	—	15.5	18.2	6,950	—	2,200	1,800			
110-120	—	9.4-10.8	—	—	—	8.0-9.2	—	—	—	—	—	—			
120	8.6	—	16.4	19.5	7.5	—	14.2	16.5	8,100	—	10,800	7,360			
220	4.7	—	8.8	10.7	4.1	—	7.7	9.1	25,892	—	10,800	7,360			
220-240	—	4.7-5.4	—	—	—	4.0-4.6	—		—	18,820	—	—			
240	4.9	—	8.2	9.8	4.3	—	7.1	8.3	26,710	—	12,100	9,120			

DC Coil Ratings

Voltage (V)	Rated Current (mA) ±15% at 20°C				Coil Resistance (Ω) ±10% at 20°C				Operation Characteristics (against rated values at 20°C)		
	SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT	Max. Continuous Applied Voltage	Pickup Voltage	Dropout Voltage
6	128	150	240	250	47	40	25	24	110%	80% maximum	10% minimum
12	64	75	120	125	188	160	100	96			
24	32	36.9	60	62	750	650	400	388			
48	18	18.5	30	31	2,660	2,600	1,600	1,550			
100-110	—	8.2-9.0	—	—	—	12,250	—	—			
110	8	—	12.8	15	13,800	—	8,600	7,340			

Standard coil voltages are in **BOLD**.

Contact Ratings

Model	Continuous Current	Maximum Contact Capacity: Allowable Contact Power: Resistive Load	Allowable Contact Power: Inductive Load	Rated Load: Voltage (V)	Rated Load: Res. Load	Rated Load: Ind. Load
SPDT	10A	1540VA 300W	990VA 210W	110 AC	10A	7A
				220 AC	7A	4.5A
				30 DC	10A	7A
DPDT 3PDT 4PDT	10A	1650VA 300W	1100VA 225W	110 AC	10A	7.5A
				220 AC	7.5A	5A
				30 DC	10A	7.5A

Note: Inductive load for the rated load — cos ø = 0.3, L/R = 7 ms

TÜV Ratings

Voltage	RH1	RH2	RH3	RH4
240V AC	10A	10A	7.5A	7.5A
30V DC	10A	10A	10A	10A

AC: cos ø = 1.0, DC: L/R = 0 ms

UL Ratings

Voltage	Resistive			General Use			Horsepower Rating		
	RH1 RH2	RH3	RH4	RH1 RH2	RH3	RH4	RH1 RH2	RH3	RH4
240V AC	10A	7.5A	7.5A	7A	6.5A	5A	1/3 HP	1/3 HP	—
120V AC	—	10A	10A	—	7.5A	7.5A	1/6 HP	1/6 HP	—
30V DC	10A	10A	—	7A	—	—	—	—	—
28V DC	—	—	10A	—	—	—	—	—	—

CSA Ratings

Voltage	Resistive				General Use				Horse-power Rating
	RH1	RH2	RH3	RH4	RH1	RH2	RH3	RH4	RH1, 2, 3
240V AC	10A	10A	—	7.5A	7A	7A	7A	5A	1/3 HP
120V AC	10A	10A	10A	10A	7.5A	7.5A	—	7.5A	1/6 HP
30V DC	10A	10A	10A	10A	7A	7.5A	—	—	—

Socket Specifications

	Sockets	Terminal	Electrical Rating	Wire Size	Torque
DIN Rail Mount Sockets	SH1B-05	(Coil) M3 screws (contact) M3.5 screws with captive wire clamp	250V, 10A	Maximum up to 2–#12AWG	5.5 - 9 in•lbs 9 - 11.5 in•lbs
	SH2B-05 SH3B-05 SH4B-05	M3.5 screws with captive wire clamp	300V, 10A	Maximum up to 2–#12AWG	9 - 11.5 in•lbs
Finger-safe DIN Rail Mount	SH1B-05C	(coil) M3 screws (contact) M3.5 screws with captive wire clamp, fingersafe	250V, 10A	Maximum up to 2–#12AWG	5.5 - 9 in•lbs 9 - 11.5 in•lbs
	SH2B-05C SH3B-05C SH4B-05C	M3.5 screws with captive wire clamp, fingersafe	300V, 10A	Maximum up to 2–#12AWG	9 - 11.5 in•lbs
Through Panel Mount Socket	SH1B-51 SH2B-51 SH3B-51 SH4B-51	Solder	300V, 10A	—	—
PCB Mount Socket	SH1B-62	PCB mount	250V, 10A	—	—
	SH2B-62 SH3B-62 SH4B-62	PCB mount	300V, 10A	—	—

Accessories

Item	Appearance	Use with	Part No.	Remarks
Aluminum DIN Rail (1 meter length)		All DIN rail sockets	BNDN1000	The BNDN1000 is designed to accommodate DIN mount sockets. Made of durable extruded aluminum, the BNDN1000 measures 0.413 (10.5mm) in height and 1.37 (35mm) in width (DIN standard). Standard length is 39" (1,000mm).
DIN Rail End Stop		DIN rail	BNL5	9.1 mm wide.
Replacement Hold-Down Spring Anchor		DIN mount sockets and hold down springs.	Y778-011	For use on DIN rail mount socket when using pullover wire hold down spring. 2 pieces included with each socket.

Specifications

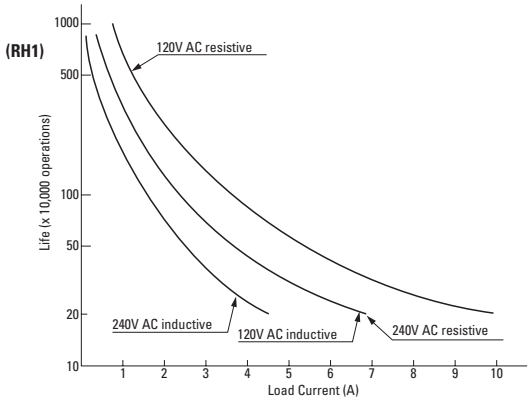
Contact Material		Silver cadmium oxide	
Contact Resistance [1]		50mΩ maximum	
Minimum Applicable Load		24V DC, 30 mA; 5V DC, 100 mA (reference value)	
Operating Time [2]	SPDT DPDT	20ms maximum	
	3PDT 4PDT	25ms maximum	
Release Time [2]	SPDT DPDT	20ms maximum	
	3PDT 4PDT	25ms maximum	
Power Consumption (approx.)	SPDT	AC: 1.1VA (50Hz), 1VA (60Hz)	DC: 0.8W
	DPDT	AC: 1.4VA (50Hz), 1.2VA (60Hz)	DC: 0.9W
	3PDT	AC: 2VA (50Hz), 1.7VA (60Hz)	DC: 1.5W
	4PDT	AC: 2.5VA (50Hz), 2VA (60Hz)	DC: 1.5W
Insulation Resistance		100MΩ minimum (500V DC megger)	
Dielectric Strength [3]	SPDT	Between live and dead parts: Between contact and coil: Between contacts of the same pole:	2,000V AC, 1 minute 2,000V AC, 1 minute 1,000V AC, 1 minute
	DPDT 3PDT 4PDT	Between live and dead parts: Between contact and coil: Between contacts of different poles: Between contacts of the same pole:	2,000V AC, 1 minute 2,000V AC, 1 minute 2,000V AC, 1 minute 1,000V AC, 1 minute
Operating Frequency		Electrical: Mechanical:	1,800 operations/hour maximum 18,000 operations/hour maximum
Vibration Resistance		Damage limits: Operating extremes:	10 to 55Hz, amplitude 0.5 mm 10 to 55Hz, amplitude 0.5 mm
Shock Resistance		Damage limits: Operating extremes:	1,000m/s^2 (100G) 200m/s^2 (20G - SPDT, DPDT) 100m/s^2 (10G - 3PDT, 4PDT)
Mechanical Life		50,000,000 operations minimum	
Electrical Life	DPDT	500,000 operations minimum (120V AC, 10A)	
	SPDT 3PDT 4PDT	200,000 operations minimum (120V AC, 10A)	
Operating Temperature [4]	SPDT DPDT 3PDT 4PDT	–25 to +70°C (no freezing)	
Operating Humidity		45 to 85% RH (no condensation)	
Weight (approx.)		SPDT: 24g, DPDT: 37g, 3PDT: 50g, 4PDT: 74g	

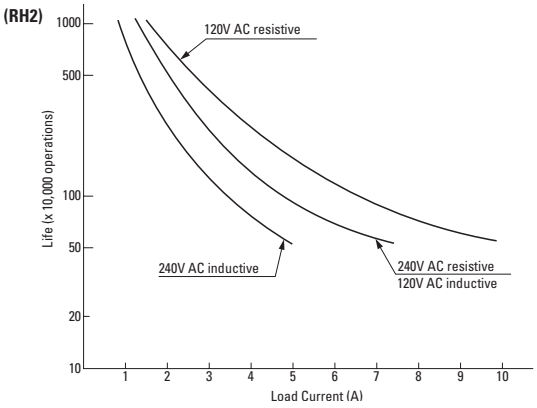
Note: Above values are initial values.
1. Measured using 5V DC, 1A voltage drop method
2. Measured at the rated voltage (at 20°C), excluding contact bouncing
   Release time of relays with diode: 40 ms maximum
3. Relays with indicator or diode: 1000V AC, 1 minute
4. For use under different temperature conditions, refer to Continuous Load Current vs. Operating Temperature Curve. The operating temperature range of relays with indicator or diode is –25 to +40°C.

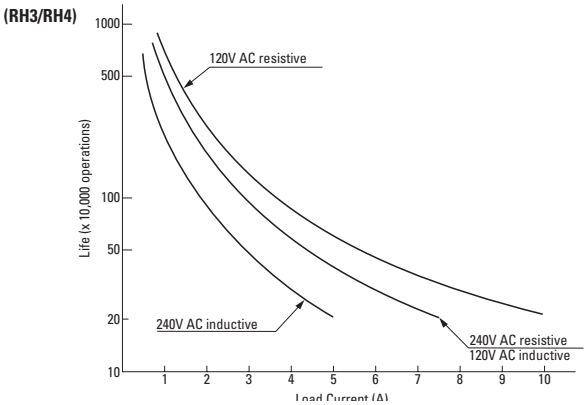
Characteristics (Reference Data)

Electrical Life Curves

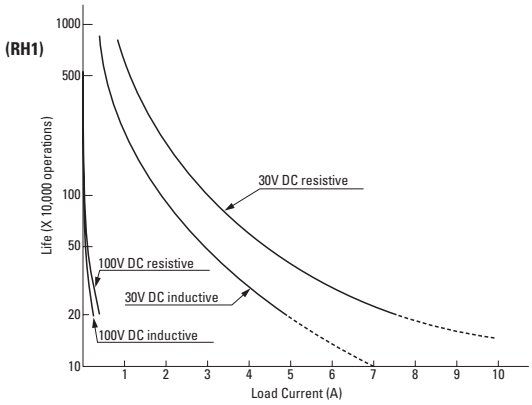
AC Load

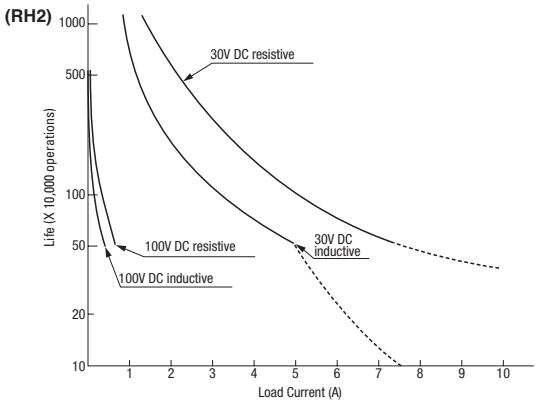


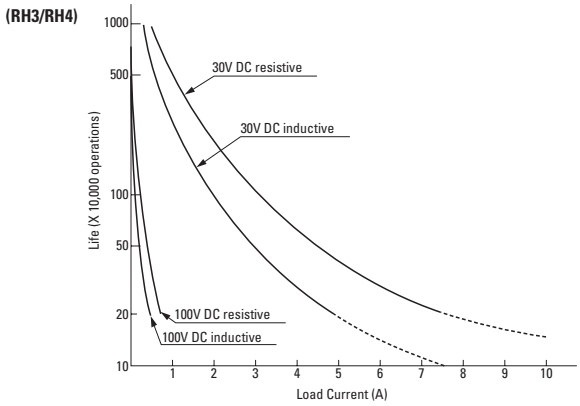




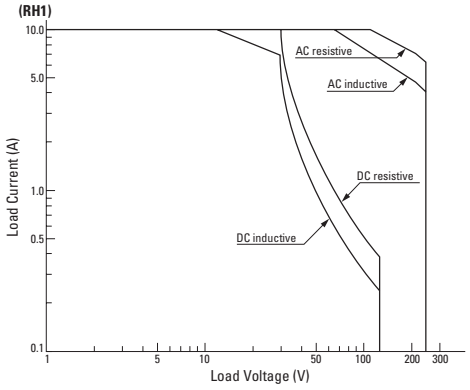
DC Load

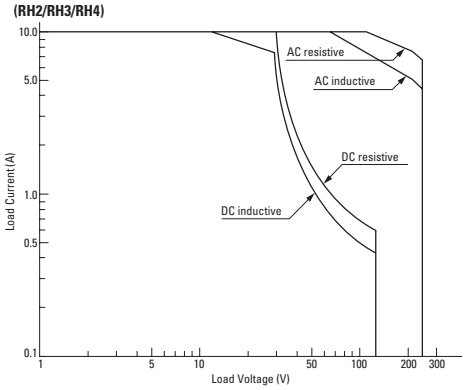






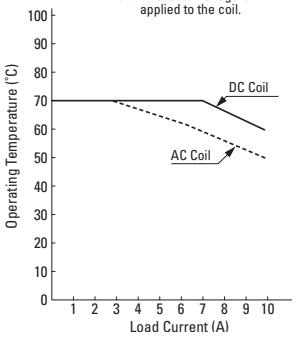
Maximum Switching Capacity



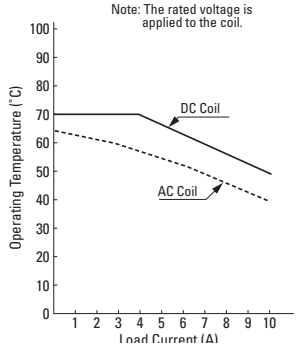


Continuous Load Current vs. Operating Temperature Curve (Basic Type, With Check Button, and Top Bracket Mounting Type)

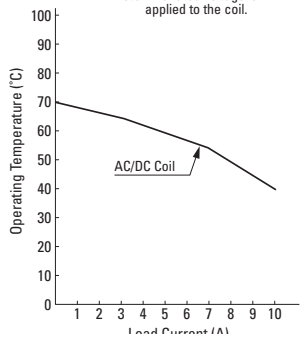
(RH1)



(RH2)



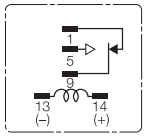
(RH3/RH4)



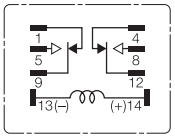
Internal Connection (View from Bottom)

Basic Type

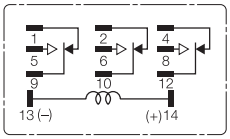
SPDT



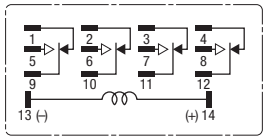
DPDT



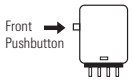
3PDT



4PDT



With Check Button

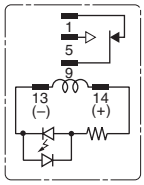


Contacts can be operated by pressing the check button.

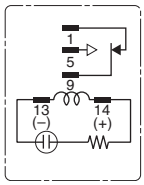
With Indicator (-L type)

SPDT

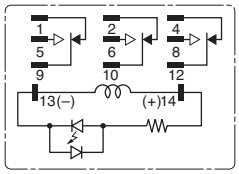
Below 100V AC/DC

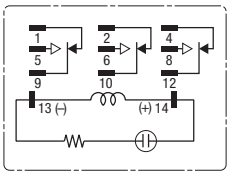


100V AC/DC and over

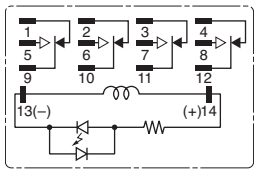


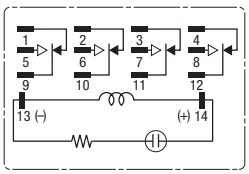
3PDT





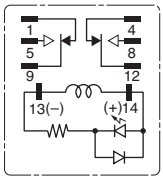
4PDT



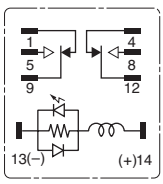


DPDT

Below 24V AC/DC



24V AC/DC and over

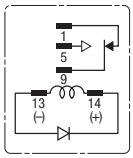


When the relay is energized, the indicator goes on.

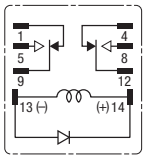
- Relay coils less than 100V DC do not contain a protection diode (except DPDT).
- Relay coils below 100V use LED indicator, coils above 100V use neon lamp indicator.
- LED color of DPDT model is green

With Diode (-D type)

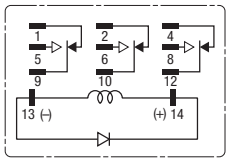
SPDT



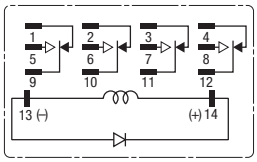
DPDT



3PDT



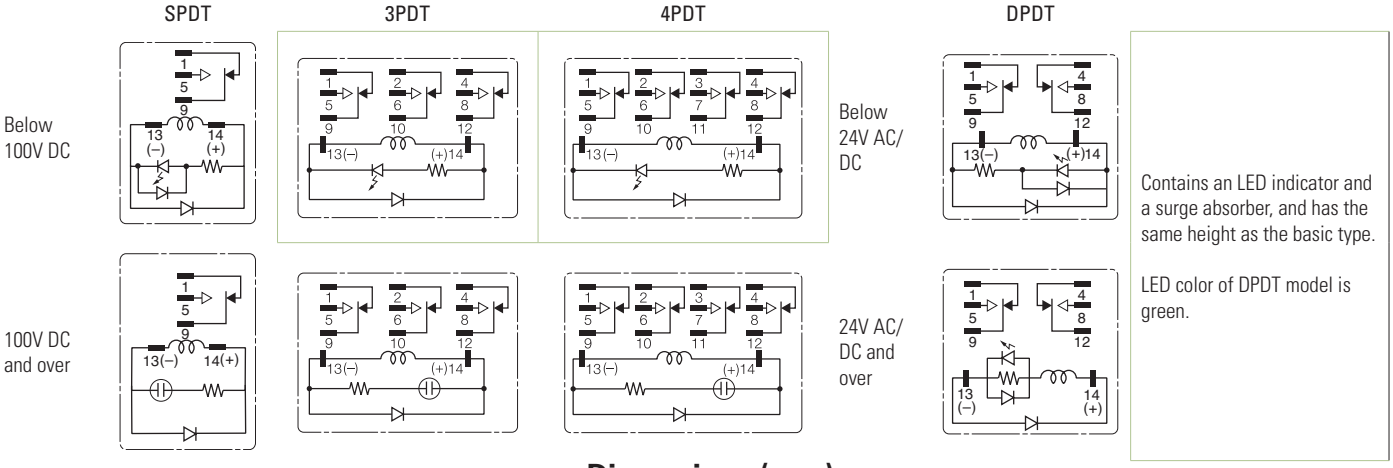
4PDT



Contains a diode to absorb the back emf generated when the coil is de-energized. The release time is slightly longer. Available for DC coil only.

- Diode Characteristics
  Reverse withstand voltage: 1,000V
  Forward current: 1A

With Indicator LED & Diode (-LD type)

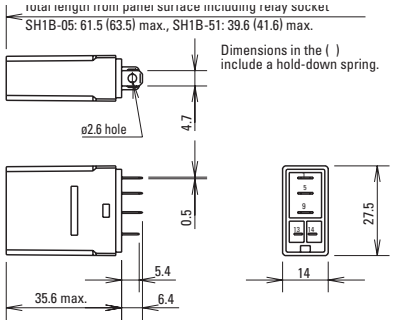


Contains an LED indicator and a surge absorber, and has the same height as the basic type.

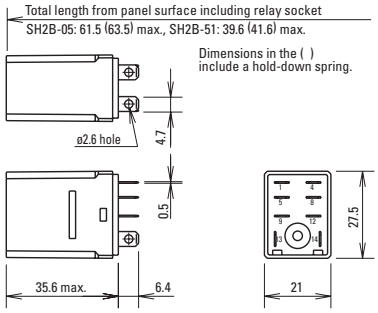
LED color of DPDT model is green.

Dimensions (mm)

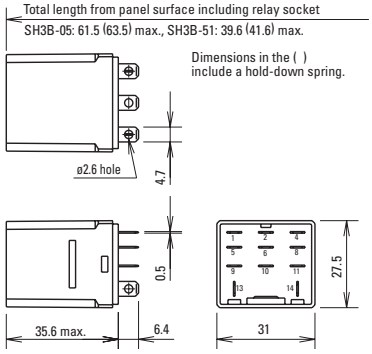
RH1B-U/RH1B-UL/RH1B-UD/RH1B-ULD



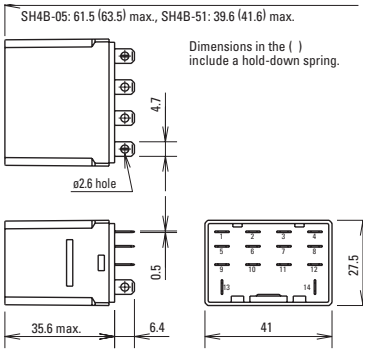
RH2B-U/RH2B-UL/RH2B-UD/RH2B-ULD



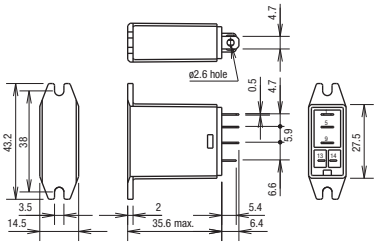
RH3B-U/RH3B-UL/RH3B-UD/RH3B-ULD



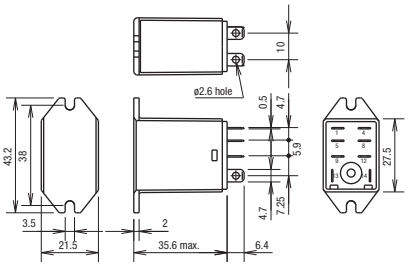
RH4B-U/RH4B-UL/RH4B-UD/RH4B-ULD



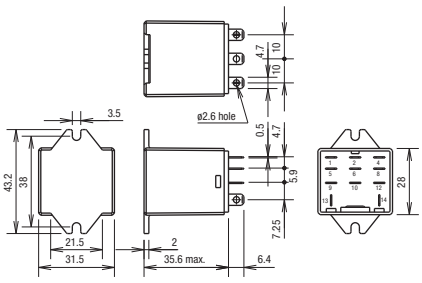
RH1B-UT



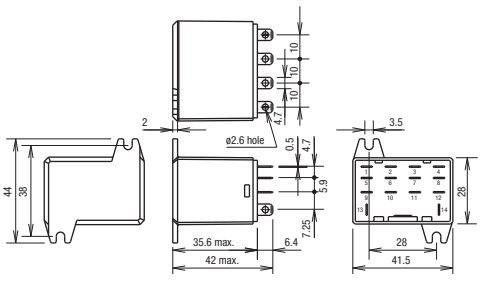
RH2B-UT



RH3B-UT

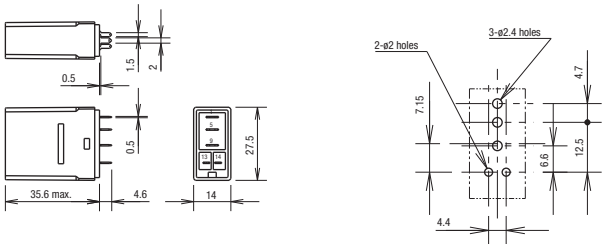


RH4B-UT



Dimensions con't (mm)

RH1V2-U/RH1V2-UD



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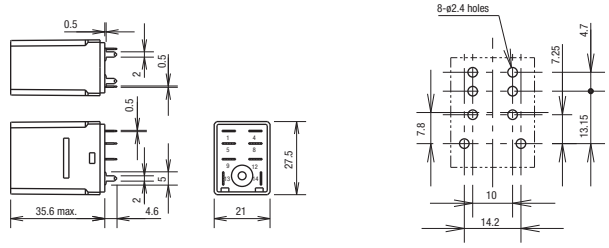

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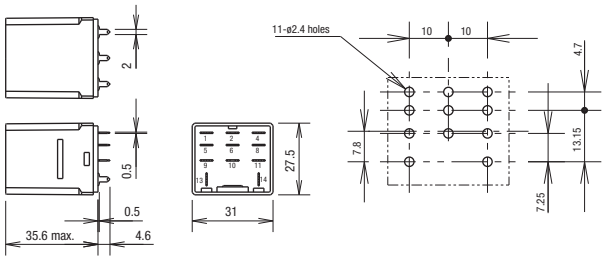

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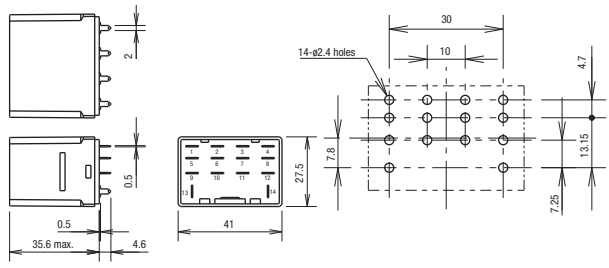
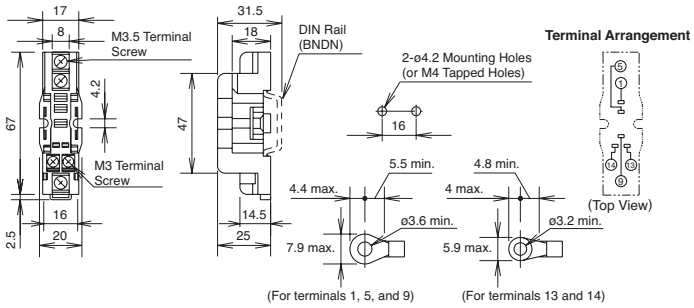
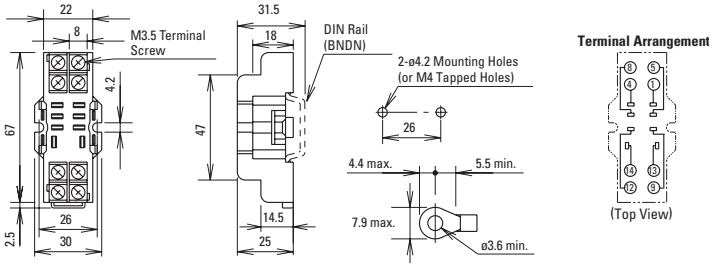


Standard DIN Rail Mount Sockets

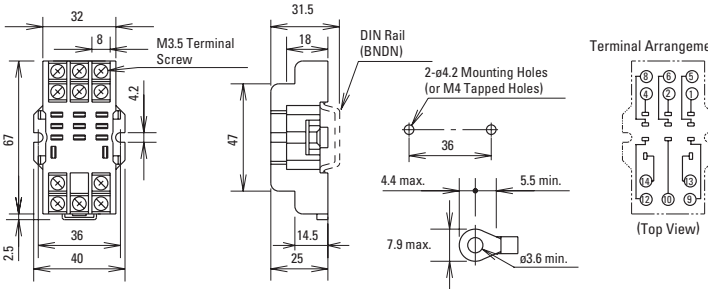
SH1B-05



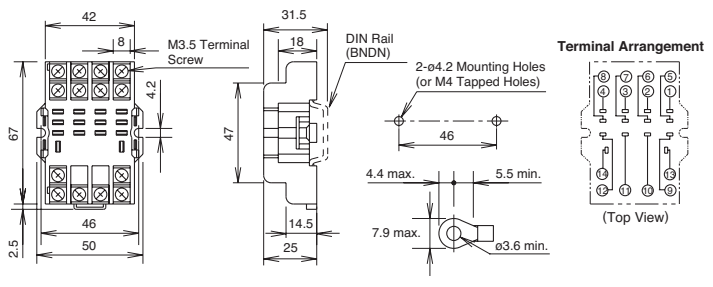
SH2B-05



SH3B-05



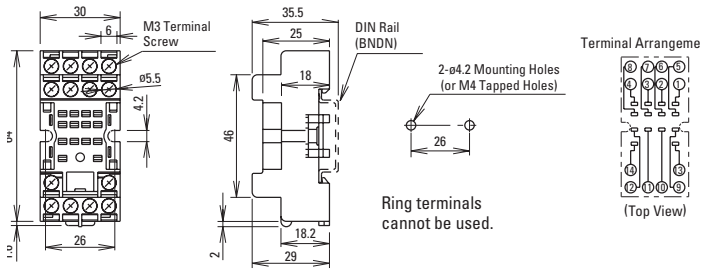
SH4B-05



Dimensions con't (mm)

Finger-safe DIN Rail Mount Sockets

SH1B-05C



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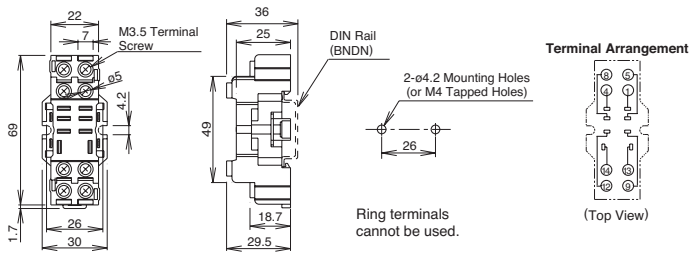

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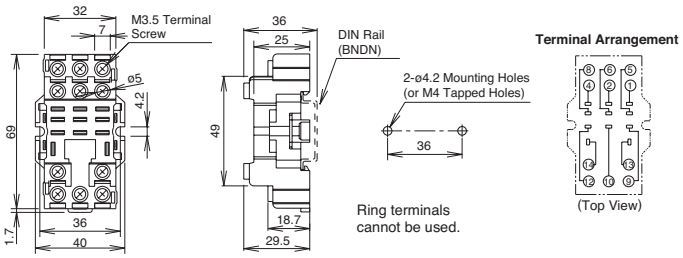

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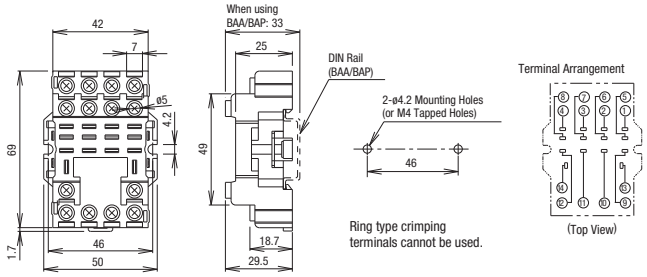
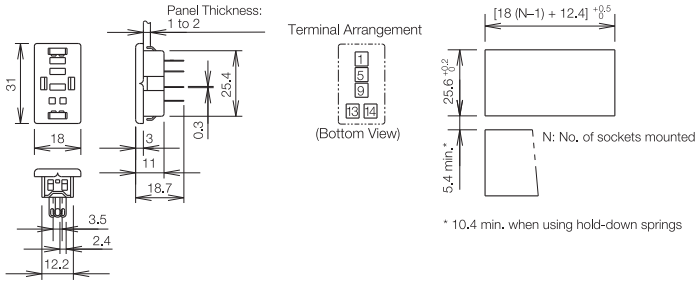


Through Panel Mount Socket

SH1B-51



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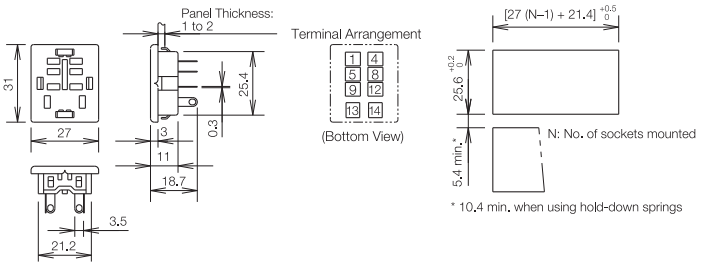

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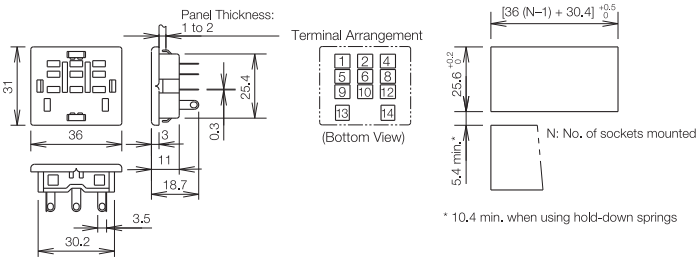
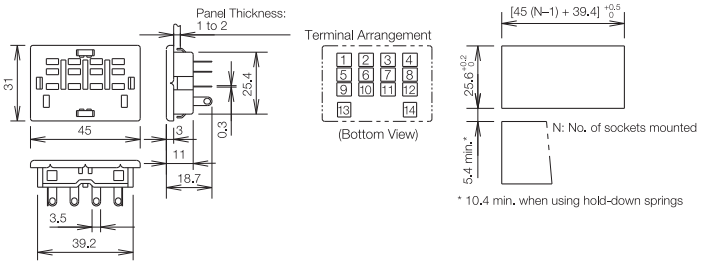


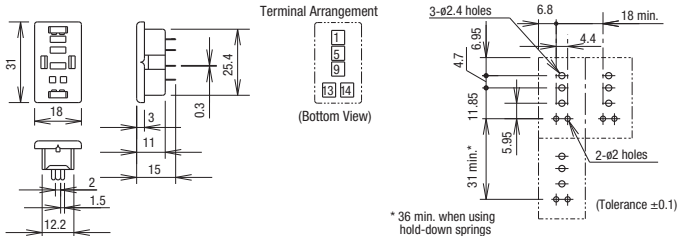
SH4B-51



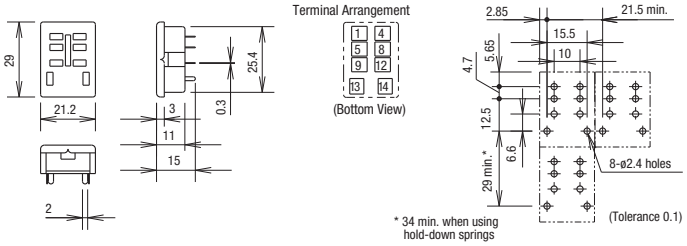
Dimensions con't (mm)

PCB Mount Sockets

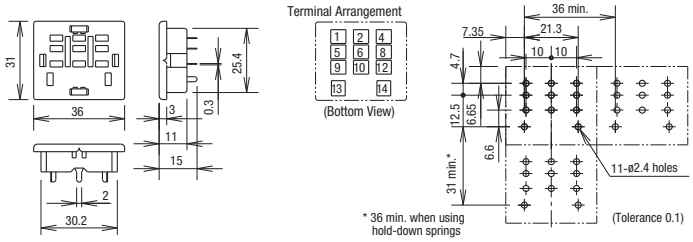
SH1B-62



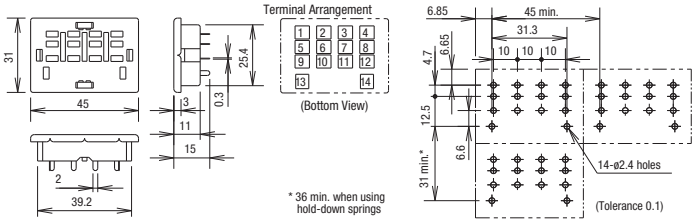
SH2B-62



SH3B-62



SH4B-62

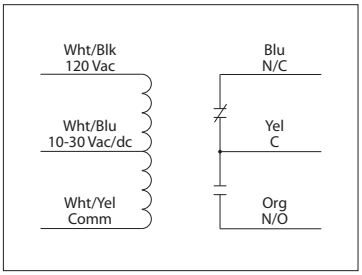


RIB Functional Devices, Inc.™ (800) 888-5538 sales@functionaldevices.com www.functionaldevices.com

10 AMP PILOT CONTROL RELAY

RIBU1C

Enclosed Relay 10 Amp SPDT with
10-30 Vac/dc/120 Vac Coil



RIBU1C-RD
• Red housing

RIBU1C-N4
• NEMA 4X housing, UL508 only

SPECIFICATIONS

 # Relays & Contact Type: One (1) SPDT Continuous Duty Coil
Expected Relay Life: 10 million cycles minimum mechanical
Operating Temperature: -30 to 140° F
Humidity Range: 5 to 95% (noncondensing)
Operate Time: 20ms
Relay Status: LED On = Activated
Dimensions: 1.70˝ x 2.80˝ x 1.50˝ with .50˝ NPT nipple
Wires: 16˝, 600V Rated
Approvals: UL Listed, UL916, UL864, C-UL
California State Fire Marshal, CE, RoHS
Housing Rating: UL Accepted for Use in Plenum, NEMA 1
Gold Flash: Yes
Override Switch: No

Contact Ratings:
10 Amp Resistive @ 277 Vac
10 Amp Resistive @ 28 Vdc
480 VA Pilot Duty @ 240-277 Vac
480 VA Ballast @ 277 Vac
Not rated for Electronic Ballast
600 Watt Tungsten @ 120 Vac (N/O)
240 Watt Tungsten @ 120 Vac (N/C)
1/3 HP @ 120-240 Vac (N/O)
1/6 HP @ 120-240 Vac (N/C)
1/4 HP @ 277 Vac (N/O)
1/8 HP @ 277 Vac (N/C)

Coil Current:
33 mA @ 10 Vac
35 mA @ 12 Vac
46 mA @ 24 Vac
55 mA @ 30 Vac
28 mA @ 120 Vac
13 mA @ 10 Vdc
15 mA @ 12 Vdc
18 mA @ 24 Vdc
20 mA @ 30 Vdc

Coil Voltage Input:
10-30 Vac/dc ; 120 Vac ; 50-60 Hz
Drop Out = 2.1 Vac / 2.8 Vdc
Pull In = 9 Vac / 10 Vdc

Note:
• Order in bulk by adding "-5PACK", "-10PACK", "-25PACK", or "-100PACK" to end of model number.

Functional Devices, Inc.
101 Commerce Drive
Sharpsville, IN 46068

Toll-free: (800) 888-5538
Office: (765) 883-5538
Fax: (765) 883-7505

Email: sales@functionaldevices.com
Website: www.functionaldevices.com

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3. TERMS OF PAYMENT: Buyer will pay the fees specified in each invoice provided by Seller in United States Dollars within thirty (30) calendar days after the invoice date unless otherwise agreed to in writing by an authorized representative of Seller. Any amount due under this Agreement that remains unpaid after its due date will bear interest from the date that such payment became delinquent until the date it is paid in full at the lower of 1.5% per month, which equals an annual percentage rate of 18%, or the maximum rate permitted by law. Seller reserves the right to establish, revoke or modify credit terms for Buyer at any time. No discounts are allowed unless otherwise agreed to in writing by an authorized representative of Seller. Buyer will pay any collection fees, legal fees, or court costs incurred by Seller to collect past due amounts. No offsets or setoffs of payments due to Seller hereunder are allowed with respect to any other agreement between the parties. Seller hereby retains a lien on the goods sold for unpaid purchase money as herein provided.

4. TAXES AND OTHER CHARGES: In addition to the prices quoted or invoiced, Buyer will pay any sales tax, excise tax, use tax, value added or consumption tax, customs duty (that is assessed on the delivery of Product(s) to a destination outside of the U.S.A.), fee or charge of any nature whatsoever imposed by any governmental authority on or measured by the transaction between Seller and Buyer. In the event Seller is required to pay any amount, Buyer will reimburse Seller therefore; or provide Seller, at the time the order is submitted, an exemption certificate or other document acceptable to the authority imposing the same. Seller does not accept and will not pay any fines, penalties or chargebacks from Buyer for any reason.

5. DELIVERY, RISK OF LOSS, CLAIMS AND FORCE MAJEURE:

A. All prices quoted for products are Ex-Works (Incoterms 2010) at a shipping facility determined by Seller, unless otherwise noted by Seller ("**Seller's Shipping Facility**"). Risk of loss or damage, and beneficial ownership, of the Products are transferred to Buyer when the Products are made available to Buyer at Seller's Shipping Facility. All delivery dates are approximate.

B. Buyer will only make written claims to Seller for damages, shortages or other delivery errors within seven (7) calendar days after receipt of shipment. All Products received by Buyer, or Buyer's clients, customers, or agents, that are not rejected within such time will be deemed accepted. Failure to provide such written notice constitutes a waiver of all such claims regarding such shipment by Buyer. Buyer will not revoke acceptance.

C. Seller is not liable for any damage as a result of any delay or failure to deliver due to any act of God, act of Buyer, embargo or other governmental act, regulation or request, fire, accident, power outage, strike, civil unrest, weather, slowdown or other labor difficulties, war, riot, act of terrorism, delay in transportation, defaults of common carriers, inability to obtain necessary labor, materials or manufacturing facilities or, without limiting the foregoing, any other delays beyond Seller's control. Buyer's sole and exclusive remedy for any delays or for Seller's inability to deliver Products for any reason, in each case, that persists for more than ninety (90) days, is to cancel the order pursuant to Seller's Order Policies and Guidelines available upon request.

6. WARRANTY; DISCLAIMER. Products are warranted to be free from manufacturing defects under normal use and conditions for five (5) years (the "**Warranty Period**").

The warranty does not apply to: (a) Damage caused by accident, abuse, mishandling, or dropping; (b) Products which have been subjected to unauthorized repair, opened, or taken apart; (c) Products not used in accordance with directions; (d) Damages exceeding the cost of such Product; and (e) Damages caused by lightning, water, or condensation. If warranty service is required during the Warranty Period, and if examination shall disclose to Seller's satisfaction that such Product was originally defective, then Seller will at its option repair or replace the product without charge upon prepaid delivery of such Product to Seller's facility with proof of date of purchase. Corrections of such defects by repair to or supplying of replacements for defective parts shall constitute fulfillment of all obligations of Seller.

Seller shall not be liable for loss, damage, or expense directly or indirectly caused from the failure of Products to perform as expected.

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For warranty service, call factory for RA number and send such Product prepared with sales receipt to: FUNCTIONAL DEVICES, INC., 101 COMMERCE DRIVE, SHARPSVILLE, IN 46068.

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8. RETURNS: Unless otherwise approved by Seller in writing in its sole discretion, except in the case of a non-conforming shipment or a warranty issue, Buyer may not return Products. If Seller approves the return of Products pursuant to the preceding sentence, such returned Products must be returned within ninety (90) days from date of invoice and will be subject to a 25% restocking fee. In the event of a non-conforming shipment or a warranty issue, Buyer may return Products, but only if Buyer first: (a) provides notice to Seller as required in this Agreement, (b) obtains prior authorization from Seller, and (c) all Products or containers for which return is properly authorized have been marked with a return authorization number supplied by Seller. Buyer will make all returns via a traceable form such as Federal Express, UPS or insured mail and in resalable condition. Buyer will pay all return shipping charges and any other charges associated therewith.

9. CANCELLATIONS: Cancellation or deferment of all or part of an order is subject to acceptance by the Seller. If accepted, any reduction in quantity of any item to less than 85% of the original item quantity is subject to a 15% cancellation charge. If an order cancellation is accepted, the Buyer will make delivery and pay for all material manufactured and in stock or in process at time of notice for such order, and for any special materials on orders for which the Seller must take delivery.

10. EXPORTS. Buyer agrees that it will comply with any and all U.S. Export Controls and will not pay for, resell, transfer or knowingly sell Products in violation of U.S. Export Controls. If Buyer resells Products within or exports Products to a country or region which imposes upon Seller and/or Buyer an obligation to fund or undertake reuse, recycling, composting, recovery of Products, or any similar obligation (e.g., the European Union's Waste Electrical and Electronic Equipment Directive, EC 2002/96/EC) (the "**Obligations**"), Buyer shall wholly undertake the Obligations or duties and shall be entirely responsible for all associated costs therewith. Seller shall have no obligation to reimburse Buyer for execution of the Obligations. In the event that Seller is named in a proceeding based upon the Obligations, Buyer shall indemnify, defend and hold Seller harmless from all actions related thereto, including all civil and governmental actions.

11. MISCELLANEOUS. This Agreement is governed by the laws of the State of Indiana, without giving effect to its conflict of laws principles. Buyer hereby irrevocably consents and submits to the exclusive jurisdiction and venue of the state and federal courts in Marion County, Indiana. The United Nations Convention for Contracts for the International Sale of Goods is explicitly excluded. Each provision contained in this Agreement constitutes a separate and distinct provision severable from all other provisions. If any provision (or any part thereof) is unenforceable under or prohibited by any present or future law, then such provision (or part thereof) will be amended, and is hereby amended, so as to be in compliance with such law, while preserving to the maximum extent possible the intent of the original provision. Any provision (or part thereof) that cannot be so amended will be severed from this Agreement; and, all the remaining provisions of this Agreement will remain unimpaired. No modification, addition or deletion, or waiver of any rights under this Agreement is binding on a party unless made in a non-preprinted agreement clearly understood by the parties to be a modification or waiver, and signed by a duly authorized representative of each party.

Cleveland Controls
Division of UniControl Inc.

Model AFS–460

ADJUSTABLE SET POINT AIR PRESSURE SENSING SWITCH WITH MANUAL RESET

APPLICATION

The **Model AFS-460** is a general purpose proving switch with a **manual reset** feature that requires operator intervention whenever it actuates. It can be used to sense positive, negative, or differential air pressure in HVAC and Energy Management applications that require operator interface.

GENERAL DESCRIPTION & OPERATION

The plated housing contains a diaphragm, a calibration spring and a snap-acting SPST–NC switch with a manual reset button.

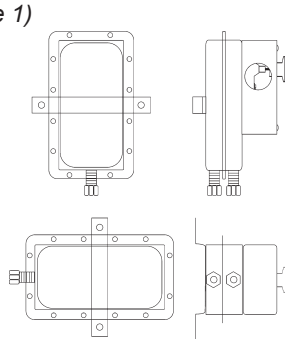
The sample line connections located on each side of the diaphragm accept ¼" OD rigid or semi-rigid tubing via the integral compression ferrule and nut.

An enclosure cover protects the operator from accidental contact with the live switch terminal screws and the set point adjusting screw. The enclosure cover has a ⅞" opening provided to accept a ½" conduit connection.

MOUNTING (SEE FIGURE 1)

Select a mounting location which is free from vibration. The **AFS-460** must be mounted with the diaphragm in any vertical plane in order to obtain the lowest specified operating set point. Avoid mounting with the sample line connections in the "up" position. Surface mount via the two 3⁄16" diameter holes in the integral mounting bracket. The mounting holes are 3-⅞" apart.

(Figure 1)



AIR SAMPLING CONNECTION (SEE FIGURE 2)

The sample line connections located on each side of the diaphragm accept ¼" OD rigid or semi-rigid tubing via the integral compression ferrule and nut. However, an optional adapter (P/N 18311) is available for slipping on ¼" ID flexible tubing For sample lines up to 10 feet, ¼" OD tubing is acceptable. For lines up to 20 feet, use ¼" ID tubing. For lines up to 60 feet, use ½" ID tubing.

Locate the sampling probe a minimum of 1-½ duct diameters downstream from the air source. Install the sampling probe as close to the center of the airstream as possible. Refer to **Figure 2** to identify the high pressure inlet (**H**) and the low pressure inlet (**L**). Select one of the following five application options, and connect the sample lines as recommended.

POSITIVE PRESSURE ONLY: Connect the sample line to inlet **H**; inlet **L** remains open to the atmosphere.

NEGATIVE PRESSURE ONLY: Connect the sample line to inlet **L**; inlet **H** remains open to the atmosphere.

TWO NEGATIVE SAMPLES: Connect the higher negative sample to inlet **L**. Connect the lower negative sample to inlet **H**.

TWO POSITIVE SAMPLES: Connect the higher positive sample to inlet **H**. Connect the lower positive sample to inlet **L**.

ONE POSITIVE AND ONE NEGATIVE SAMPLE: Connect the positive sample to inlet H. Connect the negative sample to inlet L.

Cleveland Controls
DIVISION OF UNICONTROL INC.
1111 Brookpark Rd.
Cleveland OH 44109

Tel: **216-398-0330**
Fax: **216-398-8558**
E-mail: **saleshvac@unicontrolinc.com**
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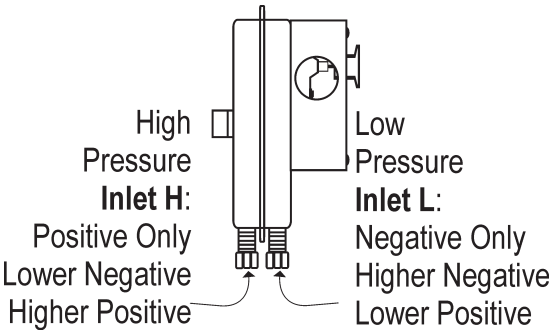
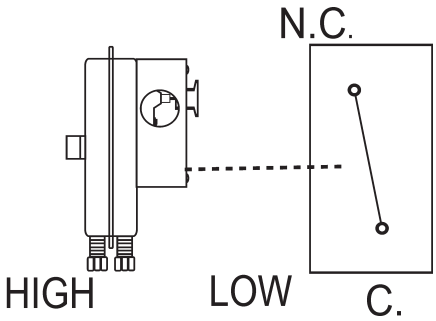
(Figure 2)



(Figure 3)



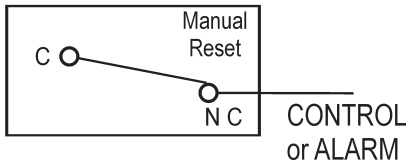
ELECTRICAL CONNECTIONS (SEE FIGURE 3)

Before pressure is applied to the diaphragm, the switch contacts will be in the normally closed (NC) position as shown in **Figure 3**.

The snap switch has screw top terminals with cup washers. Wire alarm or control application as shown in **Figure 4**.

(Figure 4)

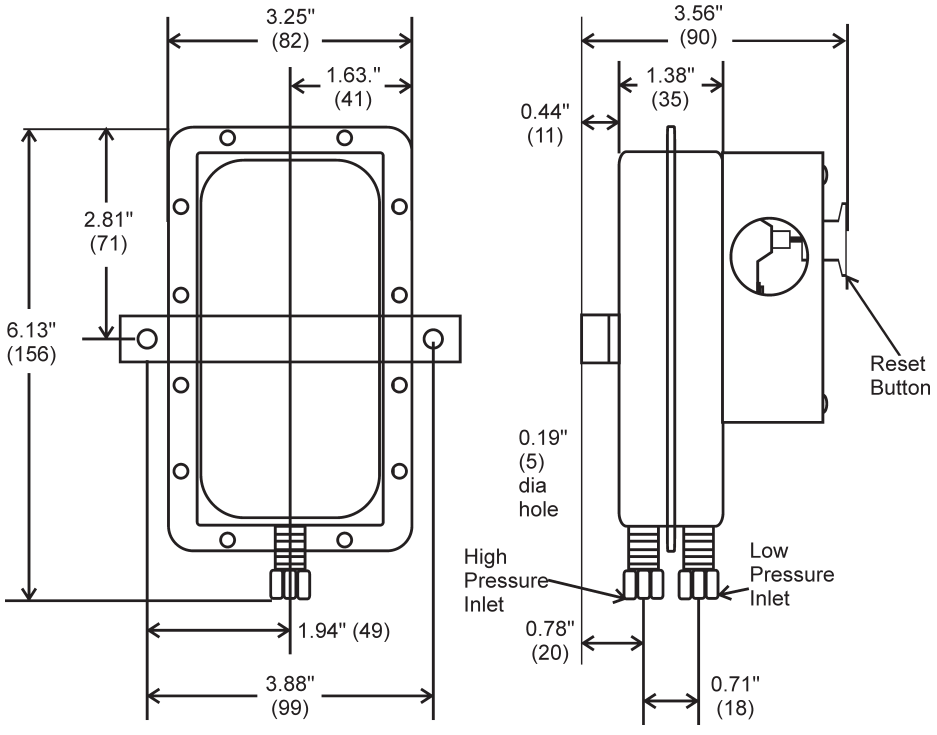
To prove excessive or insufficient air flow or pressure:



FIELD ADJUSTMENT

The adjustment range of an **AFS-460** Air Switch is 0.4" ± 0.06" w.c. to 12.0" w.c. To adjust the set point, turn the adjusting screw counterclockwise until motion has stopped. Next, turn the adjusting screw four complete turns in a clockwise direction to engage the spring. From this point, the next ten turns will be used for the actual calibration. **Each full turn represents approximately 1.16" w.c.**

Please note: To properly calibrate an air switch, a digital manometer or other measuring device should be used to confirm the actual set point.



SPECIFICATIONS

MODEL AFS-460 AIR PRESSURE SENSING SWITCH WITH MANUAL RESET FEATURE

Mounting Position:
In order to meet lowest operating specifications, mount with the diaphragm in any vertical plane.

Set Point Range:
0.40 ± 0.06"w.c. to 12.0"w.c.

Field Adjustable "Operate Range":
0.46"w.c. to 12.0" w.c.

Measured Media:
Air

Maximum Pressure:
½ psi (0.03 bar)

Life:
Exceeds UL-recognized mechanical endurance test of 6,000 cycles minimum at 0.5 psi maximum pressure each cycle and at maximum rated electrical load

Electrical Rating @ 60 Hz.:
15A @ 125, 250, or 277 VAC.
½ A @ 125 VDC, ¼ A @ 250 VDC.
¼ hp @ 125 VAC; ½ hp @ 250 VDC.

Contact Arrangement:
SPST–NC (manual reset)

Electrical Connections:
8-32 screw-top terminals with cup washers

Conduit Connection:
⅞" diameter opening accepts ½" conduit

Sample Line Connectors:
Male, externally threaded 7/16" 24 UNS 2A thread, complete with nut and self-aligning ferrule

Sample Line Connections:
Connectors accept ¼" OD rigid or semi-rigid tubing

Approval and Recognition:
UL, CSA, CE

Shipping Weight:
1.2 lbs.

Accessories:

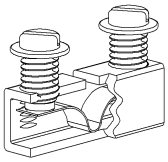
- P/N 18311 Slip-on ¼" OD Tubing Adapter, suitable for slipping on flexible plastic tubing
- Sample line probes
- Orifice plugs (pulsation dampers)

Product Data Sheet

MARATHON® SPECIAL PRODUCTS
A REGAL-BELOIT Company

6G38 TSKK C

3/8” Sectional Terminal Block
Channel Mount
40 Amps, 600 Volts (AC/DC)



TSKK: Tubular Connector with Wire Protector

32 Circuits Per Foot

Copper Wire Only

Wire Range with Wire Binding Screw: #10 - #22 AWG

Wire Termination Torque: 16 in. lbs

See table below for Wire Classes and torque

Electrical Ratings:
- 40A (Based on NEC Table 310-16, 75°C columns)
- 600 Volts AC/DC (UL 1059 Class C, User Group – General Industrial)
- Short Circuit Current Rating: 10,000A (Default)
- Factory and field wiring

Mechanical Ratings:
- Insulator base temperature: -40°C/F 125°C (257°F)* UL RTI
- Flammability rating of insulator base: UL 94V-0
- Touch protection: IP-20 (IEC 60529)

* Use outside these ratings needs to be judged in the end-use application.

Materials:
- Insulator base: Glass-filled polycarbonate (Gray Thermoplastic)
- Tubular Screw Connector: Copper, tin plated
- Screw, #10-32: Steel, nickel plated
- Wire Protector: Stainless Steel

Agency Approvals:
- UL Recognized, UL 1059 Terminal Block Standard, File No. XCFR2.E62806
- CSA Certified, CSA C22.2 No. 158, File No. LR19766
- CE compliant, IEC 60947-7-1
- RoHS Compliant

Wire Range:

		Copper Wire Stranding Classes - Number of Conductors						
Wire Size	Torque	Solid	Class B	Class C	Class G	Class H	Class I	Class K
10	16 in. lbs	1	1	1			1	1
12	16 in. lbs	1 - 2	1 - 3	1 - 2			1	1
14	16 in. lbs	1 - 2	1 - 3	1 - 3			1 - 2	1 - 2
16	16 in. lbs		1 - 4	1 - 4				1 - 2
18	16 in. lbs		1 - 5	1 - 5				1 - 2
20	16 in. lbs		1 - 5	1 - 5				
22	16 in. lbs		1 - 5	1 - 5				

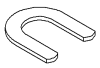
For information on copper stranded wire classes, please reference:
http://www.marathonsp.com/CatalogPDFs/Flexible-Stranded-Wire.pdf

Mounting:
- Channel mountable: #8 (M4) fastener, torque to 15-20 in. lbs.

Standard Pack Qty is 100

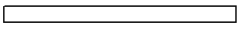
Accessories:

- Jumper: J-38

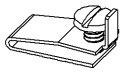


- End section: 6G38 E C

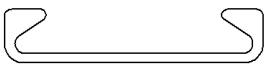
- Marking Strip (1/2” x 2” white): MS 2



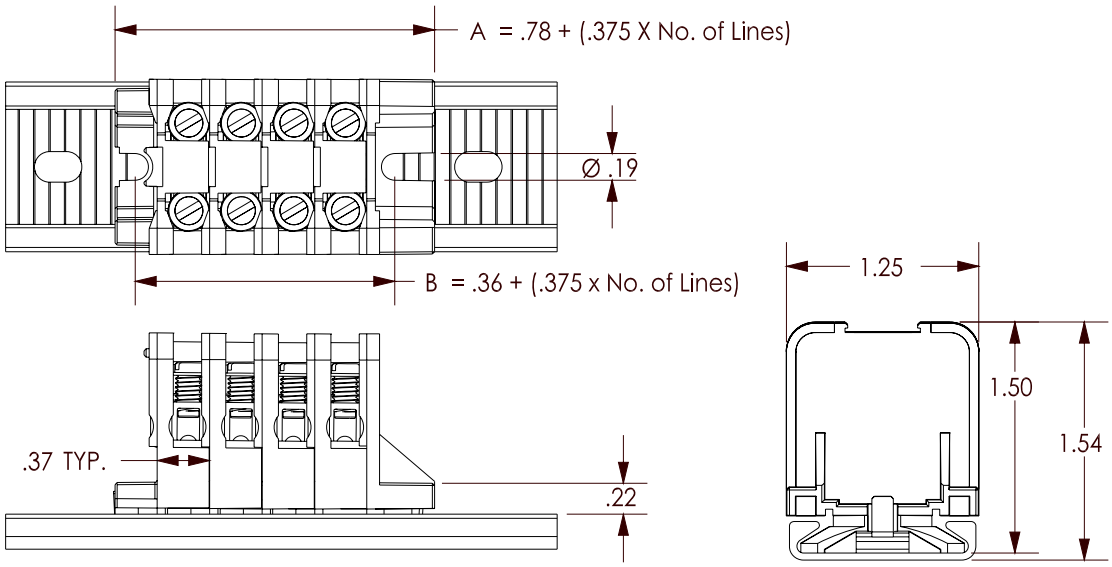
- Mounting Clamp: MC



- Channel: MPC-3 (3 foot channel) or MPC-6 (6 foot channel)



CHANNEL
MOUNT



WWW.MARATHONSP.COM
1-419-352-8441

55 Series

REMOTE MOUNTING TEMPERATURE SWITCH AND CONTROL

- Increase flexibility with multiple outputs
- Panel or surface mount for trouble-free installation
- External dial provides easy adjustment
- Space saving construction

ISO 9001 CERTIFIED COMPANY

UNITED ELECTRIC CONTROLS
LEADERS IN SAFETY, ALARM & SHUTDOWN

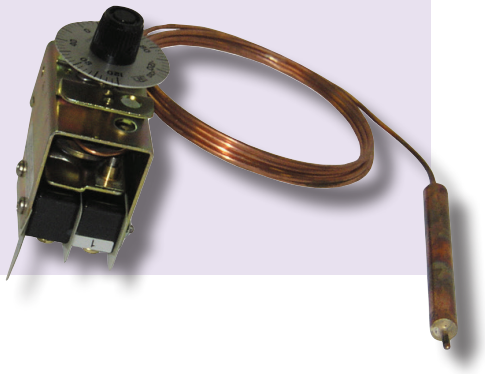
OVERVIEW

The E55 Series provides rugged, dependable temperature control for many applications. Available in single or dual output versions, with either an epoxy coated enclosure (designed to meet NEMA Type 4X) or skeleton construction, the E55 combines flexibility with compact size. It has been used in diverse applications such as food service appliances, oven control, and heat tracing.

FEATURES

- Single or dual 15 A switch output
- Skeleton or Enclosure construction - designed to meet NEMA Type 4X
- Optional external manual reset
- Compact size
- Copper or stainless steel bulb & capillary

Dual Switch, Type 4X enclosure (protective cover removed to show dial adjustment)



Dual switch, skeleton model

SPECIFICATIONS

AMBIENT TEMPERATURE LIMITS	-40 to 160°F (-40 to 71°C); set point typically shifts less than 1% of range for a 50°F (28°C) ambient temperature change
SET POINT REPEATABILITY	± 1% of adjustable range
SHOCK	Set point repeats after 15 G, 10 millisecond duration
VIBRATION	Set point repeats after 2.5 G, 5-500 Hz
ENCLOSURE CLASSIFICATION	Type E55 & E55A: Designed to meet enclosure type 4X requirements Types E55S & E55AS: Skeleton, open frame construction, not applicable
ENCLOSURE	Die cast aluminum, epoxy powder coated with stainless steel, gasketed adjustment cover (E55 and E55A)
SWITCH OUTPUT	One or two SPDT; dual switch may be separated up to 100% of range; switches may be wired "normally open" or "normally closed"
ELECTRICAL RATING*	15A, 125/250/480 VAC resistive. 22A, 480 VAC for E55-R25HT and E55-L24HT heat trace models. 2A, 24-30 VDC resistive; 1A, 24-30 VDC inductive. 0.5A, 125 VDC resistive. 0.03A, 125 VDC inductive.
ELECTRICAL CONNECTION	1/2" NPT (female) (E55 and E55A)
WEIGHT	Types E55S, E55AS (skeleton): approximately 12 oz.; Types E55, E55A: approximately 1 lb.
BULB AND CAPILLARY	Models E20BC - E23BC: 6 feet copper; Models E20BS - E23BS: 6 feet stainless steel Model R25HT: 10 feet stainless steel Model L24HT: stainless steel, Local sensor, no capillary, for ambient sensing
TEMPERATURE FILL	Non-toxic oil
TEMPERATURE DEADBAND	Typically 1% of range under laboratory conditions (70°F circulating bath at rate of 1/2°F per minute change)

***NOTE:** DC ratings are based on experience - Consult UE for further information

APPROVALS

UE declarations and third-party issued Agency certifications are available for download at www.ueonline.com/prod_approval.html.

UNITED STATES AND CANADA

E55(A) S Models
cULus Listed
cURus Recognized
UL 873, C22.2 no. 24, file #E10667

EUROPE

Low Voltage Directive (LVD) (2006/95/EC)
UEC compliant to LVD
Products rated lower than 50 VAC and 75 VDC are outside of the scope of the LVD

MODEL CHART

Model	Adjustable Set Point Range		Max. Temp.		Dial Div.		Bulb Size
Copper bulb & capillary	°F	°C	°F	°C	°F	°C	OD x Length (inches)
E20BC	-130 to 120	-90 to 48.9	170	76.7	10	5	3/8 x 4-1/2
E21BC	0 to 150	-17.8 to 65.6	200	93.3	5	5	3/8 x 7
E22BC	50 to 300	10 to 148.9	350	176.7	10	5	3/8 x 4-1/2
E23BC	150 to 650	65.6 to 343.3	700	371.1	25	10	3/8 x 3-3/4
Stainless steel bulb and capillary							
E20BS‡	-130 to 120	-90 to 48.9	170	76.7	10	5	3/8 x 4-3/4
E21BS	0 to 150	-17.8 to 65.6	200	93.3	5	5	3/8 x 7-1/4
E22BS	50 to 300	10 to 148.9	350	176.7	10	5	3/8 x 4-3/4
E23BS	150 to 650	65.6 to 343.3	700	371.1	25	10	3/8 x 4
R25HT‡‡	25 to 325	-3.9 to 162.8	600	315.6	10	–	1/4 x 7-3/16
L24HT‡‡	15 to 140	-9.4 to 60	190	87.8	5	–	3/8 x 7

‡ Not available with Type E55AS
‡‡ Not available with Types E55A, E55S, E55AS

HOW TO ORDER

BUILDING A PART NUMBER

Select a **Type**

Refer to the "Type" section below.

Determine type number based on switch output, enclosure, adjustment and reference.

Select a **Model**

Refer to the "Model Charts".

Determine model based on adjustable range, and capillary material.

Select an **Option** (if applicable)

Refer to the "Options" section.

Determine option number based on switch output, optional materials or other product enhancements.

FOR MULTIPLE OPTIONS: Call United Electric Controls.

TYPE

E55	Bulb & capillary; one SPDT output; Epoxy coated enclosure; external adjustment with reference dial, tamper-resistant cover
E55A	Bulb & capillary; two SPDT outputs; Epoxy coated enclosure; external adjustment with reference dial, tamper-resistant cover
E55S	Bulb & capillary; one SPDT output; skeleton construction; external adjustment with reference dial
E55AS	Bulb & capillary; two SPDT outputs; skeleton construction; external adjustment with reference dial

SWITCH OPTIONS*

0500	Close deadband, 5 A, 125/250 VAC resistive. 3 A, 28 VDC; 1 A, 48 VDC; 0.5 A, 125 VDC resistive. NOT AVAILABLE ON MODELS R25HT, L24HT
0140	Gold contacts, 1 A, 125 VAC resistive, NOT AVAILABLE ON MODELS E55-L24HT, E55-R25HT
1530	External manual reset, 15 A 125/250/480 VAC resistive; 0.5 A, 125 VDC; 0.25 A, 250 VDC resistive. Reset on increasing temperature. NOT AVAILABLE ON TYPES E55S, E55AS, & MODELS R25HT, L24HT
2000	20 A 125/250/480 VAC resistive. 0.5 A, 125 VDC; 0.25 A, 250 VDC resistive. NOT AVAILABLE ON MODELS R25HT, L24HT

GENERAL

M020	Pilot light. AVAILABLE HEAT TRACE MODELS R25HT, L24HT ONLY
M201	Factory set one switch; specify increasing or decreasing temperature and set point. NOT AVAILABLE ON TYPES E55A, E55AS
M202	Factory set two switches; specify increasing or decreasing temperature and set point. NOT AVAILABLE ON TYPES E55, E55S
M270	Calibrated dial in Celsius. NOT AVAILABLE ON HEAT TRACE MODELS R25HT, L24HT
M444	Paper ID tag. NOT AVAILABLE ON HEAT TRACE MODELS R25HT, L24HT
M446	Stainless steel ID tag & wire attachment; limited to 2 lines of 25 characters each max.

UNION CONNECTORS**

(Not available on model L24HT or R25HT)

Option	Replacement Number	Description
	Brass	
W027	SD6213-27	1/2" NPT w/ 3/4" bushing
W045	SD6213-45	3/4" NPT
W051	SD6213-51	1/2" NPT
	304 Stainless Steel	
W028	SD6213-28	1/2" NPT w/ 3/4" bushing
W046	SD6213-46	3/4" NPT
W050	SD6213-50	1/2" NPT

THERMOWELLS**

For all bulb & capillary switches, all 1/2" NPT Internal (Not available on models R25HT, L24HT)

	Brass	
W075	SD6225-75	1/2" NPT with 3/4" NPT bushing adapter, 4" BT
W191	SD6225-191	1/2" NPT, 4" BT
W118	SD6225-118	1/2" NPT with 3/4" NPT bushing adapter, 7" BT
W192	SD6225-192	1/2" NPT, 7" BT
	316 Stainless Steel	
W076	SD6225-76	3/4" NPT, 4.5" BT
W193	SD6225-193	1/2" NPT, 4.5" BT
W119	SD6225-119	3/4" NPT, 7.5" BT
W177	SD6225-177	1/2" NPT, 7.5" BT

OPTIONAL LENGTHS:

Optional capillary length to 50' may be available in copper or 304 st/st. Armor or Teflon® capillary protection may be available to lengths less than or equal to capillary length. Consult UE for additional information and availability.

Consult UE regarding repeatability and ambient effects on capillary lengths over 30'.

** All switch options have limited DC capabilities. Consult factory for details.*

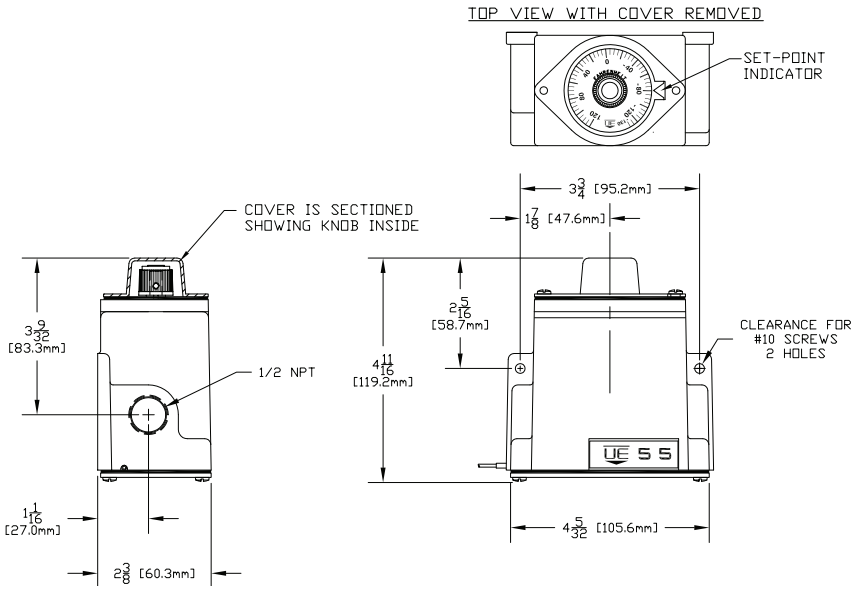
*** Dimensional drawings for union connectors and thermowells may be found at www.ueonline.com*

55 Series

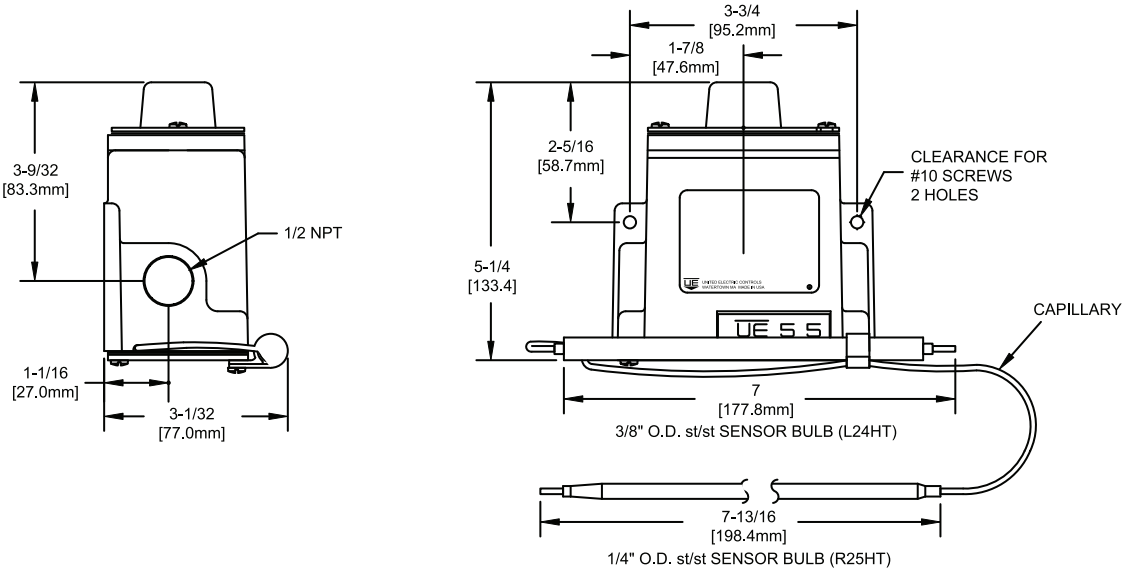
DIMENSIONAL DRAWINGS

(Dimensional drawings for all models may be found at www.ueonline.com)

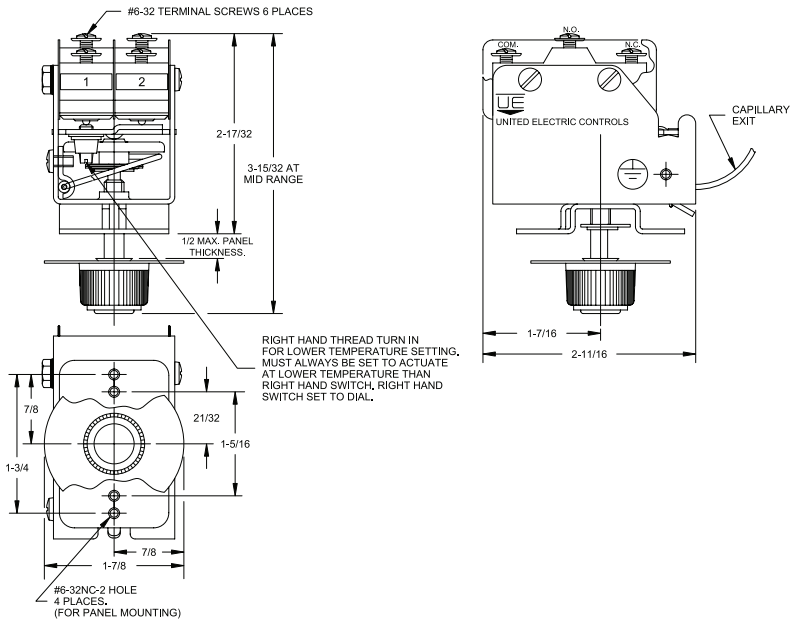
Types E55 /E55A



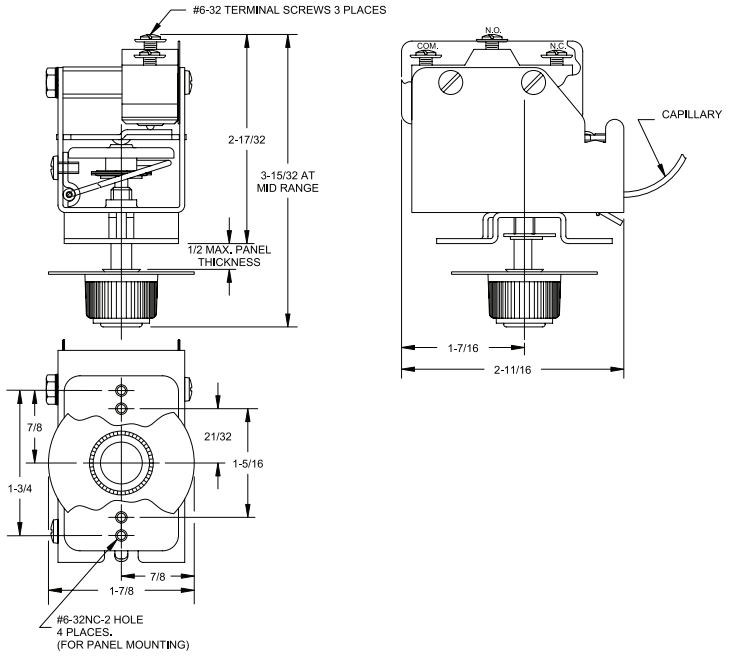
Type E55 Heat Tracing Models



Type E55AS



Type E55S



RECOMMENDED PRACTICES AND WARNINGS

United Electric Controls Company recommends careful consideration of the following factors when specifying and installing UE pressure and temperature units. Before installing a unit, the Installation and Maintenance instructions provided with unit must be read and understood.

- To avoid damaging unit, proof pressure and maximum temperature limits stated in literature and on nameplates must never be exceeded, even by surges in the system. Operation of the unit up to maximum pressure or temperature is acceptable on a limited basis (e.g., start-up, testing) but continuous operation must be restricted to the designated adjustable range. Excessive cycling at maximum pressure or temperature limits could reduce sensor life.
- A back-up unit is necessary for applications where damage to a primary unit could endanger life, limb or property. A high or low limit switch is necessary for applications where a dangerous runaway condition could result.
- The adjustable range must be selected so that incorrect, inadvertent or malicious setting at any range point cannot result in an unsafe system condition.
- Install unit where shock, vibration and ambient temperature fluctuations will not damage unit or affect operation. When applicable, orient unit so that moisture does not enter the enclosure via the electrical connection. When appropriate, this entry point should be sealed to prevent moisture entry.
- Unit must not be altered or modified after shipment. Consult UE if modification is necessary.
- Monitor operation to observe warning signs of possible damage to unit, such as drift in set point or faulty display. Check unit immediately.
- Preventative maintenance and periodic testing is necessary for critical applications where damage could endanger property or personnel.
- Electrical ratings stated in literature and on nameplate must not be exceeded. Overload on a switch can cause damage, even on the first cycle. Wire unit according to local and national electrical codes, using wire size recommended in installation sheet.
- Do not mount unit in ambient temp. exceeding published limits.

LIMITED WARRANTY

Seller warrants that the product hereby purchased is, upon delivery, free from defects in material and workmanship and that any such product which is found to be defective in such workmanship or material will be repaired or replaced by Seller (Ex-works, Factory, Watertown, Massachusetts. INCOTERMS); provided, however, that this warranty applies only to equipment found to be so defective within a period of 24 months from the date of manufacture by the Seller. Seller shall not be obligated under this warranty for alleged defects which examination discloses are due to tampering, misuse, neglect, improper storage, and in any case where products are disassembled by anyone other than authorized Seller's representatives. EXCEPT FOR THE LIMITED WARRANTY OF REPAIR AND REPLACEMENT STATED ABOVE, SELLER DISCLAIMS ALL WARRANTIES WHATSOEVER WITH RESPECT TO THE PRODUCT, INCLUDING ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.

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SELLER'S LIABILITY TO BUYER FOR ANY LOSS OR CLAIM, INCLUDING LIABILITY INCURRED IN CONNECTION WITH (I) BREACH OF ANY WARRANTY WHATSOEVER, EXPRESSED OR IMPLIED, (II) A BREACH OF CONTRACT, (III) A NEGLIGENT ACT OR ACTS (OR NEGLIGENT FAILURE TO ACT) COMMITTED BY SELLER, OR (IV) AN ACT FOR WHICH STRICT LIABILITY WILL BE INPUTTED TO SELLER, IS LIMITED TO THE "LIMITED WARRANTY" OF REPAIR AND/OR REPLACEMENT AS SO STATED IN OUR WARRANTY OF PRODUCT. IN NO EVENT SHALL THE SELLER BE LIABLE FOR ANY SPECIAL, INDIRECT, CONSEQUENTIAL OR OTHER DAMAGES OF A LIKE GENERAL NATURE, INCLUDING, WITHOUT LIMITATION, LOSS OF PROFITS OR PRODUCTION, OR LOSS OR EXPENSES OF ANY NATURE INCURRED BY

Be sure to visit www.ueonline.com for the latest information.

FOR A LIST OF OUR INTERNATIONAL AND DOMESTIC REGIONAL SALES OFFICES PLEASE VISIT OUR WEBPAGE WWW.UEONLINE.COM

UNITED ELECTRIC CONTROLS

180 Dexter Avenue
Watertown, MA 02472 USA
Telephone: 617 926-1000 Fax: 617 926-2568
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CP04131000

PennState
Physical Plant

Power Supplies

(This page is hyperlinked to the TOC)

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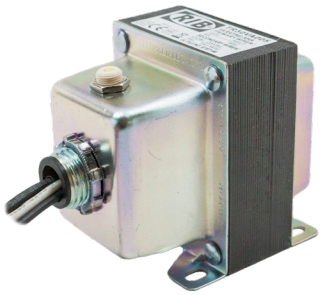
RIB Functional Devices, Inc.
(800) 888-5538 sales@functionaldevices.com www.functionaldevices.com

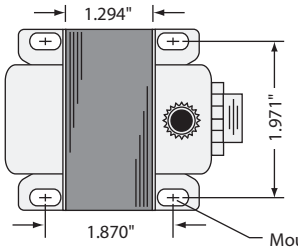
TRANSFORMER

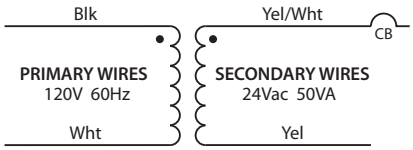
TR50VA005

Transformer 50 VA, 120 to 24 Vac, Circuit Breaker, Foot and Single Threaded Hub Mount

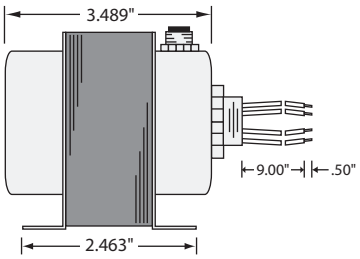
c UL us LISTED
Class 2

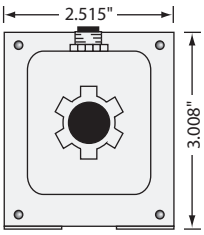






Secondary Yel/Wht wire in phase with Primary Blk wire.





SPECIFICATIONS

VA Rating: 50
Frequency: 50/60 Hz
Mounting: Foot & Single Threaded Hub
Over Current Protection: Circuit Breaker
Dimensions: 3.489˝ x 2.515˝ x 3.008˝ (w/ .500˝ NPT Hub)
Wire Length: 9˝ Typical w/ .5˝ Strip
Operating Temperature: -30 to 140° F
MTBF: 100,000 Hours @ 77° F
Construction: Split-Bobbin
Approvals: Class 2 UL5085-3 Listed, C-UL, CE, RoHS

Functional Devices, Inc.
101 Commerce Drive
Sharpsville, IN 46068

Toll-free: (800) 888-5538
Office: (765) 883-5538
Fax: (765) 883-7505

Email: sales@functionaldevices.com
Website: www.functionaldevices.com

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Where an attachment to this Agreement or separate document referencing this Agreement consists of a quotation, the quotation remains open for acceptance for a period of thirty (30) days or such other period as specified in the quotation. Seller hereby rejects any additional or different terms or provisions contained in any purchase order, acknowledgment or other communication heretofore or hereafter received from Buyer. Seller's delivery of Products does not constitute an assent to any terms proposed by Buyer. Except for an officer of Seller, no representative of Seller has any authority to waive, alter, vary, amend, or add to the terms hereof. **THESE TERMS AND CONDITIONS OF SALE CONSTITUTE THE ENTIRE AGREEMENT ("AGREEMENT") BETWEEN SELLER AND BUYER WITH RESPECT TO THE MATTERS ADDRESSED HEREIN.**

2. PRICES: The prices for the Products are based on the terms and conditions herein, including the limitations of liability and warranties, and all such terms and conditions are material to the sale of the Products. In the event Seller fails to provide a price quote and/or terms prior to the acceptance of the order, Buyer will pay Seller's then-current list price for such Products. All quotations and invoices show the net selling price of each item quoted. In the event of a mathematical error, the quoted price per Product governs.

3. TERMS OF PAYMENT: Buyer will pay the fees specified in each invoice provided by Seller in United States Dollars within thirty (30) calendar days after the invoice date unless otherwise agreed to in writing by an authorized representative of Seller. Any amount due under this Agreement that remains unpaid after its due date will bear interest from the date that such payment became delinquent until the date it is paid in full at the lower of 1.5% per month, which equals an annual percentage rate of 18%, or the maximum rate permitted by law. Seller reserves the right to establish, revoke or modify credit terms for Buyer at any time. No discounts are allowed unless otherwise agreed to in writing by an authorized representative of Seller. Buyer will pay any collection fees, legal fees, or court costs incurred by Seller to collect past due amounts. No offsets or setoffs of payments due to Seller hereunder are allowed with respect to any other agreement between the parties. Seller hereby retains a lien on the goods sold for unpaid purchase money as herein provided.

4. TAXES AND OTHER CHARGES: In addition to the prices quoted or invoiced, Buyer will pay any sales tax, excise tax, use tax, value added or consumption tax, customs duty (that is assessed on the delivery of Product(s) to a destination outside of the U.S.A.), fee or charge of any nature whatsoever imposed by any governmental authority on or measured by the transaction between Seller and Buyer. In the event Seller is required to pay any amount, Buyer will reimburse Seller therefore; or provide Seller, at the time the order is submitted, an exemption certificate or other document acceptable to the authority imposing the same. Seller does not accept and will not pay any fines, penalties or chargebacks from Buyer for any reason.

5. DELIVERY, RISK OF LOSS, CLAIMS AND FORCE MAJEURE:

A. All prices quoted for products are Ex-Works (Incoterms 2010) at a shipping facility determined by Seller, unless otherwise noted by Seller ("**Seller's Shipping Facility**"). Risk of loss or damage, and beneficial ownership, of the Products are transferred to Buyer when the Products are made available to Buyer at Seller's Shipping Facility. All delivery dates are approximate.

B. Buyer will only make written claims to Seller for damages, shortages or other delivery errors within seven (7) calendar days after receipt of shipment. All Products received by Buyer, or Buyer's clients, customers, or agents, that are not rejected within such time will be deemed accepted. Failure to provide such written notice constitutes a waiver of all such claims regarding such shipment by Buyer. Buyer will not revoke acceptance.

C. Seller is not liable for any damage as a result of any delay or failure to deliver due to any act of God, act of Buyer, embargo or other governmental act, regulation or request, fire, accident, power outage, strike, civil unrest, weather, slowdown or other labor difficulties, war, riot, act of terrorism, delay in transportation, defaults of common carriers, inability to obtain necessary labor, materials or manufacturing facilities or, without limiting the foregoing, any other delays beyond Seller's control. Buyer's sole and exclusive remedy for any delays or for Seller's inability to deliver Products for any reason, in each case, that persists for more than ninety (90) days, is to cancel the order pursuant to Seller's Order Policies and Guidelines available upon request.

6. WARRANTY; DISCLAIMER. Products are warranted to be free from manufacturing defects under normal use and conditions for five (5) years (the "**Warranty Period**").

The warranty does not apply to: (a) Damage caused by accident, abuse, mishandling, or dropping; (b) Products which have been subjected to unauthorized repair, opened, or taken apart; (c) Products not used in accordance with directions; (d) Damages exceeding the cost of such Product; and (e) Damages caused by lightning, water, or condensation. If warranty service is required during the Warranty Period, and if examination shall disclose to Seller's satisfaction that such Product was originally defective, then Seller will at its option repair or replace the product without charge upon prepaid delivery of such Product to Seller's facility with proof of date of purchase. Corrections of such defects by repair to or supplying of replacements for defective parts shall constitute fulfillment of all obligations of Seller.

Seller shall not be liable for loss, damage, or expense directly or indirectly caused from the failure of Products to perform as expected.

EXCEPT AS SET FORTH HEREIN, SELLER DISCLAIMS ALL REPRESENTATIONS OR WARRANTIES OF ANY KIND WHATSOEVER, WHETHER EXPRESS, IMPLIED OR STATUTORY, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTIES OF MERCHANTABILITY, NON-INFRINGEMENT, FITNESS FOR A PARTICULAR PURPOSE OR ANY WARRANTY ARISING FROM A COURSE OF DEALING OR USAGE OF TRADE. NO PERSON (INCLUDING ANY AGENT, DEALER OR REPRESENTATIVE OF SELLER) IS AUTHORIZED TO MAKE ANY REPRESENTATION OR WARRANTY CONCERNING PRODUCTS EXCEPT TO REFER BUYER TO THIS AGREEMENT. BUYER WARRANTS THAT BUYER HAS NOT RELIED ON ANY OTHER WARRANTIES OR REPRESENTATIONS CONCERNING THE PRODUCTS OR THIS AGREEMENT.
For warranty service, call factory for RA number and send such Product prepared with sales receipt to: FUNCTIONAL DEVICES, INC., 101 COMMERCE DRIVE, SHARPSVILLE, IN 46068.

7. LIMITATION OF LIABILITY: SELLER WILL NOT BE LIABLE FOR ANY LOSS OF PROFIT, INTERRUPTION OF BUSINESS OR ANY OTHER SPECIAL, CONSEQUENTIAL OR INCIDENTAL DAMAGES SUFFERED OR SUSTAINED BY BUYER FOR ANY REASON. EXCEPT FOR CLAIMS OF DEATH OR PERSONAL INJURY, IN NO EVENT WILL SELLER'S AGGREGATE LIABILITY TO BUYER ARISING UNDER OR IN ANY WAY RELATED TO THIS AGREEMENT FOR ANY REASON (INCLUDING, BUT NOT LIMITED TO, LIABILITY ARISING FROM NEGLIGENCE OR ON THE BASIS OF STRICT LIABILITY, OR OTHERWISE) EXCEED THE TOTAL AMOUNT PAID BY BUYER TO SELLER HEREUNDER FOR ANY PRODUCT GIVING RISE TO A CLAIM UNDER THIS AGREEMENT.

8. RETURNS: Unless otherwise approved by Seller in writing in its sole discretion, except in the case of a non-conforming shipment or a warranty issue, Buyer may not return Products. If Seller approves the return of Products pursuant to the preceding sentence, such returned Products must be returned within ninety (90) days from date of invoice and will be subject to a 25% restocking fee. In the event of a non-conforming shipment or a warranty issue, Buyer may return Products, but only if Buyer first: (a) provides notice to Seller as required in this Agreement, (b) obtains prior authorization from Seller, and (c) all Products or containers for which return is properly authorized have been marked with a return authorization number supplied by Seller. Buyer will make all returns via a traceable form such as Federal Express, UPS or insured mail and in resalable condition. Buyer will pay all return shipping charges and any other charges associated therewith.

9. CANCELLATIONS: Cancellation or deferment of all or part of an order is subject to acceptance by the Seller. If accepted, any reduction in quantity of any item to less than 85% of the original item quantity is subject to a 15% cancellation charge. If an order cancellation is accepted, the Buyer will make delivery and pay for all material manufactured and in stock or in process at time of notice for such order, and for any special materials on orders for which the Seller must take delivery.

10. EXPORTS. Buyer agrees that it will comply with any and all U.S. Export Controls and will not pay for, resell, transfer or knowingly sell Products in violation of U.S. Export Controls. If Buyer resells Products within or exports Products to a country or region which imposes upon Seller and/or Buyer an obligation to fund or undertake reuse, recycling, composting, recovery of Products, or any similar obligation (e.g., the European Union's Waste Electrical and Electronic Equipment Directive, EC 2002/96/EC) (the "**Obligations**"), Buyer shall wholly undertake the Obligations or duties and shall be entirely responsible for all associated costs therewith. Seller shall have no obligation to reimburse Buyer for execution of the Obligations. In the event that Seller is named in a proceeding based upon the Obligations, Buyer shall indemnify, defend and hold Seller harmless from all actions related thereto, including all civil and governmental actions.

11. MISCELLANEOUS. This Agreement is governed by the laws of the State of Indiana, without giving effect to its conflict of laws principles. Buyer hereby irrevocably consents and submits to the exclusive jurisdiction and venue of the state and federal courts in Marion County, Indiana. The United Nations Convention for Contracts for the International Sale of Goods is explicitly excluded. Each provision contained in this Agreement constitutes a separate and distinct provision severable from all other provisions. If any provision (or any part thereof) is unenforceable under or prohibited by any present or future law, then such provision (or part thereof) will be amended, and is hereby amended, so as to be in compliance with such law, while preserving to the maximum extent possible the intent of the original provision. Any provision (or part thereof) that cannot be so amended will be severed from this Agreement; and, all the remaining provisions of this Agreement will remain unimpaired. No modification, addition or deletion, or waiver of any rights under this Agreement is binding on a party unless made in a non-preprinted agreement clearly understood by the parties to be a modification or waiver, and signed by a duly authorized representative of each party.

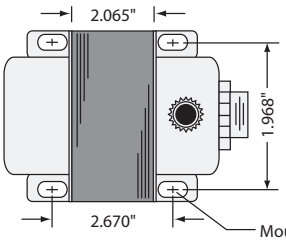
RIB Functional Devices, Inc.
(800) 888-5538 sales@functionaldevices.com www.functionaldevices.com

TRANSFORMER

TR100VA005

Transformer 96 VA, 480/277/240/120 to 24 Vac, Circuit Breaker, Foot and Single Threaded Hub Mount

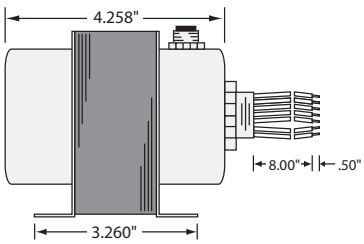
c UL us LISTED
Class 2

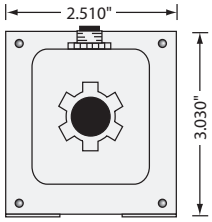


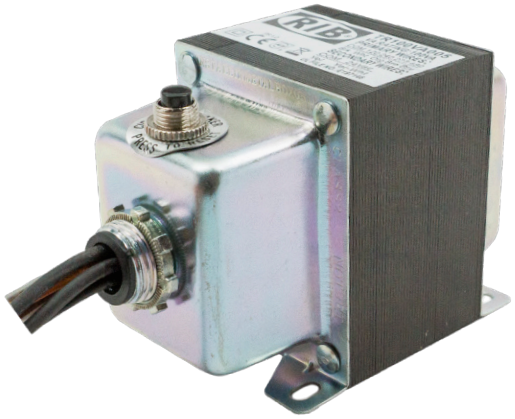
Mounting Hole = .350" x .175"

PRIMARY WIRES	SECONDARY WIRES
Gry - 480 Vac	Yel/Wht - 24 Vac
Brn - 277 Vac	
Org - 240 Vac	
Wht - 120 Vac	
Blk - Comm	Yel - Comm

Secondary Yel/Wht wire in phase with Primary Blk wire.







SPECIFICATIONS

VA Rating: 96
Frequency: 50/60 Hz
Mounting: Foot & Single Threaded Hub
Over Current Protection: Circuit Breaker
Dimensions: 4.258˝ x 2.510˝ x 3.030˝ (w/ .500˝ NPT Hub)
Wire Length: 8˝ Typical w/ .5˝ Strip
Operating Temperature: -30 to 140° F
MTBF: 100,000 Hours @ 77° F
Construction: Split-Bobbin
Approvals: Class 2 UL5085-3 Listed, C-UL, CE, RoHS

Functional Devices, Inc.
101 Commerce Drive
Sharpsville, IN 46068

Toll-free: (800) 888-5538
Office: (765) 883-5538
Fax: (765) 883-7505

Email: sales@functionaldevices.com
Website: www.functionaldevices.com

TERMS AND CONDITIONS OF SALE

1. OFFER, GOVERNING PROVISIONS AND CANCELLATIONS: This document constitutes an offer or counter-offer by Functional Devices, Inc. or any of its affiliates ("**Seller**") to sell various products as agreed by Seller ("**Products**") to the buyer named on the reverse side of this document or in other applicable print or electronic documentation ("**Buyer**") in accordance with these terms and conditions. This writing is not an acceptance of any offer made by Buyer. This offer or counter-offer is expressly conditioned upon Buyer's assent to these terms and conditions and no others. Buyer is deemed to have assented to these terms and conditions (including Seller's warranty) when the first of the following occurs: A. Buyer signs and delivers to Seller an acknowledgement copy of any of Seller's quotation, order acknowledgement or invoice forms; B. Buyer gives to Seller (orally or in writing) specifications of quantity and/or type, assortments thereof, delivery dates, shipping instructions, instructions to bill, or the like as to all or any part of the Products; C. Buyer receives delivery of any of the Products; or, D. Buyer has otherwise assented to the terms and conditions hereof.

Where an attachment to this Agreement or separate document referencing this Agreement consists of a quotation, the quotation remains open for acceptance for a period of thirty (30) days or such other period as specified in the quotation. Seller hereby rejects any additional or different terms or provisions contained in any purchase order, acknowledgment or other communication heretofore or hereafter received from Buyer. Seller's delivery of Products does not constitute an assent to any terms proposed by Buyer. Except for an officer of Seller, no representative of Seller has any authority to waive, alter, vary, amend, or add to the terms hereof. **THESE TERMS AND CONDITIONS OF SALE CONSTITUTE THE ENTIRE AGREEMENT ("AGREEMENT") BETWEEN SELLER AND BUYER WITH RESPECT TO THE MATTERS ADDRESSED HEREIN.**

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4. TAXES AND OTHER CHARGES: In addition to the prices quoted or invoiced, Buyer will pay any sales tax, excise tax, use tax, value added or consumption tax, customs duty (that is assessed on the delivery of Product(s) to a destination outside of the U.S.A.), fee or charge of any nature whatsoever imposed by any governmental authority on or measured by the transaction between Seller and Buyer. In the event Seller is required to pay any amount, Buyer will reimburse Seller therefore; or provide Seller, at the time the order is submitted, an exemption certificate or other document acceptable to the authority imposing the same. Seller does not accept and will not pay any fines, penalties or chargebacks from Buyer for any reason.

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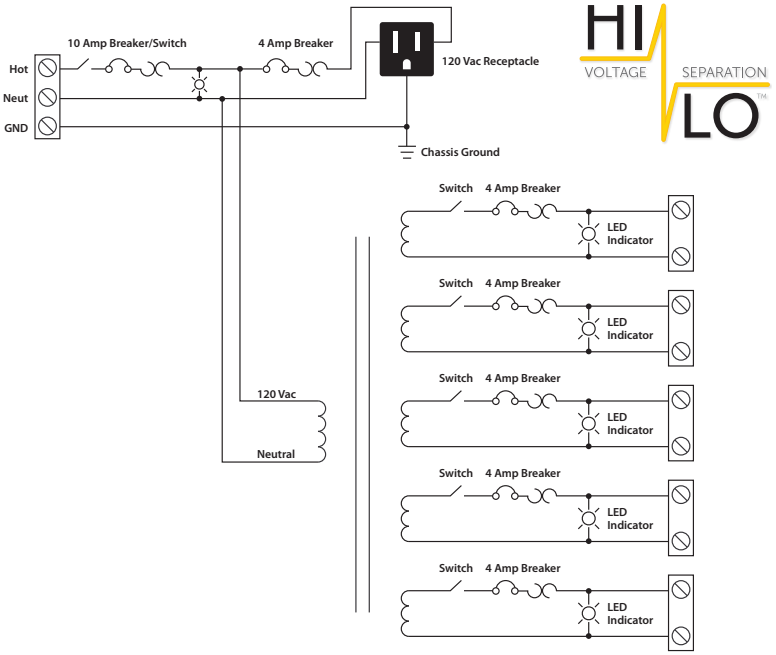
RIB Functional Devices, Inc.™ (800) 888-5538 sales@functionaldevices.com www.functionaldevices.com

AC POWER SUPPLY

PSH500AB10-LVC

Enclosed 500VA Power Supply, High/Low Voltage Separation with Five 100VA Class 2 Outputs, 120 Vac to 24 Vac with 120 Vac Receptacle



PSH500AB10-LVC
Shown With High Voltage Cover & Low Voltage Access Plate

c UL us LISTED Class 2

CE

RoHS

MADE IN THE U.S.A.

SPECIFICATIONS

Transformer: One (1) 500 VA
Over Current Protection: Circuit Breaker
Primary: 120 Vac
Frequency: 50/60 Hz
Main Breaker ON/OFF: Switch / Breaker (10 Amp) (Kills power to entire unit: 1 Outlet & Transformer)
Approvals: Class 2 (UL Approved UL5085-3), UL916, C-UL, CE, RoHS
Dimensions: 12.125″ x 12.125″ x 6.000″
Housing: NEMA1 Metal Enclosure with high/low separation

5 Secondaries:
24 Vac, with LED Indicators
4 Amp breaker for each output

24 Vac ON/OFF:
On / Off Switch & Breaker

Input:
120 Vac Finger-Safe Terminals, 8-18 AWG

Output:
5 Ungrounded, Isolated, 100 VA Class 2, 24 Vac Outputs. Removable Terminals accept16-22 AWG wire.

Ambient Temperature Derating:
4A up to 40˚ C ; 3A up to 50˚ C ; 2A up to 55˚ C
(When All 5 Outputs Operated Simultaneously)

Standby Wattage:
48.515 W @ 120 Vac

Full Load Primary Current:
4.66 A @ 120 Vac

Secondary Output Voltage vs. Load:
24.0 V @ 1 Amp
23.0 V @ 2 Amp
21.8 V @ 3 Amp
21.1 V @ 4 Amp

- When all 5 outputs operated simultaneously, at room temperature

Notes:

- 4A (Breaker protected) Convenience Receptacle Provided

Functional Devices, Inc.
101 Commerce Drive
Sharpsville, IN 46068

Toll-free: (800) 888-5538
Office: (765) 883-5538
Fax: (765) 883-7505

Email: sales@functionaldevices.com
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TERMS AND CONDITIONS OF SALE

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For warranty service, call factory for RA number and send such Product prepared with sales receipt to: FUNCTIONAL DEVICES, INC., 101 COMMERCE DRIVE, SHARPSVILLE, IN 46068.

7. LIMITATION OF LIABILITY: SELLER WILL NOT BE LIABLE FOR ANY LOSS OF PROFIT, INTERRUPTION OF BUSINESS OR ANY OTHER SPECIAL, CONSEQUENTIAL OR INCIDENTAL DAMAGES SUFFERED OR SUSTAINED BY BUYER FOR ANY REASON. EXCEPT FOR CLAIMS OF DEATH OR PERSONAL INJURY, IN NO EVENT WILL SELLER'S AGGREGATE LIABILITY TO BUYER ARISING UNDER OR IN ANY WAY RELATED TO THIS AGREEMENT FOR ANY REASON (INCLUDING, BUT NOT LIMITED TO, LIABILITY ARISING FROM NEGLIGENCE OR ON THE BASIS OF STRICT LIABILITY, OR OTHERWISE) EXCEED THE TOTAL AMOUNT PAID BY BUYER TO SELLER HEREUNDER FOR ANY PRODUCT GIVING RISE TO A CLAIM UNDER THIS AGREEMENT.

8. RETURNS: Unless otherwise approved by Seller in writing in its sole discretion, except in the case of a non-conforming shipment or a warranty issue, Buyer may not return Products. If Seller approves the return of Products pursuant to the preceding sentence, such returned Products must be returned within ninety (90) days from date of invoice and will be subject to a 25% restocking fee. In the event of a non-conforming shipment or a warranty issue, Buyer may return Products, but only if Buyer first: (a) provides notice to Seller as required in this Agreement, (b) obtains prior authorization from Seller, and (c) all Products or containers for which return is properly authorized have been marked with a return authorization number supplied by Seller. Buyer will make all returns via a traceable form such as Federal Express, UPS or insured mail and in resalable condition. Buyer will pay all return shipping charges and any other charges associated therewith.

9. CANCELLATIONS: Cancellation or deferment of all or part of an order is subject to acceptance by the Seller. If accepted, any reduction in quantity of any item to less than 85% of the original item quantity is subject to a 15% cancellation charge. If an order cancellation is accepted, the Buyer will make delivery and pay for all material manufactured and in stock or in process at time of notice for such order, and for any special materials on orders for which the Seller must take delivery.

10. EXPORTS. Buyer agrees that it will comply with any and all U.S. Export Controls and will not pay for, resell, transfer or knowingly sell Products in violation of U.S. Export Controls. If Buyer resells Products within or exports Products to a country or region which imposes upon Seller and/or Buyer an obligation to fund or undertake reuse, recycling, composting, recovery of Products, or any similar obligation (e.g., the European Union's Waste Electrical and Electronic Equipment Directive, EC 2002/96/EC) (the "**Obligations**"), Buyer shall wholly undertake the Obligations or duties and shall be entirely responsible for all associated costs therewith. Seller shall have no obligation to reimburse Buyer for execution of the Obligations. In the event that Seller is named in a proceeding based upon the Obligations, Buyer shall indemnify, defend and hold Seller harmless from all actions related thereto, including all civil and governmental actions.

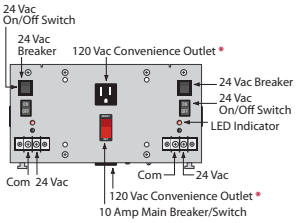
11. MISCELLANEOUS. This Agreement is governed by the laws of the State of Indiana, without giving effect to its conflict of laws principles. Buyer hereby irrevocably consents and submits to the exclusive jurisdiction and venue of the state and federal courts in Marion County, Indiana. The United Nations Convention for Contracts for the International Sale of Goods is explicitly excluded. Each provision contained in this Agreement constitutes a separate and distinct provision severable from all other provisions. If any provision (or any part thereof) is unenforceable under or prohibited by any present or future law, then such provision (or part thereof) will be amended, and is hereby amended, so as to be in compliance with such law, while preserving to the maximum extent possible the intent of the original provision. Any provision (or part thereof) that cannot be so amended will be severed from this Agreement; and, all the remaining provisions of this Agreement will remain unimpaired. No modification, addition or deletion, or waiver of any rights under this Agreement is binding on a party unless made in a non-preprinted agreement clearly understood by the parties to be a modification or waiver, and signed by a duly authorized representative of each party.

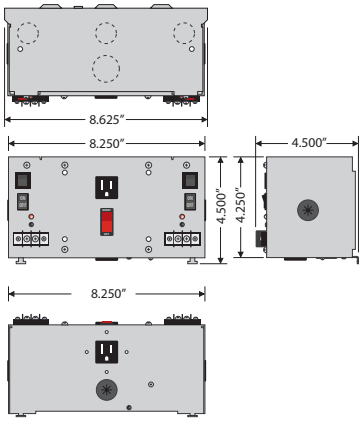
RIB Functional Devices, Inc.
(800) 888-5538 sales@functionaldevices.com www.functionaldevices.com

AC POWER SUPPLY

PSH100A100A Series

Enclosed Dual 100 VA Power Supplies, 120 to 24 Vac





c UL us LISTED Class 2

RoHS

CE

MADE IN THE U.S.A.

* Move internal jumper to "HOT" position if you wish outlets to always be hot otherwise outlets will be switched by main breaker.

PSH100A100A SERIES SELECTION GUIDE

Model #	120 Vac Outlets	Aux Output Wire	Main Breaker on Input Power	Secondary Configuration
PSH100A100A	•			External Terminal Strip
PSH100A100AW	•			Internal Wires
PSH100A100AB10*	•	•	10 Amp Switch / Breaker	External Terminal Strip
PSH100A100AWB10*	•	•	10 Amp Switch / Breaker	Internal Wires

SPECIFICATIONS

Transformer: Two 100 VA Split-Bobbin
Over Current Protection: Circuit Breaker
Frequency: 50/60 Hz
24 Vac ON/OFF: On / Off Switch & Breaker
Main Breaker ON/OFF: Switch / Breaker (10 Amp) (Kills power to entire unit: Outlets, Aux. Output, & Transformer)*
Total Combined Output 9A
Temperature: 40° C
Approvals: Class 2 (UL Approved UL5085-3), UL916, UL508, C-UL, CE, RoHS,
Special ^ Seismic Certification of Equipment and Components: OSP-0201-10
Dimensions: 4.500˝ x 8.625˝ x 4.500˝

Input Wires:

"B10˝ Models Only
Input Power Wires
BLK: 120 Vac
WHT: Neutral
GRN: Ground

Outlet Wires
BLK: 120 Vac
WHT: Neutral
GRN: Ground

All Other Models
Primary Wires
BLK: 120 Vac
WHT: Common

Output Wires:

"B10˝ Models Only
Auxiliary Output
BLU: 120 Vac

"W˝ Models Only
Transformer Output
WHT/YEL: 24 Vac
WHT/BLU: Common

Notes:

- Output derating may exceed 20% due to elevated ambient temperature or heat buildup in device over time.
- Design is in accordance with ASCE 7-05 Chapter 13: ^
  www.oshpd.ca.gov/FDD/Pre-Approval/OSP-0201-10.pdf

Functional Devices, Inc.
101 Commerce Drive
Sharpsville, IN 46068

Toll-free: (800) 888-5538
Office: (765) 883-5538
Fax: (765) 883-7505

Email: sales@functionaldevices.com
Website: www.functionaldevices.com

TERMS AND CONDITIONS OF SALE

1. OFFER, GOVERNING PROVISIONS AND CANCELLATIONS: This document constitutes an offer or counter-offer by Functional Devices, Inc. or any of its affiliates ("**Seller**") to sell various products as agreed by Seller ("**Products**") to the buyer named on the reverse side of this document or in other applicable print or electronic documentation ("**Buyer**") in accordance with these terms and conditions. This writing is not an acceptance of any offer made by Buyer. This offer or counter-offer is expressly conditioned upon Buyer's assent to these terms and conditions and no others. Buyer is deemed to have assented to these terms and conditions (including Seller's warranty) when the first of the following occurs: A. Buyer signs and delivers to Seller an acknowledgement copy of any of Seller's quotation, order acknowledgement or invoice forms; B. Buyer gives to Seller (orally or in writing) specifications of quantity and/or type, assortments thereof, delivery dates, shipping instructions, instructions to bill, or the like as to all or any part of the Products; C. Buyer receives delivery of any of the Products; or, D. Buyer has otherwise assented to the terms and conditions hereof.

Where an attachment to this Agreement or separate document referencing this Agreement consists of a quotation, the quotation remains open for acceptance for a period of thirty (30) days or such other period as specified in the quotation. Seller hereby rejects any additional or different terms or provisions contained in any purchase order, acknowledgment or other communication heretofore or hereafter received from Buyer. Seller's delivery of Products does not constitute an assent to any terms proposed by Buyer. Except for an officer of Seller, no representative of Seller has any authority to waive, alter, vary, amend, or add to the terms hereof. **THESE TERMS AND CONDITIONS OF SALE CONSTITUTE THE ENTIRE AGREEMENT ("AGREEMENT") BETWEEN SELLER AND BUYER WITH RESPECT TO THE MATTERS ADDRESSED HEREIN.**

2. PRICES: The prices for the Products are based on the terms and conditions herein, including the limitations of liability and warranties, and all such terms and conditions are material to the sale of the Products. In the event Seller fails to provide a price quote and/or terms prior to the acceptance of the order, Buyer will pay Seller's then-current list price for such Products. All quotations and invoices show the net selling price of each item quoted. In the event of a mathematical error, the quoted price per Product governs.

3. TERMS OF PAYMENT: Buyer will pay the fees specified in each invoice provided by Seller in United States Dollars within thirty (30) calendar days after the invoice date unless otherwise agreed to in writing by an authorized representative of Seller. Any amount due under this Agreement that remains unpaid after its due date will bear interest from the date that such payment became delinquent until the date it is paid in full at the lower of 1.5% per month, which equals an annual percentage rate of 18%, or the maximum rate permitted by law. Seller reserves the right to establish, revoke or modify credit terms for Buyer at any time. No discounts are allowed unless otherwise agreed to in writing by an authorized representative of Seller. Buyer will pay any collection fees, legal fees, or court costs incurred by Seller to collect past due amounts. No offsets or setoffs of payments due to Seller hereunder are allowed with respect to any other agreement between the parties. Seller hereby retains a lien on the goods sold for unpaid purchase money as herein provided.

4. TAXES AND OTHER CHARGES: In addition to the prices quoted or invoiced, Buyer will pay any sales tax, excise tax, use tax, value added or consumption tax, customs duty (that is assessed on the delivery of Product(s) to a destination outside of the U.S.A.), fee or charge of any nature whatsoever imposed by any governmental authority on or measured by the transaction between Seller and Buyer. In the event Seller is required to pay any amount, Buyer will reimburse Seller therefore; or provide Seller, at the time the order is submitted, an exemption certificate or other document acceptable to the authority imposing the same. Seller does not accept and will not pay any fines, penalties or chargebacks from Buyer for any reason.

5. DELIVERY, RISK OF LOSS, CLAIMS AND FORCE MAJEURE:

A. All prices quoted for products are Ex-Works (Incoterms 2010) at a shipping facility determined by Seller, unless otherwise noted by Seller ("**Seller's Shipping Facility**"). Risk of loss or damage, and beneficial ownership, of the Products are transferred to Buyer when the Products are made available to Buyer at Seller's Shipping Facility. All delivery dates are approximate.

B. Buyer will only make written claims to Seller for damages, shortages or other delivery errors within seven (7) calendar days after receipt of shipment. All Products received by Buyer, or Buyer's clients, customers, or agents, that are not rejected within such time will be deemed accepted. Failure to provide such written notice constitutes a waiver of all such claims regarding such shipment by Buyer. Buyer will not revoke acceptance.

C. Seller is not liable for any damage as a result of any delay or failure to deliver due to any act of God, act of Buyer, embargo or other governmental act, regulation or request, fire, accident, power outage, strike, civil unrest, weather, slowdown or other labor difficulties, war, riot, act of terrorism, delay in transportation, defaults of common carriers, inability to obtain necessary labor, materials or manufacturing facilities or, without limiting the foregoing, any other delays beyond Seller's control. Buyer's sole and exclusive remedy for any delays or for Seller's inability to deliver Products for any reason, in each case, that persists for more than ninety (90) days, is to cancel the order pursuant to Seller's Order Policies and Guidelines available upon request.

6. WARRANTY; DISCLAIMER. Products are warranted to be free from manufacturing defects under normal use and conditions for five (5) years (the "**Warranty Period**").

The warranty does not apply to: (a) Damage caused by accident, abuse, mishandling, or dropping; (b) Products which have been subjected to unauthorized repair, opened, or taken apart; (c) Products not used in accordance with directions; (d) Damages exceeding the cost of such Product; and (e) Damages caused by lightning, water, or condensation. If warranty service is required during the Warranty Period, and if examination shall disclose to Seller's satisfaction that such Product was originally defective, then Seller will at its option repair or replace the product without charge upon prepaid delivery of such Product to Seller's facility with proof of date of purchase. Corrections of such defects by repair to or supplying of replacements for defective parts shall constitute fulfillment of all obligations of Seller.

Seller shall not be liable for loss, damage, or expense directly or indirectly caused from the failure of Products to perform as expected.

EXCEPT AS SET FORTH HEREIN, SELLER DISCLAIMS ALL REPRESENTATIONS OR WARRANTIES OF ANY KIND WHATSOEVER, WHETHER EXPRESS, IMPLIED OR STATUTORY, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTIES OF MERCHANTABILITY, NON-INFRINGEMENT, FITNESS FOR A PARTICULAR PURPOSE OR ANY WARRANTY ARISING FROM A COURSE OF DEALING OR USAGE OF TRADE. NO PERSON (INCLUDING ANY AGENT, DEALER OR REPRESENTATIVE OF SELLER) IS AUTHORIZED TO MAKE ANY REPRESENTATION OR WARRANTY CONCERNING PRODUCTS EXCEPT TO REFER BUYER TO THIS AGREEMENT. BUYER WARRANTS THAT BUYER HAS NOT RELIED ON ANY OTHER WARRANTIES OR REPRESENTATIONS CONCERNING THE PRODUCTS OR THIS AGREEMENT.
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10. EXPORTS. Buyer agrees that it will comply with any and all U.S. Export Controls and will not pay for, resell, transfer or knowingly sell Products in violation of U.S. Export Controls. If Buyer resells Products within or exports Products to a country or region which imposes upon Seller and/or Buyer an obligation to fund or undertake reuse, recycling, composting, recovery of Products, or any similar obligation (e.g., the European Union's Waste Electrical and Electronic Equipment Directive, EC 2002/96/EC) (the "**Obligations**"), Buyer shall wholly undertake the Obligations or duties and shall be entirely responsible for all associated costs therewith. Seller shall have no obligation to reimburse Buyer for execution of the Obligations. In the event that Seller is named in a proceeding based upon the Obligations, Buyer shall indemnify, defend and hold Seller harmless from all actions related thereto, including all civil and governmental actions.

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PennState
Physical Plant

Uninterruptible Power Supplies

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	Eaton 9SX online, extended runtime UPS, 1000 VA, 900 W, 5-15P input, Outputs: (6) 5-15R, 9.9"Hx6.3"Wx15.1"D, 30.9 lb., network card optional
9SX1000	
General specifications	Product Name
	Catalog Number
	UPC
	Product Length/Depth
	Product Height
	Product Width
	Product Weight
	Compliances
	Certifications
Battery	Runtime graph
	Battery management
	Battery replacement
	Extended battery capability
Electrical output	Receptacle
	Topology
	Wattage
	VA rating
	Output waveform
	Voltage
	Output power factor
	Output nominal voltage
	Output frequency
	Feed type
Electrical input	Input connection
	Input cord length
	Input frequency range
	Input power factor
Communications	Communication
	Expansion slots
	User interface

	Potential free switch contact
Environmental	Temperature range
Additional specifications	Form factor
	Construction type
	Package contents
	Internal bypass
Warranty and support	Standard factory warranty
	Extended service plans
Brochures	Eaton 9SX UPS brochure
Certification reports	EC DoC Eaton 9SX
Drawings	Eaton 9SX UPS visio stencils
	9SX1000 UPS 3D technical drawing
	9SX1000 UPS 2D technical drawing
Product specification guides	Eaton 9SX UPS technical specifications
	Quick start guide for Eaton 9SX UPS 120V
User guides	models
	Eaton 9SX UPS installation and user manual
Date	Mon Nov 22 2021

Eaton 9SX UPS

9SX1000

7.43172E+11

15.1 in

9.9 in

6.3 in

30.9 lb

FCC Compliant CE Marked

cULus Listed

View runtime graph

ABM technology (3-stage charging extends battery service life by 50% and provides advance warning for battery replacement)

Hot-swappable internal batteries and extended battery modules (EBMs)

Yes

(6) 5-15R

Online/Double-conversion

900 W

1000 VA

True sine wave

120V

0.9

120V default (100/110/120/125V)

50/60 Hz

1

5-15P

8 ft

60 Hz: 50–70 Hz, 50 Hz: 40–60 Hz

>.99

(1) MiniSlot|(1) USB port|(1) Serial RS-232 port|(1) RPO/ROO/Signal input terminal|(1) mini-terminal block for output relay

(1) Mini-Slot (MS) expansion port. Optional connectivity cards may be ordered separately.|- Gigabit Web/SNMP card part number: NETWORK-M2|- Modbus card part number: MODBUS-MS|- Relay card part number: RELAY-MS

5-button graphical user interface

0° to 40°C (32° to 104°F)

Tower

Free standing model

9SX 1000 VA UPS|Quick start guide|RS-232 serial cable|USB cable

2-YEAR FACTORY WARRANTY|- 2 years|- Parts, electronics and batteries coverage|- Standard ground shipping|- Technical support

ADVANCED DEPOT EXCHANGE|-5-year depot repair: 9SW5Y-1000UC|-Expedited parts coverage for 5 years|-Parts, electronics and UPS batteries coverage|-Next business day shipping|-Technical support||5-YEAR ON-SITE PLAN: WFLN75XX-2509UC |- On-site parts and labor coverage for years 5|- Parts, electronics and UPS batteries coverage|- 24x7 on-site labor coverage, next-day response|- Next-day shipping|- Technical support

PennState
Physical Plant

Zone Sensors

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