

Catalog Page Index

Project: Kelly Walsh High School
 Casper, Wyoming
 Contract: 4216-0030

Reference Code	Description	Page #
A-306-K	OUTDOOR AIR STATIC	3
A70HA-1C	TWO CIRCUIT TEMP CONTROL	4
ADS05USRPC	ADS WORKSTATION PC TURNKEY	127
AFS-460	AIR PRESSURE SENSING SWITCH, MANUAL RESET	5
CDLSXX	VERIS DUCT CO2 TRANS, DISPLAY, 0-2000PPM	7
CSD-CA1G1-1	CURRENT SENSING DEVICE WITH RELAY	9
CSD-SF0C0-1	CURRENT SENSING DEVICE WITHOUT RELAY	9
DPT2302-050D	PRESS SENS,DP,0-50 PSI,VDC,0.25%	12
DPT2640-005D-1	DIFFERENTIAL PRESS TRANS, DIF, 0 TO 5	14
DPT2640-R25B-1	DIFFERENTIAL PRESS TRANS, DIF, -0.25 TO 0.25	14
DS224	SNOW/ICE SENSOR	146
GTC116-P	EBTRON AIRFLOW MEASURING STATION	138
EN-EWC15-0	UPM SINGLE W/TRANSFORMER	16
F-1210	FLOW METER, DUAL TURBINE, ANA OUT	17
F-STD-INSTL1	FLOW METER INSTALL KIT, STD, WELDED	17
FTG18A-600R	AIR PRESSURE PROBE	20
GRD10A-601	THERMOSTAT GUARD	21
H120	CURRENT SENSING DEVICE WITH RELAY	23
H141206HCLL-P	KELE NEMA4 ENCLOSURE, CLEAR, 14X12X6	142
H421	CURRSENS,4-20MA,SPLIT,800-2400A,2%	25
HO30K-TT-3	3% OUTSIDE AIR RH XMTR W/TEMP (0-100F)	144
HT-6703-0N00P	HUM SENS DUCT,4-20MA 0-10V W/JUMPER,3%RH	27
M9108-AGA-2	ELECTRIC ACT, NON-SPR-RET, 24VAC, 70INLB	35
M9208-BAA-3	ELECTRIC ACT, 2POS, 120VAC	39
M9220-GGA-3	ELECTRIC ACT, SPR-RET, 24VAC, PROP	45
MS-FEC1611-0	FEC DIGITAL CONTROLLER	50
MS-FEC1621-0	FEC DIGITAL CONTROLLER WITH DISPLAY	50
MS-FEC2611-0	FEC DIGITAL CONTROLLER	50
MS-IOM1711-0	IOM 4 POINT	54
MS-IOM2711-0	IOM 6 POINT	54
MS-IOM2721-0	IOM 10 POINT	54
MS-IOM3711-0	IOM 12 POINT	54
MS-NCE2566-0	NETWORK CTRL ENGINE, 33PTS, MSTP, DISPLAY	60
MS-VMA1615-0	VMA DIGITAL CONTROLLER	63
MS-VMA1630-0	VMA DIGITAL CONTROLLER	63
NS-BTB7002-0	NETWORK TEMP SENSOR WITH DISPLAY	67
NS-BTB7003-0	NETWORK TEMP SENSOR WITH DISPLAY	67
PAG100001AC0	PANEL, NAE5510-2, 20X24	74
PAGE00001FC0	PANEL NAE4510 16X20	76
PAKG00001FH0	PANEL, FEC2611,16X20	78
PAKGJH002AH0	PANEL, FEC2611/IOM3711, 20X24	80
PAKLJJ002BH0	PANEL, MS-FAC2611-0 WITH MS-IOM4711, 24X36	82
PARL00001BH0	PANEL, MS-NCE2566-0 24X36	84
RH2B-UAC24-L	RELAY DPDT,10A,HC=24 VAC,	88
RIB24P	RELAY DPDT, 20A, HC-24VAC, W/LED	94

Reference Code	Description	Page #
RIBU1C	RELAY SPDT,10A,HC=10-30 VAC/DC,W/LED	87
RPS	STAINLESS STEEL RM PRESS SENSOR 1/4 BARB	3
S66	ELECTRONIC MOTOR CONTROL	3
SD-01	SURGE DAMPENER	3
SH2B-05	RELAY DPDT RELAY BASE FOR RH2B	88
T26A-14C	LINE VOLTAGE THERMOSTAT	98
T26S-18C	LINE VOLTAGE THERMOSTAT	98
TE-6001-8	TEMP SENSOR AVERAGING ELEMENT HOLDER	100
TE-6300W-101	BRASS THERMOWELL FOR 6" TEMP SENSOR	101
TE-6300W-102	STAINLESS THERMOWELL FOR 6" TEMP SENSOR	101
TE-6311M-1	TEMP SENSOR 8" 1000 OHM NI DUCT TEMP	101
TE-6313P-1	TEMP SENSOR NICKEL OUTSIDE AIR SENSOR	101
TE-6328P-1	TEMP SENSOR PLATINUM DUCT AVERAGE,20 FEET	101
TE-631AM-2	TEMP SENSOR WELL TEMP SEN 6" 1K NI	101
TE-631GV-2	TEMP SENSOR NICKEL DUCT PROB,4 INCHES	101
VG1241AE+9T4AGA	TWO WAY BALL VLV NON-SPR-RET, FLTNG	105
VG1241AF+9T4AGA	TWO WAY BALL VLV NON-SPR-RET, FLTNG	105
VG1241BG+9T4AGA	TWO WAY BALL VLV NON-SPR-RET, FLTNG	105
VG1241CL+9T4AGA	TWO WAY BALL VLV NON-SPR-RET, FLTNG	105
VG1241CN+9T4AGA	TWO WAY BALL VLV NON-SPR-RET, FLTNG	105
VG1241DN+906AGA	TWO WAY BALL VLV NON-SPR-RET, FLTNG	105
VG1241EP+906AGA	TWO WAY BALL VLV NON-SPR-RET, FLTNG	105
VG1241BG+943BUA	TWO WAY BALL VLV SPR-RET, FLTNG, 120V	108
VG1241CL+943BUA	TWO WAY BALL VLV SPR-RET, FLTNG, 120V	108
VG1241DN+928GGA	TWO WAY BALL VLV SPR-RET, PROP, FAIL N.O.	108
VG1241DP+928GGA	TWO WAY BALL VLV SPR-RET, PROP, FAIL N.O.	108
VG1241EP+958BAA	TWO WAY BALL VLV SPR-RET, FLTNG, 120V	108
VG1241FR+928GGA	TWO WAY BALL VLV SPR-RET, PROP, FAIL N.O.	108
VG1241FR+948GGA	TWO WAY BALL VLV SPR-RET, PROP, FAIL N.C.	108
VG1241FS+928GGA	TWO WAY BALL VLV SPR-RET, PROP, FAIL N.O.	108
VG1241FS+948GGA	TWO WAY BALL VLV SPR-RET, PROP, FAIL N.C.	108
VG1241FT+928GGA	TWO WAY BALL VLV SPR-RET, PROP, FAIL N.O.	108
VG1241FT+948GGA	TWO WAY BALL VLV SPR-RET, PROP, FAIL N.C.	108
VG12A5GT+94NGGA	TWO WAY FLANGED BALL VLV SPR-RET, PROP, FAIL N.C.	111
VG12A5GU+94NGGA	TWO WAY FLANGED BALL VLV SPR-RET, PROP, FAIL N.C.	111
VG12A5HV+92NGGA	TWO WAY FLANGED BALL VLV SPR-RET, PROP, FAIL N.O.	111
VG18A5GT+94NGGA	THREE WAY FLANGED BALL VLV SPR-RET, PROP, FAIL BYF	111
VG1841AD+9T4AGA	THREE WAY BALL VLV NON-SPR-RET, FLTNG	115
VG1841AF+9T4AGA	THREE WAY BALL VLV NON-SPR-RET, FLTNG	115
VG1841AG+9T4AGA	THREE WAY BALL VLV NON-SPR-RET, FLTNG	115
VG1841BG+9T4AGA	THREE WAY BALL VLV NON-SPR-RET, FLTNG	115
VG1841ER+928GGA	THREE WAY BALL VLV SPR-RET, PROP, FAIL COIL	118
VG1841FR+928GGA	THREE WAY BALL VLV SPR-RET, PROP, FAIL COIL	118
VWN030HB+916AGC	TWO WAY BUTTERFLY VLV NON-SPR-RET, 2POS	121
VWN060LB2924AGC	TWO WAY BUTTERFLY VLV NON-SPR-RET, 2POS	121
VOPEN	VOLUME DAMPER, ALUMINUM	123
Y64T15-0	92VA CLASS 2 TRANSFORMER	125
Y65G13-0	40VA CLASS 2 TRANSFORMER	125
Y65T42-0	40VA CLASS 2 TRANSFORMER	125
COMPUTER	DELL RACK MOUNTED COMPUTER	150



PRESSURE

AIR PRESSURE SENSORS, SURGE DAMPENERS

A-300 SERIES, RPS, 21121, SD-01

DESCRIPTION

Static Pressure Sensors

A-300 Series sensors are used with pressure transmitters and pressure switches to sense duct pressures. Two sensors are required to monitor pressure across coils, filters, blowers, etc. **A-301** and **A-302** have four radial sensing holes and a 4" (10.2 cm) insertion depth. The **A-308** should be used only where accuracy is not critical. All mount in a 3/8" hole in the duct. If the interior of the duct is not accessible, an optional **A-345** flange mounting kit may be used.

Outdoor Static Pressure Sensor

The **A-306 Outdoor Static Pressure Sensor** provides an outdoor pressure signal for reference in building pressurization applications. The **A-306** includes the sensor, 50' (15.24m) of vinyl tubing, mounting bracket, and hardware.

Room Static Pressure Sensors

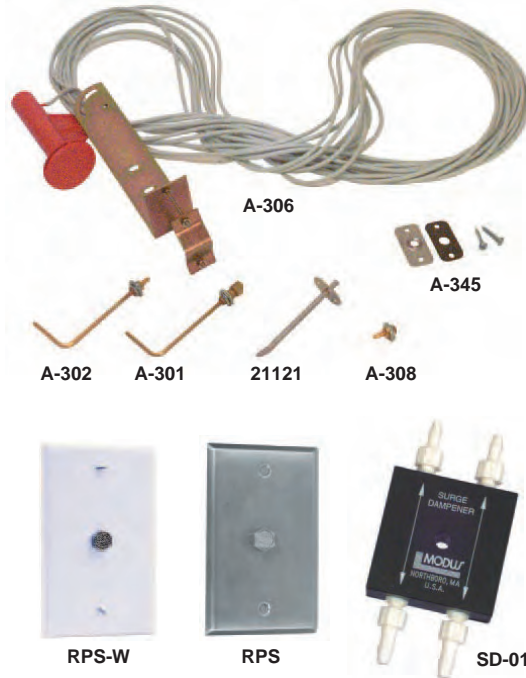
Model RPS is a stainless steel room static pressure sensor. It mounts directly to the wall or to a ceiling using a standard electrical box. **Model RPS-W** is the same as the **RPS** except with a white plastic wall plate. **RPS-I** (ivory) is also available.

Total Pressure Sensor

Model 21121 sensor is used primarily for proving air flow in ducts. The opening in the tip of the 4" (10.2 cm) aluminum tube faces upstream and senses impact (total) pressure.

Surge Dampener

Surge dampeners absorb rapid pressure fluctuations in order to steady a pressure signal. Each surge dampener has two independent channels – one for the low pressure tubing and one for the high pressure tubing. Surge dampeners are typically used with outdoor pressure sensors, which are subject to wind gusts, isolation rooms, clean rooms, or operating rooms where opening or closing doors creates sudden pressure changes.



PRESSURE

ORDERING INFORMATION

MODEL	DUCT STATIC PRESSURE SENSORS
A-301	Static Pressure Tip, 1/4" Compression
A-302	Static Pressure Tip, 1/4" Barb
A-308	Static Pressure Fitting, 1/4" Barb
A-345	Flange Mounting Kit
A-306	OUTDOOR STATIC PRESSURE SENSOR Outdoor Air Static Pressure Kit
21121	DUCT TOTAL PRESSURE SENSOR 4" Aluminum Impact Tube for 3/8" OD Plastic Tubing
B-137	1/4" Barb Adapter for #21121 (standard pack-100)
RPS	ROOM STATIC PRESSURE SENSOR Stainless Steel Room Pressure Sensor, 1/4" Barb
RPS-W	White Plastic Room Pressure Sensor, 1/4" Barb
SD-01	SURGE DAMPENERS Surge Dampener
A-605	FILTER KIT Mounting Kit for Air Filter Applications

A70 Series

Four-Wire, Two-Circuit Temperature Control

Description

The A70 Series temperature control incorporates a vapor-charged sensing element. The A70G, A70H, and A70K have a 4-wire, 2-circuit contact block that contains two isolated sets of contacts.

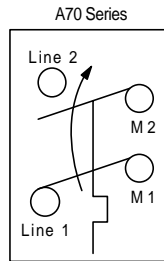
The contacts are designed so that when the main contact opens, the auxiliary contact closes.

Features

- long-life, snap-acting contacts
- automatic or manual reset models

Applications

Typical applications include energizing an indicator light after a low temperature cutout on a ventilating system.



Action on Increase on Temperature

A70 Series Action Diagram



A70GA-1

Selection Charts

A70 Series Four-Wire, Two-Circuit Temperature Control

Code Number	Switch Action		Range °F (°C)	Diff °F (°C)	Bulb and Capillary	Max Bulb Temp °F (°C)	Range Adjuster	
	Main Contacts	Auxiliary Contacts						
A70GA-1C ¹	Open Low	Close Low	15 to 55 (-9.4 to 12.8)	5 (2.8)	20 ft of 1/8 in. O.D. Tubing	400 (204.4)	Screwdriver slot	
A70GA-2C			35 to 80 (1.7 to 26.7)	3 to 30 (-16.1 to -1.1), factory set at 12 (-11.1)	3/8 in. x 3 in. 6 ft Cap.	250 (121)		
A70HA-1C ¹			Manual reset	15 to 55 (-9.4 to 12.8)	20 ft of 1/8 in. O.D. Tubing	3/8 in. x 3 in. 6 ft Cap.		400 (204.4)
A70HA-2C				35 to 80 (1.7 to 26.7)				250 (121)
A70HA-14C				15 to 55 (-9.4 to 12.8)				400 (204.4)
A70KA-1C	Open High	Close High	100 to 170 (37.8 to 76.7)		3/8 in. x 3 in. 6 ft Cap.	240 (116)		

1. On these models, the low cutout stop is set and sealed at 35°F (1.6°C). It cannot be set lower. The control responds only to the lowest temperature along any 14 to 16 in. section of the entire 20 ft element.

Replacement Covers

Code Number	Description
CVR17A-620R	Automatic reset cover
CVR17A-621R	Manual reset cover

Technical Specifications

Electrical Ratings

Pole Number	LINE-M2 (Main)						LINE-M1 (Auxiliary)			
	120	208	240	277	480 ¹	600 ¹	120	208	240	277
Motor Ratings VAC										
AC Full Load A	16.0	9.2	8.0	—	5.0	4.8	6.0	3.4	3.0	—
AC Locked Rotor A	96.0	55.2	48.0	—	30.0	28.8	36.0	20.4	18.0	—
AC Non-Inductive A	16.0	9.2	8.0	7.2	—	—	6.0	6.0	6.0	6.0
Pilot Duty – Both Poles	125 VA, 120 to 600 VAC and 57.5 VA, 120 to 300 VDC									

1. Not compressor motor loads.



Air Pressure Sensing Switch with Manual Reset Feature

Application

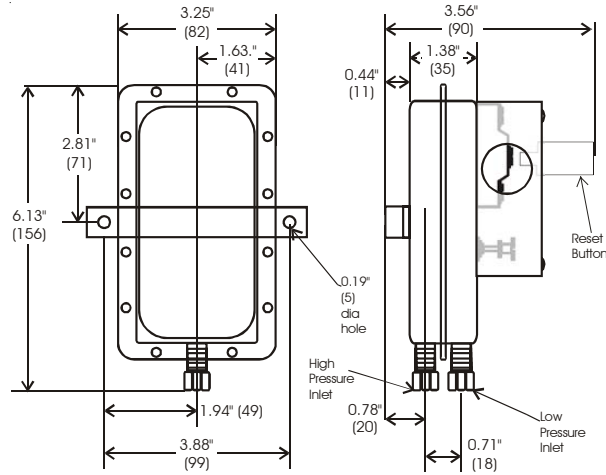
The **Model AFS-460** is a general purpose proving switch designed to require manual operator reset following actuation. It can be used to sense positive, negative, or differential air pressure in HVAC and Energy Management applications which require operator interface.

General Description & Operation

The plated housing contains a diaphragm, a calibration spring and a snap-acting SPST-NC switch with manual reset button.

The sample connections located on each side of the diaphragm accept 0.25" OD metallic 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 accepts a 0.5" conduit connection.



Dimensions in Inches (Millimeters)

Mounting (see Figure 1)

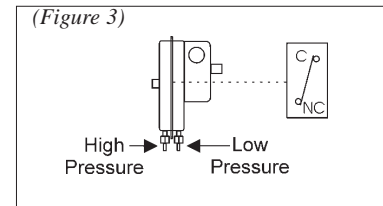
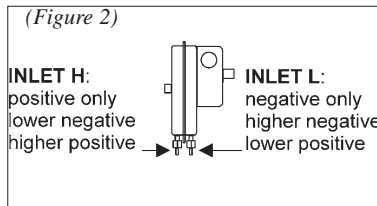
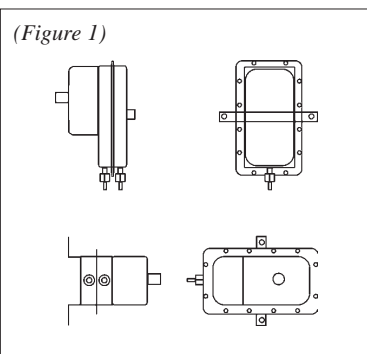
Select a mounting location which is free from vibration. The **AFS-460** must be mounted with the diaphragm in any vertical plane in order to obtain the lowest specified operating set point. Avoid mounting with the sample line connections in the "up" position. Surface mount via the two 3/16" diameter holes in the integral mounting bracket. The mounting holes are 3-7/8" apart.

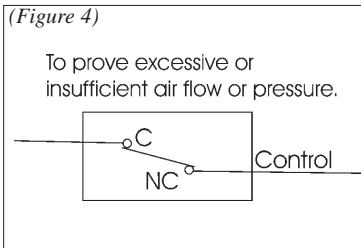
tion connections. An optional 1/4" adapter, suitable for slip-on flexible tubing is available: order part number 18311. For sample lines of up to 10 feet, 1/4" OD tubing is acceptable. For lines up to 20 feet, use 1/4" ID tubing.

For lines up to 60 feet, use 1/2" ID tubing. Locate the sampling probe a minimum of 1.5 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 five application options listed on page 2, and connect the sample lines as recommended.

Air Sampling Connection (see Figure 2)

The **AFS-460** is designed to accept firm-wall sample lines of 1/4" OD tubing by means of ferrule and nut compression.





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.

Electrical Connections (see Figure 3)

Before pressure is applied to the diaphragm, the switch contacts will be in the normally closed (NC) position.

The snap switch has screw top terminals with cup washers. Wire alarm and control applications as shown in **Figure 4**.

Field Adjustment

The adjustment range of an **AFS-460** Air Switch is $0.4" \pm 0.02"$ 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

Sample Media: Air.
Mounting Position (in order to meet lowest operating specifications): Diaphragm in any vertical plane.

Field Adjustable Range:
 $0.40 \pm 0.06"$ w.c. to $12.0"$ w.c.

Switch Differential: Progressive, increasing from approximately $0.06 \pm 0.01"$ w.c. at minimum set point, to approximately $0.8"$ w.c. at maximum set point.

Maximum Pressure:
0.5 psi (0.03 bar)

Operating Temperature Range:
-40 to 180F (-40.0 to 82.2C)

Life: Exceeds UL-recognized mechanical endurance test of 6,000 cycles minimum at 0.5 psi maximum pressure each cycle and at maximum electrical load.

Electrical Rating: @ 60 Hz.

15 amp 125, 250, or 277 VAC
¼ hp 125 V AC, ½ Hp 250 VAC,
½ amp 125 V DC,
¼ amp 250 V DC.

Contact Arrangement:
SPST-NC (manual reset).

Electrical Connections:
Screw top terminals with cup washers.

Sample Line Connections:
Ferrule and nut compression type connectors will accept 0.25" OD rigid tubing.

Shipping Weight:
1.2 lbs.

Approval and Recognition:
UL, CSA, CE.

Accessories

- P/N 18311 Slip-on ¼" OD Tubing Adapter, suitable for slipping on flexible plastic tubing.
- Sample line probes.
- Orifice plugs (pulsation dampeners).

Pressure Conversion Table

1" H₂O = 0.0361 lbs./sq. in. or 0.0736 in. mercury
1" Hg. = 0.491 lbs./sq. in. or 13.6 in. water
1 psi = 2.77 in. water or 2.036 in. Hg.

Location of Sample Lines for Typical Applications

<p>FAN OPERATION OR TRUE AIR FLOW WITH LITTLE OR NO STATIC PRESSURE.</p> <p>PROBE MUST BE PERPENDICULAR TO FLOW.</p>	<p>FAN OPERATION OR AIR FLOW WITH NO STATIC PRESSURE.</p>
<p>FAN OPERATION AND TRUE AIR FLOW WITH VARYING AMOUNTS OF STATIC PRESSURE.</p> <p>PROBE MUST BE PERPENDICULAR TO FLOW.</p>	<p>SUCTION OR FAN OPERATION.</p>
<p>PROVE POSITIVE STATIC PRESSURE.</p>	<p>NEGATIVE PRESSURE INCREASES AS FILTER GETS DIRTY.</p> <p>FILTER</p>



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Deluxe Duct and Wall CO₂ Sensors

C Series



Individual or 3-in-1 CO₂, RH, and Temperature

FEATURES

- Microprocessor-based design increases accuracy and reduces installation time
- Non-dispersive infrared technology (NDIR) repeatable to ± 20 ppm $\pm 1\%$ of measured value...high accuracy measurement
- Innovative self-calibration algorithm...easy to maintain
- 5-year calibration interval (recommended)
- Field-selectable outputs for operation flexibility
- Integrated transducer and probe...eliminates the need to install a separate pick-up tube
- Snap-on faceplate...no screws required, making installation and service easy
- CO₂, humidity, and temperature sensing all in one compact device...fewer units to buy and install

DESCRIPTION

CDL/CWL carbon dioxide sensors maximize energy savings, while helping optimize ventilation. These sensors allow ventilation systems to be controlled by the amount of CO₂ present in a space. The CWL/CDL Series detect fluctuations in CO₂ levels and signal ventilation systems to provide an inlet of fresh air optimal for the space at a given time saving energy and increasing tenant comfort.

SPECIFICATIONS

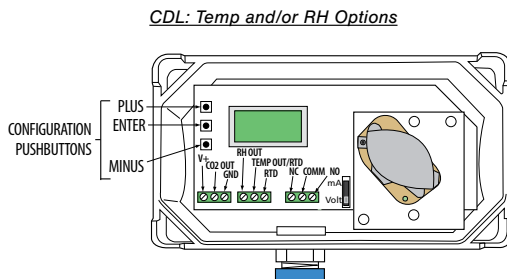
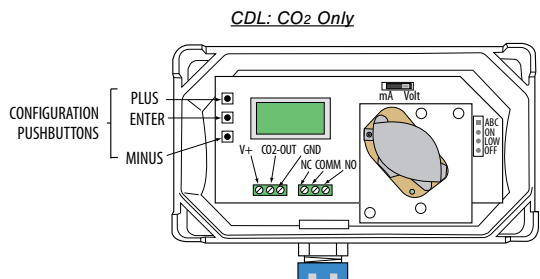
Input Power	Class 2; 20 to 30VDC/24VAC 50/60Hz; 100mA max.
Analog Output	4-20mA (clipped & capped)/0-5VDC/0-10VDC (selectable)
Operating Temp Range CDL CWL	0° to 50°C (32° to 122°F) No humidity option: 0° to 50°C (32° to 122°F); With humidity option: 10° to 35°C (50° to 95°F)
Operating Humidity Range	0 to 95% RH noncondensing
Housing Material	High impact ABS plastic
Terminal Block Torque CDL CWL	0.2N-m (2.0 in-lbf) max. 0.22N-m (2.0 in-lbf) max.
Terminal Block Wire Size CDL CWL	28-14 AWG (0.5-1.5mm ²) 30-18 AWG (0.08-0.5mm ²)
CO₂ TRANSMITTER	
Sensor Type	Non-dispersive infrared (NDIR), diffusion sampling
Output Range	0-2000/5000 ppm (programmable)
Accuracy	± 30 ppm $\pm 2\%$ of measured value*
Repeatability	± 20 ppm $\pm 1\%$ of measured value
Response Time	<60 seconds for 90% step change
RH TRANSMITTER	
HS Sensor	Fully replaceable, digitally profiled thin-film capacitive (32-bit mathematics) U.S. Patent 5,844,138
Accuracy	$\pm 2\%$ from 10 to 80% RH @ 25°C; NIST traceable multi-point calibration
Hysteresis	1.5% typical
Stability	$\pm 1\%$ @ 20°C (68°F) annually for two years
Output Range	0-100% RH
Temperature Coefficient	$\pm 0.1\%$ RH/°C above or below 25°C (typical)
TEMPERATURE TRANSMITTER	
Sensor Type	Solid-state, integrated circuit
Accuracy	$\pm 0.5^\circ\text{C}$ ($\pm 1^\circ\text{F}$) typical
Resolution	0.1°C (0.2°F)
Output Range	10° to 35°C (50° to 95°F)
RELAY CONTACTS	
1 Form C (SPDT) (on wall models, relay is only available in units without the setpoint slider option)	1A@30VDC, resistive; 30W max.

RTD/Thermistors in wall packages are not compensated for internal heating of product. EMC Conformance: Low voltage directive 2006/95/EC & EMC directive 2004/108/EC. EMC Special Note: Connect this product to a DC distribution network or an AC DC power adaptor with proper surge protection (EN 61000-6-1:2007 specification requirements). * Measured at NTP
Note: Rough handling and transportation may cause a temporary reduction of CO₂ sensor accuracy. With time, the ABC function will tune the readings back to the correct accuracy range. The default tuning speed is limited to 30 ppm per week.

APPLICATIONS

- Controlling ventilation in response to occupancy
- Facilitating compliance with ASHRAE 62.1 standard for air quality
- Office buildings, conference rooms, schools, retail stores, etc.

WIRING DIAGRAMS

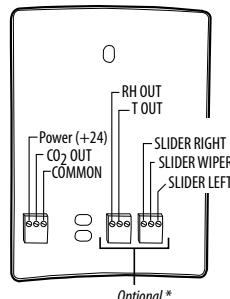
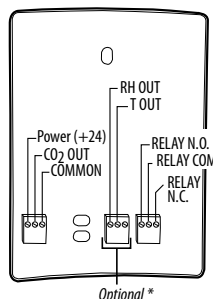
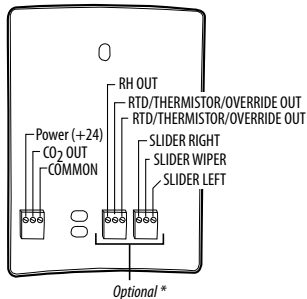
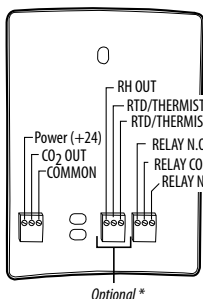


CWL: CO₂, RH, Thermistor, Pushbutton Override, and Relay Options

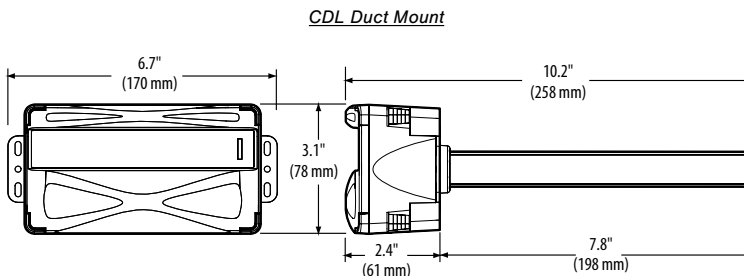
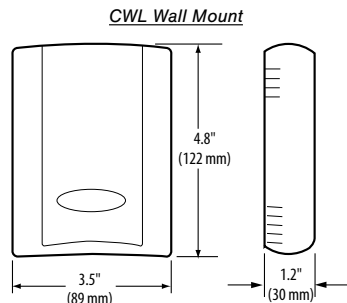
CWL: CO₂, RH, Thermistor, Pushbutton Override, and Setpoint Slider Options

CWL: CO₂, RH, Temperature Transmitter Options, and Relay Options

CWL: CO₂, RH, Temperature Transmitter, and Setpoint Slider Options



DIMENSIONAL DRAWINGS



* Note: Connector blocks & headers for optional features are not included with non-option models.

ORDERING INFORMATION

Duct Mount

RH Option	Temp	Sensor Type	Optional Cal Cert
CDLS <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
H = RH2% X = No RH	T = Temp X = No Temp (Stop here)	A = Transmitter B = 100R Platinum, RTD C = 1k Platinum, RTD D = 10k T2, Thermistor E = 2.2k, Thermistor F = 3k, Thermistor G = 10k CPC, Thermistor H = 10k T3, Thermistor J = 10k Dale, Thermistor K = 10k w/11k shunt, Thermistor M = 20k NTC, Thermistor N = 1800 ohm, Thermistor R = 10k US, Thermistor S = 10k 3A221, Thermistor T = 100k, Thermistor U = 20k "D", Thermistor W = 10k T2 high accuracy, Thermistor Y = 10k T3 high accuracy, Thermistor Z = 10k E1, Thermistor	Blank = None 1 = 1 pt Temp Cert 2 = 2 pt Temp Cert

Wall Mount

RH Option	Temp	Sensor Type	Temp Cal Cert	Option	Setpoint Slider Value	Housing
CWLS <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
H = RH 2% X = No RH	T = Temp X = No (stop here)	A = Transmitter B = 100R Platinum, RTD C = 1k Platinum, RTD D = 10k T2, Thermistor E = 2.2k, Thermistor F = 3k, Thermistor G = 10k CPC, Thermistor H = 10k T3, Thermistor J = 10k Dale, Thermistor K = 10k w/11k shunt, Thermistor M = 20k NTC, Thermistor N = 1800 ohm, Thermistor R = 10k US, Thermistor S = 10k 3A221, Thermistor T = 100k, Thermistor U = 20k "D", Thermistor W = 10k T2 high accuracy, Thermistor Y = 10k T3 high accuracy, Thermistor Z = 10k E1, Thermistor	X = No 1 = 1pt Temp Cert 2 = 2pt Temp Cert	1 = Push Button Override * 2 = Set Point Slider 3 = Push Button Override*+Set Point Slider	A = 1k F = 10k G = 20k K = 50k M = 100k	Blank = Cloud white B = Black

ACCESSORIES

Calibration kits & gases (AA01, AA26, AA27, AA28, AA29)
Handheld air quality testers (1010, 1008, 770)
Replacement covers and housing for wall units (AA52, AA52B, AA55)

Example:

CDLS H T B 2

Example:

CWLS H T C 2 2 A

* The Push Button Override feature is not available with temperature transmitter models. Only resistive temperature models qualify for this feature.

CSD Series Current Devices

Description

The Current Switch Device (CSD) Series of digital output current switches are non-intrusive devices designed to detect current flowing through a cable or wire. A cost-effective solution for monitoring on and off status or proof of operation, these units are ideal for monitoring very small current loads on motors driving fans and blowers, pumps, heating coils, and lighting.

The CSD models with command relays not only monitor the current flowing through the cable but also facilitate the start and stopping of the motor.

These units also provide a universal solid-state output and do not require a power supply. Completely self-powered, these units draw their power from current induced from the cable or line being monitored.

CSD Series Current Devices are available in the following types:

- solid core, setpoint fixed
- solid core, setpoint adjustable
- solid core with command relay, setpoint adjustable
- split core, setpoint fixed
- split core, setpoint adjustable
- split core with command relay, setpoint fixed
- split core with command relay, setpoint adjustable
- 12 VAC/VDC and 24 VAC/VDC accessory command relays

Refer to the *CSD Series Current Devices Product Bulletin (LIT-12011292)* for important product application information.

Features

- dual function — monitors current and motor start and stop
- 100% solid-state output — has no moving parts to fail
- polarity insensitive output — provides easier wiring
- snap-in mounting bracket — simplifies installation
- small size — fits in tight enclosures

Fixed Setpoint Models

CSD-SF0C0-1 (solid core)

- Setpoint fixed at 0.25 A
- Current range — 0.25 to 200 A

CSD-CF0A0-1 (split core)

- Setpoint fixed at 0.15 A
- Current range — 0.15 to 200 A

CSD-CF0J0-1 (split core)

- Setpoint fixed at 1.5 A
- Current range — 1.5 to 200 A

CSD-CF0J1-1 (split core with 24 V command relay)

- Relay Single Pole, Single Throw (SPST), Normally Open (N.O.), 10 A at 260 VAC, 5 A at 30 VDC
- Actuation coil — 20–30 VAC/DC, 40–85 mA maximum
- Setpoint fixed at 1.5 A
- Current range — 1.5 to 200 A

Adjustable Setpoint Models

CSD-SA1E0-1 (solid core)

- Multi-turn potentiometer — adjust setpoint for application
- Adjustable setpoint — wide range from 1.0 to 135 A
- Two status Light-Emitting Diodes (LEDs) — provide visual indication of off and on status

CSD-SA1E1-1 (solid core with 24 V command relay)

- Multi-turn potentiometer — adjust setpoint for application
- Adjustable setpoint — wide range from 1.00 to 135 A
- Relay SPST, N.O., 10 A at 260 VAC, 5 A at 30 VDC
- Actuation coil — 20–30 VAC/DC, 40–85 mA maximum
- Two Status LEDs — provide visual indication of off and on status

CSD-CA1G0-1 (split core)

- Multi-turn potentiometers — adjust setpoint for application
- Two status LEDs — provide visual indication of off and on status
- Adjustable setpoint — wide range from 1.25 to 135 A



CSD Series Current Device

CSD-CA1G1-1 (split core with 24 V command relay)

- Multi-turn potentiometers — adjust setpoint for application
- Adjustable setpoint — wide range from 1.25 to 135 A
- Relay SPST, N.O., 10 A at 260 VAC, 5 A at 30 VDC
- Actuation coil — 20–30 VAC/DC, 40–85 mA maximum
- Two status LEDs — provide visual indication of off and on status

CSD-SA1E2-1 (solid core with 12 V command relay)

- Multi-turn potentiometers — adjust setpoint for application
- Adjustable setpoint — wide range from 1.00 to 135 A
- Relay SPST, N.O., 10 A at 260 VAC, 5 A at 30 VDC
- Actuation coil — 10–14 VAC/VDC, 25–45 mA maximum
- Two status LEDs — provide visual indication of off and on status

Repair Information

If the CSD Series Current Device fails to operate within its specifications, replace the unit. For a replacement CSD Series Current Device, contact the nearest Johnson Controls® representative.

CSD Series Current Devices (Continued)

Selection Chart


Code Number	Core Type	Setpoint Threshold	LED Display	Low Setpoint (Amperes)	Output Relay
CSD-SF0C0-1	Solid	Fixed	No	0.25	No
CSD-SA1E0-1	Solid	Adjustable	Yes	1.00	No
CSD-SA1E1-1	Solid	Adjustable	Yes	1.00	24 V SPST, N.O. 10 A at 260 VAC, 5 A at 30 VDC
CSD-SA1E2-1	Solid	Adjustable	Yes	1.00	12 V SPST, N.O. 10 A at 260 VAC, 5 A at 30 VDC
CSD-CF0A0-1	Clamp/Split	Fixed	No	0.15	No
CSD-CF0J0-1	Clamp/Split	Fixed	No	1.5	No
CSD-CA1G0-1	Clamp/Split	Adjustable	Yes	1.25	No
CSD-CF0J1-1	Clamp/Split	Fixed	No	1.5	24 V SPST, N.O. 10 A at 260 VAC, 5 A at 30 VDC
CSD-CA1G1-1	Clamp/Split	Adjustable	Yes	1.25	24 V SPST, N.O. 10 A at 260 VAC, 5 A at 30 VDC

Accessories (Order Separately)

Code Number	Description
CR-01200-0 ¹	12 VAC/VDC SPST, N.O. Relay
CR-02400-0 ¹	24 VAC/VDC SPST, N.O. Relay


1. Refer to the *Command Relay Installation Instructions (Part No.24-10345-50)* for more information regarding the command relays.

Technical Specifications

CSD Series Current Devices - Solid Core Models				
	CSD-SF0C0-1	CSD-SA1E0-1	CSD-SA1E1-1	CSD-SA1E2-1
Amperage Range	0.25–200 A	1.00–135 A	1.00–135 A	1.00–135 A
Switch Setpoint	Fixed	Adjustable	Adjustable	Adjustable
Output Relay	No	No	24 V SPST, N.O. 10 A at 260 VAC, 5 A at 30 VDC	12 V SPST, N.O. 10 A at 260 VAC, 5 A at 30 VDC
Actuation Coil	No	No	20–30 VAC/VDC, 40–85 mA Maximum	10–14 VAC/VDC, 25–45 mA Maximum
Switch LED Indication	No	Yes	Yes	Yes
Relay LED Indication	No	No	Yes	Yes
Trip Setpoint Value	0.25 A	1.00 A	1.00–135 A	
Current Switching Mode	Under Current Sensing	Over/Under Current Sensing	Over/Under Current Sensing	
Sensor Supply Voltage	Induced from power conductor cable.			
Wire Size	2.1–0.6 mm (12–22 AWG) Diameter			
Status Output	Switch normally open.			
Switch Load Capacity	1 A at 30 VAC/42 VDC Maximum			
Isolation Voltage	600 VAC rms			
Temperature Range	-15 to 60°C (5 to 140°F)			
Frequency Range	50/60 Hz			
Humidity Range	0–95% Noncondensing			
Screw Torque	0.5 N·m (4 lb·in.)			
Dimensions	65 x 47 x 25 mm (2-9/16 x 1-7/8 x 1 in.)		65 x 65 x 40 mm (2-9/16 x 2-9/16 x 1-19/32 in.)	
Aperture (Sensing Hole) Size	18 mm Diameter (0.71 in. Diameter)			
	United States	UL Listed, File E310692, CCN NRNT, Under UL 508, Industrial Control Equipment		
	Canada	UL Listed, File E310692, CCN NRNT7, Under CAN/CSA C22.2 No. 14-M91 Industrial Control Equipment		
	Europe	CE Mark – Johnson Controls, Inc., declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive 2004/108/EC and the Low Voltage Directive 2006/95/EC.		
Shipping Weight	0.16 kg (0.35 lb)			

The performance specifications are nominal and conform to acceptable industry standards. For applications at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products. © 2013 Johnson Controls, Inc. www.johnsoncontrols.com

CSD Series Current Devices (Continued)

CSD Series Current Devices - Split Core Models				
	CSD-CF0A0-1/ CSD-CF0J0-1	CSD-CA1G0-1	CSD-CF0J1-1	CSD-CA1G1-1
Amperage Range	0.15–200 A/ 1.5–200 A	1.25–135 A	1.5–200 A	1.25–135 A
Switch Setpoint	Fixed	Adjustable	Fixed	Adjustable
Output Relay	No	No	24 V SPST, N.O. 10 A at 260 VAC, 5 A at 30 VDC	24 V SPST, N.O. 10 A at 260 VAC, 5 A at 30 VDC
Actuation Coil	No	No	20–30 VAC/VDC, 40–85 mA Maximum	20–30 VAC/VDC, 40–85 mA Maximum
Switch LED Indication	No	Yes	No	Yes
Relay LED Indication	No	No	Yes	Yes
Trip Setpoint Value	0.15 A/1.5 A	1.25–135 A	1.5 A	1.25–135 A
Current Switching Mode	Under Current Sensing	Over/Under Current Sensing	Under Current Sensing	Over/Under Current Sensing
Sensor Supply Voltage	Induced from power conductor cable.			
Wire Size	2.1–0.6 mm (12–22 AWG) Diameter Recommended			
Status Output	Switch normally open.			
Switch Load Capacity	1 A at 30 VAC/42 VDC Maximum			
Isolation Voltage	600 VAC rms			
Temperature Range	-15 to 60°C (5 to 140°F)			
Frequency Range	50/60 Hz			
Humidity Range	0–95% Noncondensing			
Screw Torque	0.5 N·m (4 lb·in.)			
Dimension	69 x 65 x 27 mm (2-23/32 x 2-9/16 x 1-1/16 in.)		69 x 65 x 44 mm (2-23/32 x 2-9/16 x 1-3/4 in.)	
Aperture (Sensing Hole) Size	18 x 20 mm Diameter (0.72 x 0.78 in. Diameter)			
	United States	UL Listed, File E310692, CCN NRNT, Under UL 508, Industrial Control Equipment		
	Canada	UL Listed, File E310692, CCN NRNT7, Under CAN/CSA C22.2 No. 14-M91 Industrial Control Equipment		
	Europe	CE Mark – Johnson Controls, Inc., declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive 2004/108/EC and the Low Voltage Directive 2006/95/EC.		
Shipping Weight	0.16 kg (0.35 lb)			

The performance specifications are nominal and conform to acceptable industry standards. For applications at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products. © 2013 Johnson Controls, Inc. www.johnsoncontrols.com

Model DPT 230

Wet/Wet Differential Pressure Transducer

(Available with 3-Valve Manifold Assembly)

Ranges: 0 to ± 0.5 psid up to 0 to 100 psid. Liquids or Gases Both Sides



Setra Systems Model 230 is a high output, low differential pressure transducer designed for wet to wet differential pressure measurements of liquids or gases. A fast-response capacitance sensor and signal conditioned electronic circuitry provide a highly accurate, linear analog output proportional to pressure. Both unidirectional and bidirectional pressure ranges are available for applications with line pressure up to 250 psig.

A unique isolation system transmits the motion of the differential pressure sensing diaphragm from the high line pressure environment (e.g. corrosive liquids) to the dry (air) enclosure where it moves one of a pair of capacitance plates proportionally to the diaphragm movement. All parts exposed to the pressure media are stainless steel and elastomer seals. The 230 has a NEMA 4/IP65 rated package to withstand environmental effects. This system responds to pressure changes approximately 20 times faster

than conventional fluid-filled transducers. The electronic circuit linearizes output vs. pressure and compensates for thermal effects of the sensor.

The Model 230 can be supplied with a 3-valve manifold assembly (ordered as Pressure Fitting Code V) to protect against excessive differential overpressure, which may occur during installation, start-up or shut-down. The 230 bleed ports allow for total elimination of air in the line and pressure cavities. The manifold's rugged, yet compact, construction requires minimum space for installation. If the Model 230 is ordered with the 3-valve manifold, the system is shipped completely assembled and ready for wall or pipe mounting. If 3-Valve Manifold Assembly is ordered separately without 230 transducer, order as DPT 3-VALVE.



Pressure Ranges

UNIDIRECTIONAL		
Pressure Range PSID	Proof Pressure High Side* PSI	Proof Pressure Low Side* PSI
0 to 1	20	2.5
0 to 2	40	5
0 to 5	100	12.5
0 to 10	100	25
0 to 25	250	62.5
0 to 50	250	125
0 to 100	250	250

NOTE: Setra quality standards including ISO 9001 are based on ANSI-Z540-1. The calibration of this product is NIST traceable. U.S. Patent nos. 4054833

BIDIRECTIONAL		
Pressure Range PSID	Proof Pressure High Side* PSI	Proof Pressure Low Side* PSI
0 to ± 0.5	20	1.25
0 to ± 1	40	2.5
0 to ± 2.5	100	6.25
0 to ± 5	100	12.5
0 to ± 10	200	25
0 to ± 25	250	62.5
0 to ± 50	250	125

*The zero will shift slightly when high differential overpressure is applied. The shift may be as much as $\pm 10\%$ FS with overpressure applied to the low pressure port. Other parameters (sensitivity, linearity, etc.) will not shift. If the overpressure is normally only in one direction, the user may apply this overpressure to preset the sensor. Subsequent overload of less magnitude will not cause additional shift. The unit is pre-zeroed at the factory after application of maximum overload pressure to the high pressure port.

159 Swanson Rd., Boxborough, MA 01719/Telephone: 978-263-1400/Fax: 978-264-0292

Applications

- Process Control
- Energy Management Systems
- Flow measurement of various gases or liquids
- Liquid level measurement of pressurized vessels
- Pressure Drop Across Filters

Features

- NEMA 4/IP65 rating
- 3-Valve Manifold Assembly
- High Accuracy
- Low Cost
- Fast Response
- Gas and Liquid Compatible
- Low Differential Ranges
- Low Line Pressure Effect
- No Liquid Fill Diaphragms



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Model 230 Specifications

Performance Data

Accuracy RSS* (at constant temp)	±0.25% FS
Non-Linearity, BFLS	±0.20% FS
Hysteresis	0.10% FS
Non-Repeatability	0.05% FS
Thermal Effects	
Compensated Range °F(°C)	30 to 150 (-1 to 65)
Zero shift %FS/°F(%FS/°C)	2.0 (1.8)
Span Shift %FS/°F(%FS/°C)	2.0 (1.8)
Line Pressure Effect	Zero shift ±0.004% FS/psig line pressure.
Resolution	Infinite, limited only by output noise level (0.02%FS)
Static Acceleration Effect	2%FS/g (most sensitive axis)
Natural Frequency	500 Hz (gaseous media)
Warm-up Shift	±0.1% FS total
Response Time	30 to 50 milliseconds
Long Term Stability	0.5%/1 YR
Maximum Working Pressure	250 psig

*RSS of Non-Linearity, Non-Repeatability and Hysteresis.

Specifications subject to change without notice.

Environmental Data

Temperature	Operating °F (°C) 0 to +175 (-18 to +80)
	Storage °F (°C) -65 to +250 (-54 to +121)
Vibration	5g from 5Hz to 500Hz
Acceleration	10g
Shock	50g
*Operating temperature limits of the electronics only. Pressure media temperatures may be considerably higher or lower.	

Physical Description

Case	Stainless Steel/Aluminum
Electrical Connection	Barrier strip terminal block with conduit enclosure & 0.875 DIA conduit opening.
Pressure Fittings	1/4" - 18" NPT internal
Weight (approx.)	14.4oz
Sensor Cavity Volume	0.27 in ³ Positive Port, 0.08 in ³ Negative Port
(With 1/4" NPT external fittings installed - does not include cavity volume of 1/4" NPT external fittings.)	

Electrical Data (Voltage)

Circuit	3-Wire (Exc., Out, Com)
Excitation	9 to 30 VDC for 0-5 VDC output 13 to 30 VDC for 0-10 VDC output

Electrical Data (Voltage) Cont'd.

Output*	0-5 VDC** 0-10 VDC**
Output Impedance	100 ohms
*Calibrated into a 50k ohm load, operable into a 5000 ohm load or greater. **Zero output factory set at 50mV (±25mV) for 0-5 VDC and 50mV (±50mV) for 0-10 VDC. ***Span output factory set at 5 VDC (±25mV) or 10 VDC (±50mV).	

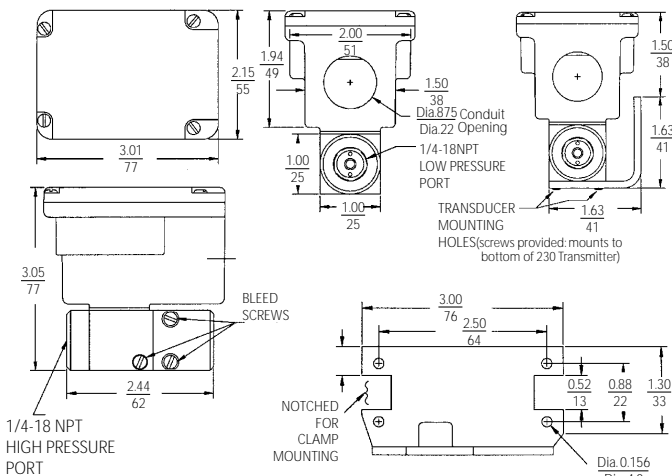
Electrical Data (Current)

Circuit	2-Wire
Output*	4 to 20mA**
External Load	0 to 1000 ohms
Minimum loop supply voltage (VDC) = 9 + 0.02 x (Resistance of receiver plus line).	
Maximum loop supply voltage (VDC) = 30 + 0.004 x (Resistance of receiver plus line).	
*Calibrated at factory with a 24 VDC loop supply voltage and a 250 ohm load. **Zero output factory set at 4mA (±.08mA) ***Span output factory set at 20mA (±.08mA)	

Pressure Media

Gases or liquids compatible with 17-4 PH Stainless Steel, 300 Series Stainless Steel, Viton and Silicone O-Rings.
Note: Hydrogen not recommended for use with 17-4 PH stainless steel.

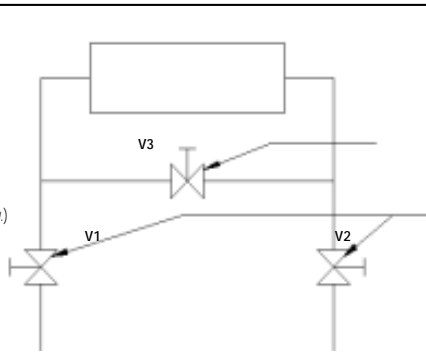
Outline Drawings



3-Valve Manifold Assembly Description

(Order by adding "-V" to standard part number. See example below.)

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



Ordering Information

Input Range PSID	Product Codes		
	0 to 5 VDC Output	0 to 10 VDC Output	4 to 20 mA Output
0 to 1	DPT2300-001D	DPT2302-001D	DPT2301-001D
0 to 2	DPT2300-002D	DPT2302-002D	DPT2301-002D
0 to 5	DPT2300-005D	DPT2302-005D	DPT2301-005D
0 to 10	DPT2300-010D	DPT2302-010D	DPT2301-010D
0 to 25	DPT2300-025D	DPT2302-025D	DPT2301-025D
0 to 50	DPT2300-050D	DPT2302-050D	DPT2301-050D
0 to 100	DPT2300-100D	DPT2302-100D	DPT2301-100D
-0.5 to 0.5	DPT2300-0R5B	DPT2302-0R5B	DPT2301-0R5B
-1 to 1	DPT2300-001B	DPT2302-001B	DPT2301-001B
-2.5 to 2.5	DPT2300-2R5B	DPT2302-2R5B	DPT2301-2R5B
-5 to 5	DPT2300-005B	DPT2302-005B	DPT2301-005B
-10 to 10	DPT2300-010B	DPT2302-010B	DPT2301-010B
-25 to 25	DPT2300-025B	DPT2302-025B	DPT2301-025B
-50 to 50	DPT2300-050B	DPT2302-050B	DPT2301-050B
Input Range PSID	Product Codes with 3-Valve Manifold Option		
	0 to 5 VDC Output	0 to 10 VDC Output	4 to 20 mA Output
0 to 1	DPT2300-001D-V	DPT2302-001D-V	DPT2301-001D-V
0 to 2	DPT2300-002D-V	DPT2302-002D-V	DPT2301-002D-V
0 to 5	DPT2300-005D-V	DPT2302-005D-V	DPT2301-005D-V
0 to 10	DPT2300-010D-V	DPT2302-010D-V	DPT2301-010D-V
0 to 25	DPT2300-025D-V	DPT2302-025D-V	DPT2301-025D-V
0 to 50	DPT2300-050D-V	DPT2302-050D-V	DPT2301-050D-V
0 to 100	DPT2300-100D-V	DPT2302-100D-V	DPT2301-100D-V
-0.5 to 0.5	DPT2300-0R5B-V	DPT2302-0R5B-V	DPT2301-0R5B-V
-1 to 1	DPT2300-001B-V	DPT2302-001B-V	DPT2301-001B-V
-2.5 to 2.5	DPT2300-2R5B-V	DPT2302-2R5B-V	DPT2301-2R5B-V
-5 to 5	DPT2300-005B-V	DPT2302-005B-V	DPT2301-005B-V
-10 to 10	DPT2300-010B-V	DPT2302-010B-V	DPT2301-010B-V
-25 to 25	DPT2300-025B-V	DPT2302-025B-V	DPT2301-025B-V
-50 to 50	DPT2300-050B-V	DPT2302-050B-V	DPT2301-050B-V

For calibration certificate, add DPT-CAL-REPORT after part number.
For separate 3-Valve Manifold order as DPT 3-VALVE
Example: Part No. 2300-005D-V for a 230 Transducer, 0 to 5 PSID. Unidirectional Range, 0 to 5 VDC Output. Assembled with the 3-Valve Manifold.

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Toll Free: 800-257-3872; Fax: 978-264-0292; email: sales@setra.com

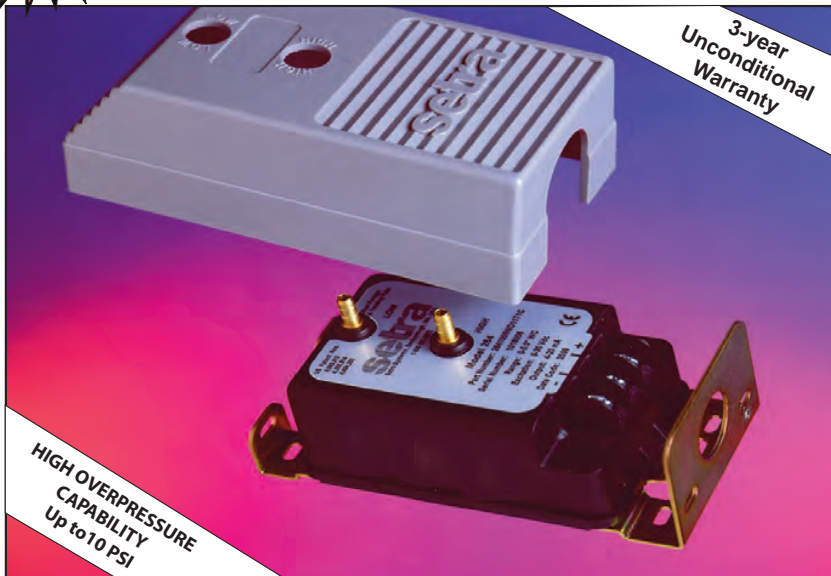




Model DPT 264

Very Low Differential Pressure Transducer

Unidirectional Ranges: 0 - 0.1 to 0 - 100 in. W.C.
Bidirectional Ranges: 0 - ±0.5 to 0 - ±50 in. W.C.
Air or Non-Conducting Gas



Setra Systems 264 pressure transducers sense differential or gauge (static) pressure and convert this pressure difference to a proportional electrical output for either unidirectional or bidirectional pressure ranges. The 264 Series is offered with a high level analog 0 to 5 VDC or 4 to 20 mA output.

Used in Building Energy Management Systems, these transducers are capable of measuring pressures and flows with the accuracy necessary for proper building pressurization and air flow control.

The 264 Series transducers are available for air pressure ranges as low as 0.1 in. W.C. full scale to 100 in. W.C. full scale. Static standard accuracy is ±1.0% full scale in normal ambient temperature environments, but higher accuracies are available. The units are temperature compensated to 0.033% FS/°F thermal error over the temperature range of 0°F to +150°F.

The Model 264 utilizes an improved all stainless steel micro-tig welded sensor. The tensioned stainless steel diaphragm and insulated stainless steel electrode, positioned close to the diaphragm, form a variable capacitor. Positive pressure moves the diaphragm toward the electrode, increasing the capacitance. A decrease in pressure moves the diaphragm away from the electrode, decreasing the capacitance. The change in capacitance is detected and converted to a linear DC electrical signal by Setra's unique electronic circuit.

The tensioned sensor allows up to 10 PSI overpressure (range dependent) with no damage to the unit. In addition, the parts that make up the sensor have thermally matched coefficients, which promote improved temperature performance and excellent long term stability.

NOTE: Setra quality standards are based on ANSI-Z540-1. The calibration of this product is NIST traceable.
U.S. Patent nos. 6019002; 6014800

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Applications

- Heating, Ventilating and Air Conditioning (HVAC)
- Energy Management Systems
- Variable Air Volume and Fan Control (VAV)
- Environmental Pollution Control
- Lab and Fume Hood Control
- Oven Pressurization and Furnace Draft Controls

Features

- Installation Time Minimized with Snap Track Mounting and Easy-To-Access Pressure Ports and Electrical Connections
- 0 to 5 VDC or 2-wire 4 to 20 mA Analog Outputs Are Compatible with Energy Management Systems
- Reverse Wiring Protection
- Internal Regulation Permits Use with Unregulated DC Power Supplies
- Fire Retardant Case (UL 94 V-0 Approved)
- Meets CE Conformance Standards

When it comes to a product to rely on - choose the Model 264. When it comes to a company to trust - choose Setra.

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Model 264 Specifications

Performance Data

	Standard	Optional
Accuracy* RSS(at constant temp)	±1.0% FS	±0.5% FS ±0.25% FS
Non-Linearity, BFSL	±0.96% FS	±0.38% FS ±0.22% FS
Hysteresis	0.10% FS	0.10% FS 0.10% FS
Non-Repeatability	0.05% FS	0.05% FS 0.05% FS

Thermal Effects**

Compensated Range °F(°C)	0 to +150 (-18 to +65)
Zero/Span Shift %FS/°F(°C)	0.033 (0.06)
Maximum Line Pressure	10 psi
Overpressure (Range Dependant)	Up to 10 psi (Range Dependent)
Long Term Stability	0.5% FS/1 YR

Position Effect	Range	Zero Offset (%FS/G)
(Unit is factory calibrated at 0g effect in the vertical position.)	To 0.5 in. WC	0.60
	To 1.0 in. WC	0.50
	To 2.5 in. WC	0.22
	To 5 in. WC	0.14

*RSS of Non-Linearity, Hysteresis, and Non-Repeatability.

**Units calibrated at nominal 70°F. Maximum thermal error computed from this datum.

Environmental Data

Temperature	
Operating* °F(°C)	0 to +175 (-18 to +79)
Storage °F(°C)	-65 to +250 (-54 to +121)

*Operating temperature limits of the electronics only. Pressure media temperatures may be considerably higher.

Physical Description

Case	Fire-Retardant Glass Filled Polyester (UL 94 V-0 Approved)
Mounting	Four screw holes on removable zinc plated steel base (designed for 2.75" snap track)
Electrical Connection	Screw Terminal Strip
Pressure Fittings	3/16" O.D. barbed brass pressure fitting for 1/4" push-on tubing
Zero and Span Adjustments	Accessible on top of case
Weight (approx.)	10 ounces

Pressure Media

Typically air or similar non-conducting gases.

Specifications subject to change without notice.

Electrical Data (Voltage)

Circuit	3-Wire (Com, Exc, Out)
Excitation	9 to 30 VDC
Output*	0 to 5 VDC**
Bidirectional output at zero pressure:	2.5 VDC**
Output Impedance	100 ohms

*Calibrated into a 50K ohm load, operable into a 5000 ohm load or greater.
 **Zero output factory set to within ±50mV (±25 mV for optional accuracies).
 **Span (Full Scale) output factory set to within ±50mV. (±25 mV for optional accuracies).

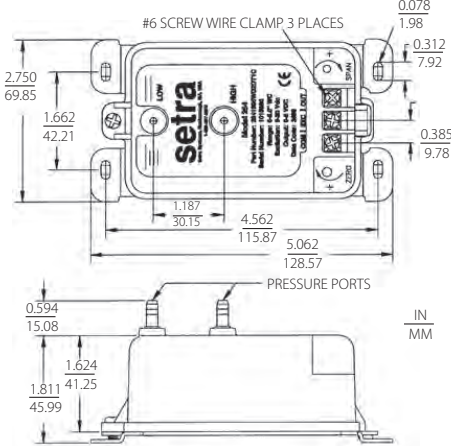
Electrical Data (Current)

Circuit	2-Wire
Output*	4 to 20mA**
Bidirectional output at zero pressure:	12mA**
External Load	0 to 800 ohms
Minimum supply voltage (VDC) = 9+ 0.02 x (Resistance of receiver plus line).	
Maximum supply voltage (VDC) = 30+ 0.004 x (Resistance of receiver plus line).	

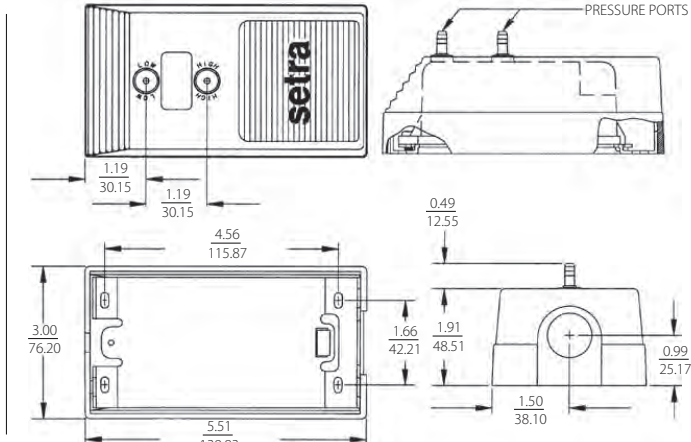
*Calibrated at factory with a 24 VDC loop supply voltage and a 250 ohm load.
 **Zero output factory set to within ±0.16mA (±0.08 mA for optional accuracies).
 **Span (Full Scale) output factory set to within ±0.16mA (±0.08 mA for optional accuracies).

Outline Drawings

Code T1 Electrical Termination Dimensions



Optional 1/2" Conduit Electrical Enclosure Dimensions



ORDERING INFORMATION

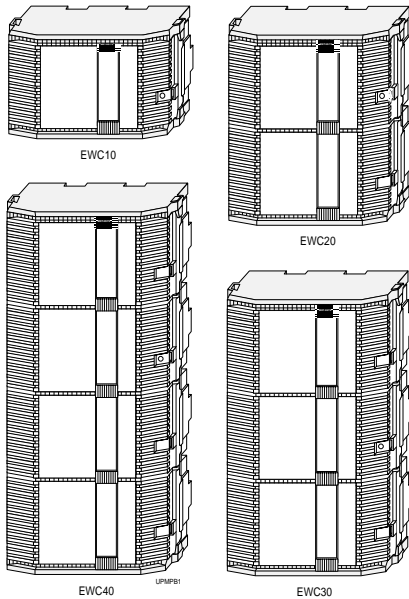
Input Range (Inches of WC)	Product Codes for Accuracy		Product Codes for 0.5% Accuracy		Product Codes for 0.25% Accuracy	
	0 to 5 VDC Output	4 to 20 mA	0 to 5 VDC Output	4 to 20 mA	0 to 5 VDC Output	4 to 20 mA
0 to 0.1	DPT2640-0R1D-1	DPT2641-0R1D-1	DPT2640-0R1D	DPT2641-0R1D	DPT2640-0R1D-A	DPT2641-0R1D-A
0 to 0.25	DPT2640-R25D-1	DPT2641-R25D-1	DPT2640-R25D	DPT2641-R25D	DPT2640-R25D-A	DPT2641-R25D-A
0 to 0.5	DPT2640-0R5D-1	DPT2641-0R5D-1	DPT2640-0R5D	DPT2641-0R5D	DPT2640-0R5D-A	DPT2641-0R5D-A
0 to 1	DPT2640-001D-1	DPT2641-001D-1	DPT2640-001D	DPT2641-001D	DPT2640-001D-A	DPT2641-001D-A
0 to 2.5	DPT2640-2R5D-1	DPT2641-2R5D-1	DPT2640-2R5D	DPT2641-2R5D	DPT2640-2R5D-A	DPT2641-2R5D-A
0 to 5	DPT2640-005D-1	DPT2641-005D-1	DPT2640-005D	DPT2641-005D	DPT2640-005D-A	DPT2641-005D-A
0 to 10	DPT2640-010D-1	DPT2641-010D-1	DPT2640-010D	DPT2641-010D	DPT2640-010D-A	DPT2641-010D-A
0 to 25	DPT2640-025D-1	DPT2641-025D-1	DPT2640-025D	DPT2641-025D	DPT2640-025D-A	DPT2641-025D-A
0 to 50	DPT2640-050D-1	DPT2641-050D-1	DPT2640-050D	DPT2641-050D	DPT2640-050D-A	DPT2641-050D-A
0 to 100	DPT2640-100D-1	DPT2641-100D-1	DPT2640-100D	DPT2641-100D	DPT2640-100D-A	DPT2641-100D-A
-0.1 to 0.1	DPT2640-0R1B-1	DPT2641-0R1B-1	DPT2640-0R1B	DPT2641-0R1B	DPT2640-0R1B-A	DPT2641-0R1B-A
-0.25 to 0.25	DPT2640-R25B-1	DPT2641-R25B-1	DPT2640-R25B	DPT2641-R25B	DPT2640-R25B-A	DPT2641-R25B-A
-0.5 to 0.5	DPT2640-0R5B-1	DPT2641-0R5B-1	DPT2640-0R5B	DPT2641-0R5B	DPT2640-0R5B-A	DPT2641-0R5B-A
-1 to 1	DPT2640-001B-1	DPT2641-001B-1	DPT2640-001B	DPT2641-001B	DPT2640-001B-A	DPT2641-001B-A
-2.5 to 2.5	DPT2640-2R5B-1	DPT2641-2R5B-1	DPT2640-2R5B	DPT2641-2R5B	DPT2640-2R5B-A	DPT2641-2R5B-A
-5 to 5	DPT2640-005B-1	DPT2641-005B-1	DPT2640-005B	DPT2641-005B	DPT2640-005B-A	DPT2641-005B-A

Add DPT-CAL-CERT for Calibration Certificate. Note: All units provided with Calibration Certificate

While we provide application assistance on all Setra products, both personally and through our literature, it is the customer's responsibility to determine the suitability of the product in the application.

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Universal Packaging Module



Description

The Universal Packaging Module (UPM) is part of an expandable enclosure system. It can house a wide range of controllers and accessories. Rugged and lockable, the enclosure also provides a wealth of built-in features to reduce installation time. These features include separate line- and low-voltage wiring troughs, preformed holes to eliminate drilling, wall thicknesses to accommodate standard conduit fasteners, easily accessible grounding, and a removable door.

If you need additional space, the UPM's modular construction lets you increase the unit's capacity without needing to unwire and rewire the controls.

The power option provides an integrated 50 VA or 100 VA transformer and two utility outlets inside a metal power entrance box. A switch activates the transformer. This single unit, which is faster, easier to install, and less expensive, allows you to eliminate a separate transformer, controller, and auxiliary gear enclosures.

A full window option allows you to monitor equipment such as gauges and LED's while keeping the equipment securely locked away from unauthorized users.

Features

- the lockable enclosures provide security against system tampering
- multiple sizes accommodate system requirements with tiered, modular construction. Flexibility to expand without rewiring, while maintaining a lightweight, durable structure
- the removable door allows full access for wiring during installation
- the built-in power integrates two utility outlets and a switched transformer (50 VA or 100 VA) for easier, less expensive installation
- the ground bonding plane simplifies grounding of incoming conduit to eliminate ground loop problems
- the window allows easy viewing of internal equipment

To Order

Specify the code number from the following selection chart.

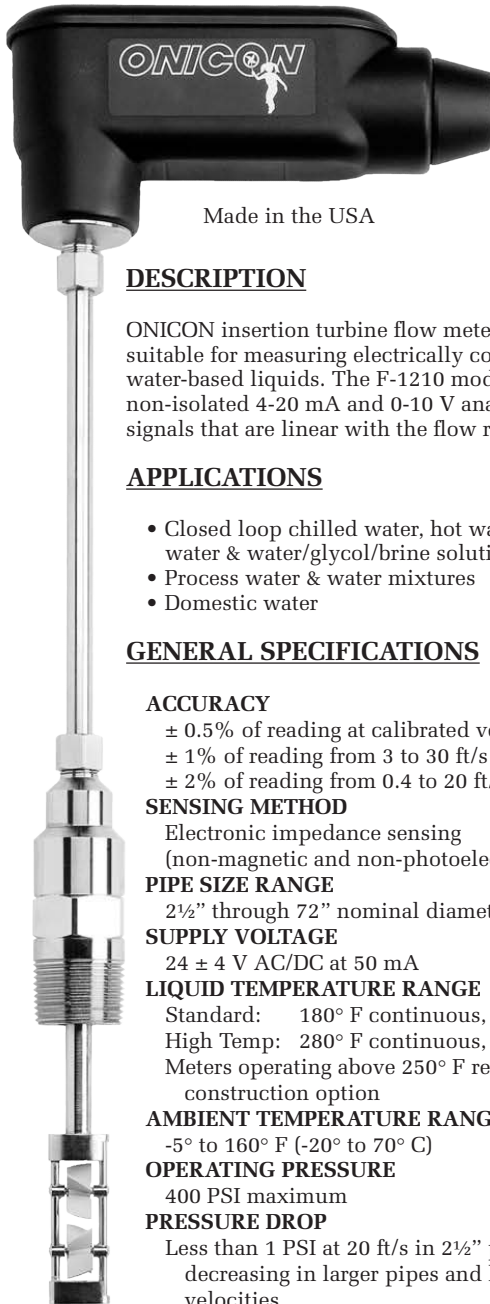
Selection Chart

Code Number	Description	Interior Dimensions	Exterior Dimensions	Power Requirements
EN-EWC10-0	Single unit	7 x 13 x 6 in. (18 x 33 x 15 cm)	9 x 16 x 7.5 in. (23 x 41 x 19 cm)	120 VAC at 60 Hz
EN-EWC12-0	Single unit and power box			
EN-EWC13-0	Single unit with 50 VA XFR and mounting bracket			
EN-EWC15-0	Single unit with 50 VA XFR and power box			
EN-EWC20-0	Double unit	14 x 13 x 6 in. (36 x 33 x 15 cm)	16 x 16 x 7.5 in. (41 x 41 x 19 cm)	
EN-EWC22-0	Double unit and power box			
EN-EWC25-0	Double unit with 50 VA XFR and power box			
EN-EWC26-0	Double unit with 50 VA XFR and two mounting brackets			
EN-EWC30-0	Triple unit	21 x 13 x 6 in. (53 x 33 x 15 cm)	23 x 16 x 7.5 in. (59 x 41 x 19 cm)	
EN-EWC35-0	Triple unit with 100 VA XFR and power box			
EN-EWC40-0	Quad unit			
EN-EWC45-0	Quad unit with 100 VA XFR and power box	28 x 13 x 6 in. (71 x 33 x 15 cm)	30 x 16 x 7.5 in. (77 x 41 x 19 cm)	
EN-EXP101-0	Expansion cover and backbone kit ^(a)			
EN-WIN101-0	Window cover and backbone kit ^(a)			

(a) Endcaps not included

Transformer and Power Box Dimensions	Dimensions	Dimensions
50 VA transformer	3.875 x 3.25 in. (9.6 x 8.3 cm)	
100 VA transformer	3.75 x 3.625 in. (9.5 x 9.2 cm)	
Power box	4 x 3.75 in. (10.2 x 9.5 cm)	

The performance specifications are nominal and conform to acceptable industry standards. For applications at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products. © 08/00 Johnson Controls, Inc



**F-1210 DUAL TURBINE •
INSERTION FLOW METER
ANALOG OUTPUT**



Made in the USA

DESCRIPTION

ONICON insertion turbine flow meters are suitable for measuring electrically conductive water-based liquids. The F-1210 model provides non-isolated 4-20 mA and 0-10 V analog output signals that are linear with the flow rate.

APPLICATIONS

- Closed loop chilled water, hot water, condenser water & water/glycol/brine solutions for HVAC
- Process water & water mixtures
- Domestic water

GENERAL SPECIFICATIONS

ACCURACY

- ± 0.5% of reading at calibrated velocity
- ± 1% of reading from 3 to 30 ft/s (10:1 range)
- ± 2% of reading from 0.4 to 20 ft/s (50:1 range)

SENSING METHOD

Electronic impedance sensing (non-magnetic and non-photoelectric)

PIPE SIZE RANGE

2½" through 72" nominal diameter

SUPPLY VOLTAGE

24 ± 4 V AC/DC at 50 mA

LIQUID TEMPERATURE RANGE

Standard: 180° F continuous, 200° F peak
High Temp: 280° F continuous, 300° F peak
Meters operating above 250° F require 316 SS construction option

AMBIENT TEMPERATURE RANGE

-5° to 160° F (-20° to 70° C)

OPERATING PRESSURE

400 PSI maximum

PRESSURE DROP

Less than 1 PSI at 20 ft/s in 2½" pipe, decreasing in larger pipes and lower velocities

OUTPUT SIGNALS PROVIDED

- Analog Output (non-isolated)
Voltage output: 0-10 V (0-5 V available)
Current output: 4-20 mA
- Frequency Output
0 – 15 V peak pulse, typically less than 300 Hz

(continued on back)

CALIBRATION

Every ONICON flow meter is wet calibrated in our flow laboratory against primary volumetric standards that are directly traceable to N.I.S.T. A certificate of calibration accompanies every meter.

FEATURES

Unmatched Price vs. Performance - Custom calibrated, highly accurate instrumentation at very competitive prices.

Excellent Long-term Reliability - Patented electronic sensing is resistant to scale and particulate matter. Low mass turbines with engineered jewel bearing systems provide a mechanical system that virtually does not wear.

Industry Leading Two-year "No-fault" Warranty - Reduces start-up costs with extended coverage to include accidental installation damage (miswiring, etc.) Certain exclusions apply. See our complete warranty statement for details.

Simplified Hot Tap Insertion Design - Standard on every insertion flow meter. Allows for insertion and removal by hand without system shutdown.

OPERATING RANGE FOR COMMON PIPE SIZES 0.17 TO 20 ft/s ±2% accuracy begins at 0.4 ft/s	
Pipe Size (Inches)	Flow Rate (GPM)
2 ½	2.5 - 230
3	4 - 460
4	8 - 800
6	15 - 1,800
8	26 - 3,100
10	42 - 4,900
12	60 - 7,050
14	72 - 8,600
16	98 - 11,400
18	120 - 14,600
20	150 - 18,100
24	230 - 26,500
30	360 - 41,900
36	510 - 60,900

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09-09

F-1210 SPECIFICATIONS cont.

MATERIAL

Wetted metal components:
 Standard: Electroless nickel plated brass
 Optional: 316 stainless steel

ELECTRONICS ENCLOSURE

Standard: Weathertight aluminum enclosure
 Optional: Submersible enclosure

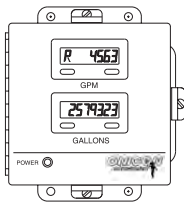
ELECTRICAL CONNECTIONS

3-wire minimum for 4-20 mA or 0-10 V output
 Second analog output and/or frequency output requires additional wires
 Standard: 10' of cable with 1/2" NPT conduit connection
 Optional: Indoor DIN connector with 10' of plenum rated cable

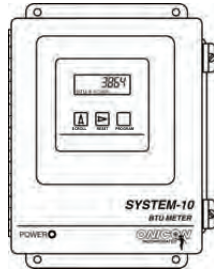
F-1210 Wiring Information

WIRE COLOR	DESCRIPTION	NOTES
RED	(+) 24 V AC/DC supply voltage, 50 mA	Connect to power supply positive
BLACK	(-) Common ground (Common with pipe ground)	Connect to power supply negative & analog input ground
GREEN	(+) Frequency output signal: 0-15 V peak pulse	Required when meter is connected to local display or Btu meter
BLUE	(+) Analog signal: 4-20 mA (non-isolated)	Both signals may be used independently
BROWN	(+) Analog signal: 0-10 V (non-isolated)	
DIAGNOSTIC SIGNALS		
ORANGE	Bottom turbine frequency	These signals are for diagnostic purposes - connect to local display or Btu meter
WHITE	Top turbine frequency	

ALSO AVAILABLE



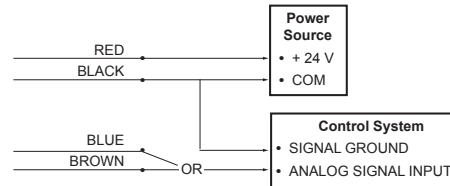
Display Modules



Btu Measurement Systems

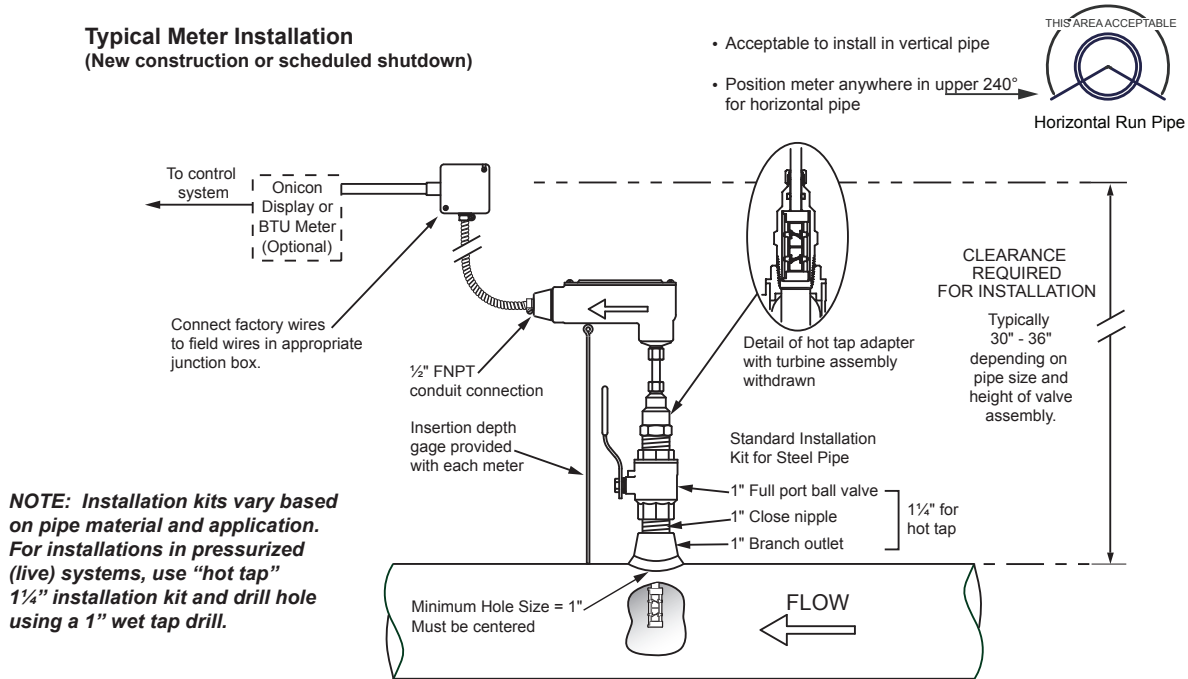
F-1210 Wiring Diagram

Flow meter into control system (no display or Btu meter)



- NOTE:** 1. Black wire is common with the pipe ground (typically earth ground).
 2. Frequency output required for ONICON display module or Btu meter, refer to wiring diagram for peripheral device.

Typical Meter Installation
 (New construction or scheduled shutdown)



NOTE: Installation kits vary based on pipe material and application. For installations in pressurized (live) systems, use "hot tap" 1 1/4" installation kit and drill hole using a 1" wet tap drill.

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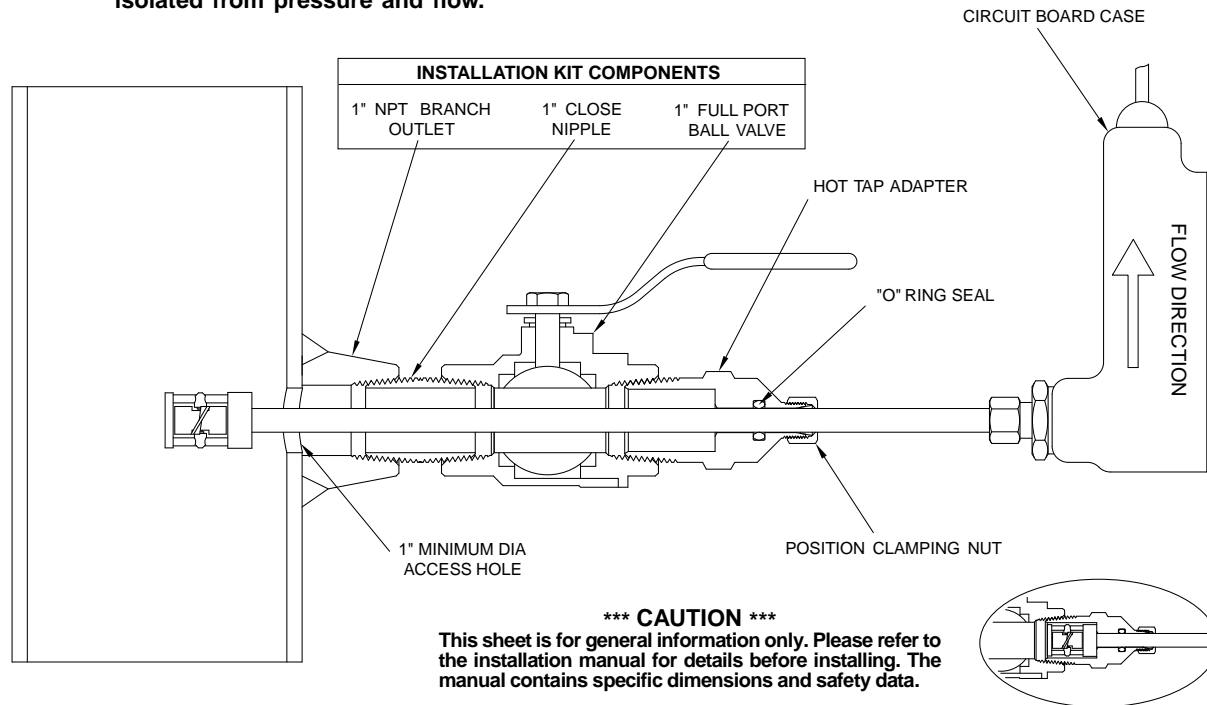
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STANDARD INSTALLATION LAYOUT FOR WELDED PIPE

The Standard Installation option allows for removal and re-insertion of the flow meter without system shutdown. For the initial installation, the 1" flow meter access hole in the pipe must be drilled before installing the valve either prior to filling the system or into a section of pipe isolated from pressure and flow.



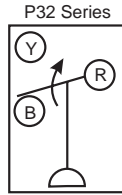
JCI ITEM #	DESCRIPTION
F-STD-INSTL1	Install kit, standard, welded steel pipe
F-STD-INSTL5	Install kit, std SS, welded steel pipe
F-STD-INSTL18	Install kit, standard 316 SS, for SS pipe

P32 Series

Sensitive Pressure Switch

Description

This differential pressure switch is used to sense pressure/air flow in ducts.



Action on Increase of Pressure

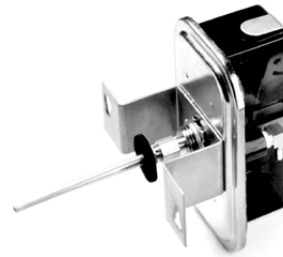
P28 Action Diagram

Features

- easy-to-read setpoint scale
- versatile mounting options

Applications

- pressure/air flow proving with electric duct heaters, humidifiers, and other equipment
- maximum pressure/air flow control for variable volume systems
- reheat duct powered systems
- clogged filter detection
- detection of icing of air conditioning coils and initiation of defrost cycle
- sensitive pressure settings
- dust-tight snap switch



P32

Selection Chart

Code Number	Ambient Temperature Min./Max.	Connector	Maximum Over-pressure psig (kPa) ¹	Contact Action	Range in. WC (kPa)	Sensitivity at Min. Set point in. WC (kPa)	Setpoint	Scale Plate	Mounting Bracket (Included)
P32AC-1C	-40°F (-40°C) min. 167°F (75°C) max.	High Pressure connectors are metal 1/8 in. female NPT inside, 1/2 in. NPSM outside for mounting Low Pressure connectors are molded, 1/8 in. female NPT	1 (6.895)	SPDT	0.15 to 12 (0.037 to 2.99)	0.07 (0.017)	Adjustable	Yes	L BKT182-1R
P32AC-2C ²									U BKT229-1R
P32AF-1C									L BKT182-1R
P32AF-2C ²									U BKT229-1R

1. Maximum overpressure at either connection

2. Supplied with 1/4 in. compression fitting, 4 in. extension tube, two mounting screws, and "O" gasket (angle barbed fitting installed)

Accessories

The switch can be mounted directly or with the supplied mounting bracket.

Code Number	Description
FTG18A-600R	Remote Mounting Kit: 4 in. flanged sensing tube, two barbed fittings, two No. 10 screws, and a gasket

Technical Specifications

Electrical Ratings

Motor Ratings VAC	120	208	240
Type P32AC (Standard Differential, 1/2 hp)			
AC Full Load A	9.8	5.65	4.9
AC Locked Rotor A	58.8	33.9	29.4
Non-Inductive or Resistive Load	15 amp 24 to 277 VAC		
Pilot Duty – 125 VA, 24 VAC; 360 VA, 120 to 277 VAC			
Type P32AF (Close Differential, 1/4 hp)			
AC Full Load A	5.8	3.3	2.9
AC Locked Rotor A	34.8	19.8	17.4
Non-Inductive or Resistive Load	10 amp, 24 to 277 VAC		
Pilot Duty – 125 VA, 24 VAC; 360 VA, 120 to 277 VAC			

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G Series

Thermostat and Humidistat Guards



GRD10-1R
Wire Guard



GRD10A-601
Cast Aluminum Guard



GRD10A-608
Large Clear Plastic Guard



GRD10A-609
Rectangular Clear Plastic Guard

Description

The G Series guards protect thermostats and humidistats from damage, vandalism, tampering, and unauthorized adjustment. They are available in plastic, cast aluminum, or wire construction.

Features

- clear plastic guards have tumbler-type key locks
- GRD10A-608 and -609 include a mounting ring for mounting to a wall or flat surface
- plastic baseplate and plastic mounting ring available
- the baseplate mounts to a flat surface or to a single or double outlet box
- the mounting ring permits mounting over a thermostat or humidistat already installed

Applications

Ideal for locations where locked protection is required, such as schools, warehouses, churches, hospitals, or offices.

Selection Chart

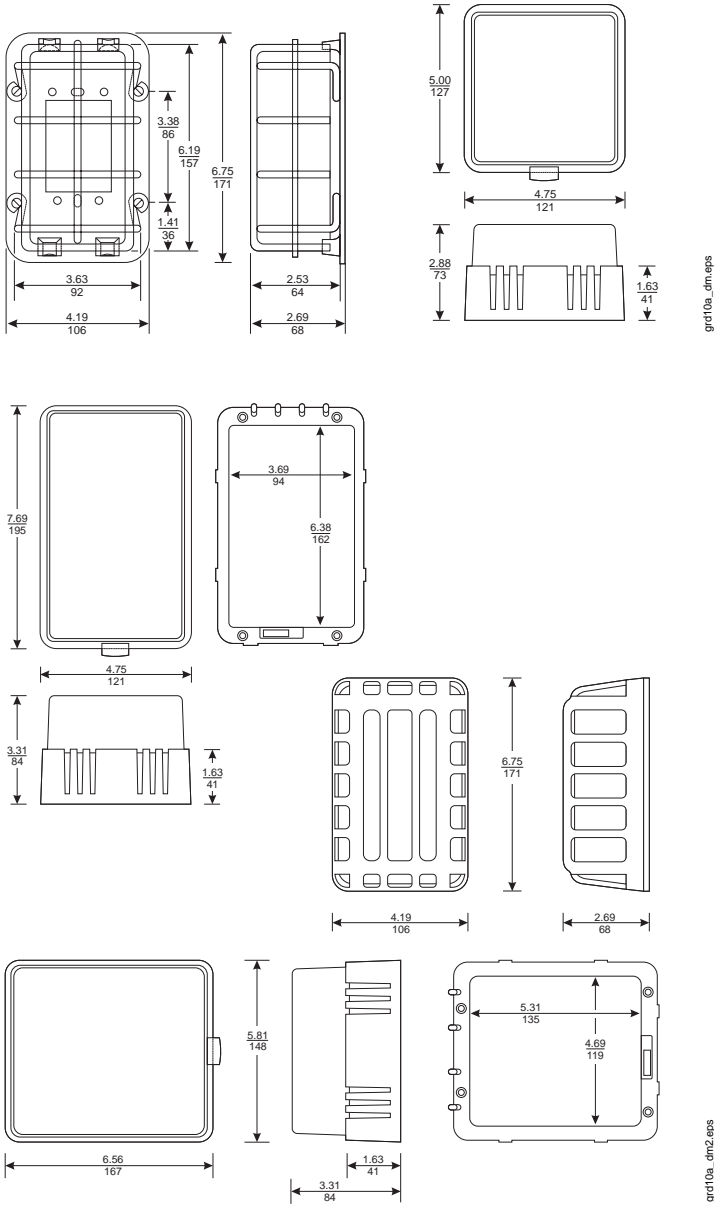
Code Number	Description	Thermostat or Humidistat Series Number				
		T22	T25	T26	T28 No Switches	T91
GRD10-1R	Wire guard only	■	—	■	—	■
GRD10A-600	Wire guard and baseplate	■	—	■	—	■
GRD10A-601	Aluminum guard and baseplate	■	—	■	■	■
GRD10A-606	Plastic guard with baseplate	■	■	—	■	■
GRD10A-608	Plastic guard with baseplate, mounting ring	■	■	■	■	■
GRD10A-609	Plastic guard with baseplate, mounting ring	■	■	■	■	■

Repair Parts

Replacement key **KEY12A-600** (set of two) is available.

Thermostat and Humidistat Guards (Continued)

Technical Specifications



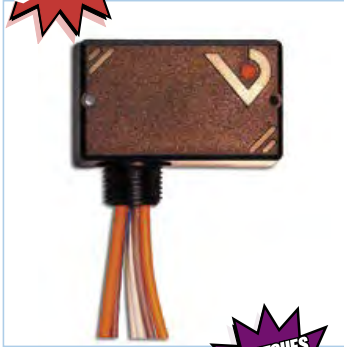
G Series Dimensions, in. (mm)

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Hawkeye®
120 Series

SPST Status Relay



The H120 Zone Ventilation Device provides control and status for all fractional horsepower motors commonly used in Zone specific mechanical system control. The installation of the relay and current switch are automatically made by connecting the relay contacts...saves the labor of mounting a traditional separate current switch.

APPLICATIONS

- Unit Ventilators
- Fan Coil Units
- Exhaust Fans
- Fan Terminal Units
- Fractional HP Motors
- Light Resistive Loads

Sleek field enclosed relay and current switch saves installation time and space

- The current switch and relay are in series...connect the contacts to the load and your current switch is automatically installed
- The nipple mount housing can be connected to any 1/2" conduit knockout for installation versatility
- Relay coil LED streamlines job commissioning and check out
- HP ratings make the H120 ideal for control and status of fractional HP motors

Super-low turn on for the smallest of loads

- 0.1A turn on easily monitors the smallest motors

SPECIFICATIONS

Operating Temperature	-15°C to 60°C (13.8A max.) -15°C to 50°C (20A max.)
Operating Humidity	0-95% non-condensing
Expected Relay Life (mechanical)	10 million cycles
Relay Status	LED ON=energized
<i>Current Switch:</i>	
Current Switch Contact	N.O., 100mA@30VAC/DC (H120); N.C., 100mA@30VAC/DC (H120NC)
Minimum Turn On Current	0.1AAC
Dimensions... (LxWxH)	2.92" x 1.80" x 1.58"; (H) 1/2" NPT nipple

RELAY CONTACT RATINGS (N.O.)	
Resistive.....	20A(I) [*] @277VAC/28VDC (250,000 Cycles)
Motor.....	120VAC, 1HP 208VAC, 1HP 250VAC, 2HP 277VAC, 2HP
Ballast.....	277VAC, 20A
Tungsten.....	120VAC, 10A

**See operating temperature specification*

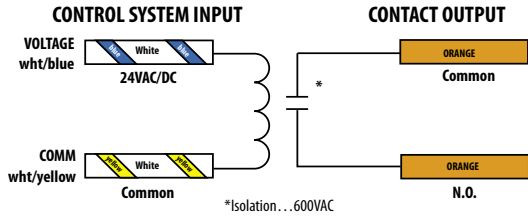
Voltage	TYPICAL COIL PERFORMANCE	
	AC	DC
24V.....	75mA	32mA

ORDERING INFORMATION

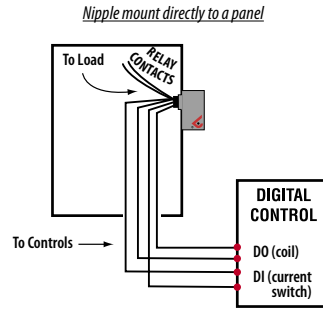
MODEL	COIL	RELAY CONTACT	CURRENT SWITCH CONTACT
H120	24VAC/DC	SPST, N.O.	N.O. 100mA@30VAC/DC
H120NC	24VAC/DC	SPST, N.O.	N.C. 100mA@30VAC/DC



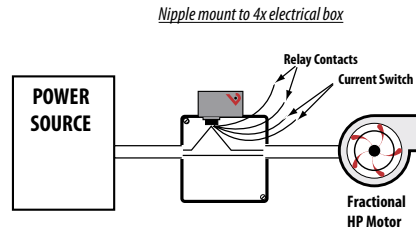
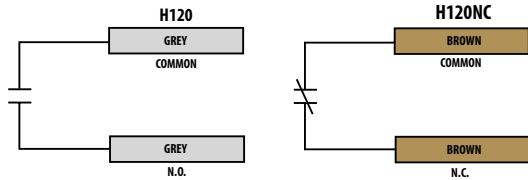
WIRE COLOR CODES



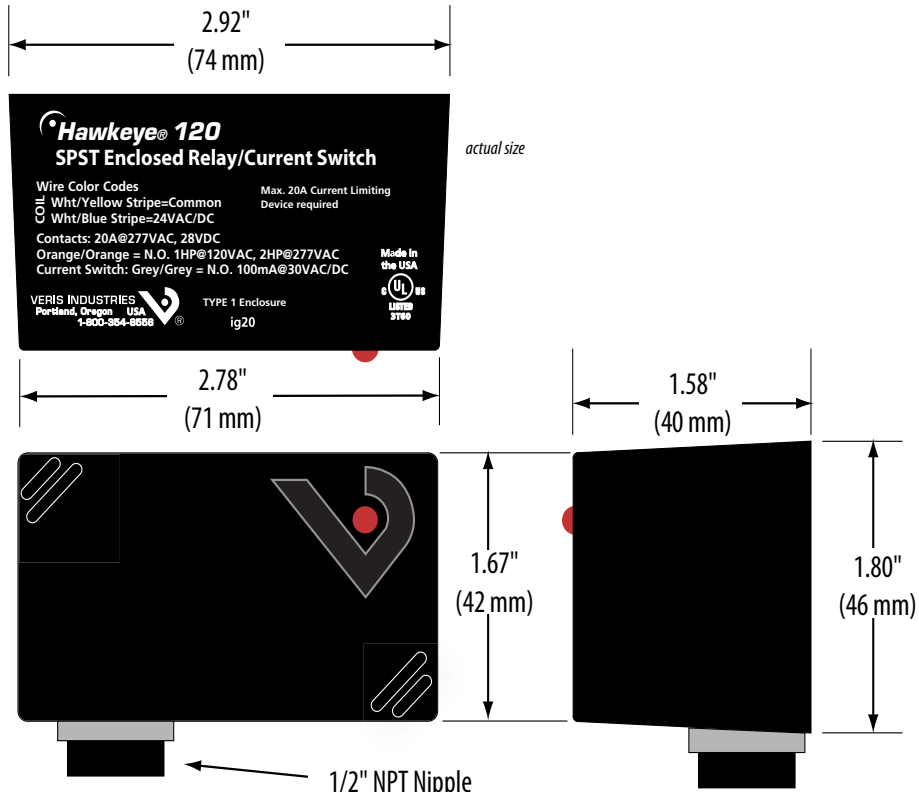
APPLICATIONS/WIRING EXAMPLE



CURRENT SWITCH WIRE COLOR CODES



DIMENSIONAL DRAWING



52



IDEAL FOR INDUSTRIAL SIZE LOADS

5 Year Warranty

Hawkeye® 221/321/421

High Amperage Split-Core Current Transducer
4-20mA Loop Powered Output

The Hawkeye 221/321/421 analog current transducers provide reliable load trending information for large motor loads (up to 2400A) with a proportional 4-20mA signal. Each sensor can be calibrated for maximum resolution using the span potentiometer.

APPLICATIONS

- Load trending of large motors
- Split-core design is ideal for retrofit load trending

Monitor larger motors & other loads up to 2400A

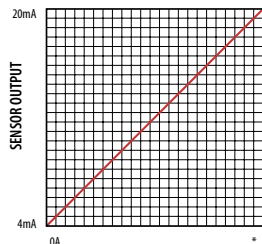
- Split-core design for easy installation
- Eliminates need for external CTs on large conductors
- Large openings for heavy conductors
- Monitor critical motors (compressor, fuel, etc.)

Loop powered 4-20mA output

- Two-wire design reduces wiring cost
- Zero and span adjustment for easy setup and high resolution
- 5-year limited warranty






H221/321/421 LINEAR OUTPUT
Scale software as shown



*Adjusted with Span Potentiometer
100 to 300A (H221)
300 to 800A (H321)
1000 to 2400A (H421)

ORDERING INFORMATION

MODEL	AMPERAGE RANGE		OUTPUT TYPE	UL
	4mA	20mA (SPAN)		
H221	0A	100 to 300A	4-20mA	
H321	0A	300 to 800A	4-20mA	
H421	0A	1000 to 2400A	4-20mA	

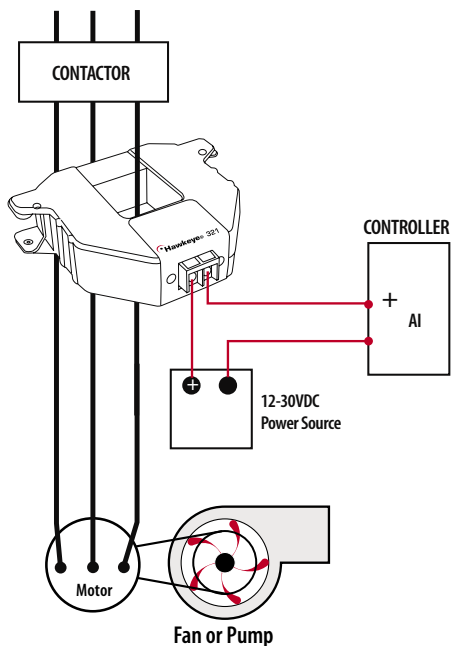


Factory calibration available upon request

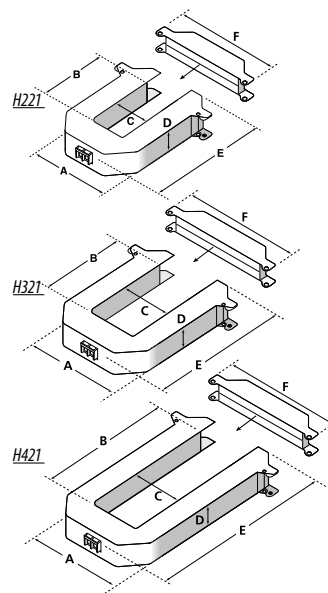
ACCESSORIES

Universal Power Supply, Universal Mounting Bracket Kit...See page 234

APPLICATIONS/WIRING EXAMPLE



DIMENSIONAL DRAWINGS



53

H221	H321	H421
A = 3.75" (96 mm)	A = 4.90" (125 mm)	A = 4.90" (125 mm)
B = 1.51" (38 mm)	B = 2.89" (73 mm)	B = 5.50" (140 mm)
C = 1.25" (32 mm)	C = 2.45" (62 mm)	C = 2.45" (62 mm)
D = 1.13" (29 mm)	D = 1.13" (29 mm)	D = 1.13" (29 mm)
E = 4.20" (107 mm)	E = 5.57" (142 mm)	E = 8.13" (207 mm)
F = 4.75" (121 mm)	F = 5.91" (151 mm)	F = 5.92" (151 mm)

SPECIFICATIONS

Amperage Range:	
Model 221	0-300A (potentiometer scalable)
Model 321	0-800A (potentiometer scalable)
Model 421	0-2400A (potentiometer scalable)
Output	4-20mA
Insulation Class	600VAC rms
Frequency Range	60Hz nominal
Temperature Range	-15° to 60°C
Humidity Range	0 - 95% non-condensing
Accuracy	2%
Response Time	2 sec.
Supply Voltage	12 to 30VDC
Supply Current	30mA max.
Zero Adjustment	3.5 to 4.5mA

HT-670x Series

TRUERH™ Humidity Transmitters

Description

TrueRH™ HT-670x Series Humidity Transmitters come in both wall or duct mount packages to meet a variety of sensing application needs. These attractively styled controllers offer ease of installation and application flexibility.

The transmitter generates a jumper-selectable output signal in either the 4 to 20mA or 0 to 10V range, corresponding to 0 to 100% Relative Humidity (RH).

TrueRH transmitters can measure RH within either $\pm 2\%$ or $\pm 3\%$ accuracy. The 2% models include a National Institute of Standards and Technology (NIST) certificate of conformance. The patented All-Polymer™ humidity sensor construction improves resistance to chemical corrosion.

Features

- TrueRH technology features patented improvements in circuitry and calibration techniques
- All-Polymer humidity sensor provides accurate and reliable humidity sensing with the patented sensing element
- tested and calibrated with equipment certified to be in compliance with National Institute of Standards and Technology (NIST) guidelines
- jumper-selectable output: 0 to 10 VDC or 4 to 20 mA maximizes application flexibility
- all-plastic material for duct probe improves thermal performance and complies with Underwriters Laboratories Inc. © (UL) flammability ratings for plenum use



HT-6703-0N00W
Wall Mount Humidity Transmitter



HT-6703-0N00P
Duct Probe Humidity Transmitter

Selection Charts

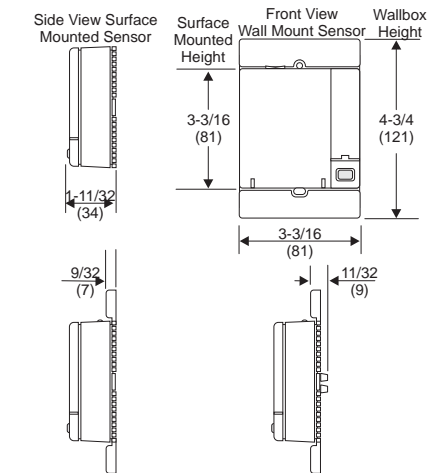
HE-670x Series Humidity Transmitters

Code Number	Description	RH Accuracy	
		$\pm 2\%$	$\pm 3\%$
HT-6702-0N00P	Duct Probe Humidity Transmitter	■	
HT-6702-0N00W	Wall Mount Humidity Transmitter	■	
HT-6703-0N00P	Duct Probe Humidity Transmitter		■
HT-6703-0N00W	Wall Mount Humidity Transmitter		■

Accessories for HE-670x Series¹

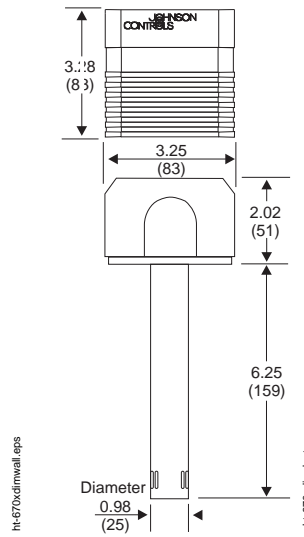
Code Number	Description
ACC-DWCLIP-0	Drywall Spring-Clip Mounting Kit (10 per bag)
ACC-INSL-0 ²	Foam Pad Kit for Wallbox Mounting (10 per package)
ACC-INSL-1 ²	Foam Pad Kit for Surface Mounting (10 per package)
GRD10A-608	Plastic Guard with Baseplate and Mounting Ring
T-4000-119	Allen-Head Adjustment Tool (30 per bag)
TE-67MB-600	Mounting Base Kit
TE-67D0-601 ³	Door Replacement Kit with Johnson Controls logo (10 per box)
TE-67D0-602 ³	Door Replacement Kit with no logo (10 per box)

1. Accessories and replacement parts available for the wall mount humidity transmitter only. (No accessories exist for the duct probe model.)
2. These foam pads will help prevent drafts from entering the unit through the wall, and make installation easier when mounting on an uneven surface.
3. Contains 10 original style and 10 new style doors.



Side View Wallbox Mounted Sensor with Phone Jack Side View Wallbox Mounted Sensor with Terminal Block

Wall Mount Humidity Transmitter Dimensions, in. (mm)



Duct Probe Humidity Transmitter Dimensions, in. (mm)

The performance specifications are nominal and conform to acceptable industry standards. For applications at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products. © 2012 Johnson Controls, Inc. www.johnsoncontrols.com



HT-670x Series TRUERH™ Humidity Transmitters (Continued)

Technical Specifications

HT-670x Series TRUERH™ Humidity Transmitters		
Power Requirements	If 0 to 10 VDC output jumper position is used:	20 to 30 VAC, 50/60 Hz at 15 mA or 14 to 30 VDC at 6 mA, Class 2
	If 4 to 20 mA output jumper position is used:	16 to 30 VDC at 20 mA, Class 2
Output Range (Jumper Selectable)		0 to 10 VDC (5k ohm minimum load impedance) or 4 to 20 mA DC (2-wire current loop) Maximum load impedance = 50 x (supply voltage - 15.5)
Humidity Transmitter Accuracy	HT-6702	±2% RH for 20 to 80% RH at 77°F (25°C) ±4% RH for 10 to 20% and 80 to 90% RH at 77°F (25°C)
	HT-6703	±3% RH for 20 to 80% RH at 77°F (25°C) ±5% RH for 10 to 20% and 80 to 90% RH at 77°F (25°C)
Humidity Element		All-Polymer sensing element
Temperature Coefficient		-0.1 to 0.05% RH/°C at 5°C (41°F) to -0.07 to -0.21% RH/°C at 65°C (149°F)
Response Time		Within 5% RH of actual in 15 minutes for 10 to 30%, 30 to 90%, and 40 to 90% RH
Electrical Connections		3-position screw terminal block
Ambient Operating Conditions		32 to 122°F (0 to 50°C) 0 to 100% RH, noncondensing; 85°F (29°C) maximum dew point
Survival Operating Conditions		-20 to 140°F (-29 to 60°C) 0 to 100% RH, noncondensing; 85°F (29°C) maximum dew point
Ambient Storage Conditions		-40 to 176°F (-40 to 80°C) 0 to 100% RH, noncondensing; 85°F (29°C) maximum dew point
Materials	Wall Mount:	White PC/ABS plastic enclosure and mounting base for surface or standard U.S. wallbox mounting, including hardware
	Duct Probe	Light gray plastic cover with dark gray housing and probe
Dimensions	Wall Mount (H x W x D)	3.20 x 3.20 x 1.34 in. (81 x 81 x 34 mm)
	Duct Probe (H x W x D)	3.28 x 3.25 x 8.27 in. (83 x 83 x 210 mm)
	Probe (L x D):	6.25 x 0.98 in. (159 x 25 mm)
Agency Compliance	Duct Probe Material:	94-5V flammability rated per UL 94

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M9102-AGA-2S, -3S and M9104-xxA-2S, -3S Series Electric Non-Spring Return Actuators

Description

The M9102 and M9104 Series Actuators are direct-mount, non-spring return electric actuators that operate on AC 24 V or 100 to 240 VAC power. These motor-driven actuators provide floating control (AGA), floating control with automatic shutoff (IGA), proportional control with selectable 0-10 or 2-10 VDC (GGA), and line voltage power supply (IUA). The -2S models are equipped with plenum cables, and the -3S models are equipped with terminal blocks.

All models are compact in size and are easily installed on VAV boxes, Variable Air Volume and Temperature (VVT) two-position zone applications, or small- to medium-sized dampers with a round shaft up to 1/2 in. (13 mm) in diameter or a 3/8 in. (10 mm) square shaft.

The M9102 Series Electric Non-Spring Return Actuators provide a running torque of 18 lb-in (2 N-m), and the nominal travel time is 30 seconds at 60 Hz (36 seconds at 50 Hz) for 90° of rotation. The M9104 Series Electric Non-Spring Return Actuators provide a running torque of 35 lb-in (4 N-m), and the nominal travel time is 60 seconds at 60 Hz for 90° of rotation.

Refer to the *M9102-AGA-2S, -3S and M9104-xGA-2S, -3S Series Electric Non-Spring-Return Actuators Product Bulletin (LIT-1201742)* for important product application information.

Features

- Two Torques Available: 18 and 35 lb-in (2 and 4 N-m)
- Short 30-Second Travel Time Available
- 35 dBA Maximum Audible Noise Rating at 1 Meter
- Synchronous Drive (AGA, IGA, GGA models)
- 100,000 Cycle Rating
- Direct Shaft Mounting with Single-Screw Coupler
- Magnetic Clutch
- Manual Gear Release
- Plenum Cable or Screw Terminal Electric Connections
- Floating, Floating with Timeout, and Proportional 0(4) to 10 VDC Control Inputs Available
- Small, Compact Design

Applications

The M9102 and M9104 Series Electric Non-Spring Return Actuators are designed to position balancing, control, round, and zone dampers in HVAC systems. These electric actuators are also designed to position blades in a VAV box, or they can be used in VVT two-position zone applications.

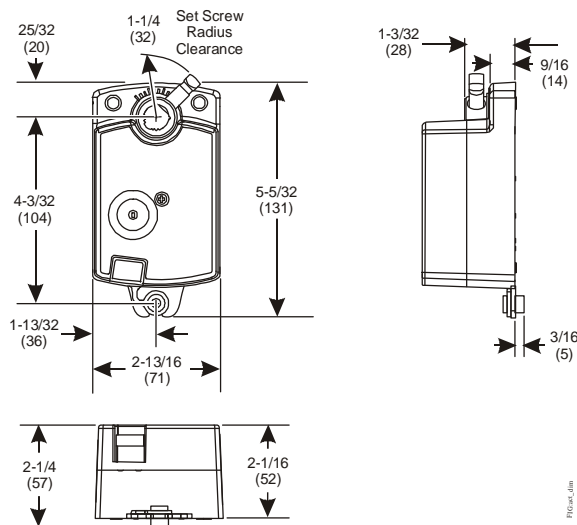
Each actuator mounts directly to the surface in any convenient orientation using a single No. 10 standard sheet metal screw (included with the actuator). No additional linkages or couplers are required. Electrical connections on the actuator are clearly labeled to simplify installation.

Repair Information

If the M9102 or M9104 Series Electric Non-Spring Return Actuator fails to operate within its specifications, replace the unit. For a replacement electric actuator, contact the nearest Johnson Controls® representative.



M9102 Series Electric Non-Spring Return Actuator



M9102/M9104 Series Electric Non-Spring Return Actuator Dimensions, in. (mm)

The performance specifications are nominal and conform to acceptable industry standards. For applications at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products. © 2014 Johnson Controls, Inc. www.johnsoncontrols.com

M9102-AGA-2S, -3S and M9104-xxA-2S, -3S Series Electric Non-Spring Return Actuators (Continued)

Selection Chart

Code Number	Control Type	Running Torque	Travel Time	Power Supply (VA rating)	Electrical Connections
M9102-AGA-2S	Floating	18 lb-in (2 N-m)	30 Seconds at 60 Hz 36 Seconds at 50 Hz	2.5	48 in. (1.2 m) UL 444 Type CMP Plenum Rated cable with 19 AWG (0.75 mm ²) conductors and .25 in. (6 mm) ferrule ends
M9102-AGA-3S	Floating	18 lb-in (2 N-m)	30 Seconds at 60 Hz 36 Seconds at 50 Hz	2.5	M3 Screw Terminals
M9104-AGA-2S	Floating	35 lb-in (4 N-m)	60 Seconds at 60 Hz 72 Seconds at 50 Hz	2.5	48 in. (1.2 m) UL 444 Type CMP Plenum Rated cable with 19 AWG (0.75 mm ²) conductors and .25 in. (6 mm) ferrule ends
M9104-AGA-3S	Floating	35 lb-in (4 N-m)	60 Seconds at 60 Hz 72 Seconds at 50 Hz	2.5	M3 Screw Terminals
M9104-IGA-2S	Floating or On/Off	35 lb-in (4 N-m)	60 Seconds at 60 Hz 72 Seconds at 50 Hz	3.2	48 in. (1.2 m) UL 444 Type CMP Plenum Rated cable with 19 AWG (0.75 mm ²) conductors and .25 in. (6 mm) ferrule ends
M9104-IGA-3S	Floating or On/Off	35 lb-in (4 N-m)	60 Seconds at 60 Hz 72 Seconds at 50 Hz	3.2	M3 Screw Terminals
M9104-GGA-2S	Proportional	35 lb-in (4 N-m)	60 Seconds at 60 Hz 72 Seconds at 50 Hz	0(2) to 10 VDC or 0(4) to 20 mA	48 in. (1.2 m) UL 444 Type CMP Plenum Rated cable with 19 AWG (0.75 mm ²) conductors and .25 in. (6 mm) ferrule ends
M9104-GGA-3S	Proportional	35 lb-in (4 N-m)	60 Seconds at 60 Hz 72 Seconds at 50 Hz	0(2) to 10 VDC or 0(4) to 20 mA	M3 Screw Terminals
M9104-IUA-2S	Floating or On/Off	35 lb-in (4 N-m)	60 Seconds at 50/60 Hz	7.5 (0.07A)	48 in. (1.2 m) UL 444 Type CMP Plenum Rated cable with 18 AWG (1.02 mm ²) conductors for 3/8 in. (10 mm) flexible metal conduit

Accessories

Code Number	Description
DMPR-KC003 ¹	7 in. (178 mm) blade pin extension without bracket for Johnson Controls direct-mount damper applications
DMPR-KR003 ¹	Sleeve pin kit for Johnson Controls round dampers with a 5/16 in. (8 mm) diameter shaft
M9000-200	Commissioning tool that provides a control signal to drive 24 V on/off, floating, proportional, and/or resistive electric actuators
M9104-100	Connector for 3/8 in. (10 mm) flexible metal conduit

1. Furnished with the damper and may be ordered separately.

M9102-AGA-2S, -3S and M9104-xxA-2S, -3S Series Electric Non-Spring Return Actuators (Continued)

Technical Specifications

Power Requirements	M910x-AGA-xS	AC 24 V +25%/-20% at 50/60 Hz, 2.1 VA, Class 2, Safety Extra-Low Voltage (SELV)
	M9104-IGA-xS	AC 24 V +25%/-20% at 50/60 Hz, 3.0 VA, Class 2, SELV
	M9104-GGA-xS	AC 24 V +25%/-20% at 50/60 Hz, 3.6 VA, Class 2, SELV
	M9104-IUA-2S	AC 100 to 240 V (-15%+10%) at 60 Hz, 0.07A, and 7.5 VA Supply
Control Type	M910x-AGA-xS	Floating Control without Timeout
	M9104-IGA-xS	Floating or On/Off Control with Timeout
	M9104-GGA-xS	Proportional Control
	M9104-IUA-2S	Floating or On/Off Control with Timeout
Input Signal	M910x-AGA-xS	AC 24 V +25%/-20% at 50/60 Hz, Class 2, SELV without Timeout
	M9104-IGA-xS	AC 24 V +25%/-20% at 50/60 Hz, Class 2, SELV with Timeout
	M9104-GGA-xS	0(2) to 10 VDC or 0(4) to 20 mA with Field-furnished 500 ohm Resistor
	M9104-IUA-2S	AC 100 to 240 V (-15%+10%) at 50/60 Hz, and 7.5 VA Supply
Feedback Signal	M9104-GGA-2S	0 to 10 VDC or 2 to 10 VDC for 90° (10 VDC at 1 mA) Corresponds to Input Signal Span Selection
Motor Input Impedance		200 ohms Nominal
Running Torque	M9102 Series	18 lb-in (2 N-m)
	M9104 Series	35 lb-in (4 N-m)
Travel Time	M9102 Series	30 Seconds at 60 Hz (36 Seconds at 50 Hz) for 90° of Rotation
	M9104 Series	60 Seconds at 60 Hz (72 Seconds at 50 Hz) for 90° of Rotation
	M9104 (IUA)	60 Seconds at 50/60 Hz for 90° of Rotation
Rotation Range		93° ±3°, CW or CCW
Cycles		100,000 Full Stroke Cycles; 2,500,00 Repositions at Rated Running Torque
Audible Noise Rating		35 dBA at 39-13/32 in. (1 m) Maximum
Electrical Connections	M9102-AGA-2S M9104-xxA-2S	48 in. (1.02 m) UL 444 Type CMP Plenum Rated Cable with 18 AWG (1.02 mm) Conductors and 1/4 in. (6 mm) Ferrule Ends
	M9102-AGA-3S M9104-xGA-3S	M3 Screw Terminals
	M9104-IUA-2S	48 in. (1.2 mm) with 18 AWG (1.02 mm ²) Conductors and Connector for 3/8 in. (10 mm) Flexible Metal Conduit
		Up to 1/2 in. (13 mm) Diameter Round Damper Shaft or 3/8 in. (10 mm) Square Damper Shaft
Enclosure	M9102-AGA-2S M9104-xxA-2S	NEMA 1, IP42
	M9102-AGA-3S M9104-xxA-3S	NEMA 1, IP40
Ambient Conditions	Operating	-4 to 140°F (-20 to 60°C); 90% RH Maximum, Noncondensing
	Storage	-20 to 150°F (-29 to 66°C); 90% RH Maximum, Noncondensing
Compliance	North America	UL Listed, File E27734, CCN XAPX (United States) and XAPX7 (Canada) Actuator Housing is Plenum Rated per CSA C22.2 No. 236/UL 1995, Heating and Cooling Equipment
	European Union	CE Mark, EMC Directive 89/336/EEC
	Australia and New Zealand	C-Tick Mark, Australia/NZ Emissions Compliant
Shipping Weight		1.0 lb (0.5 kg)

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M9106-xGx-2 Series Electric Non-Spring-Return Actuators

Description

The M9106-xGx-2 Series direct-mount electric actuators operate on AC 24 V power and are available for use with on/off, floating, or proportional controllers. These non-spring-return actuators are easily installed on a VAV box, a damper with a round shaft up to 1/2 in. (13 mm) in diameter, or a square shaft up to 3/8 in. (10 mm). The M9106 with an M9000-520 linkage can also be used to position VG1000 Series 1/2 in. (DN15) to 1-1/2 in. (DN40) ball valves.

The M9106 Series models have 53 lb-in (6 N-m) running torque. These actuators have a nominal 60-second travel time for 90° of rotation at 60 Hz (72 seconds at 50 Hz) with a load-independent rotation time.

The M9106-xGC-2 models are available with integral auxiliary switches to perform switching functions at any angle within the selected rotation range. The -GGx models feature DC 0(2) to 10 V position feedback, and the -AGF models provide 10,000 ohm position feedback.

Features

- simple direct coupling reduces installation and commissioning time and improves reliability by eliminating damper linkages; single screw coupling provides three-point shaft gripping
- designed for zone damper and ball valve actuator applications
- small, compact design allows installation in tight-fitting locations
- on/off, floating, and proportional control inputs
- 60-second running time at 60 Hz
- long life brushless synchronous drive motor technology provides constant running time independent of load
- robust 53 lb-in (6 N-m) torque rating

- whisper quiet 35 dBA noise rating
- magnetic clutch provides over torque protection over the entire range of rotation
- -4 to 125°F (-20 to 52 °C) ambient temperature rating
- 100,000 full stroke cycle, 2,500,000 reposition rating
- manual gear release simplifies setup and field adjustments
- 1/2 in. NPT threaded conduit opening meets electrical code requirements and allows the use of flexible armored cable
- position feedback (-GGx models) provides simple, closed-loop control with accurate position sensing
- adjustable rotation stops allow application versatility with 30 to 90° clockwise or counterclockwise rotation

Applications

The M9106 actuators are used to position balancing, control, round, and zone dampers in typical HVAC applications. The M9106 can also be used with an M9000-520 linkage to control 1/2 in. (DN15) to 1-1/2 in. (DN40) VG1000 Series ball valves. The M9106 Series actuator mounts directly on the duct surface, round damper, or small rectangular damper with an anti-rotation bracket and two sheet metal screws (included). Additional linkages or couplers are not required.

Refer to the damper or VAV box manufacturer's information to select the proper timing for the actuator. Refer to the appropriate application note for specific wiring diagrams and information.



M9106-xGx-2 Series Electric Non-Spring-Return Actuator

Refer to the *M9106-xGx-2 Electric Non-Spring-Return Actuators Product Bulletin (LIT-2681123)* or the *M9106-xGx-2 Electric Non-Spring-Return Actuators Installation Instructions (Part No. 34-636-1085)* for important product application information.

Repair Information

If the M9106-xGx-2 Series Electric Actuator fails to operate within its specifications, replace the unit. For a replacement actuator, contact the nearest Johnson Controls® representative.

Selection Chart

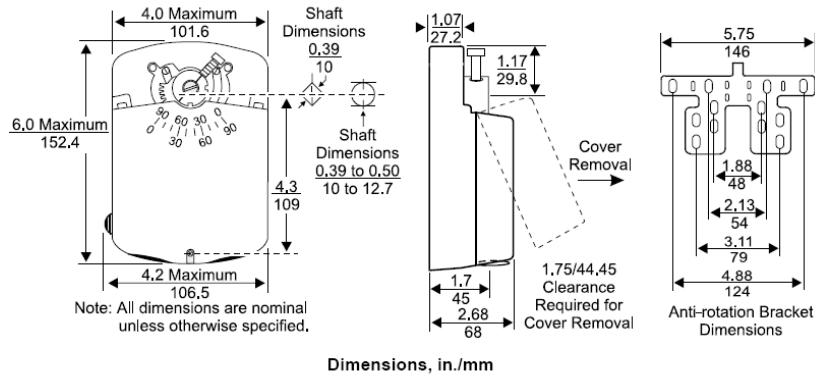
Code Number	Control Type	Torque / Timing / Voltage	Auxiliary Switches	Comments
M9106-AGA-2 ¹	Floating	53 lb-in (6 N-m) 60 seconds at 60 Hz AC 24 V 50/60 Hz	None	
M9106-AGC-2 ¹			2-SPDT	
M9106-AGF-2 ¹	Floating with resistive feedback		None	10,000 ohm feedback pot
M9106-GGA-2	DC 0(2) to 10 V		None	DC 0(2) to 10 V feedback
M9106-GGC-2	DC 0(4) to mA proportional		2-SPDT	
M9106-IGA-2	On/off / floating with timeout		None	Adjustable timing 1, 1.5, 2, 5.5, or 11 minutes
M9106-IGC-2		2-SPDT		

1. To avoid excessive wear or drive time on the motor for the -AGx models, use a controller and/or software that provides a time-out function to remove the signal at the end of rotation (stall). The -GGx and -IGx models have an auto shutoff to avoid excessive wear or drive time on the motor.

M9106-xGx-2 Series Electric Non-Spring-Return Actuators (Continued)

Accessories


Code Number	Description
CBL-2000-1	20 in. (0.5 m) wiring harness, UL accepted for plenum use, connects the M9106 and DPT-2015 to the VAV controller
CBL-2000-2	20 in. (0.5 m) plenum rated wiring harness
CBL-2000-3	72 in. (1.8 m) plenum rated wiring harness
DPT-2015-0	0 to 1.5 in. W.C. (0 to 374 Pa) differential pressure transmitter
DMPR-KC003	Square head blade pin extension without bracket supplied with Johnson Controls CD-1300 dampers and may be ordered separately for all direct-mount applications
DMPR-KC010	Adjustable blade position indicator switch kit with total switching load limited to 2,000 VA for the following applications: Pilot duty: AC 24 V, 50 VA; AC 125/250/277 V, 125 VA Motor load: AC 125/250/277 V, 1/3 hp Resistive load: AC 125 V, 11 A; AC 250 V, 8 A; AC 277 V, 7 A (all maximum values)
DMPR-KC011	Hex head blade pin extension without bracket
DMPR-KC012	Hex head blade pin extension with bracket
DMPR-KC213	Damper jackshaft 1/2 in. diameter, 1 panel
DMPR-KC214	Damper jackshaft 1/2 in. diameter, 2 panel
M9000-105	Pluggable 3-terminal block
M9000-106	Pluggable 4-terminal block
M9000-160	Replacement anti-rotation bracket for M9106 Series actuators
M9000-200	Commissioning tool provides a control signal to drive on/off, floating, proportional, or resistive actuators
M9000-520	Valve linkage kit for field mounting an M9106 Series actuator to a 1/2 in. (DN15) to 1-1/2 in. (DN40) VG1000 Series ball valve



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M9106-xGx-2 Series Electric Non-Spring-Return Actuators (Continued)

Technical Specifications

M9106-xGx-2 Series Electric Non-Spring-Return Actuators		
Power Requirement	AGx: AC 20-30 V at 50/60 Hz, 2.5 VA supply, Class 2 IGx: AC 20-30 V at 50/60 Hz, 2.8 VA supply, Class 2 GGx: AC 20-30 V at 50/60 Hz, 3.2 VA supply, Class 2	
Control Type	AGx: floating IGx: on/off, floating GGx: DC 0(2) to 10 V or DC 0(4) to 20 mA proportional	
Input Signal	AGx and IGx: AC 20 to 30 V at 50/60 Hz GGx: DC 0 to 10 V or DC 0(4) to 20 mA	
Input Signal Adjustments:	AGx and IGx: CW and COM Terminals, CW rotation; CCW and COM terminals, CCW rotation GGx (voltage input or current input): Jumper selectable: DC 0(2) to 10 V or DC 0(4) to 20 mA Factory setting: DC 0 to 10 V, CW rotation with signal increase Action is jumper selectable direct (CW) or reverse (CCW) with signal increase.	
Input Impedance	AGx: 200 ohms, nominal IGx: 160 ohms, nominal GGx: voltage input, 150,000 ohms; current input, 500 ohms	
Feedback Signal	AGF: 10,000 ohm potentiometer, 1 W GGx: DC 0 to 10 V or DC 2 to 10 V for 90° (1 mA); Corresponds to input signal span selection	
Auxiliary Switch Rating	xGC: two single-pole, double-throw (SPDT) switches rated at AC 24 V, 1.5 A inductive, 3.0 A resistive, 35 VA maximum per switch, Class 2	
Torque Rating	1, 1.5, and 2 minute settings: 53 lb-in (6 N-m) 5.5 and 11 minute settings: 35 lb-in (4 N-m)	
Cycle Life	100,000 full cycles; 2,500,000 repositions rated at 53 lb-in (6 N-m)	
Audible Noise Rating	35 dBA maximum at 39.4 in. (1 m)	
Rotation Range	Adjustable from 30 to 90°, CW or CCW	
Rotation Time	IGx: adjustable with switch settings (factory set for 1 minute) 60, 90, 120, 330, or 660 seconds (1, 1.5, 2, 5.5 or 11 minutes) at 60 Hz and 72, 108, 144, 396, or 792 seconds at 50 Hz All other models: nominal 60 seconds at 60 Hz and 72 seconds at 50 Hz for 90°	
Electrical Connection	1/4 in. spade terminals (to order optional pluggable terminal blocks, see Accessories)	
Mechanical Connection	3/8 to 1/2 in. (10 to 12.7 mm) round shaft or 3/8 in. (10 mm) square shaft	
Enclosure Rating	NEMA 2, IP32	
Ambient Operating Rating	-4 to 125°F (-20 to 52°C); 90% RH maximum, noncondensing	
Ambient Storage Rating	IGx: -40 to 186°F (-40 to 86°C); 90% RH maximum, noncondensing All other models: -40 to 176°F (-40 to 80°C); 90% RH maximum, noncondensing	
Shipping Weight	2.4 lb (1.08 kg)	
Compliance 	United States	UL 873 Listed, File E27734, CCN XAPX
	Canada	CSA C22.2 No. 139 Certified, File LR85083, Class 3221 02
	Europe	CE Mark - Johnson Controls, Inc. declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive 2004/108/EC.

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M9108, M9116, M9124, and M9132 Series Electric Non-Spring-Return Actuators

Description

The M91xx Series includes M9108, M9116, M9124, and M9132 models. All of these direct-mount electric actuators operate on AC/DC 24 V power. The M91xx actuators are available for use with on/off, floating, proportional, or resistive controllers. These bidirectional actuators do not require a damper linkage, and are easily installed on a damper with a round shaft up to a 3/4 in. (20 mm) in diameter or a square shaft up to 5/8 in. (16 mm). They may be direct or remote mounted to a damper, or mounted to a valve using one of the M9000-5xx Valve Linkage Kits.

A single M91xx model delivers up to 280 lb-in (32 N-m) of torque. Two -AGx, -GGx, or -HGx models in tandem deliver twice the torque or 560 lb-in (64 N-m). The angle of rotation is mechanically adjustable from 0 to 90° in 5-degree increments. Integral auxiliary switches are available to indicate end-stop position or to perform switching functions at any angle within the selected rotation range. Position feedback is available through switches, a potentiometer, or a DC 0(2) to 10 V signal.

Features

- simple direct coupling reduces installation and commissioning time while improving reliability by eliminating damper linkages
- six torques: 70 to 560 lb-in (8 to 64 N-m) offer the most suitable choice for the application
- four control inputs meet the needs of most applications
- output position feedback provides simple closed-loop control with accurate position sensing
- electronic stall detection ensures higher reliability by deactivating the actuator motor when a stall condition is detected

- master/slave operation allows synchronized control for two actuators
- stacked for tandem applications
- zero and span adjustment (-HGx models) allows sequential operation of dampers from a single input signal of DC 0(2) to 10 V, DC 0(4) to 20 V, or DC 0(4) to 20 mA
- jumper-selectable rotation direction and manual gear release simplify installation, setup, and field adjustments
- NPT threaded housing provides easy connection for electrical fittings
- manual gear release simplifies damper/valve setup and commissioning

Applications

M91xx actuators are designed to position air dampers and valves in HVAC systems. Applications include: positioning return air or exhaust dampers, controlling face and bypass dampers, positioning blades for variable volume fans, positioning VF4000 and VF5000 Series butterfly valves, and positioning VG1000 Series ball valves and VG7000 Series globe valves when used with the M9000-5xx Series Valve Linkages. Two of the following models provide twice the amount of running torque of a single unit when mounted in tandem: M9116-GGx or -HGx, M9124-AGx, -GGx or -HGx, and M9132-AGx or -GGx.

Refer to the manufacturer's information to properly size the damper, valve, and/or actuator. Spring-return actuators, such as the M9206 and M9216 Series actuators, are recommended for use with outdoor air dampers in cold climates. These compact M91xx actuators use a DC motor with stall detection circuitry that operates throughout the entire stroke.

The -GGx, -HGx, and -JGx models employ noise-filtering techniques on the control signal to eliminate repositioning due to line noise.



M9108 Series Electric Non-Spring-Return Actuators

Rotation is mechanically limited to 93° by integral end stops. The position of the actuator is visually indicated from 0 to 90° on the cover. An anti-rotation bracket prevents lateral movement of the actuator. Pressing the spring-loaded gear release on the actuator cover disengages the gear train for manual repositioning of the coupler.

Refer to the *M9108, M9116, M9124, M9132 Series Electric Non-Spring-Return Actuators Product Bulletin (LIT-2681058)* or the *M9108, M9116, M9124, M9132 Series Electric Non-Spring-Return Actuators Installation Instructions (Part No. 34-636-399)* for important product application information.

Repair Information

If the M9108, M9116, M9124, or M9132 Series Electric Actuator fails to operate within its specifications, replace the unit. For a replacement actuator, contact the nearest Johnson Controls representative.

Selection Chart

M9108, M9116, M9124, and M9132 Series Electric Non-Spring-Return Actuators (Part 1 of 2)

Code Number	Control Type	Torque / Timing / Voltage	Auxiliary Switches	Comments
M9108 Electric Non-Spring-Return Actuators				
M9108-AGA-2	On/off, floating	70 lb-in (8 N-m)	None	
M9108-AGC-2		25 to 50 seconds	2-SPDT	
M9108-AGD-2		AC 24 V 50/60 Hz	None	135 ohm potentiometer
M9108-AGE-2		DC 24 V	None	1,000 ohm potentiometer
M9108-GGA-2	DC 0(2) to 10 V	70 lb-in (8 N-m)	None	DC 0(2) to 10 V feedback
M9108-GGC-2	DC 0(4) to mA proportional	25 to 50 seconds	2-SPDT	
M9108-HGA-2	DC 0 to 10 V	AC 24 V 50/60 Hz	None	DC 0 to 10 V feedback
M9108-HGC-2	DC 0 to 20 mA proportional	DC 24 V	2-SPDT	
M9108-JGA-2	100 to 10,000 ohm potentiometer		None	
M9108-JGC-2			2-SPDT	

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M9108, M9116, M9124, and M9132 Series Electric Non-Spring-Return Actuators (Continued)

M9108, M9116, M9124, and M9132 Series Electric Non-Spring-Return Actuators (Part 2 of 2)

Code Number	Control Type	Torque / Timing / Voltage	Auxiliary Switches	Comments
M9116 Electric Non-Spring-Return Actuators				
M9116-AGA-2	On/off, floating	140 lb-in (16 N·m) 70 to 115 seconds	None	
M9116-AGC-2			2-SPDT	
M9116-AGD-2	DC 0(4) to mA proportional	AC 24 V 50/60 Hz DC 24 V	None	135 ohm potentiometer
M9116-AGE-2			None	1,000 ohm potentiometer
M9116-GGA-2	DC 0(2) to 10 V		None	DC 0(2) to 10 V feedback
M9116-GGC-2	DC 0(4) to mA proportional		2-SPDT	
M9116-HGA-2	DC 0 to 10 V		None	DC 0 to 10 V feedback
M9116-HGC-2	DC 0 to 20 mA proportional Adjustable start and span		2-SPDT	
M9116-JGA-2	100 to 10,000 ohm potentiometer		None	
M9116-JGC-2			2-SPDT	
M9124 Electric Non-Spring-Return Actuators				
M9124-AGA-2	On/off, floating	210 lb-in (24 N·m) 115 to 175 seconds	None	
M9124-AGC-2			2-SPDT	
M9124-AGD-2	DC 0(4) to mA proportional	AC 24 V 50/60 Hz DC 24 V	None	135 ohm potentiometer
M9124-AGE-2			None	1,000 ohm potentiometer
M9124-GGA-2	DC 0(2) to 10 V		None	DC 0(2) to 10 V feedback
M9124-GGC-2	DC 0(4) to mA proportional		2-SPDT	
M9124-HGA-2	DC 0 to 10 V		None	DC 0 to 10 V feedback
M9124-HGC-2	DC 0 to 20 mA proportional Adjustable start and span		2-SPDT	
M9124-JGA-2	100 to 10,000 ohm potentiometer		None	
M9124-JGC-2			2-SPDT	
M9132 Electric Non-Spring-Return Actuators				
M9132-AGA-2	On/off, floating	280 lb-in (32 N·m) 115 to 205 seconds	None	
M9132-AGC-2			2-SPDT	
M9132-AGE-2	DC 0(2) to 10 V	AC 24 V 50/60 Hz DC 24 V	None	1,000 ohm potentiometer
M9132-GGA-2			None	DC 0(2) to 10 V feedback
M9132-GGC-2	DC 0(4) to mA proportional		2-SPDT	

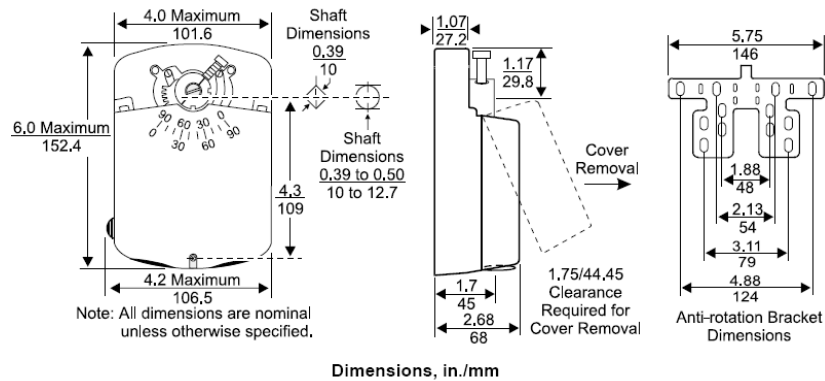
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M9108, M9116, M9124, and M9132 Series Electric Non-Spring-Return Actuators (Continued)

Accessories

Code Number	Description
DMPR-KC003 ¹	Square head blade pin extension without bracket for Johnson Controls® CD-1300 direct-mount applications
DMPR-KC011	Hex head blade pin extension without bracket
DMPR-KC012	Hex head blade pin extension with bracket
DMPR-KC210	Damper jackshaft 1 in. diameter, 1 panel
DMPR-KC211	Damper jackshaft 1 in. diameter, 2 panel
DMPR-KC212	Damper jackshaft 1 in. diameter, 3 panel
DMPR-KC213	Damper jackshaft 1/2 in. diameter, 1 panel
DMPR-KC214	Damper jackshaft 1/2 in. diameter, 2 panel
M9000-103	14 VA transformer, 120/24 VAC, 60 Hz, Class 2
M9000-104	14 VA transformer, 230/24 VAC, 60 Hz, Class 2
M9000-105	Pluggable 3-terminal block
M9000-151	Base mount linkage kit for remote inside duct mounting (not intended for M9132 actuators or any tandem application)
M9000-153	Crankarm kit for remote mounting (not intended for M9132 actuators or any tandem application)
M9000-154	1 in. jackshaft coupler for mounting on a 1 in. diameter damper shaft
M9000-155	Manual handle for positioning a damper or valve when power is removed from an M91xx actuator
M9000-158	Mounting kit to tandem mount two M9116-GGx or -HGx models; two M9124-AGx, -GGx, or -HGx; or two M9132-AGx or -GGx models on a damper
M9000-160	Replacement anti-rotation bracket for M91xx Series actuators
M9000-200	Commissioning tool provides a control signal to drive on/off, floating, proportional, or resistive actuators
M9000-516	Valve linkage kit for mounting M9108 actuators to 1/2 in. to 2 in. two-way and three-way VG1000 Series ball valves
M9000-518	Valve linkage kit for mounting M9124 actuators to 2-1/2 in. to 4 in. VG1xA5 Series flange body ball valves to VG1x43 1-1/2 in. valves


1. Furnished with the damper and may be ordered separately



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M9108, M9116, M9124, and M9132 Series Electric Non-Spring-Return Actuators (Continued)

Technical Specifications

M9108, M9116, M9124, and M9132 Series Electric Non-Spring-Return Actuators		
Power Requirement	M9108- and M9116-AGx: AC 20 to 30 V at 50/60 Hz or DC 24 V $\pm 10\%$; 6.5 VA supply minimum All other models: AC 20 to 30 V at 50/60 Hz or DC 24 V $\pm 10\%$; 7.5 VA supply minimum	
Control Type	AGx: on/off and floating GGx: DC 0(2) to 10 V or DC 0(4) to 20 mA proportional HGx: DC 0 to 10 V or DC 0 to 20 mA proportional with adjustable start and span JGx: proportional from 100 to 10,000 ohm potentiometer controller	
Input Signal	AGx: V 24 AC at 50/60 Hz or DC 24 V GGx and HGx: DC 0(2) to 10 V, DC 0(4) to 20 V, or DC 0(4) to 20 mA JGx: potentiometer value is 100 ohms minimum to 10,000 ohms maximum	
Input Signal Adjustments	AGx: factory setting, terminals 1 and 2, CW rotation; terminals 1 and 3, CCW rotation GGx and HGx (voltage input or current input): Jumper selectable: DC 0(2) to 10 V, DC 0(4) to 20 V, or DC 0(4) to 20 mA Adjustable: zero, DC 0 to 6 V, DC 0 to 12 V, or DC 0 to 12 mA Span, DC 2 to 10 V, DC 4 to 20 V, or DC 4 to 20 mA Factory setting: DC 0 to 10 V, DC 0 to 20 mA, CW rotation with signal increase GGx, HGx, and JGx: action is jumper selectable direct (CW) or reverse (CCW) with signal increase.	
Input Impedance	GGx and HGx: voltage input, 205,000 ohms for 0 (2) to 10 V and 410,000 ohms for 0 (4) to 20 V; current input, 500 ohms JGx: 1.8 megohms	
Feedback Signal	AGD: 135 ohm feedback potentiometer AGE: 1,000 ohm feedback potentiometer GGx and HGx: DC 0 to 10 V or DC 2 to 10 V for 90° (10 VDC at 1 mA) corresponds to input signal span selection. JGx: DC 0 to 10 V for 90° (10 VDC at 1 mA)	
Auxiliary Switch Rating	xGC: two single-pole, double-throw (SPDT) switches rated at 24 VAC 1.5 A inductive, 3.0 A resistive, 35 VA maximum per switch, Class 2	
Torque Rating	M9108: 70 lb-in (8 N-m) for one unit; not intended for tandem use M9116: 140 lb-in (16 N-m) for one unit, 280 lb-in (32 N-m) for two in tandem (-GGx, -HGx) M9124: 210 lb-in (24 N-m) for one unit, 420 lb-in (48 N-m) for two in tandem (-AGx, -GGx, -HGx) M9132: 280 lb-in (32 N-m) for one unit, 560 lb-in (64 N-m) for two in tandem (-AGx, -GGx)	
Cycle Life	M9108, M9116 and M9124 60,000 cycles at rated load M9132 30,000 cycles at rated load	
Audible Noise Rating	45 dBA at 1 m	
Rotation Range	0 to 90° in 5-degree increments, mechanically limited to 93° - rotation range is adjusted by repositioning the output hub	
Rotation Time	M9108: 30 seconds at 50% rated load, 25 to 50 seconds for 0 to 70 lb-in (0 to 8 N-m) M9116: 80 seconds at 50% rated load, 70 to 115 seconds for 0 to 140 lb-in (0 to 16 N-m) M9124: 130 seconds at 50% rated load, 115 to 175 seconds for 0 to 210 lb-in (0 to 24 N-m) M9132: 140 seconds at 50% rated load, 115 to 205 seconds for 0 to 280 lb-in (0 to 32 N-m)	
Electrical Connection	M9124- and M9132-AGx: 1/4 in. spade terminals with pluggable 3-terminal blocks (see Accessories) All other models: screw terminals for 22 to 14 AWG; maximum of two 18, 20, or 22 AWG per terminal	
Mechanical Connection	3/8 to 3/4 in. (10 to 20 mm) diameter round shaft or 3/8 to 5/8 in. (10 to 16 mm) square shaft 1 in. (25.4 mm) diameter jackshaft with M9000-154 coupler	
Enclosure Rating	NEMA 2, IP42	
Ambient Operating Rating	-4 to 122°F (-20 to 50°C); 0 to 95% RH, noncondensing	
Ambient Storage Rating	-40 to 186°F (-40 to 86°C); 0 to 95% RH, noncondensing	
Shipping Weight	2.9 lb (1.3 kg)	
Compliance 	United States	UL 873 Listed, File E27734, CCN XAPX
	Canada	CSA C22.2 No. 139 Certified, File LR85083, Class 3221 02
	Europe	CE Mark - Johnson Controls, Inc. declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive 2004/108/EC.

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M9208-xxx-x Series Electric Spring-Return Actuators

Description

The M9208-xxx-x Series Electric Spring-Return Actuators provide control of dampers in HVAC systems. All actuators in this series provide 70 lb-in (8 N·m) rated torque. A mechanical spring-return system provides rated torque with and without power applied to the actuator. The series includes the following control options:

- On/Off, 24 V, 120 VAC, 230 VAC power
- On/Off and Floating Point, 24 V power
- Proportional, 24 V power, for 0(2) to 10 VDC or 0(4) to 20 mA Control Signal

These actuators are configured for direct mounting and do not require a damper linkage. Actuators can be mounted directly to a damper shaft from 5/16 to 5/8 in. (8 to 16 mm) diameter with a universal clamp. For shafts up to 3/4 in. (19 mm) diameter, use the accessory Large Shaft Coupler Kit M9208-600. An accessory crankarm and remote mounting kit are available for applications where the actuator cannot be direct coupled to the damper shaft. Optional line voltage auxiliary switches indicate an end-stop position or perform switching functions within the selected rotation range.

Refer to the *M9208-xxx-x Series Electric Spring-Return Actuators Product Bulletin (LIT-12011480)* for important product application information.

Features

- 70 lb-in (8 N·m) rated torque
- direct-coupled design
- reversible mounting
- electronic stall detection
- double-insulated construction
- microprocessor-controlled brushless DC motor (-AGx and -GGx types)
- external mode selection switch (-AGx and -GGx types)
- locking manual override with auto release and crank storage
- integral cables with colored and numbered conductors
- integral connectors for 3/8 in. (10 mm) Flexible Metal Conduit (FMC)
- optional integrated auxiliary switches
- UL, CE, and C-Tick compliance
- manufactured under International Standards Organization (ISO) 9001 quality control standards
- 5-year warranty



M9208-xxx-x Series Electric Spring-Return Actuator

Accessories and Replacement Parts

Code Number	Description
DMPR-KC003 ¹	7 in. (178 mm) Blade Pin Extension (without Bracket) for Johnson Controls Direct-Mount Damper Applications (Quantity 1)
M9000-200	Commissioning Tool that Provides a Control Signal to Drive 24 V On/Off, Floating, Proportional, and/or Resistive Electric Actuators (Quantity 1)
M9000-321	Weather Shield Kit for Damper Application of M9203 and M9208 Series Electric Spring-Return Actuators (Quantity 1)
M9000-400	Jackshaft Linkage Kit. Open-Ended Design Enables Clamping onto a Jackshaft without Requiring Access to the Ends of the Jackshaft. (Quantity 1)
M9000-560	Ball Valve Linkage Kit for applying M9203 and M9208 Series Electric Spring-Return Actuators to VG1000 Series Valves (Quantity 1)
M9000-604	Replacement Anti-Rotation Bracket Kit for M9208, M9210, and M9220 Series Electric Spring-Return Actuators (Quantity 1)
M9000-606	Position Indicator for Damper Applications of M9203 and M9208 Series Actuators (Quantity 5)
M9200-100	Threaded Conduit Adapter, 1/2 NPSM, for M9210(20) and M(VA)9208 Series Actuators (Quantity 5)
M9208-100	Remote Mounting Kit, Including Mounting Bracket, M9208-150 Crankarm, Ball Joint, and Mounting Fasteners (Quantity 1)
M9208-150	Crankarm Adapter Kit (Quantity 1)
M9208-600	Large Shaft Coupler Kit (with Locking Clip) for Mounting M9208 Series Electric Spring-Return Actuators on Dampers with Round Shafts from 1/2 to 3/4 in. (12 to 19 mm) or Square Shafts from 3/8 to 9/16 in. (10 to 14 mm) (Quantity 1)
M9208-601	Replacement Standard Coupler Kit (with Locking Clip) for Mounting M9208 Series Electric Spring-Return Actuators on Dampers with Round Shafts from 5/16 to 5/8 in. (8 to 16 mm) or Square Shafts from 1/4 to 1/2 in. (6 to 12 mm) (Quantity 1)
M9208-602	Replacement Locking Clips for M9208 Series Electric Spring-Return Actuators (Quantity 5)
M9208-603	Adjustable Stop Kit for M9208 Series Electric Spring-Return Actuators (Quantity 1)
M9208-604	Replacement Manual Override Cranks for M9208 Series Electric Spring-Return Actuators with Long Crank Radius: 2.83 in. (72 mm) (Quantity 5)
M9208-605	Replacement Manual Override Cranks for M9208 Series Electric Spring-Return Actuators with Short Crank Radius: 1.83 in. (46.5 mm) (Quantity 5)

1. Furnished with the damper and may be ordered separately

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M9208-xxx-x Series Electric Spring-Return Actuators (Continued)

Selection Chart

Code Number	Rotation Time (Seconds) for 90°		Power Requirements				Power Consumption			Input Signal			Position Feedback	Auxiliary Switches	Electrical Connection		
	Power On (Running)	Power Off (Spring Return)	24 VAC +/- 25%, VDC +20%/-10%	24 VAC +/- 20%, VDC +20%/-10%	120 VAC +/- 10%	230 VAC +/- 10%	VA Rating, Transformer Sizing	VA: Running (Holding)	Amperage: Running (Holding)	On/Off	Floating Point	0(2) to 10 VDC 0(4) to 20 mA (with 500 Ohm Resistor)			0(2) to 10 VDC	2 Single-Pole, Double-Throw (SPDT), 5.0 A (2.9 A Inductive) at 240 V	48 in. (1.2 m) 18 AWG Appliance Cable
M9208-AGA-2	150	17 to 25 ¹	■				8	7.9 (5.5)	—	■	■				■	■	
M9208-AGA-3	150	17 to 25 ¹	■				8	7.9 (5.5)	—	■	■				■	■	
M9208-AGC-3	150	17 to 25 ¹	■				8	7.9 (5.5)	—	■	■				■	■	
M9208-BGA-3	55 to 71	13 to 26 ²	■				7	6.1 (1.2)	—	■					■	■	
M9208-BGC-3	55 to 71	13 to 26 ²	■				7	6.1 (1.2)	—	■					■	■	
M9208-BAA-3	55 to 71	13 to 26 ²		■			—	—	0.05 (0.03)	■					■	■	
M9208-BAC-3	55 to 71	13 to 26 ²		■			—	—	0.05 (0.03)	■					■	■	
M9208-BDA-3	55 to 71	13 to 26 ²			■		—	—	0.04 (0.03)	■					■	■	
M9208-BDC-3	55 to 71	13 to 26 ²				■	—	—	0.04 (0.03)	■					■	■	
M9208-GGA-2	150	17 to 25 ¹	■				8	7.9 (5.5)	—			■	■			■	
M9208-GGA-3	150	17 to 25 ¹	■				8	7.9 (5.5)	—			■	■			■	
M9208-GGC-3	150	17 to 25 ¹	■				8	7.9 (5.5)	—			■	■			■	

1. 22 seconds nominal at room temperature and rated load, 94 seconds maximum at rated load and -40°F (-40°C)
2. 21 seconds nominal at room temperature and rated load, 39 seconds maximum at rated load and -4°F (-20°C), 108 seconds maximum at 53 lb-in (6 N-m) and -40°F (-40°C)

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M9208-xxx-x Series Electric Spring-Return Actuators (Continued)

Technical Specifications

M9208-GGx-x Series Proportional Electric Spring-Return Actuator (Part 1 of 2)		
Power Requirements	-GGx Models	AC 24 V (AC 19.2 V to 28.8 V) at 50/60 Hz: Class 2 (North America) or Safety Extra-Low Voltage (SELV) (Europe), 7.9 VA Running, 5.5 VA Holding Position DC 24 V (DC 21.6 V to 28.8 V): Class 2 (North America) or SELV (Europe), 3.5 W Running, 1.9 W Holding Position Minimum Transformer Size: 8 VA per Actuator
Input Signal / Adjustments	-GGx Models	Factory Set at DC 0 to 10 V, CW Rotation with Signal Increase; Selectable DC 0 (2) to 10 V or 0 (4) to 20 mA with Field Furnished 500 Ohm, 0.25 W Minimum Resistor; Switch Selectable Direct or Reverse Action with Signal Increase
Control Input Impedance	-GGx Models	Voltage Input: 100,000 Ohms Current Input: 500 Ohms with Field Furnished 500 Ohm Resistor
Feedback Signal	-GGx Models	DC 0 (2) to 10 V for Desired Rotation Range up to 95° Corresponds to Rotation Limits, 0.5 mA at 10 V Maximum
Auxiliary Switch Rating	-xxC Models	Two Single-Pole, Double-Throw (SPDT), Double-Insulated Switches with Gold over Silver Contacts: AC 24 V, 50 VA Pilot Duty AC 120 V, 5.8 A Resistive, 1/4 hp, 275 VA Pilot Duty AC 240 V, 5.0 A Resistive, 1/4 hp, 275 VA Pilot Duty
Spring Return		Direction is Selectable with Mounting Position of Actuator: Actuator Face Labeled A is away from Damper or Valve: CCW Spring Return Actuator Face Labeled B is away from Damper or Valve: CW Spring Return
Rated Torque	Power On (Running)	70 lb-in (8 N-m) All Operating Temperatures
	Power Off (Spring Returning)	70 lb-in (8 N-m) All Operating Temperatures
Rotation Range		Maximum Full Stroke: 95° Adjustable Stop: 35° to 95° Maximum Position
Rotation Time for 90 Degrees of Travel	Power On (Running)	150 Seconds Constant for 0 to 70 lb-in (8 N-m) Load, At All Operating Conditions
	Power Off (Spring Returning)	17 to 25 Seconds for 0 to 70 lb-in (8 N-m) Load, at Room Temperature 22 Seconds Nominal at Full Rated Load 94 Seconds Maximum with 70 lb-in (8 N-m) Load, at -40°F (-40°C)
Life Cycles		60,000 Full Stroke Cycles with 70 lb-in (8 N-m) Load 1,500,000 Repositions with 70 lb-in (8 N-m) Load
Audible Noise Rating	Power On (Running)	< 35 dBA at 70 lb-in (8 N-m) Load, at a Distance of 39-13/32 in. (1 m)
	Power On (Holding)	< 20 dBA at a Distance of 39-13/32 in. (1 m)
	Power Off (Spring Returning)	< 52 dBA at 70 lb-in (8 N-m) Load, at a Distance of 39-13/32 in. (1 m)
Electrical Connections	Models: GGx-3	48 in. (1.2 m) UL 758 Type AWM Halogen-Free Cable with 18 AWG (0.85 mm ²) Conductors and 0.25 in. (6 mm) Ferrule Ends
	Models: GGA-2	120 in. (3.05 m) UL 444 Type CMP Plenum Rated Cable with 19 AWG (0.75 mm ²) Conductors and 0.25 in. (6 mm) Ferrule Ends
	Auxiliary Switches (-xxC Models)	48 in. (1.2 m) UL 758 Type AWM Halogen-Free Cable with 18 AWG (0.85 mm ²) Conductors and 0.25 in. (6 mm) Ferrule Ends
Conduit Connections		Integral Connectors for 3/8 in. (10 mm) Flexible Metal Conduit
Mechanical Connections	Round Shafts	Range of Sizes: 5/16 to 5/8 in. (8 to 16 mm)
	Square Shafts	Range of Sizes: 1/4 to 1/2 in. (6 to 12 mm)
Enclosure Rating		NEMA 2 (IP54) for All Mounting Directions
Ambient Conditions	Standard Operating	-40 to 140°F (-40 to 60°C); 90% RH Maximum, Noncondensing
	Storage	-40 to 185°F (-40 to 85°C); 95% RH Maximum, Noncondensing
Dimensions		6.33 x 3.90 x 2.26 in. (160.7 x 99 x 57.5 mm)

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M9208-xxx-x Series Electric Spring-Return Actuators (Continued)

M9208-GGx-x Series Proportional Electric Spring-Return Actuator (Part 2 of 2)		
	United States	UL Listed, CCN XAPX, File E27734; to UL 60730-1A: 2003-08, Ed. 3.1, Automatic Electrical Controls for Household and Similar Use; and UL 60730-2-14: 2002-02, Ed. 1, Part 2, Particular Requirements for Electric Actuators. (Models: All)
	Canada	UL Listed, CCN XAPX7, File E27734; to UL 60730-1:02-CAN/CSA: July 2002, 3rd Ed., Automatic Electrical Controls for Household and Similar Use; and CSA C22.2 No. 24-93 Temperature Indicating and Regulating Equipment (Models: All).
	Europe	CE Mark – Johnson Controls, Inc. declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive 2004/108/EC and Low Voltage Directive 2006/95/EC.
	Australia and New Zealand	C-Tick Mark, Australia/NZ Emissions Compliant (Models: All)
Shipping Weight		Models: -GGA: 3.43 lb (1.6 kg) Models: -GGC: 3.8 lb (1.7 kg)

M9208-AGx-x Series On/Off and Floating Point Control Electric Spring-Return Actuator (Part 1 of 2)		
Power Requirements	-AGx Models	AC 24 V (AC 19.2 V to 28.8 V) at 50/60 Hz: Class 2 (North America) or Safety Extra-Low Voltage (SELV) (Europe), 7.9 VA Running, 5.5 VA Holding Position DC 24 V (DC 21.6 V to 28.8 V): Class 2 (North America) or SELV (Europe), 3.5 W Running, 1.9 W Holding Position Minimum Transformer Size: 8 VA per Actuator
Input Signal	-AGx Models	AC 19.2 to 28.8 V at 50/60 Hz or DC 24 V +20%/-10%, Class 2 (North America) or SELV (Europe) Minimum Pulse Width: 500 ms
Control Input Impedance	-AGx Models	3,000 Ohm Control Inputs
Auxiliary Switch Rating	-xxC Models	Two SPDT, Double-Insulated Switches with Gold over Silver Contacts: AC 24 V, 50 VA Pilot Duty AC 120 V, 5.8 A Resistive, 1/4 hp, 275 VA Pilot Duty AC 240 V, 5.0 A Resistive, 1/4 hp, 275 VA Pilot Duty
Spring Return		Direction is Selectable with Mounting Position of Actuator: Actuator Face Labeled A is away from Damper or Valve: CCW Spring Return Actuator Face Labeled B is away from Damper or Valve: CW Spring Return
Rated Torque	Power On (Running)	70 lb-in (8 N-m) All Operating Temperatures
	Power Off (Spring Returning)	70 lb-in (8 N-m) All Operating Temperatures
Rotation Range		Maximum Full Stroke: 95° Adjustable Stop: 35 to 95° Maximum Position
Rotation Time for 90 Degrees of Travel	Power On (Running)	150 Seconds Constant for 0 to 70 lb-in (8-N m) Load, At All Operating Conditions
	Power Off (Spring Returning)	17 to 25 Seconds for 0 to 70 lb-in (8 N-m) Load, at Room Temperature 22 Seconds Nominal at Full Rated Load 94 Seconds Maximum with 70 lb-in (8 N-m) Load, at -40°F (-40°C)
Life Cycles		60,000 Full Stroke Cycles with 70 lb-in (8 N-m) Load 1,500,000 Repositions with 70 lb-in (8 N-m) Load
Audible Noise Rating	Power On (Running)	< 35 dBA at 70 lb-in (8 N-m) Load, at a Distance of 39-13/32 in. (1 m)
	Power On (Holding)	< 20 dBA at a Distance of 39-13/32 in. (1 m)
	Power Off (Spring Returning)	< 52 dBA at 70 lb-in (8 N-m) Load, at a Distance of 39-13/32 in. (1 m)
Electrical Connections	Models: AGx-3	48 in. (1.2 m) UL 758 Type AWM Halogen-Free Cable with 18 AWG (0.85 mm ²) Conductors and 0.25 in. (6 mm) Ferrule Ends
	Models: AGA-2	120 in. (3.05 m) UL 444 Type CMP Plenum Rated Cable with 19 AWG (0.75 mm ²) Conductors and 0.25 in. (6 mm) Ferrule Ends
	Auxiliary Switches (-xxC Models)	48 in. (1.2 m) UL 758 Type AWM Halogen-Free Cable with 18 AWG (0.85 mm ²) Conductors and 0.25 in. (6 mm) Ferrule Ends
Conduit Connections		Integral Connectors for 3/8 in. (10 mm) Flexible Metal Conduit
Mechanical Connections	Round Shafts	Range of Sizes: 5/16 to 5/8 in. (8 to 16 mm)
	Square Shafts	Range of Sizes: 1/4 to 1/2 in. (6 to 12 mm)
Enclosure Rating		NEMA 2 (IP54) for All Mounting Directions


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M9208-xxx-x Series Electric Spring-Return Actuators (Continued)

M9208-AGx-x Series On/Off and Floating Point Control Electric Spring-Return Actuator (Part 2 of 2)		
Ambient Conditions	Standard Operating	-40 to 140°F (-40 to 60°C); 90% RH Maximum, Noncondensing
	Storage	-40 to 185°F (-40 to 85°C); 95% RH Maximum, Noncondensing
Dimensions		6.33 x 3.90 x 2.26 in. (160.7 x 99 x 57.5 mm)
Compliance CE	United States	UL Listed, CCN XAPX, File E27734; to UL 60730-1A: 2003-08, Ed. 3.1, Automatic Electrical Controls for Household and Similar Use; and UL 60730-2-14: 2002-02, Ed. 1, Part 2, Particular Requirements for Electric Actuators. (Models: All)
	Canada	UL Listed, CCN XAPX7, File E27734; to UL 60730-1:02-CAN/CSA: July 2002, 3rd Ed., Automatic Electrical Controls for Household and Similar Use; and CSA C22.2 No. 24-93 Temperature Indicating and Regulating Equipment (Models: All).
	Europe	CE Mark – Johnson Controls, Inc. declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive 2004/108/EC and Low Voltage Directive 2006/95/EC.
	Australia and New Zealand	C-Tick Mark, Australia/NZ Emissions Compliant (Models: All)
Shipping Weight		Models: -AGA: 3.43 lb (1.6 kg) Models: -AGC: 3.8 lb (1.7 kg)
M9208-Bxx-3 Series On/Off Electric Spring-Return Actuators (Part 1 of 2)		
Power Requirements	-BGx Models	AC 24 V (AC 18 V to 30 V) at 50/60 Hz: Class 2 (North America) or Safety Extra-Low Voltage (SELV) (Europe), 6.1 VA Running, 1.2 VA Holding Position DC 24 V (DC 21.6 V to 28.8 V): Class 2 (North America) or SELV (Europe), 3.5 W Running, 0.5 W Holding Position Minimum Transformer Size: 7 VA per Actuator
	-BAx Models	AC 120 V (AC 102 V to 132 V) at 60 Hz: 0.05 A Running, 0.03 A Holding Position
	-BDx Models	AC 230 V (AC 198 V to 264 V) at 50/60 Hz: 0.04 A Running, 0.03 A Holding Position
Auxiliary Switch Rating	-xxC Models	Two SPDT, Double-Insulated Switches with Gold over Silver Contacts: AC 24 V, 50 VA Pilot Duty AC 120 V, 5.8 A Resistive, 1/4 hp, 275 VA Pilot Duty AC 240 V, 5.0 A Resistive, 1/4 hp, 275 VA Pilot Duty
Spring Return		Direction is Selectable with Mounting Position of Actuator: Actuator Side A is away from Damper or Valve: CCW Spring Return Actuator Side B is away from Damper or Valve: CW Spring Return
Rated Torque	Power On (Running)	70 lb-in (8 N-m) All Operating Temperatures
	Power Off (Spring Returning)	70 lb-in (8 N-m) at Standard Operating Temperatures 53 lb-in (6 N-m) at Extended Operating Temperatures
Rotation Range		Maximum Full Stroke: 95° Adjustable Stop: 35 to 95°, Maximum Position
Rotation Time for 90 Degrees of Travel	Power On (Running)	55 to 71 Seconds for 0 to 70 lb-in (8 N-m) Load, at All Operating Conditions 60 Seconds Nominal at Full Rated Load (0.25 rpm)
	Power Off (Spring Returning)	13 to 26 Seconds for 0 to 70 lb-in (8 N-m) Load, at Room Temperature 21 Seconds Nominal at Full Rated Load 39 Seconds Maximum with 70 lb-in (8 N-m) Load at -4°F (-20°C) 108 Seconds Maximum with 53 lb-in (6 N-m) Load at -40°F (-40°C)
Life Cycles		60,000 Full-Stroke Cycles with 70 lb-in (8 N-m) Load
Audible Noise Rating	Power On (Running)	< 47 dBA at 70 lb-in (8 N-m) Load, at a Distance of 39-13/32 in. (1 m)
	Power On (Holding)	< 20 dBA at a Distance of 39-13/32 in. (1 m)
	Power Off (Spring Returning)	< 52 dBA at 70 lb-in (8 N-m) Load, at a Distance of 39-13/32 in. (1 m)
Electrical Connections	Actuator (All Models)	48 in. (1.2 m) UL 758 Type AWM Halogen-Free Cable with 18 AWG (0.85 mm ²) Conductors and 0.25 in. (6 mm) Ferrule Ends
	Auxiliary Switches (-xxC Models)	48 in. (1.2 m) UL 758 Type AWM Halogen-Free Cable with 18 AWG (0.85 mm ²) Conductors and 0.25 in. (6 mm) Ferrule Ends
Conduit Connections		Integral Connectors for 3/8 in. (10 mm) Flexible Metal Conduit
Mechanical Connections	Round Shafts	Range of Sizes: 5/16 to 5/8 in. (8 to 16 mm)
	Square Shafts	Range of Sizes: 1/4 to 1/2 in. (6 to 12 mm)

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M9208-xxx-x Series Electric Spring-Return Actuators (Continued)

M9208-Bxx-3 Series On/Off Electric Spring-Return Actuators (Part 2 of 2)		
Ambient Conditions	Extended Operating	-40 to -4°F (-40 to -20°C); 90% RH Maximum, Noncondensing
	Storage	-40 to 185°F (-40 to 85°C); 95% RH Maximum, Noncondensing
Dimensions	6.33 x 3.90 x 2.26 in. (160.7 x 99 x 57.5 mm)	
Compliance 	United States	UL Listed, CCN XAPX, File E27734; to UL 60730-1A: 2003-08, Ed. 3.1, Automatic Electrical Controls for Household and Similar Use; and UL 60730-2-14: 2002-02, Ed. 1, Part 2, Particular Requirements for Electric Actuators. (Models: All)
	Canada	UL Listed, CCN XAPX7, File E27734; to UL 60730-1:02-CAN/CSA: July 2002, 3rd Ed., Automatic Electrical Controls for Household and Similar Use; and CSA C22.2 No. 24-93 Temperature Indicating and Regulating Equipment (Models: All).
	Europe	CE Mark – Johnson Controls, Inc. declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive 2004/108/EC and Low Voltage Directive 2006/95/EC.
	Australia and New Zealand	C-Tick Mark, Australia/NZ Emissions Compliant (Models: All)
Shipping Weight	Models: -BGC: 3.75 lb (1.7 kg) Models: -BAC and -BDC: 4.15 lb (1.9 kg)	

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M9220 Series Electric Spring-Return Actuators

Description

The M9220-xxx-3 actuators are direct-mount, spring-return electric actuators that operate with these available power options:

- AC 24 V at 50/60 Hz or DC 24 V (AGx, BGx, GGx, HGx)
- AC 120 V at 60 Hz (BAx)
- AC 230 V at 50/60 Hz (BDx)

These bidirectional actuators do not require a damper linkage, and are easily installed on dampers with 1/2 to 3/4 in. or 12 to 19 mm round shafts, or 3/8 and 1/2 in. or 10, 12, and 14 mm square shafts using the standard shaft clamp included with the actuator. An optional M9220-600 Jackshaft Coupler Kit is available for 3/4 to 1-1/16 in. or 19 to 27 mm round shafts, or 5/8 and 3/4 in. or 16, 18, and 19 mm square shafts.

A single M9220-xxx-3 Electric Spring-Return Actuator provides a running and spring-return torque of 177 lb-in (20 N-m). Two or three models mounted in tandem deliver twice or triple the torque. Integral line voltage auxiliary switches are available on the -xxC models to indicate end-stop position or to perform switching functions within the selected rotation range.

Refer to the *M9220-xxx-3 Electric Spring-Return Actuators Product Bulletin (LIT-12011057)* for important product application information.

Features

- Available Torques of 177 lb-in (20 N-m) for Single Actuators, 354 lb-in (40 N-m) for Two Models, and 531 lb-in (60 N-m) for Three Models Mounted in Tandem — offer a selection that is most suitable for the application.
- Reversible Mounting Design — simplifies installation and enables the actuator to spring return in either direction.
- Electronic Stall Detection throughout Entire Rotation Range — extends the life of the actuator by deactivating the actuator motor when an overload condition is detected.
- Removable Coupler — adapts to a shorter damper shaft.
- Integral 48 in. (1.2 m) Halogen-Free Cables with Colored and Numbered Conductors — simplify field wiring.
- Integral Auxiliary Switches (xxC Models) — provide one fixed and one adjustable switch point with line voltage capability.
- NEMA 2 (IP54) Rated Aluminum Enclosure — protects the internal components of the actuator from dirt and moisture.
- Easy-to-Use Locking Manual Override with Auto Release and Crank Storage — allows for manual positioning of the actuator hub.
- Integral Connectors for 3/8 in. Flexible Metal Conduit — simplify installation and field wiring.
- Microprocessor-Controlled Brushless DC Motor (-AGx, -GGx, and -HGx types) — provides constant run-time independent of torque.



M9220 Series Electric Spring-Return Actuator

Applications

The M9220-xxx-3 Electric Spring-Return Actuators provide reliable control of dampers and valves in HVAC systems. The M9220-xxx-3 Actuators are available for use with on/off, floating, and proportional controllers.

Repair Information

If the M9220 Series Electric Actuator fails to operate within its specifications, replace the unit. For a replacement actuator, contact the nearest Johnson Controls® representative.

Selection Chart

Code Number	Control Type	Auxiliary Switches	Power Requirements
M9220-AGA-3	Floating	None	AC 24 V at 50/60 Hz or DC 24 V
M9220-AGC-3	Floating	Two	AC 24 V at 50/60 Hz or DC 24 V
M9220-BAA-3	On/Off	None	AC 120 V at 60 Hz
M9220-BAC-3	On/Off	Two	AC 120 V at 60 Hz
M9220-BDA-3	On/Off	None	AC 230 V at 50/60 Hz
M9220-BDC-3	On/Off	Two	AC 230 V at 50/60 Hz
M9220-BGA-3	On/Off	None	AC 24 V at 50/60 Hz or DC 24 V
M9220-BGC-3	On/Off	Two	AC 24 V at 50/60 Hz or DC 24 V
M9220-GGA-3	Proportional	None	AC 24 V at 50/60 Hz or DC 24 V
M9220-GGC-3	Proportional	Two	AC 24 V at 50/60 Hz or DC 24 V
M9220-HGA-3	Proportional with Adjustable Zero and Span	None	AC 24 V at 50/60 Hz or DC 24 V
M9220-HGC-3	Proportional with Adjustable Zero and Span	Two	AC 24 V at 50/60 Hz or DC 24 V

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M9220 Series Electric Spring-Return Actuators (Continued)

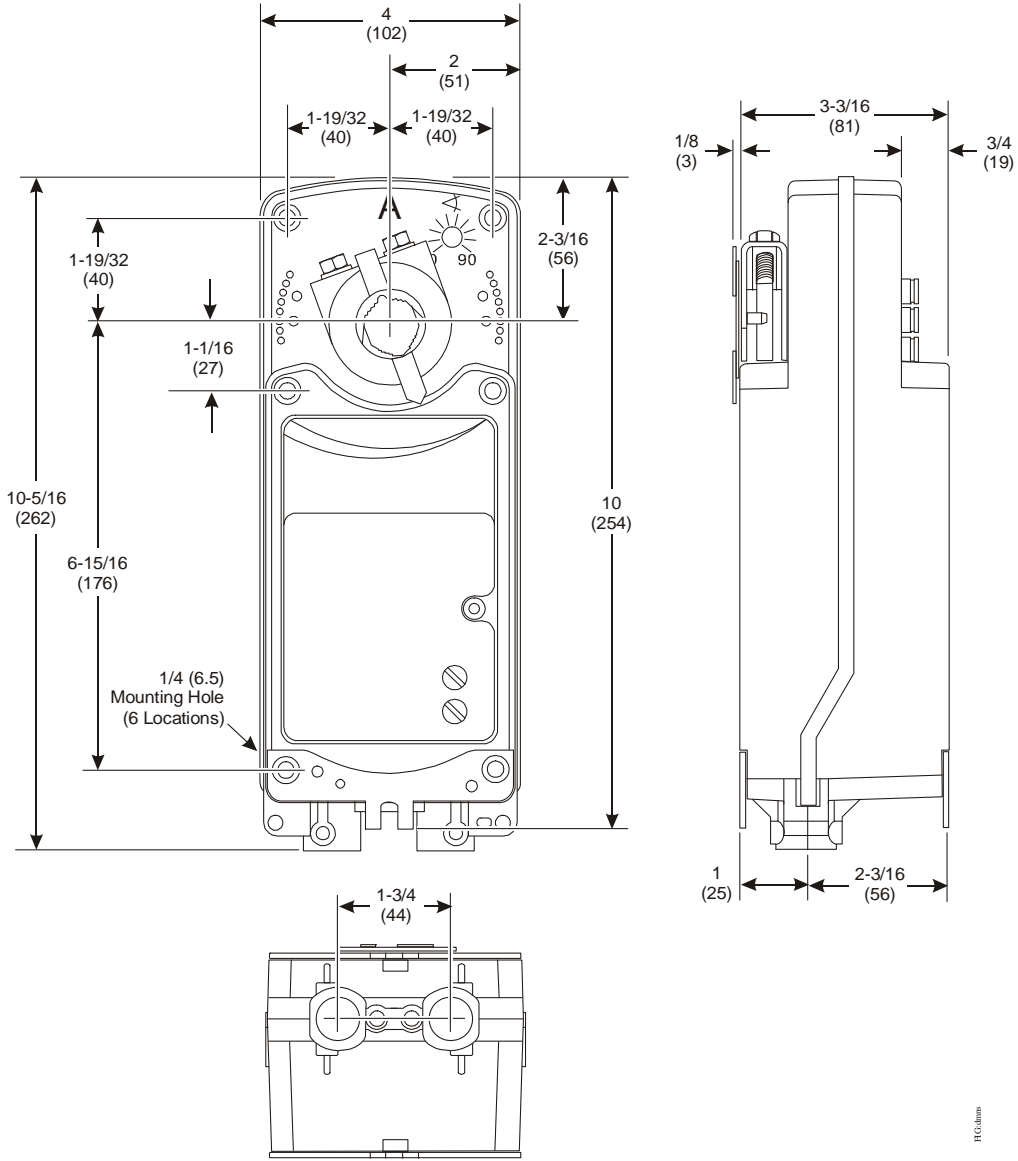
Accessories

Code Number	Description
DMPR-KC003 ¹	7 in. (178 mm) Blade Pin Extension (without Bracket) for Johnson Controls Direct-Mount Damper Applications (Quantity 5)
M9000-153	Crankarm (Quantity 1)
M9000-158	Tandem Mounting Kit Used to Mount Two Models of M9220-xxx-3 Series Proportional Electric Spring-Return Actuators (Quantity 1)
M9000-170	Remote Mounting Kit, Horizontal. Kit Includes Mounting Bracket, M9000-153 Crankarm, Ball Joint, and Mounting Bolts (Quantity 1)
M9000-171	Remote Mounting Kit, Vertical. Kit Includes Mounting Bracket, M9000-153 Crankarm, Ball Joint, and Mounting Bolts (Quantity 1)
M9000-200	Commissioning Tool that Provides a Control Signal to Drive 24 V On/Off, Floating, Proportional, and/or Resistive Electric Actuators (Quantity 1)
M9000-320	Weather Shield Enclosure - NEMA 3R Enclosure for Protecting a Single M9210/20 Actuator from Rain, Sleet, or Snow (Quantity 1)
M9000-400	Jackshaft Linkage Kit. Open-Ended Design Enables Clamping onto a Jackshaft without Requiring Access to the Ends of the Jackshaft (Quantity 1)
M9000-604	Replacement Anti-Rotation Bracket Kit (with Screws) for M9220-xxx-3 Series Proportional Electric Spring-Return Actuators (Quantity 1)
M9200-100	Threaded Conduit Adapter, 1/2 NPSM, for M9210(20) and M(VA)9208 Series Actuators (Quantity 5)
M9220-600	1 in. (25 mm) Jackshaft Coupler Kit (with Locking Clip) for Mounting M9220-xxx-3 Proportional Electric Spring-Return Actuators on Dampers with 3/4 to 1-1/16 in. or 19 to 27 mm Round Shafts, or 5/8 and 3/4 in. or 16, 18, and 19 mm Square Shafts (Quantity 1)
M9220-601	Replacement Coupler Kit (with Locking Clip) for Mounting M9220-xxx-3 Proportional Electric Spring-Return Actuators on Dampers with 1/2 to 3/4 in. or 12 to 19 mm Round Shafts, or 3/8 and 1/2 in. or 10, 12, and 14 mm Square Shafts (Quantity 1)
M9220-602	Replacement Locking Clips for M9220-xxx-3 Proportional Electric Spring-Return Actuators (Five per Bag)
M9220-603	Adjustable Stop Kit for M9220-xxx-3 Proportional Electric Spring-Return Actuators (Quantity 1)
M9220-604	Replacement Manual Override Cranks for M9220-xxx-3 Proportional Electric Spring-Return Actuators (Five per Bag)
M9220-610	Replacement Shaft Gripper, 10 mm Square Shaft with Locking Clip (Quantity 1)
M9220-612	Replacement Shaft Gripper, 12 mm Square Shaft with Locking Clip (Quantity 1)
M9220-614	Replacement Shaft Gripper, 14 mm Square Shaft with Locking Clip (Quantity 1)

1. Furnished with the damper and may be ordered separately

M9220 Series Electric Spring-Return Actuators (Continued)

Dimensions



M9220-xxx-3 Electric Spring-Return Actuator Dimensions, in. (mm)

11/16/14mm

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M9220 Series Electric Spring-Return Actuators (Continued)

Technical Specifications

M9220 Series Electric Spring-Return Actuators (Part 1 of 2)		
Product Codes		M9220-AGx-3 Models: Floating M9220-Bxx-3 Models: On/Off M9220-GGx-3 Models: Proportional M9220-HGx-3 Models: Proportional Adjustable
Power Requirements	AGx, HGx, GGx Models	AC 24 V (19.2 to 30 V) at 50/60 Hz: Class 2, 15.5 VA Running, 7.7 VA Holding Position; DC 24 V (21.6 to 26.4 V): Class 2, 6.7 W Running, 2.9 W Holding Position
	BAx Models	AC 120 V (AC 102 to 132 V) at 60 Hz: 0.25 A Running, 0.13 A Holding Position
	BDx Models	AC 230 V (AC 198 to 264 V) at 50/60 Hz: 0.15 A Running, 0.09 A Holding Position
	BGx Models	AC 24 V (19.2 to 30 V) at 50/60 Hz: Class 2, 24.6 VA Running, 7.7 VA Holding Position; DC 24 V (21.6 to 26.4 V): Class 2, 17.6 W Running, 2.8 W Holding Position
Transformer Sizing Requirements	AGx, HGx, GGx Models	20 VA Minimum per Actuator
	Bxx Models	25 VA Minimum per Actuator
Input Signal/Adjustments	AGx Models	DC 0 (2) to 10 V or 0 (4) to 20 mA with Field Furnished 500 Ohm Resistor; Switch Selectable Direct or Reverse Action with Signal Increase, 500 ms Minimum Pulse Width
	GGx Models	Factory Set DC 0 to 10 V, CW Rotation with Signal Increase; Selectable DC 0 (2) to 10 V or 0 (4) to 20 mA with Field Furnished 500 Ohm, 0.25 W Minimum Resistor; Switch Selectable Direct or Reverse Action with Signal Increase
	HGx Models	Factory Set DC 0 to 10 V, CW Rotation with Signal Increase; Selectable DC 0 to 10 V or 0 to 20 mA with Field Furnished 500 Ohm, 0.25 W Minimum Resistor; Start Point Programmable DC 0 to 10 V; Span Programmable DC 2 to 10 V; Switch Selectable Direct or Reverse Action with Signal Increase
Control Input Impedance	GGx, HGx Models	Voltage Input: 200,000 Ohms; Current Input: 500 Ohms with Field Furnished 500 Ohm Resistor
Feedback Signal	GGx Models	0 (2) to 10 VDC for Desired Rotation Range up to 90°; Corresponds to Rotation Limits, 1 mA Maximum
	HGx Models	0 to 10 VDC for Desired Rotation Range up to 90°; Corresponds to Rotation Limits, 1 mA Maximum
Auxiliary Switch Rating	xxC Models	Two Single-Pole, Double-Throw (SPDT), Double-Insulated Switches with Gold Flash Contacts: AC 24 V, 50 VA Pilot Duty; AC 120 V, 5.8 A Resistive, 1/4 hp, 275 VA Pilot Duty; AC 240 V, 5.0 A Resistive, 1/4 hp, 275 VA Pilot Duty
Spring Return		Direction is Selectable with Mounting Position of Actuator: Side A, Actuator Face away from Damper for CCW Spring Return; Side B, Actuator Face away from Damper for CW Spring Return
Running and Spring Return Torque		177 lb-in (20 N-m) for a Single Actuator; 354 lb-in (40 N-m) for Two Models Mounted in Tandem 531 lb-in (60 N-m) for Three Models Mounted in Tandem
Valid Tandem Combinations		Two M9220-Bxx-3 Three M9220-AGx-3 One M9220-HGx-3 Master with One or Two M9220-GGx-3 Slaves One M9220-GGx-3 Master with One or Two M9220-GGx-3 Slaves
Rotation Range		Adjustable from 30 to 90° CW or CCW with Optional M9220-603 Adjustable Stop Kit; Mechanically Limited to 90°
Rotation Time Power On (Running)	AGx, HGx, GGx Models	150 Seconds for 0 to 177 lb-in (0 to 20 N-m) at All Operating Conditions; Independent of Load
	BGx Models	24 to 57 Seconds for 0 to 177 lb-in (0 to 20 N-m) at All Operating Conditions; 35 Seconds Nominal at Full Rated Load
Rotation Time Power Off (Spring Returning)	AGx, HGx, GGx Models	20 Seconds for 0 to 177 lb-in (0 to 20 N-m) at Room Temperature
	BGx Models	11 to 15 Seconds for 0 to 177 lb-in (0 to 20 N-m) at Room Temperature; 35 Seconds Maximum for 0 to 177 lb-in (0 to 20 N-m) at -22°F (-30°C) 130 Seconds Maximum for 0 to 177 lb-in (0 to 20 N-m) at -40°F (-40°C)
Cycles		60,000 Full Stroke Cycles; 1,500,000 Repositions
Audible Noise Rating (AGx, HGx, GGx Models)	Power On (Running)	< 40 dBA at 39-13/32 in. (1 m)
	Power On (Holding)	< 20 dBA at 39-13/32 in. (1 m)
	Power Off (Spring Returning)	< 55 dBA at 39-13/32 in. (1 m)

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M9220 Series Electric Spring-Return Actuators (Continued)

M9220 Series Electric Spring-Return Actuators (Part 2 of 2)		
Audible Noise Rating (BGx Models)	Power On (Running)	< 66 dBA at 39-13/32 in. (1 m)
	Power On (Holding)	< 18 dBA at 39-13/32 in. (1 m)
	Power Off (Spring Returning)	< 66 dBA at 39-13/32 in. (1 m)
Electrical Connections	Actuator (All Models)	48 in. (1.2 m) Halogen-Free Cable with 18 AWG (0.75 mm ²) Wire Leads
	Auxiliary Switches (xxC Models)	48 in. (1.2 m) Halogen-Free Cable with 18 AWG (0.75 mm ²) Wire Leads
Conduit Connections		Integral Connectors for 3/8 in. (10 mm) Flexible Metal Conduit
Mechanical Connections	Standard Shaft Clamp Included with Actuator	1/2 to 3/4 in. or 12 to 19 mm Diameter Round Shafts, or 3/8 and 1/2 in. or 10, 12, and 14 mm Square Shafts
	Optional M9220-600 Jackshaft Coupler Kit	3/4 to 1-1/16 in. or 19 to 27 mm Diameter Round Shafts, or 5/8 and 3/4 in. or 16, 18, and 19 mm Square Shafts
Aluminum Enclosure		NEMA 2 (IP54) for All Mounting Orientations
Ambient Conditions	Operating	-40 to 131°F (-40 to 55°C); 90% RH Maximum, Noncondensing
	Storage	-85 to 185°F (-65 to 85°C); 95% RH Maximum, Noncondensing
Dimensions		See Dimensions .
Compliance 	United States	UL Listed, CCN XAPX, File E27734; to UL 60730-1A: 2003-08, Ed. 3.1, Automatic Electrical Controls for Household and Similar Use; and UL 60730-2-14: 2002-02, Ed. 1, Part 2, Particular Requirements for Electric Actuators. (Models: All)
	Canada	UL Listed, CCN XAPX7, File E27734; to UL 60730-1:02-CAN/CSA: July 2002, 3rd Ed., Automatic Electrical Controls for Household and Similar Use; and CSA C22.2 No. 24-93 Temperature Indicating and Regulating Equipment (Models: All).
	Europe	CE Mark – Johnson Controls, Inc. declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive 2004/108/EC and Low Voltage Directive 2006/95/EC.
	Australia and New Zealand	C-Tick Mark, Australia/NZ Emissions Compliant (Models: All)
Shipping Weight	xGx Models	6.4 lb (2.9 kg)
	BAx and BDx Models	7.6 lb (3.5 kg)

The performance specifications are nominal and conform to acceptable industry standards. For applications at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products. © 2014 Johnson Controls, Inc. www.johnsoncontrols.com

Field Equipment Controller (FEC) Series Catalog Page

Code No. LIT-1900346
 Issued November 1, 2013
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Refer to the [QuickFit website](#) for important updates to this document.

The Field Equipment Controller (FEC) Series products are programmable BACnet® Application Specific Controllers (B-ASCs) with integral Master-Slave/Token-Passing (MSTP) communications. FEC models include the 10-point FEC16 Series and the 17-point FEC26 Series.

FECs feature 32-bit microprocessor architecture, patented continuous tuning adaptive control, peer-to-peer communications, and are available with an optional built-in LCD screen local UI.

A full range of FEC models combined with the Input/Output Module (IOM) models can be applied to a wide variety of building applications ranging from simple fan coil or heat pump control to advanced central plant management.

All FEC Series Controllers support wireless communications using the ZigBee® Field Router (ZFR) Series accessories.

Important: You cannot purchase a similar third-party device and install it in a UL/ULC Listed smoke control system. Doing so voids the UL/ULC Smoke Control Listing. Third-party devices must be provided and labeled by the factory as described in the UL/ULC Smoke Control Listing.

Important: Only those Johnson Controls products identified for use in smoke control applications have been tested and listed by UL for use in a Metasys System UI. 8th Edition ULJKLQRD-C100-13 ULJKL-C Smoke Control System. Installation of a product that is not UL/ULC Listed and labeled for this application prevents the entire system from being UL/ULC Listed for smoke control.

Refer to the Metasys® System Field Equipment Controllers and Related Products Product Bulletin (LIT-12011042) for product application details.

Features

- Standard BACnet Protocol - Provides interoperability with other Building Automation System (BAS) products that use the widely accepted BACnet standard.
- Standard Hardware and Software Platform - Uses a common hardware design throughout the family line to support standardized wiring practices and installation workflows. Also uses a common software design to support use of a single tool for control applications, commissioning, and troubleshooting to minimize technical training.
- ZigBee™ Wireless Field Controller (FC)/Sensor/Actuator (SA) Bus Interface - Provides a wireless alternative to hard-wired Metasys® system counterparts, providing application flexibility and mobility with minimal disruption to building occupants.
- Bluetooth® Wireless Commissioning Interface - Provides an easy-to-use connection to the configuration and commissioning tool.
- Auto-Tuned Control Loops - Reduce commissioning time, eliminate change-of-season re-commissioning, and reduce wear and tear on mechanical devices.
- Universal Inputs, Configurable Outputs, and Point Expansion Modules - Allow multiple signal options to provide input/output flexibility.

- Optional Local User Interface Display - Allows convenient monitoring and adjusting capabilities at the local device.
- BACnet Testing Laboratories™ (BTL) Listing - Ensures interoperability with other BTL-listed devices. BTL is a third-party agency which validates that BAS vendor products meet the BACnet industry standard protocol.
- 32-bit microprocessor ensures optimum performance and meets industry specifications.
- BACnet Automatic Discovery support enables easy controller integration into Metasys BAS.
- Integral end-of-line (EOL) switch enables field controller as a terminating device on the communications bus.
- Pluggable communications bus and supply power terminal blocks expedite installation and troubleshooting.
- Wireless capabilities via a ZFR1800 Series Wireless Field Bus System enable wireless mesh connectivity between Metasys field controllers to WR2 Series Wireless Room Temperature Sensors and to supervisory controllers, facilitating easy initial location and relocation.
- Patented proportional adaptive control (P-Adaptive) and Pattern Recognition Adaptive Control (PRAC) technologies provide continuous loop tuning.
- Writable flash memory allows standard or customized applications to be downloaded from the Controller Configuration Tool (CCT) and enables persistent application data.
- Large product family provides a wide range of point mix to meet application requirements and allows for the addition of one or more IOMs and/or Network Sensors to provide even more I/O capacity.
- Local UI display provides enhanced local monitoring.
- User-friendly graphic theme and clear push-button identification facilitate easy navigation of the integral or optional UI display.

If the product fails to operate within its specifications, replace the product. For a replacement product, contact the nearest Johnson Controls representative.

Figure 1: FEC2621 Field Equipment Controller with Integral Local Display



Table 1: FEC Series Point Type Counts per Model

Point Types	Signals Accepted	FEC16	FEC26
Universal Input (UI)	Analog Input, Voltage Mode, 0–10 VDC Analog Input, Current Mode, 4–20 mA ¹ Analog Input, Resistive Mode, 0–2k ohm, resistance temperature detector (RTD) (1k NI [Johnson Controls], 1k PT, A99B SI), negative temperature coefficient (NTC) (10k Type L, 2.252k Type 2) Binary Input, Dry Contact Maintained Mode	2	6
Binary Input (BI)	Dry Contact Maintained Mode Pulse Counter/Accumulator Mode (High Speed), 100 Hz	1	2
Analog Output (AO)	Analog Output, Voltage Mode, 0–10 VDC Analog Output, Current Mode, 4–20 mA		2
Binary Output (BO)	24 VAC Triac	3	3
Configurable Output (CO)	Analog Output, Voltage Mode, 0–10 VDC Binary Output Mode, 24 VAC Triac	4	4

¹ Analog Input, Current Mode is set by hardware for the FEC26, and by software for the FEC16.

Table 2: FEC Series Ordering Information

Product Code Number	Description
MS-FEC1611-0	10-Point Field Equipment Controller with 2 UI, 1 BI, 3 BO, and 4 CO; 24 VAC; FC and SA Bus Support
MS-FEC1611-0ET	FEC1611 Extended Temperature Controller for Rooftop Applications. Supports Operational Temperature Range of -40 to 70°C.
MS-FEC1621-0	10-Point Field Equipment Controller with 2 UI, 1 BI, 3 BO, and 4 CO; 24 VAC; FC and SA Bus Support; Integral Display and 6-Button Navigation Touch Pad
MS-FEC2611-0	17-Point Field Equipment Controller with 6 UI, 2 BI, 3 BO, 2 AO, and 4 CO; 24 VAC; FC and SA Bus Support
MS-FEC2611-0ET	FEC2611 Extended Temperature controller for rooftop applications. Supports Operational Temperature Range of -40 to 70°C.
MS-FEC2621-0	17-Point Field Equipment Controller with 6 UI, 2 BI, 3 BO, 2 AO, and 4 CO; 24 VAC; FC and SA Bus Support; Integral Display and 6-Button Navigation Touch Pad

Table 3: FEC Series for Smoke Control Ordering Information

Product Code Number ^{1, 2}	Description
MS-FEC1611-0U	10-Point Field Equipment Controller with 2 UI, 1 BI, 3 BO, and 4 CO; 24 VAC, SA Bus, Mounting Base
MS-FEU1610-0U	10-Point Field Equipment Controller with 2 UI, 1 BI, 3 BO, and 4 CO; 24 VAC; FC and SA Bus Support; Mounting Base and Cover
MS-FEC2611-0U	17-Point Field Equipment Controller with 6 UI, 2 BI, 3 BO, 2 AO, and 4 CO; 24 VAC, SA Bus, Mounting Base
MS-FEU2610-0U	17-Point Field Equipment Controller with 6 UI, 2 BI, 3 BO, 2 AO, and 4 CO; 24 VAC; FC and SA Bus Support; Mounting Base and Cover

¹ These devices are UL/ULC 864 Listed, File S4977, 9th Edition UUKL/ORD-C100-13 UUKLC Smoke Control System.

² You cannot purchase a similar third-party device and install it in a UL/ULC Listed smoke control system. Doing so voids the UL/ULC Smoke Control Listing. Third-party devices must be provided and labeled by the factory as described in the UL/ULC Smoke Control Listing.

Accessories

Table 4: FEC Accessories

Product Code Number	Description
MS-DIS1710-0	Local Controller Display: Refer to <i>Local Controller Display Product Bulletin (LIT-12011273)</i> for more information.
MS-BTCVT-1	Wireless Commissioning Converter with Bluetooth® Technology
LP-KIT204-000C	BACnet® IP to Master-Slave/Token-Passing (MS/TP) Router for Connecting a Computer with CCT to MS/TP Field Controllers
MS-ZFR1811-0	Wireless Field Bus Router, 10 mW Transmission Power. Functions with Metasys BACnet FECs, VMA16s, and WRZ-TTx Series Wireless Mesh Room Temperature Sensors
MS-ZFRCBL-0	Wire Harness for Use with ZFR1811 Router. Allows ZFR1811 Router to function with FEC16xx Series, VMA16xx Series, FAC26xx Series, and FEC26xx Series Controllers in Conjunction with NS Series Sensors, Wireless Commissioning Converter, or DIS1710 Local Controller Display
MS-BTCVTCBL-700	Cable Replacement Set for the MS-BTCVT-1 or the NS-ATV7003-0; Includes One 5 ft (1.5 m) Retractable Cable
WRZ Series Sensors	WRZ Series Wireless Room Sensors: Refer to the <i>WRZ Series Wireless Room Sensors Product Bulletin (LIT-12011653)</i> for specific sensor model descriptions.
NS Series Sensors	NS Series Network Sensors: Refer to the <i>NS Series Network Sensors Product Bulletin (LIT-12011574)</i> for specific sensor model descriptions.

Table 4: FEC Accessories


Product Code Number	Description
Y64T15-0	Transformer, 120/208/240 VAC Primary to 24 VAC Secondary, 92 VA, Foot Mount, 30 in. Primary Leads and 30 in. Secondary Leads, Class 2
Y65A13-0	Transformer, 120 VAC Primary to 24 VAC Secondary, 40 VA, Foot Mount (Y65AS), 8 in. Primary Leads and 30 in. Secondary Leads, Class 2
Y65T42-0	Transformer, 120/208/240 VAC Primary to 24 VAC Secondary, 40 VA, Hub Mount (Y65SP+), 8 in. Primary Leads and Secondary Screw Terminals, Class 2
Y65T31-0	Transformer, 120/208/240 VAC Primary to 24 VAC Secondary, 40 VA, Foot Mount (Y65AR+), 8 in. Primary Leads and Secondary Screw Terminals, Class 2
AP-TBK4SA-0	Replacement MS/TP SA Bus Terminal, 4-Position Connector, Brown, Bulk Pack
AP-TBK4FC-0	Replacement MS/TP FC Bus Terminal, 4-Position Connector, Blue, Bulk Pack
AP-TBK3PW-0	Replacement Power Terminal, 3-Position Connector, Gray, Bulk Pack
ZFR-USBHA-0	<p>USB Dongle with ZigBee™ Driver provides a wireless connection through CCT to allow wireless commissioning of the wirelessly enabled FEC, Advanced Application Field Equipment Controller (FAC), IOM, and VMA16 controllers. Also allows use of the ZFR Checkout Tool (ZCT) in CCT.</p> <p>Note: The ZFR-USBHA-0 replaces the IA OEM DAUBI_2400 ZigBee USB dongle. For additional information on the ZFR-USBHA-0 ZigBee dongle, refer to the <i>ZFR1800 Series Wireless Field Bus System Technical Bulletin (LIT-12011295)</i> or <i>ZFR1800 Series Wireless Field Bus System Quick Reference Guide (LIT-12011630)</i>.</p>
TL-BRTRP-0	Portable BACnet IP to MS/TP Router

FEC Series Technical Specifications

Table 5: FEC Series

Product Code Numbers	<p>MS-FEC1611-0: 10-Point FEC</p> <p>MS-FEC2611-0: 17-Point FEC</p> <p>MS-FEC1621-0: 10-Point FEC with Integral Display and Push Button User Interface</p> <p>MS-FEC2621-0: 17-Point FEC with Integral Display and Push Button User Interface</p> <p>Smoke Control Models:</p> <p>MS-FEC1611-0U: 10-Point FEC</p> <p>MS-FEU1610-0U: 10-Point FEC</p> <p>MS-FEC2611-0U: 17-Point FEC</p> <p>MS-FEU2610-0U: 17-Point FEC</p>
Supply Voltage	24 VAC (nominal, 20 VAC minimum/30 VAC maximum), 50/60 Hz, Power Supply Class 2 (North America), Safety, Extra-Low Voltage (SELV) (Europe)
Power Consumption	<p>14 VA maximum for FEC1611 and FEC2611 (no integral display)</p> <p>20 VA maximum for FEC1621 and FEC 2621 (with integral display)</p> <p>Note: VA ratings do not include any power supplied to the peripheral devices connected to Binary Outputs (BOs) or Configurable Outputs (COs), which can consume up to 12 VA for each BO or CO, for a possible total consumption of an additional 84 VA (maximum).</p>
Ambient Conditions	<p>Operating: 0 to 50°C (32 to 122°F); 10 to 90% RH noncondensing</p> <p>Storage: -40 to 80°C (-40 to 176°F); 5 to 95% RH noncondensing</p> <p>Note: FEC models with an -0ET suffix have an operating temperature range of -40 to 70°C (-40 to 158°F).</p>
Controller Addressing	<p>DIP switch set; valid field controller device addresses 4–127</p> <p>(Device addresses 0–3 and 128–255 are reserved and not valid field controller addresses.)</p>
Communications Bus¹	<p>BACnet MS/TP, RS-485:</p> <p>3-wire FC Bus between the supervisory controller and field controllers</p> <p>4-wire SA Bus between field controller, network sensors, and other sensor/actuator devices, includes a lead to source 15 VDC supply power (from field controller) to bus devices</p>
Processor	H8SX/166xR Renesas® 32-bit microcontroller
Memory	1 MB Flash Memory and 512 KB Random Access Memory (RAM)

Table 5: FEC Series

Input and Output Capabilities	FEC16 Models: 2 - Universal Inputs: Defined as 0–10 VDC, 4–20 mA, 0–600k ohm, or Binary Dry Contact 1 - Binary Inputs: Defined as Dry Contact Maintained or Pulse Counter/Accumulator Mode 3 - Binary Outputs: Defined as 24 VAC Triac (selectable internal or external source power) 4 - Configurable Outputs: Defined as 0–10 VDC or 24 VAC Triac BO FEC26 Models: 6 - Universal Inputs: Defined as 0–10 VDC, 4–20 mA, 0–600k ohm, or Binary Dry Contact 2 - Binary Inputs: Defined as Dry Contact Maintained or Pulse Counter/Accumulator Mode 3 - Binary Outputs: Defined as 24 VAC Triac (selectable internal or external source power) 4 - Configurable Outputs: Defined as 0–10 VDC or 24 VAC Triac BO 2 - Analog Outputs: Defined as 0–10 VDC or 4–20 mA
Analog Input/Analog Output Resolution and Accuracy	Analog Input: 16-bit resolution Analog Output: 16-bit resolution and ±200 mV in 0–10 VDC applications
Terminations	Input/Output: Fixed Screw Terminal Blocks FC Bus, SA Bus, and Supply Power: 3-wire and 4-wire Pluggable Screw Terminal Blocks FC Bus Port and Sensor Port: RJ-12 6-pin Modular Jacks
Mounting	Horizontal on single 35 mm DIN rail mount (preferred), or screw mount on flat surface with three integral mounting clips on controller
Housing	Enclosure material: ABS and polycarbonate UL94 5VB; self-extinguishing; Plenum-rated protection class: IP20 (IEC529)
Dimensions (Height x Width x Depth)	FEC16 Models: 150 x 164 x 53 mm (5-7/8 x 6-7/16 x 2-1/8 in.) including terminals and mounting clips FEC26 Models: 150 x 190 x 53 mm (5-7/8 x 7-1/2 x 2-1/8 in.) including terminals and mounting clips Note: Mounting space for all field controllers requires an additional 50 mm (2 in.) space on top, bottom, and front face of controller for easy cover removal, ventilation, and wire terminations.
Weight	FEC16 Models: 0.4 kg (0.9 lb) FEC26 Models: 0.5 kg (1.1 lb)
Compliance 	United States: UL Listed, File E107041, CCN PAZX, UL 916, Energy Management Equipment; UL/ULc 864 Listed, File S4977, 9th Edition UUKL/ORD-C100-13 UUKLC Smoke Control System (models with U product code suffix only); FCC Compliant to CFR47, Part 15, Subpart B, Class A Canada: UL Listed, File E107041, CCN PAZX7, CAN/CSA C22.2 No. 205, Signal Equipment; Industry Canada Compliant, ICES-003 Europe: CE Mark – Johnson Controls, Inc., declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive 2004/108/EC. Note: For FEC26 models, conducted RF Immunity within EN 61000-6-2 meets performance criteria B. Australia and New Zealand: C-Tick Mark, Australia/NZ Emissions Compliant BACnet International: BACnet Testing Laboratories (BTL) Protocol Revision 4 Listed BACnet Application Specific Controller (B-ASC)

1 For more information, refer to the *MS/TP Communications Bus Technical Bulletin (LIT-12011034)*.



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Input/Output Module (IOM) Series Controllers Catalog Page

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Refer to the [Quick Start](#) section for the complete details of this document.

The Input/Output Module (IOM) Series Controllers are BACnet® Application Specific Controllers (ASCs) with integral RS-485 Master-Slave/Token-Passing (MSTP) communications. IOM controllers integrate into the web-based Metasys® system.

IOMs can serve in one of two capacities, depending on where they are installed in the Metasys system. When installed on the Sensor/Actuator (SA) Bus of an Field Equipment Controller (FEC), Advanced Application Field Equipment Controller (AAFC), or VMA controller, the IOMs expand the point count of these controllers. When installed on the Field Controller (FC) Bus, IOMs can be used as I/O point multipliers to support monitoring and control from an Network Automation Engine (NAE) or Network Control Engine (NCE). The point multiplier can also be useful for sharing points between other field controllers on the FC Bus using peer-to-peer connectivity.

A full range of FEC models combined with the IOM models can be applied to a wide variety of building applications ranging from simple fan coil or heat pump control to advanced central plant management.

Important: You cannot purchase a similar third-party device and install it in a UL/ULC Listed smoke control system. Doing so voids the UL/ULC Smoke Control Listing. Third-party devices must be provided and labeled by the factory as described in the UL/ULC Smoke Control Listing.

Important: Only those Johnson Controls products identified for use in smoke control applications have been tested and listed by UL for use in a Metasys System UL 864 (9th Edition) UL/ULC/CHD-C100-13 UL/ULC Smoke Control System. Installation of a product that is not UL/ULC Listed and labeled for this application prevents the entire system from being UL/ULC Listed for smoke control.

Refer to the Metasys® System Field Equipment Controllers and Related Products Product Bulletin (LIT-12011042) for product application details.

- Features**
- Standard BACnet® Protocol - Provides interoperability with other Building Automation System (BAS) products that use the widely accepted BACnet standard.
 - Standard Hardware and Software Platform - Uses a common hardware design throughout the family line to support standardized wiring practices and installation workflows. Also uses a common software design to support use of a single tool for control applications, commissioning, and troubleshooting to minimize technical training.
 - ZigBee™ Wireless FCSA Bus Interface - Provides a wireless alternative to hard-wired Metasys system counterparts, providing application flexibility and mobility with minimal disruption to building occupants.
 - Bluetooth® Wireless Commissioning Interface - Provides an easy-to-use connection to the configuration and commissioning tool.

- Auto Tuned Control Loops - Reduce commissioning time, eliminate change-of-season re-commissioning, and reduce wear and tear on mechanical devices.
 - Universal Inputs, Configurable Outputs, and Point Expansion Modules - Allow multiple signal options to provide input/output flexibility.
 - Optional Local User Interface Display - Allows convenient monitoring and adjusting capabilities at the local device.
 - BACnet Testing Laboratories™ (BTL) Listing - Ensures interoperability with other BTL-listed devices. BTL is a third-party agency which validates that BAS vendor products meet the BACnet industry standard protocol.
 - 32-bit microprocessor ensures optimum performance and meets industry specifications.
 - BACnet Automatic Discovery support enables easy controller integration into Metasys BAS.
 - Integral End-of-Line (EOL) switch enables field controller as a terminating device on the communications bus.
 - Pluggable communications bus and supply power terminal blocks expedite installation and troubleshooting.
 - Wireless capabilities via a ZW1000 Series Wireless Field Bus System enable wireless mesh connectivity between Metasys field controllers to WZC Series Wireless Room Temperature Sensors and to supervisory controllers, facilitating easy initial location and relocation.
 - Ability to reside on the FC Bus or SA Bus provides application flexibility.
- If the product fails to operate within its specifications, replace the product. For a replacement product, contact the nearest Johnson Controls® representative.

Figure 1: IOM4711



Table 1: IOM Series Point Type Counts Per Model

Point Types	Signals Accepted	IOM 1711	IOM 2711	IOM 2721	IOM 3711	IOM 3721	IOM 3731	IOM 4711
Universal Input (UI)	Analog Input, Voltage Mode, 0–10 VDC Analog Input, Current Mode, 4–20 mA Analog Input, Resistive Mode, 0–2k ohm, RTD (1k NI [Johnson Controls], 1k PT, A99B SI), NTC (10k Type L, 2.252k Type 2) Binary Input, Dry Contact Maintained Mode		2	8	4			6
Binary Input (BI)	Dry Contact Maintained Mode Pulse Counter/Accumulator Mode (High Speed), 100 Hz	4				16	8	2
Analog Output (AO)	Analog Output, Voltage Mode, 0–10 VDC Analog Output, Current Mode, 4–20 mA			2				2
Binary Output (BO) ¹	24 VAC Triac						8	3
Universal Output (UO)	Analog Output, Voltage Mode, 0–10 VDC Binary Output Mode, 24 VAC/DC FET Analog Output, Current Mode, 4–20 mA		2		4			
Configurable Output (CO)	Analog Output, Voltage Mode, 0–10 VDC Binary Output Mode, 24 VAC Triac							4
Relay Output (RO) (-0 models only)	120/240 VAC		2		4			
Relay Output (RO) (-1 models only)	24 VAC, SELV		2		4			
Relay Output (RO) (-2 models only)	240 VAC		2		4			

¹ The BOs on the IOM3731-0A model require an external low-voltage power source.

Table 2: IOM Series Ordering Information

Product Code Number	Description
MS-IOM1711-0	4-Point IOM with 4 BI, FC Bus and SA Bus Support
MS-IOM2711-0 ²	6-Point IOM with 2 UI, 2 UO, 2 BO, FC Bus, and SA Bus Support. Relays are rated for 120/240 VAC.
MS-IOM2711-1 ³	6-Point IOM with 2 UI, 2 UO, 2 BO, FC Bus, and SA Bus Support. Relays are rated for 24 VAC.
MS-IOM2711-2 ³	6-Point IOM with 2 UI, 2 UO, 2 BO, FC Bus, and SA Bus Support. Relays are rated for 240 VAC.
MS-IOM2721-0	10-Point IOM with 8 UI, 2 AO, FC Bus, and SA Bus Support
MS-IOM3711-0 ²	12-Point IOM with 4 UI, 4 UO, 4 BO, FC Bus, and SA Bus Support. Relays are rated for 120/240 VAC.
MS-IOM3711-1 ³	12-Point IOM with 4 UI, 4 UO, 4 BO, FC Bus, and SA Bus Support. Relays are rated for 24 VAC
MS-IOM3711-2 ³	12-Point IOM with 4 UI, 4 UO, 4 BO, FC Bus, and SA Bus Support. Relays are rated for 240 VAC
MS-IOM3721-0	16-Point IOM with 16 BI, FC Bus, and SA Bus Support
MS-IOM3731-0	16-Point IOM with 8 BI, 8 BO, FC Bus, and SA Bus Support
MS-IOM3731-0A ¹	16-Point IOM with 8 BI, 8 BO, FC Bus, and SA Bus Support Note: Binary Outputs (BOs) on MS-IOM3731-0A controllers do not supply power for the outputs; the BOs require external low-voltage (<30 VAC) power sources.
MS-IOM4711-0	17-Point IOM with 6 UI, 2 BI, 3 BO, 2 AO, 4 CO, FC and SA Bus Support

¹ This model is currently available only in Asia; contact your local Johnson Controls representative for more information.

² UL Listed

³ CE Marked

Table 3: IOM Series for Smoke Control Ordering Information

Product Code Number ^{1, 2}	Description
MS-IOM1710-0U	4-Point IOM with 4 BI; 24 VAC; FC Bus and SA Bus Support
MS-IOM1711-0U	4-Point IOM with 4 BI; 24 VAC; FC Bus and SA Bus Support
MS-IOM2710-0U	6-Point IOM with 2 UI, 2 UO, 2 BO; 24 VAC; FC Bus and SA Bus Support
MS-IOM2711-0U	6-Point IOM with 2 UI, 2 UO, 2 BO; 24 VAC; FC Bus and SA Bus Support
MS-IOM3710-0U	12-Point IOM with 4 UI, 4 UO, 4 BO; 24 VAC; FC Bus and SA Bus Support
MS-IOM3711-0U	12-Point IOM with 4 UI, 4 UO, 4 BO; 24 VAC; FC Bus and SA Bus Support
MS-IOU4710-0U	17-Point IOM with 6 UI, 2 BI, 3 BO, 2 AO, 4 CO; 24 VAC; FC Bus and SA Bus Support with Mounting Base
MS-IOM4711-0U	17-Point IOM with 6 UI, 2 BI, 3 BO, 2 AO, 4 CO; 24 VAC; FC Bus and SA Bus Support with Mounting Base

1 These devices are UL/ULC 864 Listed, File S4977, 9th Edition UUKL/ORD-C100-13 UUKLC Smoke Control System.

2 All field controllers in a smoke control system must be mounted in Johnson Controls custom or standard UL 864 panels or in panels that are ordered from Johnson Controls. If these field controllers are used with panels that are not supplied by Johnson Controls, they are not compliant with the UL 864 9th Edition UUKL/ORD-C100-13 UUKLC Smoke Control System listing.

Accessories

Table 4: IOM Accessories

Product Code Number	Description
MS-BTCVT-1	Wireless Commissioning Converter with Bluetooth® Technology
TL-BRTRP-0	Portable BACnet IP to MS/TP Router
MS-ZFR1811	Wireless Field Bus Router, 10 mW Transmission Power. Functions with Metasys BACnet FECs, VMA16s, and WRZ-TT Series Wireless Mesh Room Temperature Sensors
MS-BTCVTCBL-700	Cable Replacement Set for the MS-BTCVT-1 or the NS-ATV7003-0; Includes One 5 ft (1.5 m) Retractable Cable
Y64T15-0	Transformer, 120/208/240 VAC Primary to 24 VAC Secondary, 92 VA, Foot Mount, 30 in. Primary Leads and 30 in. Secondary Leads, Class 2
Y65A13-0	Transformer, 120 VAC Primary to 24 VAC Secondary, 40 VA, Foot Mount (Y65AS), 8 in. Primary Leads and 30 in. Secondary Leads, Class 2
Y65T42-0	Transformer, 120/208/240 VAC Primary to 24 VAC Secondary, 40 VA, Hub Mount (Y65SP+), 8 in. Primary Leads and Secondary Screw Terminals, Class 2
Y65T31-0	Transformer, 120/208/240 VAC Primary to 24 VAC Secondary, 40 VA, Foot Mount (Y65AR+), 8 in. Primary Leads and Secondary Screw Terminals, Class 2
AP-TBK4SA-0	Replacement MS/TP SA Bus Terminal, 4-Position Connector, Brown, Bulk Pack
AP-TBK4FC-0	Replacement MS/TP FC Bus Terminal, 4-Position Connector, Blue, Bulk Pack
AP-TBK3PW-0	Replacement Power Terminal, 3-Position Connector, Gray, Bulk Pack
ZFR-USBHA-0	USB Dongle with ZigBee™ Driver provides a wireless connection through CCT to allow wireless commissioning of the wirelessly enabled FEC, Advanced Application Field Equipment Controller (FAC), IOM, and VMA16 controllers. Also allows use of the ZFR Checkout Tool (ZCT) in CCT. Note:

IOM Series Technical Specifications

Table 5: IOM Series

Product Code Numbers	<p>MS-IOM1711-0: 4-Point IOM with 4 BI, FC Bus and SA Bus Support</p> <p>MS-IOM2711-0: 6-Point IOM with 2 UI, 2 UO, 2 BO, FC Bus, and SA Bus Support. Relays are rated for 120/240 VAC</p> <p>MS-IOM2711-1: 6-Point IOM with 2 UI, 2 UO, 2 BO, FC Bus, and SA Bus Support. Relays are rated for 24 VAC</p> <p>MS-IOM2711-2: 6-Point IOM with 2 UI, 2 UO, 2 BO, FC Bus, and SA Bus Support. Relays are rated for 240 VAC.</p> <p>MS-IOM2721-0: 10-Point IOM with 8 UI, 2 AO, FC Bus, and SA Bus Support</p> <p>MS-IOM3711-0: 12-Point IOM with 4 UI, 4 UO, 4 BO, FC Bus, and SA Bus Support. Relays are rated for 120/240 VAC</p> <p>MS-IOM3711-1: 12-Point IOM with 4 UI, 4 UO, 4 BO, FC Bus, and SA Bus Support. Relays are rated for 24 VAC</p> <p>MS-IOM3711-2: 12-Point IOM with 4 UI, 4 UO, 4 BO, FC Bus, and SA Bus Support. Relays are rated for 240 VAC</p> <p>MS-IOM3721-0: 16-Point IOM with 16 BI, FC Bus, and SA Bus Support</p> <p>MS-IOM3731-0: 16-Point IOM with 8 BI, 8 BO, FC Bus, and SA Bus Support</p> <p>MS-IOM3731-0A¹: 16-Point IOM with 8 BI, 8 BO, FC Bus, and SA Bus Support</p> <p>MS-IOM4711-0: 17-Point IOM with 6 UI, 2 BI, 3 BO, 2 AO, 4 CO, FC and SA Bus Support</p> <p>Smoke Control Models:</p> <p>MS-IOM1710-0U: 4-Point IOM with 4 BI, FC Bus and SA Bus Support</p> <p>MS-IOM1711-0U: 4-Point IOM with 4 BI, FC Bus and SA Bus Support</p> <p>MS-IOM2710-0U: 6-Point IOM with 2 UI, 2 UO, 2 BO, FC Bus, and SA Bus Support</p> <p>MS-IOM2711-0U: 6-Point IOM with 2 UI, 2 UO, 2 BO, FC Bus, and SA Bus Support</p> <p>MS-IOM3710-0U: 12-Point IOM with 4 UI, 4 UO, 4 BO, FC Bus, and SA Bus Support</p> <p>MS-IOM3711-0U: 12-Point IOM with 4 UI, 4 UO, 4 BO, FC Bus, and SA Bus Support</p> <p>MS-IOM4710-0U: 17-Point IOM with 6 UI, 2 BI, 3 BO, 2 AO, 4 CO, FC Bus and SA Bus Support with Mounting</p> <p>MS-IOM4711-0U: 17-Point IOM with 6 UI, 2 BI, 3 BO, 2 AO, 4 CO, FC Bus and SA Bus Support with Mounting</p>
Supply Voltage	24 VAC (nominal, 20 VAC minimum/30 VAC maximum), 50/60 Hz, Power Supply Class 2 (North America), Safety Extra-Low Voltage (SELV) Europe

Table 5: IOM Series

Power Consumption	14 VA maximum Note: VA ratings do not include any power supplied to the peripheral devices connected to Binary Outputs (BOs) or Configurable Outputs (COs), which can consume up to 12 VA for each BO or CO, for a possible total consumption of an additional 84 VA (maximum), depending on the IOM model.
Ambient Conditions	Operating: 0 to 50°C (32 to 122°F); 10 to 90% RH noncondensing Storage: -40 to 80°C (-40 to 176°F); 5 to 95% RH noncondensing
Addressing	DIP switch set; valid field controller device addresses 4–127 (Device addresses 0–3 and 128–255 are reserved and not valid IOM addresses).
Communications Bus²	BACnet MS/TP, RS-485 3-wire FC Bus between the supervisory controller and field devices 4-wire SA Bus between field controller, network sensors, and other sensor/actuator devices. Includes a lead source 15 VDC supply power (from field controller) to bus devices.
Processor	H8SX/166xR Renesas® 32-bit microcontroller
Memory	512 KB Flash Memory and 128 KB Random Access Memory (RAM)
Input and Output Capabilities	<p>IOM1711: 4 - Binary Inputs: Defined as Dry Contact Maintained or Pulse Counter/ Accumulator Mode</p> <p>IOM2711: 2 - Universal Inputs: Defined as 0–10 VDC, 4–20 mA, 0–600k ohm, or Binary Dry Contact 2 - Universal Outputs: Analog Output: Voltage Mode, 0-10 VDC; Binary Output Mode: 24 VAC/DC FET; Analog Output: Current Mode, 4-20 mA 2 - Relay Outputs: (Single-Pole, Double-Throw); UL 916 (-0 model only): 1/4 hp 120 VAC, 1/2 hp 240 VAC; 360 VA Pilot Duty at 120/240 VAC (B300); 3 A Non-inductive 24-240 VAC; EN 60730 (-1 model only): 6 (4) A N.O. or N.C. only, 24 VAC, SELV EN 60730 (-2 model only): 6 (4) A N.O. or N.C. only, 240 VAC</p> <p>IOM2721: 8 - Universal Inputs: Defined as 0–10 VDC, 4–20 mA, 0–600k ohm, or Binary Dry Contact 2 - Analog Outputs: Defined as 0–10 VDC or 4–20 mA</p> <p>IOM3711: 4 - Universal Inputs: Defined as 0–10 VDC, 4–20 mA, 0–600k ohm, or Binary Dry Contact 4 - Universal Outputs: Analog Output: Voltage Mode, 0-10 VDC; Binary Output Mode: 24 VAC/DC FET; Analog Output: Current Mode, 4-20 mA 4 - Relay Outputs: (Single-Pole, Double-Throw); UL 916 (-0 model only): 1/4 hp 120 VAC, 1/2 hp 240 VAC; 360 VA Pilot Duty at 120/240 VAC (B300); 3 A Non-inductive 24-240 VAC; EN 60730 (-1 model only): 6 (4) A N.O. or N.C. only, 24 VAC, SELV EN 60730 (-2 model only): 6 (4) A N.O. or N.C. only, 240 VAC</p> <p>IOM3721: 16 - Binary Inputs: Defined as Dry Contact Maintained or Pulse Counter/Accumulator Mode</p> <p>IOM3731: 8 - Binary Inputs: Defined as Dry Contact Maintained or Pulse Counter/Accumulator Mode 8 - Binary Outputs: Defined as 24 VAC Triac (Require external low-voltage power source.) Note: Binary Outputs (BOs) on MS-IOM3731-0A controllers do not supply power for the outputs; the BOs require external low-voltage (< 30 VAC) power sources.</p> <p>IOM4711: 6 - Universal Inputs: Defined as 0–10 VDC, 4–20 mA, 0–600k ohm, or Binary Dry Contact 2 - Binary Inputs: Defined as Dry Contact Maintained or Pulse/Counter Accumulator Mode 3 - Binary Outputs: Defined as 24 VAC Triac (selectable internal or external source power) 4 - Configurable Outputs: Defined as 0–10 VDC or 24 VAC Triac BO 2 - Analog Outputs: Defined as 0–10 VDC or 4–20 mA</p>

Table 5: IOM Series

Analog Input/Analog Output Resolution and Accuracy	<p>Analog Input: 16-bit resolution</p> <p>Analog Output: 16-bit resolution and ±200 mV in 0–10 VDC applications</p>
Terminations	<p>Input/Output: Fixed Screw Terminal Blocks</p> <p>SA/FC Bus and Supply Power: 4-wire and 3-wire Pluggable Screw Terminal Blocks</p> <p>SA/FC Bus Port: RJ-12 6-Pin Modular Jacks</p>
Mounting	Horizontal on single 35 mm DIN rail mount (preferred), or screw mount on flat surface with three integral mounting clips on controller
Housing	Enclosure material: ABS and polycarbonate UL94 5VB; self-extinguishing, Plenum-rated protection class: IP20 (IEC529)
Dimensions (Height x Width x Depth)	<p>IOM17 and IOM27 Family Models:</p> <p>150 x 120 x 53 mm (5-7/8 x 4-3/4 x 2-1/8 in.) including terminals and mounting clips</p> <p>IOM2721, IOM3721, and IOM3731 Models:</p> <p>150 x 164 x 53 mm (5-7/8 x 6-7/16 x 2-1/8 in.) including terminals and mounting clips</p> <p>IOM37 and IOM47 Family Models:</p> <p>150 x 190 x 53 mm (5-7/8 x 7-1/2 x 2-1/8 in.) including terminals and mounting clips</p> <p>Note: Mounting space for all field controllers requires an additional 50 mm (2 in.) space on top, bottom, and front face of controller for easy cover removal, ventilation, and wire terminations.</p>
Weight	0.5 kg (1.1 lb) maximum
Compliance	<p>United States: UL Listed, File E107041, CCN PAZX, UL 916, Energy Management Equipment; UL/ULC 864 Listed, File S4977, 9th Edition UUKL/ORD-C100-13 UUKLC Smoke Control System (models with U product code suffix only); FCC Compliant to CFR47, Part 15, Subpart B, Class A</p> <p>Note: Except IOM2711-1 and IOM2711-2; IOM 3711-1 and IOM3711-2</p> <p>Canada: UL Listed, File E107041, CCN PAZX7, CAN/CSA C22.2 No. 205, Signal Equipment; Industry Canada Compliant, ICES-003</p> <p>Note: Except IOM2711-1 and IOM2711-2; IOM 3711-1 and IOM3711-2</p> <p>Europe: CE Mark – Johnson Controls, Inc. declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive 2004/108/EC. Declared as Independently Mounted, Intended for Panel Mounting, Operating Control Type 1.B, 4kV rated impulse voltage, 100.7°C ball pressure test.</p> <p>Note: Except IOM2711-0 and IOM3711-0</p> <p>Note: For IOM47xx Models, Conducted RF Immunity within EN 61000-6-2 meets performance criteria B.</p> <p>Australia and New Zealand: C-Tick Mark, Australia/NZ Emissions Compliant</p> <p>Note: Except IOM2711-0 and IOM3711-0</p> <p>BACnet International: BACnet Testing Laboratories (BTL) Protocol Revision 4 Listed BACnet Application Specific Controller (B-ASC)</p>

- 1 This model is currently available only in Asia; contact your local Johnson Controls representative for more information.
- 2 For more information, refer to the *MS/TP Communications Bus Technical Bulletin (LIT-12011034)*.

The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.



Building Efficiency

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Network Control Engine Catalog Page

MS-NCE25xx-x

Code No. LIT-1900455
 Software Release 6.0
 Issued January 30, 2013
 Supersedes December 21, 2011

Refer to the [QuickStart Web site](#) for the most up-to-date version of this document.

The Metasys® Network Control Engine (NCE) Series controllers provide a cost-effective solution designed for integrating control plants and large built-up air handlers into your existing Metasys networks.

These network control engines combine the network supervisor capabilities and IP network connectivity of a Network Automation Engine (NAE) with the IO point connectivity and direct digital control capabilities of a Field Equipment Controller (FEC), making them the ideal choice for expanding and improving your Metasys installation for greater data visibility and control over your energy usage.

Network Control Engines (NCEs) provide supervisory control of a specified field bus trunk with up to 32 field controllers. Depending on the model, an NCE supports either a BACnet® Master/Slave/Token-Passing (MSTP) trunk, an N2 Bus trunk, or a LonWorks® network trunk. Available in Europe only are the MS-NCE200-0 and MS-NCE206-0 models, which do not provide a physical field controller trunk connection.

All NCE models feature 33 integral IO points and a Sensor/Actuator (SA) Bus, which allow you to increase the NCE's IO field point capacity and also integrate NS Series Network Sensors and Variable Frequency Drives (VFDs) into your NCE application.

Some NCE models feature an integral field controller display screen with a navigation keypad, allowing for easy modifications in the field. In addition, some NCE models feature an internal modem that supports standard dial-up capabilities when traditional IT networks are not available.

Refer to the Network Control Engine Product Bulletin (LIT-1201283) for important product application information.

Features

- Use of Commonly Accepted IT Standards at the Automation and Enterprise Level
- Web-Based User Interface
- Supervision of Either an N2 Bus, LonWorks Network, or BACnet MSTP Bus Field Controller Trunk
- Multiple Connection Options for Data Access
- Integral Field Controller with 33 IO Points
- Expandable IO Point Capacity, NS Sensor Connectivity, and VFD Control on Field Controller SA Bus

Figure 1: NCESS Network Control Engine



Ordering Information

Contact the nearest Johnson Controls® representative to order an NCE or accessories. Specify the desired product code number using Table 1 and Table 2.

Table 1: NCE Model Ordering Information

Product Code Number ¹	Description
MS-NCE25xx-x (Base Features on Each NCE)	Each NCE25 Series model requires a 24 VAC power supply and includes one RS-232-C serial port, one RS-485 serial port, one SA Bus port, one USB serial port, one Ethernet port, and an MS-SAT100-0 Data Protection Battery. Each NCE25 Series model has 33 integral IO points and supports up to 128 additional IO points on the SA Bus.
MS-NCE206-0²	Base features with no physical field controller trunk connection. Includes integral display screen.
MS-NCE210-0	Supports one N2 Bus trunk with up to 32 N2 devices.
MS-NCE211-0	Supports one N2 Bus trunk with up to 32 N2 devices. Includes internal modem.
MS-NCE216-0	Supports one N2 Bus trunk with up to 32 N2 devices. Includes integral display screen.
MS-NCE217-0	Supports one N2 Bus trunk with up to 32 N2 devices. Includes integral display screen and internal modem.
MS-NCE220-0	Supports one LonWorks network trunk with up to 32 LonWorks devices.
MS-NCE221-0	Supports one LonWorks network trunk with up to 32 LonWorks devices. Includes internal modem.
MS-NCE226-0	Supports one LonWorks network trunk with up to 32 LonWorks devices. Includes integral display screen.
MS-NCE227-0	Supports one LonWorks network trunk with up to 32 LonWorks devices. Includes integral display screen and internal modem.
MS-NCE288-0	Supports one Master/Slave/Token-Passing (MSTP) Bus trunk with up to 32 MSTP devices.
MS-NCE290-0³	Supports one MSTP Bus trunk with up to 32 MSTP devices.
	Note: This model is UL listed. File S407, ULJK, B4 - 9th Edition Smoke Control Equipment.

Network Control Engine Catalog Page



Table 1: NCE Model Ordering Information

Product Code Number ¹	Description
MS-NCE2561-0	Supports one MS/TP Bus trunk with up to 32 MS/TP devices. Includes internal modem.
MS-NCE2566-0	Supports one MS/TP Bus trunk with up to 32 MS/TP devices. Includes integral display screen.
MS-NCE2567-0	Supports one MS/TP Bus trunk with up to 32 MS/TP devices. Includes integral display screen and internal modem.

1 Some models are also available in a Buy American version (add a G after the code number). For repair parts, add -700 after the code number.

2 NCE25 model available in Europe only.

Table 2: NCE Accessories Ordering Information

Product Code Number	Description
MS-BAT1020-0	Replacement data protection battery for NAE35, NAE45, and NCE25. Rechargeable NiMH battery: 3.6 V 500 mAh, with a typical life of 5 to 7 years at 21°C (70°F)
MS-BTCVT-1	Wireless Commissioning Converter, with Bluetooth® technology, for configuring and commissioning the NCE field controller and the devices on the NCE SA Bus
MS-DIS1710-0	Local Controller Display connects to NCE on SA Bus and provides menu display and navigation keypad for monitoring status and controlling parameters on the NCE's integral field controller. Note: A DIS1710 display does not operate on NCE models that have an integral controller display.
AS-XFR100-1	Power transformer (Class 2, 24 VAC, 92 VA maximum output), with enclosure
AS-XFR10-1	Power transformer (Class 2, 24 VAC, 92 VA maximum output), no enclosure
MS-RAP-0	Ready Access Portal Server, which provides a user interface that is a natural, complementary extension of the Metasys Site Management Portal UI. Note: This option is not necessary for sites that have an ADS/ADX as the Site Director because it is provided with the ADS/ADX solution.
MS-EXPORT-0	Metasys Export Utility, which extracts historical trend, alarm, and audit data from the system and presents the historical data in a variety of formats. Note: This option is not necessary for sites that have an ADS/ADX as the Site Director because it is provided with the ADS/ADX solution.

Technical Specifications

Table 3: NCE25

Power Requirement	Dedicated nominal 24 VAC, Class 2 power supply (North America), Safety Extra-Low Voltage (SELV) power supply (Europe), at 50/60 Hz (20 VAC minimum to 30 VAC maximum)
Power Consumption	25 VA maximum for NCE25 only Note: The 25 VA rating does not include any power supplied by the NCE to devices connected at the NCE Binary Outputs (BOs). Binary Output (BO) devices connected to and powered by an NCE can require an additional 125 VA (maximum).
Ambient Operating Conditions	0 to 50°C (32 to 122°F), 10 to 90% RH, 30°C (86°F) maximum dew point
Ambient Storage Conditions	-40 to 70°C (-40 to 158°F), 5 to 95% RH, 30°C (86°F) maximum dew point
Data Protection Battery	Supports data protection on power failure. Rechargeable NiMH battery: 3.6 VDC 500 mAh, with a typical life of 5 to 7 years at 21°C (70°F); Product Code Number: MS-BAT1020-0
Processors	Supervisory Controller: 192 MHz Renesas® SH4 7760 RISC processor Field Controller: 20 MHz Renesas H8S2398 processor
Memory	Supervisory Controller: 128 MB Flash nonvolatile memory for operating system, configuration data, and operations data storage and backup and 128 MB Synchronous Dynamic Random Access Memory (SDRAM) for operations data dynamic memory Field Controller: 1 MB Flash and 1 MB Random Access Memory (RAM)
Operating System	Microsoft Windows® CE embedded 6.0
Network and Serial Interfaces (Depending on NCE model. See Table 1 for model information.)	One Ethernet port; 10/100 Mbps; 8-pin RJ-45 connector One optically isolated RS-485 SA Bus port; with a pluggable and keyed 4-position terminal block (on all NCE25 models) One optically isolated RS-485 port; with a pluggable and keyed 4-position terminal block (only on NCE25 models that support an N2 Bus or MS/TP bus trunk) One LonWorks port; FTT10 78 Kbps; pluggable, keyed 3-position terminal block (only on NCE25 models that support a LonWorks Network trunk) One RS-232-C serial port with standard 9-pin sub-D connector that supports standard baud rates One USB serial port with standard USB connector Option: One 6-pin modular jack for connecting to internal modem; up to 56 Kbps
Analog Input/Analog Output Point Resolution	Analog Input Points: 16-bit resolution Analog Output Points: 16-bit resolution and ±200 mV accuracy on 0-10 VDC applications

Table 3: NCE25

Input/Output Capabilities	<p>10-Universal Inputs: Defined as 0-10 VDC, 4-20mA, 0-600k ohm, or Binary Dry Contact</p> <p>8-Binary Inputs: Defined as Dry Contact Maintained or Pulse/Accumulator Mode</p> <p>4-Analog Outputs: Defined as 0-10 VDC or 4-20mA</p> <p>7-Binary Outputs: Defined as 24 VAC Triac (selectable internal or external source power)</p> <p>4-Configurable Outputs: Defined as 0-10 VDC or 24 VAC Triac BO</p>
Dimensions (Height x Width x Depth)	155 x 270 x 64 mm (6.1 x 10.6 x 2.5 in.) Minimum mounting space required: 250 x 370 x 110 mm (9.8 x 14.6 x 4.3 in.)
Housing	<p>Plastic housing</p> <p>Plastic material: ABS and polycarbonate</p> <p>Protection: IP20 (IEC60529)</p>
Mounting	On flat surface with screws on three mounting clips or a single 35 mm DIN rail
Shipping Weight	1.2 kg (2.7 lb)
Compliance	<p>United States: UL Listed, File E107041, CCN PAZX, UL 916, Energy Management Equipment FCC Compliant to CFR47, Part 15, Subpart B, Class A</p> <p>Canada: UL Listed, File E107041, CCN PAZX7, CAN/CSA C22.2 No. 205, Signal Equipment Industry Canada Compliant, ICES-003</p> <p>Europe: CE Mark - Johnson Controls, Inc., declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive 2004/108/EC.</p> <p>Australia and New Zealand: C-Tick Mark, Australia/NZ Emissions Compliant</p> <p>BACnet International: BACnet Testing Laboratories™ (BTL) 135-2004 Listed BACnet Building Controller (B-BC)</p>

The performance specifications are nominal and conform to acceptable industry standard. For application at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.

United States Federal Communications Commission (FCC) Compliance Statement

This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when this equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area may cause harmful interference, in which case the users will be required to correct the interference at their own expense.

Canadian Compliance Statement

This Class (A) digital apparatus meets all the requirements of the Canadian Interference-Causing Equipment Regulations.
 Cet appareil numérique de la Classe (A) respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.



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VMA1615, VMA1617, VMA1630, and VMA1632 VAV Controllers Catalog Page

Code No. LIT-1900764
Issued April 2, 2014
Supersedes November 1, 2013

[Refer to the Control System Configuration and Installation Manual](#)

VMA16s (32-bit) are programmable digital controllers tailored for VAV applications that communicate via the BACnet Master/Slave/Token Passing (MSTP) protocol. The VMA16 (32-bit) controllers feature an integral digital pressure sensor, an integral damper actuator, and a 32-bit microprocessor. The controller's small package size facilitates quick field installation and efficient use of space, while not compromising high-tech control performance. The VMA16 (32-bit) controllers connect easily to the NS Series Network Sensors for zone and discharge air temperature sensing.

These features make the VMA16 (32-bit) the product of choice for VAV systems. The wide variety of network sensor models provides options for measuring and displaying zone temperature, occupancy detection, duct temperature, zone humidity and dewpoint determination, carbon dioxide (CO₂) level, setpoint adjustments, VAV box fan speed control, and discharge air temperature.

Refer to the Metasys® System Field Equipment Controllers and Related Products Product Bulletin (LIT-12011642) for product application details.

Features

- Standard BACnet Protocol - Provides interoperability with other Building Automation System (BAS) products that use the widely accepted BACnet standard.
- Standard Hardware and Software Platform - Uses a common hardware design throughout the family line to support standardized wiring practices and installation workflows. Also uses a common software design to support use of a single tool for control applications, commissioning, and troubleshooting to minimize technical training.
- ZigBee™ Wireless Field Controller (FC)/Sensor/Actuator (SA) Bus Interface - Provides a wireless alternative to hard-wired Metasys® system counterparts, providing application flexibility and mobility with minimal disruption to building occupants.
- Bluetooth® Wireless Commissioning Interface - Provides an easy-to-use connection to the configuration and commissioning tool.
- Auto Tuned Control Loops - Reduce commissioning time, eliminate change-of-season re-commissioning, and reduce wear and tear on mechanical devices.
- Universal Inputs, Configurable Outputs, and Point Expansion Modules - Allow multiple signal options to provide input/output flexibility.
- Optional Local User Interface Display - Allows convenient monitoring and adjusting capabilities at the local device.
- BACnet Testing Laboratories™ (BTL) Listing - Ensures interoperability with other BTL-listed devices. BTL is a third-party agency which validates that BAS vendor products meet the BACnet industry standard protocol.
- 32-bit microprocessor ensures optimum performance and meets industry specifications.
- BACnet Automatic Discovery support enables easy controller integration into Metasys BAS.
- Integral End-of-Line (EOL) switch enables field controller as a terminating device on the communications bus.

- Pluggable communications bus and supply power terminal blocks expedite installation and troubleshooting.
- Wireless capabilities via a ZFR1800 Series Wireless Field Bus System enable wireless mesh connectivity between Metasys field controllers to WR2 Series Wireless Room Temperature Sensors, and to supervisory controllers, facilitating easy initial location and relocation.
- Patterned proportional adaptive control (P-Adaptive) and Pattern Recognition Adaptive Control (PRAC) technologies provide continuous loop tuning.
- Writable flash memory allows standard or customized applications to be downloaded from the Controller Configuration tool (CCT) and enables persistent application data.
- Large product family provides a wide range of point mix to meet application requirements and allows for the addition of one or more Input/Output Module (IOM) and/or Network Sensors to provide even more I/O capacity.
- Two additional Universal Inputs that provide more low-cost sensor options.
- A 33 percent smaller package than the VMA16s (16-bit).
- The phone jack-style connector on the FC Bus and SA Bus of the VMA1615 and VMA1630 to support quick connection to the BTL CVT Wireless Commissioning Connector, ZFR1811 wireless router, and network sensors.
- A fail response actuator that drives the damper from full open to full closed (90°) in 60 seconds to reduce commissioning time.

If the product fails to operate within its specifications, replace the product. For a replacement product, contact the nearest Johnson Controls® representative.

Figure 1: VMA1630 Controller



Table 1: VMA16 (32-bit) Series Point Type Counts per Model

Point Types	Signals Accepted	VMA1615	VMA1630	VMA1617 ²	VMA1632 ²
Modular Jacks		6-pin SA Bus with four communicating sensors and 6-pin FC Bus for tool support		8-pin SA Bus supports analog non-communicating sensor	
Universal Input (UI)	Analog Input, Voltage Mode, 0–10 VDC Analog Input, Resistive Mode, 0–2k ohm, RTD (1k NI [Johnson Controls], 1k PT, A998 SI), NTC (10k Type L, 2.252k Type 2) Binary Input, Dry Contact Maintained Mode	3	3	3	3
Binary Output (BO)	24 VAC Triac	2	3	2	3
Configurable Output (CO)	Analog Output, Voltage Mode, 0–10 VDC Binary Output Mode, 24 VAC Triac		2		2
Integrated Actuator	Internal	1	1	1	1
Integrated Flow Sensor	Internal	1	1	1	1
Zone Sensor Input	On SA Bus ¹	Up to 4 NS Series Network Zone Sensors Up to 9 WRZ sensors when using the ZFR1811 wireless router configuration and up to 5 WRZ sensors when using the one-to-one WRZ-78xx wireless configuration			

1 A total of 10 MS/TP master addresses (IOMs), not including sensor addresses (MS/TP slaves), can be used in a single VMA controller.

2 This model is currently available only in Asia; contact your local Johnson Controls representative for more information.

Table 2: VMA16 (32-bit) Series Ordering Information

Product Code Number	Description
MS-VMA1615-0	32-bit, Integrated VAV Controller/Actuator/Pressure Sensor, 3 UI and 2 BO; 24 VAC; Field Controller (FC) Bus, and Sensor/Actuator (SA) Bus
MS-VMA1630-0	32-bit, Integrated VAV Controller/Actuator/Pressure Sensor, 3 UI, 3 BO, and 2 CO; 24 VAC; FC Bus, and SA Bus
MS-VMA1617-0¹	Same description as VMA1615, but includes 8-pin TSTAT Port for use with TE-7xx Series Non-Communicating Sensors
MS-VMA1632-0¹	Same description as VMA1630, but includes 8-pin TSTAT Port for use with TE-7xx Series Non-Communicating Sensors

1 This model is currently available only in Asia; contact your local Johnson Controls representative for more information.

Accessories

Table 3: VMA16 (32-bit) Accessories

Product Code Number	Description
MS-DIS1710-0	Local Controller Display: Refer to <i>Local Controller Display Product Bulletin (LIT-12011273)</i> for more information.
MS-BTCVT-1	Wireless Commissioning Converter with Bluetooth® Technology
MS-ZFR1810	Wireless Field Bus Coordinator, 10 mW Transmission Power. Functions with NAE35, NAE45, NAE55, and NCE25 Models
MS-ZFR1811	Wireless Field Bus Router, 10 mW Transmission Power. Functions with Metasys BACnet Field Equipment Controller (FEC)s, VMA16s, and WRZ-TT Series Wireless Mesh Room Temperature Sensors
MS-ZFRCBL-0	Wire Harness for Use with ZFR1811 Router. Allows ZFR1811 Router to function with FEC16 Series, VMA16 Series, FAC26 Series, and FEC26 Series Controllers in Conjunction with NS Series Sensors, Wireless Commissioning Converter, or DIS1710 Local Controller Display
MS-BTCVTCBL-700	Cable Replacement Set for the MS-BTCVT-1 or the NS-ATV7003-0; Includes One 5 ft (1.5 m) Retractable Cable
WRZ Series Sensors	WRZ Series Wireless Room Sensors: Refer to the <i>WRZ Series Wireless Room Sensors Product Bulletin (LIT-12011653)</i> for specific sensor model descriptions.
NS Series Sensors	NS Series Network Sensors: Refer to the <i>NS Series Network Sensors Product Bulletin (LIT-12011574)</i> for specific sensor model descriptions.
Y64T15-0	Transformer, 120/208/240 VAC Primary to 24 VAC Secondary, 92 VA, Foot Mount, 30 in. Primary Leads and 30 in. Secondary Leads, Class 2
Y65A13-0	Transformer, 120 VAC Primary to 24 VAC Secondary, 40 VA, Foot Mount (Y65AS), 8 in. Primary Leads and 30 in. Secondary Leads, Class 2
Y65T42-0	Transformer, 120/208/240 VAC Primary to 24 VAC Secondary, 40 VA, Hub Mount (Y65SP+), 8 in. Primary Leads and Secondary Screw Terminals, Class 2
Y65T31-0	Transformer, 120/208/240 VAC Primary to 24 VAC Secondary, 40 VA, Foot Mount (Y65AR+), 8 in. Primary Leads and Secondary Screw Terminals, Class 2
AP-TBK1002-0	2-Position Screw Terminal that Plugs onto VMA Output Point Spade Lug

Table 3: VMA16 (32-bit) Accessories

Product Code Number	Description
AP-TBK1003-0	3-Position Screw Terminal that Plugs onto VMA Output Point Spade Lugs
AP-TBK4SA-0	Replacement MS/TP SA Bus Terminal, 4-Position Connector, Brown, Bulk Pack
AP-TBK4FC-0	Replacement MS/TP FC Bus Terminal, 4-Position Connector, Blue, Bulk Pack
AP-TBK3PW-0	Replacement Power Terminal, 3-Position Connector, Gray, Bulk Pack
AP-TBK2PW-0	Replacement Power Terminal, 2-Position Connector, Gray, Bulk Pack
MS-VMAACT-701	VMA Actuator Assembly Gearbox Replacement Kit (Canada Only)
NS-WALLPLATE-0	Network Sensor Wall Plate
TL-BRTRP-0	Portable BACnet IP to MS/TP Router
WRZ-7860-0	Receiver for One-to-One Wireless Room Sensing Systems
WRZ-SST-100	Wireless Sensing System Tool Kit
ZFR-USBHA-0	USB Dongle with ZigBee™ Driver provides a wireless connection through CCT to allow wireless commissioning of the wirelessly enabled FEC, Advanced Application Field Equipment Controller (FAC), IOM, and VMA16 controllers. Also allows use of the ZFR Checkout Tool (ZCT) in CCT. Note:

VMA16 (32-bit) Series Technical Specifications

Table 4: VMA16 (32-bit) Series

Product Code Numbers	<p>MS-VMA1615-0: 32-bit, Integrated VAV Controller/Actuator/Pressure Sensor, 3 UI and 2 BO; 24 VAC; FC and SA Bus</p> <p>MS-VMA1630-0: 32-bit, Integrated VAV Controller/Actuator/Pressure Sensor, 3 UI, 3 BO, 2 CO; 24 VAC; FC and SA Bus</p> <p>MS-VMA1617-0¹: Same description as VMA1615 but includes 8-pin TSTAT Port for use with TE-7xx Series Non-Communicating Sensors</p> <p>MS-VMA1632-0¹: Same description as VMA1630 but includes 8-pin TSTAT Port for use with TE-7xx Series Non-Communicating Sensors</p>
Supply Voltage	24 VAC (nominal, 20 VAC minimum/30 VAC maximum), 50/60 Hz, Power Supply Class 2 (North America), Safety Extra-Low Voltage (SELV) (Europe)
Power Consumption	10 VA typical, 14 VA maximum Note: VA ratings do not include any power supplied to the peripheral devices connected to Binary Outputs (BOs) or Configurable Outputs (COs), which can consume up to 12 VA for each BO or CO, for a possible total consumption of an additional 60 VA (maximum).
Ambient Conditions	<p>Operating: 0 to 50°C (32 to 122°F)</p> <p>Storage: -40 to 70°C (-40 to 158°F)</p>
Terminations	<p>VMA1615 and VMA1630: Inputs/Outputs: 6.3 mm (1/4 in.) Spade Lugs FC Bus, SA Bus, and Supply Power: 4-Wire and 2-Wire Pluggable Screw Terminal Blocks FC and SA Bus Modular Ports: RJ-12 6-Pin Modular Jacks</p> <p>VMA1617 and VMA1632: Inputs/Outputs, SA Bus, and Supply Power: 6.3 mm (1/4 in.) Spade Lugs FC Bus Pluggable Screw Terminal Block TSTAT Modular Port: RJ-45 8-Pin Modular Jack</p>
Controller Addressing	DIP switch set; valid field controller device addresses 4–127 (Device addresses 0–3 and 128–255 are reserved and not valid field controller addresses.)
Communications Bus²	<p>BACnet MS/TP, RS-485:</p> <p>3-wire FC Bus between the supervisory controller and field controllers</p> <p>4-wire SA Bus from the VMA controller, network sensors, and other sensor/actuator devices, includes a terminal to source 15 VDC supply power from VMA to SA Bus devices.</p>
Processor	RX630 32-bit Renesas® microcontroller
Memory	1 MB Flash Memory and 512 KB Random Access Memory (RAM)
Input and Output Capabilities	<p>1 - Universal Input: Defined as 0–10 VDC, 4–20 mA, 0–600k ohm, or Binary Dry Contact</p> <p>3 - Binary Outputs: Defined as 24 VAC Triac (internal power source)</p> <p>2 - Configurable Outputs: Defined as 0–10 VDC or 24 VAC Triac BO</p>

Table 4: VMA16 (32-bit) Series

Analog Input/Analog Output Accuracy	Analog Input: 15-bit resolution on UIs Analog Output: 0–10 VDC ± 200 mV
Air Pressure Differential Sensor	Range: -1.5 in. to 1.5 in. W.C. Performance Characteristics: Accuracy +/-1.3% Full Span Maximum ³ (+/- .039 in. w.c.) Typical accuracy at zero (null) pressure is +/-0.2% full scale ⁴
Mounting	Mounts to damper shaft using single set screw and to duct with single mounting screw.
Actuator Rating	4 N•m (35 lb•in.) minimum shaft length = 44 mm (1-3/4 in.)
Dimensions	Height x Width x Depth: 165 x 125 x 73 mm (6.5 x 4.92 x 2.9 in.) Center of Output Hub to Center of Captive Spacer: 135 mm (5-5/16 in.)
Weight	0.65 kg (1.45 lb)
Compliance	United States: UL Listed, File E107041, CCN PAZX, UL 916, Energy Management Equipment. Suitable for use in other environmental air space (plenums) in accordance with Section 300.22(C) of the National Electric Code (VMA1615 and VMA1630 only). FCC Compliant to CFR47, Part 15, Subpart B, Class A. Canada: UL Listed, File E107041, CCN PAZX7, CAN/CSA C22.2 No. 205, Signal Equipment; Industry Canada Compliant, ICES-003 Europe: CE Mark – Johnson Controls, Inc. declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive 2004/108/EC. Australia and New Zealand: C-Tick Compliant (N1813), Australia/NZ Emissions Compliant. BACnet International: BACnet Testing Laboratories (BTL) Protocol Revision 7 Listed BACnet Application Specific Controller (B-ASC)

1 This model is currently available only in Asia; contact your local Johnson Controls representative for more information.

2 For more information, refer to the *MS/TP Communications Bus Technical Bulletin (LIT-12011034)*.

3 Combined error due to offset, non-linearity, and temperature variation.

4 Includes error due to non-linearity.

The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.



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VMA1615, VMA1617, VMA1630, and VMA1632 VAV Controllers Catalog Page

4

NS Series Network Sensors

Description

The NS Series Network Sensor offering includes NS Series Network Zone Sensors and NS Series Network Discharge Air Sensors. The NS Series Network Sensors are designed to function directly with Metasys® system Field Equipment Controllers (FECs), Input/Output Modules (IOMs), Variable Air Volume (VAV) Modular Assembly (VMA16) Controllers, and Facility Explorer FX-PC Series Programmable Controllers (FX-PCGs, FX-PCVs, and FX-PCXs).

The majority of NS Series Network Zone Sensors monitor room temperature; however, options are available to also monitor zone humidity, carbon dioxide (CO₂), local temperature setpoint adjustments, and other variables. This data is transmitted to a controller on the Sensor Actuator (SA) Bus.

Some models of NS Series Network Zone Sensors include an onboard passive infrared (PIR) occupancy sensor that detects motion to determine if a space is occupied. This feature maximizes up to 30% energy savings in high-energy usage environments such as schools, dormitories, offices, hospitals, and hotels by adjusting the temperature of the space based on the occupancy status. In addition, the PIR occupancy sensor facilitates trending of floor space usage in these environments.

The NS Series Network Zone Sensors include models with a temperature setpoint dial and Liquid Crystal Display (LCD) that allows occupants to view the zone temperature, Relative Humidity (RH), and view and adjust the zone temperature setpoint. Some temperature and humidity models include a push button to toggle between temperature and RH on the display. These models also have the capability to set the desired default display to either temperature or RH.

A fan mode push button is included to set the desired fan speed (AUTO-OFF-low-medium-high). An occupancy override function allows the user to signal the controller that the zone is occupied to override the scheduled mode. Some models have DIP switches to set a unique address for applications that require multiple sensors.

For communication wiring flexibility, the wires connecting the network zone sensor to a controller can be terminated using a modular jack or screw terminals.

Each network sensor includes an SA Bus access port to allow accessories to access the SA Bus. This plug allows accessories to service or commission the connected controller or gain access to any other controller on the same Field Controller (FC) Bus.

The NS Series Network Zone Sensor offering includes models that can be surface mounted, vertical wallbox mounted, or flush mounted to meet the requirements of the specific application.

The NS Series Network Discharge Air Sensors monitor the duct temperature, typically at the discharge of the VAV box, and transmit this data to a local controller on the SA Bus using the 10 ft (305 cm) wiring lead included with the unit. The 10 ft (305 cm) wiring lead consists of four 22 AWG (0.6 mm) trade size color-coded wires encased in a plenum-rated jacket. Each of the wires is stripped and tinned for easy connection to the SA Bus screw terminal block.

The NS Series Network Discharge Air Sensors are available with either a 4 or 8 in. (102 or 203 mm) temperature probe. All models include DIP switches for applications requiring multiple discharge air sensors, each with a unique DIP switch address.



NS Series Network Sensors

Features

- BACnet® Master-Slave/Token-Passing (MS/TP) protocol communication — provides compatibility with Metasys system field controllers and Facility Explorer programmable controllers in a proven communication network
- backlit Liquid Crystal Display (LCD) available on some models — provides real-time status of the environment with backlighting activated during user interaction
- simple temperature setpoint adjustment available on some models — enables you to change the setpoint with the turn of a dial
- onboard PIR occupancy sensor available on some models — maximizes up to 30% energy savings in high-energy usage environments, and facilitates trending of floor space usage
- temporary occupancy available on some models — provides a timed override command, which temporarily initiates an alternate mode
- field selectable default display setting on some models — allows you to toggle between temperature and RH on the display, and set the desired default for continuous viewing
- Fahrenheit/Celsius (F/C) button available on some models — toggles the display temperature between degrees Celsius and degrees Fahrenheit

Note: Since some NS Series Network Sensor features are not supported in previous releases of Metasys or Facility Explorer system software, it is recommended that the system software be kept up to date.

Repair Information

If the NS Series Network Zone Sensor or the NS Series Network Discharge Air Sensor fails to operate within its specifications, replace the unit. For a replacement sensor, contact the nearest Johnson Controls® representative.

NS Series Network Sensors (Continued)

Selection Charts

Network Zone Sensor Ordering Information — Temperature Only Models

Product Code Number	Size (mm), Height x Width	Vertical Wallbox-Mounted (WB) or Surface-Mounted (SM)	Johnson Controls Logo	LCD Display	Temperature Adjustment: Setpoint (Set) or Warmer/Cooler Dial (W/C)	Occupancy Override Button, PIR Occupancy Sensor	F/C Scale Toggle	Fan Control	Screw Terminals (ST) or Modular Jack (MJ)	Address Switches	VAV Balancing Feature
NS-ATA7001-0	80 x 80	SM	Yes	Yes	Set	Yes, No	No	No	MJ	No	No
NS-ATA7002-0	80 x 80	SM	Yes	Yes	Set	Yes, No	No	No	ST	No	No
NS-ATA7003-0	80 x 80	SM	Yes	Yes	Set	Yes, No	No	No	ST	Yes	No
NS-ATB7001-0	80 x 80	SM	Yes	Yes	Set	Yes, No	Yes	No	MJ	No	No
NS-ATB7002-0	80 x 80	SM	Yes	Yes	Set	Yes, No	Yes	No	ST	No	No
NS-ATB7003-0	80 x 80	SM	Yes	Yes	Set	Yes, No	Yes	No	ST	Yes	No
NS-ATC7001-0	80 x 80	SM	Yes	Yes	Set	Yes, No	No	Yes	MJ	No	No
NS-ATC7002-0	80 x 80	SM	Yes	Yes	Set	Yes, No	No	Yes	ST	No	No
NS-ATD7001-0	80 x 80	SM	Yes	Yes	Set	Yes, No	Yes	Yes	MJ	No	No
NS-ATD7002-0	80 x 80	SM	Yes	Yes	Set	Yes, No	Yes	Yes	ST	No	No
NS-ATF7001-0	80 x 80	SM	Yes	Yes	W/C	Yes, No	Yes	No	MJ	No	No
NS-ATF7002-0	80 x 80	SM	Yes	Yes	W/C	Yes, No	Yes	No	ST	No	No
NS-ATN7001-0	80 x 80	SM	Yes	No	N/A	No, No	No	No	MJ	No	No
NS-ATN7001-2	80 x 80	SM	No	No	N/A	No, No	No	No	MJ	No	No
NS-ATN7003-0	80 x 80	SM	Yes	No	N/A	No, No	No	No	ST	Yes	No
NS-ATN7003-2	80 x 80	SM	No	No	N/A	No, No	No	No	ST	Yes	No
NS-ATP7001-0	80 x 80	SM	Yes	No	W/C	Yes, No	No	No	MJ	No	No
NS-ATP7001-2	80 x 80	SM	No	No	W/C	Yes, No	No	No	MJ	No	No
NS-ATP7002-0	80 x 80	SM	Yes	No	W/C	Yes, No	No	No	ST	No	No
NS-ATP7002-2	80 x 80	SM	No	No	W/C	Yes, No	No	No	ST	No	No
NS-ATP7003-0	80 x 80	SM	Yes	No	W/C	Yes, No	No	No	ST	Yes	No
NS-ATP7003-2	80 x 80	SM	No	No	W/C	Yes, No	No	No	ST	Yes	No
NS-ATV7001-0	80 x 80	SM	Yes	Yes	Set	Yes, No	Yes	No ¹	MJ	No	Yes
NS-ATV7002-0	80 x 80	SM	Yes	Yes	Set	Yes, No	Yes	No ¹	ST	No	Yes
NS-BTB7001-0	120 x 80	WB, SM	Yes	Yes	Set	Yes, No	Yes	No	MJ	No	No
NS-BTB7001-2	120 x 80	WB, SM	No	Yes	Set	Yes, No	Yes	No	MJ	No	No
NS-BTB7002-0	120 x 80	WB, SM	Yes	Yes	Set	Yes, No	Yes	No	ST	No	No
NS-BTB7003-0	120 x 80	WB, SM	Yes	Yes	Set	Yes, No	Yes	No	ST	Yes	No
NS-BTB7003-2	120 x 80	WB, SM	No	Yes	Set	Yes, No	Yes	No	ST	Yes	No
NS-BTF7001-0	120 x 80	WB, SM	Yes	Yes	W/C	Yes, No	Yes	No	MJ	No	No
NS-BTF7002-0	120 x 80	WB, SM	Yes	Yes	W/C	Yes, No	Yes	No	ST	No	No
NS-BTN7001-0	120 x 80	WB, SM	Yes	No	N/A	No, No	No	No	MJ	No	No
NS-BTN7001-2	120 x 80	WB, SM	No	No	N/A	No, No	No	No	MJ	No	No
NS-BTN7003-0	120 x 80	WB, SM	Yes	No	N/A	No, No	No	No	ST	Yes	No
NS-BTN7003-2	120 x 80	WB, SM	No	No	N/A	No, No	No	No	ST	Yes	No
NS-BTP7001-0	120 x 80	WB, SM	Yes	No	W/C	Yes, No	No	No	MJ	No	No
NS-BTP7001-2	120 x 80	WB, SM	No	No	W/C	Yes, No	No	No	MJ	No	No
NS-BTP7002-0	120 x 80	WB, SM	Yes	No	W/C	Yes, No	No	No	ST	No	No
NS-BTP7002-2	120 x 80	WB, SM	No	No	W/C	Yes, No	No	No	ST	No	No
NS-BTP7003-0	120 x 80	WB, SM	Yes	No	W/C	Yes, No	No	No	ST	Yes	No
NS-BTV7001-0	120 x 80	WB, SM	Yes	Yes	Set	Yes, No	Yes	No ¹	MJ	No	Yes
NS-BTV7002-0	120 x 80	WB, SM	Yes	Yes	Set	Yes, No	Yes	No ¹	ST	No	Yes
NS-MTB7001-0	120 x 80	WB, SM	Yes	Yes	Set	No, Yes	Yes	No	MJ	No	No
NS-MTB7002-0	120 x 80	WB, SM	Yes	Yes	Set	No, Yes	Yes	No	ST	No	No
NS-MTL7001-0	120 x 80	WB, SM	Yes	No	N/A	Yes, Yes	No	No	MJ	No	No
NS-MTL7002-0	120 x 80	WB, SM	Yes	No	N/A	Yes, Yes	No	No	ST	No	No

1. In the VAV balancing models, the fan control button is replaced by a light bulb button used in the VAV balancing process.

NS Series Network Sensors (Continued)

Network Zone Sensor Ordering Information — Temperature and Humidity Models without RH Display

Product Code Number	Size (mm), Height x Width	Vertical Wallbox-Mounted (WB) or Surface-Mounted (SM)	Johnson Controls Logo	LCD Display, RH Display	Humidity Element Accuracy	Temperature Adjustment: Setpoint (Set) or Warmer/Cooler Dial (W/C)	Occupancy Override Button, PIR Occupancy Sensor	F/C Scale Toggle	Screw Terminals (ST) or Modular Jack (MJ)	Address Switches
NS-AHA7001-0	80 x 80	SM	Yes	Yes, No	3%	Set	Yes, No	No	MJ	No
NS-AHA7002-0	80 x 80	SM	Yes	Yes, No	3%	Set	Yes, No	No	ST	No
NS-AHB7001-0	80 x 80	SM	Yes	Yes, No	3%	Set	Yes, No	Yes	MJ	No
NS-AHB7002-0	80 x 80	SM	Yes	Yes, No	3%	Set	Yes, No	Yes	ST	No
NS-AHB7003-0	80 x 80	SM	Yes	Yes, No	3%	Set	Yes, No	Yes	ST	Yes
NS-AHN7001-0	80 x 80	SM	Yes	None	3%	N/A	No, No	No	MJ	No
NS-AHP7001-0	80 x 80	SM	Yes	None	3%	W/C	Yes, No	No	MJ	No
NS-AHN7001-2	80 x 80	SM	No	None	3%	N/A	No, No	No	MJ	No
NS-APA7001-0	80 x 80	SM	Yes	Yes, No	2%	Set	Yes, No	No	MJ	No
NS-APA7002-0	80 x 80	SM	Yes	Yes, No	2%	Set	Yes, No	No	ST	No
NS-APB7001-0	80 x 80	SM	Yes	Yes, No	2%	Set	Yes, No	Yes	MJ	No
NS-APB7002-0	80 x 80	SM	Yes	Yes, No	2%	Set	Yes, No	Yes	ST	No
NS-APB7003-0	80 x 80	SM	Yes	Yes, No	2%	Set	Yes, No	Yes	ST	Yes
NS-BHB7001-0	120 x 80	WB, SM	Yes	Yes, No	3%	Set	Yes, No	Yes	MJ	No
NS-BHB7002-0	120 x 80	WB, SM	Yes	Yes, No	3%	Set	Yes, No	Yes	ST	No
NS-BHB7003-0	120 x 80	WB, SM	Yes	Yes, No	3%	Set	Yes, No	Yes	ST	Yes
NS-BHN7001-0	120 x 80	WB, SM	Yes	None	3%	N/A	No, No	No	MJ	No
NS-BHN7001-2	120 x 80	WB, SM	No	None	3%	N/A	No, No	No	MJ	No
NS-BHP7001-0	120 x 80	WB, SM	Yes	None	3%	W/C	Yes, No	No	MJ	No
NS-BPB7001-0	120 x 80	WB, SM	Yes	Yes, No	2%	Set	Yes, No	Yes	MJ	No
NS-BPB7002-0	120 x 80	WB, SM	Yes	Yes, No	2%	Set	Yes, No	Yes	ST	No
NS-BPB7003-0	120 x 80	WB, SM	Yes	Yes, No	2%	Set	Yes, No	Yes	ST	Yes
NS-MHL7001-0	120 x 80	WB, SM	Yes	No, No	3%	N/A	Yes, Yes	No	MJ	No
NS-MHL7002-0	120 x 80	WB, SM	Yes	No, No	3%	N/A	Yes, Yes	No	ST	No

Network Zone Sensor Ordering Information — Temperature and Humidity Models with Temperature or RH Display (Field Selectable Default Display)

Product Code Number	Size (mm), Height x Width	Vertical Wallbox-Mounted (WB) or Surface-Mounted (SM)	LCD Display, RH Display	Humidity Element Accuracy	Temperature Adjustment: Setpoint (Set) or Warmer/Cooler Dial (W/C)	Occupancy Override Button	F/C Scale Toggle	Screw Terminals (ST) or Modular Jack (MJ)	Address Switches
NS-AHR7101-0	80 x 80	SM	Yes, Yes	3%	Set	Yes	Yes	MJ	No
NS-AHR7102-0	80 x 80	SM	Yes, Yes	3%	Set	Yes	Yes	ST	No
NS-AHR7103-0	80 x 80	SM	Yes, Yes	3%	Set	Yes	Yes	ST	Yes
NS-APR7101-0	80 x 80	SM	Yes, Yes	2%	Set	Yes	Yes	MJ	No
NS-APR7102-0	80 x 80	SM	Yes, Yes	2%	Set	Yes	Yes	ST	No
NS-BHR7101-0	120 x 80	WB, SM	Yes, Yes	3%	Set	Yes	Yes	MJ	No
NS-BHR7103-0	120 x 80	WB, SM	Yes, Yes	3%	Set	Yes	Yes	ST	Yes

Network Zone Sensor Ordering Information — Motion Detection Only Models (No Temperature or Humidity Sensing)

Product Code Number	Size (mm), Height x Width	Vertical Wallbox-Mounted (WB), or Surface-Mounted (SM)	LCD Display	PIR Occupancy Sensor	Screw Terminals (ST), or Modular Jack (MJ)	Address Switches
NS-MNN7001-0	120 x 80	WB, SM	No	Yes	MJ	No
NS-MNN7003-0	120 x 80	WB, SM	No	Yes	ST	Yes

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NS Series Network Sensors (Continued)

Network Zone Sensor Ordering Information — CO₂ Models

Product Code Number	Size (mm), Height x Width	Vertical Wallbox-Mounted (WB), or Surface-Mounted (SM)	LCD Display	CO ₂ Measurement Range	Johnson Controls Logo	Screw Terminals (ST), or Modular Jack (MJ)	Sensor Addressing
NS-BCN7004-0	120 x 80	WB, SM	No	0 to 2,000 ppm	Yes	ST, MJ	DIP Switch (212 to 219)
NS-BCN7004-2	120 x 80	WB, SM	No	0 to 2,000 ppm	No	ST, MJ	DIP Switch (212 to 219)

Network Zone Sensor Ordering Information — Flush-Mount Temperature Only Models

Product Code Number	Faceplate Dimensions, Height x Width	Mounting	LCD Display	Temperature Measurement Range	Johnson Controls Logo	Terminations	Sensor Addressing
NS-FTN7003-0	4-1/2 in. x 2-3/4 in. (114 mm x 70 mm)	Flush-Mount	No	32.0°F/0.0°C to 104.0°F/40.0°C	Yes	Screw Terminal Block	DIP Switch (200 to 203)
NS-FTN7003-2	4-1/2 in. x 2-3/4 in. (114 mm x 70 mm)	Flush-Mount	No	32.0°F/0.0°C to 104.0°F/40.0°C	No	Screw Terminal Block	DIP Switch (200 to 203)

Network Discharge Air Sensor Ordering Information


Product Code Number	Dimensions, Height x Width x Depth	Temperature Probe Length	10 ft (305 cm) Wiring Lead Included	Terminations	Sensor Addressing
NS-DTN7043-0	3 in. x 3 in. x 2 in. (76 mm x 76 mm x 51 mm)	4 in. (102 mm)	Yes	Screw Terminal Block	DIP Switch (204 to 211)
NS-DTN7083-0	3 in. x 3 in. x 2 in. (76 mm x 76 mm x 51 mm)	8 in. (203 mm)	Yes	Screw Terminal Block	DIP Switch (204 to 211)


Technical Specifications

NS Series Network Zone Sensors — Temperature Only Models and Temperature and Humidity Models (Part 1 of 2)	
Supply Voltage	9.8 to 16.5 VDC; 15 VDC Nominal (From SA Bus)
Current Consumption	Temperature Only Models with LCD Display: 21 mA Maximum (Non-transmitting) Temperature Only Models without LCD Display: 13 mA Maximum (Non-transmitting) Temperature and Humidity Models with LCD Display: 25 mA Maximum (Non-transmitting) Temperature and Humidity Models without LCD Display: 17 mA Maximum (Non-transmitting)
Terminations	Modular Jack or Screw Terminal Block
Sensor Addressing	NS-AHx7003-0, NS-APB7003-0, NS-ATx7003-0, NS-BHx7003-0, NS-BPB7003-0, NS-BTB7003-0, NS-BTN7003-0, and NS-BTP7003-0 Models: DIP Switch Set from 200 to 203; Factory Set at 203 All Other Models: Fixed Address of 199
Wire Size	Modular Jack Models: 24 or 26 AWG (0.5 or 0.4 mm Diameter) Recommended; Three Twisted Pair (Six Conductors) Screw Terminal Block Models: 18 to 22 AWG (1.0 to 0.6 mm Diameter); 22 AWG (0.6 mm Diameter) Recommended
Communication Rate	Auto-Detect: 9.6k, 19.2k, 38.4k, or 76.8k bps
Mounting	Surface-Mounted: 80 x 80 mm Surface-Mounted or Vertical Wallbox-Mounted: 120 x 80 mm
Temperature Measurement Range	32.0°F/0.0°C to 104.0°F/40.0°C
Humidity Measurement Range	Full Range: 0 to 100% RH Calibrated Range: 10 to 90% RH
Temperature Sensor Type	Local 1k ohm Platinum Resistance Temperature Detector (RTD); Class A per IEC 60751
Humidity Sensor Type	Thin Film Capacitive Sensor
Temperature Resolution (Models with LCD)	±0.5F°/±0.5C°
Temperature Accuracy	NS Series Network Zone Sensor: ±1.0F°/±0.6C° Temperature Element Only: 0.35F° at 70°F (0.19C° at 21°C)
Humidity Element Accuracy	NS-APx700x-0 and NS-BPB700x-0 Models: ±2% RH for 20 to 80% RH; ±4% RH for 10 to 20% and 80 to 90% RH NS-AHx700x-0, NS-BHx700x-0, and NS-MHL700x-0 Models: ±3% RH for 20 to 80% RH; ±6% RH for 10 to 20% and 80 to 90% RH
Time Constant	10 Minutes Nominal at 10 fpm Airflow
Default Temperature Setpoint Adjustment Range	With LCD Display: 50.0°F/10.0°C to 86.0°F/30.0°C in 0.5° Increments Without LCD Display: ±5.0F°/±3.0C°
PIR Occupancy Sensor Motion Detection (Models with PIR Occupancy Sensor)	Minimum 94 Angular Degrees up to a Distance of 15 ft (4.6 m); Based on a Clear Line of Sight

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NS Series Network Sensors (Continued)


NS Series Network Zone Sensors — Temperature Only Models and Temperature and Humidity Models (Part 2 of 2)		
Ambient Conditions		
Operating: 32 to 104°F (0 to 40°C); 10 to 90% RH, Noncondensing; 85°F (29°C) Maximum Dew Point		
Storage with LCD Display: -4 to 140°F (-20 to 60°C); 5 to 95% RH, Noncondensing		
Storage without LCD Display: -40 to 158°F (-40 to 70°C); 5 to 95% RH, Noncondensing		
Compliance 	BACnet International	BACnet Testing Laboratories™ (BTL) 135-2004 Listed BACnet Smart Sensor (B-SS) Note: Excludes the NS-ATV700x-0 and NS-BTV700x-0 models.
	United States	UL Listed, File E107041, CCN PAZX, Under UL 916, Energy Management Equipment; FCC Compliant to CFR 47, Part 15, Subpart B, Class A
	Canada	UL Listed, File E107041, CCN PAZX7, Under CAN/CSA C22.2 No. 205, Signal Equipment; Industry Canada, ICES-003
	Europe	CE Mark – Johnson Controls, Inc., declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive 2004/108/EC.
	Australia and New Zealand	C-Tick Mark, Australia/NZ Emissions Compliant
Accessory (Order Separately)		NS-WALLPLATE-0: Adapts an 80 x 80 mm NS Series Network Zone Sensor to a Standard 80 x 120 mm Wallbox
Shipping Weight		NS-Axx7xxx-0 Models: 0.20 lb (0.09 kg)
		NS-Bxx7xxx-0 and NS-Mxx700x-0 Models: 0.25 lb (0.11 kg)


NS Series Network Zone Sensors — Motion Detection Only Models (No Temperature or Humidity Sensing)		
Supply Voltage		9.8 to 16.5 VDC; 15 VDC Nominal (From SA Bus)
Current Consumption		13 mA Maximum (Non-transmitting)
Terminations		Modular Jack or Screw Terminal Block
Sensor Addressing (NS-MNN7003-0 Model)		DIP Switch Set from 200 to 203; Factory Set at 203
Wire Size		Modular Jack Model: 24 AWG or 26 AWG (0.5 or 0.4 mm Diameter) Recommended; Three Twisted Pair (Six Conductors) Screw Terminal Block Model: 18 to 22 AWG (1.0 to 0.6 mm Diameter); 22 AWG (0.6 mm Diameter) Recommended
Communication Rate		Auto-Detect: 9.6k, 19.2k, 38.4k, or 76.8k bps
Mounting		Surface-Mounted or Vertical Wallbox-Mounted: 120 x 80 mm
PIR Occupancy Sensor Motion Detection		Minimum 94 Angular Degrees up to a Distance of 15 ft (4.6 m); Based on a Clear Line of Sight
Ambient Conditions		Operating: 32 to 104°F (0 to 40°C); 10 to 90% RH, Noncondensing; 85°F (29°C) Maximum Dew Point Storage: -40 to 158°F (-40 to 70°C); 5 to 95% RH, Noncondensing
Compliance 	BACnet International	BACnet Testing Laboratories™ (BTL) 135-2004 Listed BACnet Smart Sensor (B-SS)
	United States	UL Listed, File E107041, CCN PAZX, Under UL 916, Energy Management Equipment; FCC Compliant to CFR 47, Part 15, Subpart B, Class A
	Canada	UL Listed, File E107041, CCN PAZX7, Under CAN/CSA C22.2 No. 205, Signal Equipment; Industry Canada, ICES-003
	Europe	CE Mark – Johnson Controls, Inc., declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive 2004/108/EC.
	Australia and New Zealand	C-Tick Mark, Australia/NZ Emissions Compliant
Shipping Weight		0.25 lb (0.11 kg)

NS Series Network Zone Sensor — CO ₂ Models (Part 1 of 2)		
Supply Voltage		Non-isolated: 20 to 30 VAC (18 to 30 VDC), Class 2 or Safety Extra-Low Voltage (SELV) Isolated: 9.8 to 16.5 VDC; 15 VDC Nominal (From SA Bus)
Current Consumption		Non-isolated: 22 mA Average at 24 VAC; 28 mA Average at 24 VDC Isolated: 5 mA Maximum, Non-transmitting (From SA Bus)
Power Consumption		Non-isolated: Less Than 0.7 W Average
Terminations		Non-isolated Supply: Screw Terminal Block SA Bus: Modular Jack or Screw Terminal Block
Sensor Addressing		DIP Switch Set from 212 to 219; Factory Set at 212
Wire Size		Modular Jack: 24 or 26 AWG (0.5 or 0.4 mm Diameter) Recommended; Three Twisted Pair (Six Conductors) Screw Terminal Block: 18 to 22 AWG (1.0 to 0.6 mm Diameter); 22 AWG (0.6 mm Diameter) Recommended
Communication Rate		Auto-Detect: 9.6k, 19.2k, 38.4k, or 76.8k bps
CO₂ Measurement Range		0 to 2,000 ppm

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NS Series Network Sensors (Continued)


NS Series Network Zone Sensor — CO ₂ Models (Part 2 of 2)		
CO ₂ Sensing Accuracy	Plus or Minus the Sum of 40 ppm and 2.0% of the CO ₂ Reading at 77°F (25°C) and 978 hPa or an Altitude of 1,000 ft/300 m Note: All accuracy specifications reflect the testing of the device using high-grade certified gases. This device is intended for an altitude range of 0 ft/0 m to 2,000 ft/600 m above sea level without compensation. Temperature Dependence of Output: -0.35% of the CO ₂ Reading per 1.8F°/1C° Typical Pressure Dependence of Output: +0.15% of the CO ₂ Reading per 1 hPa Typical	
CO ₂ Sensing Resolution	1 ppm	
CO ₂ Sensing Response Time	1 Minute (0 to 90%)	
CO ₂ Sensing Warm-Up Time	Less Than 1 Minute; Less Than 10 Minutes for Full Accuracy	
CO ₂ Sensing Long-Term Stability	Less Than ±100 ppm Over 5 Years	
Mounting	Surface-Mounted or Vertical Wallbox-Mounted: 120 x 80 mm	
Ambient Conditions	Operating: 32 to 104°F (0 to 40°C); 10 to 90% RH, Noncondensing; 85°F (29°C) Maximum Dew Point; 700 to 1,200 hPa Storage: -40 to 158°F (-40 to 70°C); 0 to 95% RH, Noncondensing	
	Compliance	BACnet Testing Laboratories™ (BTL) 135-2004 Listed BACnet Smart Sensor (B-SS)
	BACnet International	
	United States	UL Listed, File E107041 CCN PAZX, Under UL 916, Energy Management Equipment; FCC Compliant to CFR 47, Part 15, Subpart B, Class A
	Canada	UL Listed, File E107041, CCN PAZX7, Under CAN/CSA C22.2 No. 205, Signal Equipment; Industry Canada, ICES-003
	Europe	CE Mark – Johnson Controls, Inc., declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive 2004/108/EC.
Australia and New Zealand	C-Tick Mark, Australia/NZ Emissions Compliant	
Supply Voltage	0.35 lb (0.16 kg)	

NS Series Network Zone Sensor — Flush-Mount Temperature Only Models		
Supply Voltage	9.8 to 16.5 VDC; 15 VDC Nominal (From SA Bus)	
Current Consumption	12 mA Maximum (Non-transmitting) per Flush-Mount Network Sensor	
Terminations	Screw Terminal Block Note: Wire leads are field supplied and are not tinned.	
Sensor Addressing	DIP Switch Set from 200 to 203; Factory Set at 203	
Wire Size	18 to 22 AWG (1.0 to 0.6 mm Diameter); 22 AWG (0.6 mm Diameter) Recommended; 10 ft (304.8 cm) Wiring Lead Included with the Unit	
Communication Rate	Auto-Detect: 9.6k, 19.2k, 38.4k, or 76.8k bps	
Temperature Measurement Range	32.0°F/0.0°C to 104.0°F/40.0°C	
Temperature Sensor Type	Local 1k ohm Platinum Resistance Temperature Detector (RTD); Class A per IEC 60751	
Temperature Accuracy	NS Series Network Zone Sensor: ±1.0F°/±0.6C° Temperature Element Only: 0.35F° at 70°F (0.19C° at 21°C)	
Ambient Conditions	Operating: 32 to 104°F (0 to 40°C); 10 to 90% RH, Noncondensing; 85°F (29°C) Maximum Dew Point Storage: -40 to 158°F (-40 to 70°C); 5 to 95% RH, Noncondensing	
	Compliance	BACnet Testing Laboratories™ (BTL) 135-2004 Listed BACnet Smart Sensor (B-SS)
	BACnet International	
	United States	UL Listed, File E107041, CCN PAZX, Under UL 916, Energy Management Equipment; FCC Compliant to CFR 47, Part 15, Subpart B, Class A
	Canada	UL Listed, File E107041, CCN PAZX7, Under CAN/CSA C22.2 No. 205, Signal Equipment; Industry Canada, ICES-003
	Europe	CE Mark – Johnson Controls, Inc., declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive 2004/108/EC.
Australia and New Zealand	C-Tick Mark, Australia/NZ Emissions Compliant	
Shipping Weight	0.25 lb (0.11 kg)	

NS Series Network Discharge Air Sensors (Part 1 of 2)	
Supply Voltage	9.8 to 16.5 VDC; 15 VDC Nominal
Current Consumption	12 mA Maximum (Non-transmitting) per Discharge Air Sensor
Terminations	Four Color-Coded Wiring Leads, Stripped and Tinned; Factory-Installed at the Discharge Air Sensor Screw Terminal Block
Sensor Addressing	DIP Switch Set from 204 to 211; Factory Set at 204

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NS Series Network Sensors (Continued)

NS Series Network Discharge Air Sensors (Part 2 of 2)		
Wire Size	18 to 22 AWG (1.0 to 0.6 mm Diameter); 22 AWG (0.6 mm Diameter) Recommended; 10 ft (305 cm) Wiring Lead Included with the Unit	
Communication Rate	Auto-Detect: 9.6k, 19.2k, 38.4k, or 76.8k bps	
Mounting	Duct-Mounted: 4 or 8 in. (102 or 203 mm) Temperature Probe Length	
Temperature Measurement Range	14°F/-10°C to 140°F/60°C	
Temperature Sensor Type	Local 1k ohm Platinum Resistance Temperature Detector (RTD); Class A per IEC 60751	
Temperature Accuracy	NS Series Network Discharge Air Sensor: ±1.0F°/±0.6C° Temperature Element Only: 0.35F° at 70°F (0.19C° at 21°C)	
Ambient Conditions	Operating: 14 to 140°F (-10 to 60°C); 10 to 90% RH, Noncondensing; 85°F (29°C) Maximum Dew Point Storage: -40 to 158°F (-40 to 70°C); 5 to 95% RH, Noncondensing	
Compliance 	BACnet International	BACnet Testing Laboratories™ (BTL) 135-2004 Listed BACnet Smart Sensor (B-SS)
	United States	UL Listed, File E107041, CCN PAZX, Under UL 916, Energy Management Equipment; FCC Compliant to CFR 47, Part 15, Subpart B, Class A
	Canada	UL Listed, File E107041, CCN PAZX7, Under CAN/CSA C22.2 No. 205, Signal Equipment; Industry Canada, ICES-003
	Europe	CE Mark – Johnson Controls, Inc., declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive 2004/108/EC.
	Australia and New Zealand	C-Tick Mark, Australia/NZ Emissions Compliant
Shipping Weight	NS-DTN7043-0: 1.15 lb (0.52 kg) NS-DTN7083-0: 1.17 lb (0.53 kg)	

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PAGx0000xAC0 NAE Standard Control Panel Assembly Mounted in a 20 in. x 24 in. Enclosure

Description

The PAGx0000xAC0 is a prewired, preassembled standard control panel and enclosure that contains the Metasys® Network Automation Engine (NAE). These Web-based network controllers communicate using Information Technology (IT) and Internet languages while incorporating the communication technology of the building automation industry, including the BACnet® protocol, LONWORKS® network, and the N2 Bus.

The PAGx0000xAC0 Control Panel is shipped complete, mounted in a 20 in. W x 24 in. H steel enclosure. In addition to the Network Automation Engine, the assembly also contains a 5-port Ethernet switch and a power supply incorporating a 5 A circuit breaker, a 96 VA 120/24 VAC transformer, and two 120 VAC outlets.



PAGx0000xAC0 NAE Standard Control Panel Assembly Mounted in a 20 in. x 24 in. Enclosure

Features

- consistent layout for all standard control panel solutions simplifies installation and commissioning
- panel prebuilt, pre-wired, and pretested in an ISO-9002 manufacturing facility provides products of consistently high quality
- power supply with resettable circuit breaker and transformer provides high and low voltage protection
- 5-Port switch simplifies installation and commissioning
- Network Automation Engine (NAE) speaks IT and internet language to web browsers and remote operations centers
- Network Automation Engine (NAE) monitors and supervises Heating, Ventilating, and Air Conditioning (HVAC) equipment; lighting; fire systems; security; and access control systems
- Web Browser-based User Interface allows access to system data in the NAE from any standard Web browser device connected to the network, including remote users connected by dial-up telephone or an Internet Service Provider (ISP)
- California Office of Statewide Health Planning and Development (OSHPD) Special Seismic Certification Preapproved control panel assembly meets standards for rigid and flexible mounting conditions to account for unit-mounted and remote-mounted application
- UL 508A Rated Control Panel and UL 50 Rated, CSA Approved Enclosure meets local and national code requirements for US and Canada (cULus listed)

Ordering Information

Basic Control Panel Bill of Material

Quantity	Description
1	Enclosure: 20 in. W x 24 in. H x 9-1/4 in. D (508 mm W x 610 mm H x 235 mm D), Type 1, with keyed lock
1	MS-NAE55xx-2: Network Automation Engine (NAE)
1	96 VA 120/24 VAC power supply with 5 A primary circuit protection and two 120 VAC outlets
1	5-Port Ethernet switch

Product Code Numbers

Product Code Number	Description/Options
PAG100001AC0	MS-NAE5510-2 mounted in 20 in. W x 24 in. H x 9-1/4 in. D custom enclosure with 96 VA 120/24 VAC power supply and 5-port switch
PAGX00001AC0	MS-NAE5511-2 mounted in 20 in. W x 24 in. H x 9-1/4 in. D custom enclosure with 96 VA 120/24 VAC power supply and 5-port switch
PAGY00001AC0	NS-NAE5520-2 mounted in 20 in. W x 24 in. H x 9-1/4 in. D custom enclosure with 96 VA 120/24 VAC power supply and 5-port switch
PAGZ00001AC0	MS-NAE5521-2 mounted in 20 in. W x 24 in. H x 9-1/4 in. D custom enclosure with 96 VA 120/24 VAC power supply and 5-port switch

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PAGx0000xAC0 NAE Standard Control Panel Assembly Mounted in a 20 in. x 24 in. Enclosure (Continued)

Technical Specifications

Product	PAGx0000xAC0 NAE standard control panel mounted in a 20 x 24 in. enclosure
Wiring	24 VAC prewired from transformer secondary to NAE
Wire Size	Ground wire: 14 AWG; 24 VAC controller wires: 16 AWG
Enclosure Rating	Type 1
Finish	ANSI 61 gray polyester powder coating (inside and outside over phosphatized surfaces)
Ambient Operating Condition	32–122°F (0–50°C) 10–90% RH
Ambient Storage Condition	-40–158°F (-40–70°C) 5–95% RH
Dimensions (Width x Height x Depth)	20 x 24 x 9-1/4 in. (508 x 610 x 235 mm)
Weight	55 lb (25.0 kg)
Compliance	Control panel: UL 508A Rated (cULus); Enclosure: UL 50 Rated, CSA Approved OSHPD Special Seismic Certification Preapproval: OSP-0140-10 California Building Code (CBC) - 2010, International Building Code (IBC) - 2009 Seismic Performance Characteristics: $S_{DS}(g) = 2.26$, $z/h = 1.0$, $I_p = 1.5$

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PAGx00001FC0 NAE Standard Control Panel Assembly Mounted in a 16 in. x 20 in. Enclosure

Description

The PAGx00001FC0 is a prewired, preassembled standard control panel and enclosure that contains the Metasys® Network Automation Engine (NAE). These Web-based network controllers communicate using Information Technology (IT) and Internet languages while incorporating the communication technology of the building automation industry, including the BACnet® protocol, LonWORKS® network, and the N2 Bus.

The PAGx00001FC0 Control Panel is shipped complete, mounted in a 16 in. W x 20 in. H steel enclosure. In addition to the NAE, the assembly also contains a 5-port Ethernet switch and a power supply incorporating a 5 A circuit breaker, a 96 VA 120/24 VAC transformer, and two 120 VAC outlets.



PAGx00001FC0 NAE Standard Control Panel Assembly Mounted in a 16 in. x 20 in. Enclosure

Features

- consistent layout for all standard control panel solutions simplifies installation and commissioning
- panel prebuilt, pre-wired, and retested in an ISO-9002 manufacturing facility provides products of consistently high quality
- power supply with resettable circuit breaker and transformer provides high and low voltage protection
- 5-port switch simplifies installation and commissioning
- Network Automation Engine (NAE) speaks IT and internet language to web browsers and remote operations centers
- Network Automation Engine (NAE) monitors and supervises Heating, Ventilating, and Air Conditioning (HVAC) equipment; lighting; fire systems; security; and access control system
- Web Browser-Based User Interface allows access to system data in the NAE from any standard Web browser device connected to the network, including remote users connected by dial-up telephone or an Internet Service Provider (ISP)
- California Office of Statewide Health Planning and Development (OSHPD) Special Seismic Certification Preapproved control panel assembly meets standards for rigid and flexible mounting conditions to account for unit-mounted and remote-mounted application
- UL 508A Rated Control Panel and UL 50 Rated, Canadian Standards Association (CSA) Approved Enclosure meets local and national code requirements for US and Canada (cULus listed)

Ordering Information

Basic Control Panel Bill of Material

Quantity	Description
1	Enclosure: 16 in. W x 20 in. H x 6-5/8 in. D (406 mm W x 508 mm H x 168 mm D), Type 1, with keyed lock
1	MS-NAE45xx-2 or MS-NAE35xx-2: Network Automation Engine (NAE)
1	96 VA 120/24 VAC power supply with 5 A primary circuit protection and two 120 VAC outlets
1	5-Port Ethernet switch

Product Code Numbers

Product Code Number	Description/Options
PAGE00001FC0	MS-NAE4510-2 mounted in 16 in. W x 20 in. H x 6-5/8 in. D custom enclosure with 96 VA 120/24 VAC power supply and 5-port switch
PAGF00001FC0	MS-NAE4511-2 mounted in 16 in. W x 20 in. H x 6-5/8 in. D custom enclosure with 96 VA 120/24 VAC power supply and 5-port switch
PAGG00001FC0	MS-NAE4520-2 mounted in 16 in. W x 20 in. H x 6-5/8 in. D custom enclosure with 96 VA 120/24 VAC power supply and 5-port switch
PAGH00001FC0	MS-NAE4521-2 mounted in 16 in. W x 20 in. H x 6-5/8 in. D custom enclosure with 96 VA 120/24 VAC power supply and 5-port switch
PAGJ00001FC0	MS-NAE3510-2 mounted in 16 in. W x 20 in. H x 6-5/8 in. D custom enclosure with 96 VA 120/24 VAC power supply and 5-port switch
PAGK00001FC0	MS-NAE3511-2 mounted in 16 in. W x 20 in. H x 6-5/8 in. D custom enclosure with 96 VA 120/24 VAC power supply and 5-port switch
PAGL00001FC0	MS-NAE3520-2 mounted in 16 in. W x 20 in. H x 6-5/8 in. D custom enclosure with 96 VA 120/24 VAC power supply and 5-port switch
PAGM00001FC0	MS-NAE3521-2 mounted in 16 in. W x 20 in. H x 6-5/8 in. D custom enclosure with 96 VA 120/24 VAC power supply and 5-port switch
PAGS00001FC0	MS-NAE3514-2 mounted in 16 in. W x 20 in. H x 6-5/8 in. D custom enclosure with 96 VA 120/24 VAC power supply and 5-port switch
PAGT00001FC0	MS-NAE3515-2 mounted in 16 in. W x 20 in. H x 6-5/8 in. D custom enclosure with 96 VA 120/24 VAC power supply and 5-port switch
PAGU00001FC0	MS-NAE3524-2 mounted in 16 in. W x 20 in. H x 6-5/8 in. D custom enclosure with 96 VA 120/24 VAC power supply and 5-port switch
PAGV00001FC0	MS-NAE3525-2 mounted in 16 in. W x 20 in. H x 6-5/8 in. D custom enclosure with 96 VA 120/24 VAC power supply and 5-port switch

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PAGx00001FC0 NAE Standard Control Panel Assembly Mounted in a 16 in. x 20 in. Enclosure (Continued)

Technical Specifications

Product	PAGx00001FC0 NAE standard control panel mounted in a 16 in. x 20 in. enclosure
Wiring	24 VAC pre-wired from transformer secondary to NAE
Wire Size	Ground wire: 14 AWG; 24 VAC controller wires: 16 AWG
Enclosure Rating	Type 1
Finish	ANSI 61 gray polyester powder coating (inside and outside over phosphatized surfaces)
Ambient Operating Condition	32–122°F (0–50°C) 10–90% RH
Dimensions (Width x Height x Depth)	16 in. x 20 in. x 6-5/8 in. (406 mm x 508 mm x 168 mm)
Weight	40 lb (18.1 kg)
Ambient Storage Condition	-40–158°F (-40–70°C) 5–95% RH
Agency Compliance	Control panel: UL 508A rated (cULus); Enclosure: UL 50 rated, CSA approved OSHPD Special Seismic Certification Preapproval: OSP-0140-10 California Building Code (CBC) - 2010, International Building Code (IBC) - 2009 Seismic Performance Characteristics: $S_{DS}(g) = 2.26$, $z/h = 1.0$, $I_p = 1.5$

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FEC Standard Control Panel Assembly Mounted in a 16 in. x 20 in. Enclosure

Description

The 16 in. x 20 in. Field Equipment Controller (FEC) control panel is a pre-wired, preassembled standard control panel and enclosure that contains an FEC digital controller. This predesigned solution saves both time and money, and can be tailored to a variety of common applications for additional savings.

The control panel is shipped complete, mounted in a 16 in. x 20 in. steel enclosure. In addition to the controller(s), the assembly also contains a power supply incorporating a 5 A circuit breaker, a 96 VA 120/24 VAC transformer, and two 120 VAC outlets. A five-point 24 VAC distribution terminal block that allows for termination of additional field-mounted devices is also included. Noted models are provided with an integral display on the face of the controller or a remote mounted display (MS-DIS1710-0), which is visible on the panel face. Space is reserved in the panel along with a section of DIN rail to mount relays and/or transducers, if desired.

These control panels allow for direct wire termination to the controller, making installation, commissioning, and servicing quicker and easier.

Features

- consistent layout for all standard control panel solutions simplifies installation and commissioning
- controller with screw terminals provides easily identifiable input/output points at the controller
- power supply with resettable circuit breaker and transformer provides high- and low-voltage protection
- space and DIN rail reserved for future component additions allows easy upgrading to a standard-plus control panel
- prebuilt, prewired, and pretested in an ISO-9002 manufacturing facility provides products of consistently high quality



FEC Standard Control Panel Assembly Mounted in a 16 in. x 20 in. Enclosure

- UL 508A rated control panel and UL 50, Canadian Standards Association (CSA) approved enclosure meets local and national code requirements for the United States and Canada (cULus listed)
- California Office of Statewide Health Planning and Development (OSHPD) Special Seismic Certification Preapproved control panel assembly meets standards for rigid and flexible mounting conditions to account for unit-mounted and remote-mounted application

Repair Information

If the FEC control panel assembly fails to operate within its specifications, replace the unit. For a replacement assembly, contact the nearest Johnson Controls® representative.

Components Included with the FEC Standard Control Panel Assembly

Quantity	Description
1	Enclosure: 16 in. W x 20 in. H x 6-5/8 in. D (406 mm W x 508 mm H x 168 mm D), Type 1, with slotted flush latch
1	MS-FEC1611-0, MS-FEC1621-0, MS-FEC2611-0, or MS-FEC2621-0 digital controller
1	MS-DIS1710-0 remote mount display (if applicable)
1	96 VA 120/24 VAC power supply with 5 A primary circuit protection and two 120 VAC outlets
1	Five-point 24 VAC distribution terminal block

Selection Chart

Product Code Number	Description
PAKF00001FH0	MS-FEC1611-0 panel mounted in a 16 in. W x 20 in. H x 6-5/8 in. D Hoffman® enclosure
PAKF00001FH4	MS-FEC1611-0 panel mounted in a 16 in. W x 20 in. H x 6-5/8 in. D Hoffman enclosure with remote mount display
PAKG00001FH0	MS-FEC2611-0 panel mounted in a 16 in. W x 20 in. H x 6-5/8 in. D Hoffman enclosure
PAKG00001FH4	MS-FEC2611-0 panel mounted in a 16 in. W x 20 in. H x 6-5/8 in. D Hoffman enclosure with remote mount display
PAKH00001FH0	MS-FEC1621-0 panel mounted in a 16 in. W x 20 in. H x 6-5/8 in. D Hoffman enclosure with integral display
PAKJ00001FH0	MS-FEC2621-0 panel mounted in a 16 in. W x 20 in. H x 6-5/8 in. D Hoffman enclosure with integral display

FEC Standard Control Panel Assembly Mounted in a 16 in. x 20 in. Enclosure (Continued)

Technical Specifications

FEC Standard Control Panel Assembly Mounted in a 16 in. x 20 in. Enclosure	
Terminals	Controller mounted screw termination
Wire Size	Ground wire: 14 AWG; Transformer wires: 16 AWG
Enclosure Rating	Type 1
Finish	ANSI 61 gray polyester powder coating (perforated panel and enclosure)
Ambient Operating Condition	32–122°F (0–50°C) 10–90% RH
Dimensions (Width x Height x Depth)	16 x 20 x 6-5/8 in. (406 x 508 x 168 mm)
Weight	50.0 lb (22.7 kg)
Ambient Storage Condition	-40–176°F (-40–80°C) 5–95% RH
Agency Compliance	UL 508A Rated (cULus listed); Enclosure UL 50 Rated, CSA Approved OSHPD Special Seismic Certification Preapproval: OSP-0140-10 California Building Code (CBC) - 2010, International Building Code (IBC) - 2009 Seismic Performance Characteristics: $S_{DS}(g) = 2.26$, $z/h = 1.0$, $I_p = 1.5$

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FEC/IOM

Standard Control Panel Assembly Mounted in a 20 in. x 24 in. Enclosure

Description

The 20 in. x 24 in. Field Equipment Controller (FEC) and Input/Output Module (IOM) control panel is a pre-wired, preassembled standard control panel and enclosure that contains an FEC and/or IOM digital controller. This predesigned solution saves both time and money. In addition, the assembly may be tailored to a variety of common applications for additional savings.

The control panel is shipped complete, mounted in a 20 in. x 24 in. steel enclosure. In addition to the controller(s), the assembly also contains a power supply incorporating a 5 A circuit breaker, a 96 VA 120/24 VAC transformer, and two 120 VAC outlets; an optional second 96 VA 120/24 VAC transformer is also available. A five- or ten-point 24 VAC distribution terminal block that allows for termination of additional field mounted devices is also included. Noted models are provided with an integral display on the face of the controller or a remote mounted display (MS-DIS1710-0), which is visible on the face of the panel. Space is reserved in the panel along with a section of DIN rail to mount relays and/or transducers, if desired.

These control panels allow for direct wire termination to the controller, making installation, commissioning, and servicing quicker and easier.

Features

- consistent layout for all standard control panel solutions simplifies installation and commissioning
- power supply with resettable circuit breaker and transformer provides high- and low-voltage protection
- space and DIN rail reserved for future component additions allows easy upgrading to a standard-plus control panel
- prebuilt, pre-wired, and pretested in an ISO-9002 manufacturing facility provides products of consistently high quality



FEC/IOM Standard Control Panel Assembly Mounted in a 20 in. x 24 in. Enclosure

- UL 508A rated control panel and UL 50, Canadian Standards Association (CSA) approved enclosure meets local and national code requirements for the United States and Canada (cULus listed)
- California Office of Statewide Health Planning and Development (OSHPD) Special Seismic Certification Preapproved control panel assembly meets standards for rigid and flexible mounting conditions to account for unit-mounted and remote-mounted application
- controller with color-coded and clearly labeled screw terminals provides easily identifiable input/output points at the controller

Repair Information

If the FEC/IOM control panel assembly fails to operate within its specifications, replace the unit. For a replacement assembly, contact the nearest Johnson Controls® representative.

Components Included with the FEC/IOM Standard Control Panel Assembly

Quantity	Description
1	Enclosure: 20 in. W x 24 in. H x 6-5/8 in. D, Type 1, with slotted flush latch
1	MS-FEC1611-0, MS-FEC2611-0, or MS-FEC2621-0 digital controller
1	MS-IOM1711-0, MS-IOM1721-0, MS-IOM2721-0, MS-IOM3711-0, MS-IOM3721-0, MS-IOM3731-0, and/or MS-IOM4711-0 (if applicable)
1	MS-DIS1710-0 remote mount display (if applicable)
1	96 VA 120/24 VAC power supply with 5 A primary circuit protection and two 120 VAC outlets (standard on all panels)
1	96 VA 120/24 VAC transformer with secondary protection (if applicable)
1	Five- or ten-point 24 VAC distribution terminal block ¹

1. All panels with a single power supply ship with a five-point terminal block. Panels with an additional transformer ship with a ten-point terminal block.

Selection Chart

Product Code Number (Part 1 of 2)	Description
PAKF00001AH0	MS-FEC1611-0 panel mounted in a 20 in. W x 24 in. H x 6-5/8 in. D Hoffman® enclosure
PAKFJF001AH0	MS-FEC1611-0 and MS-IOM1711-0 panel mounted in a 20 in. W x 24 in. H x 6-5/8 in. D Hoffman enclosure
PAKFJG002AH0	MS-FEC1611-0 and MS-IOM2711-0 panel mounted in a 20 in. W x 24 in. H x 6-5/8 in. D Hoffman enclosure with additional 96 VA transformer
PAKFJH002AH0	MS-FEC1611-0 and MS-IOM3711-0 panel mounted in a 20 in. W x 24 in. H x 6-5/8 in. D Hoffman enclosure with additional 96 VA transformer
PAKFJJ002AH0	MS-FEC1611-0 and MS-IOM4711-0 panel mounted in a 20 in. W x 24 in. H x 6-5/8 in. D Hoffman enclosure with additional 96 VA transformer
PAKG00001AH0	MS-FEC2611-0 panel mounted in a 20 in. W x 24 in. H x 6-5/8 in. D Hoffman enclosure
PAKG00002AH0	MS-FEC2611-0 panel mounted in a 20 in. W x 24 in. H x 6-5/8 in. D Hoffman enclosure with additional 96 VA transformer
PAKG00001AH4	MS-FEC2611-0 panel mounted in a 20 in. W x 24 in. H x 6-5/8 in. D Hoffman enclosure with remote mount display
PAKFJF001AH0	MS-FEC2611-0 and MS-IOM1711-0 panel mounted in a 20 in. W x 24 in. H x 6-5/8 in. D Hoffman enclosure
PAKFJG002AH0	MS-FEC2611-0 and MS-IOM2711-0 panel mounted in a 20 in. W x 24 in. H x 6-5/8 in. D Hoffman enclosure with additional 96 VA transformer
PAKFJH002AH0	MS-FEC2611-0 and MS-IOM3711-0 panel mounted in a 20 in. W x 24 in. H x 6-5/8 in. D Hoffman enclosure with additional 96 VA transformer
PAKFJJ002AH0	MS-FEC2611-0 and MS-IOM4711-0 panel mounted in a 20 in. W x 24 in. H x 6-5/8 in. D Hoffman enclosure with additional 96 VA transformer

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Standard Control Panel Assembly Mounted in a 20 in. x 24 in. Enclosure (Continued)

Product Code Number (Part 2 of 2)	Description
PAKGJL002AH0	MS-FEC2611-0 and MS-IOM2721-0 panel mounted in a 20 in. W x 24 in. H x 6-5/8 in. D Hoffman enclosure with additional 96 VA transformer
PAKGJM002AH0	MS-FEC2611-0 and MS-IOM3721-0 panel mounted in a 20 in. W x 24 in. H x 6-5/8 in. D Hoffman enclosure with additional 96 VA transformer
PAKGJN002AH0	MS-FEC2611-0 and MS-IOM3731-0 panel mounted in a 20 in. W x 24 in. H x 6-5/8 in. D Hoffman enclosure with additional 96 VA transformer
PAKJ00001AH0	MS-FEC2621-0 panel mounted in a 20 in. W x 24 in. H x 6-5/8 in. D Hoffman enclosure with integral display
PAKJJF001AH0	MS-FEC2621-0 and MS-IOM1711-0 panel mounted in a 20 in. W x 24 in. H x 6-5/8 in. D Hoffman enclosure with integral display
PAKJJG002AH0	MS-FEC2621-0 and MS-IOM2711-0 panel mounted in a 20 in. W x 24 in. H x 6-5/8 in. D Hoffman enclosure with integral display and additional 96 VA transformer
PAKJJH002AH0	MS-FEC2621-0 and MS-IOM3711-0 panel mounted in a 20 in. W x 24 in. H x 6-5/8 in. D Hoffman enclosure with integral display and additional 96 VA transformer
PAKJJJ002AH0	MS-FEC2621-0 and MS-IOM4711-0 panel mounted in a 20 in. W x 24 in. H x 6-5/8 in. D Hoffman enclosure with integral display and additional 96 VA transformer

Technical Specifications

FEC/IOM Standard Control Panel Assembly Mounted in a 20 in. x 24 in. Enclosure	
Terminals	Controller mounted screw termination
Wire Size	Ground wire: 14 AWG; Transformer wires: 16 AWG
Enclosure Rating	Type 1
Finish	ANSI 61 gray polyester powder coating (perforated panel and enclosure)
Ambient Operating Condition	32–122°F (0–50°C) 10–90% RH
Dimensions (Width x Height x Depth)	20 in. x 24 in. x 6-5/8 in. (508 mm x 610 mm x 168 mm)
Weight	50.0 lb (22.7 kg)
Ambient Storage Condition	-40–176°F (-40–80°C) 5–95% RH
Agency Compliance	UL 508A Rated (cULus listed); Enclosure UL 50 Rated, CSA Approved OSHDPD Special Seismic Certification Preapproval: OSP-0140-10 California Building Code (CBC) - 2010, International Building Code (IBC) - 2009 Seismic Performance Characteristics: $S_{DS}(g) = 2.26$, $z/h = 1.0$, $I_p = 1.5$

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FAC/IOM Standard Control Panel Assembly

Description

The Advanced Field Equipment Controller (FAC) and Input/Output Module (IOM) control panel is a pre-wired, preassembled standard control panel and enclosure that contains FAC and IOM digital controllers. This predesigned solution saves time and money. In addition, the assembly may be tailored to a variety of common applications for additional savings.

The control panel is shipped complete, mounted in a steel enclosure. In addition to the controllers, the assembly contains a power supply incorporating a 5 A circuit breaker, a 96 VA 120/24 VAC transformer, and two 120 VAC outlets. An optional second 96 VA 120/24 VAC transformer is also available. A five- or ten-point 24 VAC distribution terminal block that allows for termination of additional field mounted devices is also included. Noted models are provided with a remote mounted display (MS-DIS1710-0), which is visible on the face of the panel. Space is reserved in the panel along with a section of DIN rail to mount relays and/or transducers, if desired.

These control panels allow for direct wire termination to the controller, making installation, commissioning, and servicing quicker and easier.

Features

- consistent layout for all standard control panel solutions simplifies installation and commissioning
- power supply with resettable circuit breaker and transformer provides high- and low-voltage protection
- space and DIN rail reserved for future component additions allows easy upgrading to a standard-plus control panel
- prebuilt, pre-wired, and pretested in an ISO-9002 manufacturing facility provides products of consistently high quality



FAC/IOM Standard Control Panel Assembly

- UL 508A rated control panel and UL 50, Canadian Standards Association (CSA) approved enclosure meets local and national code requirements for the United States and Canada (cULus listed)
- California Office of Statewide Health Planning and Development (OSHPD) Special Seismic Certification Preapproved control panel assembly meets standards for rigid and flexible mounting conditions to account for unit-mounted and remote-mounted application
- controller with color-coded and clearly labeled screw terminals provides easily identifiable input/output points at the controller

Repair Information

- If the FAC/IOM control panel assembly fails to operate within its specifications, replace the unit. For a replacement assembly, contact the nearest Johnson Controls® representative.

Components Included with the FAC/IOM Standard Control Panel Assembly

Quantity	Description
1	Metal Enclosure, Type 1, with slotted flush latch
1	MS-FAC2611-0 digital controller
1	MS-IOM1711-0, MS-IOM2711-0, MS-IOM3711-0, and/or MS-1OM4711-0 (if applicable)
1	MS-DIS1710-0 remote mount display (if applicable)
1	96 VA 120/24 VAC power supply with 5 A primary circuit protection and two 120 VAC outlets (standard on all panels)
1	96 VA 120/24 VAC transformer with secondary protection (if applicable)
1	Five- or ten-point 24 VAC distribution terminal block ¹

1. All panels with a single power supply ship with a five-point terminal block. Panels with an additional transformer ship with a ten-point terminal block.

Selection Chart

Panels — 16 x 20 Enclosure

Product Code Number	Description
PAKL00001FH0	MS-FAC2611-0 panel mounted in a 16 in. W x 20 in. H x 6-5/8 in. D Hoffman enclosure
PAKL00001FH4	MS-FAC2611-0 panel mounted in a 16 in. W x 20 in. H x 6-5/8 in. D Hoffman enclosure with remote mount display

Panels — 20 x 24 Enclosure

Product Code Number	Description
PAKL00001AH0	MS-FAC2611-0 panel mounted in a 20 in. W x 24 in. H x 6-5/8 in. D Hoffman enclosure
PAKL00002AH0	MS-FAC2611-0 panel mounted in a 20 in. W x 24 in. H x 6-5/8 in. D Hoffman enclosure with additional 96 VA transformer
PAKL00001AH4	MS-FAC2611-0 panel mounted in a 20 in. W x 24 in. H x 6-5/8 in. D Hoffman enclosure with remote mount display
PAKLJF001AH0	MS-FAC2611-0 and MS-IOM1711-0 panel mounted in a 20 in. W x 24 in. H x 6-5/8 in. D Hoffman enclosure with additional 96 VA transformer
PAKLJG002AH0	MS-FAC2611-0 and MS-IOM2711-0 panel mounted in a 20 in. W x 24 in. H x 6-5/8 in. D Hoffman enclosure with additional 96 VA transformer

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FAC/IOM Standard Control Panel Assembly (Continued)

Panels — 20 x 24 Enclosure

Product Code Number	Description
PAKLJH002AH0	MS-FAC2611-0 and MS-IOM3711-0 panel mounted in a 20 in. W x 24 in. H x 6-5/8 in. D Hoffman enclosure with additional 96 VA transformer
PAKLJJ002AH0	MS-FAC2611-0 and MS-IOM4711-0 panel mounted in a 20 in. W x 24 in. H x 6-5/8 in. D Hoffman enclosure with additional 96 VA transformer

Panels — 24 x 24 Enclosure

Product Code Number	Description
PAKL00011EH0	MS-FAC2611-0 panel mounted in a 24 in. W x 24 in. H x 6-5/8 in. D Hoffman enclosure with terminal blocks

Panels — 24 x 36 Enclosure

Product Code Number	Description
PAKL00001BH0	MS-FAC2611-0 panel mounted in a 24 in. W x 36 in. H x 6-5/8 in. D Hoffman enclosure
PAKL00011BH0	MS-FAC2611-0 panel mounted in a 24 in. W x 36 in. H x 6-5/8 in. D Hoffman enclosure with terminal blocks
PAKL00001BH4	MS-FAC2611-0 panel mounted in a 24 in. W x 36 in. H x 6-5/8 in. D Hoffman enclosure with remote mount display
PAKLJF001BH0	MS-FAC2611-0 and MS-IOM1711-0 panel mounted in a 24 in. W x 36 in. H x 6-5/8 in. D Hoffman enclosure
PAKLJF011BH0	MS-FAC2611-0 and MS-IOM1711-0 panel mounted in a 24 in. W x 36 in. H x 6-5/8 in. D Hoffman enclosure with terminal blocks
PAKLJG002BH0	MS-FAC2611-0 and MS-IOM2711-0 panel mounted in a 24 in. W x 36 in. H x 6-5/8 in. D Hoffman enclosure with additional 96 VA transformer
PAKLJG012BH0	MS-FAC2611-0 and MS-IOM2711-0 panel mounted in a 24 in. W x 36 in. H x 6-5/8 in. D Hoffman enclosure with additional 96 VA transformer and terminal blocks
PAKLJH002BH0	MS-FAC2611-0 and MS-IOM3711-0 panel mounted in a 24 in. W x 36 in. H x 6-5/8 in. D Hoffman enclosure with additional 96 VA transformer
PAKLJH012BH0	MS-FAC2611-0 and MS-IOM3711-0 panel mounted in a 24 in. W x 36 in. H x 6-5/8 in. D Hoffman enclosure with additional 96 VA transformer and terminal blocks
PAKLJJ002BH0	MS-FAC2611-0 and MS-IOM4711-0 panel mounted in a 24 in. W x 36 in. H x 6-5/8 in. D Hoffman enclosure with additional 96 VA transformer
PAKLJJ012BH0	MS-FAC2611-0 and MS-IOM4711-0 panel mounted in a 24 in. W x 36 in. H x 6-5/8 in. D Hoffman enclosure with additional 96 VA transformer and terminal blocks
PAKLJJ002BH4	MS-FAC2611-0 and MS-IOM4711-0 panel mounted in a 24 in. W x 36 in. H x 6-5/8 in. D Hoffman enclosure with additional 96 VA transformer and remote mount display
PAKLJK002BH0	MS-FAC2611-0, MS-IOM1711-0 and MS-IOM4711-0 panel mounted in a 24 in. W x 36 in. H x 6-5/8 in. D Hoffman enclosure with two 96 VA transformers

Technical Specifications

FAC/IOM Standard Control Panel Assembly	
Terminals	Controller mounted screw termination
Wire Size	Ground wire: 14 AWG; Transformer wires: 16 AWG
Enclosure Rating	Type 1
Finish	ANSI 61 gray polyester powder coating (perforated panel and enclosure)
Ambient Operating Condition	32 to 122°F (0 to 50°C) 10 to 90% RH
Dimensions (Width x Height x Depth)	16 in. W x 20 in. H x 6-5/8 in. D (406 mm W x 508 mm H x 168 mm D) 24 in. W x 24 in. H x 6-5/8 in. D (508 mm W x 610 mm H x 168 mm D) 20 in. W x 24 in. H x 6-5/8 in. D (508 mm W x 610 mm H x 168 mm D) 24 in. W x 36 in. H x 6-5/8 in. D (610 mm W x 914 mm H x 168 mm D)
Weight	50.0 lb (22.7 kg)
Ambient Storage Condition	-40 to 176°F (-40 to 80°C) 5 to 95% RH
Agency Compliance	Control Panel, cULus, UL508A Enclosure UL50 Listed, CSA certified OSHPD Special Seismic Certification Preapproval: OSP-0140-10 California Building Code (CBC) - 2010, International Building Code (IBC) - 2009 Seismic Performance Characteristics: $S_{DS}(g) = 2.26$, $z/h = 1.0$, $I_p = 1.5$

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Standard Control Panel Assembly Mounted in a 24 in. x 36 in. Enclosure

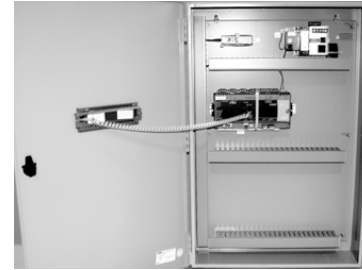
Description

The Network Control Engine (NCE) 24 in. x 36 in. control panel is a prewired, preassembled standard control panel and enclosure that contains an NCE. Such a predesigned solution saves time and money. In addition, the assembly may be tailored to a variety of common applications for additional savings.

The control panel is shipped complete, already mounted in a 24 in. x 36 in. steel enclosure. In addition to the NCE, the assembly contains a 5-port Ethernet switch and a power supply incorporating a 5 A circuit breaker, a 96 VA 120/24 VAC transformer, and two 120 VAC outlets. Certain models are available with an integral display or a remote mounted display.

Features

- consistent layout for all standard control panel solutions simplifies installation and commissioning
- power supply with resettable circuit breaker and transformer provides high- and low-voltage protection
- prebuilt, prewired, and pretested in an ISO-9002 manufacturing facility, which provides products of consistently high quality
- UL 508A rated control panel and UL 50 rated, CSA-approved enclosure meets local and national code requirements for the United States and Canada (cULus listed)
- California Office of Statewide Health Planning and Development (OSHPD) Special Seismic Certification Preapproved control panel assembly meets standards for rigid and flexible mounting conditions to account for unit-mounted and remote-mounted application



NCE Standard Control Panel Assembly Mounted in a 24 in. x 36 in. Enclosure (Model with Remote Display Shown)

- 5-port Ethernet switch simplifies installation and commissioning

Repair Information

If the NCE control panel assembly fails to operate within its specifications, replace the unit. For a replacement assembly, contact the nearest Johnson Controls® representative.

Components Included with the NCE Standard Control Panel Assembly

Quantity	Description
1	Enclosure: 24 in. W x 36 in. H x 6.62 in. D (610 mm W x 914 mm H x 168 mm D), Type 1
1	96 VA 120/24 VAC power supply with 5 A primary circuit protection and two 120 VAC outlets
1	MS-NCE25xx-0 controller
1	5-port Ethernet switch
1	MS-DIS1710-0 remote mount display (if applicable)

Selection Chart

MS-NCE251x-0 Panels

Product Code Number	Description
PARA0001BH0	MS-NCE2510-0 controller mounted in a 24 in. x 36 in. enclosure with 96 VA 120/24 VAC power supply and 5-port switch
PARB0001BH0	MS-NCE2511-0 controller mounted in a 24 in. x 36 in. enclosure with 96 VA 120/24 VAC power supply and 5-port switch
PARG0001BH0	MS-NCE2516-0 controller mounted in a 24 in. x 36 in. enclosure with 96 VA 120/24 VAC power supply and 5-port switch, integral display
PARH0001BH0	MS-NCE2517-0 controller mounted in a 24 in. x 36 in. enclosure with 96 VA 120/24 VAC power supply and 5-port switch, integral display
PARA0001BH4	MS-NCE2510-0 controller mounted in a 24 in. x 36 in. enclosure with 96 VA 120/24 VAC power supply, 5-port switch, and remote mounted display
PARB0001BH4	MS-NCE2511-0 controller mounted in a 24 in. x 36 in. enclosure with 96 VA 120/24 VAC power supply, 5-port switch, and remote mounted display
PARH0001BH0	MS-NCE2517-0 controller mounted in a 24 in. x 36 in. enclosure with 96 VA 120/24 VAC power supply, 5-port switch, and terminal blocks
PARG0001BH0	MS-NCE2517-0 controller mounted in a 24 in. x 36 in. enclosure with 96 VA 120/24 VAC power supply, 5-port switch, and terminal blocks
PARB0001BH4	MS-NCE2511-0 controller mounted in a 24 in. x 36 in. enclosure with 96 VA 120/24 VAC power supply, 5-port switch, remote mounted display, and terminal blocks
PARB0001BH0	MS-NCE2511-0 controller mounted in a 24 in. x 36 in. enclosure with 96 VA 120/24 VAC power supply, 5-port switch, and terminal blocks
PARA0001BH4	MS-NCE2510-0 controller mounted in a 24 in. x 36 in. enclosure with 96 VA 120/24 VAC power supply, 5-port switch, remote mounted display, and terminal blocks
PARA0001BH0	MS-NCE2510-0 controller mounted in a 24 in. x 36 in. enclosure with 96 VA 120/24 VAC power supply, 5-port switch, and terminal blocks

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Standard Control Panel Assembly Mounted in a 24 in. x 36 in. Enclosure (Continued)

MS-NCE252X-0 Panels

Product Code Number	Description
PARC00001BH0	MS-NCE2520-0 controller mounted in a 24 in. x 36 in. enclosure with 96 VA 120/24 VAC power supply and 5-port switch
PARD00001BH0	MS-NCE2521-0 controller mounted in a 24 in. x 36 in. enclosure with 96 VA 120/24 VAC power supply and 5-port switch
PARJ00001BH0	MS-NCE2526-0 controller mounted in a 24 in. x 36 in. enclosure with 96 VA 120/24 VAC power supply and 5-port switch, integral display
PARK00001BH0	MS-NCE2527-0 controller mounted in a 24 in. x 36 in. enclosure with 96 VA 120/24 VAC power supply and 5-port switch, integral display
PARC00001BH4	MS-NCE2520-0 controller mounted in a 24 in. x 36 in. enclosure with 96 VA 120/24 VAC power supply, 5-port switch, and remote mounted display
PARD00001BH4	MS-NCE2521-0 controller mounted in a 24 in. x 36 in. enclosure with 96 VA 120/24 VAC power supply, 5-port switch, and remote mounted display
PARK00011BH0	MS-NCE2527-0 controller mounted in a 24 in. x 36 in. enclosure with 96 VA 120/24 VAC power supply, 5-port switch, and terminal blocks
PARJ00011BH0	MS-NCE2526-0 controller mounted in a 24 in. x 36 in. enclosure with 96 VA 120/24 VAC power supply, 5-port switch, and terminal blocks
PARD00011BH4	MS-NCE2521-0 controller mounted in a 24 in. x 36 in. enclosure with 96 VA 120/24 VAC power supply, 5-port switch, remote mounted display, and terminal blocks
PARD00011BH0	MS-NCE2521-0 controller mounted in a 24 in. x 36 in. enclosure with 96 VA 120/24 VAC power supply, 5-port switch, and terminal blocks
PARC00011BH4	MS-NCE2520-0 controller mounted in a 24 in. x 36 in. enclosure with 96 VA 120/24 VAC power supply, 5-port switch, remote mounted display, and terminal blocks
PARC00011BH0	MS-NCE2520-0 controller mounted in a 24 in. x 36 in. enclosure with 96 VA 120/24 VAC power supply, 5-port switch, and terminal blocks

MS-NCE256x-0 Panels

Product Code Number	Description
PARE00001BH0	MS-NCE2560-0 controller mounted in a 24 in. x 36 in. enclosure with 96 VA 120/24 VAC power supply and 5-port switch
PARF00001BH0	MS-NCE2561-0 controller mounted in a 24 in. x 36 in. enclosure with 96 VA 120/24 VAC power supply and 5-port switch
PARL00001BH0	MS-NCE2566-0 controller mounted in a 24 in. x 36 in. enclosure with 96 VA 120/24 VAC power supply and 5-port switch
PARM00001BH0	MS-NCE2567-0 controller mounted in a 24 in. x 36 in. enclosure with 96 VA 120/24 VAC power supply and 5-port switch
PARE00001BH4	MS-NCE2560-0 controller mounted in a 24 in. x 36 in. enclosure with 96 VA 120/24 VAC power supply, 5-port switch, and remote mounted display
PARF00001BH4	MS-NCE2561-0 controller mounted in a 24 in. x 36 in. enclosure with 96 VA 120/24 VAC power supply, 5-port switch, and remote mounted display
PARM00011BH0	MS-NCE2567-0 controller mounted in a 24 in. x 36 in. enclosure with 96 VA 120/24 VAC power supply, 5-port switch, and terminal blocks
PARL00011BH0	MS-NCE2566-0 controller mounted in a 24 in. x 36 in. enclosure with 96 VA 120/24 VAC power supply, 5-port switch, and terminal blocks
PARF00011BH4	MS-NCE2561-0 controller mounted in a 24 in. x 36 in. enclosure with 96 VA 120/24 VAC power supply, 5-port switch, remote mounted display, and terminal blocks
PARE00011BH0	MS-NCE2560-0 controller mounted in a 24 in. x 36 in. enclosure with 96 VA 120/24 VAC power supply, 5-port switch, and terminal blocks

Technical Specifications

NCE Standard Control Panel Assembly Mounted in a 24 in. x 36 in. Enclosure	
Wiring	24 VAC prewired from transformer secondary to NCE
Wire Size	Ground wire: 14 AWG; Transformer wires: 16 AWG
Enclosure Rating	Type 1
Finish	ANSI 61 gray polyester powder coating (perforated panel and enclosure)
Ambient Operating Condition	32–122°F (0–50°C) 10–90% RH
Dimensions (Width x Height x Depth)	24 in. W x 36 in. H x 6.62 in. D (610 mm W x 914 mm H x 168 mm D)
Sheet Metal Thickness	Enclosure: 16 Gauge; Door: 14 Gauge
Weight	100 lb (45 kg)
Ambient Storage Condition	-40–158°F (-40–70°C) 5–95% RH
Agency Compliance	UL 508A Rated (cULus listed); Enclosure UL 50 Rated, CSA Approved OSHPD Special Seismic Certification Preapproval: OSP-0140-10 California Building Code (CBC) - 2010, International Building Code (IBC) - 2009 Seismic Performance Characteristics: $S_{DS}(g) = 2.26$, $z/h = 1.0$, $I_p = 1.5$

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RIB24P

Enclosed Relay 20 Amp DPDT with 24 Vac/dc Coil



Functional Devices, Inc. A600D 2006



Contact Ratings:

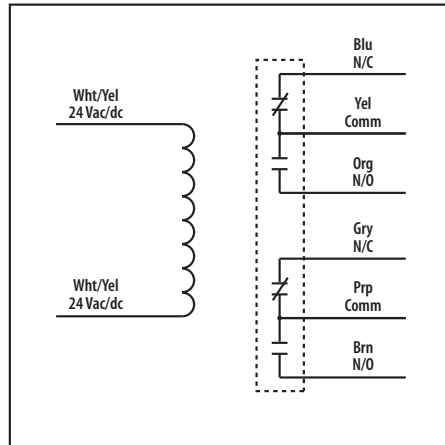
20 Amp Resistive @ 300 Vac
 20 Amp Resistive @ 28 Vdc
 20 Amp Ballast @ 277-480 Vac
 15 Amp Resistive @ 600 Vac
 770 VA Pilot Duty @ 120 Vac
 1158 VA Pilot Duty @ 240 Vac
 1110 VA Pilot Duty @ 277 Vac
 1640 VA Pilot Duty @ 480 Vac
 3 HP @ 480-600 Vac
 2 HP @ 240-277 Vac
 1 HP @ 120 Vac

Coil Current:

100 mA @ 20 Vac
 125 mA @ 24 Vac
 50 mA @ 20 Vdc
 50 mA @ 24 Vdc
 70 mA @ 30 Vdc

Coil Voltage Input:

24 Vac/dc; 50-60 Hz
 Drop Out = 3 Vac / 3.8 Vdc
 Pull In = 20 Vac / 20 Vdc



Relays & Contact Type: One (1) DPDT Continuous Duty Coil
Expected Relay Life: 10 million cycles minimum mechanical
Operating Temperature: -30 to 140° F
Operate Time: 18mS
Relay Status: LED On = Activated
Dimensions: 2.30" x 3.20" x 1.80" with .50" NPT Nipple
Wires: 16', 600V Rated
Approvals: UL Listed, UL916, UL864, C-UL
 California State Fire Marshal, CE
Housing Rating: Plenum, NEMA 1
Gold Flash: Yes
Override Switch: No

NOTES

RIBU1C

Enclosed Relay 10 Amp SPDT with 10-30 Vac/dc/120 Vac Coil



Functional Devices, Inc. A600D 2006

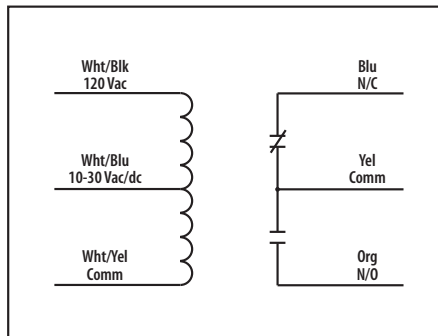


Contact Ratings:
 10 Amp Resistive @ 120-277 Vac
 10 Amp Resistive @ 28 Vdc
 480 VA Pilot Duty @ 240-277 Vac
 480 VA Ballast @ 277 Vac
 600 Watt Tungsten @ 120 Vac N/O
 240 Watt Tungsten @ 120 Vac N/C
 1/3 HP for N/O @ 120-240 Vac
 1/6 HP for N/C @ 120-240 Vac
 1/4 HP for N/O @ 277 Vac
 1/8 HP for N/C @ 277 Vac

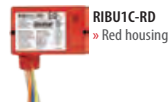
Coil Current:

30 mA @ 10 Vac	12 mA @ 10 Vdc
32 mA @ 12 Vac	14 mA @ 12 Vdc
42 mA @ 24 Vac	16 mA @ 24 Vdc
50 mA @ 30 Vac	18 mA @ 30 Vdc
25 mA @ 120 Vac	

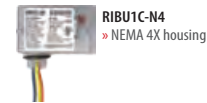
Coil Voltage Input:
 10-30 Vac/dc ; 120 Vac ; 50-60 Hz
 Drop Out = 2.1 Vac / 2.8 Vdc
 Pull In = 9 Vac / 10 Vdc



Relays & Contact Type: One (1) SPDT Continuous Duty Coil
Expected Relay Life: 10 million cycles minimum mechanical
Operating Temperature: -30 to 140° F
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, UL924, C-UL
 California State Fire Marshal, CE
Housing Rating: Plenum, NEMA 1
Gold Flash: Yes
Override Switch: No



RIBU1C-RD
 » Red housing



RIBU1C-N4
 » NEMA 4X housing

NOTES

RH Series — General Purpose Midget Relays

Key features of the RH series include:

- Compact midget size saves space
- High switching capacity (10A)
- Choice of blade or PCB style terminals
- Relay options include indicator light, check button, and top mounting bracket
- DIN rail, surface, panel, and PCB type sockets available for a wide range of mounting applications



UL Recognized
Files No. E67770
E59804
E64245



CSA Certified
File No. LR35144



File No. BL951113332319



Specifications	Contact Material	Silver cadmium oxide
	Contact Resistance	50mΩ maximum (initial value)
	Minimum Applicable Load	24V DC/30mA, 5V DC/100mA (reference value)
	Operating Time	SPDT (RH1), DPDT (RH2): 20ms maximum 3PDT (RH3), 4PDT (RH4): 25ms maximum
	Release Time	SPDT (RH1), DPDT (RH2): 20ms maximum 3PDT (RH3), 4PDT (RH4): 25ms maximum
	Power Consumption	SPDT (RH1): DC: 0.8W AC: 1.1VA (50Hz), 1VA (60Hz) DPDT (RH2): DC: 0.9W AC: 1.4VA (50Hz), 1.2VA (60Hz) 3PDT (RH3): DC: 1.5W AC: 2VA (50Hz), 1.7VA (60Hz) 4PDT (RH4): DC: 1.5W AC: 2.5VA (50Hz), 2VA (60Hz)
	Insulation Resistance	100MΩ min (measured with a 500V DC megger)
	Dielectric Strength	SPDT (RH1) Between live and dead parts: 2,000V AC, 1 minute; Between contact circuit and operating coil: 2,000V AC, 1 minute; Between contacts of the same pole: 1,000V AC, 1 minute DPDT (RH2), 3PDT (RH3), 4PDT (RH4) Between live and dead parts: 2,000V AC, 1 minute; Between contact circuit and operating coil: 2,000V AC, 1 minute; Between contact circuits: 2,000V AC, 1 minute; Between contacts of the same pole: 1,000V AC, 1 minute
	Frequency Response	1,800 operations/hour
	Temperature Rise	Coil: 85°C maximum Contact: 65°C maximum
	Vibration Resistance	0 to 6G (55Hz maximum)
	Shock Resistance	SPDT/DPDT: 200N (approximately 20G) 3PDT/4PDT: 100N (approximately 10G)
	Life Expectancy	Electrical: over 500,000 operations at 120V AC, 10A; (over 200,000 operations at 120V AC, 10A for SPDT [RH1], 3PDT [RH3], 4PDT [RH4]) Mechanical: 50,000,000 operations
	Operating Temperature	-30 to +70°C
Weight	SPDT: 24g, DPDT: 37g (approximately) 3PDT: 50g, 4PDT: 74g (approximately)	



See page D-29 for dimensions.

Operational Characteristics

Maximum Continuous Applied Voltage (AC/DC) at 20°C	110% of the rated voltage
Minimum Operating Voltage (AC/DC) at 20°C	80% of the rated voltage
Drop-Out Voltage (AC)	30% or more of the rated voltage
Drop-Out Voltage (DC)	10% or more of the rated voltage

Ordering Information

Order standard voltages for fastest delivery. Allow extra delivery time for non-standard voltages.

Basic Part No.	Coil Voltage:
<u>RH2B-U</u>	<u>AC110-120V</u>

D

Part Numbers

Part Numbers: RH Series with Options

Termination	Contact Configuration	Basic Part No.	Indicator Light	Check Button	Indicator Light and Check Button	Top Bracket
B (blade)	SPDT	RH1B-U	RH1B-L*	—	—	RH1B-UT
	DPDT	RH2B-U	RH2B-UL	RH2B-UC	RH2B-ULC	RH2B-UT
	3PDT	RH3B-U	RH3B-UL	RH3B-UC	RH3B-ULC	RH3B-UT
	4PDT	RH4B-U	RH4B-UL	RH4B-UC	RH4B-ULC	RH4B-UT
V2 (PCB 0.078" [2mm] wide)	SPDT	RH1V2-U	RH1V2-L*	—	—	—
	DPDT	RH2V2-U	RH2V2-UL	RH2V2-UC	RH2V2-ULC	—
	3PDT	RH3V2-U	RH3V2-UL	RH3V2-UC	RH3V2-ULC	—
	4PDT	RH4V2-U	RH4V2-UL	RH4V2-UC	RH4V2-ULC	—



- * RH1B(V2)-L is not UL recognized.
- For Coil and Contact Ratings, see the next page.

D

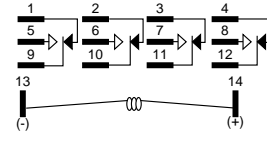
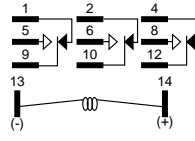
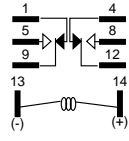
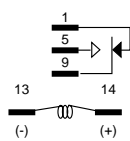
Part Numbers: Sockets

Relay	Standard DIN Rail Mount	Finger-Safe DIN Rail Mount	Surface Mount	Panel Mount	PCB Mount	Spring (optional)
RH1B	SH1B-05	SH1B-05C	—	SH1B-51	SH1B-62	SY2S-02F1 SFA-101 SFA-202 SY4S-51F1 SFA-301 SFA-302
RH2B	SH2B-05	SH2B-05C	SH2B-02	SH2B-51	SH2B-62	SY4S-02F1 SFA-101 SFA-202 SY4S-51F1
RH3B	SH3B-05	SH3B-05C	—	SH3B-51	SH3B-62	SH3B-05F1 SFA-101, -202 SY4S-51F1
RH4B	SH4B-05	SH4B-05C	—	SH4B-51	SH4B-62	SH4B-02F1 SFA-101, -202 SY4S-51F1



- See Section F for details on sockets. All DIN rail mount sockets shown above can be mounted using DIN rail BNDN1000.

Internal Circuit



Ratings

Coil Ratings

Rated Voltage	Rated Current ±15% at 20°C								Coil Resistance ±15% at 20°C				
	60Hz				50Hz				SPDT	DPDT	3PDT	4PDT	
	SPDT		DPDT		3PDT		4PDT						
AC	6V	150mA	200mA	280mA	330mA	170mA	238mA	330mA	387mA	18.8Ω	9.4Ω	6.0Ω	5.4Ω
	12V	75mA	100mA	140mA	165mA	86mA	118mA	165mA	196mA	76.8Ω	39.3Ω	25.3Ω	21.2Ω
	24V	37mA	50mA	70mA	83mA	42mA	59.7mA	81mA	98mA	300Ω	153Ω	103Ω	84.5Ω
	120V*	7.5mA	11mA	14.2mA	16.5mA	8.6mA	12.9mA	16.4mA	19.5mA	7,680Ω	4,170Ω	27,70Ω	22,20Ω
	240V†	3.2mA	5.5mA	7.1mA	8.3mA	3.7mA	6.5mA	8.2mA	9.8mA	3,1200Ω	15,210Ω	12,100Ω	91,20Ω
DC	6V	SPDT		DPDT		3PDT		4PDT		SPDT	DPDT	3PDT	4PDT
		128mA		150mA		240mA		250mA		47Ω	40Ω	25Ω	24Ω
	12V	64mA		75mA		120mA		125mA		188Ω	160Ω	100Ω	96Ω
	24V	32mA		36.9mA		60mA		62mA		750Ω	650Ω	400Ω	388Ω
	48V	18mA		18.5mA		30mA		31mA		2,660Ω	2,600Ω	1,600Ω	15,50Ω
110V‡	8mA		9.1mA		12.8mA		15mA		13,800Ω	12,100Ω	8,600Ω	7,340Ω	



* For RH2 relays = 110/120V AC.
 † For RH2 relays = 220/240V AC.
 ‡ For RH2 relays = 100/110V DC.

D

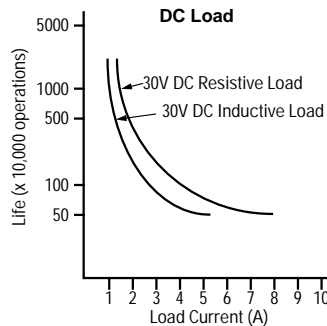
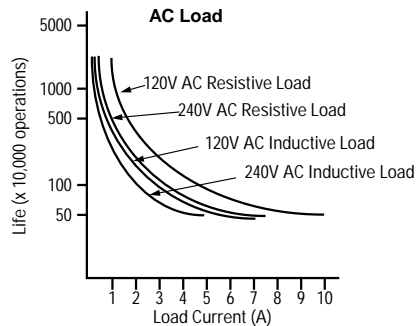
Contact Ratings

Voltage	Rating	Resistive				Inductive				Motor Load	
		SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT	SPDT	DPDT
28V DC	UL	10A	10A	10A	10A	7.5A	—	—	7.5A	—	—
30V DC	UL	10A	10A	10A	—	7A	7A	—	—	—	—
	CSA				10A		7.5A	—	—	—	
	Nominal				10A		7.5A	7.5A	—	—	
110V DC	Nominal	0.5A	0.5A	0.5A	0.5A	0.3A	0.3A	0.3A	0.3A	—	—
120V AC	UL	10A	10A	10A	10A	7.5A	—	—	7.5A	1/6	1/6
	CSA					7A	7.5A	—		—	
	Nominal					7A	7.5A	—		—	
240V AC	UL	10A	10A	—	7.5A	7A	7A	*	5A	1/3	1/3
	CSA			7A				7A		—	—
	Nominal			7A				7.5A		7.5A	4.5A



1. * 6.5A/pole, 20A total.
 2. Inductive load $\cos \phi = 0.3$, $L/R = 7ms$.

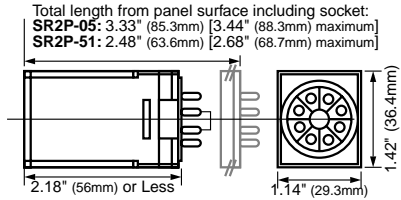
Electrical Life Curves



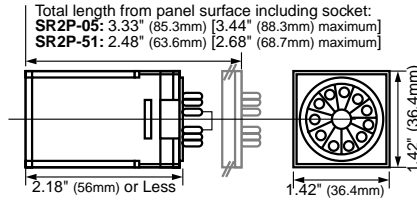
General Purpose and Latching Relay Dimensions

RR Series

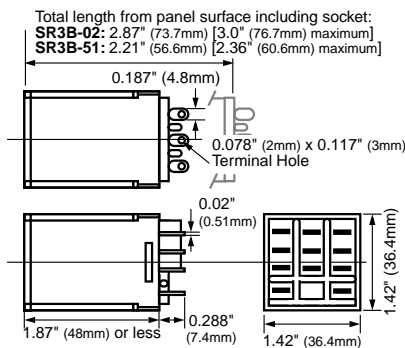
**8-Pin
RR2P**



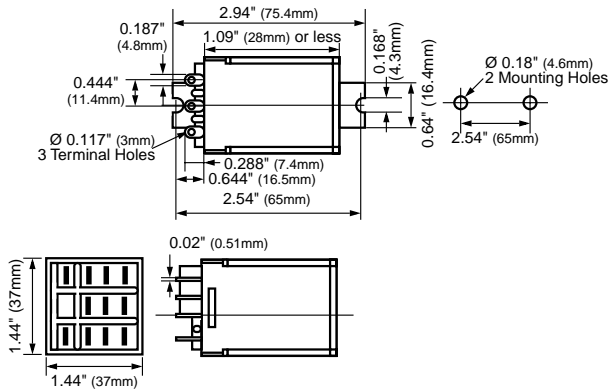
**11-Pin
RR3PA**



**Blade
RR1BA, RR2BA, RR3B**



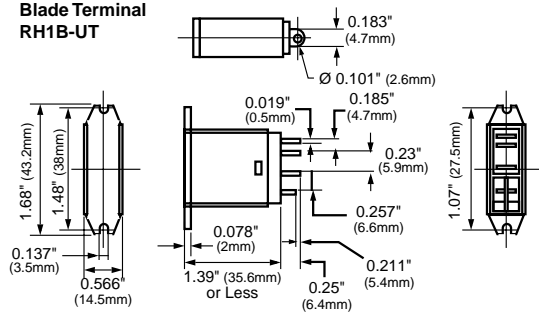
**Side Flange
RR1BA-US, RR2BA-US, RR3B-US**



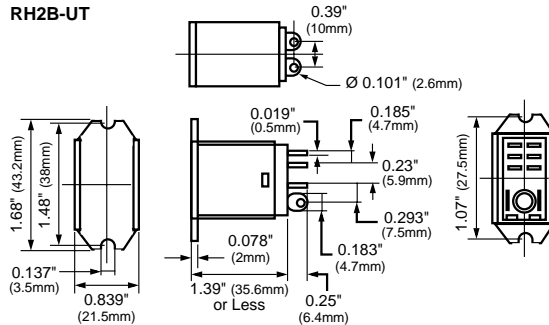
Note: Dimensions in [] include hold-down spring.

RH Series

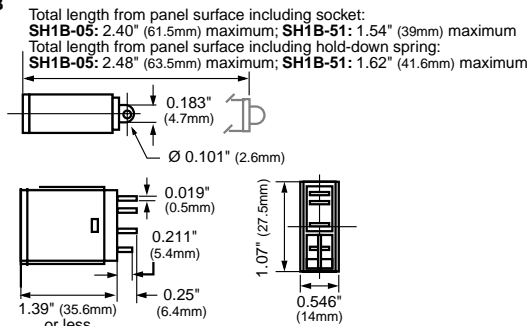
**Top Bracket Mounting
Blade Terminal
RH1B-UT**



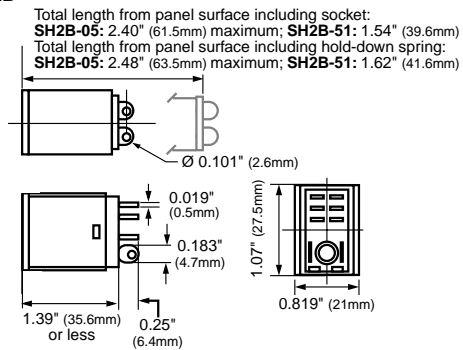
RH2B-UT



**Plug-in
Blade Terminal
RH1B**



RH2B



USA: (800) 262-4332 or (408) 747-0550, Western Canada: (888) 578-9988 or Eastern Canada (888) 317-4332

D-29

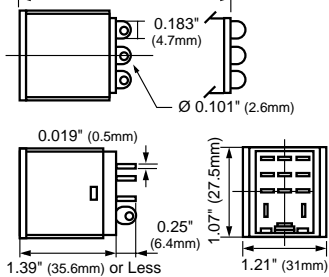
Dimensions, continued

RH Series, continued

Plug-in
Blade Terminal

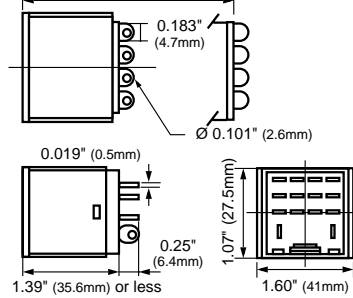
RH3B

Total length from panel surface including socket:
SH3B-05: 2.57" (66mm) maximum
 Total length from panel surface including hold-down spring:
SH3B-05: 2.65" (68mm) maximum



RH4B

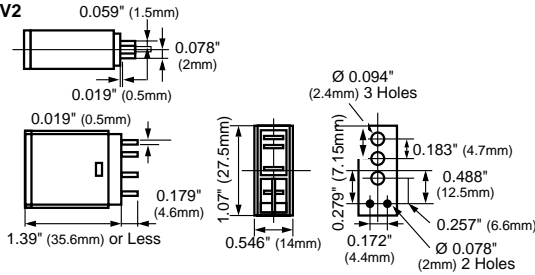
Total length from panel surface including socket:
SH4B-05: 2.40" (61.5mm) or less; **SH4B-51:** 1.54" (39.6mm)
 Total length from panel surface including hold-down spring:
SH4B-05: 2.48" (63.5mm) or less; **SH4B-51:** 1.62" (41.6mm)



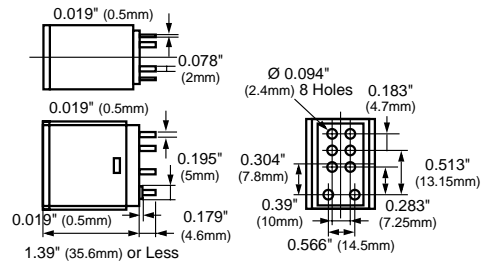
D

PCB Terminal

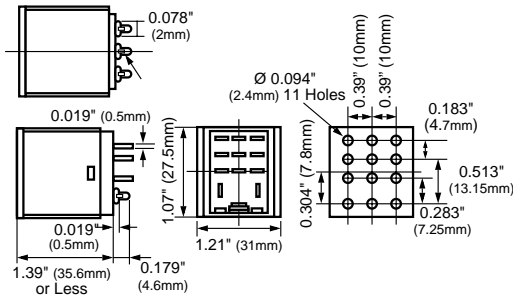
RH1V2



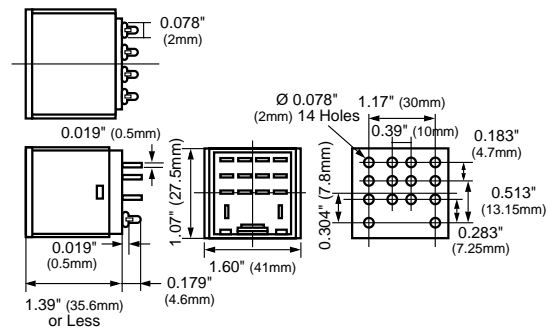
RH2V2



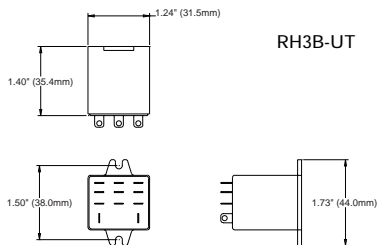
RH3V2



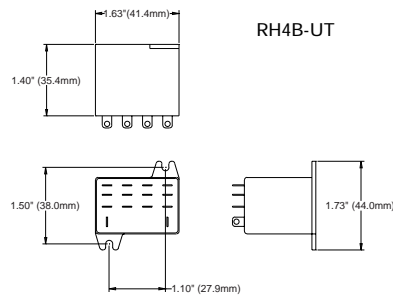
RH4V2



RH3B-UT















RH4B-UT




Selection Guides, continued

General Purpose Relays







	RR Series	RH Series	RM Series	RY Series
Appearance				
Page	D-8	D-11	D-14	D-17
Features	<ul style="list-style-type: none"> • Highly reliable • Large capacity • 8-pin, 11-pin, or 11-blade plug-in base • 1 to 3 pole switching • AC or DC coils 	<ul style="list-style-type: none"> • Compact midjet size • Highly reliable • Large capacity • AC or DC coils • 1 to 4 pole switching 	<ul style="list-style-type: none"> • Compact miniature size • Highly reliable • AC or DC coils 	<ul style="list-style-type: none"> • Compact ice-cube size • 2- or 4-pole switching • Bifurcated contacts for dry circuit switching
Options	Indicator light Check button Side flange	Indicator light Check button Top mount	Indicator light Check button Top mount	Indicator light Check button Top mount
Contact Configuration	1, 2, 3 Form C	1, 2, 3, 4 Form C	2 Form C	2, 4 Form C
Contact Rating (resistive)	10A, 30V DC 10A, 120V, 240V AC 1/3HP, 240V AC 1/4HP, 120V AC	10A, 30V DC 10A, 120V, 240V AC 1/3HP, 240V AC 1/6HP, 120V AC	5A, 30V DC 5A, 120V AC, 240V AC	DPDT: 3A, 30V DC; 3A, 120V AC, 240V AC 4PDT: 5A, 30V DC; 5A, 120V AC, 240V AC
Contact Material	Silver	Silver-cadmium oxide	Silver	Silver, gold-plated
Minimum Electrical Life	500,000 operations (10A, 120V AC)	500,000 operations (10A, 120V AC)	500,000 operations (5A, 240V AC)	200,000 operations (DPDT: 3A, 120V AC) (4PDT: 5A, 120V AC)
Minimum Mechanical Life	10,000,000 operations	50,000,000 operations	50,000,000 operations	50,000,000 operations
Dielectric Strength (between contact and coil)	2,000V AC, 1 minute	2,000V AC, 1 minute	2,000V AC, 1 minute	2,000V AC, 1 minute (4-pole version)
Coil Voltage	6, 12, 24, 48, 110V DC 6, 12, 24, 120, 240V AC	6, 12, 24, 48, 110V DC 6, 12, 24, 120, 240V AC	6, 12, 24, 48, 110V DC 6, 12, 24, 120, 240V AC	6, 12, 24, 48, 110V DC 6, 12, 24, 120, 240V AC
Power Consumption (approximately)	2.5VA/1.5W	SPDT: 1VA/0.8W 2PDT: 1.2VA/0.9W 3PDT: 1.7VA/1.5W 4PDT: 2VA/1.5W	1.4VA/0.9W	DPDT: 1.0VA/0.8W 4PDT: 1.2VA/0.9W
Termination	Pin/Blade	Blade/PCB	Blade/PCB	Blade/PCB
Sockets	SR2P SR3P SR3B	SH1B SH2B SH3B SH4B	SY4S	SY2S SY4S
Approvals	 UL Recognized Files No. E67770 E59804 E64245  * File No. BL951113332319  CSA Certified File No. LR35144  *		 UL Recognized Files No. E59804 E64245  * File No. BL951113332319  CSA Certified File No. LR35144  *	

D

 * CE marking and TUV ratings do not apply to RR blade style relays.

Selection Guides, continued

General Purpose Latching Relays

	RR2KP Series	RH2L Series	RY2KS Series	RY2L Series
Appearance				
Page	D-20	D-22	D-24	D-26
D Features	<ul style="list-style-type: none"> • Magnetic dual coil • Self-maintaining without power • Separate set and reset coils • AC or DC coils 	<ul style="list-style-type: none"> • Midget size latch relay • 10A capacity • Dual coil • Power saving pulse input • Indicator shows set-reset condition • AC or DC coils 	<ul style="list-style-type: none"> • Magnetic dual coil • Self-maintaining without power • Separate set and reset coil • AC or DC coils 	<ul style="list-style-type: none"> • Miniature size latch relay • 3A capacity • Dual coil • Power saving pulse input • Mechanical indicator to show set/reset condition • AC or DC coils
Options	Check button	—	Check button	—
Contact Configuration	2 Form C	2 Form C	2 Form C	2 Form C
Contact Rating (resistive)	10A, 30V DC 10A, 120V AC	10A, 30V DC 7.5A, 240V AC 10A, 120V AC	3A, 30V DC 3A, 120V AC	3A, 30V DC 3A, 120V AC 3A, 240V AC
Contact Material	Silver	Silver-cadmium oxide	Silver, gold-plated	Silver, gold-flashed
Minimum Electrical Life	500,000 operations	200,000 operations	200,000 operations	200,000 operations
Minimum Mechanical Life	5,000,000 operations	10,000,000 operations	5,000,000 operations	10,000,000 operations
Dielectric Strength (between contact and coil)	1,500V AC, 1 minute	2,000V AC, 1 minute	1,500V AC, 1 minute	1,500V AC, 1 minute
Coil Voltage	6, 12, 24, 110V DC 6, 12, 24, 120, 240V AC	6, 12, 24V DC 6, 12, 24, 120V AC	6, 12, 24, 110V DC 6, 12, 24, 120, 240V AC	6, 12, 24V DC 6, 12, 24, 120V AC
Power Consumption	AC: 2.2VA DC: 1.5W	1.2VA/2W (set) 0.5VA/0.9W (reset)	AC: 1.5VA DC: 1.2W	0.7VA/1.2W (set) 0.35VA/0.6W (reset)
Termination	Pin	Blade/PCB	Blade	Blade/PCB
Sockets	SR3P	SH3B	SY4S	SY4S
Approvals	 UL Recognized Files No. E67770 E55996		 CSA Certified File No. LR35144	

Sockets (for reference only)
Panel Mount



SH1B-51



SH3B-51



SY2S-61






SY4S-51



For more socket information, see Section F.

Selection Guides, continued

Solid State Relays

		RSS Series	RA Series	RB Series
Appearance				
Page		D-35	D-39	D-42
Isolation Method		Phototransistor coupler	Phototransistor coupler	Phototransistor coupler
Zero-Voltage Switching		Yes	Yes	Yes
Input Rating	Voltage Range	DC: 4 – 32V AC: 90 – 280V	3 – 28V DC	3 – 28V DC
	Impedance	1500Ω (DC) 40K, +10% (AC)	1.2kΩ (approximately)	1.5kΩ (approximately)
Output Rating	Maximum Load Current	10, 25, 50, 75, and 90A	1.2A	1.5A, 2A
	Voltage Range	48 – 660V AC	70 – 250V AC	5 – 60V DC
	Drop-Out Voltage	1.5V, maximum	0.8V DC, minimum	0.8V DC, minimum
Mounting Style		Panel mount	Blade/Plug-in, Pin/Plug-in, PC mount	
Sockets		—	SR2P-... SH1B-...	SR2P-... SH1B-... SH2B-...
Approvals		  UL Recognized Files No. E59804	 CSA Certified File No. LR38595-94M	—

D

Sockets (for reference only)

DIN Rail Mount



DIN Rail



PC Mount



Hold-Down Springs/Clips



For more details on sockets, see Section F.

USA: (800) 262-4332 or (408) 747-0550, Western Canada: (888) 578-9988 or Eastern Canada (888) 317-4332

D-5

T22 / T25 / T26 Series

Line Voltage Wall Thermostat (Heating, Cooling, or Heating and Cooling)

Description

For line voltage control of residential, commercial, or industrial heating or year-round air conditioning. Heat or cold anticipators are not required. The liquid-charged temperature sensing element and highly efficient diaphragm and leverage provide close temperature control.

Features

- attractive beige colored, high-impact plastic enclosure (T26 Series)
- close differential without the need for anticipators
- bi-metal thermometer supplied as standard except where indicated
- equipped with adjustable dial stops (T26 Series)

Specifications

Temperature range is 40 to 90°F (5 to 30°C), except energy conservation models.

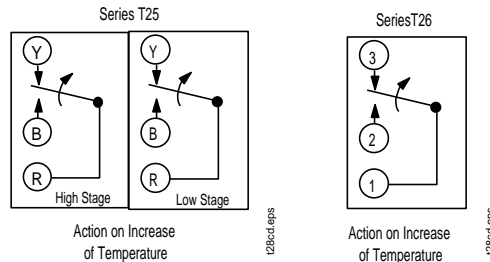
Accessories

- replacement knobs and faceplates
- for double trim plate for mounting two T22s or T26s



Applications

Use for line voltage control of heating and cooling equipment.



T25, T26 Series Action Diagrams

Selection Chart

T22 / T25 / T26 Series Line Voltage Wall Thermostat (Heating, Cooling, or Heating and Cooling)

Code Number ¹	Type of Adjustment	Application	Selector Switch	Differential Approximately °C (°F)		Ship Wt. (lb)
				Heating	Cooling	
HEATING						
T22AAA-1C	Knob	SPST	Off-Auto	1-3/4 (1)	-	1.3
T22ABC-1C	Concealed		Auto-Off-Fan			
T22BBC-1C		Knob	SPST, Medium Duty	-	3 (1.7)	1.0
T22CBC-1C	Concealed	SPST, Heavy Duty				
T22CBC-3C		Knob	SPST, Energy Conservation Heating model, max. setting 75°F (24°C)	None	2 (1.1)	
T26A-14C (No thermometer)	Knob	SPST, Energy Conservation Heating model, max. setting 65°F (18°C)				
T26A-15C (No thermometer)						
COOLING						
T22JAA-1C	Knob	SPST	Off-Auto	-	2-1/4 (1.3)	1.3
T22JCC-1C			Auto-Off-Fan			
T26J-7C (No thermometer)	Knob	SPST, Energy Conservation Cooling model, min. setting 75°F (24°C)	None	-	2 (1.1)	1.0
T26J-9C (No thermometer)		SPST, Energy Conservation Cooling model, min. setting 78°F (26°C)				

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Line Voltage Wall Thermostat (Heating, Cooling, or Heating and Cooling) (Continued)

T22 / T25 / T26 Series Line Voltage Wall Thermostat (Heating, Cooling, or Heating and Cooling) (Continued)

Code Number ¹	Type of Adjustment	Application	Selector Switch	Differential Approximately °C (°F)		Ship Wt. (lb)
				Heating	Cooling	
HEATING AND COOLING						
T22SDA-1C	Knob	SPDT, permits system shutdown at the thermostat	Off-Auto	1-3 /4 (1)	2-1/4 (1.3)	1.3
T22SEB-1C		SPDT, used when the same device controls heating and cooling	Heat-Off-Cool			
T22SFB-1C ²		SPDT, used to control separate loads on heating and cooling				
T22TFB-1C ²		SPDT, heavy duty, used to control separate loads on heating and cooling				
T26S-18C ³		SPDT	None	1-3/4 (1)	2-1/4 (1.3)	
T26T-3C ²	SPDT, heavy duty		3 (1.7)	3 to 4 (1.7 to 2.2)		
TWO-STAGE						
T25A-1C	Knob	Two SPDT switches	None	1-3/4 (1)	2-1/4 (1.3)	1.5
T25A-16C	Concealed	Two-stage heating, cooling or one stage heating and one stage cooling		3 (1.7) between stages		

- For the thermostat guard, refer to *G Series Thermostat and Humidistat Guards Catalog Page, LIT-1922145*.
- Can also be used where one unit provides both heating and cooling by adding a jumper between terminals 2 and 3. (See *Typical Wiring Diagram and Electrical Ratings for Line Voltage Thermostats Catalog Page, LIT-1922600*.)
- Includes a faceplate for horizontal mounting. The plate is for on-the-job installation over a vertical plate. Can field-convert to other configurations.
The T26S-18 is a universal replacement for Honeywell T451A, -B, T651A; White Rodgers 179-1, 180-1, 181-1, 182-101, -102; Robertshaw TA500, TH71, -72, -79, -500, TX550.
T26T-3 replaces: Honeywell T4051A, -B, T6051A; White-Rodgers 151-6, 152-9, 159-3, -5.

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TE-6001 Series

Hardware Assemblies for TE-6000 Sensors

Description

TE-6001 hardware assemblies are used in conjunction with the TE-6000 Series elements in a wide variety of temperature-sensing applications.

Repair Information

If the TE-6001 Series Hardware Assemblies for TE-6000 Sensors fail to operate within their specifications, replace the unit. For replacement assemblies, contact the nearest Johnson Controls® representative.

Applications

The TE-6001 assemblies used in conjunction with the TE-6000 sensors cover a wide range of sensing applications including:

- duct
- immersion
- dew point
- outside air
- room

There are also two additional TE-6001 assemblies (TE-6001-961 and TE-6001-962), which are available for auxiliary pushbutton and toggle switch applications.

Selection Chart

Code Number	Description
TE-6001-1	Duct temperature element holder with handi-box
TE-6001-2	Housing for outside air temperature sensing element
TE-6001-3	Packing nut and fittings for use with WZ-1000 wells in immersion well applications
TE-6001-4	Single/dual element holder for TE-6000 elements in room temperature sensing applications
TE-6001-5	Dew point sensor kit
TE-6001-6	10 adhesive mounting pads for use with T-4100, T-4110
TE-6001-7	10 clips for use with T-4002/4003 and H-4100/5100
TE-6001-8	Mounting bracket for use with TE-6100 and TE-6300 averaging sensors
TE-6001-11	Duct temperature and humidity element holder (without the handi-box)
TE-6001-961	Momentary pushbutton switch
TE-6001-962	Maintained toggle switch

Accessories (T-4000 Plastic Covers For TE-6001-4)

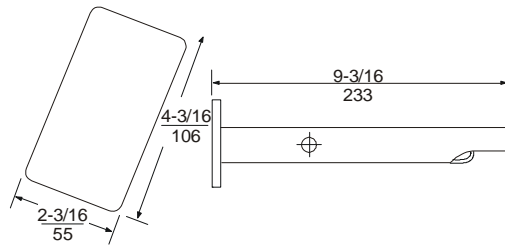
Code Number	Description	
T-4000-2139	Horizontal	Without setpoint window or thermometer, with JCI logo, silver faceplate
T-4000-2140		Without setpoint window, with F/C thermometer and JCI logo, silver faceplate
T-4000-2639		Concealed setpoint, without thermometer, with JCI logo, gold faceplate
T-4000-2640		Concealed setpoint, with thermometer and JCI logo, gold faceplate
T-4000-2138	Horizontal or Vertical	Without setpoint window, thermometer, or JCI logo, with silver faceplate
T-4000-2144		Vertical

TE-6001-1 Description

The TE-6001-1 duct temperature element holder is used with TE-6000 elements in duct insertion applications. The TE-6001-1 is designed to hold one or two temperature sensors. A handi-box is supplied with the element holder.



TE-6001-1 Duct Temperature Element Holder



TE-6001-1 Duct Temperature Element Holder Dimensions, (in./mm)

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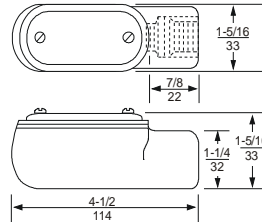
Hardware Assemblies for TE-6000 Sensors (Continued)

TE-6001-2 Description

The TE-6001-2 is a metal housing used with the TE-6000 temperature element in applications requiring outside air temperature sensing. A factory-mounted plastic clip is provided to hold the TE-6000 sensor in place.



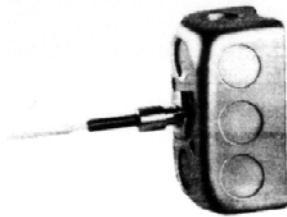
TE-6001-2 Metal Housing



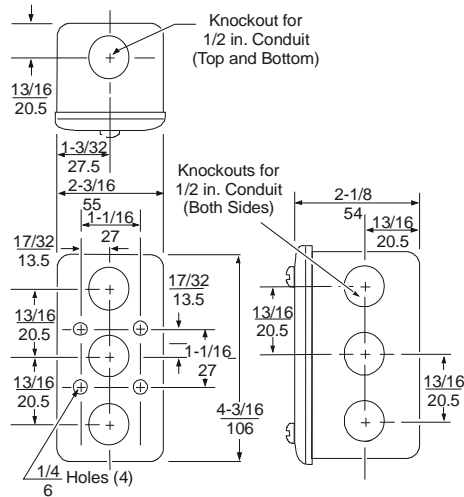
TE-6001-2 Metal Housing Dimensions, (in./mm)

TE-6001-3 Description

The TE-6001-3 packing nut, fittings, and handi-box are used with WZ-1000-2, -4 and -5 immersion wells to house TE-6000 elements in well insertion applications.



TE-6001-3 Kit



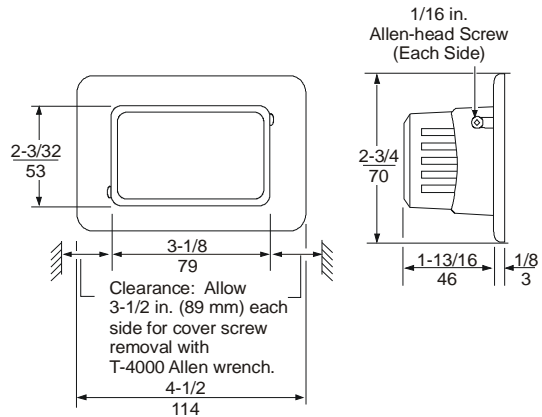
TE-6001-3 Kit Dimensions, (in./mm)

TE-6001-4 Description

The TE-6001-4 temperature element holder is used with TE-6000 sensors in room-sensing applications. The TE-6001-4 can hold up to two temperature sensors. A mounting bracket and wallplate adapter are supplied. A T-4000 cover is required and must be ordered separately. See the *Accessories* table.



TE-6001-4 Temperature Element Holder



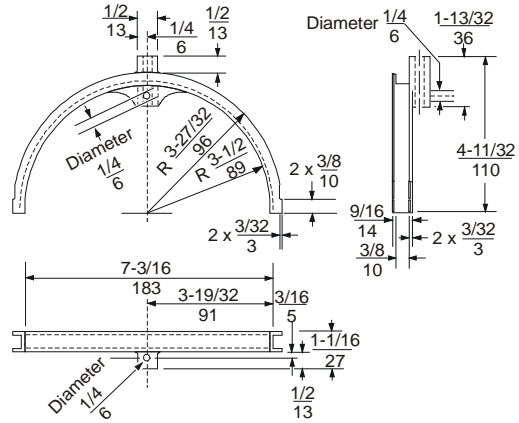
TE-6001-4 Temperature Element Holder Dimensions, (in./mm)

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Hardware Assemblies for TE-6000 Sensors (Continued)

TE-6001-8 Mounting Bracket Description

The TE-6001-8 Mounting Bracket is used with the TE-6100 and TE-6300 averaging sensors to maintain the minimum bend radius recommended for these sensors. It mounts to duct work with a single sheet metal screw.



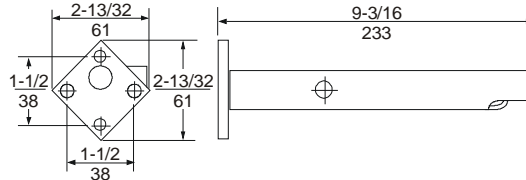
TE-6001-8 Mounting Bracket Dimensions, (in./mm)

TE-6001-11 Description

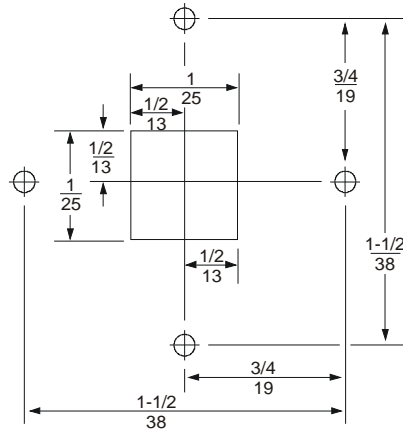
The TE-6001-11 duct temperature holder is used with the TE-6000 sensors. It has a rigid aluminum support that extends into the duct to hold one or two TE-6000 temperature sensing elements.



TE-6001-11 Duct Temperature Holder



TE-6001-11 Duct Temperature Holder Dimensions, (in./mm)



Installing the TE-6001-1 and TE-6001-11 Products

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TE-6300 Series Temperature Sensors

Description

The TE-6300 Temperature Sensor line provides economical solutions for a wide variety of temperature sensing needs, including wall-mount, outdoor-air, duct, strap-mount, well-insertion, duct-averaging, and Variable Air Volume (VAV) flange-mount duct-probe applications. The TE-6300 line offers both a metal and a plastic enclosure for the most popular models.

Sensors are available in the following types:

- 1k ohm thin-film nickel
- 1k ohm nickel averaging
- 1k ohm thin-film platinum
- 100 ohm platinum equivalent averaging
- 1k ohm platinum equivalent averaging
- 2.2k (2,252) ohm thermistor
- 10k ohm thermistor, Johnson Controls® Type II

Each sensor is packaged with the necessary mounting accessories to maximize ordering and installation ease and reduce both commissioning time and cost.

Refer to the *TE-6300 Temperature Sensors Product Bulletin (LIT-216320)* for important product application information.

Features

- full line of versatile sensors — supports all your temperature sensing needs from a single supplier: wall mount, outdoor air, duct probe, duct averaging, strap-mount, well insertion, and flange mount duct probe
- single assembly ordering — simplifies ordering; provides a complete assembly in one box
- models featuring an integral NPT Adaptor — increase sensor connection strength, which eliminates the need for a special adaptor
- models with a stainless steel sensor probe — protect the sensor while increasing corrosion resistance
- metal enclosure (TE-63xxM Models only) — meets plenum requirements
- models featuring a retainer for the sensor holder — allow you to lock the sensor holder into the conduit box
- brushed stainless steel mounting plate — offers a durable, aesthetically-pleasing design
- low profile flush mount design — provides a tamper-proof installation ideally suited for schools, sporting complexes, retailers, prisons, and more

All TE-6300 series sensors are two-wire, passive, resistance output devices.

TE-63xxA Models

The TE-63xxA (adjustable length) models:

- provide a thermoplastic mounting flange and gland nut to adjust the length of the probe

- include two hex-head self-drilling screws for mounting
- come equipped with a 10 ft (3 m) plenum-rated cable with 1/4 in. (6.35 mm) female insulated quick-connect terminations on leads

TE-63xxF Models

The TE-63xxF (flush mount) models:

- provide a low profile when installed in an electrical box
- feature thermally isolated sensor from the wall with a foam pad
- offer a rugged stainless steel cover
- provide 22 AWG lead wires with low voltage installation

TE-63xxM Models

The TE-63xxM (metal enclosure) models:

- come with a corrosion-protected steel enclosure with a 0.88 in. (22 mm) hole for a 1/2 in. (12.7 mm) conduit fitting
- include two hex-head self-drilling screws for mounting the duct and duct averaging models
- offer (well models only) either a direct mount or 1/2-14 NPT threaded well sensor holder for mounting in TE-6300W Series thermal wells (Order the thermal well separately.)
- provide optional well sensor holders (order separately) to mount duct models in thermal wells.
- meet UL 1995 plenum use requirements
- offer optional accessory kit (order separately) to replace plastic hole plug and wiring bushing to meet International Mechanical Code (IMC) requirements

TE-63xxP Models

The TE-63xxP (plastic enclosure) models:

- provide a thermoplastic conduit box with 1/2-14 NPT female thread for connecting to conduit
- provide aluminum mounting plate and 1/2-14 NPT threaded hub mounting options for the duct and duct averaging models
- use the 1/2-14 NPT female thread to mount the Outdoor Air models directly to ridged conduit
- provide optional sensor holders (order separately) to mount duct models in thermal wells
- offer an optional accessory metal cover kit (order separately) to replace the plastic cover to meet UL 1995 plenum use requirements
- include a replaceable sensing probe on duct probe, outdoor air, and well insertion models



TE-6300 Series Temperature Sensors

TE-63x4P Wall Mount Models

The TE-63x4P (plastic enclosure) models:

- come with a white thermoplastic ventilated cover with a brushed aluminum face plate and a steel mounting plate for surface mounting
- include faceplates for both horizontal and vertical mounting
- offer an accessory mounting kit for mounting to a standard electrical box
- offer optional covers

TE-63xS Models

The TE-63xS (Strap-Mount) models:

- provide a 1/4 in. (6.35 mm) diameter stainless steel probe without an enclosure
- include three cable ties for mounting to pipe up to 2-5/8 in. (67 mm) diameter
- come equipped with a 10 ft (3 m) plenum rated cable
- meet UL 1995 plenum use requirements
- offer an accessory mounting kit for mounting to a pipe up to 11 in. (280 mm) diameter

TE-63xxV Models

The TE-63xxV (VAV flange mount) models:

- provide a stainless steel mounting flange with two hex-head self-drilling mounting screws
- come equipped with a 10 ft (3 m) plenum rated cable with 1/4 in. (6.35 mm) female insulated quick-connect terminations on leads
- meet UL 1995 plenum use requirements

Repair Information

If the TE-6300 Series Temperature Sensor fails to operate within its specifications, refer to the *TE-6300 Series Temperature Sensors Product Bulletin (LIT-216320)* for a list of repair parts available.

TE-6300 Series Temperature Sensors (Continued)

Selection Charts

Sensor	Mounting Style	Probe Length in. (mm)	Product Code Number	
Nickel (1k ohm)	Adjustable ¹	8 (203)	TE-6311A-1	
		Averaging	8 ft (2.4 m)	TE-6315M-1
			17 ft (5.2 m)	TE-6316M-1
	Duct	4 (102)	TE-6316V-2 ¹	
		8 (203)	TE-6311P-1	
		18 (457)	TE-6311M-1	
			TE-6311J-1	
		Flange	4 (102)	TE-6311V-2
			8 (203)	TE-6311V-2
	Flush	N/A	TE-6310F-0	
			TE-6310F-1	
	Outdoor Air	3 (76)	TE-6313P-1	
	Strap-Mount	3 (76)	TE-631S-1	
	Wall ²	N/A	TE-6314P-1	
	Well	6 (152)	TE-631AM-2	
		8 (203)	TE-6312M-1	
	Platinum (1k ohm)	Adjustable	8 (203)	TE-6351-A
Duct			4 (102)	TE-635GM-1
			8 (203)	TE-6351M-1
				TE-6351P-1
			18 (457)	TE-635JM-1
Flange		4 (102)	TE-635GV-2	
		8 (203)	TE-6351V-2	
Flush		N/A	TE-6350F-0	
			TE-6350F-1	
Strap-Mount		3 (76)	TE-635S-1	
Outdoor Air		3 (76)	TE-6353P-1	
Wall ²		N/A	TE-6324P-1	
Well		6 (152)	TE-635AM-2	
		8 (203)	TE-6352M-1	

Sensor	Mounting Style	Probe Length in. (mm)	Product Code Number	
Platinum Equivalent	1k ohm Averaging ¹	10 ft (3 m)	TE-6327P-1	
		20 ft (6.1 m)	TE-6328P-1	
	100 ohm Averaging ¹	10 ft (3 m)	TE-6337P-1	
		20 ft (6.1 m)	TE-6338P-1	
Thermistor (2.2k ohm)	Adjustable	8 (203)	TE-6341A-1	
	Duct	8 (203)	TE-6341P-1	
		Flange	4 (102)	TE-634GV-2
		8 (203)	TE-6341V-2	
	Outdoor Air	3 (76)	TE-6343P-1	
	Wall ²	N/A	TE-6344P-1	
	Well	8 (203)	TE-6342M-1	
		6 (152)	TE-634AM-2	
	Thermistor (10k ohm) Type II	Adjustable	8 (203)	TE-6361A-1
		Duct	4 (102)	TE-636GM-1
8 (203)			TE-6361M-1	
18 (457)			TE-6361P-1	
Flange		4 (102)	TE-636GV-2	
		8 (203)	TE-6361V-2	
Flush		N/A	TE-6360F-0	
			TE-6360F-1	
Outdoor Air		3 (76)	TE-6363P-1	
Strap-Mount		3 (76)	TE-636S-1	
Well		6 (152)	TE-636AM-2	
	8 (203)	TE-6362M-1		

- Two TE-6001-8 Element Holders come with the platinum equivalent averaging sensors. Order separately to use with a nickel averaging sensor.
- Order the TE-1800-9600 Mounting Hardware separately to mount the wall unit to a wallbox.

Optional Accessories

Product Code Number	Description
F-1000-182	Thermal Conductive Grease for element wells (8 oz.)
T-4000-xxxx	Wall Mount Cover
T-4000-119	Allen Head Tool for Wall Mount Cover Screws (order in multiples of 30)
TE-1800-9600	Mounting Hardware for mounting the wall mount unit to a wall box
TE-6001-8	Element Holder for mounting an averaging sensor (order in multiples of 10)
TE-6001-13	Metal Cover and Gasket Kit (5 per package)
TE-6300-101	12 in. (305 mm) (1k ohm) Nickel Probe (cut to an appropriate length) ¹
TE-6300-105	12 in. (305 mm) (1k ohm) Platinum Class A Probe (cut to an appropriate length) ¹
TE-6300-103	1/2-14 NPT Plastic Sensor Holder without retainer (order in multiples of 10)
TE-6300-104	12 in. (305 mm) (2.2k ohm) Thermistor Probe (cut to an appropriate length) ¹
TE-6300-613	IMC Kit, Metal Knockout Plug, Metal Clamp Connector (order in multiples of 10)
TE-6300-614	Cable Tie Mounting Kit, 0.50 to 2.625 in. (12.7 to 66.7 mm) Bundle Diameter (10 per package)
TE-6300-615	Cable Tie Mounting Kit, 11 in. (280 mm) Max Bundle Diameter
TE-6300-616	8 in. (203 mm) 1k ohm Platinum Class A Probe
TE-6300-617	3 in. (76 mm) 1k ohm Platinum Class A Probe
TQ-6000-1	4 to 20 mA Output Transmitter for use with the 100 ohm platinum sensor
TE-6300W-102	6 in. (152 mm) Stainless Steel Well (direct mount)
TE-6300W-101	6 in. (152 mm) Brass Well (direct mount with thermal grease included)
TE-6300W-110	8 in. (203 mm) Stainless Steel Well

1. Cut 12 in. probes to a minimum of 3 in. (76 mm).

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TE-6300 Series Temperature Sensors (Continued)

T-4000 Covers Available for the Wall Mount TE-63x4P Series

Product Code Number	Horizontal Johnson Controls Logo	Vertical Johnson Controls Logo	Thermometer, with °F/°C Scale	Faceplate/Cover Color
T-4000-2138 ¹				Brushed Aluminum/Beige
T-4000-2139	■			
T-4000-2140	■		■	
T-4000-2144		■		
T-4000-2639	■			Brown and Gold/Beige
T-4000-2640	■		■	
T-4000-2644		■		
T-4000-3139	■			Brushed Aluminum/White
T-4000-3140	■		■	
T-4000-3144		■		

1. Without Johnson Controls logo

Technical Specifications

TE-6300 Series Temperature Sensors (Part 1 of 2)		
Sensor Reference Resistance	1k ohm Nickel	1k ohms at 70°F (21°C)
	1k ohm Nickel Averaging	
	1k ohm Platinum	1k ohms at 32°F (0°C)
	100 ohm Platinum Averaging	100 ohms at 32°F (0°C)
	1k ohm Platinum Averaging	1k ohms at 32°F (0°C)
	2.2k ohm Thermistor	2,252 ohms at 77°F (25°C)
	10k ohm Thermistor	10.0k ohms at 77°F (25°C)
Sensor Accuracy	1k ohm Nickel	±0.34F° at 70°F (±0.19C° at 21°C)
	1k ohm Nickel Averaging	±3.4F° at 70°F (±1.9C° at 21°C)
	1k ohm Platinum Class A	±0.35F° at 70°F (±0.19C° at 21°C), DIN Class A
	1k ohm Platinum Class B	±0.73F° at 70°F (±0.41C° at 21°C), DIN Class B
	100 ohm Platinum Averaging	±1.0F° at 70°F (±0.58C° at 21°C)
	1k ohm Platinum Averaging	
	10k ohm Thermistor	±0.9F° (±0.5C°) in the range: 32 to 158°F (0 to 70°C)
Sensor Temperature Coefficient	1k ohm Nickel	Approximately 3 ohms/F° (5.4 ohms/C°)
	1k ohm Nickel Averaging	
	1k ohm Platinum	Approximately 2 ohms/F° (3.9 ohms/C°) 3850 ppm/K
	100 ohm Platinum Averaging	Approximately 0.2 ohms/F° (0.39 ohms/C°)
	1k ohm Platinum Averaging	Approximately 2 ohms/F° (3.9 ohms/C°)
	2.2k ohm Thermistor	Nonlinear, Negative Temperature Coefficient (NTC)
Electrical Connection	TE-63xxM	22 AWG (0.6 mm diameter) x 6 in. (152 mm) long
	TE-63xxP	
	TE-63xxF	22 AWG (0.6 mm diameter) x 12 ft (3 m) braided-copper wires, low voltage insulation, half-stripped ends
	TE-63xxP Nickel Averaging	18 AWG (1.0 mm diameter) x 6 in. (152 mm) long
	TE-63xS	22 AWG (0.6 mm diameter) x 10 ft (3 m) long plenum-rated cable
	TE-63xxA, TE-63xxV	22 AWG (0.6 mm diameter) x 10 ft (3 m) long plenum-rated cable with 0.25 in. (6.35 mm) female quick-connect terminals

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TE-6300 Series Temperature Sensors (Continued)

TE-6300 Series Temperature Sensors (Part 2 of 2)		
Materials	Probes	Nickel Averaging: 0.094 in. (2.4 mm) Outside Diameter (O.D.) copper tubing Nickel Averaging Adaptor: 0.25 in. (6.35 mm) O.D. Brass Platinum Averaging Probe: 0.19 in. (4.8 mm) Aluminum tubing All others (except Averaging): 0.25 in. (6.35 mm) O.D. Stainless Steel
	TE-63xxA	Mounting Adapter Plate and Gland: Thermoplastic
	TE-63xxF	Flush Mount: Stainless Steel
	TE-63xxM	Enclosure: Corrosion-Protected Steel Well Sensor Holder: 0.875 in. (22.2 mm) Hex Brass
	TE-63xxP	Conduit box and Shield: Rigid Thermoplastic Mounting Plate: Aluminum Sensor Holder: Rigid Thermoplastic Wall Mount Base Plate: Corrosion-Protected Steel Wall Mount Cover: Rigid Thermoplastic (White) Wall Mount Face Plate: Brushed Aluminum
	TE-63xxV	Mounting Flange: Stainless Steel
Operating Conditions	TE-63xxA	-50 to 140°F (-46 to 60°C)
	TE-63xxF	32 to 104°F (0 to 40°C)
	TE-63xxM	-50 to 220°F (-46 to 104°C)
	TE-63xxP	Enclosure: -50 to 122°F (-46 to 50°C) Sensor Probe: -50 to 220°F (-46 to 104°C)
	TE-63xS	Sensor Probe: -50 to 220°F (-46 to 104°C)
	TE-63xxV	Wire Harness: -50 to 122°F (-46 to 50°C)
Shipping Weight	TE-63xxA	0.2 lb (0.09 kg)
	TE-63xxF	0.25 lb (113.4 kg)
	TE-63xxM	Duct Averaging: 0.9 lb (0.41 kg) Duct Mount: 0.4 lb (0.18 kg) Well Insertion: 0.5 lb (0.23 kg)
	TE-63xxP	Duct Averaging: 0.5 lb (0.23 kg) Duct Mount: 0.4 lb (0.18 kg) Outdoor Air: 0.5 lb (0.23 kg) Wall Mount: 0.2 lb (0.09 kg) Well Insertion: 0.35 lb (0.16 kg)
	TE-63xS	Strap-Mount: 0.2 lb (0.09 kg)
	TE-63xxV	Duct Averaging: 0.7 lb (0.32 kg) Duct Mount: 0.2 lb (0.09 kg)
Dimensions (H x W x D)	TE-63xxA	2.17 in. (55 mm) diameter plus 4 or 8 in. (102 or 203 m) element
	TE-63xxF	Flush Mount: 4-1/2 x 2-3/4 in. (114 x 70 mm)
	TE-63xxM	Duct Averaging: 1.87 x 1.87 x 1.80 in. (47.5 x 47.5 x 45.8 mm) plus 8 or 17 ft (2.4 or 5.2 m) element Duct Mount: 1.87 x 1.87 x 1.80 in. (47.5 x 47.5 x 45.8 mm) plus 4, 8, or 18 in. (102, 203, or 457 mm) element Well Insertion: 1.87 x 1.87 x 1.80 in. (47.5 x 47.5 x 45.8 mm) plus 6 or 8 in. (152 or 203 mm) element
	TE-63xxP	Duct Averaging: 5.97 x 1.38 x 2.75 in. (152 x 35 x 70 mm) plus 8, 10, 17, or 20 ft (2.4, 3.0, 5.2, or 6.1 m) element Duct Mount: 5.97 x 1.38 x 2.75 in. (152 x 35 x 70 mm) plus 6 or 8 in. (152 or 203 mm) probe Outdoor Air: 5.97 x 3.47 x 4.46 in. (152 x 88 x 113 mm) Wall Mount: 2.09 x 3.12 x 1.80 in. (53 x 79 x 46 mm) Well Insertion: 5.97 x 1.38 x 2.75 in. (152 x 35 x 70 mm) plus 6 or 8 in. (152 or 203 mm) probe
	TE-63xS	Strap-Mount: 0.25 in. (6.35 mm) diameter x 3.00 in. (76 mm.) long
	TE-63xxV	Duct Averaging: 2.25 x 1.50 in. (57 x 38 mm) plus 8 or 17 ft (2.4 or 5.2 m) element Duct Mount: 2.25 x 1.50 in. (57 x 38 mm) plus 4 or 8 in. (102 or 203 m) element

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VG1000 Series Two-Way, Plated Brass Trim, NPT End Connections Ball Valves with Non-Spring-Return Electric Actuators

Description

VG1000 Series Ball Valves are designed to regulate the flow of hot or chilled water and, for some models, low-pressure steam in response to the demand of a controller in HVAC systems. Available in sizes 1/2 through 2 in. (DN15 through DN50), this family of two- and three-way forged brass valves is factory or field mounted to Johnson Controls® VA9104, M9106, M9109, and M9100 Series Non-Spring-Return and VA9203 and VA9208 Series Spring-Return Electric Actuators for on/off, floating, or proportional control.

Refer to the *VG1000 Series Forged Brass Ball Valves Product Bulletin (LIT-977132)* for important product application information.

- Graphite-Reinforced Polytetrafluoroethylene (PTFE) Seats — include 15% graphite-reinforced ball seals, providing better wear resistance.
- Chrome-Plated Brass Ball and Stem Assembly Standard — handles both chilled and hot water applications with a fluid temperature range of 23 to 203°F (-5 to 95°C).
- 500:1 Rangeability — provides accurate control under all load conditions.



VG1000 Series Two-Way Non-Spring-Return Plated Brass Ball and Stem Ball Valve Assemblies

Repair Information

If the VG1000 Series Ball Valve fails to operate within its specifications, replace the valve body, actuator, or entire assembly. For replacement parts, contact the nearest Johnson Controls representative.

Features

- Forged Brass Body — provides 580 psig static pressure rating.
- 200 psi Closeoff Pressure Rating — provides tight shutoff.

Selection Charts

Two-Way Plated Brass Trim Valves, Non-Spring Return, VA9104 Electric Actuators without Switches

Fluid Temperatures: 23 to 203°F (-5 to 95°C) Not Rated for Steam Service				24 VAC		
Valve	Size, in.	Cv	Closeoff psig	On/Off (Floating) without Timeout ¹	On/Off (Floating) with Timeout	DC 0 to 10 V Proportional
Actuators with M3 Screw Terminals				VA9104-AGA-3S	VA9104-IGA-3S	VA9104-GGA-3S
VG1241AD	1/2	1.2 ²	200	VG1241AD+9T4AGA	VG1241AD+9T4IGA	VG1241AD+9T4GGA
VG1241AE		1.9 ²		VG1241AE+9T4AGA	VG1241AE+9T4IGA	VG1241AE+9T4GGA
VG1241AF		2.9 ²		VG1241AF+9T4AGA	VG1241AF+9T4IGA	VG1241AF+9T4GGA
VG1241AG		4.7 ²		VG1241AG+9T4AGA	VG1241AG+9T4IGA	VG1241AG+9T4GGA
VG1241AL		7.4 ²		VG1241AL+9T4AGA	VG1241AL+9T4IGA	VG1241AL+9T4GGA
VG1241AN		11.7		VG1241AN+9T4AGA	VG1241AN+9T4IGA	VG1241AN+9T4GGA
VG1241BG	3/4	4.7 ²	200	VG1241BG+9T4AGA	VG1241BG+9T4IGA	VG1241BG+9T4GGA
VG1241BL		7.4 ²		VG1241BL+9T4AGA	VG1241BL+9T4IGA	VG1241BL+9T4GGA
VG1241BN		11.7		VG1241BN+9T4AGA	VG1241BN+9T4IGA	VG1241BN+9T4GGA
VG1241CL	1	7.4 ²	200	VG1241CL+9T4AGA	VG1241CL+9T4IGA	VG1241CL+9T4GGA
VG1241CN		11.7 ²		VG1241CN+9T4AGA	VG1241CN+9T4IGA	VG1241CN+9T4GGA
VG1241CP		18.7		VG1241CP+9T4AGA	VG1241CP+9T4IGA	VG1241CP+9T4GGA
Actuators with 48 in. (1.2 m) 18 AWG Plenum Cable				VA9104-AGA-2S	VA9104-IGA-2S	VA9104-GGA-2S
VG1241AD	1/2	1.2 ²	200	VG1241AD+9A4AGA	VG1241AD+9A4IGA	VG1241AD+9A4GGA
VG1241AE		1.9 ²		VG1241AE+9A4AGA	VG1241AE+9A4IGA	VG1241AE+9A4GGA
VG1241AF		2.9 ²		VG1241AF+9A4AGA	VG1241AF+9A4IGA	VG1241AF+9A4GGA
VG1241AG		4.7 ²		VG1241AG+9A4AGA	VG1241AG+9A4IGA	VG1241AG+9A4GGA
VG1241AL		7.4 ²		VG1241AL+9A4AGA	VG1241AL+9A4IGA	VG1241AL+9A4GGA
VG1241AN		11.7		VG1241AN+9A4AGA	VG1241AN+9A4IGA	VG1241AN+9A4GGA
VG1241BG	3/4	4.7 ²	200	VG1241BG+9A4AGA	VG1241BG+9A4IGA	VG1241BG+9A4GGA
VG1241BL		7.4 ²		VG1241BL+9A4AGA	VG1241BL+9A4IGA	VG1241BL+9A4GGA
VG1241BN		11.7		VG1241BN+9A4AGA	VG1241BN+9A4IGA	VG1241BN+9A4GGA
VG1241CL	1	7.4 ²	200	VG1241CL+9A4AGA	VG1241CL+9A4IGA	VG1241CL+9A4GGA
VG1241CN		11.7 ²		VG1241CN+9A4AGA	VG1241CN+9A4IGA	VG1241CN+9A4GGA
VG1241CP		18.7		VG1241CP+9A4AGA	VG1241CP+9A4IGA	VG1241CP+9A4GGA

- To avoid excessive wear or drive time on the motor for the AGA models, use a controller or software that provides a timeout function to remove the signal at the end of rotation (stall).
- Valve has a characterizing disk.

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VG1000 Series Two-Way, Plated Brass Trim, NPT End Connections Ball Valves with Non-Spring-Return Electric Actuators (Continued)

Two-Way Plated Brass Trim Ball Valves, Non-Spring Return, M9106/M9109 Electric Actuators without Switches

Fluid Temperatures: 23 to 203°F (-5 to 95°C) Not Rated for Steam Service				AC 24 V		
Valve	Size, in.	Cv	Closeoff psig	On/Off (Floating) without Timeout ¹	On/Off (Floating) with Timeout	DC 0 to 10 V Proportional
				M9106-AGA-2 M9109-AGA-2	M9106-IGA-2	M9106-GGA-2 M9109-GGA-2
VG1241DN	1-1/4	11.7 ²	200	VG1241DN+906AGA	VG1241DN+906IGA	VG1241DN+906GGA
VG1241DP		18.7 ²		VG1241DP+906AGA	VG1241DP+906IGA	VG1241DP+906GGA
VG1241DR		29.2		VG1241DR+906AGA	VG1241DR+906IGA	VG1241DR+906GGA
VG1241EP	1-1/2	18.7 ²	200	VG1241EP+906AGA	VG1241EP+906IGA	VG1241EP+906GGA
VG1241ER		29.2 ²		VG1241ER+906AGA	VG1241ER+906IGA	VG1241ER+906GGA
VG1241ES		46.8		VG1241ES+906AGA	VG1241ES+906IGA	VG1241ES+906GGA
VG1241FR	2	29.2 ²	200	VG1241FR+909AGA		VG1241FR+909GGA
VG1241FS		46.8 ²		VG1241FS+909AGA		VG1241FS+909GGA
VG1241FT		73.7		VG1241FT+909AGA		VG1241FT+909GGA

1. To avoid excessive wear or drive time on the motor for the AGA models, use a controller or software that provides a timeout function to remove the signal at the end of rotation (stall).
2. Valve has a characterizing disk.

Two-Way Plated Brass Trim Ball Valves, Non-Spring Return, M9106/M9109 Electric Actuators with Switches

Fluid Temperatures: 23 to 203°F (-5 to 95°C) Not Rated for Steam Service				AC 24 V		
Valve	Size, in.	Cv	Closeoff psig	On/Off (Floating) without Timeout ¹	On/Off (Floating) with Timeout	DC 0 to 10 V Proportional
				M9106-AGC-2 M9109-AGC-2	M9106-IGC-2	M9106-GGC-2 M9109-GGC-2
VG1241AD	1/2	1.2 ²	200	VG1241AD+906AGC	VG1241AD+906IGC	VG1241AD+906GGC
VG1241AE		1.9 ²		VG1241AE+906AGC	VG1241AE+906IGC	VG1241AE+906GGC
VG1241AF		2.9 ²		VG1241AF+906AGC	VG1241AF+906IGC	VG1241AF+906GGC
VG1241AG		4.7 ²		VG1241AG+906AGC	VG1241AG+906IGC	VG1241AG+906GGC
VG1241AL		7.4 ²		VG1241AL+906AGC	VG1241AL+906IGC	VG1241AL+906GGC
VG1241AN		11.7		VG1241AN+906AGC	VG1241AN+906IGC	VG1241AN+906GGC
VG1241BG	3/4	4.7 ²	200	VG1241BG+906AGC	VG1241BG+906IGC	VG1241BG+906GGC
VG1241BL		7.4 ²		VG1241BL+906AGC	VG1241BL+906IGC	VG1241BL+906GGC
VG1241BN		11.7		VG1241BN+906AGC	VG1241BN+906IGC	VG1241BN+906GGC
VG1241CL	1	7.4 ²	200	VG1241CL+906AGC	VG1241CL+906IGC	VG1241CL+906GGC
VG1241CN		11.7 ²		VG1241CN+906AGC	VG1241CN+906IGC	VG1241CN+906GGC
VG1241CP		18.7		VG1241CP+906AGC	VG1241CP+906IGC	VG1241CP+906GGC
VG1241DN	1-1/4	11.7 ²	200	VG1241DN+906AGC	VG1241DN+906IGC	VG1241DN+906GGC
VG1241DP		18.7 ²		VG1241DP+906AGC	VG1241DP+906IGC	VG1241DP+906GGC
VG1241DR		29.2		VG1241DR+906AGC	VG1241DR+906IGC	VG1241DR+906GGC
VG1241EP	1-1/2	18.7 ²	200	VG1241EP+906AGC	VG1241EP+906IGC	VG1241EP+906GGC
VG1241ER		29.2 ²		VG1241ER+906AGC	VG1241ER+906IGC	VG1241ER+906GGC
VG1241ES		46.8		VG1241ES+906AGC	VG1241ES+906IGC	VG1241ES+906GGC
VG1241FR	2	29.2 ²	200	VG1241FR+909AGC		VG1241FR+909GGC
VG1241FS		46.8 ²		VG1241FS+909AGC		VG1241FS+909GGC
VG1241FT		73.7		VG1241FT+909AGC		VG1241FT+909GGC

1. To avoid excessive wear or drive time on the motor for the AGC models, use a controller or software that provides a timeout function to remove the signal at the end of rotation (stall).
2. Valve has a characterizing disk.

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VG1000 Series Two-Way, Plated Brass Trim, NPT End Connections Ball Valves with Non-Spring-Return Electric Actuators (Continued)

Technical Specifications

VG1000 Series Two-Way, Plated Brass Trim, NPT End Connections Ball Valves with Non-Spring-Return Electric Actuators		
Service¹		Hot Water, Chilled Water, or 50/50 Glycol Solutions for HVAC Systems
Valve Fluid Temperature Limits	Water	23 to 203°F (-5 to 95°C)
	Steam	Not Rated for Steam Service
Maximum Actuator Fluid Temperature Limit	203°F (95°C)	VA9104 Series Non-Spring-Return Actuators M9104 Series Non-Spring-Return Actuators with M9000-550 Linkage M9106 or M9109 Series Non-Spring-Return Actuators with M9000-520 Linkage
Valve Body Pressure Rating	Water	580 psig (4,000 kPa) (PN40)
	Steam	Not Rated for Steam Service
Maximum Closeoff Pressure		200 psid (1,378 kPa)
Maximum Recommended Operating Pressure Drop		50 psid (340 kPa)
Flow Characteristics	Two-Way	Equal Percentage
Rangeability²		Greater than 500:1
Minimum Ambient Operating Temperature		-4°F (-20°C)
Maximum Ambient Operating Temperature³ (Limited by the Actuator and Linkage)	140°F (60°C)	VA9104 Series Non-Spring-Return Actuators M9104 Series Non-Spring-Return Actuators with M9000-550 Linkage
	125°F (52°C)	M9106 and M9109 Series Non-Spring-Return Actuators with M9000-520 Linkage
Leakage		0.01% of Maximum Flow per ANSI/FCI 70-2, Class 4
End Connections		National Pipe Thread (NPT)
Materials	Body	Forged Brass
	Ball	Chrome Plated Brass
	Blowout-Proof Stem	Nickel Plated Brass
	Seats	Graphite-Reinforced PTFE with Ethylene Propylene Diene Monomer (EPDM) O-Ring Backing
	Stem Seals	EPDM Double O-Rings
	Characterizing Disk	Amodel® AS-1145HS Polyphthalamide Resin

1. Proper water treatment is recommended; refer to the VDI 2035 Guideline.

2. Rangeability is defined as the ratio of maximum controllable flow to minimum controllable flow.

3. In steam applications, install the valve with the stem horizontal to the piping, and wrap the valve and piping with insulation.

VG1000 Series Two-Way, Plated Brass Trim, NPT End Connections Ball Valves with Spring-Return Electric Actuators without Switches

Description

VG1000 Series Ball Valves are designed to regulate the flow of hot or chilled water and, for some models, low-pressure steam in response to the demand of a controller in HVAC systems. Available in sizes 1/2 through 2 in. (DN15 through DN50), this family of two- and three-way forged brass valves is factory or field mounted to Johnson Controls® VA9104, M9106, M9109, and M9100 Series Non-Spring-Return and VA9203 and VA9208 Series Spring-Return Electric Actuators for on/off, floating, or proportional control.

Refer to the *VG1000 Series Forged Brass Ball Valves Product Bulletin (LIT-977132)* for important product application information.

Features

- Forged Brass Body — provides 580 psig static pressure rating.
- Chrome-Plated Brass Ball and Stem Assembly Standard — handles both chilled water and hot water applications with a fluid temperature range of 23 to 203°F (-5 to 95°C).
- Graphite-Reinforced Polytetrafluoroethylene (PTFE) Seats — include 15% graphite-reinforced ball seals, providing better wear resistance.
- 500:1 Rangeability — provides accurate control under all load conditions.
- Maintenance-Free Design — performs without failure in excess of 200,000 full stroke cycles in iron-oxide contaminated water.



Repair Information

If the VG1000 Series Ball Valve fails to operate within its specifications, replace the valve body, actuator, or entire assembly. For replacement parts, contact the nearest Johnson Controls representative.

VG1000 Series Two-Way, Spring-Return, Plated Brass Ball and Stem Ball Valve Assemblies without End Switches

Selection Chart

Two-Way — Spring Return without Switches (Part 1 of 2)

Fluid Temperatures: 23 to 203°F (-5 to 95°C)				AC 24 V			AC 85–264 V (VA9203) AC 120 V (VA9208)
Valve	Size, in.	Cv	Closeoff psig	Floating	DC 0 to 10 V Proportional	On/Off	On/Off
				Spring Return Open — Valve Normally Open			
				VA9203-AGA-2Z	VA9203-GGA-2Z	VA9203-BGA-2	VA9203-BUA-2
VG1241AD	1/2	1.2 ¹	200	VG1241AD+923AGA	VG1241AD+923GGA	VG1241AD+923BGA	VG1241AD+923BUA
VG1241AE		1.9 ¹		VG1241AE+923AGA	VG1241AE+923GGA	VG1241AE+923BGA	VG1241AE+923BUA
VG1241AF		2.9 ¹		VG1241AF+923AGA	VG1241AF+923GGA	VG1241AF+923BGA	VG1241AF+923BUA
VG1241AG		4.7 ¹		VG1241AG+923AGA	VG1241AG+923GGA	VG1241AG+923BGA	VG1241AG+923BUA
VG1241AL		7.4 ¹		VG1241AL+923AGA	VG1241AL+923GGA	VG1241AL+923BGA	VG1241AL+923BUA
VG1241AN		11.7		VG1241AN+923AGA	VG1241AN+923GGA	VG1241AN+923BGA	VG1241AN+923BUA
VG1241BG	3/4	4.7 ¹	200	VG1241BG+923AGA	VG1241BG+923GGA	VG1241BG+923BGA	VG1241BG+923BUA
VG1241BL		7.4 ¹		VG1241BL+923AGA	VG1241BL+923GGA	VG1241BL+923BGA	VG1241BL+923BUA
VG1241BN		11.7		VG1241BN+923AGA	VG1241BN+923GGA	VG1241BN+923BGA	VG1241BN+923BUA
VG1241CL	1	7.4 ¹	200	VG1241CL+923AGA	VG1241CL+923GGA	VG1241CL+923BGA	VG1241CL+923BUA
VG1241CN		11.7 ¹		VG1241CN+923AGA	VG1241CN+923GGA	VG1241CN+923BGA	VG1241CN+923BUA
VG1241CP		18.7		VG1241CP+923AGA	VG1241CP+923GGA	VG1241CP+923BGA	VG1241CP+923BUA
				Spring Return Open — Valve Normally Open			
				VA9208-AGA-2	VA9208-GGA-2	VA9208-BGA-3	VA9208-BAA-3
VG1241DN	1-1/4	11.7 ¹	200	VG1241DN+928AGA	VG1241DN+928GGA	VG1241DN+938BGA	VG1241DN+938BAA
VG1241DP		18.7 ¹		VG1241DP+928AGA	VG1241DP+928GGA	VG1241DP+938BGA	VG1241DP+938BAA
VG1241DR		29.2		VG1241DR+928AGA	VG1241DR+928GGA	VG1241DR+938BGA	VG1241DR+938BAA
VG1241EP	1-1/2	18.7 ¹	200	VG1241EP+928AGA	VG1241EP+928GGA	VG1241EP+938BGA	VG1241EP+938BAA
VG1241ER		29.2 ¹		VG1241ER+928AGA	VG1241ER+928GGA	VG1241ER+938BGA	VG1241ER+938BAA
VG1241ES		46.8		VG1241ES+928AGA	VG1241ES+928GGA	VG1241ES+938BGA	VG1241ES+938BAA
VG1241FR	2	29.2 ¹	200	VG1241FR+928AGA	VG1241FR+928GGA	VG1241FR+938BGA	VG1241FR+938BAA
VG1241FS		46.8 ¹		VG1241FS+928AGA	VG1241FS+928GGA	VG1241FS+938BGA	VG1241FS+938BAA
VG1241FT		73.7		VG1241FT+928AGA	VG1241FT+928GGA	VG1241FT+938BGA	VG1241FT+938BAA

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VG1000 Series Two-Way, Plated Brass Trim, NPT End Connections Ball Valves with Spring-Return Electric Actuators without Switches (Continued)

Two-Way — Spring Return without Switches (Part 2 of 2)

Fluid Temperatures: 23 to 203°F (-5 to 95°C)				AC 24 V			AC 85–264 V (VA9203) AC 120 V (VA9208)
Valve	Size, in.	Cv	Closeoff psig	Floating	DC 0 to 10 V Proportional	On/Off	On/Off
Spring Return Closed — Valve Normally Closed							
				VA9203-AGA-2Z	VA9203-GGA-2Z	VA9203-BGA-2	VA9203-BUA-2
VG1241AD	1/2	1.2 ¹	200	VG1241AD+943AGA	VG1241AD+943GGA	VG1241AD+943BGA	VG1241AD+943BUA
VG1241AE		1.9 ¹		VG1241AE+943AGA	VG1241AE+943GGA	VG1241AE+943BGA	VG1241AE+943BUA
VG1241AF		2.9 ¹		VG1241AF+943AGA	VG1241AF+943GGA	VG1241AF+943BGA	VG1241AF+943BUA
VG1241AG		4.7 ¹		VG1241AG+943AGA	VG1241AG+943GGA	VG1241AG+943BGA	VG1241AG+943BUA
VG1241AL		7.4 ¹		VG1241AL+943AGA	VG1241AL+943GGA	VG1241AL+943BGA	VG1241AL+943BUA
VG1241AN		11.7		VG1241AN+943AGA	VG1241AN+943GGA	VG1241AN+943BGA	VG1241AN+943BUA
VG1241BG	3/4	4.7 ¹	200	VG1241BG+943AGA	VG1241BG+943GGA	VG1241BG+943BGA	VG1241BG+943BUA
VG1241BL		7.4 ¹		VG1241BL+943AGA	VG1241BL+943GGA	VG1241BL+943BGA	VG1241BL+943BUA
VG1241BN		11.7		VG1241BN+943AGA	VG1241BN+943GGA	VG1241BN+943BGA	VG1241BN+943BUA
VG1241CL	1	7.4 ¹	200	VG1241CL+943AGA	VG1241CL+943GGA	VG1241CL+943BGA	VG1241CL+943BUA
VG1241CN		11.7 ¹		VG1241CN+943AGA	VG1241CN+943GGA	VG1241CN+943BGA	VG1241CN+943BUA
VG1241CP		18.7		VG1241CP+943AGA	VG1241CP+943GGA	VG1241CP+943BGA	VG1241CP+943BUA
Spring Return Closed — Valve Normally Closed							
				VA9208-AGA-2	VA9208-GGA-2	VA9208-BGA-3	VA9208-BAA-3
VG1241DN	1-1/4	11.7 ¹	200	VG1241DN+948AGA	VG1241DN+948GGA	VG1241DN+958BGA	VG1241DN+958BAA
VG1241DP		18.7 ¹		VG1241DP+948AGA	VG1241DP+948GGA	VG1241DP+958BGA	VG1241DP+958BAA
VG1241DR		29.2		VG1241DR+948AGA	VG1241DR+948GGA	VG1241DR+958BGA	VG1241DR+958BAA
VG1241EP	1-1/2	18.7 ¹	200	VG1241EP+948AGA	VG1241EP+948GGA	VG1241EP+958BGA	VG1241EP+958BAA
VG1241ER		29.2 ¹		VG1241ER+948AGA	VG1241ER+948GGA	VG1241ER+958BGA	VG1241ER+958BAA
VG1241ES		46.8		VG1241ES+948AGA	VG1241ES+948GGA	VG1241ES+958BGA	VG1241ES+958BAA
VG1241FR	2	29.2 ¹	200	VG1241FR+948AGA	VG1241FR+948GGA	VG1241FR+958BGA	VG1241FR+958BAA
VG1241FS		46.8 ¹		VG1241FS+948AGA	VG1241FS+948GGA	VG1241FS+958BGA	VG1241FS+958BAA
VG1241FT		73.7		VG1241FT+948AGA	VG1241FT+948GGA	VG1241FT+958BGA	VG1241FT+958BAA

1. Valve has a characterizing disk.

The performance specifications are nominal and conform to acceptable industry standards. For applications at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products. © 2014 Johnson Controls, Inc. www.johnsoncontrols.com

VG1000 Series Two-Way, Plated Brass Trim, NPT End Connections Ball Valves with Spring-Return Electric Actuators without Switches (Continued)

Technical Specifications

VG1000 Series Two-Way, Plated Brass Trim, NPT End Connections Ball Valves with Spring-Return Electric Actuators without Switches		
Service¹		Hot Water, Chilled Water, 50/50 Glycol Solutions
Fluid Temperature Limits	Water	23 to 203°F (-5 to 95°C)
	Steam	Not Rated for Steam Service
Valve Body Pressure Rating	Water	580 psig (4,000 kPa) (PN40)
	Steam	Not Rated for Steam Service
Maximum Closeoff Pressure		200 psid (1,378 kPa)
Maximum Recommended Operating Pressure Drop		50 psid (340 kPa)
Flow Characteristics	Two-Way	Equal Percentage
Rangeability²		Greater than 500:1
Minimum Ambient Operating Temperature	-22°F (-30°C)	VA9203 Series Spring-Return Actuators
	-40°F (-40°C)	VA9208 Series Spring-Return Actuators
Maximum Ambient Operating Temperature³ (Limited by the Actuator)	140°F (60°C)	VA9203 or VA9208 Series Spring-Return Actuators
Leakage		0.01% of Maximum Flow per ANSI/FCI 70-2, Class 4
End Connections		National Pipe Thread (NPT)
Materials	Body	Forged Brass
	Ball	Chrome Plated Brass
	Blowout-Proof Stem	Nickel Plated Brass
	Seats	Graphite-Reinforced PTFE with Ethylene Propylene Diene Monomer (EPDM) O-Ring Backing
	Stem Seals	EPDM Double O-Rings
	Characterizing Disk	Amodel® AS-1145HS Polyphthalamide Resin

1. Proper water treatment is recommended; refer to the VDI 2035 Guideline.
2. Rangeability is defined as the ratio of maximum controllable flow to minimum controllable flow.
3. In steam applications, install the valve with the stem horizontal to the piping and wrap the valve and piping with insulation.

VG1000 Series Flanged Ball Valves

Description

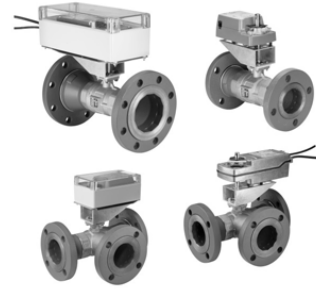
VG1000 Series Flanged Ball Valves are designed primarily to regulate the flow of hot water, chilled water, and 50% glycol solutions in response to the demand of a controller in HVAC systems. The valves come in sizes of 2-1/2, 3, and 4 in. (DN65, DN80, and DN100). These American Society of Mechanical Engineers (ASME) Class 150 flanged valves come in both two- and three-way configurations. Johnson Controls offers valve, linkage, and actuator assemblies for factory or field mounting with either spring-return or non-spring-return actuators.

Refer to the *VG1000 Series Flanged Ball Valves Product Bulletin (LIT-12011228)* for important product application information.

Features

- Closeoff Pressure Rating: 100 psi for Two-Way Valves; 50 psi for Three-Way Valves — provides tight shutoff.
- 300 Stainless Steel Ball and Stem Assembly — applies to systems with high-temperature water (0 to 284°F [-18 to 140°C]) or 25 psi saturated steam.
- 500:1 Rangeability — provides accurate control under all load conditions.

- Amodel® Flow Characterizing Disk — provides equal percentage flow characteristics for best temperature control; available in a wide array of Cv ranges to cover a broad variety of applications.
- Ethylene Propylene Diene Monomer (EPDM) Double O-Ring Stem Seal — offers tested leak-free operation for 200,000 cycles in iron-oxide contaminated water.
- Graphite-Reinforced Polytetrafluoroethylene (PTFE) Seats — include 15% graphite-reinforced ball seals that last twice as long in iron-oxide contaminated water when compared to virgin Teflon® ball seats.
- PTFE Thermal Spacer — provides thermal isolation between the actuator and the valve.
- Seats Backed with EPDM O-Rings — maintain a constant seating force that compensates for expansion, contraction, and seat wear without increasing operating torque.
- Maintenance-Free Design — performs without failure in excess of 200,000 full stroke cycles in iron-oxide contaminated water.
- Available with Factory-Mounted M9124 or M9220 Series Electric Actuators — reduces field installation time and cost.



VG1000 Series Ball Valves Shown with Field Mounted M9000 Series Actuators

- M9000-330 and M9000-340 Weather Shields Available for Field Installation — protect the actuator from corrosion, rain, freezing rain, sleet, and snow.

Repair Information

If the VG1000 Series Ball Valve fails to operate within its specifications, replace the valve body, actuator, or entire assembly. For replacement parts, contact the nearest Johnson Controls® representative.

Selection Charts

Flanged Stainless Steel Trim Ball Valves with Non-Spring-Return Electric Actuators

Valve	Size, In.	Cv	Closeoff psig	AC 24 V			
				Without Switches		With Two Auxiliary Switches	
				On/Off (Floating)	DC 0 to 10 V Proportional	On/Off (Floating)	DC 0 to 10 V Proportional
				M9124-AGA-2	M9124-GGA-2	M9124-AGC-2	M9124-GGC-2
Two-Way							
VG12A5GS	2-1/2	47 ¹	100	VG12A5GS+924AGA	VG12A5GS+924GGA	VG12A5GS+924AGC	VG12A5GS+924GGC
VG12A5GT		74 ¹		VG12A5GT+924AGA	VG12A5GT+924GGA	VG12A5GT+924AGC	VG12A5GT+924GGC
VG12A5GU		117 ¹		VG12A5GU+924AGA	VG12A5GU+924GGA	VG12A5GU+924AGC	VG12A5GU+924GGC
VG12A5HT	3	74 ¹	100	VG12A5HT+924AGA	VG12A5HT+924GGA	VG12A5HT+924AGC	VG12A5HT+924GGC
VG12A5HU		117 ¹		VG12A5HU+924AGA	VG12A5HU+924GGA	VG12A5HU+924AGC	VG12A5HU+924GGC
VG12A5HV		176 ¹		VG12A5HV+924AGA	VG12A5HV+924GGA	VG12A5HV+924AGC	VG12A5HV+924GGC
VG12A5HW		211		VG12A5HW+924AGA	VG12A5HW+924GGA	VG12A5HW+924AGC	VG12A5HW+924GGC
VG12A5JU	4	117 ¹	100	VG12A5JU+924AGA	VG12A5JU+924GGA	VG12A5JU+924AGC	VG12A5JU+924GGC
VG12A5JV		176		VG12A5JV+924AGA	VG12A5JV+924GGA	VG12A5JV+924AGC	VG12A5JV+924GGC
Three-Way							
VG18A5GS	2-1/2	47 / 29 ¹	50	VG18A5GS+924AGA	VG18A5GS+924GGA	VG18A5GS+924AGC	VG18A5GS+924GGC
VG18A5GT		74 / 47 ¹		VG18A5GT+924AGA	VG18A5GT+924GGA	VG18A5GT+924AGC	VG18A5GT+924GGC
VG18A5GU		117 / 74 ¹		VG18A5GU+924AGA	VG18A5GU+924GGA	VG18A5GU+924AGC	VG18A5GU+924GGC
VG18A5HT	3	74 / 47 ¹	50	VG18A5HT+924AGA	VG18A5HT+924GGA	VG18A5HT+924AGC	VG18A5HT+924GGC
VG18A5HU		117 / 74 ¹		VG18A5HU+924AGA	VG18A5HU+924GGA	VG18A5HU+924AGC	VG18A5HU+924GGC
VG18A5HV		176 / 88 ¹		VG18A5HV+924AGA	VG18A5HV+924GGA	VG18A5HV+924AGC	VG18A5HV+924GGC
VG18A5HW		211 / 105		VG18A5HW+924AGA	VG18A5HW+924GGA	VG18A5HW+924AGC	VG18A5HW+924GGC
VG18A5JU	4	117 / 74 ¹	50	VG18A5JU+924AGA	VG18A5JU+924GGA	VG18A5JU+924AGC	VG18A5JU+924GGC
VG18A5JV		176 / 88		VG18A5JV+924AGA	VG18A5JV+924GGA	VG18A5JV+924AGC	VG18A5JV+924GGC

1. Valve has a characterizing disk.

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VG1000 Series Flanged Ball Valves (Continued)

Flanged Stainless Steel Trim Ball Valves with Spring-Return Electric Actuators without Switches

Valve	Size, In.	Cv	Closeoff psig	AC 24 V			AC 120 V
				Floating	DC 0 to 10 V Proportional	On/Off	On/Off
				M9220-AGA-3	M9220-GGA-3	M9220-BGA-3	M9220-BAA-3
Two-Way — Valve Open (Normally Open)							
VG12A5GS	2-1/2	47 ¹	100	VG12A5GS+92NAGA	VG12A5GS+92NGGA	VG12A5GS+92NBGA	VG12A5GS+92NBAA
VG12A5GT		74 ¹		VG12A5GT+92NAGA	VG12A5GT+92NGGA	VG12A5GT+92NBGA	VG12A5GT+92NBAA
VG12A5GU		117 ¹		VG12A5GU+92NAGA	VG12A5GU+92NGGA	VG12A5GU+92NBGA	VG12A5GU+92NBAA
VG12A5HT	3	74 ¹	100	VG12A5HT+92NAGA	VG12A5HT+92NGGA	VG12A5HT+92NBGA	VG12A5HT+92NBAA
VG12A5HU		117 ¹		VG12A5HU+92NAGA	VG12A5HU+92NGGA	VG12A5HU+92NBGA	VG12A5HU+92NBAA
VG12A5HV		176 ¹		VG12A5HV+92NAGA	VG12A5HV+92NGGA	VG12A5HV+92NBGA	VG12A5HV+92NBAA
VG12A5HW		211		VG12A5HW+92NAGA	VG12A5HW+92NGGA	VG12A5HW+92NBGA	VG12A5HW+92NBAA
VG12A5JU	4	117 ¹	100	VG12A5JU+92NAGA	VG12A5JU+92NGGA	VG12A5JU+92NBGA	VG12A5JU+92NBAA
VG12A5JV		176		VG12A5JV+92NAGA	VG12A5JV+92NGGA	VG12A5JV+92NBGA	VG12A5JV+92NBAA
Two-Way — Valve Closed (Normally Closed)							
VG12A5GS	2-1/2	47 ¹	100	VG12A5GS+94NAGA	VG12A5GS+94NGGA	VG12A5GS+94NBGA	VG12A5GS+94NBAA
VG12A5GT		74 ¹		VG12A5GT+94NAGA	VG12A5GT+94NGGA	VG12A5GT+94NBGA	VG12A5GT+94NBAA
VG12A5GU		117 ¹		VG12A5GU+94NAGA	VG12A5GU+94NGGA	VG12A5GU+94NBGA	VG12A5GU+94NBAA
VG12A5HT	3	74 ¹	100	VG12A5HT+94NAGA	VG12A5HT+94NGGA	VG12A5HT+94NBGA	VG12A5HT+94NBAA
VG12A5HU		117 ¹		VG12A5HU+94NAGA	VG12A5HU+94NGGA	VG12A5HU+94NBGA	VG12A5HU+94NBAA
VG12A5HV		176 ¹		VG12A5HV+94NAGA	VG12A5HV+94NGGA	VG12A5HV+94NBGA	VG12A5HV+94NBAA
VG12A5HW		211		VG12A5HW+94NAGA	VG12A5HW+94NGGA	VG12A5HW+94NBGA	VG12A5HW+94NBAA
VG12A5JU	4	117 ¹	100	VG12A5JU+94NAGA	VG12A5JU+94NGGA	VG12A5JU+94NBGA	VG12A5JU+94NBAA
VG12A5JV		176		VG12A5JV+94NAGA	VG12A5JV+94NGGA	VG12A5JV+94NBGA	VG12A5JV+94NBAA
Three-Way — Port A (Coil) Open to Port AB (Common)							
VG18A5GS	2-1/2	47/29 ¹	50	VG18A5GS+92NAGA	VG18A5GS+92NGGA	VG18A5GS+92NBGA	VG18A5GS+92NBAA
VG18A5GT		74/47 ¹		VG18A5GT+92NAGA	VG18A5GT+92NGGA	VG18A5GT+92NBGA	VG18A5GT+92NBAA
VG18A5GU		117/74 ¹		VG18A5GU+92NAGA	VG18A5GU+92NGGA	VG18A5GU+92NBGA	VG18A5GU+92NBAA
VG18A5HT	3	74/47 ¹	50	VG18A5HT+92NAGA	VG18A5HT+92NGGA	VG18A5HT+92NBGA	VG18A5HT+92NBAA
VG18A5HU		117/74 ¹		VG18A5HU+92NAGA	VG18A5HU+92NGGA	VG18A5HU+92NBGA	VG18A5HU+92NBAA
VG18A5HV		176/88 ¹		VG18A5HV+92NAGA	VG18A5HV+92NGGA	VG18A5HV+92NBGA	VG18A5HV+92NBAA
VG18A5HW		211/105		VG18A5HW+92NAGA	VG18A5HW+92NGGA	VG18A5HW+92NBGA	VG18A5HW+92NBAA
VG18A5JU	4	117/74	50	VG18A5JU+92NAGA	VG18A5JU+92NGGA	VG18A5JU+92NBGA	VG18A5JU+92NBAA
VG18A5JV		176/88		VG18A5JV+92NAGA	VG18A5JV+92NGGA	VG18A5JV+92NBGA	VG18A5JV+92NBAA
Three-Way — Port B (Bypass) Open to Port AB (Common)							
VG18A5GS	2-1/2	47/29 ¹	50	VG18A5GS+94NAGA	VG18A5GS+94NGGA	VG18A5GS+94NBGA	VG18A5GS+94NBAA
VG18A5GT		74/47 ¹		VG18A5GT+94NAGA	VG18A5GT+94NGGA	VG18A5GT+94NBGA	VG18A5GT+94NBAA
VG18A5GU		117/74 ¹		VG18A5GU+94NAGA	VG18A5GU+94NGGA	VG18A5GU+94NBGA	VG18A5GU+94NBAA
VG18A5HT	3	74/47 ¹	50	VG18A5HT+94NAGA	VG18A5HT+94NGGA	VG18A5HT+94NBGA	VG18A5HT+94NBAA
VG18A5HU		117/74 ¹		VG18A5HU+94NAGA	VG18A5HU+94NGGA	VG18A5HU+94NBGA	VG18A5HU+94NBAA
VG18A5HV		176/88 ¹		VG18A5HV+94NAGA	VG18A5HV+94NGGA	VG18A5HV+94NBGA	VG18A5HV+94NBAA
VG18A5HW		211/105		VG18A5HW+94NAGA	VG18A5HW+94NGGA	VG18A5HW+94NBGA	VG18A5HW+94NBAA
VG18A5JU	4	117/74 ¹	50	VG18A5JU+94NAGA	VG18A5JU+94NGGA	VG18A5JU+94NBGA	VG18A5JU+94NBAA
VG18A5JV		176/88		VG18A5JV+94NAGA	VG18A5JV+94NGGA	VG18A5JV+94NBGA	VG18A5JV+94NBAA

1. Valve has a characterizing disk.

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VG1000 Series Flanged Ball Valves (Continued)

Flanged Stainless Steel Trim Ball Valves with Spring-Return Electric Actuators with Two Switches

Valve	Size, in.	Cv	Closeoff psig	AC 24 V			AC 120 V
				Floating	0 to 10 VDC Proportional	On/Off	On/Off
				M9220-AGC-3	M9220-GGC-3	M9220-BGC-3	M9220-BAC-3
Two-Way — Valve Open (Normally Open)							
VG12A5GS	2-1/2	47 ¹	100	VG12A5GS+92NAGC	VG12A5GS+92NGGC	VG12A5GS+92NBGC	VG12A5GS+92NBAC
VG12A5GT		74 ¹		VG12A5GT+92NAGC	VG12A5GT+92NGGC	VG12A5GT+92NBGC	VG12A5GT+92NBAC
VG12A5GU		117 ¹		VG12A5GU+92NAGC	VG12A5GU+92NGGC	VG12A5GU+92NBGC	VG12A5GU+92NBAC
VG12A5HT	3	74 ¹	100	VG12A5HT+92NAGC	VG12A5HT+92NGGC	VG12A5HT+92NBGC	VG12A5HT+92NBAC
VG12A5HU		117 ¹		VG12A5HU+92NAGC	VG12A5HU+92NGGC	VG12A5HU+92NBGC	VG12A5HU+92NBAC
VG12A5HV		176 ¹		VG12A5HV+92NAGC	VG12A5HV+92NGGC	VG12A5HV+92NBGC	VG12A5HV+92NBAC
VG12A5HW		211		VG12A5HW+92NAGC	VG12A5HW+92NGGC	VG12A5HW+92NBGC	VG12A5HW+92NBAC
VG12A5JU	4	117 ¹	100	VG12A5JU+92NAGC	VG12A5JU+92NGGC	VG12A5JU+92NBGC	VG12A5JU+92NBAC
VG12A5JV		176		VG12A5JV+92NAGC	VG12A5JV+92NGGC	VG12A5JV+92NBGC	VG12A5JV+92NBAC
Two-Way — Valve Closed (Normally Closed)							
VG12A5GS	2-1/2	47 ¹	100	VG12A5GS+94NAGC	VG12A5GS+94NGGC	VG12A5GS+94NBGC	VG12A5GS+94NBAC
VG12A5GT		74 ¹		VG12A5GT+94NAGC	VG12A5GT+94NGGC	VG12A5GT+94NBGC	VG12A5GT+94NBAC
VG12A5GU		117 ¹		VG12A5GU+94NAGC	VG12A5GU+94NGGC	VG12A5GU+94NBGC	VG12A5GU+94NBAC
VG12A5HT	3	74 ¹	100	VG12A5HT+94NAGC	VG12A5HT+94NGGC	VG12A5HT+94NBGC	VG12A5HT+94NBAC
VG12A5HU		117 ¹		VG12A5HU+94NAGC	VG12A5HU+94NGGC	VG12A5HU+94NBGC	VG12A5HU+94NBAC
VG12A5HV		176 ¹		VG12A5HV+94NAGC	VG12A5HV+94NGGC	VG12A5HV+94NBGC	VG12A5HV+94NBAC
VG12A5HW		211		VG12A5HW+94NAGC	VG12A5HW+94NGGC	VG12A5HW+94NBGC	VG12A5HW+94NBAC
VG12A5JU	4	117 ¹	100	VG12A5JU+94NAGC	VG12A5JU+94NGGC	VG12A5JU+94NBGC	VG12A5JU+94NBAC
VG12A5JV		176		VG12A5JV+94NAGC	VG12A5JV+94NGGC	VG12A5JV+94NBGC	VG12A5JV+94NBAC
Three-Way — Port A (Coil) Open to Port AB (Common)							
VG18A5GS	2-1/2	47/29 ¹	50	VG18A5GS+92NAGC	VG18A5GS+92NGGC	VG18A5GS+92NBGC	VG18A5GS+92NBAC
VG18A5GT		74/47 ¹		VG18A5GT+92NAGC	VG18A5GT+92NGGC	VG18A5GT+92NBGC	VG18A5GT+92NBAC
VG18A5GU		117/74 ¹		VG18A5GU+92NAGC	VG18A5GU+92NGGC	VG18A5GU+92NBGC	VG18A5GU+92NBAC
VG18A5HT	3	74/47 ¹	50	VG18A5HT+92NAGC	VG18A5HT+92NGGC	VG18A5HT+92NBGC	VG18A5HT+92NBAC
VG18A5HU		117/74 ¹		VG18A5HU+92NAGC	VG18A5HU+92NGGC	VG18A5HU+92NBGC	VG18A5HU+92NBAC
VG18A5HV		176/88 ¹		VG18A5HV+92NAGC	VG18A5HV+92NGGC	VG18A5HV+92NBGC	VG18A5HV+92NBAC
VG18A5HW		211/105		VG18A5HW+92NAGC	VG18A5HW+92NGGC	VG18A5HW+92NBGC	VG18A5HW+92NBAC
VG18A5JU	4	117/74 ¹	50	VG18A5JU+92NAGC	VG18A5JU+92NGGC	VG18A5JU+92NBGC	VG18A5JU+92NBAC
VG18A5JV		176/88		VG18A5JV+92NAGC	VG18A5JV+92NGGC	VG18A5JV+92NBGC	VG18A5JV+92NBAC
Three-Way — Port B (Bypass) Open to Port AB (Common)							
VG18A5GS	2-1/2	47/29 ¹	50	VG18A5GS+94NAGC	VG18A5GS+94NGGC	VG18A5GS+94NBGC	VG18A5GS+94NBAC
VG18A5GT		74/47 ¹		VG18A5GT+94NAGC	VG18A5GT+94NGGC	VG18A5GT+94NBGC	VG18A5GT+94NBAC
VG18A5GU		117/74 ¹		VG18A5GU+94NAGC	VG18A5GU+94NGGC	VG18A5GU+94NBGC	VG18A5GU+94NBAC
VG18A5HT	3	74/47 ¹	50	VG18A5HT+94NAGC	VG18A5HT+94NGGC	VG18A5HT+94NBGC	VG18A5HT+94NBAC
VG18A5HU		117/74 ¹		VG18A5HU+94NAGC	VG18A5HU+94NGGC	VG18A5HU+94NBGC	VG18A5HU+94NBAC
VG18A5HV		176/88 ¹		VG18A5HV+94NAGC	VG18A5HV+94NGGC	VG18A5HV+94NBGC	VG18A5HV+94NBAC
VG18A5HW		211/105		VG18A5HW+94NAGC	VG18A5HW+94NGGC	VG18A5HW+94NBGC	VG18A5HW+94NBAC
VG18A5JU	4	117/74 ¹	50	VG18A5JU+94NAGC	VG18A5JU+94NGGC	VG18A5JU+94NBGC	VG18A5JU+94NBAC
VG18A5JV		176/88		VG18A5JV+94NAGC	VG18A5JV+94NGGC	VG18A5JV+94NBGC	VG18A5JV+94NBAC

1. Valve has a characterizing disk.

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VG1000 Series Flanged Ball Valves (Continued)

Technical Specifications

VG1000 Series Flanged Ball Valves		
Service¹	Hot Water, Chilled Water, 50/50 Glycol Solutions, and 25 psig (172 kPa) Saturated Steam for HVAC Systems	
Valve Fluid Temperature Limits	0 to 284°F (-18 to 140°C)	
Valve Body Pressure/Temperature Rating	Water	ASME Class 150 250 psi at -20 to 100°F (29 to 38°C) 235 psi at 200°F(93°C) 218 psi at 284°F(140°C)
	Steam	25 psig (172 kPa) Saturated Steam for HVAC Systems
Maximum Closeoff Pressure	Two-Way	100 psi (689 kPa)
	Three-Way	50 psi (345 kPa)
Maximum Recommended Operating Pressure Drop	30 psi (207 kPa) for Quiet Service	
Flow Characteristics	Two-Way	Equal Percentage
	Three-Way	Equal Percentage Flow Characteristics of In-Line Port or Linear Percentage Flow Characteristics of Angle Port
Rangeability²	Greater than 500:1	
Minimum Ambient Operating Temperature	-4°F (-20°C)	M9124 Series Non-Spring-Return Actuators
	-40°F (-40°C)	M9220 Series Spring-Return Actuators
Maximum Ambient Operating Temperature³	122°F (50°C)	M9124 Series Non-Spring-Return Actuators
	131°F (55°C)	M9220 Series Spring-Return Actuators
Leakage	Two- or Three-Way	0.01% of Maximum Flow, Control Port, ANSI/FCI 70-2, Class 4
	Three-Way	1% of Maximum Flow, Bypass Port
End Connections	ASME Class 150 Flange	
Materials	Body	Brass
	Flanges	Ductile Iron
	Ball	300 Series Stainless Steel
	Stem	300 Series Stainless Steel
	Seats	Graphite Reinforced PTFE with EPDM O-Ring Backing
	Stem Seals	EPDM O-Rings
	Flow Control Disk	Amodel AS-1145HS Polyphthalamide Resin

1. Refer to the VDI 2035 Guideline for proper water treatment.

2. Rangeability is defined as the ratio of maximum controllable flow to minimum controllable flow.

3. In steam applications, install the valve with the stem horizontal to the piping and wrap the valve and piping with insulation.

VG1000 Series Three-Way, Plated Brass Trim, NPT End Connections Ball Valves with Non-Spring-Return Electric Actuators

Description

VG1000 Series Ball Valves are designed to regulate the flow of hot or chilled water and, for some models, low-pressure steam in response to the demand of a controller in HVAC systems. Available in sizes 1/2 through 2 in. (DN15 through DN50), this family of two- and three-way forged brass valves is factory or field mounted to Johnson Controls® VA9104, M9106, M9109, and M9100 Series Non-Spring-Return and VA9203 and VA9208 Series Spring-Return Electric Actuators for on/off, floating, or proportional control.

Refer to the *VG1000 Series Forged Brass Ball Valves Product Bulletin (LIT-977132)* for important product application information.

Features

- Forged Brass Body — provides 580 psig static pressure rating.
- 200 psi Closeoff Pressure Rating — provides tight shutoff.

- Graphite-Reinforced Polytetrafluoroethylene (PTFE) Seats — include 15% graphite-reinforced ball seals, providing better wear resistance.
- 500:1 Rangeability — provides accurate control under all load conditions.
- Chrome-Plated Brass Ball and Stem Assembly Standard — handles both chilled and hot water applications with a fluid temperature range of 23 to 203°F (-5 to 95°C).

Repair Information

If the VG1000 Series Ball Valve fails to operate within its specifications, replace the valve body, actuator, or entire assembly. For replacement parts, contact the nearest Johnson Controls representative.



VG1000 Series Three-Way, Spring-Return, Plated Brass Ball and Stem Ball Valve Assemblies without End Switches

Selection Charts

Three-Way Plated Brass Trim Ball Valves, Non-Spring Return, VA9104 Electric Actuators without Switches

Fluid Temperatures: 23 to 203°F (-5 to 95°C) Not Rated for Steam Service				AC 24 V		
Valve	Size, in.	Cv	Closeoff psig	On/Off (Floating) without Timeout ¹	On/Off (Floating) with Timeout	0 to 10 VDC Proportional
Actuators with M3 Screw Terminals				VA9104-AGA-3S	VA9104-IGA-3S	VA9104-GGA-3S
VG1841AD	1/2	1.2/0.7 ²	200	VG1841AD+9T4AGA	VG1841AD+9T4IGA	VG1841AD+9T4GGA
VG1841AE		1.9/1.2 ²		VG1841AE+9T4AGA	VG1841AE+9T4IGA	VG1841AE+9T4GGA
VG1841AF		2.9/1.9 ²		VG1841AF+9T4AGA	VG1841AF+9T4IGA	VG1841AF+9T4GGA
VG1841AG		4.7/2.9 ²		VG1841AG+9T4AGA	VG1841AG+9T4IGA	VG1841AG+9T4GGA
VG1841AL		7.4/4.7 ²		VG1841AL+9T4AGA	VG1841AL+9T4IGA	VG1841AL+9T4GGA
VG1841AN		11.7/5.8		VG1841AN+9T4AGA	VG1841AN+9T4IGA	VG1841AN+9T4GGA
VG1841BG	3/4	4.7/2.9 ²	200	VG1841BG+9T4AGA	VG1841BG+9T4IGA	VG1841BG+9T4GGA
VG1841BL		7.4/4.7 ²		VG1841BL+9T4AGA	VG1841BL+9T4IGA	VG1841BL+9T4GGA
VG1841BN		11.7/5.8		VG1841BN+9T4AGA	VG1841BN+9T4IGA	VG1841BN+9T4GGA
VG1841CL	1	7.4/4.7 ²	200	VG1841CL+9T4AGA	VG1841CL+9T4IGA	VG1841CL+9T4GGA
VG1841CN		11.7/7.4 ²		VG1841CN+9T4AGA	VG1841CN+9T4IGA	VG1841CN+9T4GGA
VG1841CP		18.7/9.4		VG1841CP+9T4AGA	VG1841CP+9T4IGA	VG1841CP+9T4GGA
Actuators with 48 in. (1.2 m) 18 AWG Plenum Cable				VA9104-AGA-2S	VA9104-IGA-2S	VA9104-GGA-2S
VG1841AD	1/2	1.2/0.7 ²	200	VG1841AD+9A4AGA	VG1841AD+9A4IGA	VG1841AD+9A4GGA
VG1841AE		1.9/1.2 ²		VG1841AE+9A4AGA	VG1841AE+9A4IGA	VG1841AE+9A4GGA
VG1841AF		2.9/1.9 ²		VG1841AF+9A4AGA	VG1841AF+9A4IGA	VG1841AF+9A4GGA
VG1841AG		4.7/2.9 ²		VG1841AG+9A4AGA	VG1841AG+9A4IGA	VG1841AG+9A4GGA
VG1841AL		7.4/4.7 ²		VG1841AL+9A4AGA	VG1841AL+9A4IGA	VG1841AL+9A4GGA
VG1841AN		11.7/5.8		VG1841AN+9A4AGA	VG1841AN+9A4IGA	VG1841AN+9A4GGA
VG1841BG	3/4	4.7/2.9 ²	200	VG1841BG+9A4AGA	VG1841BG+9A4IGA	VG1841BG+9A4GGA
VG1841BL		7.4/4.7 ²		VG1841BL+9A4AGA	VG1841BL+9A4IGA	VG1841BL+9A4GGA
VG1841BN		11.7/5.8		VG1841BN+9A4AGA	VG1841BN+9A4IGA	VG1841BN+9A4GGA
VG1841CL	1	7.4/4.7 ²	200	VG1841CL+9A4AGA	VG1841CL+9A4IGA	VG1841CL+9A4GGA
VG1841CN		11.7/7.4 ²		VG1841CN+9A4AGA	VG1841CN+9A4IGA	VG1841CN+9A4GGA
VG1841CP		18.7/9.4		VG1841CP+9A4AGA	VG1841CP+9A4IGA	VG1841CP+9A4GGA

- To avoid excessive wear or drive time on the motor for the AGA models, use a controller or software that provides a timeout function to remove the signal at the end of rotation (stall).
- Valve has a characterizing disk.

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VG1000 Series Three-Way, Plated Brass Trim, NPT End Connections Ball Valves with Non-Spring-Return Electric Actuators (Continued)

Three-Way Plated Brass Trim Ball Valves, Non-Spring Return, M9106 and M9109 Electric Actuators without Switches

Fluid Temperatures: 23 to 203°F (-5 to 95°C) Not Rated for Steam Service				AC 24 V		
				On/Off (Floating) without Timeout ¹	On/Off (Floating) with Timeout	0 to 10 VDC Proportional
Valve	Size, in.	Cv	Closeoff psig	M9106-AGA-2 M9109-AGA-2	M9106-IGA-2	M9106-GGA-2 M9109-GGA-2
VG1841DN	1-1/4	11.7/7.4 ²	200	VG1841DN+906AGA	VG1841DN+906IGA	VG1841DN+906GGA
VG1841DP		18.7/11.7 ²		VG1841DP+906AGA	VG1841DP+906IGA	VG1841DP+906GGA
VG1841DR		29.2/14.6		VG1841DR+906AGA	VG1841DR+906IGA	VG1841DR+906GGA
VG1841EP	1-1/2	18.7/11.7 ²	200	VG1841EP+906AGA	VG1841EP+906IGA	VG1841EP+906GGA
VG1841ER		29.2/18.7 ²		VG1841ER+906AGA	VG1841ER+906IGA	VG1841ER+906GGA
VG1841ES		46.8/23.4		VG1841ES+906AGA	VG1841ES+906IGA	VG1841ES+906GGA
VG1841FR	2	29.2/18.7 ²	200	VG1841FR+909AGA		VG1841FR+909GGA
VG1841FS		46.8/29.2 ²		VG1841FS+909AGA		VG1841FS+909GGA
VG1841FT		73.7/36.8		VG1841FT+909AGA		VG1841FT+909GGA

- To avoid excessive wear or drive time on the motor for the AGA models, use a controller or software that provides a timeout function to remove the signal at the end of rotation (stall).
- Valve has a characterizing disk.

Three-Way Plated Brass Trim Ball Valves, Non-Spring Return, M9106 and M9109 Electric Actuators with Switches

Fluid Temperatures: 23 to 203°F (-5 to 95°C) Not Rated for Steam Service				AC 24 V		
				On/Off (Floating) without Timeout ¹	On/Off (Floating) with Timeout	0 to 10 VDC Proportional
Valve	Size, in.	Cv	Closeoff psig	M9106-AGC-2 M9109-AGC-2	M9106-IGC-2	M9106-GGC-2 M9109-GGC-2
VG1841AD	1/2	1.2/0.7 ²	200	VG1841AD+906AGC	VG1841AD+906IGC	VG1841AD+906GGC
VG1841AE		1.9/1.2 ²		VG1841AE+906AGC	VG1841AE+906IGC	VG1841AE+906GGC
VG1841AF		2.9/1.9 ²		VG1841AF+906AGC	VG1841AF+906IGC	VG1841AF+906GGC
VG1841AG		4.7/2.9 ²		VG1841AG+906AGC	VG1841AG+906IGC	VG1841AG+906GGC
VG1841AL		7.4/4.7 ²		VG1841AL+906AGC	VG1841AL+906IGC	VG1841AL+906GGC
VG1841AN		11.7/5.8		VG1841AN+906AGC	VG1841AN+906IGC	VG1841AN+906GGC
VG1841BG	3/4	4.7/2.9 ²	200	VG1841BG+906AGC	VG1841BG+906IGC	VG1841BG+906GGC
VG1841BL		7.4/4.7 ²		VG1841BL+906AGC	VG1841BL+906IGC	VG1841BL+906GGC
VG1841BN		11.7/5.8		VG1841BN+906AGC	VG1841BN+906IGC	VG1841BN+906GGC
VG1841CL	1	7.4/4.7 ²	200	VG1841CL+906AGC	VG1841CL+906IGC	VG1841CL+906GGC
VG1841CN		11.7/7.4 ²		VG1841CN+906AGC	VG1841CN+906IGC	VG1841CN+906GGC
VG1841CP		18.7/9.4		VG1841CP+906AGC	VG1841CP+906IGC	VG1841CP+906GGC
VG1841DN	1-1/4	11.7/7.4 ²	200	VG1841DN+906AGC	VG1841DN+906IGC	VG1841DN+906GGC
VG1841DP		18.7/11.7 ²		VG1841DP+906AGC	VG1841DP+906IGC	VG1841DP+906GGC
VG1841DR		29.2/14.6		VG1841DR+906AGC	VG1841DR+906IGC	VG1841DR+906GGC
VG1841EP	1-1/2	18.7/11.7 ²	200	VG1841EP+906AGC	VG1841EP+906IGC	VG1841EP+906GGC
VG1841ER		29.2/18.7 ²		VG1841ER+906AGC	VG1841ER+906IGC	VG1841ER+906GGC
VG1841ES		46.8/23.4		VG1841ES+906AGC	VG1841ES+906IGC	VG1841ES+906GGC
VG1841FR	2	29.2/18.7 ²	200	VG1841FR+909AGC		VG1841FR+909GGC
VG1841FS		46.8/29.2 ²		VG1841FS+909AGC		VG1841FS+909GGC
VG1841FT		73.7/36.8		VG1841FT+909AGC		VG1841FT+909GGC

- To avoid excessive wear or drive time on the motor for the AGx models use a controller or software that provides a timeout function to remove the signal at the end of rotation (stall).
- Valve has a characterizing disk.

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VG1000 Series Three-Way, Plated Brass Trim, NPT End Connections Ball Valves with Non-Spring-Return Electric Actuators (Continued)

Technical Specifications

VG1000 Series Three-Way, Plated Brass Trim, NPT End Connections Ball Valves with Non-Spring-Return Electric Actuators		
Service¹		Hot Water, Chilled Water, and 50/50 Glycol Solutions for HVAC Systems
Valve Fluid Temperature Limits	Water	23 to 203°F (-5 to 95°C)
	Steam	Not Rated for Steam Service
Maximum Actuator Fluid Temperature Limit	203°F (95°C)	VA9104
		M9104 with M9000-551 Linkage
		M9106 or M9109 with M9000-520 Linkage
Valve Body Pressure Rating	Water	580 psig (4,000 kPa) (PN40)
	Steam	Not Rated for Steam Service
Maximum Closeoff Pressure		200 psid (1,378 kPa)
Maximum Recommended Operating Pressure Drop		50 psid (340 kPa)
Flow Characteristics	Three-Way	Equal Percentage Flow Characteristics of In-Line Port A (Coil) and Linear Flow Characteristics of Angle Port B (Bypass)
Rangeability²		Greater than 500:1
Minimum Ambient Operating Temperature		-4°F (-20°C)
Maximum Ambient Operating Temperature (Limited by the Actuator and Linkage)	140° (60°C)	VA9104 Series Non-Spring-Return Actuators
		M9104 Series Non-Spring-Return Actuators with M9000-551 Linkage
	125° (52°C)	M9106 and M9109 Series Non-Spring-Return Actuators with M9000-520 Linkage
Leakage		0.01% of Maximum Flow per ANSI/FCI 70-2, Class 4
End Connections		National Pipe Thread (NPT)
Materials	Body	Forged Brass
	Ball	Chrome Plated Brass
	Blowout-Proof Stem	Nickel Plated Brass
	Seats	Graphite-Reinforced PTFE with Ethylene Propylene Diene Monomer (EPDM) O-Ring Backing
	Stem Seals	EPDM Double O-Rings
	Characterizing Disk	Amodel® AS-1145HS Polyphthalamide Resin

1. Proper water treatment is recommended; refer to the VDI 2035 Guideline.

2. Rangeability is defined as the ratio of maximum controllable flow to minimum controllable flow.

VG1000 Series Three-Way, Plated Brass Trim, NPT End Connections Ball Valves with Spring-Return Electric Actuators without Switches

Description

VG1000 Series Ball Valves are designed to regulate the flow of hot or chilled water and, for some models, low pressure steam in response to the demand of a controller in HVAC systems. Available in sizes 1/2 through 2 in. (DN15 through DN50), this family of two- and three-way forged brass valves is factory or field mounted to Johnson Controls® VA9104, M9106, M9109, and M9100 Series Non-Spring-Return and VA9203 and VA9208 Series Spring-Return Electric Actuators for on/off, floating, or proportional control.

Refer to the *VG1000 Series Forged Brass Ball Valves Product Bulletin (LIT-977132)* for important product application information.

Features

- Forged Brass Body — provides 580 psig static pressure rating.
- Chrome-Plated Brass Ball and Stem Assembly Standard — handles both chilled and hot water applications with a fluid temperature range of 23 to 203°F (-5 to 95°C).
- Graphite-Reinforced Polytetrafluoroethylene (PTFE) Seats — include 15% graphite-reinforced ball seals, providing better wear resistance.
- 500:1 Rangeability — provides accurate control under all load conditions.
- Maintenance-Free Design — performs without failure in excess of 200,000 full stroke cycles in iron-oxide contaminated water.



Three-Way, Spring-Return, Plated Brass Ball and Stem Ball Valve Assemblies with End Switches

Repair Information

If the VG1000 Series Ball Valve fails to operate within its specifications, replace the valve body, actuator, or entire assembly. For replacement parts, contact the nearest Johnson Controls representative.

Selection Chart

Three-Way — Spring Return — without Switches (Part 1 of 2)

Fluid Temperatures: 23 to 203°F (-5 to 95°C)				AC 24 V			AC-85-264V (VA9203) AC 120 V (VA9208)
Valve	Size, in. (mm)	Cv	Closeoff psig	Floating	DC 0 to 10 V Proportional	On/Off	On/Off
				Spring Return Port A Open — Valve Spring Return Counterclockwise			
				VA9203-AGA-2Z	VA9203-GGA-2Z	VA9203-BGA-2	VA9203-BUA-2
VG1841AD	1/2	1.2/0.7 ¹	200	VG1841AD+923AGA	VG1841AD+923GGA	VG1841AD+923BGA	VG1841AD+923BUA
VG1841AE		1.9/1.2 ¹		VG1841AE+923AGA	VG1841AE+923GGA	VG1841AE+923BGA	VG1841AE+923BUA
VG1841AF		2.9/1.9 ¹		VG1841AF+923AGA	VG1841AF+923GGA	VG1841AF+923BGA	VG1841AF+923BUA
VG1841AG		4.7/2.9 ¹		VG1841AG+923AGA	VG1841AG+923GGA	VG1841AG+923BGA	VG1841AG+923BUA
VG1841AL		7.4/4.7 ¹		VG1841AL+923AGA	VG1841AL+923GGA	VG1841AL+923BGA	VG1841AL+923BUA
VG1841AN		11.7/7.4		VG1841AN+923AGA	VG1841AN+923GGA	VG1841AN+923BGA	VG1841AN+923BUA
VG1841BG	3/4	4.7/2.9 ¹	200	VG1841BG+923AGA	VG1841BG+923GGA	VG1841BG+923BGA	VG1841BG+923BUA
VG1841BL		7.4/4.7 ¹		VG1841BL+923AGA	VG1841BL+923GGA	VG1841BL+923BGA	VG1841BL+923BUA
VG1841BN		11.7/11.7		VG1841BN+923AGA	VG1841BN+923GGA	VG1841BN+923BGA	VG1841BN+923BUA
VG1841CL	1	7.4/4.7 ¹	200	VG1841CL+923AGA	VG1841CL+923GGA	VG1841CL+923BGA	VG1841CL+923BUA
VG1841CN		11.7/7.4 ¹		VG1841CN+923AGA	VG1841CN+923GGA	VG1841CN+923BGA	VG1841CN+923BUA
VG1841CP		18.7/11.7		VG1841CP+923AGA	VG1841CP+923GGA	VG1841CP+923BGA	VG1841CP+923BUA
				Spring Return Port A Open — Valve Spring Return Counterclockwise			
				VA9208-AGA-2	VA9208-GGA-2	VA9208-BGA-3	VA9208-BAA-3
VG1841DN	1-1/4	11.7/7.4 ¹	200	VG1841DN+928AGA	VG1841DN+928GGA	VG1841DN+938BGA	VG1841DN+938BAA
VG1841DP		18.7/11.7 ¹		VG1841DP+928AGA	VG1841DP+928GGA	VG1841DP+938BGA	VG1841DP+938BAA
VG1841DR		29.2/18.7		VG1841DR+928AGA	VG1841DR+928GGA	VG1841DR+938BGA	VG1841DR+938BAA
VG1841EP	1-1/2	18.7/11.7 ¹	200	VG1841EP+928AGA	VG1841EP+928GGA	VG1841EP+938BGA	VG1841EP+938BAA
VG1841ER		29.2/18.7 ¹		VG1841ER+928AGA	VG1841ER+928GGA	VG1841ER+938BGA	VG1841ER+938BAA
VG1841ES		46.8/29.2		VG1841ES+928AGA	VG1841ES+928GGA	VG1841ES+938BGA	VG1841ES+938BAA
VG1841FR	2	29.2/18.7 ¹	200	VG1841FR+928AGA	VG1841FR+928GGA	VG1841FR+938BGA	VG1841FR+938BAA
VG1841FS		46.8/29.2 ¹		VG1841FS+928AGA	VG1841FS+928GGA	VG1841FS+938BGA	VG1841FS+938BAA
VG1841FT		73.7/36.8		VG1841FT+928AGA	VG1841FT+928GGA	VG1841FT+938BGA	VG1841FT+938BAA

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VG1000 Series Three-Way, Plated Brass Trim, NPT End Connections Ball Valves with Spring-Return Electric Actuators without Switches (Continued)

Three-Way — Spring Return — without Switches (Part 2 of 2)

Fluid Temperatures: 23 to 203°F (-5 to 95°C)				AC 24 V			AC-85-264V (VA9203) AC 120 V (VA9208)
Valve	Size, in. (mm)	Cv	Closeoff psig	Floating	DC 0 to 10 V Proportional	On/Off	On/Off
				Spring Return Port A Closed — Valve Spring Return Clockwise			
				VA9203-AGA-2Z	VA9203-GGA-2Z	VA9203-BGA-2	VA9203-BUA-2
VG1841AD	1/2	1.2/0.7 ¹	200	VG1841AD+943AGA	VG1841AD+943GGA	VG1841AD+943BGA	VG1841AD+943BUA
VG1841AE		1.9/1.2 ¹		VG1841AE+943AGA	VG1841AE+943GGA	VG1841AE+943BGA	VG1841AE+943BUA
VG1841AF		2.9/1.9 ¹		VG1841AF+943AGA	VG1841AF+943GGA	VG1841AF+943BGA	VG1841AF+943BUA
VG1841AG		4.7/2.9 ¹		VG1841AG+943AGA	VG1841AG+943GGA	VG1841AG+943BGA	VG1841AG+943BUA
VG1841AL		7.4/4.7 ¹		VG1841AL+943AGA	VG1841AL+943GGA	VG1841AL+943BGA	VG1841AL+943BUA
VG1841AN		11.7/7.4 ¹		VG1841AN+943AGA	VG1841AN+943GGA	VG1841AN+943BGA	VG1841AN+943BUA
VG1841BG	3/4	4.7/2.9 ¹	200	VG1841BG+943AGA	VG1841BG+943GGA	VG1841BG+943BGA	VG1841BG+943BUA
VG1841BL		7.4/4.7 ¹		VG1841BL+943AGA	VG1841BL+943GGA	VG1841BL+943BGA	VG1841BL+943BUA
VG1841BN		11.7/7.4 ¹		VG1841BN+943AGA	VG1841BN+943GGA	VG1841BN+943BGA	VG1841BN+943BUA
VG1841CL	1	7.4/4.7 ¹	200	VG1841CL+943AGA	VG1841CL+943GGA	VG1841CL+943BGA	VG1841CL+943BUA
VG1841CN		11.7/7.4 ¹		VG1841CN+943AGA	VG1841CN+943GGA	VG1841CN+943BGA	VG1841CN+943BUA
VG1841CP		18.7/11.7 ¹		VG1841CP+943AGA	VG1841CP+943GGA	VG1841CP+943BGA	VG1841CP+943BUA
				Spring Return Port A Closed — Valve Spring Return Clockwise			
				VA9208-AGA-2	VA9208-GGA-2	VA9208-BGA-3	VA9208-BAA-3
VG1841DN	1-1/4	11.7/7.4 ¹	200	VG1841DN+948AGA	VG1841DN+948GGA	VG1841DN+958BGA	VG1841DN+958BAA
VG1841DP		18.7/11.7 ¹		VG1841DP+948AGA	VG1841DP+948GGA	VG1841DP+958BGA	VG1841DP+958BAA
VG1841DR		29.2/18.7 ¹		VG1841DR+948AGA	VG1841DR+948GGA	VG1841DR+958BGA	VG1841DR+958BAA
VG1841EP	1-1/2	18.7/11.7 ¹	200	VG1841EP+948AGA	VG1841EP+948GGA	VG1841EP+958BGA	VG1841EP+958BAA
VG1841ER		29.2/18.7 ¹		VG1841ER+948AGA	VG1841ER+948GGA	VG1841ER+958BGA	VG1841ER+958BAA
VG1841ES		46.8/29.2 ¹		VG1841ES+948AGA	VG1841ES+948GGA	VG1841ES+958BGA	VG1841ES+958BAA
VG1841FR	2	29.2/18.7 ¹	200	VG1841FR+948AGA	VG1841FR+948GGA	VG1841FR+958BGA	VG1841FR+958BAA
VG1841FS		46.8/29.2 ¹		VG1841FS+948AGA	VG1841FS+948GGA	VG1841FS+958BGA	VG1841FS+958BAA
VG1841FT		73.7/36.8 ¹		VG1841FT+948AGA	VG1841FT+948GGA	VG1841FT+958BGA	VG1841FT+958BAA

1. Valve has a characterizing disk.

The performance specifications are nominal and conform to acceptable industry standards. For applications at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products. © 2014 Johnson Controls, Inc. www.johnsoncontrols.com

VG1000 Series Three-Way, Plated Brass Trim, NPT End Connections Ball Valves with Spring-Return Electric Actuators without Switches (Continued)

Technical Specifications

VG1000 Series Three-Way, Plated Brass Trim, NPT End Connections Ball Valves with Spring-Return Electric Actuators without Switches		
Service¹		Hot Water, Chilled Water, 50/50 Glycol Solutions
Fluid Temperature Limits	Water	23 to 203°F (-5 to 95°C)
	Steam	Not Rated for Steam Service
Valve Body Pressure Rating	Water	580 psig (4,000 kPa) (PN40)
	Steam	Not Rated for Steam Service
Maximum Closeoff Pressure		200 psid (1,378 kPa)
Maximum Recommended Operating Pressure Drop		50 psid (340 kPa)
Flow Characteristics	Three-Way	Equal Percentage Flow Characteristics of In-Line Port A (Coil) and Linear Flow Characteristics of Angle Port B (Bypass)
Rangeability²		Greater than 500:1
Minimum Ambient Operating Temperature	-22°F (-30°C)	VA9203 Series Spring-Return Actuators
	-40°F (40°C)	VA9208 Series Spring-Return Actuators
Maximum Ambient Operating Temperature³ (Limited by the Actuator and Linkage)	140°F (60°C)	Direct Mount: VA9203 or VA9208 Series Spring-Return Actuators
Leakage		0.01% of Maximum Flow per ANSI/FCI 70-2, Class 4
		1% of Maximum Flow for Three-Way Bypass Port
End Connections		National Pipe Thread (NPT)
Materials	Body	Forged Brass
	Ball	Chrome Plated Brass
	Blowout-Proof Stem	Nickel Plated Brass
	Seats	Graphite-Reinforced PTFE with Ethylene Propylene Diene Monomer (EPDM) O-Ring Backing
	Stem Seals	EPDM Double O-Rings
	Characterizing Disk	Amodel® AS-1145HS Polyphthalamide Resin

1. Proper water treatment is recommended; refer to the VDI 2035 Guideline.

2. Rangeability is defined as the ratio of maximum controllable flow to minimum controllable flow.

3. In steam applications, install the valve with the stem horizontal to the piping and wrap the valve and piping with insulation.

M9000 Electrically Actuated, Standard-Pressure, Standard-Temperature, Two-Way Butterfly Valves (with Weather Shield)

Description

VF Series M9000 Electrically Actuated, Standard-Pressure, Standard-Temperature, Two-Way Butterfly Valves are specifically designed for a wide range of HVAC applications, including two-position and modulating control of hot, chilled, or condenser water, and 50/50 glycol solutions. These valves are also bidirectional, allowing positive shutoff with the flow in either direction.

Two-way configurations are available in sizes 2 through 6 in. non-spring return, and 2 through 5 in. spring return. M9000 electrically actuated, weather shield models feature an integral handle for manual positioning of the valve, independent of a power supply.

Refer to the *VF Series Standard-Pressure, Standard-Temperature Butterfly Valves Product Bulletin (LIT-977205P)* for important product application information.

Features

- low seating/unseating torques
- bubble-tight shutoff
- broad range of pre-assembled actuators
- compatible with all types of American National Standards Institute (ANSI) 125/150 slip-on and weld-neck flanges
- high-integrity components
- M9000 electric actuators available with or without a rugged, factory-installed weather shield
- M9000 electric actuators available with or without end switches

Repair Information

If the VF Series Butterfly Valve fails to operate within its specifications, refer to the *VF Series Standard-Pressure, Standard-Temperature Butterfly Valves Product Bulletin (LIT-977205P)* for a list of repair parts available.



Two-Way Valve with M9000 Series Electric Actuator (with Weather Shield)

Selection Chart

M9000 Electrically Actuated, Standard-Pressure, Standard-Temperature, Two-Way Butterfly Valves (with Weather Shield) (Part 1 of 2)

Valve Code Number	Size, in.	Cv at 90°	Cv at 70°	Closeoff Pressure, psig ¹	Two-Way Valve with M9000 Series Electric Actuator (with Weather Shield)			
					Spring Open	Spring Closed	Spring Open	Spring Closed
					Spring Return — Floating Control			
					M9220-AGA-3 without End Switches		M9220-AGC-3 with 2 End Switches	
VWN020HB	2	144	84	175	VWN020HB+92NAGA	VWC020HB+94NAGA	VWN020HB+92NAGC	VWC020HB+94NAGC
VWN025HB	2-1/2	282	163	175	VWN025HB+92NAGA	VWC025HB+94NAGA	VWN025HB+92NAGC	VWC025HB+94NAGC
VWN030HB	3	461	267	175	VWN030HB+92NAGA	VWC030HB+94NAGA	VWN030HB+92NAGC	VWC030HB+94NAGC
VWN040LB	4	841	496	50	VWN040LB+92NAGA	VWC040LB+94NAGA	VWN040LB+92NAGC	VWC040LB+94NAGC
VWN040HB	4	841	496	175	VWN040HB292NAGA ²	VWC040HB294NAGA ²	VWN040HB292NAGC ²	VWC040HB294NAGC ²
VWN050LB	5	1,376	775	50	VWN050LB292NAGA ²	VWC050LB294NAGA ²	VWN050LB292NAGC ²	VWC050LB294NAGC ²
					Spring Return — On/Off			
					M9220-BGA-3 without End Switches		M9220-BGC-3 with 2 End Switches	
VWN020HB	2	144	84	175	VWN020HB+92NBGA	VWC020HB+94NBGA	VWN020HB+92NBGC	VWC020HB+94NBGC
VWN025HB	2-1/2	282	163	175	VWN025HB+92NBGA	VWC025HB+94NBGA	VWN025HB+92NBGC	VWC025HB+94NBGC
VWN030HB	3	461	267	175	VWN030HB+92NBGA	VWC030HB+94NBGA	VWN030HB+92NBGC	VWC030HB+94NBGC
VWN040LB	4	841	496	50	VWN040LB+92NBGA	VWC040LB+94NBGA	VWN040LB+92NBGC	VWC040LB+94NBGC
VWN040HB	4	841	496	175	VWN040HB292NBGA ²	VWC040HB294NBGA ²	VWN040HB292NBGC ²	VWC040HB294NBGC ²
VWN050LB	5	1,376	775	50	VWN050LB292NBGA ²	VWC050LB294NBGA ²	VWN050LB292NBGC ²	VWC050LB294NBGC ²
					Spring Return — 0 to 10 VDC Proportional Control			
					M9220-GGA-3 without End Switches		M9220-GGC-3 with 2 End Switches	
VWN020HB	2	144	84	175	VWN020HB+92NGGA	VWC020HB+94NGGA	VWN020HB+92NGGC	VWC020HB+94NGGC
VWN025HB	2-1/2	282	163	175	VWN025HB+92NGGA	VWC025HB+94NGGA	VWN025HB+92NGGC	VWC025HB+94NGGC
VWN030HB	3	461	267	175	VWN030HB+92NGGA	VWC030HB+94NGGA	VWN030HB+92NGGC	VWC030HB+94NGGC
VWN040LB	4	841	496	50	VWN040LB+92NGGA	VWC040LB+94NGGA	VWN040LB+92NGGC	VWC040LB+94NGGC
VWN040HB	4	841	496	175	VWN040HB292NGGA ²	VWC040HB294NGGA ²	VWN040HB292NGGC ²	VWC040HB294NGGC ²
VWN050LB	5	1,376	775	50	VWN050LB292NGGA ²	VWC050LB294NGGA ²	VWN050LB292NGGC ²	VWC050LB294NGGC ²

The performance specifications are nominal and conform to acceptable industry standards. For applications at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products. © 2014 Johnson Controls, Inc. www.johnsoncontrols.com



M9000 Electrically Actuated, Standard-Pressure, Standard-Temperature, Two-Way Butterfly Valves (with Weather Shield) (Continued)

M9000 Electrically Actuated, Standard-Pressure, Standard-Temperature, Two-Way Butterfly Valves (with Weather Shield)
(Part 2 of 2)

Valve Code Number	Size, in.	Cv at 90°	Cv at 70°	Closeoff Pressure, psig ¹	Two-Way Valve with M9000 Series Electric Actuator (with Weather Shield)			
					Spring Open	Spring Closed	Spring Open	Spring Closed
					Two-Way — Non-Spring Return			
					On/Off (Floating) Control		0 to 10 VDC Proportional Control	
					M91xx-AGA-2 without switches	M91xx-AGC-2 with 2 Switches	M91xx-GGA-2 without switches	M91xx-GGC-2 with 2 Switches
VWN020HB	2	144	84	175	VWN020HB+916AGA	VWN020HB+916AGC	VWN020HB+916GGA	VWN020HB+916GGC
VWN025HB	2-1/2	282	163	175	VWN025HB+916AGA	VWN025HB+916AGC	VWN025HB+916GGA	VWN025HB+916GGC
VWN030HB	3	461	267	175	VWN030HB+916AGA	VWN030HB+916AGC	VWN030HB+916GGA	VWN030HB+916GGC
VWN040HB	4	841	496	175	VWN040HB+924AGA	VWN040HB+924AGC	VWN040HB+924GGA	VWN040HB+924GGC
VWN050LB	5	1376	775	50	VWN050LB+924AGA	VWN050LB+924AGC	VWN050LB+924GGA	VWN050LB+924GGC
VWN050HB	5	1376	775	175	VWN050HB2924AGA ²	VWN050HB2924AGC ²	VWN050HB2924GGA ²	VWN050HB2924GGC ²
VWN060LB	6	1850	1025	50	VWN060LB2924AGA ²	VWN060LB2924AGC ²	VWN060LB2924GGA ²	VWN060LB2924GGC ²

- Valves rated for 175 psig closeoff have 75 psig maximum dead-end service rating. Valves rated for 50 psig closeoff are not rated for dead-end service.
- Valve assemblies have two actuators mounted in tandem.

Technical Specifications

M9000 Electrically Actuated, Standard-Pressure, Standard-Temperature, Two-Way Butterfly Valves (with Weather Shield) ¹		
Service	Hot, Chilled, or Condenser Water, and 50/50 Glycol Solutions (Not Designed for Use in Steam Applications)	
Body Styles and Sizes	Two-Way, 2 through 6 in., Fully Lugged	
Fluid Temperature Limits	-40°F to 250°F (-40°C to 121°C)	
Body Pressure Rating	175 psig	
Maximum Fluid Velocity	30 ft/second (9 m/second)	
Rangeability	Refer to the <i>VF Series Standard-Pressure, Standard-Temperature Butterfly Valves Product Bulletin (LIT-977205P)</i> .	
Leakage	Bubble Tight	
Flow Characteristics	Modified Equal Percentage	
Materials	Body	Cast Iron ASTM A126 Class B
	Tee (Three-Way Valves Only)	Cast Iron
	Disc	Ductile Iron, Nylon 11 Coated, ASTM A536 Gr 65-45-12
	Seat	Ethylene Propylene Diene Monomer (EPDM)
	Stem	416 Stainless Steel
Ambient Temperature Limits	Storage	-20 to 150°F (-29 to 66°C), Preferably 40 to 85°F (4 to 29°C)
	Operating	Spring-Return Actuator: -40 to 131°F (-40 to 55°C) Non-Spring-Return Actuator: -4 to 122°F (-20 to 50°C)
Weather Shield Rating	National Electrical Manufacturers' Association (NEMA) 4	

- Refer to the *VF Series Standard-Pressure, Standard-Temperature Butterfly Valves Product Bulletin (LIT-977205P)* for actuator specifications.

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VD-1300 Control Dampers

Description

Since 1905, Johnson Controls has provided the highest quality control dampers that fit your application and size requirements.

- VD-1330 - Airfoil-shaped aluminum blades/galvanized frame
- VD-1320 - Double-piece blades/galvanized frame
- VD-1310 - 16-gauge blades/galvanized frame (Not for outdoor air applications)

The VD-1300 dampers are designed to control the flow of air in Heating, Ventilating, and Air Conditioning (HVAC) systems, and to meet different application and environmental requirements. These applications include, but are not limited to:

- volume (air) control applications, which regulate the flow of air
- temperature control applications, which maintain a constant temperature
- pressure control applications, which maintain a constant pressure

Dampers are tested at an Air Movement Control Association (AMCA) Certified Laboratory using instrumentation and procedures in accordance with AMCA Standard No. 500, Test Methods for Louvers, Dampers, and Shutters. The VD-1300 Series includes Class IA, I, and III leakage-rated dampers, available in 1-inch increments.

Features

- tested to over 100,000 cycles assures long damper life.
- 3-year warranty on materials and workmanship provides confidence of company standing behind product.
- 3-working-day standard shipping after order entry results in fast response for short lead time projects.
- 1-working-day Fast Track shipping provides Fast Track at a cost premium.
- factory-installed actuator reduces installation and commissioning time.
- factory-installed jackshaft reduces installation and commissioning time.

VD-1310 Class III Dampers (Not for Outdoor Air Applications) Submittal Specifications

Furnish and install Johnson Controls® VD-1310 Class III volume control dampers.

Frames are to be constructed of formed 13-gauge galvanized sheet steel, mechanically joined with linkage concealed in the side channels to eliminate noise and friction. Compressible spring stainless steel side seals and self-lubricating bearings shall also be provided.

Blades are to be constructed with formed 16-gauge galvanized steel. Damper blade width shall not exceed 8 inches and shall have seals. Blade rotation is to be parallel or opposed as shown on the schedules.

Performance shall be designed for normal shutoff in return air applications and tested in accordance with AMCA Standard 500. Leakage resistance for a 48-inch x 48-inch damper with seals shall not exceed 17 cfm per square foot at a 1-inch pressure differential, 45 cfm per square foot at a 4-inch pressure differential. Damper operating force at a 4-inch differential shall not exceed 6 lb-in/sq ft. The damper must be rated to operate over a temperature range of -40 to 200°F (-40 to 93°C) standard and -40 to 250°F (-40 to 121°C) high temperature.

Sizing shall be determined by the designer in accordance with accepted industry practices to ensure proper system performance.

VD-1320 Class I or VD-1330 Class IA Dampers Submittal Specifications

Furnish and install Johnson Controls VD-1320 Class I or VD-1330 Class IA volume control dampers.

Frames are to be constructed of formed 13-gauge galvanized sheet steel, mechanically joined with linkage concealed in the side channel to eliminate noise and friction. Compressible spring stainless steel side seals and self-lubricating bearings shall also be provided.

Blades are to be constructed with 1/16-inch extruded aluminum in an airfoil shape. Damper blade width shall not exceed 8 inches and shall have seals. Blade rotation is to be parallel or opposed as shown on the schedules.

Performance shall be designed for very tight shutoff and tested in accordance with AMCA Standard 500. Leakage resistance for a 48-inch x 48-inch damper with seals shall not exceed 2.2 cfm per square foot at a 1-inch pressure differential, 3.7 cfm per square foot at a 4-inch pressure differential. Damper sealing force at a 4-inch differential shall not exceed 6 lb-in/sq ft. The damper must be rated to operate over a temperature range of -40 to 200°F (-40 to 93°C) standard and -40 to 250°F (-40 to 121°C) high temperature.

Sizing shall be determined by the designer in accordance with accepted industry practices to ensure proper system performance.



VD-1300 Control Dampers

Repair Information

Johnson Controls VD-1300 dampers have no components that require routine scheduled maintenance.

If the VD-1300 Volume Control Damper fails to operate within its specifications, replace the unit. For a replacement VD-1300 damper, contact the nearest Johnson Controls representative.

Refer to the *VD-1300 Volume Control Dampers Product Bulletin (LIT-1201635)* for important product application information and a list of repair parts available.

VD-1300 Control Dampers (Continued)

Technical Specifications

VD-1300 Series Control Dampers ¹					
Leakage Resistance	VD-1310	17 cfm/sq. ft maximum at 1 in. static pressure 45 cfm/sq. ft maximum at 4 in. static pressure			
	VD-1320	3.4 cfm/sq. ft maximum at 1 in. static pressure 6.0 cfm/sq. ft maximum at 4 in. static pressure			
	VD-1330	2.2 cfm/sq. ft maximum at 1 in. static pressure 3.7 cfm/sq. ft maximum at 4 in. static pressure			
Operating Torque	0.5 in. static pressure and 100 fpm fully open approach velocity 1 in. static pressure and 1,000 fpm fully open approach velocity			4.5 lb-in/sq. ft 5.5 lb-in/sq. ft	
Pressure Drop (inches WG) - Fully Open	Size (in.)	Approach Velocity (fpm)			
		1,000	2,000	3,000	4,000
	12 x 12	0.16	0.42	--	--
	24 x 24	0.05	0.20	0.42	0.57
	48 x 48	0.03	0.10	0.25	0.45
Velocity Requirements		Width (in.)			
		12	24	36	48
	VD-1310	6,000 fpm at 6 in. static	4,500 fpm at 6 in. static	3,000 fpm at 4.5 in. static	1,500 fpm at 3 in. static
	VD-1320	8,000 fpm at 8 in. static	6,000 fpm at 8 in. static	4,000 fpm at 6 in. static	2,000 fpm at 4 in. static
	VD-1330	8,000 fpm at 12 in. static	8,000 fpm at 10 in. static	6,000 fpm at 10 in. static	4,000 fpm at 4 in. static
Temperature Rating	Normal and Extended Operating Conditions			-40 to 200°F (-40 to 93°C)	
	High (with Bronze Bearings and Silicone Seals)			-40 to 250°F (-40 to 121°C)	
	Actuator			-4 to 122°F (-20 to 50°C)	
Approximate Weight	Damper	5 lb/sq. ft (2.7 kg/sq. ft)			
	Actuator	2.9 lb (1.6 kg) per actuator			

1. All performance data is determined using instrumentation and procedures at an AMCA Certified Laboratory in accordance with AMCA Standard No. 500, Test Methods for Louvers, Dampers, and Shutters.

Y63, Y64, Y65, Y66, and Y69 Series

Transformers

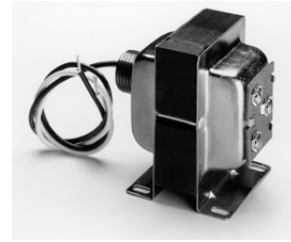
Description

The Series Y63, Y64, Y65, Y66, and Y69 Transformers provide 24 VAC power for loads of 40 VA through 300 VA. These transformers are designed for use on digital controllers, gas controls, ignition systems, motor actuators, staging controls, and most other 24 VAC Heating, Ventilation, Air Conditioning, and Refrigeration (HVACR) control systems.

The Y6x Series meets the requirements of UL 1585, UL 506, and CSA C22.2 No. 66, providing compliance in both the United States and Canada. The Y63, Y64, Y65, and Y66 transformers are listed as Class 2 transformers (UL 1585, CSA C22.2 No. 66). The Y69 is listed as a general purpose transformer (UL 506, CSA C22.2 No. 66).

Features

- split-bobbin design—provides best primary/secondary isolation
- multi-tap primaries—reduce stocking requirements and offer application flexibility
- choice of foot, plate, or conduit hub mounting—provides mounting flexibility
- choice of primary voltages—meets a wide range of power requirements from 24 VAC through 480 VAC
- color-coded lead wires—provide simplicity and standardization
- cULus listed or cURus recognized—meets US and Canadian requirements for Class 2 transformers (Y63, Y64, Y65, and Y66) and general purpose transformers (Y69)
- built-in, easy-reset circuit breakers—eliminate replacement time and cost caused by burn-out (Y63, Y64, Y66, and Y69)
- open frame Y65 models—serve as ideal models when end bells are not required



Y65 Series Transformer

Repair Information

Do not make any field repairs to transformers. For a replacement transformer, contact the nearest Johnson Controls® distributor or sales representative.

Selection Chart

Y63, Y64, Y65, Y66, and Y69 Series Transformers (Part 1 of 2)

Code Number	Primary Voltage VAC	Secondary Voltage VAC	Primary Connection	Secondary Connection	Mounting	Agency Requirement
40 VA Capacity Transformers with Energy Limiting Type Overload Protection						
Y65G13-0	24	24	Male Fitting 8 in. primary leads	Male Fitting 30 in. secondary leads	Foot	cULus Class 2
Y65A13-0	120	24	Male Fitting 8 in. primary leads	Male Fitting 30 in. secondary leads	Foot	cULus Class 2
Y65A21-0	120	24	End bell holes 8 in. primary leads	Three screw terminals (one is blind)	4 in. x 4 in. plate	cULus Class 2
Y65T31-0	120/208/240	24	Male Fitting 8 in. primary leads	Three screw terminals (one is blind)	Foot 4 in. x 4 in. plate ¹	cULus Class 2
Y65T42-0	120/208/240	24	Common Male Fitting 8 in. primary leads	Common Male Fitting 8 in. secondary leads	Hub 4 in. x 4 in. plate ¹	cURus Class 2
Y65T54-0	120/208/240	24	8 in. primary leads	8 in. secondary leads	Foot-skeleton	cURus Class 2
Y65S13-0	208/240	24	Male Fitting 8 in. primary leads	Male Fittings 30 in. secondary leads	Foot	cULus Class 2
Y65F13-0	277/480	24	Male Fitting 8 in. primary leads	Male Fitting 30 in. secondary leads	Foot	cULus Class 2
Y65F42-0	277/480	24	Common Male Fitting 8 in. primary leads	Common Male Fitting 8 in. secondary leads	Hub 4 in. x 4 in. plate ¹	cURus Class 2
50 VA Capacity Transformers with Circuit Breakers						
Y63T22-0	120/208/240	24	End bell Hole 8 in. primary leads	End bell Hole 8 in. secondary leads	4 in. x 4 in. plate	cURus Class 2
Y63T31-0	120/208/240		Male Fitting 8 in. primary leads	Three screw terminals (one is blind)	Foot 4 in. x 4 in. plate ¹	cULus Class 2
Y63F22-0	277/480	24	End bell Hole 8 in. primary leads	End bell Hole 8 in. secondary leads	4 in. x 4 in. plate	cURus Class 2

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Transformers (Continued)

Y63, Y64, Y65, Y66, and Y69 Series Transformers (Part 2 of 2)

Code Number	Primary Voltage VAC	Secondary Voltage VAC	Primary Connection	Secondary Connection	Mounting	Agency Requirement
75 VA Capacity Transformers with Circuit Breakers						
Y66T12-0	120/208/240	24	Common Male Fitting 8 in. primary leads	Common Male Fitting 8 in. secondary leads	Foot	cURus Class 2
Y66T13-0	120/208/240	24	Male Fitting 8 in. primary leads	Male Fitting 30 in. secondary leads	Foot	cULus Class 2
Y66F12-0	277/480	24	Common Male Fitting 8 in. primary leads	Common Male Fitting 8 in. secondary leads	Foot	cURus Class 2
Y66F13-0	277/480	24	Male Fitting 8 in. primary leads	Male Fitting 30 in. secondary leads	Foot	cULus Class 2
92 VA Capacity Transformers with Circuit Breakers						
Y64T15-0	120/208/240	24	Male Fitting 8 in. primary leads	Female Fitting 30 in. secondary leads	Foot	cULus Class 2
Y64T21-0	120/208/240	24	End bell holes 8 in. primary leads	Three screw terminals (one is blind)	Plate	cULus Class 2
Y64T22-0	120/208/240	24	End bell Hole 8 in. primary leads	End bell Hole 8 in. secondary leads	Plate	cURus Class 2
300 VA Capacity Transformers with Circuit Breakers						
Y69T15-0	120/208/240	24	Male Fitting 8 in. primary leads	Female Fitting 30 in. secondary leads	Foot	cULus Power Transformer

1. 4 in. x 4 in. plate and nut packed with transformer.

Technical Specifications

Series Y63, Y64, Y65, Y66, Y69 Transformers													
Input Power Requirements	24–480 VAC at 60 Hz												
Full Load Secondary Voltage	23.5 VAC (Nominal)												
Open Circuit Secondary Voltage (No Load)	27.0 VAC (Nominal)												
Full Load Secondary VA Rating	<table border="1"> <thead> <tr> <th>Series</th> <th>Volt-Amperes</th> </tr> </thead> <tbody> <tr> <td>Y63</td> <td>50 VA</td> </tr> <tr> <td>Y64</td> <td>92 VA</td> </tr> <tr> <td>Y65</td> <td>40 VA</td> </tr> <tr> <td>Y66</td> <td>75 VA</td> </tr> <tr> <td>Y69</td> <td>300 VA</td> </tr> </tbody> </table>	Series	Volt-Amperes	Y63	50 VA	Y64	92 VA	Y65	40 VA	Y66	75 VA	Y69	300 VA
Series	Volt-Amperes												
Y63	50 VA												
Y64	92 VA												
Y65	40 VA												
Y66	75 VA												
Y69	300 VA												
Finish	End bells, frame, feet, and mounting plates are corrosion resistant												
Ambient Operating Temperature	-40 to 104°F (-40 to 40°C)												
Ambient Storage Temperature	-40 to 140°F (-40 to 60°C)												
Shipping Weight	<table border="1"> <tbody> <tr> <td>Y63</td> <td>3.0 lb/1.4 kg</td> </tr> <tr> <td>Y64</td> <td>4.0 lb/1.8 kg</td> </tr> <tr> <td>Y65</td> <td>2.0 lb/0.9 kg</td> </tr> <tr> <td>Y66</td> <td>3.0 lb/1.4 kg</td> </tr> <tr> <td>Y69</td> <td>11.0 lb/5.0 kg</td> </tr> </tbody> </table>	Y63	3.0 lb/1.4 kg	Y64	4.0 lb/1.8 kg	Y65	2.0 lb/0.9 kg	Y66	3.0 lb/1.4 kg	Y69	11.0 lb/5.0 kg		
Y63	3.0 lb/1.4 kg												
Y64	4.0 lb/1.8 kg												
Y65	2.0 lb/0.9 kg												
Y66	3.0 lb/1.4 kg												
Y69	11.0 lb/5.0 kg												
Agency Compliance	UL Listed Y63, Y64, Y65, Y66; File E95575, CCN's XOKV (US) and XOKV7 (Canada) UL Recognized Y63, Y64, Y65, Y66; File E95575, CCN's XOKV2 (US) and XOKV8 (Canada) UL Listed Y69; File E95138, CCN's XPTQ (US) and XPTQ7 (Canada) All transformers are Class 2 except the Y69 (300 VA), which is listed as a power transformer.												

The performance specifications are nominal and conform to acceptable industry standards. For applications at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products. © 2012 Johnson Controls, Inc. www.johnsoncontrols.com

Application and Data Server (ADS) and Extended Application and Data Server (ADX) Catalog Page

MS-ADSxxx-x MS-ADXxxx-x

Code No. LIT-1900200
Software Release 6.5
Issued February 14, 2014
Supersedes June 17, 2013

Refer to the [QuickLIT website](#) for the most up-to-date version of this document.

The Application and Data Server (ADS) and Extended Application and Data Server (ADX) are optional components of the Metasys® system that manage the collection and presentation of large amounts of trend data, event messages, operator transactions, and system configuration data. The ADS is an entry level server that runs on personal computers and supports up to 5 users. The ADX is a larger scale system that runs on a server operating system to provide extended historical archiving and reporting capabilities. The ADX is offered in several models to support up to 10, 25, or 50 users. As Site Director, the ADS/ADX provides secure communication to a network of Network Automation Engines (NAEs), Network Control Engines (NCEs), and Network Integration Engines (NIEs).

The Site Management Portal UI of the ADS/ADX provides flexible system navigation, user graphics, comprehensive alarm management, trend analysis, and summary reporting capabilities. With the Site Management Portal UI, you can efficiently manage occupant comfort and energy usage, quickly respond to critical events, and optimize control strategies. The ADS/ADX includes an Open Database Connectivity (ODBC) compliant database package for secure storage of historical and configuration data.

An optional user interface called the Ready Access Portal provides an intuitive, task-based user experience designed to allow remote operations of your building system. The Ready Access Portal is available for computers or mobile devices and requires only a Web browser.

The Metasys system can communicate with cloud-based applications easily and securely. To make this connection, the Metasys system requires minor programming and set up by Johnson Controls. Once connected, you can access multiple cloud-based applications and features. To learn more, please visit www.jci.com and visit the Metasys product information page.

For the ADX, the Metasys Advanced Reporting System and Energy Essentials report on system configuration performance, energy usage, demand, and cost.

Note: In this document, the term engine refers to NAEs, NCEs, and NIEs, unless otherwise noted.

Refer to the *ADS Product Bulletin (LIT-1201525)* for important product application information.

Features

- Support of IT Standards and Internet Technologies
- Secure User Access
- Flexible System Navigation and Dynamic User Graphics
- Alarm and Event Management

Ordering Information

For complete ordering information, refer to the *Metasys System Software Purchase Options Product Bulletin (LIT-12011703)*.

- Long-Term Trend Data Storage
- Optional Metasys Advanced Reporting System and Energy Essentials

Figure 1: ADS/ADX Site Management UI



Applications

Use an ADS when:

- the number of engines becomes larger than a single engine can handle efficiently as Site Director
- long-term historical data storage needs exceed the capacity of a typical engine
- the number of simultaneous users logging on exceeds the capacity of a single engine. The ADS supports up to 5 simultaneous users, and up to 10 to 14 NxE engines. Refer to the *Metasys System Configuration Guide (LIT-12011832)*.

Use an ADX when:

- the Metasys Advanced Reporting System, Energy Essentials, or the Metasys for Validated Environments (MVE), Extended Architecture application is required
- You need to support more than 5 simultaneous users. The ADX supports up to 10, 25, or 50 users; and up to 500 to 1000 NxE engines. Refer to the *Metasys System Configuration Guide (LIT-12011832)*
- any one of your data storage or access requirements is not met by an ADS

Table 1: ADS/ADX Ordering Information for New or Upgrade Software

Base Product Code	Product Descriptions	New Software Product Code Number	Upgrade Software Product Code Number	Migration Software Product Code Number
MS-ADS05U	Application and Data Server For up to 5 users Single Processor or 4 cores	MS-ADS05U-0	MS-ADS05U-6	MS-ADS05U-8
MS-ADX10U	Extended Application and Data Server For up to 10 users Single Processor	MS-ADX10U-0	MS-ADX10U-6	MS-ADX10U-8
MS-ADX10SQL	Extended Application and Data Server For up to 10 users Single Processor Includes Microsoft® SQL Server™ 2012 software with core license	MS-ADX10SQL-0	MS-ADX10SQL-6	MS-ADX10U-8
MS-ADXSWO	Extended Application and Data Server For up to 25 users Single Processor	MS-ADXSWO-0	MS-ADXSWO-6	MS-ADXSWO-8
MS-ADXSWSOQL	Extended Application and Data Server For up to 25 users Single Processor Includes Microsoft SQL Server 2012 software with core license	MS-ADXSWSOQL-0	MS-ADXSWSOQL-6	MS-ADXSWSOQL-8
MS-ADX50U	Extended Application and Data Server For up to 50 users Single Processor	MS-ADX50U-0	MS-ADX50U-6	MS-ADX50U-8
MS-ADX50SQL	Extended Application and Data Server For up to 50 users Single Processor Includes Microsoft SQL Server 2012 software with core license	MS-ADX50SQL-0	MS-ADX50SQL-6	MS-ADS50SQL-8
MS-ADX50SQL2	Extended Application and Data Server For up to 50 users Dual Processors Recommended for user on server with dual processors or 8 cores Includes Microsoft SQL Server 2012 software with a core license	MS-ADX50SQL2-0	MS-ADX50SQL2-6	MS-ADX50SQL2-8

Operating Systems, SQL Server Combinations

The following table lists by operating system the Microsoft® SQL Server™ software editions that have been fully qualified by Johnson Controls for Release 6.5. You can select other combinations, but we recommend that you select from the following pairings.

Table 2: Recommended Operating System and SQL Server Combinations

Operating System	Database Software									
	ADS					ADX				
	SQL 2012 Express SP1, 64-bit	SQL 2008 R2 Express SP2, 64-bit	SQL 2008 R2 Express SP2, 32-bit	SQL 2008 Express SP3, 64-bit	SQL 2008 Express SP3, 32-bit	SQL 2012 SP1, 64-bit	SQL 2008 R2 SP2, 64-bit	SQL 2008 R2 SP2, 32-bit	SQL 2008 SP3, 64-bit	SQL 2008 SP3, 32-bit
Windows® 8.1 and Windows 8.1 Pro (64-bit)	x	x								
Windows 8 and Windows 8 Pro (64-bit)	x	x		x						
Windows 7 Professional, Enterprise, and Ultimate Editions with SP1 (64-bit)	x	x		x						
Windows 7 Professional, Enterprise, and Ultimate Editions with SP1 (32-bit)			x		x					
Windows Server® 2012 R2 Standard and Enterprise Editions (64-bit)						x	x			
Windows Server 2012 Standard and Enterprise Editions (64-bit)						x	x			
Windows Server 2008 R2 Standard and Enterprise Editions with SP1 (64-bit)						x	x		x	
Windows Server 2008 Standard and Enterprise Editions with SP2 (32-bit)								x		x

Technical Specifications

Application and Data Server (ADS) System Requirements

Table 3: Application and Data Server (ADS) System Requirements (5 Users)

Recommended Computer Platform ¹	2.8 GHz Intel® Core™ 2 Duo processor
	2 x 320 GB hard disk (RAID 1) ² with 40 GB free space after installation of all prerequisite software and before installation of ADS software. Configure RAID 1 (mirroring) with disk write-caching turned on.
	DVD drive
Recommended Memory ⁴	Note: Prerequisite software includes the supported operating system, database software, .NET Framework, and any other software or service packs required for your ADS configuration.
	Graphics card (1 GB RAM, ATI® Technologies or NVIDIA® Corporation, 64-bit compatible [for 64-bit operating systems], Small Form Factor [SFF] if required) ³
	4 GB RAM (32-bit systems)
	8 to 16 GB RAM (64-bit systems)

Table 3: Application and Data Server (ADS) System Requirements (5 Users)

Supported Operating Systems ⁵ and Database Software	Windows® 8.1 and Windows 8.1 Pro (64-bit) Supports Microsoft SQL Server™ 2012 Express with SP1 (64-bit) or Microsoft SQL Server 2008 R2 Express with SP2 (64-bit)	
	Windows 8 and Windows 8 Pro (64-bit) Supports Microsoft SQL Server 2012 Express with SP1 (64-bit) or Microsoft SQL Server 2008 R2 Express with SP2 (64-bit)	
	Windows 7 Professional, Enterprise, and Ultimate Editions with SP1 (32-bit or 64-bit) Supports Microsoft SQL Server 2012 Express with SP1 (64-bit), Microsoft SQL Server 2008 R2 Express with SP2 (32-bit or 64-bit), or Microsoft SQL Server 2008 Express with SP3 (32-bit) Note: The OS and software must both be 32-bit or 64-bit.	
Supported Operating Systems for Metasys Client Computer	Windows 8.1. or Windows 8.1 Pro Windows 8 or Windows 8 Pro Windows 7 Professional, Enterprise, or Ultimate Edition with SP1 (32-bit or 64-bit) Windows XP® Professional with SP3 Apple® OS X® 10.9 Mavericks Apple OS X 10.8 Mountain Lion Note: Windows XP and Apple operating systems are supported for Metasys client computers only.	
Supported Web Browser Software for Metasys Client Computers	Windows Internet Explorer® version 8, 9, 10, and 11 Note: In Internet Explorer 11, select the option Display all websites in Compatibility View , found under Tools > Compatibility View Settings, to ensure websites appear and function correctly. Apple Safari® version 6.0.5 and 7.0 (Other browsers, such as Google® Chrome and Mozilla™ Firefox™, may also be used but are not fully supported.) Note: You use the web browser to download the Launcher application. After you install the Launcher application, you use the Launcher, not the web browser, to log in to the Metasys UI.	
Network Communication	Ethernet network interface card (100 or 1000 Mbps) Note: The ADS supports only one network interface card.	
Additional Software Included with the ADS	CCT software	Launcher software
	Export Utility software	Microsoft SQL Server 2012 Express software with SP1 (64-bit)
	Metasys Database Manager software	Microsoft SQL Server 2008 R2 Express software with SP2 (32-bit and 64-bit)
	Ready Access Portal software	Microsoft .NET Framework Version 3.5 SP1
	SCT software	SCT Manager software
Optional Hardware	Any network or local printer supported by the qualified Windows operating system	
Optional Software	Graphic Generation Tool	

1 Our computer platform and memory recommendations are not meant to imply that older or slower machines are not usable. Refer to the *Network and IT Guidance for the BAS Professional Technical Bulletin (LIT-12011279)* for more information regarding computer/server recommendations.
2 For best performance, use Serial Attached SCSI (SAS) hard drives, not Small Computer System Interface (SCSI) hard drives.
3 For improved performance in configurations where ADS and Ready Access Portal share the same computer.
4 For best performance, use the maximum amount of memory that the computer allows.
5 Refer to the *Network and IT Guidance for the BAS Professional Technical Bulletin (LIT-1201279)* for specific Microsoft Windows operating system settings that may be required for your Metasys system configuration.

Extended Application and Data Server System Requirements (Unified 10 or 25 User ADX)

Table 4: Extended Application and Data Server System Requirements (Unified ADX Systems, 10 or 25 Users)

Recommended Server Platform¹	2.4 GHz Intel Xeon® single processor 2 x 600 GB hard disk (RAID 1) ² with 40 GB free space after installation of all prerequisite software and before installation of ADS software. Configure RAID 1 (mirroring) with disk write-caching turned on. DVD drive Note: ADX prerequisite software includes the Windows operating system, SQL Server software, Windows .NET Framework, and any other software or SPs required by your ADX configuration.	
Recommended Memory³	16 GB RAM (10 or 25 user ADX)	
Supported Operating Systems⁴ and Database Software	Windows Server® 2012 R2 Standard and Enterprise Editions (64-bit)⁵ Supports Microsoft SQL Server™ 2012 Standard or Enterprise with SP1 (64-bit) or Microsoft SQL Server 2008 R2 Standard or Enterprise with SP2 (64-bit)	
	Windows Server 2012 Standard and Enterprise Editions (64-bit)⁵ Supports Microsoft SQL Server 2012 Standard or Enterprise with SP1 (64-bit) or Microsoft SQL Server 2008 R2 Standard or Enterprise with SP2 (64-bit)	
	Windows Server 2008 R2 Standard and Enterprise Editions with SP1 (64-bit)⁶ Supports Microsoft SQL Server 2012 Standard or Enterprise with SP1 (64-bit), Microsoft SQL Server 2008 R2 Standard or Enterprise with SP2 (64-bit), or Microsoft SQL Server 2008 Standard or Enterprise with SP3 (64-bit)	
	Windows Server 2008 Standard and Enterprise Editions with SP2 (32-bit)⁶ Supports Microsoft SQL Server 2008 R2 Standard or Enterprise with SP2 (32-bit) or Microsoft SQL Server 2008 Standard or Enterprise with SP3 (32-bit) Note: A 32-bit operating system only supports a maximum of 4 GB memory. For best performance, use a 64-bit operating system.	
Support Operating Systems for Metasys Client Computer	Windows 8.1, or Windows 8.1 Pro Windows 8 or Windows 8 Pro Windows 7 Professional, Enterprise, or Ultimate Edition with SP1 (32-bit or 64-bit) Windows XP® Professional with SP3 Apple® OS X® 10.9 Mavericks Apple OS X 10.8 Mountain Lion Note: Windows XP and Apple operating systems are supported for Metasys client computers only.	
Supported Web Browser Software for Metasys Client Computers	Windows Internet Explorer® version 8, 9, 10, and 11 Note: In Internet Explorer 11, select the option Display all websites in Compatibility View , found under Tools > Compatibility View Settings, to ensure websites appear and function correctly. Apple Safari® version 6.0.5 and 7.0 (Other browsers, such as Google® Chrome and Mozilla™ Firefox™, may also be used but are not fully supported.) Note: You use the web browser to download the Launcher application. After you install the Launcher application, you use the Launcher, not the web browser, to log in to the Metasys UI.	
Network Communication	Ethernet network interface card (100 or 1000 Mbps) Note: The ADX supports only one network interface card.	
Additional Software Included with the ADX	CCT software	Launcher software
	Export Utility software	Microsoft SQL Server 2012 software with SP1 (64-bit)
	Metasys Database Manager software	SCT software
	Ready Access Portal software	SCT Manager software
	Microsoft .NET Framework Version 3.5 SP1	
Note: The Metasys Advanced Reporting System requires an ADX. The SCT computer must be online and accessible to the ADX at all times.		

Table 4: Extended Application and Data Server System Requirements (Unified ADX Systems, 10 or 25 Users)

Optional Hardware	Any network or local printer supported by the qualified Windows operating system
Optional Software	Energy Essentials Graphic Generation Tool

- 1 Our computer platform and memory recommendations are not meant to imply that older or slower machines are not usable. Refer to the *Network and IT Guidance for the BAS Professional Technical Bulletin (LIT-12011279)* for more information regarding computer/server recommendations.
- 2 For best performance, use SAS hard drives (not SATA hard drives) that use RAID controllers with write caching enabled.
- 3 For best performance, use the maximum amount of memory. An ADX with 16 GB RAM has much greater performance than an ADX with only 4 GB RAM. A 32-bit operating system does not support more than 4 GB of RAM.
- 4 Refer to the *Network and IT Guidance for the BAS Professional Technical Bulletin (LIT-12011279)* for specific Microsoft Windows operating system settings that may be required for your Metasys system configuration.
- 5 For SQL Server 2012 software, you must purchase a SQL Server software license for each individual processor core (with a minimum of four core licenses). For example, if you have a single processor with dual cores, purchase four core licenses (the minimum) for SQL Server 2012 software.
- 6 For SQL Server 2008 R2 or SQL Server 2008 software, you must purchase a SQL Server software license for each individual processor you have. You do not need to purchase multiple licenses if you have a single processor divided into multiple cores. For example, if you have a single processor with dual cores, purchase one license for SQL Server software.

Extended Application and Data Server System Requirements (Unified 50 User ADX)

Table 5: Extended Application and Data Server System Requirements (Unified ADX Systems, 50 Users)

Recommended Server Platform¹	2.2 GHz Intel Xeon® dual processors 6 x 300 GB hard disk (RAID 5) ² with 50 GB free space after installation of all prerequisite software and before installation of ADS software. Configure RAID 5 with disk write-caching turned on. DVD drive Note: ADX prerequisite software includes the Windows operating system, SQL Server software, Windows .NET Framework, and any other software or SPs required by your ADX configuration.
Recommended Memory	32 GB RAM
Supported Operating Systems³ and Database Software	<p>Windows Server® 2012 R2 Standard and Enterprise Editions (64-bit)⁴ Supports Microsoft SQL Server™ 2012 Standard or Enterprise with SP1 (64-bit) or Microsoft SQL Server 2008 R2 Standard or Enterprise with SP2 (64-bit)</p> <p>Windows Server 2012 Standard and Enterprise Editions (64-bit)⁴ Supports Microsoft SQL Server 2012 Standard or Enterprise with SP1 (64-bit) or Microsoft SQL Server 2008 R2 Standard or Enterprise with SP2 (64-bit)</p> <p>Windows Server 2008 R2 Standard and Enterprise Editions with SP1 (64-bit)⁵ Supports Microsoft SQL Server 2012 Standard or Enterprise with SP1 (64-bit), Microsoft SQL Server 2008 R2 Standard or Enterprise with SP2 (64-bit), or Microsoft SQL Server 2008 Standard or Enterprise with SP3 (64-bit)</p> <p>Windows Server 2008 Standard and Enterprise Editions with SP2 (32-bit)⁵ Supports Microsoft SQL Server 2008 R2 Standard or Enterprise with SP2 (32-bit) or SQL Server 2008 Standard or Enterprise with SP3 (32-bit) Note: A 32-bit operating system only supports a maximum of 4 GB memory. For best performance, use a 64-bit operating system.</p>
Supported Operating Systems for Metasys Client Computer	Windows 8.1. or Windows 8.1 Pro Windows 8 or Windows 8 Pro Windows 7 Professional, Enterprise, or Ultimate Edition with SP1 (32-bit or 64-bit) Windows XP® Professional with SP3 Apple® OS X® 10.9 Mavericks Apple OS X 10.8 Mountain Lion Note: Windows XP and Apple operating systems are supported for Metasys client computers only.

Table 5: Extended Application and Data Server System Requirements (Unified ADX Systems, 50 Users)

Supported Web Browser Software for Metasys Client Computers	Windows Internet Explorer® version 8, 9, 10, and 11 Note: In Internet Explorer 11, select the option Display all websites in Compatibility View , found under Tools > Compatibility View Settings, to ensure websites appear and function correctly. Apple Safari® version 6.0.5 and 7.0 (Other browsers, such as Google® Chrome and Mozilla™ Firefox™, may also be used but are not fully supported.) Note: You use the web browser to download the Launcher application. After you install the Launcher application, you use the Launcher, not the web browser, to log in to the Metasys UI.	
Network Communication	Ethernet network interface card (1000 Mbps) Note: The ADX supports only one network interface card.	
Additional Software Included with the ADX	CCT software	Launcher software
	Export Utility software	Microsoft SQL Server 2012 software with SP1 (64-bit)
	Metasys Database Manager software	Microsoft .NET Framework Version 3.5 SP1
	Ready Access Portal software	SCT software
	Note: The Metasys Advanced Reporting System requires an ADX. The SCT computer must be online and accessible to the ADX at all times.	
Optional Hardware	Any network or local printer supported by the qualified Windows operating system.	
Optional Software	Energy Essentials	
	Graphic Generation Tool	

- 1 Our computer platform and memory recommendations are not meant to imply that older or slower machines are not usable. Refer to the *Network and IT Guidance for the BAS Professional Technical Bulletin (LIT-12011279)* for more information regarding computer/server recommendations.
- 2 For best performance, use SAS hard drives (not SATA hard drives) that use RAID controllers with write caching enabled.
- 3 Refer to the *Network and IT Guidance for the BAS Professional Technical Bulletin (LIT-12011279)* for specific Microsoft Windows operating system settings that may be required for your Metasys system configuration.
- 4 For SQL Server 2012 software, you must purchase a SQL Server software license for each individual processor core (with a minimum of four core licenses). For example, if you have a single processor with dual cores, purchase four core licenses (the minimum) for SQL Server 2012 software.
- 5 For SQL Server 2008 R2 or SQL Server 2008 software, you must purchase a SQL Server software license for each individual processor you have. You do not need to purchase multiple licenses if you have a single processor divided into multiple cores. For example, if you have a single processor with dual cores, purchase one license for SQL Server software.

Extended Application and Data Server System Requirements (Split 10 or 25 User ADX)

Table 6: Extended Application and Data Server System Requirements (Split ADX Systems, 10 or 25 Users)

Split ADX System, 10 Users	Supports up to 100 NxEs Supports up to 10 Site Management Portal users Supports up to 10 Ready Access Portal users
Split ADX System, 25 Users	Supports up to 100 NxEs Supports up to 25 Site Management Portal users Supports up to 25 Ready Access Portal users
Recommended Server Platform¹	Web/Application Server 2.4 GHz Intel Xeon® single processor 2 x 600 GB hard disk (RAID 1) ² with 40 GB free space after installation of all prerequisite software ⁴ and before installation of ADS software. Configure RAID 1 (mirroring) with disk write-caching turned on. DVD drive Note: ARS and Energy Essentials can reside on the ADX Web/Application Server
	Database Server 2.4 GHz Intel Xeon® single processor 2 x 600 GB hard disk (RAID 1) with 40 GB free space after installation of all prerequisite software ⁴ and before installation of ADS software. Configure RAID 1 (mirroring) with disk write-caching turned on. DVD drive
	SCT Computer In a split configuration, you cannot install SCT or Ready Access Portal software on either the ADX Web/Application server computer or the ADX Database Server computer. Refer to the <i>System Configuration Tool Catalog Page (LIT-1900198)</i> for current SCT computer requirements.

Table 6: Extended Application and Data Server System Requirements (Split ADX Systems, 10 or 25 Users)

Recommended Memory³	16 GB RAM (web/application server and database server for 10 or 25 user ADX)	
Supported Operating Systems^{5, 6} with Supported Database Software	Windows Server® 2012 R2 Standard and Enterprise Editions (64-bit)⁷ Supports Microsoft SQL Server™ 2012 Standard or Enterprise with SP1 (64-bit) or Microsoft SQL Server 2008 R2 Standard or Enterprise with SP2 (64-bit)	
	Windows Server 2012 Standard and Enterprise Editions (64-bit)⁷ Supports Microsoft SQL Server 2012 Standard or Enterprise with SP1 (64-bit) or Microsoft SQL Server 2008 R2 Standard or Enterprise with SP2 (64-bit)	
	Windows Server 2008 R2 Standard and Enterprise Editions with SP1 (64-bit)⁸ Supports Microsoft SQL Server 2012 Standard or Enterprise with SP1 (64-bit), Microsoft SQL Server 2008 R2 Standard or Enterprise with SP2 (64-bit), or Microsoft SQL Server 2008 Standard or Enterprise with SP3 (64-bit)	
	Windows Server 2008 Standard and Enterprise Editions with SP2 (32-bit)⁸ Supports Microsoft SQL Server 2008 R2 Standard or Enterprise with SP2 (32-bit) or Microsoft SQL Server 2008 Standard or Enterprise with SP3 (32-bit) Note: A 32-bit operating system only supports a maximum of 4 GB memory. For best performance, use a 64-bit operating system.	
Supported Operating Systems for Metasys Client Computer	Windows 8.1. or Windows 8.1 Pro Windows 8 or Windows 8 Pro Windows 7 Professional, Enterprise, or Ultimate Edition with SP1 (32-bit or 64-bit) Windows XP® Professional with SP3 Apple® OS X® 10.9 Mavericks Apple OS X 10.8 Mountain Lion Note: Windows XP and Apple operating systems are supported for Metasys client computers only.	
Supported Web Browser Software for Metasys Client Computers	Windows Internet Explorer® version 8, 9, 10, and 11 Note: In Internet Explorer 11, select the option Display all websites in Compatibility View , found under Tools > Compatibility View Settings, to ensure websites appear and function correctly. Apple Safari® version 6.0.5 and 7.0 (Other browsers, such as Google® Chrome and Mozilla™ Firefox™, may also be used but are not fully supported.) Note: You use the web browser to download the Launcher application. After you install the Launcher application, you use the Launcher, not the web browser, to log in to the Metasys UI.	
Network Communication	Ethernet network interface card (100 or 1000 Mbps) Note: The ADX supports only one network interface card.	
Additional Software Included with the ADX	CCT software	Launcher software
	Export Utility software	Microsoft SQL Server 2012 software with SP1 (64-bit)
	Metasys Database Manager software	Microsoft .NET Framework Version 3.5 SP1
	Ready Access Portal software	SCT software
	Note: The Metasys Advanced Reporting System requires an ADX. The SCT computer must be online and accessible to the ADX at all times.	

Table 6: Extended Application and Data Server System Requirements (Split ADX Systems, 10 or 25 Users)

Optional Hardware	Any network or local printer supported by the qualified Windows operating system.
Optional Software	Energy Essentials Graphic Generation Tool

- 1 Our computer platform and memory recommendations are not meant to imply that older or slower machines are not usable. Refer to the *Network and IT Guidance for the BAS Professional Technical Bulletin (LIT-12011279)* for more information regarding computer/server recommendations.
- 2 For best performance, use SAS hard drives (not SATA hard drives) that use RAID controllers with write caching enabled.
- 3 For best performance, use the maximum amount of memory. An ADX with 16 GB RAM has much greater performance than an ADX with only 4 GB RAM. Also, a 32-bit operating system only supports a maximum of 4 GB of RAM.
- 4 ADX prerequisite software includes the Windows operating system and SQL Server software, Windows .NET Framework, and any other software or service packs required for your ADX configuration.
- 5 The web/application and database servers must have the same operating system installed.
- 6 Refer to the *Network and IT Guidance for the BAS Professional Technical Bulletin (LIT-12011279)* for specific Microsoft Windows operating system settings that may be required for your Metasys system configuration.
- 7 For SQL Server 2012 software, you must purchase a SQL Server software license for each individual processor core (with a minimum of four core licenses). For example, if you have a single processor with dual cores, purchase four core licenses (the minimum) for SQL Server 2012 software.
- 8 For SQL Server 2008 R2 or SQL Server 2008 software, you must purchase a SQL Server software license for each individual processor you have. You do not need to purchase multiple licenses if you have a single processor divided into multiple cores. For example, if you have a single processor with dual cores, purchase one license for SQL Server software.

Extended Application and Data Server System Requirements (Split 50 User ADX)

Table 7: Extended Application and Data Server System Requirements (Split ADX System, 50 Users)

Split ADX System, 50 Users	Supports up to 500 NxEs Supports up to 50 Site Management Portal users Supports up to 50 Ready Access Portal users Optional installation of Ready Access Portal, Metasys Advanced Reporting System, Energy Essentials
Recommended Server Platform¹	<p>Web/Application Server</p> <p>2.2 GHz Intel Xeon® single processor</p> <p>6 x 300 GB hard disk (RAID 5)² with 50 GB free space after installation of all prerequisite software⁴ and before installation of ADS software. Configure RAID 5 with disk write-caching turned on.</p> <p>DVD drive</p> <p>Note: ARS and Energy Essentials can reside on the ADX Web/Application Server.</p> <hr/> <p>Database Server</p> <p>2.2 GHz Intel Xeon® single processor</p> <p>6 x 300 GB hard disk (RAID 5) with 50 GB free space after installation of all prerequisite software⁴ and before installation of ADS software. Configure RAID 5 with disk write-caching turned on.</p> <p>DVD drive</p> <hr/> <p>SCT Computer</p> <p>In a split configuration, you cannot install SCT or Ready Access Portal software on either the ADX Web/Application Server computer or the ADX Database Server computer. Refer to the <i>System Configuration Tool Catalog Page (LIT-1900198)</i> for current SCT computer requirements.</p>
Recommended Memory³	32 GB RAM

Table 7: Extended Application and Data Server System Requirements (Split ADX System, 50 Users)

Supported Operating Systems and Database Software ^{5,6}	Windows Server® 2012 R2 Standard and Enterprise Editions (64-bit) ⁷ Supports Microsoft SQL Server™ 2012 Standard or Enterprise with SP1 (64-bit) or Microsoft SQL Server 2008 R2 Standard or Enterprise with SP2 (64-bit)	
	Windows Server 2012 Standard and Enterprise Editions (64-bit) ⁷ Supports Microsoft SQL Server 2012 Standard or Enterprise with SP1 (64-bit) or Microsoft SQL Server 2008 R2 Standard or Enterprise with SP2 (64-bit)	
	Windows Server 2008 R2 Standard and Enterprise Editions with SP1 (64-bit) ⁸ Supports Microsoft SQL Server 2012 Standard or Enterprise with SP1 (64-bit), Microsoft SQL Server 2008 R2 Standard or Enterprise with SP2 (64-bit), or Microsoft SQL Server 2008 Standard or Enterprise with SP3 (64-bit)	
	Windows Server 2008 Standard and Enterprise Editions with SP2 (32-bit) ⁸ Supports Microsoft SQL Server 2008 R2 Standard or Enterprise with SP2 (32-bit) or Microsoft SQL Server 2008 Standard or Enterprise with SP3 (32-bit) Note: A 32-bit operating system only supports a maximum of 4 GB memory. For best performance, use a 64-bit operating system.	
Support Operating Systems for Metasys Client Computer	Windows 8.1. or Windows 8.1 Pro	
	Windows 8 or Windows 8 Pro	
	Windows 7 Professional, Enterprise, or Ultimate Edition with SP1 (32-bit or 64-bit)	
	Windows XP® Professional with SP3	
	Apple® OS X® 10.9 Mavericks Apple OS X 10.8 Mountain Lion Note: Windows XP and Apple operating systems are supported for Metasys client computers only.	
Supported Web Browser Software for Metasys Client Computers	Windows Internet Explorer® version 8, 9, 10, and 11 Note: In Internet Explorer 11, select the option Display all websites in Compatibility View , found under Tools > Compatibility View Settings, to ensure websites appear and function correctly.	
	Apple Safari® version 6.0.5 and 7.0 (Other browsers, such as Google® Chrome and Mozilla™ Firefox™, may also be used but are not fully supported.) Note: You use the web browser to download the Launcher application. After you install the Launcher application, you use the Launcher, not the web browser, to log in to the Metasys UI.	
Network Communication	Ethernet network interface card (100 or 1000 Mbps) Note: The ADX supports only one network interface card.	
Additional Software Included with the ADX	CCT software	Launcher software
	Export Utility software	Microsoft SQL Server 2012 software with SP1 (64-bit)
	Metasys Database Manager software	SCT software
	Ready Access Portal software	Microsoft .NET Framework Version 3.5 SP1
	Note: The Metasys Advanced Reporting System requires an ADX. The SCT computer must be online and accessible to the ADX at all times.	

Table 7: Extended Application and Data Server System Requirements (Split ADX System, 50 Users)

Optional Hardware	Any network or local printer supported by the qualified Windows operating system
Optional Software	Energy Essentials Graphic Generation Tool

- 1 Our computer platform and memory recommendations are not meant to imply that older or slower machines are not usable. Refer to the *Network and IT Guidance for the BAS Professional Technical Bulletin (LIT-12011279)* for more information regarding computer/server recommendations.
- 2 For best performance, use SAS hard drives (not SATA hard drives) that use RAID controllers with write caching enabled.
- 3 For best performance, use the maximum amount of memory. An ADX with 32 GB RAM has much greater performance than an ADX with only 16 GB RAM. A 32-bit operating system does not support more than 4 GB of RAM.
- 4 ADX prerequisite software includes the Windows operating system and SQL Server software, Windows .NET Framework, and any other software or service packs required for your ADX configuration.
- 5 The web/application and database servers must have the same operating system installed.
- 6 Refer to the *Network and IT Guidance for the BAS Professional Technical Bulletin (LIT-12011279)* for specific Microsoft Windows operating system settings that may be required for your Metasys system configuration.
- 7 For SQL Server 2012 software, you must purchase a SQL Server software license for each individual processor core (with a minimum of four core licenses). For example, if you have a single processor with dual cores, purchase four core licenses (the minimum) for SQL Server 2012 software.
- 8 For SQL Server 2008 R2 or SQL Server 2008 software, you must purchase a SQL Server software license for each individual processor you have. You do not need to purchase multiple licenses if you have a single processor divided into multiple cores. For example, if you have a single processor with dual cores, purchase one license for SQL Server software.



Building Efficiency
507 E. Michigan Street, Milwaukee, WI 53202

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Project Name	<input type="text" value="Kelly Walsh High"/>	
Engineer	<input type="text" value="Engineering Design"/>	
Contractor	<input type="text" value="JCI"/>	
<input type="checkbox"/> SCHEDULE ATTACHED		
Item #	Tag ID	
Probe Length	Adj. Side Length	Internal Insulation

Refer to attached SCHEDULE for table details if button is checked in any of the tables

<input type="radio"/> BASE MODEL
<input checked="" type="checkbox"/> GTC116-P
<input type="checkbox"/> GTM116-P
<input type="checkbox"/> GTL116-P
<input type="checkbox"/> GTD116-P
<input type="checkbox"/> Other _____

<input type="radio"/> PROBES & SENSOR NODES	
<input checked="" type="checkbox"/> P+ Density (see density table, next page)	
<input type="checkbox"/> Custom	Probes: ____
	Nodes/Probe: ____
<input type="checkbox"/> Custom meets or exceeds P+ density	

<input checked="" type="checkbox"/> AVERAGING
<input checked="" type="checkbox"/> Airflow: Independent, arithmetic average
<input checked="" type="checkbox"/> Temperature: Independent, field selectable, velocity weighted (default) or arithmetic average

LISTINGS
<input checked="" type="checkbox"/> UL 873
<input checked="" type="checkbox"/> BTL (GTC116 and GTM116)
<input type="checkbox"/> CE (European shipments only)
<input type="checkbox"/> Other _____

<input type="radio"/> INDIVIDUAL SENSING NODES	
HOUSING	<input checked="" type="checkbox"/> Glass-filled polypropylene (std.) <input type="checkbox"/> Solid Kynar (/SS option)
THERMISTORS	<input checked="" type="checkbox"/> Self-heated sensor: Hermetically-sealed bead-in-glass thermistor probe <input checked="" type="checkbox"/> Temperature sensor: Hermetically-sealed bead-in-glass thermistor probe
INTERNAL WIRING	<input checked="" type="checkbox"/> Kynar coated copper
AIRFLOW MEASUREMENT	<input checked="" type="checkbox"/> Accuracy: ±2% of reading <input checked="" type="checkbox"/> Calibrated range: 0 to 5,000 fpm <input checked="" type="checkbox"/> Calibration points: 16 <input checked="" type="checkbox"/> NIST-traceable calibration
TEMPERATURE MEASUREMENT	<input checked="" type="checkbox"/> Accuracy: ±0.15°F <input checked="" type="checkbox"/> Calibrated range: -20 to 160°F <input checked="" type="checkbox"/> Calibration points: 3 <input checked="" type="checkbox"/> NIST-traceable calibration

<input checked="" type="checkbox"/> PROBE ENVIRONMENTAL LIMITS	
TEMPERATURE	
Probe	<input checked="" type="checkbox"/> -20 to 160°F
Transmitter	<input checked="" type="checkbox"/> -20 to 120°F
HUMIDITY (non-condensing)	
Probe	<input checked="" type="checkbox"/> 0 to 100%
Transmitter	<input checked="" type="checkbox"/> 5 to 95%

X P+ SENSOR DENSITY TABLE (# Probes/# Sensor nodes per probe)

		Probe Length (inches)																						
		□ 6	□ 8	□ 10	□ 12	□ 14	□ 16	□ 18	□ 20	□ 22	□ 24	□ 30	□ 36	□ 42	□ 48	□ 54	□ 60	□ 66	□ 72	□ 84	□ 96	□ 108	□ 120	
Round ▶		1/1	1/1	1/2	1/2	2/2	2/2	2/2	2/4	2/4	2/4	2/4	2/4	2/6	2/8	2/8	2/8	2/8	4/4	4/4	4/4	4/4	4/4	
Flat Oval ▶	All flat ovals are custom. Contact EBTRON or your representative for information on flat ovals.																							
Square/Rectangle Adjacent Side Length (inches)	□6	1/1	1/1	1/1	1/1	1/2	1/2	1/2	1/2	1/2	1/2	1/4	1/4	1/4	1/4	1/6	1/6	1/6	1/6	1/6	1/6	1/8	1/8	
	□8	1/1	1/1	1/2	1/2	1/2	1/2	1/2	1/4	1/4	1/4	1/4	1/4	1/6	1/6	1/6	1/6	1/6	1/6	1/6	1/8	1/8	1/8	1/8
	□10	1/1	1/2	1/2	1/2	1/2	1/4	1/4	1/4	1/4	1/4	1/6	1/6	1/6	1/6	1/6	1/8	1/8	1/8	1/8	1/8	1/8	1/8	2/6
	□12	1/1	1/2	1/2	1/2	2/2	2/2	2/2	2/2	1/4	1/4	1/4	1/6	1/6	1/6	1/6	1/8	1/8	1/8	1/8	1/8	1/8	2/6	2/6
	□14	2/1	2/1	1/2	2/2	2/2	2/2	2/2	2/2	1/6	1/6	1/6	1/6	1/8	1/8	1/8	1/8	1/8	1/8	1/8	2/6	2/6	2/6	2/6
	□16	2/1	2/1	2/2	2/2	2/2	2/2	2/2	2/3	2/3	2/3	2/3	1/6	1/6	1/8	1/8	1/8	1/8	1/8	1/8	2/6	2/6	2/6	2/7
	□18	2/1	2/1	2/2	2/2	2/2	2/2	2/3	2/3	2/3	2/3	2/3	1/6	1/8	1/8	1/8	1/8	1/8	2/6	2/6	2/6	2/6	2/7	2/8
	□20	2/1	2/2	2/2	2/2	2/2	2/3	2/3	2/3	2/3	2/3	2/3	2/4	1/8	1/8	1/8	1/8	2/6	2/6	2/6	2/6	2/7	2/8	2/8
	□22	2/1	2/2	2/2	2/2	3/2	2/3	2/3	2/3	2/3	2/3	2/3	2/4	1/8	1/8	1/8	2/6	2/6	2/6	2/6	2/7	2/8	2/8	2/8
	□24	2/1	2/2	2/2	2/2	3/2	2/3	2/3	2/3	2/3	2/3	2/3	2/4	2/4	1/8	1/8	2/6	2/6	2/6	2/6	2/7	2/8	2/8	2/8
	□30	4/1	2/2	3/2	3/2	3/2	3/2	3/2	2/4	2/4	2/4	2/4	2/4	2/4	2/6	2/6	2/6	2/7	2/7	2/8	2/8	2/8	2/8	2/8
	□36	4/1	2/2	3/2	3/2	3/2	3/2	4/2	4/2	4/2	4/2	2/4	2/4	2/6	2/6	2/6	2/7	2/8	2/8	2/8	2/8	2/8	2/8	2/8
	□42	4/1	3/2	3/2	3/2	4/2	4/2	4/2	4/2	4/2	4/2	2/6	2/6	2/7	2/7	2/8	2/8	2/8	2/8	2/8	2/8	2/8	2/8	2/8
□48	4/1	3/2	3/2	3/2	4/2	4/2	4/2	4/2	4/2	4/2	3/4	2/6	2/7	2/8	2/8	2/8	2/8	2/8	2/8	2/8	2/8	2/8	2/8	
□54	4/1	3/2	3/2	4/2	4/2	4/2	4/2	4/2	3/4	3/4	3/4	2/7	2/8	2/8	2/8	2/8	2/8	2/8	4/4	2/8	2/8	2/8	2/8	
□60	4/1	3/2	4/2	4/2	4/2	4/2	4/2	3/4	3/4	3/4	4/4	4/4	2/8	2/8	2/8	4/4	4/4	4/4	4/4	4/4	2/8	2/8	2/8	
□66	4/1	3/2	4/2	4/2	4/2	4/2	4/3	3/4	3/4	3/4	4/4	4/4	4/4	2/8	2/8	4/4	4/4	4/4	4/4	4/4	4/4	2/8	2/8	
□72	4/1	3/2	4/2	4/2	4/2	4/2	4/3	3/4	3/4	3/4	4/4	4/4	4/4	2/8	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	2/8	
□84	4/1	4/2	4/2	4/2	4/2	4/2	4/3	3/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	
□96	4/1	4/2	4/2	4/2	4/2	4/2	4/3	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	
□108	4/1	4/2	4/2	4/2	4/2	4/2	4/3	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	
□120	4/1	4/2	4/2	4/2	4/2	4/2	4/3	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	

The P+ sensor density will typically result in an installed accuracy of ±3% of reading or better over the entire calibrated range of airflow rates when locations meet or exceed EBTRON's suggested guidelines.

Installed accuracy is the combined uncertainty of the measuring device and the sampling uncertainty that results from having a finite number of sensor nodes in a velocity profile created by duct disturbances up and downstream of the measurement location.

RECTANGULAR PROBE POSITIONING IN DUCT

# of Probes	a	b
□ 1	1/2 X	NA
□ 2	1/4 X	1/2 X
□ 3	1/6 X	1/3 X
□ 4	1/8 X	1/4 X

b = distance from probe 1 to 2, 2 to 3 and 3 to 4

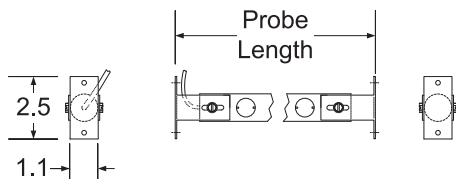
ROUND PROBE POSITIONING IN DUCT

# of Probes	a
□ 1	NA
□ 2	90°
□ 3	60°
□ 4	45°

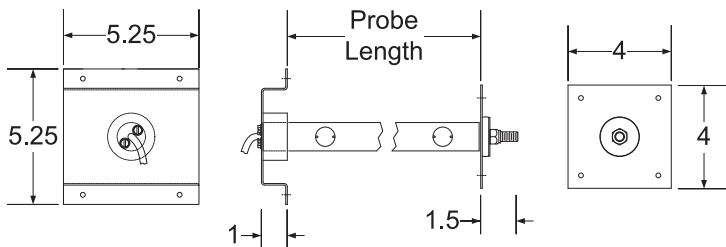
a = angle from probe 1 to 2, 2 to 3 and 3 to 4
Note: # probes=2 shown for illustration

PROBE MOUNTING STYLE

INTERNAL - 304 stainless steel brackets

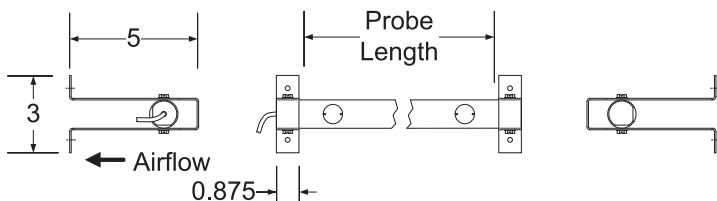


INSERTION - 304 stainless steel brackets



Probes < 18 in. are 1/4 in. undersized and do not have a terminal stud

STAND-OFF - 304 stainless steel brackets



Overall tube length is 2 in. > ordered probe length

TRANSMITTER

<input checked="" type="checkbox"/> GTC116	Two isolated analog output signals (field selectable/scalable 0-5/0-10 VDC or 4-20mA) plus one isolated RS-485 network connection (field selectable BACnet MS/TP or Modbus RTU)
<input type="checkbox"/> GTM116	Two isolated analog output signals (field selectable/scalable 0-5/0-10 VDC or 4-20mA) plus one isolated Ethernet network connection (simultaneously supported BACnet Ethernet, BACnet IP, Modbus TCP or TCP/IP)
<input type="checkbox"/> GTL116	One isolated Lonworks Free Topology network connection
<input type="checkbox"/> GTD116	One USB connection for thumb drive data-logging of sensor airflow and temperature over specified time intervals
<input type="checkbox"/> EB-Link (/EL opt.)	Interface for handheld EB-Link Reader (provided separately)

24 VAC TRANSFORMER SELECTION

For information only - Transformer supplied by

TOTAL SENSORS							
<input type="checkbox"/> 2	<input type="checkbox"/> 4	<input type="checkbox"/> 6	<input type="checkbox"/> 8	<input type="checkbox"/> 10	<input type="checkbox"/> 12	<input type="checkbox"/> 14	<input type="checkbox"/> 16
13 VA	14 VA	15 VA	16 VA	17 VA	18 VA	19 VA	20 VA

PROBE TUBE MATERIAL

<input checked="" type="checkbox"/> Stand-ard	Gold anodized 6063 aluminum (1.1" dia.)
<input type="checkbox"/> /SS option	316 stainless steel (1.125" dia.)

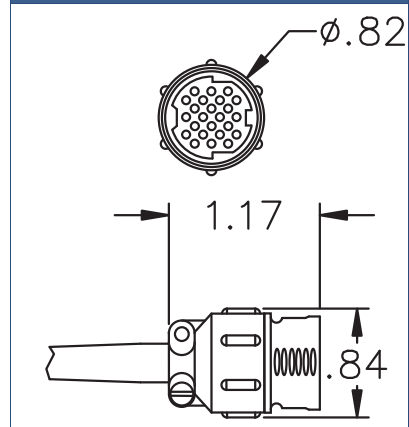
CABLE TYPE

<input checked="" type="checkbox"/> FEP Plenum Rated (std.)
<input type="checkbox"/> Other _____

CABLE LENGTH

<input checked="" type="checkbox"/> 10 ft. (std.)	<input type="checkbox"/> 30 ft.
<input type="checkbox"/> 15 ft.	<input type="checkbox"/> 40 ft.
<input type="checkbox"/> 20 ft.	<input type="checkbox"/> 50 ft. (max.)
<input type="checkbox"/> 25 ft.	<input type="checkbox"/> Custom ___ ft.

CONNECTOR PLUG DIMENSIONS



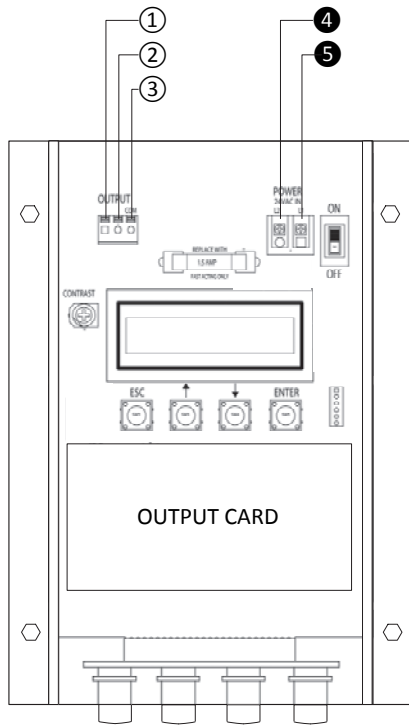
TRANSMITTER CONNECTOR PLATE

# OF PROBES	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4
MAX. SENS/PROBE	8	4		
TYPE	A	B		
RECEPTACLES	2	4		

CONNECTORS & INTERCONNECTS

- Gold plated plug/receptacle pins
- Gold plated PCB edge card fingers
- Gold plated PCB interconnects
- ENIG plated printed circuit boards

○ MAIN CIRCUIT BOARD CONNECTIONS



ANALOG OUTPUT

Models	<input checked="" type="checkbox"/> GTC116-P	
	<input type="checkbox"/> GTM116-P	
	+	Common
Airflow	①	③
Temperature or Alarm	②	③

NETWORK CONNECTIONS

Models	<input type="checkbox"/> GTL116-P	
	Net +	Net -
Lon Free Top.	①	②

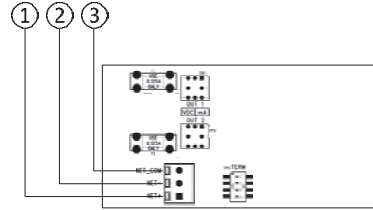
24 VAC POWER CONNECTIONS

Models	<input checked="" type="checkbox"/> ALL	
	L2 (gnd.)	L1 (hot)
24 VAC	④	⑤

○ OUTPUT CARD CONNECTIONS

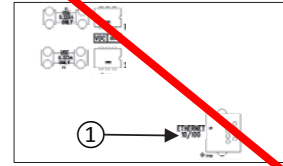
NETWORK CONNECTIONS

Models	<input checked="" type="checkbox"/> GTC116-P		
	Net +	Net -	Net Com
RS-485	①	②	③



NETWORK CONNECTIONS

Models	<input type="checkbox"/> GTM116-P	
Ethernet	① RJ-45 (10/100)	





ENCLOSURES

NON-METALLIC ENCLOSURES H AND G SERIES

DESCRIPTION

Premium H and G Series enclosures have hinged covers that close with stainless steel latches and are designed for use in any electrical application requiring a sturdy enclosure.

FEATURES

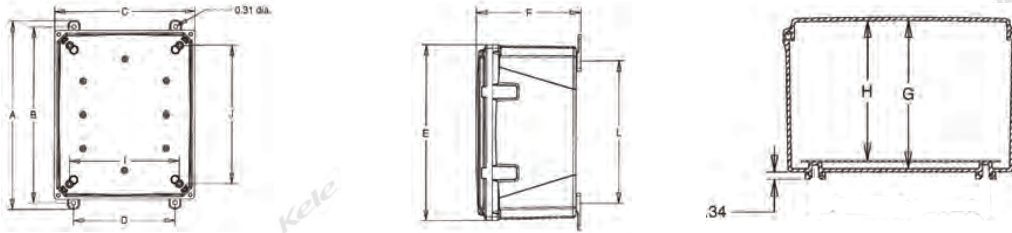
- NEMA 4X
- Polycarbonate construction
- Stainless steel latches
- Light gray gloss finish
- Gasketed opaque & lockable cover
- Unique Integra Panel Suspension System
- Multiple bosses for easy installation of devices or DIN rails
- UL-50 / c-UL listed, File #E207562



5

ENCLOSURES

DIMENSIONS/ORDERING INFORMATION



Enclosure Model	Dimensions in (cm)											Aluminum Panel
	Weight	A	B	D	C	E	F	G	H	I	J	
H6064HLL	2.0 (0.91)	8.07 (20.5)	7.13 (18.11)	3.63 (9.22)	7.36 (18.68)	6.47 (16.43)	5.47 (13.89)	4.75 (12.07)	4.25 (10.80)	4.25 (10.80)	4.25 (10.80)	ABP66
H6064HCLL	2.0 (0.91)	8.07 (20.5)	7.13 (18.11)	3.63 (9.22)	7.36 (18.69)	6.47 (16.43)	5.47 (13.89)	4.75 (12.07)	4.25 (10.80)	4.25 (10.80)	4.25 (10.80)	ABP66
H8064HLL	2.5 (1.2)	9.75 (24.77)	8.75 (22.23)	4.00 (10.16)	7.36 (18.69)	8.44 (21.44)	5.35 (13.59)	4.75 (12.07)	4.25 (10.80)	4.25 (10.80)	6.25 (15.88)	ABP86
H8064HCLL	2.5 (1.2)	9.75 (24.77)	8.75 (22.23)	4.00 (10.16)	7.36 (18.69)	8.44 (21.44)	5.35 (13.59)	4.75 (12.07)	4.25 (10.80)	4.25 (10.80)	6.25 (15.88)	ABP86
H8084HLL	3.0 (1.4)	10.44 (26.52)	9.50 (24.13)	5.25 (13.34)	9.31 (23.65)	8.44 (21.44)	5.47 (13.89)	4.75 (12.07)	4.25 (10.80)	6.25 (15.88)	6.25 (15.88)	ABP88
H8084HCLL	3.0 (1.4)	10.44 (26.52)	9.50 (24.13)	5.25 (13.34)	9.31 (23.65)	8.44 (21.44)	5.47 (13.89)	4.75 (12.07)	4.25 (10.80)	6.25 (15.88)	6.25 (15.88)	ABP88
H10082HLL	3.0 (1.4)	11.06 (28.09)	10.12 (25.70)	9.54 (24.23)	8.54 (21.69)	9.54 (24.23)	3.51 (8.92)	3.21 (8.15)	3.21 (8.15)	6.25 (15.88)	6.25 (15.88)	ABP108
H10082HCLL	3.0 (1.4)	11.06 (28.09)	10.12 (25.70)	9.54 (24.23)	8.54 (21.69)	9.54 (24.23)	3.51 (8.92)	3.21 (8.15)	3.21 (8.15)	6.25 (15.88)	6.25 (15.88)	ABP108
H10084HLL	3.0 (1.4)	12.07 (33.66)	11.13 (28.27)	5.63 (14.30)	9.36 (23.77)	10.54 (26.77)	5.47 (13.89)	4.75 (12.07)	4.25 (10.80)	6.25 (15.88)	8.25 (20.96)	ABP108
H10084HCLL	3.5 (1.6)	12.07 (33.66)	11.13 (28.27)	5.63 (14.30)	9.36 (23.77)	10.54 (26.77)	5.47 (13.89)	4.75 (12.07)	4.25 (10.80)	6.25 (15.88)	8.25 (20.96)	ABP108
H10086HLL	3.5 (1.6)	12.07 (30.66)	11.13 (28.27)	5.63 (14.30)	9.36 (23.77)	10.54 (26.77)	7.47 (18.97)	6.75 (17.15)	6.25 (15.88)	6.25 (15.88)	8.25 (20.96)	ABP108
H10086HCLL	4.0 (1.8)	12.07 (30.66)	11.13 (28.27)	5.63 (14.30)	9.36 (23.77)	10.54 (26.77)	7.47 (18.97)	6.75 (17.15)	6.25 (15.88)	6.25 (15.88)	8.25 (20.96)	ABP108
H12104HLL	4.0 (1.8)	13.69 (34.77)	12.75 (32.39)	8.00 (20.32)	11.36 (28.85)	12.54 (31.85)	5.35 (13.59)	4.71 (11.96)	4.23 (10.74)	8.25 (20.96)	10.25 (26.04)	ABP1210
H12104HCLL	4.0 (1.8)	13.69 (34.77)	12.75 (32.39)	8.00 (20.32)	11.36 (28.85)	12.54 (31.85)	5.35 (13.59)	4.71 (11.96)	4.23 (10.74)	8.25 (20.96)	10.25 (26.04)	ABP1210
H12106HLL	4.5 (2.0)	14.07 (35.74)	13.13 (33.35)	7.63 (19.38)	11.36 (28.85)	12.54 (31.85)	7.35 (18.67)	6.71 (17.04)	6.23 (15.82)	8.25 (20.96)	10.25 (26.04)	ABP1210
H12106HCLL	4.5 (2.0)	14.07 (35.74)	13.13 (33.35)	7.63 (19.38)	11.36 (28.85)	12.54 (31.85)	7.35 (18.67)	6.71 (17.04)	6.23 (15.82)	8.25 (20.96)	10.25 (26.04)	ABP1210
H141206HLL	6.0 (2.7)	15.69 (39.85)	14.75 (37.47)	10.00 (25.40)	13.36 (33.93)	14.58 (37.03)	7.38 (18.75)	6.66 (19.62)	6.18 (15.70)	10.25 (26.04)	12.25 (31.12)	ABP1412
H141206HCLL	6.0 (2.7)	15.69 (39.85)	14.75 (37.47)	10.00 (25.40)	13.36 (33.93)	14.58 (37.03)	7.38 (18.75)	6.66 (19.62)	6.18 (15.70)	10.25 (26.04)	12.25 (31.12)	ABP1412
H161407HLL	9.0 (4.1)	17.69 (44.93)	16.75 (42.55)	12.00 (30.48)	15.00 (38.40)	16.70 (42.42)	8.38 (21.29)	8.38 (21.29)	7.18 (18.24)	12.25 (31.12)	14.25 (36.20)	ABP1614
H161407HCLL	9.0 (4.1)	17.69 (44.93)	16.75 (42.55)	12.00 (30.48)	15.00 (38.40)	16.70 (42.42)	8.38 (21.29)	8.38 (21.29)	7.18 (18.24)	12.25 (31.12)	14.25 (36.20)	ABP1614
H181610HLL	14.0 (6.4)	19.69 (50.01)	18.75 (47.63)	14.00 (35.56)	17.64 (44.81)	18.91 (48.03)	11.50 (29.22)	11.50 (29.21)	10.16 (25.81)	14.25 (36.20)	16.25 (41.28)	ABP1816
H181610HCLL	14.0 (6.4)	19.69 (50.01)	18.75 (47.63)	14.00 (35.56)	17.64 (44.81)	18.91 (48.03)	11.50 (29.22)	11.50 (29.21)	10.16 (25.81)	14.25 (36.20)	16.25 (41.28)	ABP1816
G242410	31 (14.1)	27.16 (689.8)	25.94 (659)	18 (45.7)	27.81 (706.3)	25.25 (641)	11.50 (292)	11.50 (292)	10.61 (269.5)	19.25 (489)	19.25 (489)	ABP-2424

† Add P to the end of the H Series part number to order optional perf panel.

264

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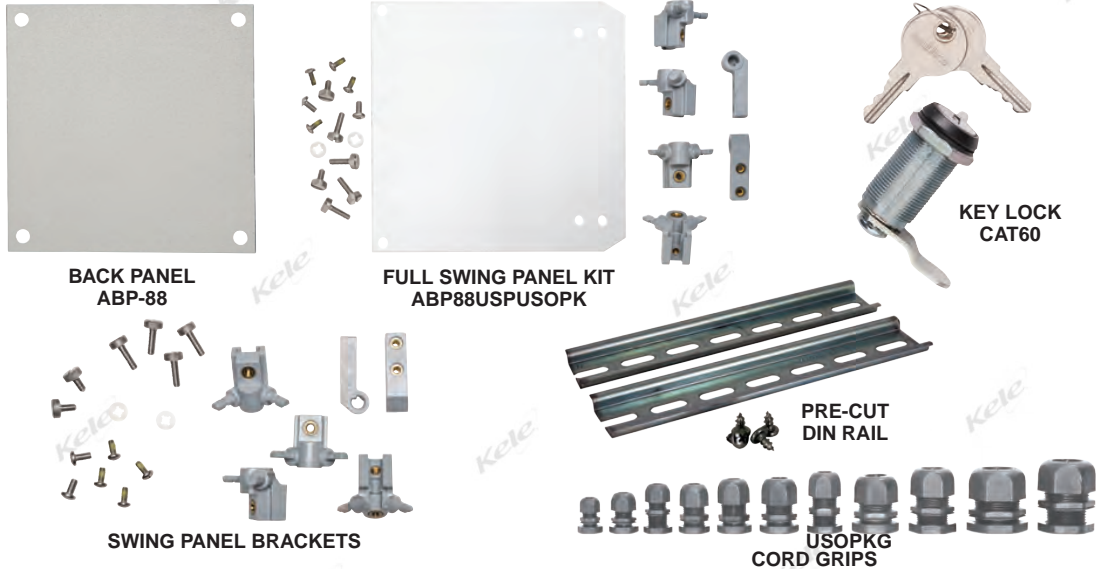
March 2014

ENCLOSURES

NON-METALLIC ENCLOSURES H AND G SERIES



ACCESSORIES



5

ENCLOSURES

ACCESSORIES

MODEL	DESCRIPTION		
ABP108	Aluminum panel for 10"x8" enclosure	DIN12	DIN Rail Kit for 12" wide enclosure (2 rails, 4 screws)
ABP1082	Aluminum panel for 10"x8"x2" enclosure	DIN14	DIN Rail Kit for 14" wide enclosure (2 rails, 4 screws)
ABP108USPUSOPK	Aluminum swing panel Kit for 10"x8"	DIN16	DIN Rail Kit for 16" wide enclosure (2 rails, 4 screws)
ABP1210	Aluminum panel for 12"x10" enclosure	DIN18	DIN Rail Kit for 18" wide enclosure (2 rails, 4 screws)
ABP1210USPUSOPK	Aluminum swing panel Kit for 12"x10"	DIN6	DIN Rail Kit for 6" wide enclosure (2 rails, 4 screws)
ABP1412	Aluminum panel 14"x12" enclosure	DIN8	DIN Rail Kit for 8" wide enclosure (2 rails, 4 screws)
ABP1412USPUSOPK	Aluminum swing panel Kit for 14"x12"	ICGLTF13.5	PC hub cord grip w/ lock nut (0.236-0.472)
ABP1614	Aluminum panel for 16"x14" enclosure	SP10I	Screw Pack (10 pcs)
ABP1614USPUSOPK	Aluminum swing panel Kit for 16"x14"	USPOKB	Swing panel kit - Black
ABP1816	Aluminum panel for 18"x16" enclosure	USPOKG	Swing panel kit - Gray
ABP1816USPUSOPK	Aluminum swing panel Kit for 18"x16"	ABP2424	Aluminum back panel/swing panel only for G242410 Models
ABP66	Aluminum panel for 6"x6" enclosure	ABP2424GSOPK	Aluminum 24" back panel/swing panel and 24" hinge for swing panel for G242410 Models
ABP66USPUSOPK	Aluminum swing panel Kit for 6"x6"	ASP2424	Aluminum side panel only for Genesis G242410 Models
ABP86	Aluminum panel for 8"x6" enclosure	GMMR10 Kit	Multi-Max Rails with screws - 10" depth (set of 4 with screws) for G242410 Models
ABP86USPUSOPK	Aluminum swing panel Kit for 8"x6"	GPP Kit	Panel Pad kit - (four panel brackets that mount on Multi-max rail) for G242410 Models
ABP88	Aluminum panel for 8"x8" enclosure	GSOPK24	24" aluminum hinge for swing panel (use standard back panel as swing panel) for G242410 Models
ABP88USPUSOPK	Aluminum swing panel Kit for 8"x8"		
CAT60	Keylock		
CGLTF11	PC hub cord grip w/ lock nut (0.217-0.394)		
CGLTF16	PC hub cord grip w/ lock nut (0.315-0.551)		
CGLTF21	PC hub cord grip w/ lock nut (0.472-0.709)		
CGLTF29	PC hub cord grip w/ lock nut (0.669-0.984)		
CGLTF7	PC hub cord grip w/ lock nut (0.177-0.256)		
CGLTF9	PC hub cord grip w/ lock nut (0.197-0.315)		
CGNPT1	NPT cord grip w/ lock nut (0.669-0.984)		
CGNPT1/2	NPT cord grip w/ lock nut (0.236-0.472)		
CGNPT3/4	NPT cord grip w/ lock nut (0.433-0.709)		
CGNPT3/8	NPT cord grip w/ lock nut (0.197-0.315)		
DIN10	DIN Rail Kit for 10" wide enclosure (2 rails, 2 screws)		

March 2014

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265



HUMIDITY

3% WALL, DUCT AND OSA HUMIDITY TRANSMITTERS H_30K SERIES

DESCRIPTION

The **Kele Series H_30K Humidity Transmitters** have been specifically designed for use with HVAC/BAS applications. These instruments measure relative humidity from 5 to 90% with 3% accuracy and produce a two wire, 4-20mA linear output. All can come equipped with an optional passive RTD or thermistor. The duct and OSA versions may also be fitted with a 4-20mA temperature transmitter.



OPERATION

The temperature compensated circuitry converts the relative humidity into a 4-20 mA signal. The optional temperature sensors, RTDs or thermistors, offer direct connection to most automation systems. On duct and OSA units, an optional 4-20 mA temperature transmitter may also be employed and is rangeable from -30° to 250°F (-34° to 121°C).

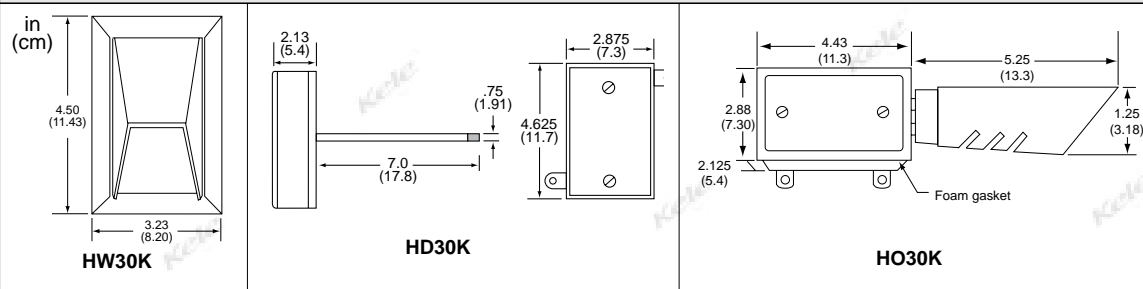
FEATURES

- **3% accuracy (5% to 90%)**
- **Two wire, 4-20mA RH output**
- **Optional temperature thermistor**
- **Optional temperature RTD**
- **Optional temperature 4-20mA (Duct or OSA)**

9

HUMIDITY

DIMENSIONS



SPECIFICATIONS

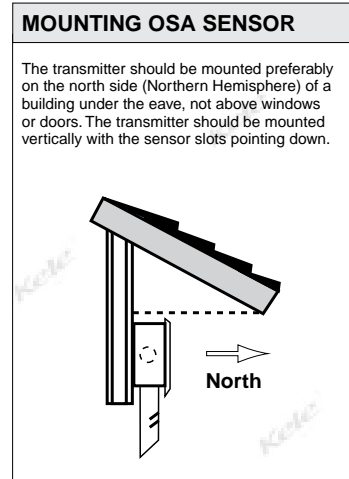
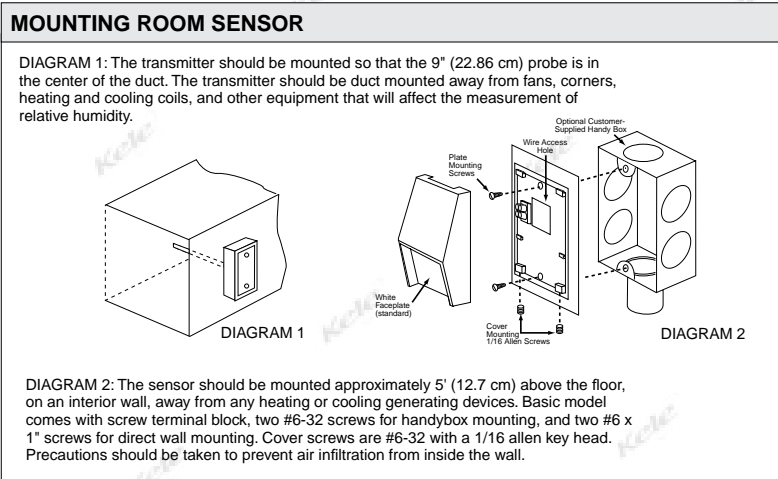
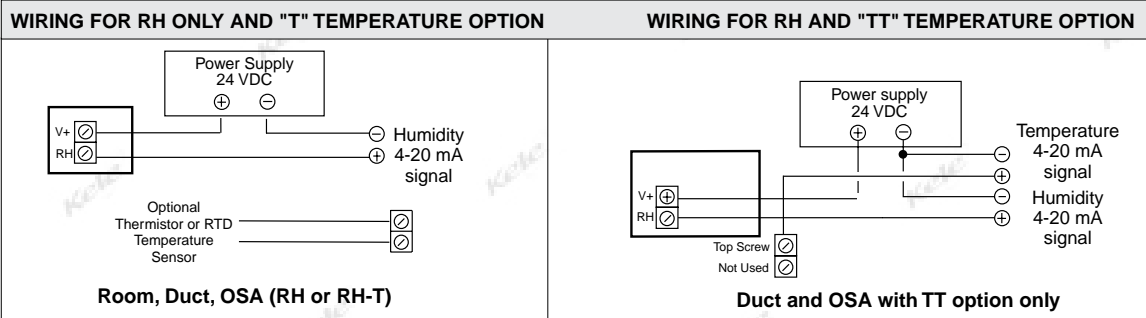
Accuracy	3% RH @ 73°F (23°C) from 5% to 90%; (0-5% & 90%-100%) add 4% typically <0.5% drift per year	Sensor Protection	Sintered filter (duct and OSA)
Stability		Operating Humidity	0-100% RH non-condensing
Thermal Effect	0.07% per °F	Operating Temperature	-20° to 158°F (-29° to 70°C)
Supply Voltage	9.5-28 VDC	Enclosure	Beige plastic (room), weather resistant cast aluminum (duct and OSA)
Signal Output	RH: 4-20 mA Temperature: 4-20 mA, optional thermistor, RTD	Wiring Terminations	Terminal block (22 to 16 AWG)
Maximum Output Impedance	725Ω @ 24VDC (Supply voltage - 9.5V) / 0.02	Weight	
Measurement Range		Wall	0.3 lb (0.09 kg)
RH	0-100%	Duct	1.14 lb (0.52 kg)
Temperature	-20° to 140°F (-29° to 60°C) (see ordering information)	OSA	1.2 lb (0.54 kg)
		Approvals	RoHs
		Warranty	1 year

530

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March 2014



ORDERING INFORMATION

MODEL	DESCRIPTION
HW30K	3% beige room humidity transmitter, 4-20 mA output
HD30K	3% duct-mount humidity transmitter, 4-20 mA output
HO30K	3% OSA-mount humidity transmitter, 4-20 mA output
OPTIONS (Temperature Sensors or Transmitters)	
--	No temperature sensor
T3	10,000Ω thermistor @ 77°F (25°C), Type III
T21	2252Ω thermistor @ 77°F (26°C), Type II
T22	3000Ω thermistor @ 77°F (26°C), Type II
T24	10,000Ω thermistor @ 77°F (25°C), Type II
T27	100,000Ω thermistor @ 77°F (26°C), Type II
T42	20,000Ω thermistor @ 77°F (26°C), Type IV
T63	1000Ω nickel SS flush mounted plate RTD @ 70°F (26°C), Type III (yellow leads)
T81	1000Ω RTD @ 32°F (0°C), 385 platinum curve
T85	1000Ω 385 platinum RTD
T91	1000Ω 375 platinum RTD
TT-2	-20° to 140°F (-29° to 60°C) transmitter, 4-20 mA (duct and OSA only)
TT-3	0° to 100°F (-18° to 38°C) transmitter, 4-20 mA (duct and OSA only)
XN1	NIST 1 point, 30% (Humidity only)
XN2	NIST 2 point, 30% and 50% (Humidity only)
XN3	NIST 3 point, 30%, 50% and 70% (Humidity only)

Example: HD30K-T3 Duct-mount humidity sensor with 10 kΩ Type III temperature sensor

DCPA-1.2
DCP-1.5-W

RELATED PRODUCTS

Power supply, 120 VAC IN to 24 VAC/24 VDC OUT
Power supply, 24 VAC IN to 24 VDC OUT

PAGE

994
995

LIMITED WARRANTY

The DS-224 is warranted against defects in workmanship and materials for two years from date of sale. This warranty does not apply to damage resulting from accident, misuse, or alteration nor where connected voltage is more than 10% above the configured operating voltage, nor to equipment improperly installed or wired or maintained in violation of this Owner's Manual. No other written or oral warranty applies. No employee, agent, dealer or other person is authorized to give any warranties on behalf of ASE.

The customer shall be responsible for all costs incurred in the removal or reinstallation and shipping of the product for repairs. Within the limitations of this warranty, inoperative units should be returned, freight prepaid, to ASE, and we will repair or replace, at our option, at no charge to you with return freight paid by ASE. It is agreed that such repair or replacement is the exclusive remedy available from ASE and that ASE IS NOT RESPONSIBLE FOR DAMAGES OF ANY KIND, INCLUDING INCIDENTAL AND CONSEQUENTIAL DAMAGE. Some states do not allow the exclusion or limitation of incidental or consequential damages so the above exclusion may not apply to you. The warranty gives you specific legal rights, and you may also have other rights which vary from state to state.



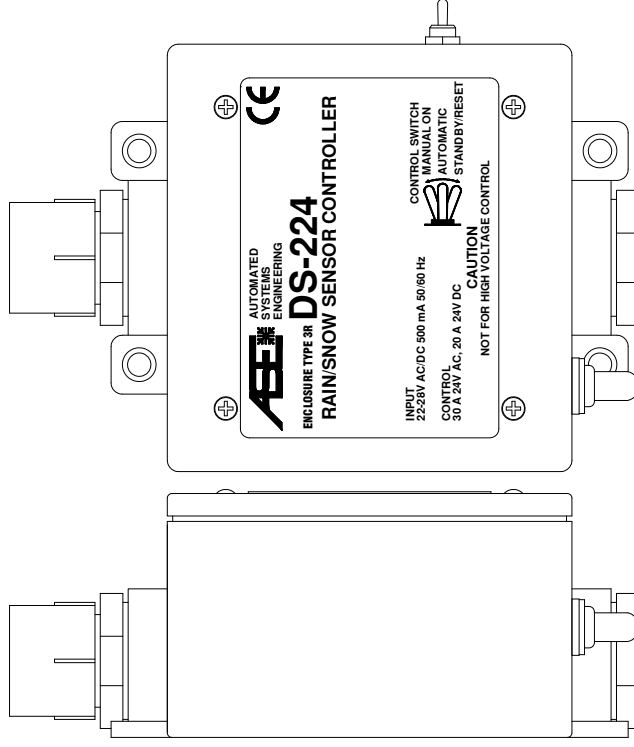
AUTOMATED SYSTEMS ENGINEERING, INC.
2519 E SAINT VRAIN ST
COLORADO SPRINGS, COLORADO 80909
PHONE: 719-599-7477 FAX: 719-599-7482
Visit us on the Internet at: www.goase.com



CAUTION: Read all instructions carefully before installation.
Save this Installation Manual for future reference.

DS-224

RAIN/SNOW SENSOR CONTROLLER INSTALLATION MANUAL



Manufactured By



2519 East Saint Vrain St Colorado Springs, Colorado 80909

General Safety Instructions

1. THIS UNIT SHOULD BE INSTALLED, OPENED, AND REPAIRED BY QUALIFIED PERSONNEL ONLY!

- To avoid shock hazard do not open the front cover with power connected to the DS-224 or any controlled equipment.
- Limit input voltage to 22-28 VAC/VDC.
- Replace fuse F1 with a 2 Amp 32 V or 250 V 3AG fast acting fuse ONLY.

Selecting a Mounting Location for the DS-224

The interleaved grid on the top of the DS-224 is the precipitation sensor or "moisture grid." The rubber "boot" protruding from the bottom of the enclosure is the temperature sensor. For reliable rain and snow detection the unit must be mounted in a location that exposes the moisture grid to a clear view of the sky. The unit should not be mounted directly under eaves or overhangs. It should not be mounted so close to the ground that it may become buried in snow. For proper temperature detection the DS-224 must be mounted outdoors, away from furnace vents, dryer vents, and other sources of heat. Note that, when powered, the DS-224 moisture grid will always remain hot. This is normal. This allows the grid to continuously melt snow and evaporate both rain and snow from the grid.

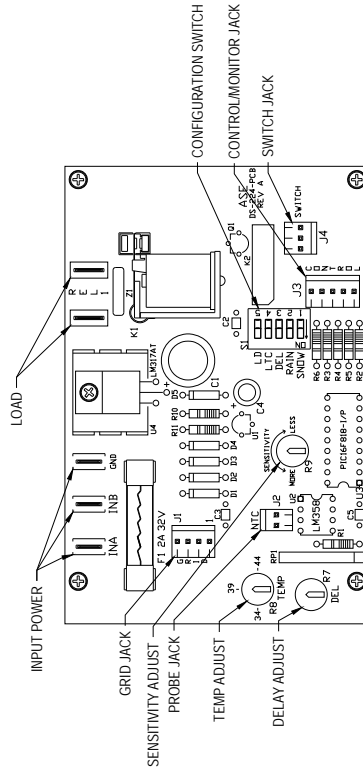
The DS-224 can be mounted by screwing the base conduit hub onto an appropriate size free-standing conduit or by using the mounting holes in each corner of the enclosure.

DO NOT DRILL HOLES THROUGH THE ENCLOSURE FOR MOUNTING!

This can allow water into the enclosure causing a potential shock or fire hazard. It is recommended that a weatherproof conduit or junction box be mounted below the DS-224 for termination of the power and load signals to the building wiring.

ALWAYS USE CARE WHEN REPLACING THE ENCLOSURE FRONT COVER!

Be sure the front cover gasket is not pinched or rolled. Do not overtighten the front cover screws.



External Control/Monitor Operation

An external control/monitor jack is provided on the DS-224. Order the optional CS-1 control/monitor cable to access this feature. Connecting Black to White will activate the "Manual On" function. Connecting Green to White will activate the "Standby/Reset" function. The Red/Orange leads are connected to an internal low power monitor relay. This relay, rated at 24 VAC/VDC at 400 ma, will close with the load relay and can be used to externally monitor activation of the sensor.

Pin	Color	Function
1	Green	Standby/Reset
2	Black	Manual On
3	Orange	Deice On Mon
4	Red	Deice On Mon
5	White	Return

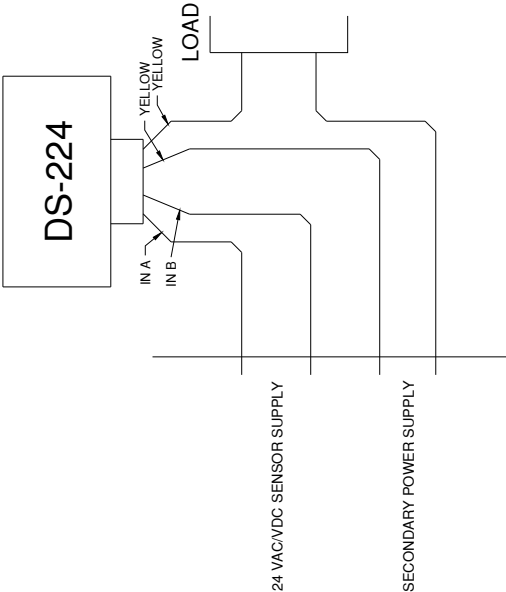
Preseason Snow Detection Testing

It is always a good idea to test the operation of the DS-224 prior to the winter season. Procure some clean water and, if the outdoor temperature is above the trigger point, a can of spray component cooler (Radio Shack Part #64-4321 or equivalent.) Clean the moisture grid following the procedure outlined above and allow it to dry. Apply power to the DS-224 and drip some of the water onto the moisture grid, and then spray the temperature sensor protruding from the base of the enclosure with the component cooler. Once the temperature sensor has reached the trigger point with water still present on the grid the DS-224 will activate. The user should hear the internal control relay close. Proper operation has been confirmed. Allow the grid to dry completely. To clear the Delay-Off timer place the override switch into "Standby/Reset", and then back to the "Automatic" position.

Need Indoor Monitoring & Control?
Take a Look at the ASE CDP-2



Compatible with the DS-224
Simple Installation & Operation at a Competitive Price
Visit www.goase.com for more information



24VACVDC Sensor Supply, Secondary Voltage Out

These are just some of the possible wiring schemes that can be used to connect the DS-224 to your load for control. Remember, these are only suggestions. **You should always check with a qualified electrician to insure conformance with local electrical codes!**

Moisture Grid Maintenance & Replacement

It is recommended that the DS-224 be powered down and the grid wiped clean with clear water at least once every 4 months. Heavy deposits may be removed using Scotch-Brite. However, after a number of years, the corrosive elements left behind when water is evaporated out of the moisture grid will eventually damage the grid rings. The moisture grid can be easily replaced by ordering and installing an MG-4 "Moisture Grid Assembly" and following the procedure below:

THIS PROCEDURE SHOULD ONLY BE PERFORMED BY QUALIFIED PERSONNEL!

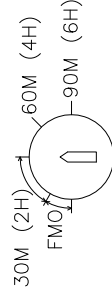
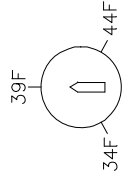
Open all power and load supplies connected to the DS-224. Open the front cover and remove the moisture grid cable from the Grid Jack. While holding the reducing bushing, unscrew and remove the old moisture grid. Install the supplied thread sealing tape to the threads of the new moisture grid, place the new grid into the top hole and screw the assembly into the reducing bushing. Tighten the grid hand tight plus 1/4 turn. This will properly seat the rubber sealing ring. Reconnect the new cable to the Grid Jack. Confirm that the four connector pins are properly aligned with the jack. Close the front cover, confirming that the front cover gasket is properly sealed. Reapply power.

ALWAYS USE CARE WHEN REPLACING THE ENCLOSURE FRONT COVER!

Be sure the front cover gasket is not pinched or rolled. Do not overtighten the front cover screws.

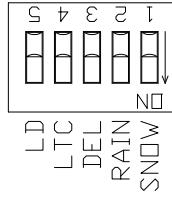
Setting the Configuration Switches and Adjustments

The following table outlines the operating modes for the DS-224 and explains the functions of the adjustments. Trigger temp (TT) is adjustable from 34°F-44°F using the "Temp Adjust" control. When ambient air temperature (AT) is below this trigger point precipitation is assumed to be snow. When above this temperature, precipitation is assumed to be rain. The SNOW switch will cause the sensor to activate when snow is detected. The RAIN switch will cause the sensor to activate when rain is detected.

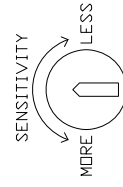


The DEL configuration switch activates the "Delay Off" drying cycle timer on the DS-224. The timer allows the DS-224 to dry the heated surface through evaporation once precipitation has stopped. The drying cycle reduces the chance of moisture left behind refreezing into ice. The Long Delay (LD) configuration switch determines the time span of the drying cycle. LD off sets a 30-90 minute span. LD on sets a 2-6 hour span. This timer is restarted by each precipitation detection. Therefore, the DS-224 will continue to operate as long as precipitation is detected, then for the Delay Off period once precipitation has stopped. All "sensor" modes (DEL off) provide a 2 minute closure to reduce cycling of an external controller. When in "controller" mode (DEL on) the Delay Off time can be adjusted from 30-90 minutes (LD Off) or 2-6 hours (LD On) using the "Delay Adjust" control. Note the "Forced Manual On" function at the low end of the Delay Adjust control. The relay will close when this area is entered and open when exited. Only use the "Forced Manual On" function for testing. Never leave the Delay Adjust control near the "Forced Manual On" area during normal operation.

The Low Temperature Cutoff (LTC) option is typically used on snow melting systems with limited output capacity. If selected, the sensor will not trigger if precipitation is initially detected below 15°F. However, if the deicing system has been activated, precipitation continues, and the ambient temperature drops below 15°F, LTC will be ignored. This assures that water on the surface from melting snow will not immediately refreeze into ice as a result of deactivating the deicing system.



The DS-224 precipitation sensor can detect even a single snow flake or rain drop. However, if the DS-224 is mounted in an area susceptible to high winds, dripping condensation, or blowing ground snow, nuisance triggering of the sensor may occur. While proper placement is the best remedy, the Sensitivity control can also be used to reduce nuisance triggering. An internal timer checks the precipitation sensor for moisture once per second and keeps a running count of the number of continuous seconds the grid is triggered. The highest sensitivity setting (forward Less) requires a full 4 minutes of detection before the unit triggers. If a trace amount of snow blows onto the grid from a drift or overhang it will likely be melted and evaporated within 1-2 minutes. Similarly, a very light snowfall may also clear quickly from the grid. If these conditions should be ignored by the sensor the Sensitivity control can be adjusted as required. However, to prevent non-triggering during a true event, it is recommended that the user start at highest sensitivity (More), then adjust while monitoring operation over time.



POWER MUST BE CYCLED FOR CONFIGURATION SWITCH CHANGES TO TAKE EFFECT

Recommended Switch Settings by Function

Function	Trigger	LD Off	LD On	LTC	DEL	RAIN	SNOW
Snow sensor w/o LTC	TT>AT	2 Min	2 Min	OFF	OFF	OFF	ON
Snow sensor w/LTC	TT>AT>15°F	2 Min	2 Min	ON	OFF	OFF	ON
Snow controller w/o LTC	TT>AT	30-90 Min	2-6 Hr	OFF	ON	OFF	ON
Snow controller w/LTC	TT>AT>15°F	30-90 Min	2-6 Hr	ON	ON	OFF	ON
Precipitation sensor	Not Used	2 Min	2 Min	X	OFF	ON	ON
Precipitation controller	Not Used	30-90 Min	2-6 Hr	X	ON	ON	ON
Rain sensor	AT>TT	2 Min	2 Min	X	OFF	ON	OFF
Rain controller	AT>TT	30-90 Min	2-6 Hr	X	ON	ON	OFF

Fine Adjustment for Efficient Operation

The DS-224 is shipped with the TEMP and DEL adjustments in the center position, representing 39°F (3.9°C) and 30 minutes of Delay-Off time respectively. The Sensitivity control is set for highest sensitivity. Depending on local conditions the user may find that fine adjustment of the controls may provide more satisfactory operation. If the sensor does not trigger during very wet snows the trigger temperature may need to be adjusted higher. Conversely, if the user notices false triggers during cold rains that do not freeze, the trigger temperature may need to be lowered. Locations susceptible to blowing ground snow or snow falling from eaves or trees may benefit from a lower sensitivity adjustment. The Delay-Off time can also be adjusted or the range expanded using the LD configuration switch to provide clean melt-off without excessive running time. Fine adjustment can both save operating expense and provide more reliable operation. However, to keep reliability high, always make adjustments in small increments.

ALWAYS USE CARE WHEN REPLACING THE ENCLOSURE FRONT COVER!

Be sure the front cover gasket is not pinched or rolled. Do not overtighten the front cover screws.

Manual Override Switch Operation

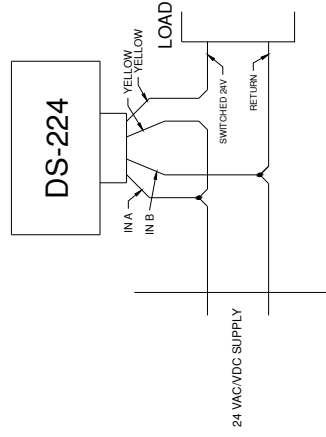
An override switch mounted on the side is provided for testing and special operational requirements. Placing the switch in the "Automatic" position will allow the sensor to operate normally, activating the controlled equipment as needed. Placing the switch in "Manual On" will close the load relay, activating the controlled equipment. The "Standby/Reset" position prohibits triggering of the unit, clears any active delay timer, and opens the load relay. In order to reduce excessive runtime for the heater the "Manual On" mode will remain in effect for a maximum of 40 hours, then return to "Automatic" mode even if the switch is still in the "Manual On" position. You may put the DS-224 back into "Manual On" mode by switching to "Automatic", then back to "Manual On". This will restart the 40 hour timer.

If the override switch is placed in "Manual On" for less than 2 seconds, then switched back to "Automatic", the controller will execute one delay off cycle. This can be used to clear a frost or hail buildup without the danger of leaving the system in a continuous "Manual On" condition. "Standby/Reset" can still be used to clear this delay off cycle.

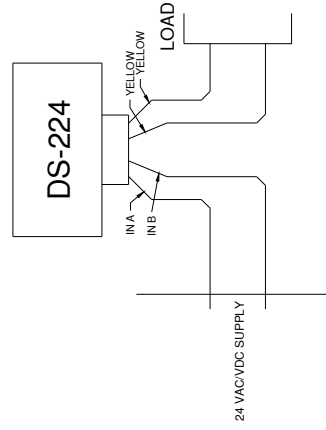
Typical Wiring

The sensor supply voltage can be in the range of 22-28 VAC/VDC. The supply input leads (IN A and IN B) are not polarity sensitive and can be connected to either polarity of a DC supply. A standard 24VAC 20VA HVAC-type transformer will supply enough power for the DS-224 and an optional CDP-2 indoor control/display panel.

The two load leads of the DS-224 do not supply power directly to your load. The relay inside the DS-224, like a switch or thermostat, is used to switch a voltage of your choice. While not as convenient as directly supplying power for the load this allows you to operate the DS-224 from one voltage while controlling a load of a different voltage without adding an external relay or contactor. For example, the DS-224 can be powered from 24VAC but can directly control a 12VDC signal for a contactor coil or can operate from 24VAC and provide a dry contact thermostat-style closure for a boiler. The following diagrams show some possible wiring schemes for connecting the DS-224 to your load. For clarity the GROUND lead is not shown.



24VAC/VDC Sensor Supply, Supply Voltage Out



24VAC/VDC Sensor Supply, Dry Contact Thermostat-Style Control



Dell Precision Rack 7910
Intel Xeon Processor 3.0 GHz
With integrated 1Gbit NIC



Operating System:
Windows® 8.1 Pro, 64-bit



Memory:
8.0GB DDR4 RDIMM



Hard Drive:
(2) 500GB SATA 7200rpm Hard Drives

Video Card
NVIDIA 512MB

DVD ROM, SATA, Internal

Software
MS Excel
MS Internet Explorer 10