1.3 BACnet Control Systems, Data Submittals

Control Submittal

Project:	**NASA Infrared Telescope**
Location:	**Mauna Kea, Hawaii**

Section: 1	Description:	Manufacturer:
A	User Interface	Schneider Electric
B	StruxureWare Controllers	Schneider Electric
C	Continuum Controllers & Expansion Modules	Schneider Electric
D	Room Temperature Sensor/Outside Air	Schneider Electric
E	Duct, Pipe, & Averaging Temperature Sensor	Mamac
F	CO2 Sensor	Schneider Electric
G	Current Sensor	Veris
H	Pressure Sensor	Schneider Electric/Kele
I	Damper Actuators and Schedule	Schneider Electric
J	Valves and Schedule	Schneider Electric
K	Relays	Veris
L	Wiring & Standard Type	Schneider Electric
M	Transformers	Veris
N	Panel Enclosure	Schneider Electric
P	Humidity Sensors	Schneider Electric
Q	Smoke Detectors	APAC

A

BACnet Testing Laboratories Product Listing

This product has been tested at a qualified BACnet Testing Laboratory and found to comply with all the necessary interoperability requirements in place on the published test date. This listing represents the tested capability of the Listed Product. For information on additional functionality that was not covered in the test process, refer to the Manufacturer's PICS statement on the BI website.

Listing Information

Vendor		Listing Status
Schneider Electric Buildings, LLC 1 High St North Andover MA 01845 USA		Listed Product
Test Requirements	BACnet Protocol Revision	Date Tested
Requirements as of July 2009	Revision 6	April 2011

Product Name	Model Number(s)	Software Version
Automation Server BACnet	AS-B	1.1

Device Profiles

Profile	Model Numbers
BACnet Building Controller (B-BC)	AS-B

BIBBs Supported

Data Sharing	ReadProperty-A	DS-RP-A
	WriteProperty-A	DS-WP-A
	ReadProperty-B	DS-RP-B
	WriteProperty-B	DS-WP-B
	ReadPropertyMultiple-A	DS-RPM-A
	ReadPropertyMultiple-B	DS-RPM-B
	WritePropertyMultiple-B	DS-WPM-B
	COV-A	DS-COV-A
	COV-B	DS-COV-B

Alarm and Event Management	Alarm and Event-Notification Internal-B	AE-N-I-B
	Alarm and Event-ACK-B	AE-ACK-B
	Alarm and Event-Enrollment Summary-B	AE-ESUM-B

	Alarm and Event-Information-B	AE-INFO-B

Scheduling	Scheduling Internal-B	SCHED-I-B
	Scheduling External-B	SCHED-E-B

Trending	Viewing and Modifying Trends Internal-B	T-VMT-I-B
	Viewing and Modifying Trends External-B	T-VMT-E-B
	Automated Trend Retrieval-B	T-ATR-B

Device and Network Management	Dynamic Device Binding-A	DM-DDB-A
	Dynamic Device Binding-B	DM-DDB-B
	Dynamic Object Binding-B	DM-DOB-B
	Backup and Restore-B	DM-BR-B
	TimeSynchronization-A	DM-TS-A
	TimeSynchronization-B	DM-TS-B
	UTCTimeSynchronization-B	DM-UTC-B
	DeviceCommunicationControl-B	DM-DCC-B
	ReinitializeDevice-B	DM-RD-B
	Object Creation and Deletion-B	DM-OCD-B

Object Type Support

Analog Input	Analog Output	Analog Value
Binary Input	Binary Output	Binary Value
Calendar	Device	Event Enrollment
File	Loop	
Multi-state Input	Multi-state Output	Multi-state Value
Notification Class	Schedule	Trend Log

Data Link Layer Options

Media	Options
MS/TP master	9600, 19200, 38400, 76800
BACnet/IP (Annex J)	BBMD

Character Set Support

ANSI X3.4 / UTF-8
ISO 8859-1

StruxureWare™ for Buildings

Automation Server

A StruxureWare server is the core of the system and performs key functionality, such as control logic, trend logging, and alarm supervision. The Automation Server is the hardware version of a StruxureWare Server. The distributed intelligence of the Automation Servers ensures fault tolerance in the system and provides a fully featured user interface through WorkStation and WebStation.

Make the most of your energy℠

Schneider Electric

StruxureWare for Buildings Automation Server Features

The Automation Server is a powerful device that can act as a standalone StruxureWare server and also control I/O modules and monitor and manage field bus devices. In a small installation, the embedded Automation Server acts as a stand-alone StruxureWare server, mounted with its I/O modules in a small footprint. In medium and large installations, functionality is distributed over multiple Automation Servers that communicate over TCP/IP.

PRODUCT AT A GLANCE

- Communications hub for the system
- Variety of connectivity options
- WorkStation/WebStation interface
- Native support for open protocols – BACnet, LonWorks and Modbus
- Scalable custom configurations
- Two programming options
- 4 GB of memory for data and backup
- IT friendly and secure
- Hot-connect / Hot-swap
- Patented two-piece design
- Auto-addressing
- Simple DIN-rail installation

Communications hub for the system

Capable of coordinating traffic from above and below its location, the Automation Server can deliver data directly to the operator or to other servers throughout the site. The Automation Server can run multiple control programs, manage local I/O, alarms, and users, handle scheduling, and logging, and communicate using a variety of protocols. Because of this, most parts of the system function autonomously and will continue to run as a whole even if communication fails or individual servers or devices go offline.

Variety of connectivity options

The Automation Server has numerous ports that enable it to communicate with a wide range of protocols, devices, and servers. The Automation server has one 10/100 Ethernet port, two RS-485 ports, and one built-in I/O bus port. Additionally, there are two USB host ports and one USB device port. The device port allows you to upgrade and interact with the Automation Server using the Device Administrator. In the future, host ports will enable expansion of the system and integration of more devices, including serial expansion modules, other products from Schneider Electric, and products from other vendors.

WorkStation/WebStation interface

Through any client, the user experience is identical regardless of which StruxureWare server the user is logged on to. The user can log directly on to an Automation Server to engineer, commission, supervise, and monitor the Automation server as well as its attached I/O modules, and field bus devices.

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StruxureWare for Buildings Automation Server Features (continued)

Native support for open protocols
One of the cornerstones of StruxureWare is support for open standards.

Native BACnet support (AS-B)
The AS-B module communicates directly to BACnet/IP and BACnet MS/TP networks. Compliant with ASHRAE 135-2004, the AS-B adheres to BACnet Building Controller (B-BC), the most advanced BACnet Device Profile. This capability provides access to the full range of BACnet devices from Schneider Electric and other vendors. The AS-B can also serve as a BACnet Broadcast Management Device (BBMD) to facilitate BACnet systems that span multiple IP networks.

Native LonWorks support (AS-L)
The AS-L module has a built in FTT-10 port for integrated LonWorks functionality to enable access to any Schneider Electric LonWorks field controller or third party LonWorks devices. Lonworks networks can be commissioned, bound, and configured from the AS using the built-in LonWorks Network Management Tool. No third-party tools are needed. A protocol analyzer with powerful debugging and network quality monitoring features is also included.

Native Modbus support
The Automation Server natively integrates Modbus RS-485 master and slave configurations, as well as TCP client and server. This allows full access to the range of Schneider Electric products that communicate on the Modbus protocol, such as power meters, UPS, circuit breakers, and lighting controllers.

Scalable custom configurations
The Automation Server and its family of I/O modules were designed to meet the unique needs of each installation. Depending on the configuration, each Automation Server can control up to 464 I/O points. Because power and communications are delivered along a common bus, multiple modules can be plugged together without tools in a simple one-step process using the built-in connectors.

Two programming options
Unique to the industry, the Automation Server has both Script and Function Block programming options. This flexibility assures that the best programming method can be selected for the application.

4 GB of memory for data and backup
The Automation Server has an available capacity of 4 GB of memory. This represents 2 GB for application and historical data and 2 GB dedicated for backup storage. This ensures that all data is safe from damage, loss, or unintended edits. Users can also manually back up or restore the Automation Server to a storage location on a PC or network. Through the Enterprise Server, users have the ability to perform scheduled backups of associated Automation Servers to network storage for even greater levels of protection.

IT friendly and secure
The Automation Server communicates using networking standards, such as DHCP, and HTTP (see sidebar for more). This makes installation easy, management simple, and transactions secure.

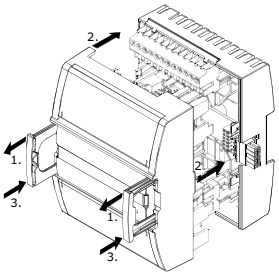
Hot-connect / Hot-swap
Because critical applications require 24-hour operation, Schneider Electric designed the entire family of I/O modules for hot-connection of terminal bases and hot-swapping of modules to and from their bases. This design ensures continuous power and communication during many service operations.

Patented two-piece design
Each module can be separated from its terminal base to allow the site to be wired prior to the installation of the electronics. The patented locking mechanism serves as handles for removing the module from its base. All critical components have a protective cover that permits natural convection cooling to occur.

Auto-addressing
The auto-addressing feature eliminates the need for setting DIP switches or pressing commission buttons. With the Automation Server family, each I/O module automatically knows its order in the chain and assigns itself accordingly.

Simple DIN-rail installation
Fasteners easily snap into a locked position for panel installation. The fastener has a quick-release feature for easy DIN rail removal.

Supported Protocols
- IP addressing (IPv6 ready)
- TCP communications
- DHCP / DNS for rapid deployment and lookup of addresses
- HTTP - Internet access through firewalls, enabling for remote monitoring, and control
- NTP (Network Time Protocol) for time synchronization throughout the system
- SMTP enables sending email messages
- JSON messages are used to structure the exchange of data



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StruxureWare for Buildings Automation Server Specifications

Specifications

Electrical

DC input

Nominal voltage

24 VDC

Power consumption

max. 7 W

Mechanical

Enclosure

Eco Friendly ABS/PC

Enclosure rating

IP 20

Plastic rating

UL94-5VB rated plastic

Dimensions (including terminal base)

90 W x 114 H x 64 D mm

(3.6 W x 4.5 H x 2.5 D in.)

Weight (including terminal base)

0.294 kg (0.65 lb)

Weight (excluding terminal base)

0.194 kg (0.43 lb)

Installation

DIN-rail or panel installation

Operation environment

Ambient temperature, operating

0 °C to 50 °C (32 °F to 122 °F)

Ambient temperature, storage

–20 °C to +70 °C (–4 °F to +158 °F)

Humidity

Max. 95 % RH (non-condensing)

Agency compliances

Emission

C-Tick; EN 61000-6-3;

FCC Part 15, Sub-part B, Class B

Immunity

EN 61000-6-2

Safety

UL 916 C-UL US Listed

Real-Time Clock backup

30 days

Communications

Ethernet LAN interface

10/100 Mbit/s; twisted pair cable with RJ-45 connector

USB

1 device and 2 host ports

BACnet (AS-B)

BACnet/IP and MS/TP

LonWorks (AS-L)

TP/FT-10

COM A

2-wire RS-485

COM B

2-wire RS-485 and 3.3 VDC

I/O Modules

RS-485

TCP

(binary, port configurable, default 4444)

HTTP

(non-binary, port configurable, default 80)

SMTP

(email sending, port configurable, default 25)

CPU

Frequency

160 MHz

SDRAM

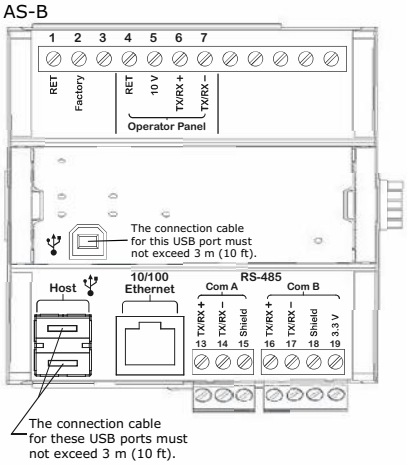
128 MB

Flash memory

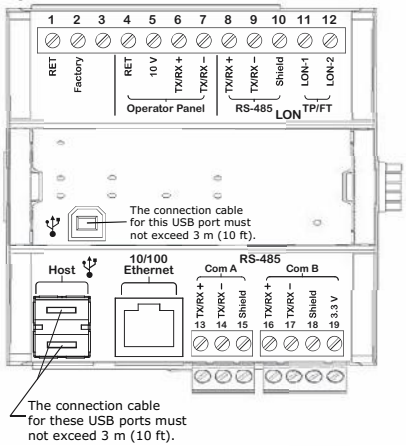
4 GB

Connectors

AS-B



AS-L



Part numbers

AS-L Automation Server LonWorks

SXWASLXXX10001

AS-B Automation Server BACnet

SXWASBXXX10001

TB-AS-W1 Term Base AS W1

SXWTBASW110001

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B

BACnet Testing Laboratories Product Listing

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Requirements as of July 2009	Revision 6	April 2011

Product Name	Model Number(s)	Software Version
Automation Server BACnet	AS-B	1.1

Device Profiles

Profile	Model Numbers
BACnet Building Controller (B-BC)	AS-B

BIBBs Supported

Data Sharing	ReadProperty-A	DS-RP-A
	WriteProperty-A	DS-WP-A
	ReadProperty-B	DS-RP-B
	WriteProperty-B	DS-WP-B
	ReadPropertyMultiple-A	DS-RPM-A
	ReadPropertyMultiple-B	DS-RPM-B
	WritePropertyMultiple-B	DS-WPM-B
	COV-A	DS-COV-A
	COV-B	DS-COV-B

Alarm and Event Management	Alarm and Event-Notification Internal-B	AE-N-I-B
	Alarm and Event-ACK-B	AE-ACK-B
	Alarm and Event-Enrollment Summary-B	AE-ESUM-B

	Alarm and Event-Information-B	AE-INFO-B

Scheduling	Scheduling Internal-B	SCHED-I-B
	Scheduling External-B	SCHED-E-B

Trending	Viewing and Modifying Trends Internal-B	T-VMT-I-B
	Viewing and Modifying Trends External-B	T-VMT-E-B
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Device and Network Management	Dynamic Device Binding-A	DM-DDB-A
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	Backup and Restore-B	DM-BR-B
	TimeSynchronization-A	DM-TS-A
	TimeSynchronization-B	DM-TS-B
	UTCTimeSynchronization-B	DM-UTC-B
	DeviceCommunicationControl-B	DM-DCC-B
	ReinitializeDevice-B	DM-RD-B
	Object Creation and Deletion-B	DM-OCD-B

Object Type Support

Analog Input	Analog Output	Analog Value
Binary Input	Binary Output	Binary Value
Calendar	Device	Event Enrollment
File	Loop	
Multi-state Input	Multi-state Output	Multi-state Value
Notification Class	Schedule	Trend Log

Data Link Layer Options

Media	Options
MS/TP master	9600, 19200, 38400, 76800
BACnet/IP (Annex J)	BBMD

Character Set Support

ANSI X3.4 / UTF-8
ISO 8859-1

StruxureWare™ for Buildings

Automation Server I/O Module Family

StruxureWare provides a broad spectrum of I/O modules that can be combined to meet the unique requirements of each installation. An Automation Server system can have a maximum of 32 modules, including one Automation Server and a mixture of Power Supply modules and I/O modules.

Make the most of your energy℠

Schneider Electric

StruxureWare for Buildings Automation Server I/O Module Family Features

Each high density I/O module is designed to accommodate a fixed number of inputs and outputs. Some I/O modules only support a single electrical type, such as digital inputs. Other modules support a combination of electrical types, such as universal inputs mixed with digital outputs. The variety of modules available ensures the right combination of points for any project.

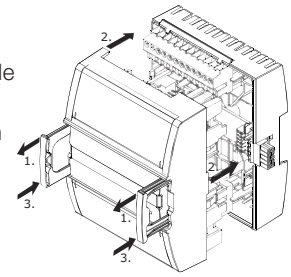
PRODUCT AT A GLANCE

- Modular and scalable system
- Patented two-piece design
- Hot-connect/ Hot-swap
- Auto-addressing
- Simple DIN-rail installation
- Efficient terminal management
- Accommodates multiple row panel installations
- Hand/Off/Auto switches
- LED status indicators
- Protection

Modular and scalable system

StruxureWare is a modular system that delivers power and communications on a common bus. Connecting modules is a one-step process: just slide the modules together using the built-in connectors.

Patented two-piece design



Each module can be separated from its terminal base to enable the site to be wired prior to the installation of the electronics. The patented locking mechanism also serves as handles for removing the module from its base. All critical components have a protective cover that permits natural convection cooling to occur.

Hot-connect / Hot-swap

Because critical applications require 24-hour operation, Schneider Electric designed the Automation Server and its family of I/O modules for hot-connection of terminal bases and hot-swapping of servers and modules to their bases. This design ensures continuous power and communication during service operations.

StruxureWare for Buildings Automation Server I/O Module Family Features (continued)

Auto-addressing
The auto-addressing feature eliminates the need for setting DIP switches or pressing commission buttons. With the Automation Server family, each module automatically knows its order in the chain and assigns itself accordingly - significantly reducing engineering and maintenance time.

Simple DIN-rail installation
Fasteners easily snap into a locked position for panel installation. The fastener has a quick-release feature for easy DIN rail removal.

Efficient terminal management
The I/O module terminals are clearly labeled and protected by a transparent cover. The input and output terminals are at the top and bottom of each module and are accessible for maintenance without removing the module. The StruxureWare WorkStation software can generate custom as-built labels for each module. Pre-perforated letter and A4 size label sheets are available as an accessory.

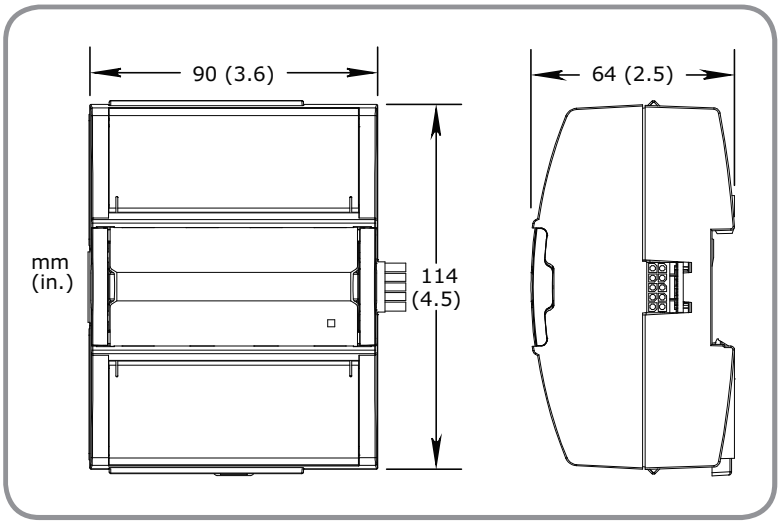
Accommodates multiple row panel installations
The Automation Server module family uses built-in connectors for single row connectivity. If a panel size requires multiple rows, interconnection cables are available.

Hand/Off/Auto switches
Some modules are available with Hand/Off/Auto (HOA) switches to provide override control of the outputs. Analog outputs with HOA switches also have a potentiometer to modulate the output signal when the switch is in the hand position. The position of the HOA switch is readable through operator interfaces, such as the StruxureWare WorkStation software, enabling more precise monitoring and control.

LED status indicators
Every module has a status indicator that denotes the health and status of that module. Some modules also have LEDs that can be configured to indicate the state of a digital input or output.

Protection
Unipolar voltage suppressors on all inputs protect against high voltage or current during both transient events as well as improper wiring.

Dimensional drawing



StruxureWare for Buildings Automation Server I/O Module Family Specifications

The following technical specifications apply to all I/O modules, unless otherwise noted.

I/O bus power

24 VDC, max. 30 W per I/O bus power supply, Class 2

Maximum addresses per I/O bus

32

Operation environment

Ambient temperature, operating

0 °C to 50 °C (32 °F to 122 °F)

Ambient temperature, storage

–20 °C to +70 °C (–4 °F to +158 °F)

Humidity

Max. 95 % RH (non-condensing)

Mechanical

Dimensions (including terminal base)

90 W x 114 H x 64 D mm

(3.6 W x 4.5 H x 2.5 D in.)

Enclosure Eco Friendly ABS/PC

Enclosure rating IP 20

Plastic rating

UL94-5VB rated plastic

Mounting

DIN-rail mounting or with screws on wall

The following technical specifications apply to all UI modules:

Thermistor Accuracy

Non-linearized 1.8 kohm and 10 kohm

-50 to -30 °C: ±1.5 °C (-58 to -22 °F: ±2.7 °F)

-30 to 0 °C: ±0.5 °C (-22 to 32 °F: ±0.9 °F)

0 to 50 °C: ±0.2 °C (32 to 122 °F: ±0.4 °F)

50 to 100 °C: ±0.5 °C (122 to 212 °F: ±0.9 °F)

100 to 150 °C: ±1.5 °C (212 to 302 °F: ±2.7 °F)

Balco 1 kohm

-50 to 150 °C: ±1.5 °C (-58 to 302° F: ±2.7 °F)

Linearized 10 kohm

-50 to -30 °C: ±3.0 °C (-58 to -22 °F: ±5.4 °F)

-30 to 0 °C: ±1.0 °C (-22 to 32 °F: ±1.8 °F)

0 to 50 °C: ±0.3 °C (32 to 122 °F: ±0.5 °F)

50 to 100 °C: ±0.5 °C (122 to 212 °F: ±0.9 °F)

100 to 150 °C: ±2.0 °C (212 to 302 °F: ±3.6 °F)

I/O Module Inputs and Outputs

Device name	Inputs								Outputs					HOA
		Digital			Analog					Digital		Analog		
	Quantity	Contact	Counter	Supervised	Voltage	Current	Resistance	Thermistor	Quantity	Form-A	Form-C	Voltage	Current	
Input Only														
DI-16	16	x	x											
UI-16	16	x	x	x	x	x	x	x						
Output Only														
DO-FA-12									12	x				
DO-FA-12-H									12	x				x
DO-FC-8									8		x			
DO-FC-8-H									8		x			x
AO-8									8			x	x	
AO-8-H									8			x	x	x
AO-V-8									8			x		
AO-V-8-H									8			x		x
Mixed IO														
UI-8/DO-FC-4	8	x	x	x	x	x	x	x	4		x			
UI-8/DO-FC-4-H	8	x	x	x	x	x	x	x	4		x			x
UI-8/AO-4	8	x	x	x	x	x	x	x	4			x	x	
UI-8/AO-4-H	8	x	x	x	x	x	x	x	4			x	x	x
UI-8/AO-V-4	8	x	x	x	x	x	x	x	4			x		
UI-8/AO-V-4-H	8	x	x	x	x	x	x	x	4			x		x

Related part numbers

SXWDINEND10001, DIN-RAIL-CLIP,- DIN-Rail End Clip, package of 25 pieces

SXWTERLBL10011, PRINTOUT-A4-W, Printout sheets for Terminal Labels for W1, A4, 100 sheets

SXWTERLBL10012, PRINTOUT-LTR-W1, Printout sheets for Terminal Labels for W1, Letter, 100 sheets

SXWSCABLE10001, S-CABLE, - S-Cable extension cord for StruxureWare CIO bus, Straight connectors, 1.5 m

SXWSCABLE10002, S-CABLE-L, S-Cable extension cord for StruxureWare CIO bus, L shaped connectors, 1.5 m

N1831

Schneider Electric One High Street, North Andover, MA 01845 USA Telephone: +1 978 975 9600 Fax: +1 978 975 9698 www.schneider-electric.com/buildings

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16 Channel Universal Input (UI-16)

Automation Server I/O Module

I/O Module
UI-16

The UI-16 is a universal input, 16-channel I/O module. Each channel is capable of supporting digital (contact, counter, and supervised) or analog (voltage, current, thermistor, and resistance) point types.

Analog and digital applications

This module is ideal for any mix of temperature, pressure, flow, status points, and similar inputs in a building control system. The UI-16 supports a 12-bit A/D conversion.

Counter applications

The maximum counter frequency is 25 Hz on all sixteen inputs with a minimum pulse width of 20 milliseconds. This input type is commonly used in energy metering applications.

Security applications

Supervised points are used for security applications where it is critical to know whether or not a wire has been cut or shorted. These events provide a separate indication of alarm and trouble conditions to the system.

Status indicators

Each channel has a dedicated two color (red and green) status LED that provides local monitoring of digital input types. The LED can be configured to display either red or green for each input state.

Protection

28 V unipolar transient voltage suppressors on all inputs protect against high voltage short duration transient events.

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UI-16
Automation Server I/O Module Specifications

DC input power
24 VDC, 1.8 W

Input channels
16

Digital Inputs

Contact
Pulse width 20 ms minimum
Range
Open collector/open drain, 24 V 2.4 mA, dry contact switch closure

Counter
Range
Open collector/open drain, 24 V 2.4 mA, dry contact switch closure
Pulse width 20 ms minimum
LED polarity
Software selectable, if the LED is activated when the input is high or low
LED color
Red or green, software selectable

Supervised
Detected resistor values
Open circuit, short circuit, contact open, and contact closed
5 V circuit, 1 or 2 resistors, monitored switch combinations
Series only, parallel only, and series and parallel
Resistor range
1 k to 10 kohms. For a 2-resistor configuration, each resistor is assumed to have the same value.

Analog inputs

Voltage
Range
0-10V
Resolution
12 bits
Accuracy
+- (0.7mV+0.2% of reading)
Reliability
Ability to define the reliability level for upper and lower electrical limits
Impedance: 100 kOhm

Current
Range
0-20mA
Resolution
12 bits
Accuracy
+- (0.03mA+0.4% of reading)
Reliability
Ability to define the reliability level for upper and lower electrical limits
Impedance
47 Ohm

Resistance
10 ohm to 10 kohm
±(7 + 4 x 10 -3 x R) (ohm)
10 kohm to 60 kohm
±(0.4 + 7 x 10 -6 x R) (%)
Reliability
Ability to define the reliability level for upper and lower electrical limits.

Thermistor
Range
-50 to 150 °C (-58 to 302 °F)
Resolution
12 bits
Supported thermistors
1.8 kohm. 10 kohm, and 1 kohm Balco temp. sensor

Internal pull-up resistor
10 kohms thermistors: 10 kohm to 5 V
1.0 (Balco) and 1.8 kohm thermistors: 1.5 kohm to 1 V

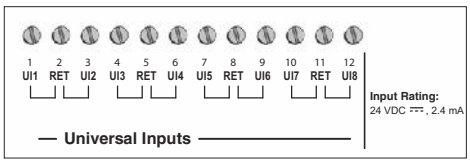
Mechanical
Weight (including terminal base)
0.269 kg (0.59 lb)
Weight (excluding terminal base)
0.146 kg (0.32 lb)

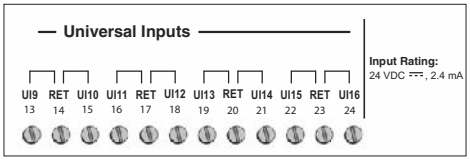
Terminal base
TB-IO-W1

Part numbers
UI-16, I/O Module – 16 universal inputs
SXWUI16XX10001

TB-IO-W1, Term base IO W1
SXWTBIOW110001

Connectors





16 Channel Digital Input (DI-16)

Automation Server I/O Module

I/O Module
DI-16

The DI-16 is a digital input, 16-channel I/O module. Each channel is capable of supporting digital (contact and counter) point types.

Digital applications

This module can be used for cost-effective sensing of multiple dry digital inputs in applications, such as equipment status monitoring or alarm point monitoring.

Counter applications

The maximum counter frequency is 25 Hz on all sixteen inputs with a minimum pulse width of 20 milliseconds. This input type is commonly used in energy metering applications.

Protection

28 V unipolar transient voltage suppressors on all inputs protect against high voltage short duration transient events. The DI-16 is designed to accept dry contact inputs but can withstand up to 24 VDC continuous voltages on all sixteen channels.

Status indicators

Each channel has a dedicated two color (red and green) status LED that provides local monitoring of digital input types. The LED can be configured to display either red or green for each input state.

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DI-16
Automation Server I/O Module Specifications

DC input power
24 VDC, 1.6 W

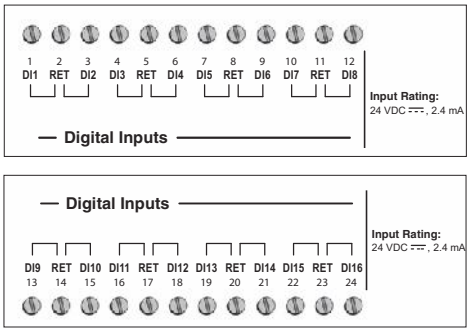
Input channels
16

Digital Inputs

Contact
Pulse width
20 ms minimum
Range
Open collector/open drain, 24 V 2.4 mA, dry contact switch closure

Counter
Range
Open collector/open drain, 24 V 2.4 mA, dry contact switch closure
Pulse width
20 ms minimum
LED polarity
Software selectable, if the LED is activated when the input is high or low
LED color
Red or green, software selectable

Connectors



Mechanical
Weight (including terminal base)
0.255 kg (0.56 lb)
Weight (excluding terminal base)
0.131 kg (0.29 lb)

Terminal base
TB-IO-W1

Part numbers
DI-16, I/O Module – 16 digital inputs
SXWDI16XX10001

TB-IO-W1, Term base IO W1
SXWTBIOW110001

8 Channel Analog output (AO-8), (AO-8-H)

Automation Server I/O Module

I/O Module
AO-8-H

The AO-8 and AO-8-H are analog output, 8-channel I/O modules. Each channel is capable of supporting analog (voltage and current) point types.

Analog applications

The AO-8 and AO-8-H are designed for a maximum control range of 0-10 V outputs and therefore support a wide-range of devices, such as valves and actuators.

Current applications

The AO-8 and AO-8-H can be used to drive a maximum control range of 0-20 mA current signals on any of its eight channels.

Protection

These I/O Modules have protection against short-circuit to ground.

Overrides

The front panel of the AO-8-H includes Hand/Off/Auto (HOA) override switches with adjustable potentiometers.

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AO-8
AO-8-H*
Automation Server I/O Module Specifications

DC input power
24 VDC, 4.9 W

Output channels
8

Analog outputs

Voltage
Range
0 to 10 VDC
Resolution
50 mV
Accuracy
±100 mV
Terminals
Voltage (V), Return
Minimum load
Source: 2 mA
Sink: -1 mA

Current
Range
0 to 20 mA
Resolution
0.1 mA
Reliability
Ability to define the reliability level for upper and lower electrical limits.
Accuracy
±0.2 mA

Terminals
Current (I), Return
Maximum load
Output load should not exceed 650 ohm

Mechanical
Dimensions (including terminal base)
90 W x 114 H x 64 D mm
(3.6 W x 4.5 H x 2.5 D in.)
Weight (including terminal base)
0.282 kg (0.62 lb)
Weight (excluding terminal base)
0.159 kg (0.35 lb)

Terminal base
TB-IO-W1

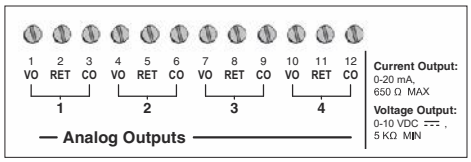
Part numbers
AO-8, I/O Module – 8 analog current/ Voltage outputs
SXWAO8XXX10001

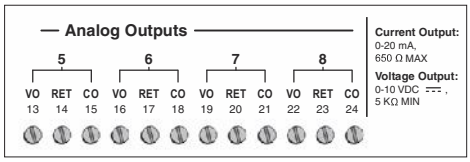
AO-8-H, I/O Module – 8 analog current/ voltage outputs w hand control
SXWAO8HXX10001

TB-IO-W1, Term base IO W1
SXWTBIOW110001

(*I/O module types with an “H” contain Hand/Off/Auto override switches and potentiometers)

Connectors





8 Channel Analog Output (AO-V-8), (AO-V-8-H)

Automation Server I/O Module

I/O Module
AO-V-8-H

The AO-V-8 and AO-V-8-H are analog output, 8-channel I/O modules. Each channel is capable of supporting analog (voltage) point types.

Analog applications

The AO-V-8 and AO-V-8-H are designed for a maximum control range of 0-10 V outputs and therefore support a wide-range of devices, such as valves and actuators.

Protection

These I/O Modules have protection against short-circuit to ground.

Overrides

The front panel of the AO-V-8-H module includes Hand/Off/Auto (HOA) override switches with adjustable potentiometers.

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AO-V-8
AO-V-8-H*
Automation Server I/O Module Specifications

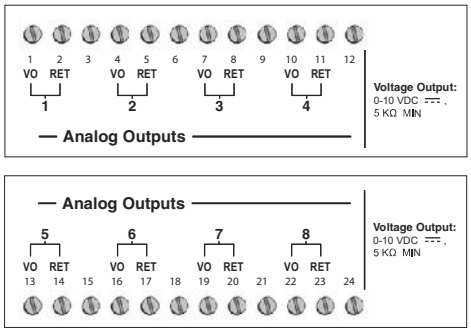
DC input power
24 VDC, 0.7 W

Output channels
8

Analog outputs

Voltage
Range
0 to 10 VDC
Resolution
50 mV
Accuracy
±100 mV
Terminals
Voltage (V), Return
Minimum load
Source: 2 mA
Sink: -1 mA

Connectors



Mechanical
Weight (including terminal base)
0.279 kg (0.61 lb)
Weight (excluding terminal base)
0.156 kg (0.34 lb)

Terminal base
TB-IO-W1

Part numbers
AO-V-8, I/O Module – 8 analog voltage outputs
SXWAOV8XX10001

AO-V-8-H, I/O Module – 8 analog voltage outputs w hand control
SXWAOV8HX10001

TB-IO-W1, Term base IO W1
SXWTBIOW110001

(*I/O module types with an “H” contain Hand/Off/Auto override switches and potentiometers)

12 Channel Digital Output, Form-A (DO-FA-12), (DO-FA-12-H)

Automation Server I/O Module

I/O Module
DO-FA-12

The DO-FA-12 and DO-FA-12 are digital output 12-channel I/O modules. Each channel is capable of supporting digital (Form-A) point types.

Direct load applications

The Form-A relays in the DO-FA-12 and DO-FA-12-H are designed for direct load applications for up to 2 A per output.

Status indicators and overrides

The front panel of the DO-FA-12 and DO-FA-12-H module includes a digital output indicator using a green LED. Additionally, the DO-FA-12-H module has Hand/Off/Auto (HOA) override switches.

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DO-FA-12
DO-FA-12-H*
Automation Server I/O Module Specifications

DC input power
24 VDC, 1.8 W

Output channels
12

Contact rating
250 VAC, 30 VDC, 2 A

Digital outputs
Form A relay
Terminals
Common (C), Normally Open (NO)
Pulse width
100 ms minimum
Isolation
1500 VAC minimum, coil to contact

Mechanical
Weight (including terminal base)
0.317 kg (0.70 lb)
Weight (excluding terminal base)
0.194 kg (0.43 lb)

Terminal base
TB-IO-W1

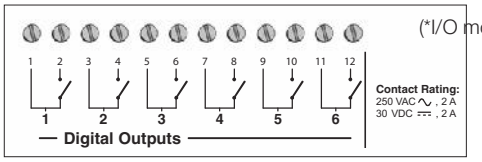
Part numbers
DO-FA-12, I/O Module – 12 Form A digital outputs
SXWDOA12X10001

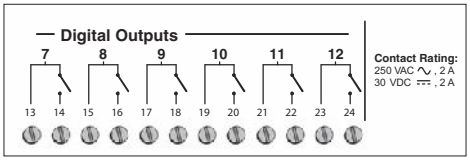
DO-FA-12-H, I/O Module – 12 Form A digital outputs w hand control
SXWDOA12H10001

TB-IO-W1, Term base IO W1
SXWTBIOW110001

Connectors

(*I/O module types with an “H” contain Hand/Off/Auto override switches)





8 Channel Digital Output, Form-C (DO-FC-8), (DO-FC-8-H)

Automation Server I/O Module

I/O Module
DO-FC-8

The DO-FC-8 and DO-FC-8-H are digital output 8-channel I/O modules. Each channel is capable of supporting digital (Form-C) point types.

Direct load applications

The Form-C relays in the DO-FC-8 and DO-FC-8-H are designed for direct load applications for up to 3 A per output.

Status indicators and overrides

The front panel of the DO-FC-8 and DO-FC-8-H modules includes a digital output indicator using a green LED. Additionally, the DO-FC-8-H module has Hand/Off/Auto (HOA) override switches.

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DO-FC-8
DO-FC-8-H*
Automation Server I/O Module Specifications

DC input power
24 VDC, 2.2 W

Output channels
8

Contact rating
250 VAC, 30 VDC, 3 A

Digital outputs
Form C Relay
Terminals
Common (C), Normally Open (NO), Normally Closed (NC)
Pulse width
100 ms minimum
Isolation
1500 VAC minimum, coil to contact

Mechanical
Weight (including terminal base)
0.332 kg (0.73 lb)
Weight (excluding terminal base)
0.209 kg (0.46 lb)

Terminal Base
TB-IO-W1

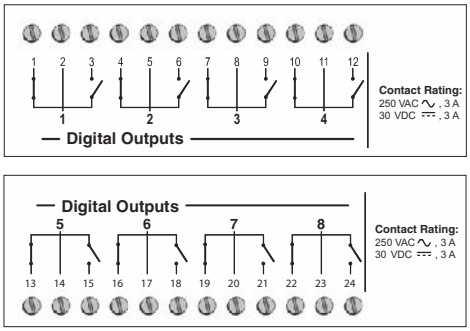
Part numbers
DO-FC-8, I/O Module – 8 Form C Digital Outputs
SXWDOC8XX10001

DO-FC-8-H, I/O Module – 8 Form C Digital Outputs w Hand Control
SXWDOC8HX10001

TB-IO-W1, Term base IO W1
SXWTBIOW110001

(*I/O module types with an “H” contain Hand/Off/Auto override switches)

Connectors



8 Channel Universal Inputs with 4 Analog Outputs (UI-8/AO-4, UI-8/AO-4-H)

Automation Server I/O Module

I/O Module
UI-8/AO-4-H

The UI-8/AO-4 and UI-8/AO-4-H are combination I/O modules supporting 8 universal input channels and 4 analog output channels. These compact modules are ideal when an application requires a mix of point types.

Analog and digital applications

This module is ideal for any mix of temperature, pressure, flow, status points, and similar inputs in a building control system. The eight input channels supports a 12 bit A/D conversion.

Counter applications

The maximum counter frequency on all eight inputs with a minimum pulse width is 20 milliseconds. This input type is commonly used in energy metering applications.

Security applications

Supervised points are used for security applications where it is critical to know whether or not a wire has been cut or shorted. These events provide a separate indication of alarm and trouble conditions to the system.

Analog applications

The UI-8/AO-4 and UI-8/AO-4-H are designed for a maximum control range of 0-10 V outputs and therefore support a wide-range of devices, including valves and actuators on any of its eight output channels.

Current applications

The UI-8/AO-4 and UI-8/AO-4-H can be used to drive a maximum control range of 0-20 mA current signals on any of its eight output channels.

Protection

28 V unipolar transient voltage suppressors on all inputs protect against high voltage short duration transient events.

Status indicators and overrides

The front panel of the UI-8/AO-4 and UI-8/AO-4-H I/O modules includes a digital output indicator using a green LED. Additionally, the UI-8/AO-4-H module has Hand/Off/Auto (HOA) override switches with adjustable potentiometers for each output.

UI-8/AO-4
UI-8/AO-4-H*
Automation Server I/O Module Specifications

DC input power
24 VDC, 3.2 W

Input channels
8

Digital Inputs

Contact
Pulse width 20 ms minimum
Range
Open collector/open drain, 24 V 2.4 mA, dry contact switch closure

Counter
Range
Open collector/open drain, 24 V 2.4 mA, dry contact switch closure
Pulse width 20 ms minimum
LED polarity
Software selectable, if the LED is activated when the input is high or low
LED color
Red or green, software selectable

Supervised
Detected resistor values
Open circuit, short circuit, contact open, and contact closed
5 V circuit, 1 or 2 resistors, monitored switch combinations
Series only, parallel only, and series and parallel
Resistor range
1 k to 10 kohm. For a 2-resistor configuration, each resistor is assumed to have the same value.

Analog inputs

Voltage
Range 0 to 20 mA
Resolution 12 bit
Accuracy ±(7 mV + 0.2% of reading)
Impedance 100 kohm

Current
Accuracy
±(0.03 mA + 0.4 % of reading)
Reliability
Ability to define the reliability level for upper and lower electrical limits.
Resolution 12 bit
Accuracy ±(0.03 mA + 0.4 % of reading)
Impedance 47 ohm

Resistance
10 ohm to 10 kohm
±(7 + 4 x 10 -3 x R) (ohm)
10 kohm to 60 kohm
±(0.4 + 7 x 10 -6 x R) (%)
Reliability
Ability to define the reliability level for upper and lower electrical limits.

Thermistor
Range
-50 to 150 °C (-58 to 302 °F)
Resolution
12 bits
Supported thermistors
1.8 kohm. 10 kohm, and 1 kohm Balco temp. sensor

Internal pull-up resistor
10 kohms thermistors: 10 kohm to 5 V
1.0 (Balco) and 1.8 kohms thermistors: 1.5 kohm to 1 V

Output channels
4

Analog outputs

Voltage
Range 0 to 10 VDC
Resolution 50 mV
Accuracy ±100 mV
Terminals Voltage (V), Return
Minimum load Source, 2 mA; Sink, -1 mA

Current
Range 0 to 20 mA
Resolution 0.1 mA
Accuracy ±0.2 mA
Terminals Current (I), Return
Maximum load
Output load should not exceed 650 ohms

Mechanical
Weight (including terminal base)
0.276 kg (0.61 lb)
Weight (excluding terminal base)
0.152 kg (0.34 lb)

Terminal base
TB-IO-W1

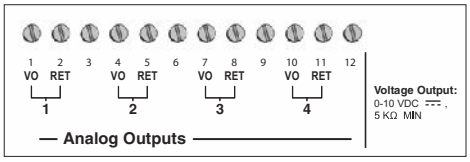
Part numbers
UI-8/AO-4, I/O Module – 8 universal inputs/ 4 analog voltage/current outputs
SXWUI8A4X10001

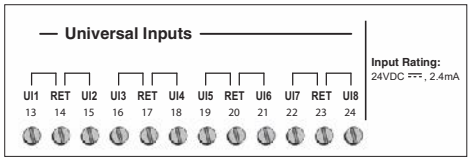
UI-8/AO-4-H, I/O Module – 8 universal inputs/ 4 analog voltage/current outputs w hand control
SXWUI8A4H10001

TB-IO-W1, Term base IO W1
SXWTBIOW110001

(*I/O module types with an “H” contain Hand/Off/Auto override switches and potentiometers)

Connectors





8 Channel Universal Inputs with 4 Channel Voltage Outputs (UI-8/AO-V-4, UI-8/AO-V-4-H)

Automation Server I/O Module

I/O Module
UI-8/AO-V-4-H

The UI-8/AO-V-4 and UI-8/AO-V-4-H are combination I/O modules supporting 8 universal input channels and 4 voltage output channels. These compact modules are ideal when an application requires a mix of point types.

Analog and digital applications

This module is ideal for any mix of temperature, pressure, flow, status points, and similar inputs in a building control system. The eight input channels supports a 12 bit A/D conversion.

Counter applications

The maximum counter frequency on all eight inputs with a minimum pulse width is 20 milliseconds. This input type is commonly used in energy metering applications.

Security applications

Supervised points are used for security applications where it is critical to know whether or not a wire has been cut or shorted. These events provide a separate indication of alarm and trouble conditions to the system.

Analog applications

The UI-8/AO-4 and UI-8/AO-4-H are designed for a maximum control range of 0-10 V outputs and therefore support a wide-range of devices, such as valves and actuators on any of its eight output channels.

Protection

28 V unipolar transient voltage suppressors on all inputs protect against high voltage short duration transient events.

Status indicators and overrides

The front panel of the UI-8/AO-4 and UI-8/AO-4-H I/O modules includes a digital output indicator using a green LED. Additionally, the UI-8/AO-4-H module has Hand/Off/Auto (HOA) override switches with adjustable potentiometers for each output.

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UI-8/AO-V-4
UI-8/AO-V-4-H*
Automation Server I/O Module Specifications

DC input power
24 VDC, 1.0 W

Input channels
8

Digital Inputs

Contact
Pulse width 20 ms minimum
Range
Open collector/open drain, 24 V 2.4 mA, dry contact switch closure

Counter
Range
Open collector/open drain, 24 V 2.4 mA, dry contact switch closure
Pulse width 20 ms minimum
LED polarity
Software selectable, if the LED is activated when the input is high or low
LED color
Red or green, software selectable

Supervised
Detected resistor values
Open circuit, short circuit, contact open, and contact closed
5 V circuit, 1 or 2 resistors, monitored switch combinations
Series only, parallel only, and series and parallel
Resistor range
1 k to 10 kohm. For a 2-resistor configuration, each resistor is assumed to have the same value.

Analog inputs

Voltage
Range 0 to 20 mA
Resolution 12 bit
Accuracy ±(7 mV + 0.2% of reading)
Impedance 100 kohm

Current
Accuracy
±(0.03 mA + 0.4 % of reading)
Reliability
Ability to define the reliability level for upper and lower electrical limits.
Resolution 12 bit
Accuracy ±(0.03 mA + 0.4 % of reading)
Impedance 47 ohm

Resistance
10 ohm to 10 kohm
±(7 + 4 x 10 -3 x R) (ohm)
10 kohm to 60 kohm
±(0.4 + 7 x 10 -6 x R) (%)
Reliability
Ability to define the reliability level for upper and lower electrical limits.

Thermistor
Range
-50 to 150 °C (-58 to 302 °F)
Resolution
12 bits
Supported thermistors
1.8 kohm. 10 kohm, and 1 kohm Balco temp. sensor

Internal pull-up resistor
10 kohms thermistors: 10 kohm to 5 V
1.0 (Balco) and 1.8 kohms thermistors:
1.5 kohm to 1 V

Output channels
4

Analog outputs

Voltage
Range
0 to 10 VDC
Resolution
50 mV
Accuracy
±100 mV
Terminals
Voltage (V), Return
Minimum load
Source, 2 mA; Sink, -1 mA

Internal pull-up resistor
10 kohms thermistors:10 kohm to 5 V
1.0 (Balco) and 1.8 kohms thermistors:
1.5 kohm to 1 V

Mechanical
Weight (including terminal base)
0.275 kg (0.61 lb)
Weight (excluding terminal base)
0.152 kg (0.34 lb)

Terminal base
TB-IO-W1

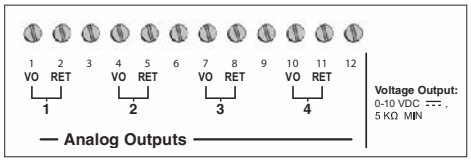
Part numbers
UI-8/AO-V-4, I/O Module – 8 universal inputs/ 4 analog voltage outputs
SXWUI8V4X10001

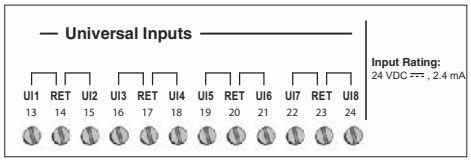
UI-8/AO-V-4-H, I/O Module – 8 universal inputs/ 4 analog voltage outputs w hand control
SXWUI8V4H10001

TB-IO-W1, Term base IO W1
SXWTBIOW110001

(*I/O module types with an “H” contain Hand/Off/Auto override switches and potentiometers)

Connectors





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8 Channel Universal Inputs with 4 Channel Digital Outputs, Form-C (UI-8/DO-FC-4, UI-8/DO-FC-4-H)

Automation Server I/O Module

I/O Module
UI-8/DO-FC-4

The UI-8/DO-FC-4 and UI-8/DO-FC-4-H are a combination I/O modules supporting 8 universal input channels and 4 digital output channels. These compact modules are ideal when an application requires a mix of point types.

Analog and digital applications

This module is ideal for any mix of temperature, pressure, flow, status points, and similar inputs in a building control system. The eight input channels supports a 12 bit A/D conversion.

Counter applications

The maximum counter frequency on all eight inputs with a minimum pulse width is 20 milliseconds. This input type is commonly used in energy metering applications.

Security applications

Supervised points are used for security applications where it is critical to know whether or not a wire has been cut or shorted. These events provide a separate indication of alarm and trouble conditions to the system.

Protection

28 V unipolar transient voltage suppressors on all inputs to protect against high voltage short duration transient events.

Status indicators and overrides

The front panel of the UI-8/AO-4 and UI-8/AO-4-H I/O modules includes a digital output indicator using a green LED. Additionally, the UI-8/AO-4-H module has Hand/Off/Auto (HOA) override switches with adjustable potentiometers for each output.

Direct load applications

The Form-C relays are designed for direct load applications for up to 3 A per output.

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UI-8/DO-FC-4
UI-8/DO-FC-4-H*
Automation Server I/O Module Specifications

DC input power
24 VDC, 1.9 W

Input channels
8

Digital Inputs

Contact
Pulse width 20 ms minimum
Range
Open collector/open drain, 24 V 2.4 mA, dry contact switch closure

Counter
Range
Open collector/open drain, 24 V 2.4 mA, dry contact switch closure
Pulse width 20 ms minimum
LED polarity
Software selectable, if the LED is activated when the input is high or low
LED color
Red or green, software selectable

Supervised
Detected resistor values
Open circuit, short circuit, contact open, and contact closed
5 V circuit, 1 or 2 resistors, monitored switch combinations
Series only, parallel only, and series and parallel
Resistor range
1 k to 10 kohm. For a 2-resistor configuration, each resistor is assumed to have the same value.

Analog inputs

Voltage
Range 0 to 20 mA
Resolution 12 bit
Accuracy ±(7 mV + 0.2% of reading)
Impedance 100 kohm

Current
Accuracy
±(0.03 mA + 0.4 % of reading)
Reliability
Ability to define the reliability level for upper and lower electrical limits.
Resolution 12 bit
Accuracy ±(0.03 mA + 0.4 % of reading)
Impedance 47 ohm

Resistance
10 ohm to 10 kohm
±(7 + 4 x 10 -3 x R) (ohm)
10 kohm to 60 kohm
±(0.4 + 7 x 10 -6 x R) (%)
Reliability
Ability to define the reliability level for upper and lower electrical limits.

Thermistor
Range
-50 to 150 °C (-58 to 302 °F)
Resolution
12 bits
Supported thermistors
1.8 kohm. 10 kohm, and 1 kohm Balco temp. sensor

Internal pull-up resistor
10 kohms thermistors: 10 kohm to 5 V
1.0 (Balco) and 1.8 kohms thermistors: 1.5 kohm to 1 V

Outputs

Digital channels
4

Digital outputs

Form C relay
Terminals
Common (C), Normally Open (NO), Normally Closed (NC)
Pulse Width
100 ms minimum
Isolation
1500 VAC minimum, coil to contact

Internal pull-up resistor
10 kohm to 5 V, or 1.5 kohm to 1 V

Mechanical
Weight (including terminal base)
0.304 kg (0.67 lb)
Weight (excluding terminal base)
0.181 kg (0.40 lb)

Terminal base
TB-IO-W1

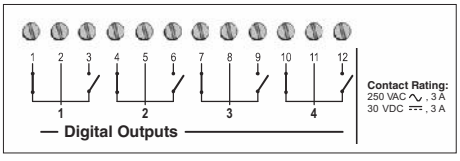
Part numbers
UI-8/DO-FC-4, I/O Module – 8 universal inputs/ 4 digital Form C outputs
SXWUI8D4X10001

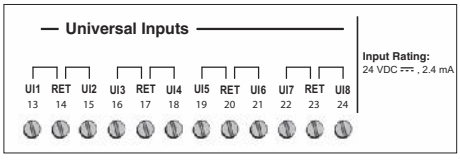
UI-8/DO-FC-4-H, I/O Module – 8 universal inputs/ 4 digital Form C outputs w hand control
SXWUI8D4H10001

TB-IO-W1, Term base IO W1
SXWTBIOW110001

(*I/O module types with an “H” contain Hand/Off/Auto override switches and potentiometers)

Connectors





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StruxureWare™ for Buildings

Automation Server

PS-24V Power Supply Module

Automation Server power supply modules are designed to accommodate the specific power requirements of StruxureWare installations. The power supply module provides power to the Automation Server and its connected I/O modules.

Make the most of your energy℠

Schneider Electric

StruxureWare for Buildings
Automation Server PS-24V Power Supply Module
Features

The PS-24V is a power supply module that accommodates 24 VAC or 24 VDC input power.

PRODUCT AT A GLANCE

- Reliable consistent output power
- Modular and scalable system
- Polarity independent
- Overload protection
- Patented two-piece design
- Hot-connect / Hot-swap
- Auto-addressing
- Simple DIN-rail installation
- Accommodates multiple row panel installations
- 30 W rating
- Status indicators

Reliable consistent output power

Each power supply module delivers reliable and consistent output power of 24 VDC to the backplane.

Modular and scalable system

This power supply supports the Automation Server and its family of I/O modules. This modular system delivers power and communications on a common bus. Connecting modules is a one-step process: just slide the modules together using the built-in connectors.

A 30 W power supply can deliver power to the Automation Server and a number of I/O modules calculated from the Power Budget Table (located on page 3). If more I/O modules are needed, another power supply can be added to the bus. The power supplies are isolated from each other while also providing communication pass-through.

Polarity independent

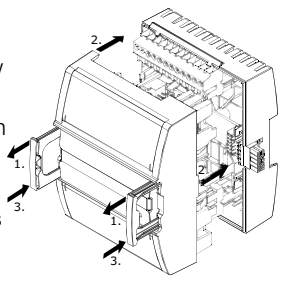
The power supply input (from main power) and output (to modules) are galvanically isolated. This removes the risk of damage due to earth currents and permits the input power to be wired without concern for polarity matching.

Overload protection

When a power supply module's load (total load of Automation Server, I/O modules, communication modules) exceeds its rating, the power supply will protect itself from being damaged.

Patented two-piece design

Each module can be separated from its terminal base to allow the site to be wired prior to the installation of the electronics. The patented locking mechanism serves as handles for removing the module from its base. All critical components have a protective cover that permits natural convection cooling to occur.



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StruxureWare for Building Automation Server PS-24 Power Supply Module Features (continued)

Power Budget Table

	Power Requirements
	24 VDC Power
Automation Server	7 W
Input Only I/O	
DI-16	1.6 W
UI-16	1.8 W
Output Only I/O	
DO-FA-12	1.8 W
DO-FA-12-H	1.8 W
DO-FC-8	2.2 W
DO-FC-8-H	2.2 W
AO-8	4.9 W
AO-8-H	4.9 W
AO-V-8	0.7 W
AO-V-8-H	0.7 W
Mixed I/O	
UI-8/DO-FC-4	1.9 W
UI-8/DO-FC-4-H	1.9 W
UI-8/AO-4	3.2 W
UI-8/AO-4-H	3.2 W
UI-8/AO-V-4	1.0 W
UI-8/AO-V-4-H	1.0 W

Hot-connect / Hot-swap

Because critical applications require 24-hour operation, Schneider Electric designed the entire family of modules for hot-connection of terminal bases and hot-swapping of modules to and from their bases. This design ensures continuous power and communication during service operations.

Auto-addressing

The auto-addressing feature eliminates the need for setting DIP switches or pressing commission buttons. With the Automation Server family, each module automatically knows its order in the chain and assigns itself accordingly.

Simple DIN-rail installation

Fasteners easily snap into a locked position for panel installation. The fastener has a quick-release feature for easy DIN rail removal.

Accommodates multiple row panel installations

The Automation Server module family uses built-in connectors for single row connectivity. If a panel size requires multiple rows, an interconnection cable is available.

30 W rating

This power supply module can supply power for loads up to 30 W. The consumption of downstream modules can vary. A PS-24V can typically power an Automation Server and a number of I/O modules calculated from the Power Budget Table.

Status indicators

The front panel of the PS-24V module includes status LEDs for input and output power. The LED for input power indicates the status of the main power. The output power indicator shows if the power supply output is within the proper range.

StruxureWare for Buildings
Automation Server PS-24 Power Supply Module Specifications

Common Technical Specifications

Electrical

I/O bus power

24 VDC, max. 30 W per I/O bus power supply, Class 2

Maximum addresses per I/O bus

32

AC input

Nominal voltage

24 VAC, 50/60 Hz

Operating range

24 VAC, ±20 %, 50/60 Hz

Input current

Max. 2.5 A rms

Recommended transformer rating

≥ 60 VA

DC input

Nominal voltage

24 to 30 VDC

Operating range

21 to 33 VDC

Power consumption

max. 40 W

DC output

Output voltage

24 V ±1 V

Output power

max. 30 W

Mechanical

Enclosure

Eco Friendly ABS/PC

Enclosure rating

IP 20

Plastic rating

UL94-5VB rated plastic

Dimensions (including terminal base)

90 W x 114 H x 64 D mm

(3.6 W x 4.5 H x 2.5 D in.)

Weight (including terminal base)

0.285 kg (0.63 lb)

Weight (excluding terminal base)

0.186 kg (0.41 lb)

Installation

DIN-rail or panel installation

Operation environment

Ambient temperature, operating

0 °C to 50 °C (32 °F to 122 °F)

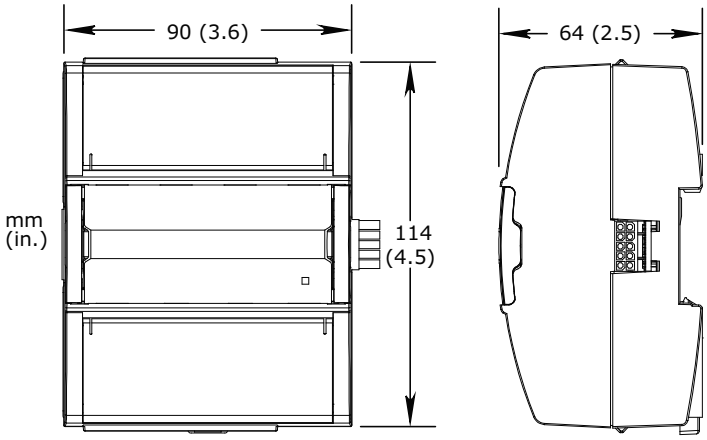
Ambient temperature, storage

–20 °C to +70 °C (–4 °F to +158 °F)

Humidity

Max. 95 % RH (non-condensing)

Dimensional drawing



Agency compliances

Emission

C-Tick; EN 61000-6-3; FCC Part 15, Sub-part B, Class B

Immunity

EN 61000-6-2

Safety

UL 916 C-UL US Listed

Part numbers

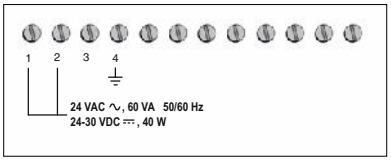
PS-24V Power Supply 24 VAC/VDC

SXWPS24VX10001

TB-PS-W1 Term Base Pwr Sup W1

SXWTBPSW110001

Connectors



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C

Product Implementation Conformance Statement
for the b3xxx Series

Date: April, 2008
Vendor Name: Schneider Electric
Product Name: Continuum
Product Model Number: b3xxx Series (See Table on Page 2)
Applications Software Version: 4.5 **Firmware Revision: 4.5**
BACnet Protocol Version: 1 **BACnet Protocol Revision: 4**

Product Description

The b3xxx Series of programmable controllers are BACnet Advanced Application Controllers (B-AAC). The models are functionally similar, but have different input and output capabilities. The table below details the differences.

Model Name	Number and Type of Inputs	Number and Type of Outputs	Expansion Modules Support	Smart Sensor Support
b3608	8 Universal Inputs		No	No
b3624	24 Universal Inputs		No	No
b3800	8 Universal Inputs	8 Digital Outputs	No	Yes
b3804	8 Universal Inputs	4 Analog Outputs, 4 Digital Outputs	No	Yes
b3810	8 Universal Inputs	8 Digital Outputs	Yes	Yes
b3814	8 Universal Inputs	4 Analog Outputs, 4 Digital Outputs	Yes	Yes
b3850	1 Flow Sensor 4 Universal Inputs	4 Digital Outputs	Yes	Yes
b3851	4 Universal Inputs	4 Digital Outputs	Yes	Yes
b3853	2 Flow Sensors 4 Universal Inputs	4 Digital Outputs	Yes	Yes
b3865	1 Flow Sensor 4 Universal Inputs	1 Actuator Output, 3 Digital Outputs	No	Yes
b3865-V	1 Flow Sensor 4 Universal Inputs	1 Actuator Output, 3 Digital Outputs	No	Yes
b3866	1 Flow Sensor 4 Universal Inputs	1 Actuator Output, 2 Analog Outputs, 3 Digital Outputs	No	Yes
b3866-V	1 Flow Sensor 4 Universal Inputs	1 Actuator Output, 2 Analog Outputs, 3 Digital Outputs	No	Yes
b3867	4 Universal Inputs	2 Analog Outputs, 5 Digital Outputs	No	Yes
b3885	1 Flow Sensor 2 Universal Inputs	1 Actuator Output 2 Digital Outputs	No	No
b3885-V	1 Flow Sensor 2 Universal Inputs	1 Actuator Output 2 Digital Outputs	No	No
b3887	3 Universal Inputs	5 Digital Outputs	No	Yes
b3920	16 Universal Inputs	8 Analog Outputs, 8 Digital Outputs	Yes	Yes

BACnet Standardized Device Profile (Annex L)

	BACnet Operator Workstation (B-OWS)
	BACnet Building Controller (B-BC)
X	BACnet Advanced Application Controller (B-AAC)
	BACnet Application Specific Controller (B-ASC)
	BACnet Smart Actuator (B-SA)
	BACnet Smart Sensor (B-SS)

BACnet Interoperability Building Blocks (BIBBs) Supported

BIBB	Name	BACnet Service	Support	Init	Exec
DS-RP-A[1]	Data Sharing - ReadProperty-A	ReadProperty	X	X	
DS-RP-B	Data Sharing - ReadProperty-B	ReadProperty	X		X
DS-RPM-B	Data Sharing - ReadPropertyMultiple-B	ReadPropertyMultiple	X		X
DS-RPC-B	Data Sharing - ReadPropertyConditional-B	ReadPropertyConditional	X		X
DS-WP-A[1]	Data Sharing - WriteProperty-A	WriteProperty	X	X	
DS-WP-B	Data Sharing - WriteProperty-B	WriteProperty	X		X
DS-WPM-B	Data Sharing - WritePropertyMultiple-B	WritePropertyMultiple	X		X
DS-COV-A	Data Sharing - COV-A	SubscribeCOV	X	X	
		ConfirmedCOVNotification	X		X
		UnconfirmedCOVNotification	X		X
DS-COV-B	Data Sharing - COV-B	SubscribeCOV	X		X
		ConfirmedCOVNotification	X	X	
		UnconfirmedCOVNotification	X	X	
AE-N-I-B	Alarm and Event-Notification-B	ConfirmedEventNotification	X	X	
		UnconfirmedEventNotification	X	X	
AE-ACK-B	Alarm and Event-ACK-B	AcknowledgeAlarm	X		X
AE-INFO-B	Alarm and Event-Information-B	GetEventInformation	X		X
SCHED-I-B	Scheduling-Internal-B		X		
T-VMT-I-B	Trending - Viewing and Modifying Trends Internal-B	ReadRange	X		X
T-ATR-B[1]	Trending – Automated Trend Retrieval-B	ConfirmedEventNotification	X	X	
		ReadRange	X		X
DM-DDB-A	Device Management-Dynamic Device Binding-A	Who-Is	X	X	
		I-Am	X		X
DM-DDB-B	Device Management-Dynamic Device Binding-B	Who-Is	X		X
		I-Am	X	X	
DM-DOB-A	Device Management-Dynamic Object Binding-A	Who-Has	X	X	
		I-Have	X		X
DM-DOB-B	Device Management-Dynamic Object Binding-B	Who-Has	X		X
		I-Have	X	X	
DM-DCC-B	Device Management-DeviceCommunicationControl-B	DeviceCommunicationControl	X		X
DM-TS-B	Device Management-TimeSynchronization-B	TimeSynchronization	X		X
DM-UTC-B	Device Management-UTCTimeSynchronization-B	UTCTimeSynchronization	X		X
DM-RD-B	Device Management-ReinitializeDevice-B	ReinitializeDevice	X		X
DM-BR-B[2]	Device Management-Backup and Restore-B	AtomicReadFile	X		X
		AtomicWriteFile	X		X
		ReinitializeDevice	X		X
DM-OCD-B	Device Management-Object Creation and Deletion-B	CreateObject	X		X
		DeleteObject	X		X

[1] Not supported by b3885, b3885-V, and b3887.

[2] A single stream-based file object is provided, to support Backup and Restore. Record-based access is *not* supported. The file has a proprietary format, which is produced by the controller during a Backup operation. Any attempt to write the file using data not obtained by reading it, will result in an error.

Segmentation Capability

X	Able to transmit segmented messages	Window Size: 1
X	Able to receive segmented messages	Window Size: 1

Standard Object Types Supported

Object Type	Supported	Creatable[1]	Deletable[1]
Analog Input	**X**		
Analog Output	**X**		
Analog Value	**X**	**X**	**X**
Binary Input	**X**		
Binary Output	**X**		
Binary Value	**X**	**X**	**X**
Calendar	**X**	**X**	**X**
Command	**X**	**X**	**X**
Device	**X**		
Event Enrollment	**X**	**X**	**X**
File	**X**		
Loop	**X**	**X**	**X**
Multi-state Input	**X**		
Multi-state Output	**X**		
Multi-state Value	**X**	**X**	**X**
Notification Class	**X**	**X**	**X**
Program	**X**		
Schedule	**X**	**X**	**X**
Trend Log	**X**	**X**	**X**

[1] Except for Device and File, instances of all supported object types can be created, deleted and configured using CyberStation.

Object Types and Properties Supported

Properties that are Supported (S), Writable (W) and Optional (O) are indicated. See Restrictions on Object Identifiers and Names, below. All other strings are restricted to 32 characters. Unsigned values are limited to 4 294 967 294.

All Input and Output objects restrict Out_Of_Service to **true** if Channel is not configured.

Analog Input			
Property	**S**	**W**	**O**
COV_Increment	X	X	
Description	X	X	X
Event_State	X		
Object_Identifier	X		
Object_Name	X		
Object_Type	X		
Out_Of_Service	X	X	
Present_Value	X	X	
Status_Flags	X		
Units	X	X	

Analog Output			
Property	**S**	**W**	**O**
COV_Increment	X	X	
Description	X	X	X
Event_State	X		
Object_Identifier	X		
Object_Name	X		
Object_Type	X		
Out_Of_Service	X	X	
Present_Value	X	X	
Priority_Array	X		
Relinquish_Default	X	X	
Status_Flags	X		
Units	X	X	

Analog Value			
Property	**S**	**W**	**O**
COV_Increment	X	X	
Description	X	X	X
Event_State	X		
Object_Identifier	X		
Object_Name	X	X	
Object_Type	X		
Out_Of_Service	X	X	
Present_Value	X	X	
Priority_Array	X		
Relinquish_Default	X	X	
Status_Flags	X		
Units	X	X	

Binary Input			
Property	**S**	**W**	**O**
Active_Text	X	X	X
Description	X	X	X
Event_State	X		
Inactive_Text	X	X	X
Object_Identifier	X		
Object_Name	X		
Object_Type	X		
Out_Of_Service	X	X	
Polarity	X	X	
Present_Value	X	X	
Status_Flags	X		

Binary Output			
Property	**S**	**W**	**O**
Active_Text	X	X	X
Description	X	X	X
Event_State	X		
Inactive_Text	X	X	X
Object_Identifier	X		
Object_Name	X		
Object_Type	X		
Out_Of_Service	X	X	
Polarity	X	X	
Present_Value	X	X	
Priority_Array	X		
Relinquish_Default	X	X	
Status_Flags	X		

Binary Value			
Property	**S**	**W**	**O**
Active_Text	X	X	X
Description	X	X	X
Event_State	X		
Inactive_Text	X	X	X
Object_Identifier	X		
Object_Name	X	X	
Object_Type	X		
Out_Of_Service	X	X	
Present_Value	X	X	
Priority_Array	X		
Relinquish_Default	X	X	
Status_Flags	X		

Calendar			
Property	**S**	**W**	**O**
Active_Text	X	X	
Description	X	X	X
Event_State	X		
Inactive_Text	X	X	
Object_Identifier	X		
Object_Name	X		

Dates are restricted to years 1989-2105. See Interpretation of Wildcards in Dates, below.

Command			
Property	**S**	**W**	**O**
Action	X	X	
Action_Text	X	X	X
All_Writes_Successful	X		
Description	X	X	X
In_Process	X		
Object_Identifier	X		
Object_Name	X	X	
Object_Type	X		
Present_Value	X	X	

Action is restricted to reference objects in the same device.

Device			
Property	**S**	**W**	**O**
Active_COV_Subscriptions	X		
APDU_Segment_Timeout	X	X	
APDU_Timeout	X	X	
Application_Software_Version	X		
Backup_Failure_Timeout	X	X	
Configuration_Files	X		
Database_Revision	X		
Daylight_Savings_Status	X	X	
Description	X	X	X
Device_Address_Binding	X		
Firmware_Revision	X		
Infinity_Path	X		X
Last_Restore_Time	X		
Local_Date	X		
Local_Time	X		
Location	X	X	X
Max_APDU_Length_Accepted	X		
Max_Info_Frames	X	X	
Max_Master	X	X	
Max_Segments_Accepted	X		
Model_Name	X		
Number_Of_APDU_Retries	X		X
Object_Identifier	X		
Object_List	X		
Object_Name	X		X
Object_Type	X		
Protocol_Object_Types_Supported	X		
Protocol_Revision	X		
Protocol_Services_Supported	X		
Protocol_Version	X		
Segmentation_Supported	X		
Serial_Number	X		X
System_Status	X		
UTC_Offset	X	X	
Vendor_Identifier	X		
Vendor_Name	X		

Infinity_Path is a proprietary property. See “Infinity Path Property” below.

Max_Info_Frames is restricted to the range 1..127.

Number_Of_APDU_Retries is restricted to the range 0..255.

Serial_Number is a proprietary property – See “Serial Number Property” below.

Event Enrollment			
Property	**S**	**W**	**O**
Acked_Transitions	X		
Description	X	X	X
Event_Enable	X	X	
Event_Parameters	X	X	
Event_State	X		
Event_Time_Stamps	X		
Event_Type	X		
Notification_Class	X	X	
Notify_Type	X	X	
Object_Identifier	X		
Object_Name	X	X	
Object_Property_Reference	X	X	
Object_Type	X		

Event_Type limited to Change_Of_State, Change_Of_Value, Floating_Limit, Out_Of_Range and Buffer_Ready.

Object_Property_Reference must reference Present_Value of point in same controller.

File			
Property	**S**	**W**	**O**
Archive	X	X	
File_Access_Method	X		
File_Size	X	X	
File_Type	X		
Modification_Date	X		
Object_Identifier	X		
Object_Name	X		
Object_Type	X		
Read_Only	X		

File_Size is writable when in Restore mode. Values limited to zero and current file size.

Loop			
Property	**S**	**W**	**O**
Action	X	X	
Bias	X	X	X
Controlled_Variable_Reference	X	X	
Controlled_Variable_Units	X	X	
Controlled_Variable_Value	X		
Derivative_Constant	X	X	X
Derivative_Constant_Units	X	X	X
Description	X	X	X
Event_State	X		
Integral_Constant	X	X	X
Integral_Constant_Units	X	X	X
Manipulated_Variable_Reference	X	X	
Maximum_Output	X	X	X
Minimum_Output	X	X	X
Object_Identifier	X		
Object_Name	X	X	
Object_Type	X		
Out_Of_Service	X	X	
Output_Units	X	X	
Present_Value	X	X	
Priority_For_Writing	X	X	
Proportional_Constant	X	X	X
Proportional_Constant_Units	X	X	X
Reliability	X		X
Setpoint	X	X	
Setpoint_Reference	X	X	
Status_Flags	X		
Update_Interval	X	X	X

Present_Value is writable only when Out_Of_Service is true.

Multistate Input			
Property	**S**	**W**	**O**
Description	X	X	X
Event_State	X		
Number_Of_States	X		
Object_Identifier	X		
Object_Name	X		
Object_Type	X		
Out_Of_Service	X	X	
Present_Value	X	X	
State_Text	X		X
Status_Flags	X		

Multistate Output			
Property	**S**	**W**	**O**
Description	X	X	X
Event_State	X		
Number_Of_States	X		
Object_Identifier	X		
Object_Name	X		
Object_Type	X		
Out_Of_Service	X	X	
Present_Value	X	X	
Priority_Array	X		
Relinquish_Default	X	X	
State_Text	X		X
Status_Flags	X		

Multistate Value			
Property	**S**	**W**	**O**
Description	X	X	X
Event_State	X		
Number_Of_States	X		
Object_Identifier	X		
Object_Name	X	X	
Object_Type	X		
Out_Of_Service	X	X	
Present_Value	X	X	
Priority_Array	X		
Relinquish_Default	X	X	
State_Text	X		X
Status_Flags	X		

Cyberstation can configure the State_Text.

Notification Class			
Property	**S**	**W**	**O**
Ack_Required	X	X	
Notification_Class	X		
Description	X	X	X
Object_Identifier	X		
Object_Name	X	X	
Object_Type	X		
Priority	X	X	
Recipient_List	X	X	

Program			
Property	**S**	**W**	**O**
Description	X	X	X
Object_Identifier	X		
Object_Name	X		
Object_Type	X		
Out_Of_Service	X	X	
Program_Change	X	X	
Program_State	X		
Status_Flags	X		

Read_Property of Program_Change always return Ready.

Schedule			
Property	**S**	**W**	**O**
Description	X	X	X
Effective_Period	X	X	
Exception_Schedule	X	X	X
Following_Transition_Time	X		
List_Of_Obj_Property_References	X	X	
Next_Transition_Time	X		
Object_Identifier	X		
Object_Name	X	X	
Object_Type	X		
Out_Of_Service	X	X	
Present_Value	X	X	
Previous_Transition_Time	X		
Priority_For_Writing	X	X	
Reliability	X		
Schedule_Default	X	X	
Status_Flags	X		
Weekly_Schedule	X	X	

In Effective_Period and Exception_Schedule, dates are restricted to years 1989-2105. See Interpretation of Wildcards in Dates, below.

List_Of_Obj_Property_References is limited to internal objects.

Present_Value is writable only when Out_Of_Service is true.

Previous_Transition_Time, Next_Transition_Time and Following_Transition_Time are proprietary properties – See “Support for Optimum Start-Stop” below.

Trend Log			
Property	**S**	**W**	**O**
Buffer_Size	X	X	
COV_Resubscription_Interval	X		X
Description	X	X	X
Event_State	X		
Log_Buffer	X		
Log_Device_Object_Property	X	X	
Log_Enable	X	X	
Log_Interval	X	X	
Object_Identifier	X		
Object_Name	X	X	
Object_Type	X		
Record_Count	X	X	
Start_Time	X	X	
Stop_Time	X	X	
Stop_When_Full	X	X	
Total_Record_Count	X		

Log_Device_Object_Property is limited to reference objects in the same device.

In Start_Time and Stop_Time, dates are restricted to years 1989-2105.

Buffer_Size is required to be at least 2 but is otherwise limited only by available memory.

Data Link Layer Options

	BACnet IP
	BACnet IP, Foreign Device
	ISO 8802_3, Ethernet
	ANSI/ATA 878.1, 2.5 MB ARCNET
	ANSI/ATA 878.1, RS_485, baud rate(s)_____
X	MS/TP master, baud rate(s)_____9600,19200,38400,76800_____
	MS/TP slave, baud rate(s)_____
	Point-To-Point, EIA 232, baud rate(s)_____
	Point-To-Point, modem, baud rate(s)_____
	LonTalk, medium: _____
	Other

Device Address Binding

Static Device Binding Supported	☐	YES	■	NO

Networking Options

☐ Router List all routing configurations
_____

☐ Annex H, BACnet Tunneling Router over IP

☐ BACnet/IP Broadcast Management Device (BBMD)

☐ Support registrations by foreign devices

Character Sets Supported

■ ANSI X3.4	■ ISO 8859-1
☐ ISO 10646 (UCS-2)	☐ ISO 10646 (UCS-4)
☐ IBM /Microsoft DBCS	☐ JIS C 6626

Serial Number Property

Every Continuum device has a unique serial number, assigned at the factory. The serial number is made available by the Serial_Number property of the Device object. The property identifier is 515, and the data type is Unsigned.

Infinity Path Property

Continuum devices can also be accessed via the proprietary Infinity protocol, which requires specific path information to access each device. Accordingly, the Infinity_Path property (identifier 517) of the Device object provides an unsigned integer value composed as follows:

Byte Position	bCX controllers	b3xxx controllers
Lowest	ACC Net ID of the device	ACC Net ID of the parent bCX device [bCX or other BACnet router]
Second	0	Commport Id [in the parent bCX] of the MSTP network
Third	0	MSTP Mac address of the controller

Support for Optimum Start-Stop

The controller includes a proprietary extension that can be used, together with Plain English programming, to optimize the start and stop times for heating and cooling systems based on scheduled occupancy times. The extension consists of three proprietary properties of the Schedule object type:

Name	Identifier	Meaning
Previous_Transition_Time	512	The time when the Schedule's Present_Value most recently changed value
Next_Transition_Time	513	The time when the Schedule's Present_Value is next scheduled to change value
Following_Transition_Time	514	The time when the Schedule's Present_Value is next scheduled to change value after the time indicated by Next_Transition

These properties are unsigned integer values, each giving a date and time expressed as the number of seconds after midnight, January 1, 1970. The Plain English language, which is used to specify the behavior of Program objects, includes the ability to compare these times with the present time, and to compute time intervals.

Each transition indicates a scheduled change in the value of the Schedule's Present_Value attribute. When determining a transition, time-value pairs that do not change the value are not considered transitions.

Restrictions on Object Identifiers and Names

The instance number portion of the Object_Identifier property has a restricted range, which depends to some extent on the object type. The following table gives the valid range of instance numbers:

Object Type	Minimum	Maximum
Device	1	4194302
File[1]	1	1
All others	1	200

For all object types, the Object_Name is limited to 16 characters. The first character must be alphabetic, and the remaining characters must be alphabetic, numeric, or one of '_' or '.'.

Interpretation of Wildcards in Dates

The BACnet specification [ANSI/ASHRAE Standard 135-2001] is open to multiple interpretations regarding the meaning of wildcards in dates, especially when used to specify date ranges. The following describes how the controllers, especially in the context of the Schedule properties Exception_Schedule and Effective_Period, and the Calendar property Date_List, interpret wildcards.

For purposes of comparing dates, the day-of-week fields are not used. That is, they are totally redundant. When comparing dates, a wildcard field is considered equal to the corresponding field in the date being compared. A date falls within the range if it is not before the StartDate and not after the EndDate.

Because the day-of-week field is redundant, its value must be either unspecified or consistent with the other fields. Because it can be consistent with those fields only if they are specified, the controllers allow the day-of-week to be specified only if the other three fields are specified as well.

Accordingly, the following conditions in a date range are treated as errors and will prevent a WriteProperty from completing:

1. A day-of-week is specified but two or fewer of the other fields in the Date are specified.
2. A day-of-week is specified, but is inconsistent with the Date specified by the other fields.
3. A year field is specified, which is outside the range limit of 1989 – 2105.
4. The endDate is earlier than the StartDate.
5. Any of the specified fields are out of range (e.g., 31st day of February).

[1] Only one file object exists (for backup and restore) and users do not create objects of this type.

Continuum®

- Native BACnet/IP or BACnet MS/TP Communications for Interoperability to Third-Party Systems
- Powerful & Flexible Controllers for the Most Demanding Applications
- Expandable I/O Meets Additional Point Count Needs
- Non-Volatile Flash Memory Provides Utmost Reliability — Stores Both Application Program and Operating System
- Flash Memory Allows Easy On-Line Software Updates
- Local, On-Board Service Port
- Local, Extended Storage of Log Data
- View and Modify Information with Optional *Smart Sensor* Display
- BTL Listed as B-AAC, B-BC (pending)

BACnet Family of Controllers

Open standards provide the building owners with flexibility and choice when selecting building automation technology. There is no standard more clearly open than BACnet. BACnet provides a universal model for creating building automation systems that can interoperate with one another.

The Andover *Continuum*® family of native BACnet controllers are ready to meet your most demanding control applications. As native BACnet controllers, they are listed with the **BACnet Testing Labs (BTL)** as **BACnet Advanced Application Controllers (B-AAC)** or **Building Controllers (B-BC, pending)** and communicate as MS/TP or BACnet/IP Devices to all other third-party BACnet Devices on the network and attached sub-networks, in strict accordance with **ANSI/ASHRAE standard 135-2001**. In addition, the open architecture of *Continuum* permits *Continuum*'s access controllers, lighting controllers, digital video recorders, and 200+ protocol drivers to work with native BACnet Devices from Tour Andover Controls and other third-party BACnet manufacturers.

All *Continuum* devices, both BACnet and Infinet, are fully compatible with the *Continuum* BACnet Operator Workstation (B-OWS), a fully native BACnet front-end.

INCREASED RELIABILITY WITH FLASH MEMORY

All *Continuum* BACnet controllers feature Flash memory, providing the utmost in reliability. This non-volatile Flash memory stores your application programs and operating system, so that in the event of a power loss, your application will be restored when power is returned. In addition, the Flash memory allows for easy upgrades of your operating system via software downloads, eliminating the need to swap out proms. Almost all *Continuum* BACnet controllers include an on-board battery to safeguard your runtime data — protecting all point data and log data from being lost if power is removed.

EASY INSTALLATION

The sleek new open-class design of *Continuum*'s BACnet controllers provides easy access to the terminal points and eliminates the need to remove any covers. Inputs are on the left and outputs on the right for easy wiring and troubleshooting. The snap-on cover provides quick access for battery or fuse replacement, when necessary. And exposed mounting holes on all the controllers allow you to easily mount them in any enclosure.

SMART SENSOR INTERFACE

Almost all *Continuum*'s BACnet controllers come standard with an additional input to provide direct connection to the Smart Sensor, Sensor Plus, or any standard room temperature sensor.

t.a.c®
TourAndoverControls

Building Controller

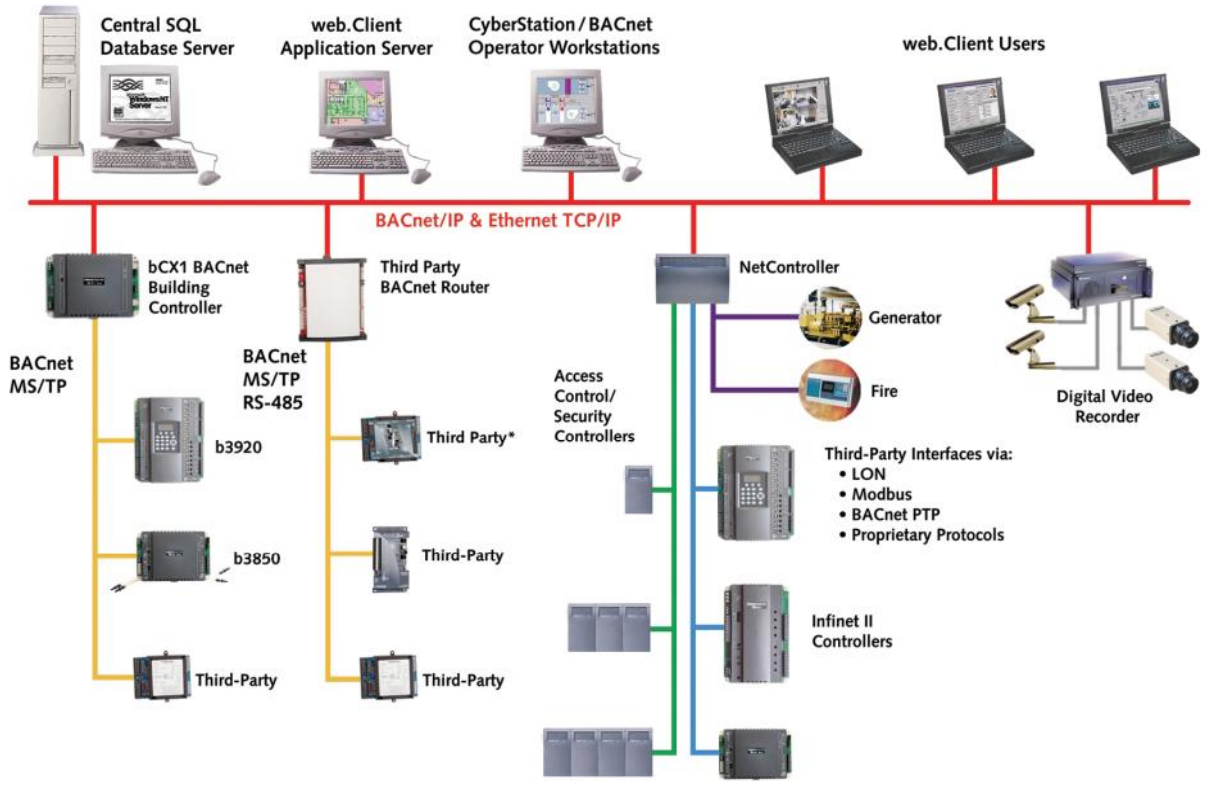
bCX1 ROUTER/CONTROLLER SERIES

The *Continuum* bCX1 is the latest in a complete family of BACnet controllers for the *Continuum* line of controllers. The bCX1-R (Router only) model provides all the functionality to route messages between BACnet/IP and MS/TP networks with support for 64 MS/TP nodes.

The bCX1-CR (Controller/Router) is a full function Building Controller (B-BC) not only routing messages between BACnet/IP and MS/TP but in addition providing all the power of a programmable controller. Supporting local I/O (xP modules), trending, schedules and the ability to create Plain English programs for coordinated control strategies, the bCX1 gives you the freedom to move data between 3rd party devices that do not have the peer to peer functionality provided in all *Continuum* controllers. Both bCX1 models (–R & –CR) provide a built in BBMD to route messages across sub-networks and basic SNMP monitoring support. The -CR also features advanced SNMP alarm functionality, providing alarm delivery for any device on the MS/TP network it manages.

Features & Models	bCX1-R	bCX1-CR
Ports	3	3
Ethernet	10/100	10/100
Comm 1	Modem	Modem/Raw Port
Comm 2	MSTP	MSTP/Raw Port
Protocol	BACnet	BACnet
BBMD	Yes	Yes
Profile	Router Only	B-BC
Field Bus	MS/TP	MS/TP
Nodes Option	64	32, 64, 127
Plain English	No	Yes
Advanced Flash Memory	Yes	Yes
Web Support		
Basic Configuration	Yes	Yes
Embedded Web Server	No	Yes
xP Expansion I/O	No	2+Display
SNMP		
SNMP Monitoring	Yes	Yes
SNMP Alarming	No	Optional

EXPANDED BACnet ARCHITECTURE



System Controllers

b4 920

The b4920 is a powerful system controller that also performs all the functions of a BACnet/IP-to-BACnet MS/TP router, routing messages from the Ethernet network to the field controllers. The b4920 provides built-in I/O, which is expandable if additional points are required. Acting as an BACnet Advanced Application Controller (B-AAC), the b4920 has the ability to talk to other Ethernet BACnet IP or BACnet MS/TP devices.

Specifications	b4920
Ethernet Port - BACnet/IP	10/100
RS-485 Port - BACnet/MSTP	Yes
UI (0-10 Volts) - 12 bit	16
Smart Sensor/Room Sensor Input	1
DO - Form C Relay; 3A, 24 VAC	8
AO (0-10V, 0-20mA) - 8 bit	8
Expansion I/O Port	Yes
Local Service Port	Yes
Real Time Clock	Yes
Flash Memory Size (Application)	512K
4-Line, 16-Character Display	Optional
BACnet Device Profile	B-AAC

b3 920

No Air Handling Unit is too big for the b3920 System Controller. The largest of the stand-alone controllers with 512K of memory. Built-in Real Time Clock plus support for additional I/O for larger applications.

Specifications	b3920
RS-485 Port - BACnet/MSTP	Yes
UI (0-10 Volts) - 12 bit	16
Smart Sensor/Room Sensor Input	1
DO - Form C Relay; 3A, 24 VAC	8
AO (0-10V, 0-20mA) - 8 bit	8
Expansion I/O Port	Yes
Local Service Port	Yes
Real Time Clock	Yes
Flash Memory Size (Application)	512K
4-Line, 16-Character Display	Optional
BACnet Device Profile	B-AAC

b3 800 SERIES

The b3800 Series is perfect for the small Air Handling Unit/Roof Top controller. The b3800 and b3804 feature a built-in 24 VAC and 12-24 VDC auto sensing power supply.

Specifications	b3800	b3804
RS-485 Port - BACnet/MSTP	Yes	Yes
UI (0-5 Volts) - 10 bit	8	24
Smart Sensor/Room Sensor Input	1	1
DO - Form C Relay; 3A, 24 VAC	8	4
AO (0-10 Volts) - 8 bit	-	4
Expansion I/O Port	-	-
Local Service Port	Yes	Yes
Flash Memory Size (Application)	128K	128K
BACnet Device Profile	B-AAC	B-AAC

b3 810 SERIES

The b3810 and b3814 provide the same power as the b3800 series, but also include wider-range universal inputs, additional memory, removable terminal blocks, HOA switches, and expansion I/O capability.

Specifications	b3810	b3814
RS-485 Port - BACnet/MSTP	Yes	Yes
UI (0-10 Volts) - 12 bit	8	8
Smart Sensor/Room Sensor Input	1	1
DO - Form C Relay; 3A, 24 VAC	8	4
AO (0-10V, 0-20mA) - 8 bit	-	4
Expansion I/O Port	Yes	Yes
Local Service Port	Yes	Yes
Real Time Clock	Yes	Yes
Flash Memory Size (Application)	256K	256K
BACnet Device Profile	B-AAC	B-AAC

Note: Minimum software version for all b3/b4 controllers is *Continuum* Rev 1.7 and controller firmware version 4.2 or greater

Terminal Controllers

885

The b3885 is a cost-effective, reduced point-count VAV controller with a built-in actuator. It includes the same CPU used on all i2 controllers, plus Flash memory provides storage of both the operating system and the application program.

Specifications	b3885
RS-485 Port - BACnet/MSTP	Yes
UI (0-5 Volts) - 10 bit	2
Smart Sensor/Room Sensor Input	-
Airflow Sensor (0-1")	1
Damper Actuator	1
DO - Form A Triac; 0.5A, 24 VAC	2
Expansion I/O Port	-
Local Service Port	Yes
Flash Memory Size (Application and OS)	512K
BACnet Device Profile	B-AAC

Notes: No on-board battery
No Supervised Inputs

887/887-L

The b3887 is a unique, low-cost, general purpose terminal controller designed for Fan Coil and Heat Pump applications. The standard b3887 model uses 24 VAC input power; the b3887-L version is designed to use incoming line voltage at 115/230 VAC.

Specifications	b3887	b3887-L -115	b3887-L -230
RS-485 Port - BACnet/MSTP	Yes	Yes	Yes
Supply Voltage	24 VAC	115 VAC	230 VAC
UI (0-5 Volts) - 10 bit	3	3	3
Smart Sensor/Room Sensor Input	1	1	1
DO- Form A Triac; 0.3A, 24 VAC	4	4	4
DO - Form A Relay; 3A, 277VAC	1	1	1
Expansion I/O Port	-	-	-
Local Service Port	Yes	Yes	Yes
Flash Memory Size (Application and OS)	512K	512K	512K
BACnet Device Profile	B-AAC	B-AAC	B-AAC

Notes: No on-board battery
No Supervised Inputs

865/866

The b3865 and b3866 are full-featured VAV controllers that come equipped with a built-in actuator. Compared to the b3885, the b3865 series provides more I/O to handle your full range of VAV applications.

Specifications	b3865	b3866
RS-485 Port - BACnet/MSTP	Yes	Yes
UI (0-5 Volts) - 10 bit	4	4
Smart Sensor/Room Sensor Input	1	1
Airflow Sensor (0-2")	1	1
Damper Actuator	1	1
DO - Form A Triac; 0.5A, 24 VAC	3	3
AO (0-10 Volts) - 10 bit	-	2
Expansion I/O Port	-	-
Local Service Port	Yes	Yes
Flash Memory Size (Application)	128K	128K
BACnet Device Profile	B-AAC	B-AAC

867

The b3867 is a compact terminal controller that provides DDC control of package units, heat pumps, unit ventilators, and other terminal unit applications. Compared to the b3887, the b3867 provides more I/O for greater flexibility.

Specifications	b3867
RS-485 Port - BACnet/MSTP	Yes
UI (0-5 Volts) - 10 bit	4
Smart Sensor/Room Sensor Input	1
DO - Form A Triac; 0.5A, 24 VAC	5
AO (0-10 Volts) - 8 bit	2
Expansion I/O Port	-
Local Service Port	Yes
Flash Memory Size (Application)	128K
BACnet Device Profile	B-AAC

Note: Minimum software version for all b3/b4 controllers is *Continuum* Rev 1.7 and controller firmware version 4.2 or greater

Terminal Controllers (continued)

b3 850 SERIES

The b3850 series is a perfect fit for your VAV applications where external actuators are used. If additional I/O points are required, the built-in I/O Expansion Port provides the link and the module power for these points. The b3853 is designed for dual-duct VAV applications that require two airflow sensors.

Specifications	b3850	b3851	b3853
RS-485 Port - BACnet/MSTP	Yes	Yes	Yes
UI (0-5 Volts) - 10 bit	4	4	4
Smart Sensor/Room Sensor Input	1	1	1
Airflow Sensor (0-2")	1	-	2
DO - Form A Relay; 3A, 24 VAC	3	3	3
DO - Tri-State Form K; 3A, 24 VAC	1	1	1
Expansion I/O Port	Yes	Yes	Yes
Local Service Port	Yes	Yes	Yes
Flash Memory Size (Application)	128K	128K	128K
BACnet Device Profile	B-AAC	B-AAC	B-AAC

b3 600 SERIES

The b3600 Series is ideal for small or large groups of inputs that require monitoring in a concentrated area. Equiped with a built-in 24 VAC and 12-24 VDC auto sensing power supply, the unit allows any Universal Input to be configured as a Supervised Input for monitoring open wires or short circuits.

Specifications	b3608	b3624
RS-485 Port - BACnet/MSTP	Yes	Yes
UI (0-5 Volts) - 10 bit	8	24
Smart Sensor/Room Sensor Input	-	-
Expansion I/O Port	-	-
Local Service Port	Yes	Yes
Flash Memory Size (Application)	128K	128K
BACnet Device Profile	B-AAC	B-AAC

xP EXPANSION I/O

When additional I/O points are required, the I/O Expansion Family of attachable modules are available to solve all your application needs. The b3810, b3850, b3920 and the bCX1-CR series controllers support up to two I/O Expansion modules and/or a remote mounted display.

Exp. Models:	Provides Additional:
xPDI8	8 Digital Inputs
xPUI4	4 Universal Inputs
xPAO2	2 Analog Outputs with overrides
xPA04	4 Analog Outputs with overrides
xPDO2	2 Digital Outputs with overrides
xPDO4	4 Digital Outputs with overrides
xP Display	Local Display Module (4-Line, 16-Character)

In addition to the standard xP modules available for the field controller, (2) new modules have been developed to enhance the functionality of the bCX1-CR Building Controller.

xPBD4	4 Universal Inputs 4 Digital Outputs with overrides
xPBA4	4 Universal Inputs 4 Analog Outputs with overrides

Note: Minimum software version for all b3/b4 controllers is *Continuum* Rev 1.7 and controller firmware version 4.2 or greater

DS-B-FAMILY-A

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D

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ET Series

Temperature Sensors

General Instructions

APPLICATION

Thermistors offer high accuracy and interchangeability over a wide temperature range. The ET series can be used in the following applications:

- Space
- Duct
- Immersion
- Averaging
- Strap-On
- Bead/Bullet
- Outdoor Air

ET Series Photo

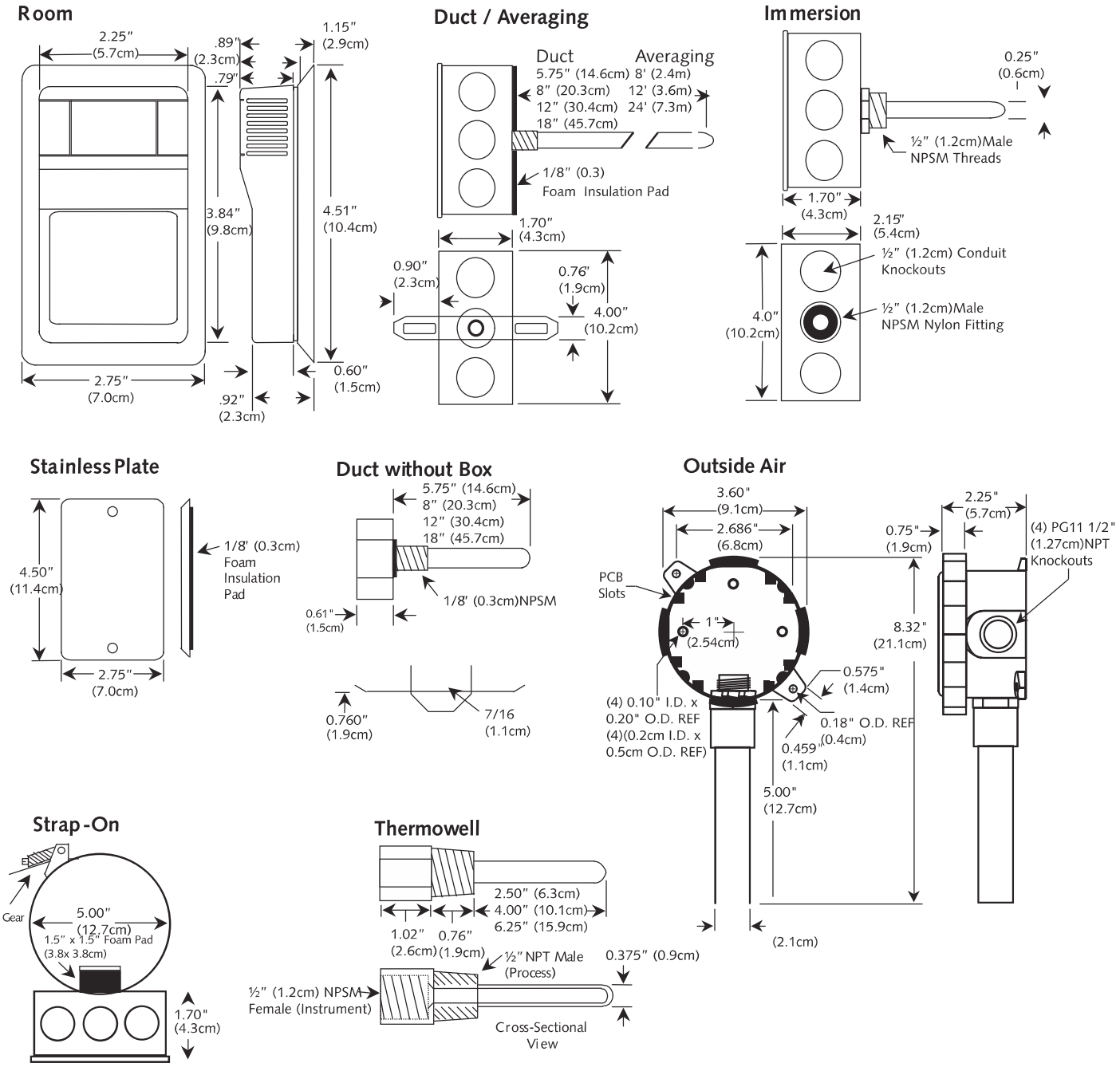
FEATURES

- Offer high accuracy and interchangeability over a wide temperature range.
- Non-polarity sensitive

SPECIFICATIONS

	For TAC Vista, I/NET, Continuum, and I/A	1000 Ohm Platinum	1000 Ohm BALCO
Output	1.8K Ohms @ 77° F (25° C) Vista 10K Ohms @ 77° F (25° C) I/Net 10K Ohms @ 77° F (25° C) Continuum 10K Ohms @ 77° F (25° C) with 11K Ohms shunt resistor I/A	1K Ohms @ 32°F (0°C)	1000 Ohms @ 70°F (21°C)
Temperature Range	-40° to 302° F (-40° to 150° C)	-58° to 392°F (-50 to 200°C) -50° to 275°F (-45.5° to 134.8°C)	-40° to 240°F (-40° to 116°C)
Interchangeability	+/- 0.2 C (0° to 70° C)		
Dissipation Constant Stability	3 mW / C		
Accuracy	+/- 0.2° C (0° to 70° C)	+/- 0.06% @ 32°F (0°C) Single Point +/- 1.0 Ohm @ 70°F (Averaging)	+/- 0.1%
Operating Humidity	0 to 90% RH non-condensing		

DIMENSIONS



INSTALLATION

ROOM TEMPERATURE SENSORS
This unit is suitable for either drywall mounting or junction box mounting. The room sensor is provided with screw terminal blocks for all connections. Remove the cover from the unit and mount the housing base to the wall using the (2) 6/32" x 1" machine screws. Replace the cover and tighten down, using the (2) 1/16" Allen Screws located on the bottom of the enclosure.

DUCT AND DUCT AVERAGING SENSORS
Duct temperature sensors - drill a 3/8" hole in the duct and insert the probe through the hole until the foam pad is tight to the duct. Now insert (2) screws through the mounting holes in flange and tighten them until the unit is held firmly to the duct. Duct Averaging sensors - Drill a 3/8" hole in the duct and insert the averaging element through the hole until the foam pad is tight to the duct. Now insert the (2) screws through the holes in the mounting flange and tighten until the unit is held firmly to the duct. The sensor should then be strung in a criss-cross pattern throughout the duct using the mounting clips provided, in a pattern that covers the greatest surface area of the duct, to insure that there is no stratification. When bending the copper tubing, be careful that you use a gradual bend and that you DO Not kink the copper tubing.

IMMERSION TEMPERATURE SENSORS
The TAC Fluid Immersion-type sensors are provided with a 2 ½", 4", or 6 ¼" insertion length, 304 series stainless steel thermowell. The thermowell has a 1/2" NPT external or process thread and a 1/2" NPT internal or instrument thread. Heat transfer compound may be used but it is not necessary.

STRAP-ON TEMPERATURE SENSORS
The TAC Strap-On sensors, are provided in a NEMA 1 rated junction box with an adjustable 2" to 5" pipe clamp. The unit should be mounted on the bottom side of the pipe to ensure proper heat transfer and a true temperature reading. Heat transfer compound and insulating the sensor will help the overall accuracy of the sensor. By ordering extra straps, and fastening them together, it is possible to make them fit larger pipes.

OUTSIDE AIR TEMPERATURE SENSORS
The TAC Outdoor Air temperature sensors are provided in a weatherproof enclosure. An optional weatherproof Aluminum Bell Box or NEMA 4X Polycarbonate enclosure is also available upon request for an additional charge. All of the mounting hardware is provided with the sensor. Be sure to mount the sensor out of direct sunlight, with the sensor probe pointing downward.

STAINLESS PLATE TEMPERATURE SENSORS
The TAC Stainless Plate temperature sensors are mounted on the back of a 1 Gang stainless steel plate. The foam pad will insulate the sensor from any drafts in the wall. (2) 6/32" x 1" machine screws are provided for junction box mounting. Be sure that the sensor is not mounted on an outside wall, due to the extreme temperature changes from either drafts or heat transfer.

WIRING DIAGRAMS

Diagram for ETR Sensors

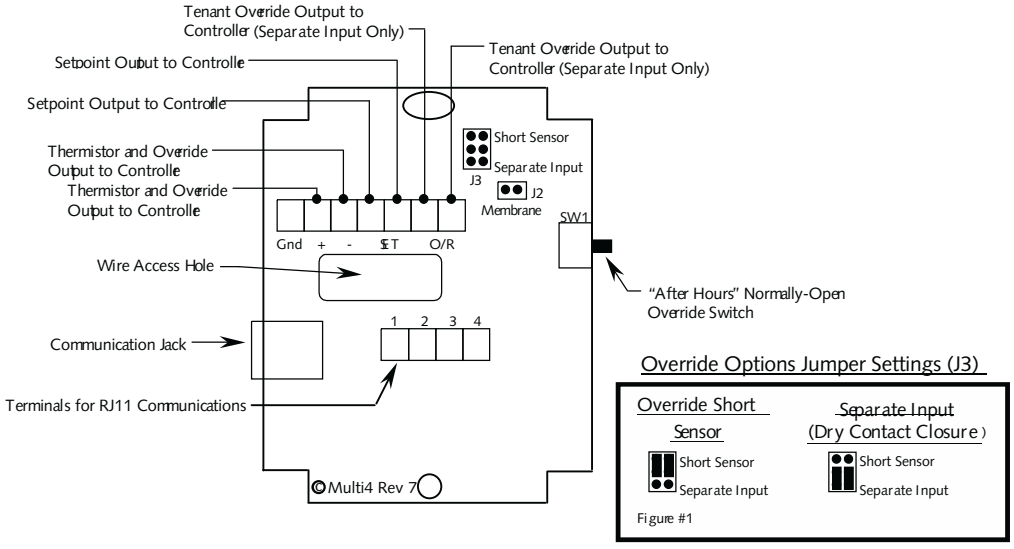
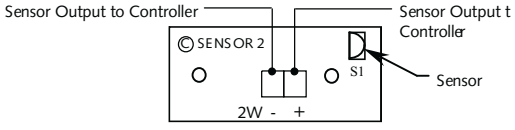


Figure #1

Diagram for ET Sensors Except ETR



ET Series

SPECIFICATIONS

	For TAC Vista, I/NET, Continuum, and I/A	1000 Ohm Platinum	1000 Ohm BALCO
Output	1.8K Ohms @ 77° F (25° C) Vista 10K Ohms @ 77° F (25° C) I/Net 10K Ohms @ 77° F (25° C) Continuum 10K Ohms @ 77° F (25° C) with 11K Ohms shunt resistor I/A	1K Ohms @ 32°F (0°C)	1000 Ohms @ 70°F (21°C)
Temperature Range	-40° to 302° F (-40° to 150° C)	-58° to 392°F (-50 to 200°C) -50° to 275°F (-45.5° to 134.8°C)	-40° to 240°F (-40° to 116°C)
Interchangeability	+/- 0.2 C (0° to 70° C)		
Temperature Coefficient		0.00385 Ohm/Ohm/°C	2.2 Ohms/°F
Dissipation Constant Stability	3 mW / C		
Accuracy	+/- 0.2° C (0° to 70° C) +/- 0.4° F (32° to 158° C)	+/- 0.06% @ 32°F (0°C) Single Point +/- 1.0 Ohm @ 70°F (Averaging)	+/- 0.1%
Operating Humidity	0 to 90% RH non-condensing		

Application

Thermistors offer high accuracy and interchangeability over a wide temperature range. The ET series can be used in the following applications:

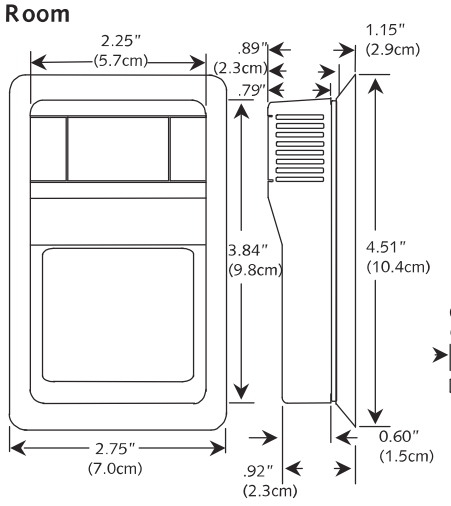
- Space
- Duct
- Immersion
- Averaging
- Strap-On
- Bead/Bullet
- Outdoor Air

Features

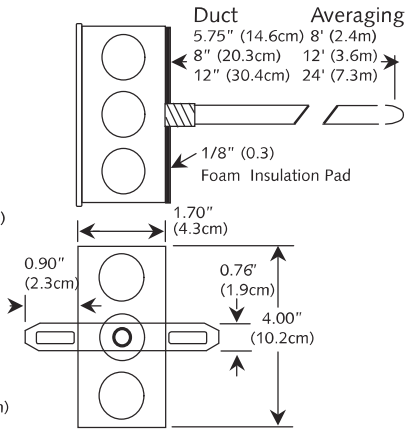
- Offer high accuracy and interchangeability over a wide temperature range.
- Non-polarity sensitive

DIMENSIONS

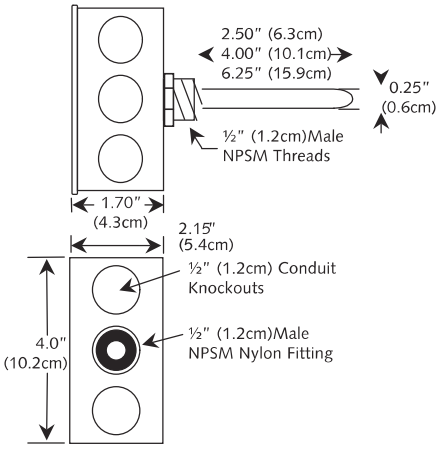
Room



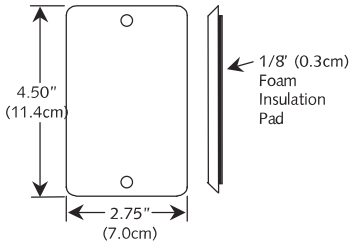
Duct / Averaging



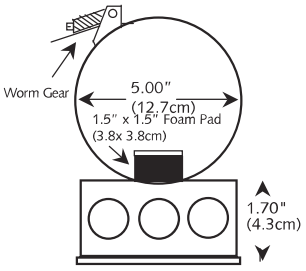
Immersion



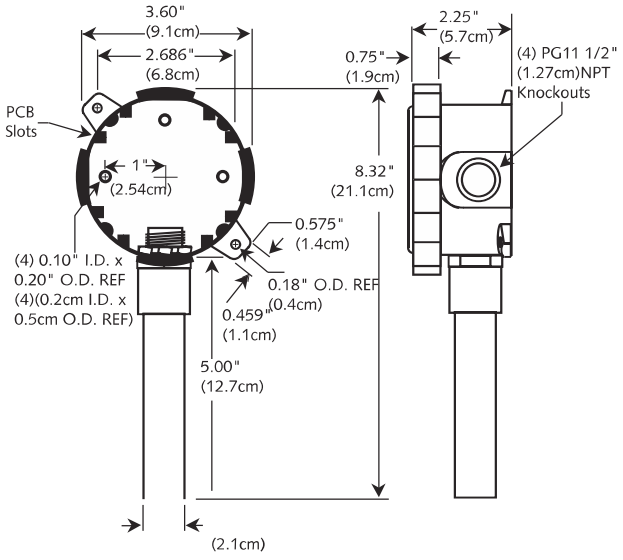
Stainless Plate



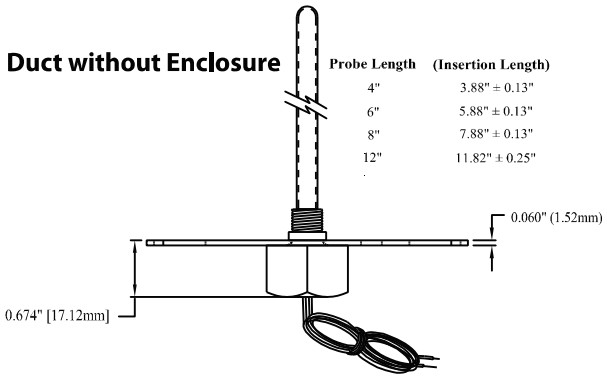
Strap-On



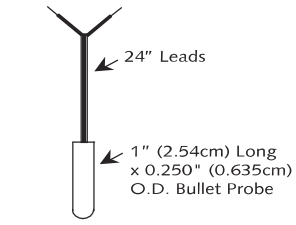
Outside Air



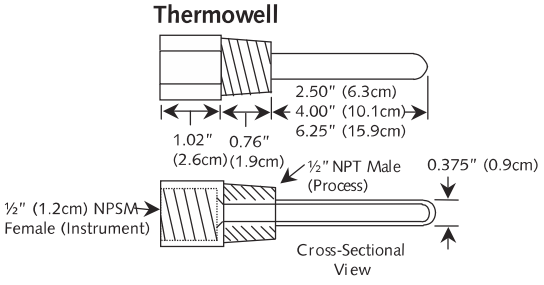
Duct without Enclosure



Bullet Probe



Thermowell



INSTALLATION

Room Temperature Sensors

This unit is suitable for either drywall mounting or junction box mounting. The room sensor is provided with screw terminal blocks for all connections. Remove the cover from the unit and mount the housing base to the wall using the (2) 6/32" x 1" machine screws. Replace the cover and tighten down, using the (2) 1/16" Allen Screws located on the bottom of the enclosure.

Duct and Duct Averaging Sensors

Duct temperature sensors - drill a 3/8" hole in the duct and insert the probe through the hole until the foam pad is tight to the duct. Now insert (2) screws through the mounting holes in flange and tighten them until the unit is held firmly to the duct. Duct Averaging sensors - Drill a 3/8" hole in the duct and insert the averaging element through the hole until the foam pad is tight to the duct. Now insert the (2) screws through the holes in the mounting flange and tighten until the unit is held firmly to the duct. The sensor should then be strung in a criss-cross pattern throughout the duct using the mounting clips provided, in a pattern that covers the greatest surface area of the duct, to insure that there is no stratification. When bending the copper tubing, be careful that you use a gradual bend and that you DO Not kink the copper tubing.

Immersion Temperature Sensors

The Fluid Immersion-type sensors are provided with a 2 ½", 4", or 6 ¼" insertion length, 304 series stainless steel thermowell. The thermowell has a 1/2" NPT external or process thread and a 1/2" NPS Female process thread. Heat transfer compound may be used but it is not necessary.

Strap-On Temperature Sensors

The TAC Strap-On sensors, are provided in a NEMA 1 rated junction box with an adjustable 2" to 5" pipe clamp. The unit should be mounted on the bottom side of the pipe to ensure proper heat transfer and a true temperature reading. Heat transfer compound and insulating the sensor will help the overall accuracy of the sensor. By ordering extra straps, and fastening them together, it is possible to make them fit larger pipes.

Outside Air Temperature Sensors

The TAC Outdoor Air temperature sensors are provided in a weatherproof enclosure. An optional weatherproof Aluminum Bell Box or NEMA 4X Polycarbonate enclosure is also available upon request for an additional charge. All of the mounting hardware is provided with the sensor. Be sure to mount the sensor out of direct sunlight, with the sensor probe pointing downward.

Stainless Plate Temperature Sensors

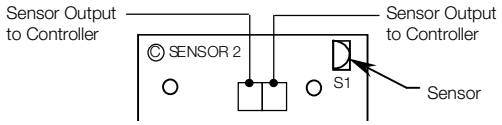
The TAC Stainless Plate temperature sensors are mounted on the back of a 1 Gang stainless steel plate. The foam pad will insulate the sensor from any drafts in the wall. (2) 6/32" x 1" machine screws are provided for junction box mounting. Be sure that the sensor is not mounted on an outside wall, due to the extreme temperature changes from either drafts or heat transfer.

WIRING

For wiring Information on room temperature sensors, please refer to the following documents:

System	F-Number
Vista	F-27616
I/NET	F-27617
Continuum	F-27618
I/A	F-27619

Diagram for ET Sensors Except ETR



ORDERING INFORMATION

Temperature Sensor Description	TAC Vista	I/NET	Continuum	I/A	1000 Ohm Platinum	1000 Ohm BALCO
Room	ETR100	ETR200	ETR500	ETR800	-	-
Room with Setpoint	ETR101	ETR201	ETR501	ETR801	-	-
Room with Override Pushbutton	ETR102	ETR202	ETR502	ETR802	-	-
Room with Setpoint and Override Pushbutton	ETR103	ETR203	ETR503	ETR803	-	-
Wallplate (Stainless Steel)	ETP100	ETP200	ETP500	ETP800		
4" Duct (Galvanized Steel Enclosure)	ETD100-4	ETD200-4	ETD500-4	ETD800-4	ETDPK0-4	ETDBK0-4
6" Duct Galvanized Steel Enclosure)	ETD100-6	ETD200-6	ETD500-6	ETD800-6	ETDPK0-6	ETDBK0-6
8" Duct (Galvanized Steel Enclosure)	ETD100-8	ETD200-8	ETD500-8	ETD800-8	ETDPK0-8	ETDBK0-8
12" Duct (Galvanized Steel Enclosure)	ETD100-12	ETD200-12	ETD500-12	ETD800-12	ETDPK0-12	ETDBK0-12
4" Duct without Enclosure	ETD100-NE-4	ETD200-NE-4	ETD500-NE-4	ETD800-NE-4	ETDPK0-NE-4	ETDBK0-NE-4
6" Duct without Enclosure	ETD100-NE-6	ETD200-NE-6	ETD500-NE-6	ETD800-NE-6	ETDPK0-NE-6	ETDBK0-NE-6
8" Duct without Enclosure	ETD100-NE-8	ETD200-NE-8	ETD500-NE-8	ETD800-NE-8	ETDPK0-NE-8	ETDBK0-NE-8
12" Duct without Enclosure	ETD100-NE-12	ETD200-NE-12	ETD500-NE-12	ETD800-NE-12	ETDPK0-NE-12	ETDBK0-NE-12
2.5" Immersion (Galvanized Steel Enclosure)*	ETI100-2	ETI200-2	ETI500-2	ETI800-2	ETIPK0-2	ETIBK0-2
4" Immersion (Galvanized Steel Enclosure)*	ETI100-4	ETI200-4	ETI500-4	ETI800-4	ETIPK0-4	ETIBK0-4
6.25" Immersion (Galvanized Steel Enclosure)*	ETI100-6	ETI200-6	ETI500-6	ETI800-6	ETIPK0-6	ETIBK0-6
8' Averaging (Flexible Copper)	ETA100-8	ETA200-8	ETA500-8	ETA800-8	-	-
12' Averaging (Flexible Copper)	ETA100-12	ETA200-12	ETA500-12	ETA800-12	ETAPK0-12	ETABK0-12
24' Averaging (Flexible Copper)	ETA100-24	ETA200-24	ETA500-24	ETA800-24	ETAPK0-24	ETABK0-24
Outside Air	ETO100	ETO200	ETO500	ETO800	-	-
Strap On	ETS100	ETS200	ETS500	ETS800	-	-
Bead / Bullet	ETB100	ETB200	ETB500	ETB800	-	-

* Length indicates immersion depth.

Miscellaneous Options	Code
LCD Display in Fahrenheit (for room units only)	-LCD
LED Indicator* (for room units with override only)	-LED
Thermometer Indicator (for room units only)	-TI
RS232 Communication Jack (for use with I/NET systems only)	-RS232
Four-Pin RJ11 Communication Jack (for use with TAC Vista and Continuum systems only)	-RJ4

* Not available on I/A, 1000 Ohm Platinum, or 1000 Ohm BALCO.

Well Type	Part Number
2.5" Stainless Steel Well*	ETI-WELL-2S
4" Stainless Steel Well*	ETI-WELL-4S
6.25" Stainless Steel Well*	ETI-WELL-6S

* Length indicates immersion depth.

ORDERING INFORMATION

Temperature Sensor Description	TAC Vista	I/NET	Continuum	I/A	1000 Ohm Platinum	1000 Ohm BALCO
Room	ETR100	ETR200	ETR500	ETR800	-	-
Room with Setpoint	ETR101	ETR201	ETR501	ETR801	-	-
Room with Override Pushbutton	ETR102	ETR202	ETR502	ETR802	-	-
Room with Setpoint and Override Pushbutton	ETR103	ETR203	ETR503	ETR803	-	-
Wallplate (Stainless Steel)	ETP100	ETP200	ETP500	ETP800		
4″ Duct (Galvanized Steel Enclosure)	ETD100-4	ETD200-4	ETD500-4	ETD800-4	ETDPK0-4	ETDBK0-4
6″ Duct Galvanized Steel Enclosure)	ETD100-6	ETD200-6	ETD500-6	ETD800-6	ETDPK0-6	ETDBK0-6
8″ Duct (Galvanized Steel Enclosure)	ETD100-8	ETD200-8	ETD500-8	ETD800-8	ETDPK0-8	ETDBK0-8
12″ Duct (Galvanized Steel Enclosure)	ETD100-12	ETD200-12	ETD500-12	ETD800-12	ETDPK0-12	ETDBK0-12
4″ Duct without Enclosure	ETD100-NE-4	ETD200-NE-4	ETD500-NE-4	ETD800-NE-4	ETDPK0-NE-4	ETDBK0-NE-4
6″ Duct without Enclosure	ETD100-NE-6	ETD200-NE-6	ETD500-NE-6	ETD800-NE-6	ETDPK0-NE-6	ETDBK0-NE-6
8″ Duct without Enclosure	ETD100-NE-8	ETD200-NE-8	ETD500-NE-8	ETD800-NE-8	ETDPK0-NE-8	ETDBK0-NE-8
12″ Duct without Enclosure	ETD100-NE-12	ETD200-NE-12	ETD500-NE-12	ETD800-NE-12	ETDPK0-NE-12	ETDBK0-NE-12
2″ Immersion (Galvanized Steel Enclosure)	ETI100-2	ETI200-2	ETI500-2	ETI800-2	ETIPK0-2	ETIBK0-2
4″ Immersion (Galvanized Steel Enclosure)	ETI100-4	ETI200-4	ETI500-4	ETI800-4	ETIPK0-4	ETIBK0-4
6″ Immersion (Galvanized Steel Enclosure)	ETI100-6	ETI200-6	ETI500-6	ETI800-6	ETIPK0-6	ETIBK0-6
8′ Averaging (Flexible Copper)	ETA100-8	ETA200-8	ETA500-8	ETA800-8	-	-
12′ Averaging (Flexible Copper)	ETA100-12	ETA200-12	ETA500-12	ETA800-12	ETAPK0-12	ETABK0-12
24′ Averaging (Flexible Copper)	ETA100-24	ETA200-24	ETA500-24	ETA800-24	ETAPK0-24	ETABK0-24
Outside Air	ETO100	ETO200	ETO500	ETO800	-	-
Strap On	ETS100	ETS200	ETS500	ETS800	-	-
Bead / Bullet	ETB100	ETB200	ETB500	ETB800	-	-

Miscellaneous Options	Code
LCD Display (for room units only)	-LCD
LED Indicator (for room units with override only)	-LED
Thermometer Indicator (for room units only)	-TI
RS232 Communication Jack (for use with I/NET systems only)	-RS232
Four-Pin RJ11 Communication Jack (for use with TAC Vista and Continuum systems only)	-RJ4

Well Type	Part Number
2″ Stainless Steel Well	ETI-WELL-2S
4″ Stainless Steel Well	ETI-WELL-4S
6″ Stainless Steel Well	ETI-WELL-6S

TAC
1354 Clifford Ave
P.O. Box 2940
Loves Park, IL 61132-2940

www.tac.com

t.a.c® by Schneider Electric

E

Duct Temperature Sensors

Model TE-701 / 702

- **More than 15 types of interchangeable NTC thermistors, precision platinum, nickel or balco RTD's are available for universal compatibility.**
- **Five installation options — probe with mounting flange or bulkhead fitting, plastic, galvanized steel, or NEMA-4 / IP-65 steel enclosure offer the industry's most extensive range to satisfy all HVAC, appliance and industrial applications.**
- **304 SS thin wall probe with a cold rolled hermitically sealed end forms a monolithic encapsulation cavity for the sensor and is immune to failures caused by high humidity, contamination, thermal shock and vibration.**
- **The flat probe end provides a large thermally sensitive area and the sensor is in direct thermal contact to this surface. As a result, extremely fast response is achieved to changes in temperature.**
- **Probe is attached to the enclosure or the flange using a patented process to provide a rugged, reliable and low profile attachment for ease of installation.**

TE-701/702 temperature sensors offer the industry's most extensive range of enclosure, installation and sensor types to satisfy all HVAC, industrial and commercial applications. These revolutionary sensors incorporate more than twenty five years of product development and experience drawn from millions of installations world wide in all types of applications. This product and process design combined with automated manufacturing processes yields a rugged, reliable, repeatable and stable temperature sensor at a low cost. The only line of temperature sensors offering lifetime warranty against moisture migration related failures.

For large volume OEM customers, TE-701/702 temperature sensors are available in many custom configurations. Wire type, length or gage, terminals, connectors, probe lengths, enclosure options or sensor types may be customized based on volume.

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Pensnett Estate • Kingswinford
West Midlands • DY6 7YA • United Kingdom
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Holden Hill • S.A. 5088 • Australia
08-8395-4333 • Fax 08-8395-4433

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905-474-9215 • Fax 905-474-0876

No. 22 Lorong 21A Geylang # 11-02
Prosper Industrial Building
Singapore • 388421
656-3927273 • Fax 656-3927276

TE-701-A/B Temperature Sensor Flange Mount

Incorporate a hermitically sealed 304 SS probe, crimped on to a Steel flange providing a rugged assembly for duct temperature sensing. Two mounting holes are provided for #8 screws and the flange mating surface is fully gasketted to seal off the probe and screw holes. TE-701-A is available with 3 in/75mm wire leads and the TE-701-B has 6 ft/1.8 meter plenum rated cable. TE-701-A/B is an ideal product for a rugged, reliable, quick and easy installation in air handlers, fan coil units, ducts, furnaces, freezers, ovens or any other through the wall temperature sensing application.

TE-701-C/D Temperature Sensor Bulkhead Mount

Fast response 304 SS probe with a brass bulkhead fitting and a compression sleeve forms a strong assembly for duct temperature sensing if adjustable insertion depth is desired. The bulkhead fitting is installed in the duct, compression sleeve loosened, probe inserted to the desired length and the sleeve is tightened. Sensor is available with 3 in/75mm leads or 6 ft/1.8 meter plenum rated cable. TE-701-C/D sensors provide a low cost, rugged, quick and easy installation in air handlers, fan coil units, ducts, plenum, furnaces, freezers, ovens or any other through the wall temperature sensing application which requires adjustable insertion length.

TE-702-A Temperature Sensor Polycarb Enclosure

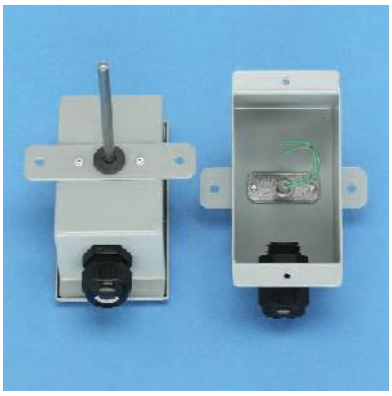
Corrosion free 30% glass filled polycarbonate enclosure designed to withstand temperature extremes, mechanical shock and vibration. 304 SS probe crimp attached to the enclosure flange for a low profile mating surface, external mounting bracket to conform to irregular surfaces, single screw cover attachment, are some of the features which improve reliability and lower installation cost. TE-702-A temperature sensors provide a cost effective and reliable solution for air handlers, fan coil units, ducts, plenums, furnaces or any other application which does not require conduit wiring.

TE-702-B **Temperature Sensor**
Galvanized Steel Enclosure

Industry standard NEMA-1 / IP-30 galvanized sheet metal enclosure designed for all industrial and commercial duct temperature sensing applications. Hermitically sealed, fast response 304 SS probe crimp attached to the enclosure flange to provide a low profile mating surface, external mounting bracket to conform to uneven surfaces, keyed enclosure cover to swing open without removing the screws, 1/2" conduit opening, are some of the features which improve reliability and lower installation cost.

TE-702-C **Temperature Sensor**
Powder Coated Steel Enclosure

Rugged steel enclosure with welded seams, gasketted cover and powder coated finish, rated NEMA-4 / IP-65 for harsh environments. TE-702-C has all the other features including a 304 SS probe, external mounting bracket, conduit opening similar to the TE-702-B series except designed for applications in unconditioned environments where the unit maybe subjected to dirt, condensation, oil vapor and other contaminants.

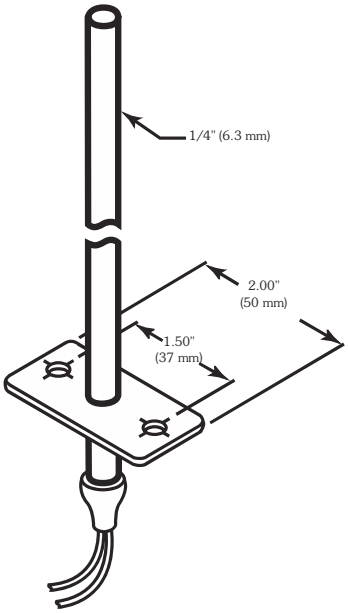


SPECIFICATIONS:

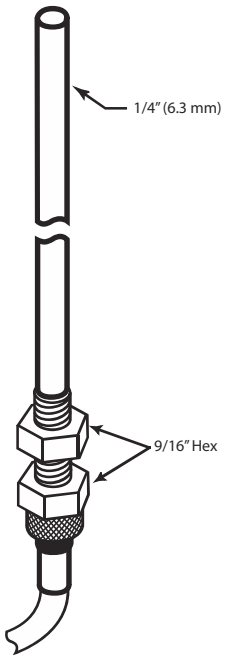
Platinum RTD sensors:	+/- 0.1% @ 0 C, Alpha : 385 per DIN 43760
Nickel RTD sensors: (#2)	+/- 0.5 C @ 0 C, 5000 PPM/K T.C.R.
Nickel RTD sensors: (#4)	+/- 0.5 F @ 70 F / 21.1 C, 6000 PPM/K T.C.R.
Balco RTD sensors:	+/- 0.5 F @ 70 F /21.1 C, 4300 PPM/K T.C.R.
Thermistor sensors:	+/- 0.2 C interchangeability @ 77 F/ 0 C
Probe Material:	1/4" / 6.3mm O.D, 0.020" / 0.5mm wall 304 Stainless Steel
Flange Material:	Galvanized Steel
Bulkhead Fitting:	Brass with poly compression sleeve
Plastic Enclosure:	Polycarbonate 30% glass filled, rated UL 94V-5-0
Steel NEMA-1 / IP-30:	18 Ga. Galvanized Steel
Steel NEMA-4 / IP-65:	18 Ga. Cold Rolled Steel, Powder coated
Operating Temp:	-40F/-40C to 210F/100C
Ambient Temp:	-40F/-40C to 160F/70C
Warranty:	Five Years (Lifetime on Moisture Migration).

U.S. PATENT NO. 6457857, 6555748, 7036224

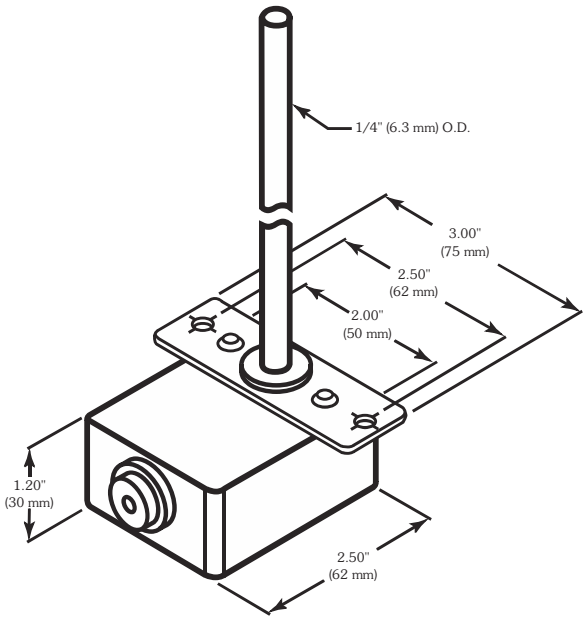
TE-701-A/B



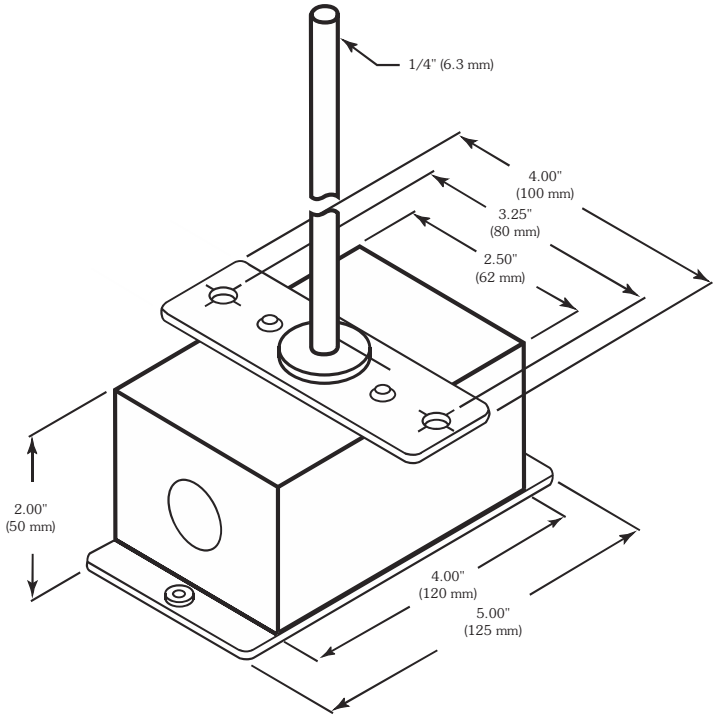
TE-701-C/D



TE-702-A



TE-702-B/C



ORDERING INFORMATION: TE-701

Installation	Sensor*	Probe Length
A Flange mount 3 in/175mm wire leads	**1** 100 ohm Platinum RTD	**A** 4 inches/100mm
B Flange mount 6 ft/1.8m plenum cable	**2** 1,000 ohm Nickel RTD (5000 PPM)	**B** 6 inches/150mm
C Bulkhead mount 3 in/175mm wire leads	**3** 1,000 ohm Platinum RTD	**C** 8 inches/200mm
D Bulkhead mount 6 ft/1.8m plenum cable	**4** 1,000 ohm Nickel RTD (6000 PPM)	**D** 12 inches/300mm
	5 1,000 ohm Balco RTD	
	7 10,000 ohm NTC thermistor (Type III)	
	8 10,000 ohm NTC thermistor (Carel)	
	10 3,000 ohm NTC thermistor	
	12 10,000 ohm NTC thermistor (Type II)	
	13 5,000 ohm NTC thermistor	
	14 1,035 ohm Silicon PTC	
	15 100,000 ohm NTC thermistor	
	17 20,000 ohm NTC thermistor	
	18 2,252 ohm NTC thermistor	
	21 1,800 ohm NTC thermistor	

Example: TE-701-B-10-A: Flange mount with 6 ft cable, 3000 ohm thermistor and 4 inch probe length.

ORDERING INFORMATION: TE-702

Installation	Sensor*	Probe Length
A Polycarb Plastic Enclosure IP-54	**1** 100 ohm Platinum RTD	**A** 4 inches/100mm
B Galvanized Steel Enclosure NEMA-1 / IP-30	**2** 1,000 ohm Nickel RTD (5000 PPM)	**B** 6 inches/150mm
C Painted Steel Enclosure NEMA-4 / IP-65	**3** 1,000 ohm Platinum RTD	**C** 8 inches/200mm
	4 1,000 ohm Nickel RTD (6000 PPM)	**D** 12 inches/300mm
	5 1,000 ohm Balco RTD	
	7 10,000 ohm NTC thermistor (Type III)	
	8 10,000 ohm NTC thermistor (Carel)	
	10 3,000 ohm NTC thermistor	
	12 10,000 ohm NTC thermistor (Type II)	
	13 5,000 ohm NTC thermistor	
	14 1,035 ohm Silicon PTC	
	15 100,000 ohm NTC thermistor	
	17 20,000 ohm NTC thermistor	
	18 2,252 ohm NTC thermistor	
	21 1,800 ohm NTC thermistor	

Example: TE-702-A-3-D: Polycarb plastic enclosure with 1000 ohm Platinum RTD and 12 inch probe length.

* For sensor compatibility, please refer to TI.700-10.

** For a complete Resistance vs. Temperature tables, please refer to TI.700-11.

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West Midlands • DY6 7YA • United Kingdom
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DN701/2.2 ***Printed in USA***

Pipe Temperature Sensors

Model TE-703 / 704

- **More than 15 types of interchangeable NTC thermistors, precision platinum, nickel or balco RTD's are available for universal compatibility.**

- **Four immersion thermowell installation options — brass adapter with 304SS probe for adjustable insertion, plastic, galvanized steel or NEMA-4/IP-65 steel enclosure. Four strap on surface mount installation options — rugged 304SS hermitically sealed probe, plastic, galvanized steel or NEMA-4/IP-65 contact surface temperature sensors offer the industry's most extensive range to satisfy all HVAC, appliance and industrial applications.**

- **304 SS thin wall probe with a cold rolled hermitically sealed end forms a monolithic encapsulated cavity for the sensor and is immune to failures caused by high humidity, contamination, thermal shock and vibration.**

- **Fast response brass contact sensor for strap on applications is insulated from the enclosure to provide accurate pipe surface temperature measurement.**

TE 703/704 temperature sensors offer the industry's most extensive range of enclosure, installation and sensor types to satisfy all HVAC, industrial and commercial applications. These revolutionary sensors incorporate more than twenty five years of product development and experience drawn from millions of installations world wide in all types of applications. This product and process design combined with automated manufacturing processes yields a rugged, reliable, repeatable and stable temperature sensor at a low cost. The only line of temperature sensors offering lifetime warranty against moisture migration related failures.

For large volume OEM customers, TE-703/704 temperature sensors are available in many custom configurations. Wire type, length or gage, terminals, connectors, probe lengths, enclosures options or sensor types may be customized based on volume.

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Holden Hill • S.A. 5088 • Australia
08-8395-4333 • Fax 08-8395-4433

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Ontario • L3R ON6 • Canada
905-474-9215 • Fax 905-474-0876

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TE-703

TE-703-A Immersion Temperature Sensor Thermowell Adapter Mount

Incorporate a hermitically sealed 304 SS probe and a brass adapter with a compression sleeve providing a rugged assembly for immersion temperature sensing if field adjustable insertion depth is desired. The brass adapter is screwed in to the thermowell, compression sleeve is loosened, probe inserted to desired length and the sleeve is tightened. Sensor has 6ft/1.8m plenum rated cable for remote termination. TE-703-A sensors provide a cost effective and reliable solution for hot/chilled water, condenser water or low pressure steam applications which require adjustable insertion length.

TE-703-B Immersion Temperature Sensor Polycarb Enclosure

Corrosion free 30% glass filled polycarbonate enclosure designed to withstand temperature extremes, mechanical shock and vibration. 304 SS probe crimp attached to the enclosure for a low profile mating surface. Patented locking thermowell adapter, single screw cover attachment, are some of the features which improve reliability and lower installation costs. TE-703-B sensors provide a cost effective and reliable solution for hot/chilled water, condenser water or low pressure steam applications.

TE-703-C Immersion Temperature Sensor Galvanized Enclosure

Industry standard NEMA-1 / IP-30 galvanized sheet metal enclosure designed for all industrial and commercial immersion temperature sensing applications. Hermitically sealed, fast response 304 SS probe crimp attached to the enclosure for a low profile mating surface. Keyed enclosure cover to swing open without removing the screws, 1/2" conduit opening, are some of the features which improve reliability and lower installation cost.

TE-703-D Immersion Temperature Sensor Powder Coated Steel Enclosure

Rugged steel enclosure with welded seams, gasketted cover and powder coated finish, rated NEMA-4 / IP-65 for harsh environments. TE-703-D has all other features including a 304 SS probe, conduit opening similar to the TE-703-C series except designed for applications in unconditioned environments where the unit maybe subjected to dirt, condensation, oil vapor and other contaminants.

TE-704

TE-704-A Surface Temperature Sensor Strap On Probe

Incorporates a 2" 304 SS probe with a 6 ft/1.8m plenum rated cable for pipe surface temperature sensing. Nylon ties are provided to secure the probe to the pipe. TE-704-A provides a cost effective and reliable solution for surface contact temperature measurement of conditioned water pipes, low pressure steam or refrigerant lines.

TE-704-B Surface Temperature Sensor Polycarb Enclosure

Corrosion free 30% glass filled polycarbonate enclosure designed to withstand temperature extremes, mechanical shock and vibration. Fast response brass contact sensor attached to the enclosure for a low profile mating surface, mounting bracket for pipe clamp installation, single screw cover attachment, are some of the features which improve reliability and lower installation costs.

TE-704-C Surface Temperature Sensor Galvanized Enclosure

Industry standard NEMA-1 / IP-30 galvanized sheet metal enclosure designed for all industrial and commercial surface temperature sensing applications. Fast response brass contact sensor attached to the enclosure for a low profile mating surface. Keyed enclosure cover to swing open without removing the screws, 1/2" conduit opening, are some of the features which improve reliability and lower installation cost.

TE-704-D Surface Temperature Sensor Powder Coated Steel Enclosure

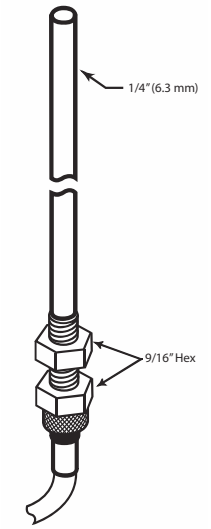
Rugged steel enclosure with welded seams, gasketted cover and powder coated finish, rated NEMA-4 / IP-65 for harsh environments. TE-704-D has all other features including a fast response brass contact sensor, conduit opening similar to the TE-704-C series except designed for applications in unconditioned environments where the unit maybe subjected to dirt, condensation, oil vapor and other contaminants.

SPECIFICATIONS:

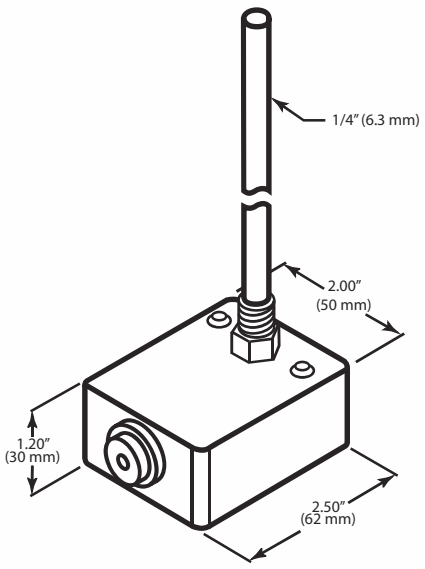
Platinum RTD sensors:	+/- 0.1% @ 0 C, Alpha : 385 per DIN 43760
Nickel RTD sensors: (#2)	+/- 0.5 C @ 0 C, 5000 PPM/K T.C.R.
Nickel RTD sensors: (#4)	+/- 0.5 F @ 70 F / 21.1 C, 6000 PPM/K T.C.R.
Balco RTD sensors:	+/- 0.5 F @ 70 F /21.1 C, 4300 PPM/K T.C.R.
Thermistor sensors:	+/- 0.2 C interchangeability @ 77 F/ 0 C
Probe Material:	1/4" / 6.3mm O.D, 0.020" / 0.5mm wall 304 Stainless Steel
Flange Material:	Galvanized Steel
Bulkhead Fitting:	Brass with poly compression sleeve
Plastic Enclosure:	Polycarbonate 30% glass filled, rated UL 94V-5-0
Steel NEMA-1 / IP-30:	18 Ga. Galvanized Steel
Steel NEMA-4 / IP-65:	18 Ga. Cold Rolled Steel, Powder coated
Operating Temp:	-40F/-40C to 210F/100C
Ambient Temp:	-40F/-40C to 160F/70C
Warranty:	Five Years (Lifetime on Moisture Migration).

U.S. PATENT NO. 6457857, 6555748, 6599012, 7036224

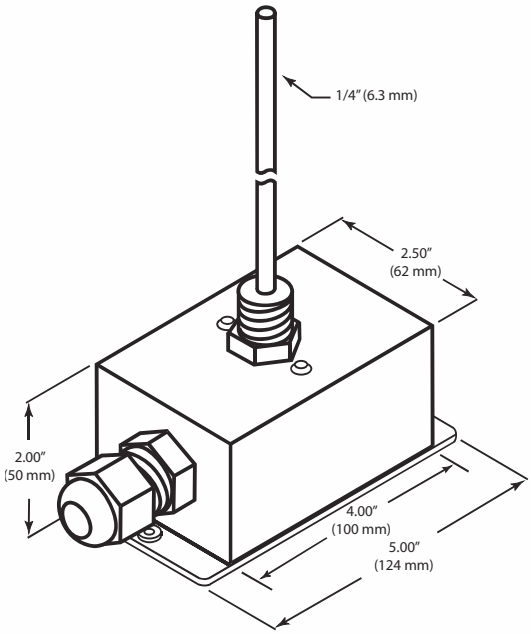
TE-703-A



TE-703-B



TE-703-C/D



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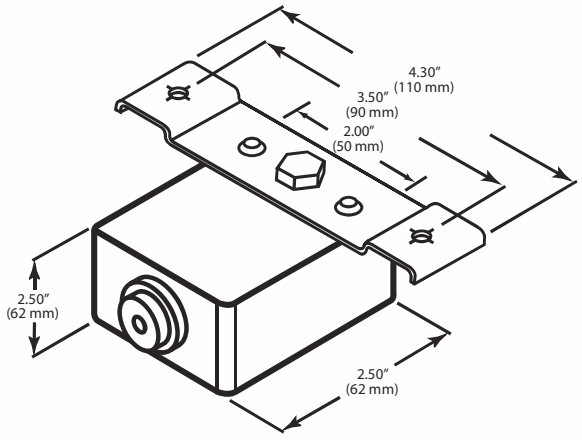
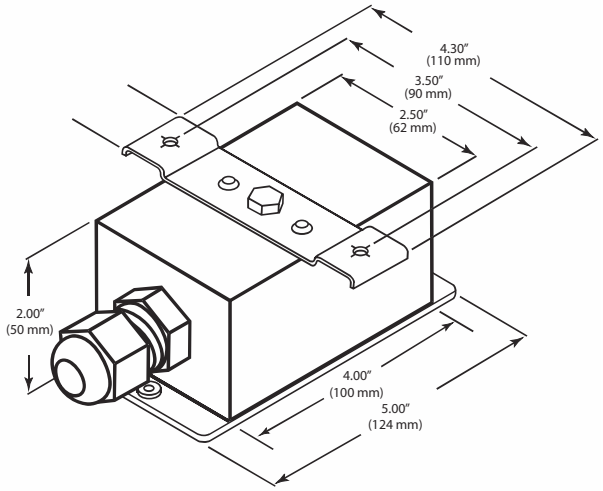


TE-704-C/D



ORDERING INFORMATION: TE-703

Installation	Sensor*	Probe Length	Adapter
A Immersion style With adapter	**1** 100 ohm Platinum RTD	**A** 4 inches/100mm	**1** 1/8" NPT
B Polycarb Plastic Enclosure IP-54	**2** 1,000 ohm Nickel RTD (5000 PPM)	**B** 6 inches/150mm	**2** 1/4" NPT
C Galvanized Steel Enclosure NEMA-1 / IP-30	**3** 1,000 ohm Platinum RTD	**C** 8 inches/200mm	**3** 1/2" NPT
D Painted Steel Enclosure NEMA-4 / IP-65	**4** 1,000 ohm Nickel RTD (6000 PPM)		
	5 1,000 ohm Balco RTD		
	7 10,000 ohm NTC therm. (Type III)		
	8 10,000 ohm NTC therm. (Carel)		
	10 3,000 ohm NTC therm.		
	12 10,000 ohm NTC therm. (Type II)		
	13 5,000 ohm NTC therm.		
	14 1,035 ohm Silicon PTC		
	15 100,000 ohm NTC therm.		
	17 20,000 ohm NTC therm.		
	18 2,252 ohm NTC therm.		
	21 1,800 ohm NTC therm.		

Example: TE-703-A-10-A-3: Immersion style with 1/2" adapter, 3000 ohm thermistor and 4 inch probe.
Example: TE-703-D-10-C-2: NEMA-4 enclosure, 3000 ohm thermistor, 8 inch probe and 1/4" NPT brass fitting.

ORDERING INFORMATION: TE-704

Installation	Sensor*
A Surface Mount Strap-on	**1** 100 ohm Platinum RTD
B Polycarb Plastic Enclosure IP-54	**2** 1,000 ohm Nickel RTD (5000 PPM)
C Galvanized Steel Enclosure NEMA-1 / IP-30	**3** 1,000 ohm Platinum RTD
D Painted Steel Enclosure NEMA-4 / IP-65	**4** 1,000 ohm Nickel RTD (6000 PPM)
	5 1,000 ohm Balco RTD
	7 10,000 ohm NTC therm. (Type III)
	8 10,000 ohm NTC therm. (Carel)
	10 3,000 ohm NTC therm.
	12 10,000 ohm NTC therm. (Type II)
	13 5,000 ohm NTC therm.
	14 1,035 ohm Silicon PTC
	15 100,000 ohm NTC therm.
	17 20,000 ohm NTC therm.
	18 2,252 ohm NTC therm.
	21 1,800 ohm NTC therm.

Example: TE-704-C-1: NEMA-1 enclosure with 100 ohm Platinum RTD surface mount sensor.

* For sensor compatibility, please refer to TI.700-10.
** For a complete Resistance vs Temperature tables, please refer to TI.700-11.

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8189 Century Boulevard • Minneapolis, MN 55317-8002 • USA
800-843-5116 • 952-556-4900 • Fax 952-556-4997
sales@mamacsys.com • www.mamacsys.com

Baird House, Units 6&7
Pensnett Estate • Kingswinford
West Midlands • DY6 7YA • United Kingdom
01384-271113 • Fax 01384-271114

4 Arminger Court, Unit 2
Holden Hill • S.A. 5088 • Australia
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Flexible Averaging Temp Sensor

CE

Model TE-707

RoHS

- **Two probe construction options - plenum rated cable or metallic armored cable.**
- **Sensor nodes are moisture sealed with a patented process to handle condensation and contaminants.**
- **An aluminum bracket is crimped over the sensing modules to stress relief the assembly to withstand installation and operational physical abuse.**
- **Available with polycarb, galvanized steel or NEMA-4 / IP-65 powder coated steel enclosure to cover all applications.**
- **More than 15 types of interchangeable NTC thermistors, precision platinum, nickel or balco RTDs are available for universal compatibility.**

TE-707 flexible averaging temperature sensors offer many benefits over rigid tubular sensors. Rigid sensors have to be uncoiled and then bent into position using a tube bender. If kinked, moisture will enter, condense and cause intermittent shorts. Flexible sensors are easy to install and are moisture sealed. Just clip or tie directly to the heat exchanger, coil or duct. Unlike tube averaging sensors, the sensing nodes in flexible cable are clearly identified and can be positioned to correctly average the temperature across the face of the coil or duct. The sensing elements in rigid tubular averaging sensors are not in contact with the tube and may have an air gap resulting in slow response time. The sensing nodes in flexible averaging sensors have a thin protective sheath directly in contact to the sensing element resulting in an extremely fast response time thus eliminating false freeze stat trips.

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TE-707

Flexible Plenum Cable Duct Averaging Temp Sensor

The TE-707 Plenum Cable averaging temperature sensor incorporates four equally spaced sensor modules interconnected with a UL listed CL3P plenum rated cable. The sensor nodes are moisture sealed with epoxy encapsulation and protected by a polyolefin sheath to provide a rugged and reliable assembly.

Sensor modules are mechanically protected against flex and physical abuse with an aluminum clip which is crimped across the module to form a bridge to stress relieve the assembly. The averaging temp sensor incorporates four even spaced sensor modules over 6, 12 or 24 ft / 1.8, 3.6, or 7.2 meter lengths to handle any size duct or plenum.

Available with polycarb, galvanized steel or NEMA-4 / IP-65 powder coated steel enclosure to cover all applications.

Flexible Armored Cable Duct Averaging Temp Sensor

The TE-707 Armored Cable averaging temperature sensors incorporate the same plenum cable sensors except the assembly is protected with a woven metallic sheath to enhance ruggedness and to improve thermal conductivity across the four sensing modules. 384 monolithic 32 gauge tin plated copper fibers are woven into a continuous metallic sheath over the plenum rated, moisture sealed, averaging cable temperature sensor.

The metallic woven sheath is secured to the cable sensor ends and all installation and operational stress or pull force is absorbed by the 384 copper fibers resulting in a very rugged flexible sensor. Tin plated copper fibers provide excellent thermal conductivity across the length of the flexible sensor and bridging clips across the sensing modules support the assembly against flex and mechanical abuse. The averaging temp sensor incorporates four even spaced sensor modules over 6, 12 or 24 ft / 1.8, 3.6, or 7.2 meter lengths.

SPECIFICATIONS:

Platinum RTD sensors:	+/- 0.1% @ 0 C, Alpha : 385 per DIN 43760
Nickel RTD sensors: (#2)	+/- 0.5 C @ 0 C, 5000 PPM/K T.C.R.
Nickel RTD sensors: (#4)	+/- 0.5 F @ 70 F / 21.1 C, 6000 PPM/K T.C.R.
Balco RTD sensors:	+/- 0.5 F @ 70 F / 21.1 C, 4300 PPM/K T.C.R.
Operating Temp:	-40 F - 200 F (-40 C - 93 C)
Thermistor sensors:	+/- 0.2 C interchangeabiltiy @ 77 F / 25 C
Plastic Enclosure:	Polycarbonate 30% glass filled, rated UL 94V-5-0
Steel NEMA-1 / IP-30:	18 Ga. Galvanized Steel
Steel NEMA-4 / IP-65:	18 Ga. Cold Rolled Steel, Powder coated
Warranty:	Five Years (Lifetime on Moisture Migration)
EMC Conformance:	EN 55022, 55024, 61000-3-3, 61000-4-2, 3, 4, 5, 6 & 11
RoHS Compliant	

Covered under: U.S. PATENT NO. 6592254, 7465087

ORDERING INFORMATION: TE-707-

Installation

- **A** Polycarb Plastic Enclosure
- **B** Galvanized Steel Enclosure NEMA-1/IP-30
- **C** Painted Steel Enclosure NEMA-4/IP-65

Sensor*

- **1** 100 ohm Platinum RTD
- **2** 1,000 ohm Nickel RTD (5000 PPM)
- **3** 1,000 ohm Platinum RTD
- **4** 1,000 ohm Nickel RTD (6000 PPM)
- **5** 1,000 ohm Balco RTD
- **7** 10,000 ohm NTC thermistor (Type III)
- **8** 10,000 ohm NTC thermistor (Carel)
- **10** 3,000 ohm NTC thermistor
- **12** 10,000 ohm NTC thermistor (Type II)
- **13** 5,000 ohm NTC thermistor
- **14** 1,035 ohm Silicon PTC
- **15** 100,000 ohm NTC thermistor
- **17** 20,000 ohm NTC thermistor
- **18** 2,252 ohm NTC thermistor
- **21** 1,800 ohm NTC thermistor

Probe Length

- **A** 6 feet / 1.8 m
- **B** 12 feet / 3.6 m
- **C** 24 feet / 7.2 m

Probe Type

- **1** Plenum cable
- **2** Armored cable

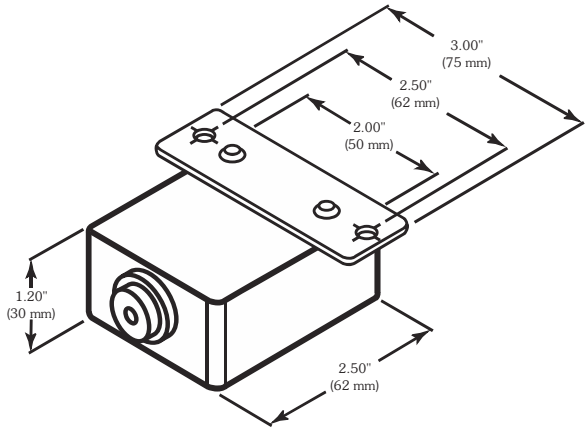
Example: TE-707-B-10-B-1: Duct averaging sensor, 12 feet flexible plenum cable, 3000 ohm thermistor, NEMA-1 enclosure.

* For sensor compatibility, please refer to TI.700-10.

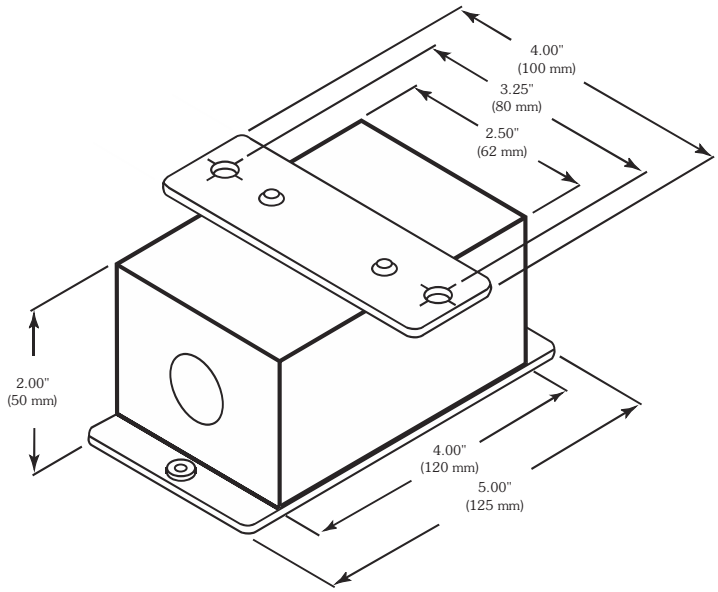
** For a complete Resistance vs. Temperature tables, please refer to TI.700-11.

TE-707

TE-707-A



TE-707-B/C



WARRANTY: MAMAC Systems, Inc. warrants its products to be free of defects in material and workmanship for a period of five (5) years from date of shipment. If a unit is malfunctioning, it must be returned to the factory for evaluation. A return authorization number (RMA) will be issued by the customer service department and this number must be written or prominently displayed on the shipping boxes and all related documents. The defective part should be shipped freight pre-paid to the factory. Upon examination by MAMAC Systems, Inc., if the unit is found to be defective, it will be repaired or replaced at no charge to the customer. However, this warranty is void if the unit shows evidence of being tampered with, damaged during installation, misapplied, misused, or used in any other operating condition outside of the unit's published specifications.

MAMAC Systems, Inc. makes no other warranties or representations of any kind whatsoever, expressed or implied, except that of title. All implied warranties including any warranty of merchantability and fitness for a particular purpose are hereby disclaimed. User is responsible to determine suitability for intended use.

LIMITATIONS OF LIABILITY: The remedies of buyer set forth herein are exclusive and the total liability of MAMAC Systems, Inc. with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the product upon which liability is based. **In no event shall MAMAC Systems, Inc. be liable for consequential, incidental or special damages.** MAMAC Systems, Inc. reserves the right to change any specifications without notice to improve performance, reliability, or function of our products.

Every precaution for accuracy has been taken in the preparation of this manual, however, MAMAC Systems, Inc. neither assumes responsibility for any omissions or errors that may appear nor assumes liability for any damages that result from the use of the product in accordance with the information contained in the manual.

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F

SCD Series

Schneider Electric's SCD series of duct mount sensors measure the levels of CO2, RH (if equipped) and temperature of air inside a duct. The CO2 sensor employs the Automatic Baseline Calibration (ABC) feature which enables the sensor to operate within accuracy specifications for the calibration interval of 5 years. The temperature element is warranted to meet accuracy specifications for a period of 5 years. RH equipped models of the SCD feature a replaceable humidity element that is warranted to meet accuracy specifications for a period of 1 year. HS2NX and HS2XX replaceable humidity elements are available through Schneider Electric. To maintain accurate functionality, keep all vents clear and free of dust, debris, etc.

SPECIFICATIONS

Input Voltage . . . . . .24 Vac, 20 to 36 Vdc Class 2
Analog Output . . . . . .4-20mA (clipped & capped)/ 0-5VDC/0-10VDC (selectable)
Sensor Current Draw . . . . . .20-36VDC 40mA avg., 105mA max.
24VAC 50mA avg., 150mA max.
Operating Temperature Range . . . . . .0° to 50°C (32° to 122°F)
Operating Humidity Range . . . . . .0-95% (noncondensing)
Housing Material . . . . . High impact ABS plastic

CO2 Transmitter

Sensor Type . . . . . Non-dispersive infrared (NDIR), diffusion sampling
Output Range . . . . . .0-2000 ppm
Accuracy . . . . . ±1.5% of measurement range ±2% of measured value*
Repeatability . . ±20 ppm ±1% of measured value
Response Time . . . . . <60 seconds for 90% step change

RH Transmitter

HS Sensor . . . Digitally profiled thin-film capacitive (32-bit mathematics); U.S. Patent 5,844,138
Accuracy . . . . . ±2% from 10 to 80% RH @ 25°C;
Hysteresis . . . . . 1.5% typical
Linearity . . . . . Included in Accuracy spec.
Stability ±1% @ 20°C (68°F) annually, for two years
Output Range . . . . . 0 to 100% RH
Temperature Coefficient . . . ±0.1% RH/°C above or below 25°C (typical)

Temperature

Sensor Type . . . . . Thermistor
Accuracy . . . . . ±0.5°C (±1°F) typical

Relay Contacts:

1 Form C . . . . . 1A@30VDC, resistive; 30W max.

Specified accuracy with 24VDC supplied power with rising humidity.

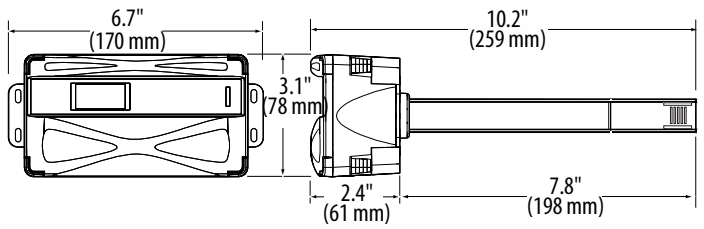
EMC Conformance:

. . . . . .EN 6100-6-3: 2007 Class B
. . . . . EN 61326-1: 2006 Class B
. . . . . EN61000-6-2: 2005

*** Accuracy is specified at NTP (20°C at 101.3 kPa).**

In the event that validation gas is required, the accuracy of validation gas mixture must be added to the sensor specified accuracy for absolute measurements.

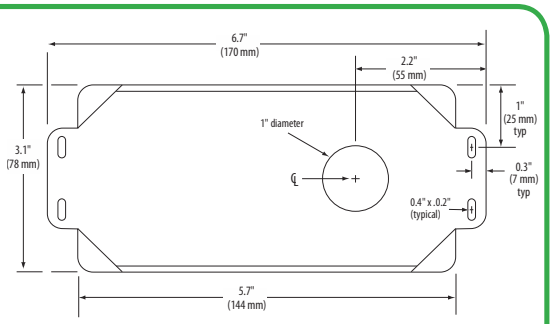
DIMENSIONS

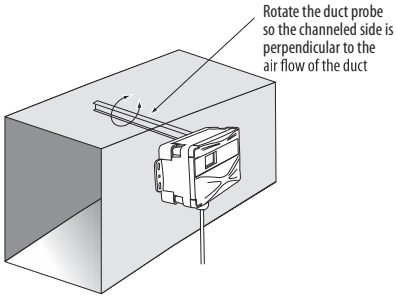


Schneider Electric

INSTALLATION

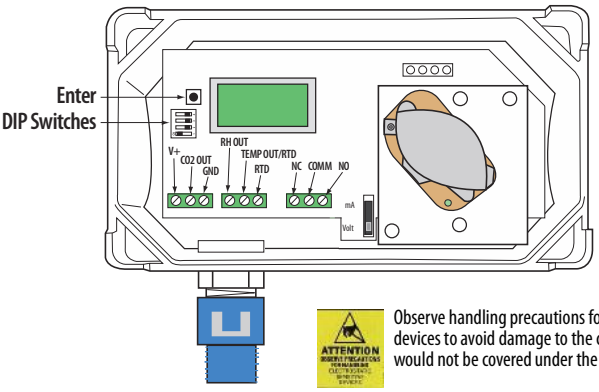
1. Choose a location to mount the sensor. The centerline of the housing must be parallel to the direction of air flow in the duct.
2. Use the mounting diagram to drill four holes in the duct for securing the sensor.
3. Insert the probe into the hole. Rotate the housing so that the widest surface is perpendicular to the air flow.
4. Attach the sensor to the duct using sheet metal screws. Make sure that the gasket on the back of the housing is compressed between the housing and the duct for a secure fit.
5. Wire the device. See Wiring section.
6. Configure the system using configuration section.



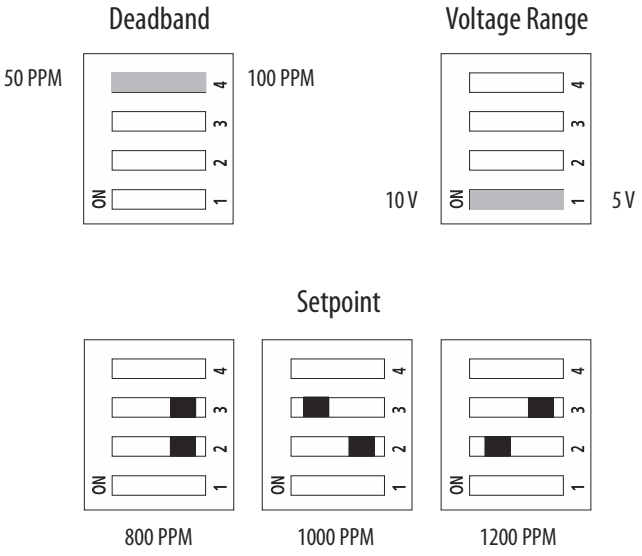


WIRING, RELAY, AND DIP SWITCH SETTINGS

1. Feed control wire through grommeted compression fitting on the bottom of the housing.
2. Remove terminal blocks by pulling the assemblies away from the main board.
3. Connect wires as shown and push terminal blocks back in to black receptacles.
4. Tighten compression fitting around control wire until sealed.
5. Refer to specifications for power requirements and relay rating.
6. Select mA or Volt output using selector switch.
7. If Volt output is selected, select 5V (0-5VDC) or 10V (0-10VDC) using switch 1 on the 4 throw dipswitch.
8. Select a relay setpoint of 800, 1000 or 1200PPM of CO2 using switch 2 and 3 on the 4 throw dipswitch (see setpoint diagram for dipswitch settings).
9. Select deadband of 50PPM or 100PPM using switch 4 on the 4 throw dipswitch. This setting allows for additional flexibility when using the relay setpoint. The actual relay trip point is the setpoint PPM ± the deadband PPM. Example: If the relay setpoint is set for 1000PPM and the deadband is set for 50PPM, with dropping CO_2 levels the relay will trip at 950PPM (1000PPM – 50PPM), with rising CO_2 levels the relay will trip at 1050 ppm (1000PPM + 50PPM).

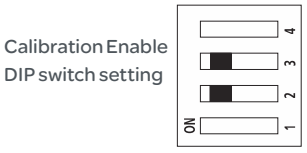


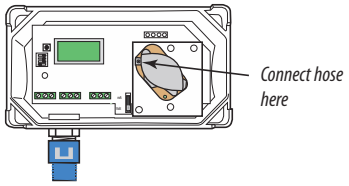
Observe handling precautions for static sensitive devices to avoid damage to the circuitry which would not be covered under the factory warranty.

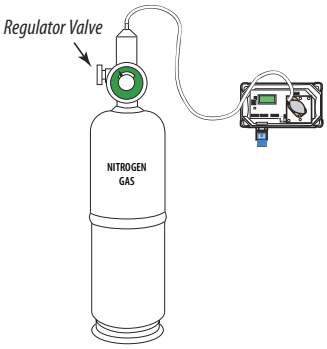


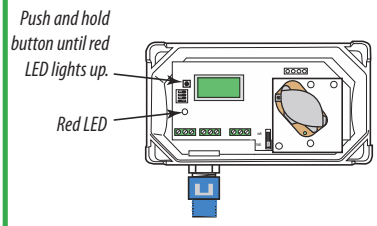
CALIBRATION PROCESS

1. Remove cover and connect gas cylinder hose to the plastic port located on sensing module. Note: only connect one sensor to the calibration gas cylinder at a time.
2. Set DIP switches 2 and 3 to the ON position to enable calibration.
3. Start flowing nitrogen gas (0 ppm CO_2). Use a flow rate of 0.3 to 0.5 liter/minute.
4. Push and hold Enter button until red LED lights up.
5. Calibrate until red LED turns off (approximately 5 min). Unit will return to normal operation when finished. Return DIP switches to Setpoint position (see Wiring, Relay, and DIP Switch Settings section) when calibration is complete.



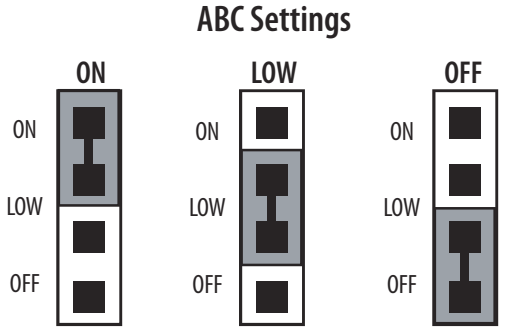






ABC CALIBRATION ALGORITHM:

ABC (Automatic Baseline Calibration) is a patented self-calibration feature that automatically adjusts the CO2 sensor to compensate for drift. When ABC is enabled, the sensor records the lowest reading within every 24-hour interval and compares these values over a running 7-day or 28-day period. If a statistically significant amount of drift is detected, the ABC applies an automatic correction factor. This enables the sensor to operate within specifications for the 5-year calibration interval.



ON POSITION. Recommended Setting. Use the ON setting for applications where the building is unoccupied within a 24-hour timeframe.

LOW POSITION. Use the LOW setting for buildings occupied 24 hours a day.

OFF POSITION. Not Recommended.

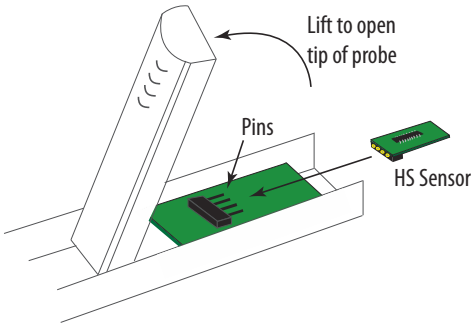
NOTE: After changing the ABC settings, power cycle the unit for changes to take effect.

HUMIDITY SENSOR REPLACEMENT

SCD models with optional RH have replaceable humidity sensors.

To Replace Humidity Sensor:

1. Power down unit
2. Remove SCD from duct to access probe tip.
3. Open tip of duct probe
4. Slide old HS sensor off pins
5. Slide new HS sensor onto pins.
6. Re-install SCD in duct and re-secure with screws provided.
7. Power unit back on



OUTPUT SCALING

Output scaling: 0-2000 ppm

	CO2 ppm	0-5 Volt Output	0-10 Volt Output	mA Output
Outside	300-500	0.75 to 1.25	1.5 to 2.5	6.4 to 8
Over-Ventilated	Under 600	under 1.5	Under 3	Under 8.8

AVAILABLE PRODUCTS

Part Number	Model Number	Duct Mounted CO2 Sensor with			
		Temp	2% RH	LCD	System
5152300000	SCD110	x			Vista 1.8K
5152302000	SCD110-D	x		x	Vista 1.8K
5152304000	SCD110-H	x	x		Vista 1.8K
5152306000	SCD110-D-H	x	x	x	Vista 1.8K
5152308000	SCD210	x			I/NET 10K T2
5152310000	SCD210-D	x		x	I/NET 10K T2
5152312000	SCD210-H	x	x		I/NET 10K T2
5152314000	SCD210-D-H	x	x	x	I/NET 10K T2
5152316000	SCD510	x			Continuum 10K T3
5152318000	SCD510-D	x		x	Continuum 10K T3
5152320000	SCD510-H	x	x		Continuum 10K T3
5152322000	SCD510-D-H	x	x	x	Continuum 10K T3
5152324000	SCD610	x			Satchwell 10K T3 Resistor/Shunt
5152326000	SCD610-D	x		x	Satchwell 10K T3 Resistor/Shunt
5152328000	SCD610-H	x	x		Satchwell 10K T3 Resistor/Shunt
5152330000	SCD610-D-H	x	x	x	Satchwell 10K T3 Resistor/Shunt
5152332000	SCD810	x			I/A 10K T3 w/Shunt
5152334000	SCD810-D	x		x	I/A 10K T3 w/Shunt
5152336000	SCD810-H	x	x		I/A 10K T3 w/Shunt
5152338000	SCD810-D-H	x	x	x	I/A 10K T3 w/Shunt
5152339010	HS2NX	Replaceable RH Element, 2%, NIST.			
5152339000	HS2XX	Replaceable RH Element, 2%.			

THERMISTOR TABLE

°C	°F	Vista 1.8K	I/NET 10K T2	Continuum 10K T3	Satchwell 10K T3 w/Resistor & Shunt	I/A 10K T3 w/Shunt
-50	-58	82,207	692,644	447,497	9,781	10,736
-40	-40	42,848	344,702	242,599	9,604	10,523
-30	-22	23,563	180,148	136,484	9,318	10,180
-20	-4	13,585	98,324	79,472	8,884	9,663
-10	14	8,167	55,786	47,772	8,272	8,941
0	32	5,096	32,773	29,575	7,480	8,018
5	41	4,077	25,456	23,504	7,024	7,493
10	50	3,287	19,931	18,809	6,541	6,941
15	59	2,671	15,725	15,146	6,039	6,372
20	68	2,185	12,497	12,271	5,530	5,800
25	77	1,800	10,000	10,000	5,025	5,238
30	86	1,492	8,055	8,195	4,534	4,696
35	95	1,245	6,528	6,752	4,066	4,184
40	104	1,044	5,323	5,592	3,627	3,707
45	113	881	4,365	4,655	3,222	3,271
50	122	747	3,599	3,893	2,854	2,875

G

Current Switches: Fixed Trip Point

0.15 A TURN-ON!

Split-Core & Solid-Core On/Off Status Current Switches

DESCRIPTION

Hawkeye x00 on/off current switches provide a cost-effective solution for monitoring status on unit vents, exhaust fans, recirculation pumps, and other fixed loads where belt loss is not a concern.

Veris has applied new technology to the H300, H600, and H800 models to achieve impressive improvement in turn-on levels. The Hawkeye H300 and H600 now have the lowest turn-on current in the industry at a mere 150mA!

APPLICATIONS

- Monitoring status of electrical loads
- Monitoring direct-drive units, exhaust fans, pumps, process motors, and other fixed loads
- Verifying lighting run times

CURRENT SENSING THE ULTIMATE PROOF OF FLOW

Maximize Reliability
Minimize Installed Cost

FEATURES

- More reliable for status than relays across auxiliary contacts
- Ideal for direct-drive units, unit vents, fan coil units, exhaust fans, and other fixed loads
- Great for lighting status–less expensive than 277V relays
- Low 0.15 A turn-on (H300 and H600)...ideal for small exhaust fans (not intended to detect belt loss)
- Removable mounting bracket provides installation flexibility
- Bracket on H900 can be installed in three different configurations...installer convenience
- Split-core H300, H600, and H900 for fast retrofit installation
- Mini solid-core H800 and micro split-core H300 fit in tight enclosures... saves valuable panel space
- 100% solid-state, no moving parts to fail
- Polarity insensitive output
- 5-year warranty

CURRENT MONITORING

SPECIFICATIONS

5 Year Warranty

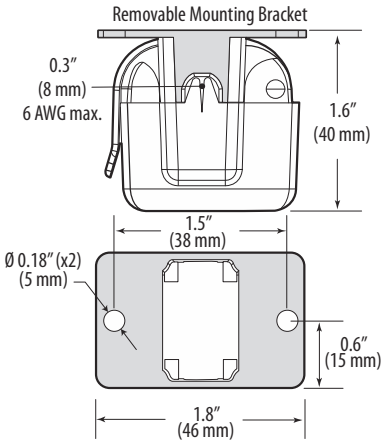
Sensor Power (N.O. Models)	Induced from monitored current
Insulation Class	600VAC RMS (UL), 300VAC RMS (CE)
Frequency Range	50/60 Hz
Temperature Range	H800, H800NC, H300, H900: -15° to 60°C (5° to 140°F) H600: -15° to 40°C (5° to 104°F) (to 200A); -15° to 60°C (5° to 140°F) (to 150A) H800HV: -40° to 50°C (-40° to 122°F) (to 200A); -40° to 75°C (-40° to 167°F) (to 100A, & 0.25A status output)
Humidity Range	10-90% RH non-condensing
Sensor Power (N.C. Models)	5-30VDC, permanently connected
Off State Leakage (N.C. Models)	34µA@5VDC, 200µA@30VDC
On State Voltage Drop (N.C. Models)	1.9VDC (max.) @0.1A
Terminal Block Maximum Wire Size	14 AWG (16 AWG for H300)
Terminal Block Torque (nominal)	4 in-lbs (7 in-lbs for H300)
Agency Approvals	UL 508 open device listing; CE:EN61010-1:2001-02, CAT III, deg. 2, basic insulation

Do not use the LED status indicators as evidence of applied voltage.

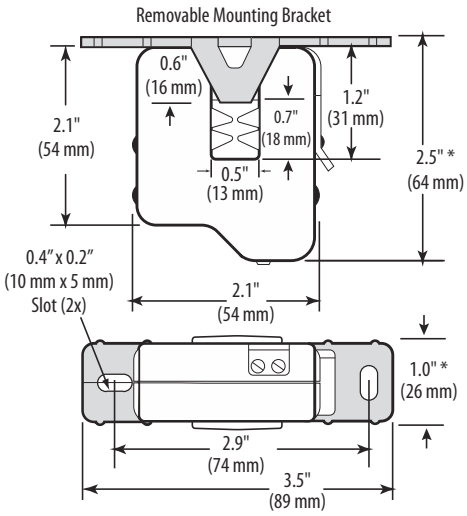
VERIS INDUSTRIES

DIMENSIONAL DRAWINGS

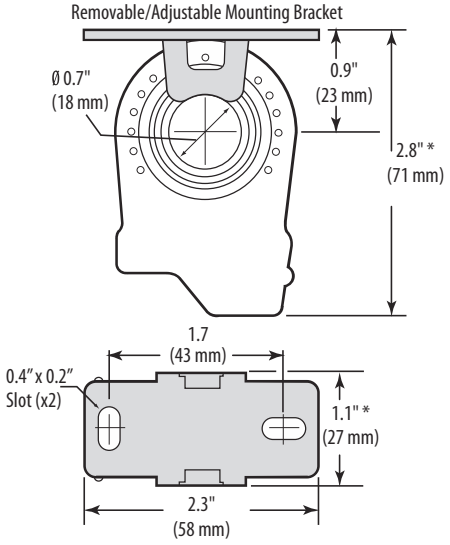
H300



H600

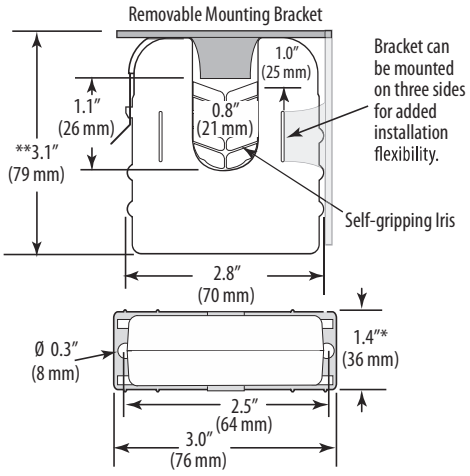


H800, H800HV, H800NC



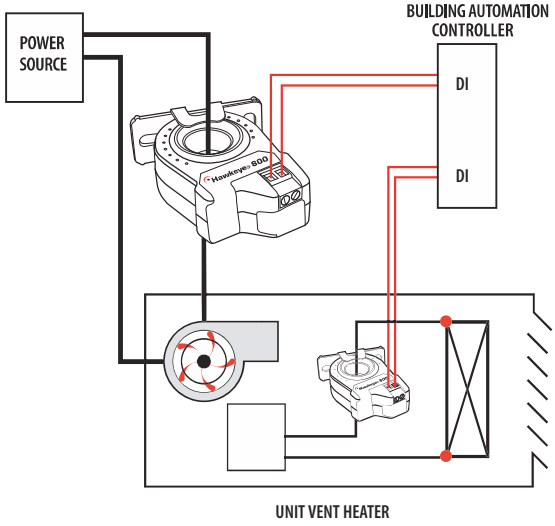
** Terminal block may extend up to 1/8″ over the height dimensions shown.*

H900



APPLICATION/WIRING DIAGRAM

Unit Vent Heater Control



ORDERING INFORMATION

MODEL	AMPERAGE RANGE	STATUS OUTPUT (max.)	TRIP POINT	HOUSING	UL	CE	RoHS
H300	0.15 - 60A	N.O. 1.0A@30VAC/DC	0.15A or less	Split-core	●	●[2]	●
H600	0.15 - 200A	N.O. 1.0A@30VAC/DC	0.15A or less	Split-core	●[1]	●	●
H800	0.25 -200A	N.O. 1.0A@30VAC/DC	0.25A or less	Solid-core	●[1]	●	●
H800NC	0.5 - 200A	N.C. 0.1A@30VDC	0.5A or less	Solid-core	●[1]		●
H800HV	0.75 - 200A	N.O. 0.5A@250VAC/DC	0.75A or less	Solid-core	●[3]		
H900	1.5 - 200A	N.O. 1.0A@30VAC/DC	1.5A or less	Split-core	●	●	

[1] Listed for use on 75°C insulated conductors.
[2] Product provides functional insulation only.
[3] Listed for use on 90°C insulated conductors.

ACCESSORIES

DIN Rail Clip Set (AH01, AH27)
DIN Rail (AV01) and DIN Stop Clip (AV02)

CURRENT MONITORING

H

Digital Pressure Transducer
Dry Media

Installation Instructions

NOTICE

- This product is not intended for life or safety applications.
- Do not install this product in hazardous or classified locations.
- Read and understand the instructions before installing this product.
- Turn off all power supplying equipment before working on it.
- The installer is responsible for conformance to all applicable codes.

Quick Install

1. Plan the installation. Panel or duct mount?.
2. For duct mounting, thread the probe into the rear of the device housing.
3. Configure the internal tubing for the selected installation method.
4. Mount the housing vertically.
5. Attach pilot tubing.

Product Identification

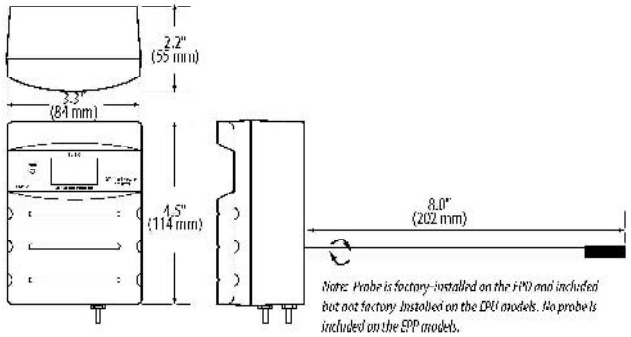
	Enclosure	Range	Local Display
EP	D = Duct P = Panel	101 = 0-1"W.C./0-250Pa 102 = 0-10"W.C./0-2.500kPa	Blank = No Display -LCD = LCD Display

	Enclosure	Range	Local Display
EP	U = Universal	105 = 0-10"W.C./0-2.500kPa	Blank = No Display -LCD = LCD Display

Accessories

AA54 Duct Probe Replacement Kit

Dimensions



Schneider Electric

SPECIFICATIONS

Media Compatibility
Dry air or inert gas

Pressure Ranges - all switch selectable

EPD101/EPP101:
Unidirectional: 0.1/0.25/0.5/1.0" W.C. F.S
Bidirectional: ±0.1/±0.25/±0.5/±1.0" W.C. F.S.
Unidirectional: 25 Pa/50 Pa/100 Pa/250 Pa, F.S.
Bidirectional: ±25 Pa/±50 Pa/±100 Pa/±250 Pa, F.S.

EPD102/EPP102:
Unidirectional: 1.0/2.5/5.0/10" W.C. F.S
Bidirectional: ±1.0/±2.5/±5.0/±10" W.C. F.S
Unidirectional: 0.250 kPa/0.500 kPa/1.000 kPa/2.500 kPa, F.S.
Bidirectional: ±0.250 kPa/±0.500 kPa/±1.000 kPa/±2.500 kPa, F.S.

EPU105:
Unidirectional: 0.1/0.25/0.5/1.0/2.5/5.0/10" W.C. F.S
Bidirectional: ±0.1/0.25/0.5/1.0/2.5/5.0/10" W.C. F.S
Unidirectional: 25 Pa/50 Pa/100 Pa/250 Pa/ 0.5kPa/1.0kPa/2.5kPa, F.S.
Bidirectional: ±25 Pa/50 Pa/100 Pa/250 Pa/ 0.5kPa/1.0kPa/2.5kPa, F.S.

Response Time
Standard: T95 in 20 sec.;
Fast: T95 in 2 sec. jumper selectable

Mode
Unidirectional or bidirectional, jumper selectable

Proof Pressure
3 psid (20.6 kPa)

Burst Pressure
5 pisd (34.5 kPa)

Accuracy
±1% F.S (combined linearity and hysterisis)

Temperature Effect
1" (250Pa) models: 0.05%/°C;
10" (2.5 kPa) models: 0.01%/°C.
(Relative to 25°C) 0 to 50°C (32 to 122°F)

Zero Drift (1-year)
1" (250Pa) models: 2.0% max.
10" (2.5 kPa) models: 0.5% max.

Zero Adjust
Pushbutton aut-zero and digital input (2-pos terminal block)

Operating Environment
0-60°C (32 to 140°F); 0 to 90% RH non-condensing

Fittings
Brass barb; 0.24" (6.1 mm) O.D.

Physical
UL 94 V-O Fire Retardant ABS

ELECTRICAL

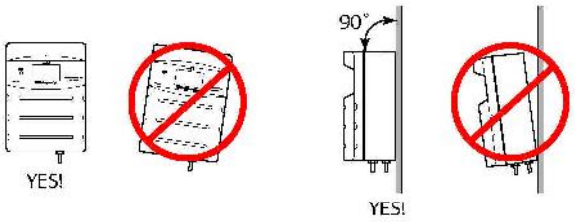
Input Power
12-30 Vdc or 24 Vac nominal

Output
Field selectable: 2-wire, loop-powered 4-20 mA (DC only, clipped and capped), or 3-wire 0-5V/0-10 V

EMC Conformances: EN 61000-6-3:2001 Class B, EN 61000-6-1:2001, EN 61000-3-2:2000, EN 61000-3-3:2001, EMC Test Methods: CISPR 22:1997 (Amended A1:2000, Class B A2:2002), IEC 61000-4-2:2002, IEC 61000-4-3:2006, IEC 61000-4-4:2004, IEC 61000-4-5:2001, IEC 61000-4-6:2004, IEC 61000-4-8:2001, IEC 61000-4-11:2004, EMC Special Note: Connect this product to a DC distribution network or an AC/DC power adaptor with proper SURGE PROTECTION (EN 61000-6-1:2001 specification requirement).

INSTALLATION

1. Plan the installation. Panel or duct mount?
2. For duct mount applications, thread the probe into the back of the device housing.
3. Configure the internal tubing for the selected installation method as shown below. Use the larger diameter tubing for the duct mount configuration.
4. Mount the transducer (see Figure 2). Position transducer vertically.
5. Determine length of pilot tubing needed.



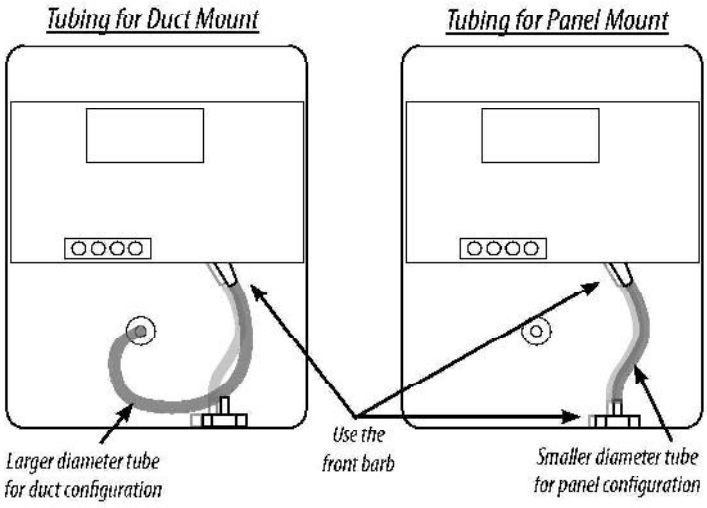


FIGURE 1 - TUBING INSTALLATION

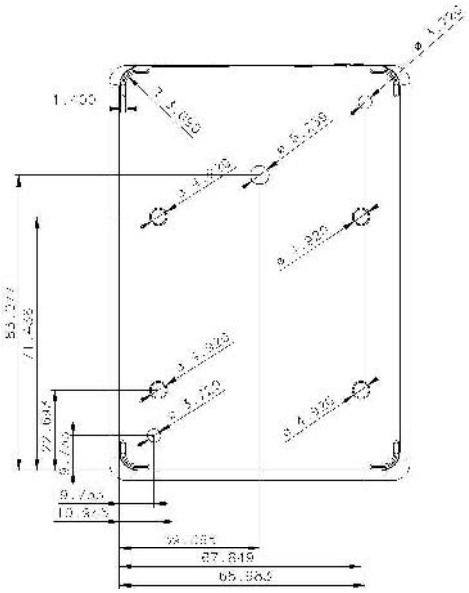


FIGURE 2 - SCREW HOLE MOUNTING

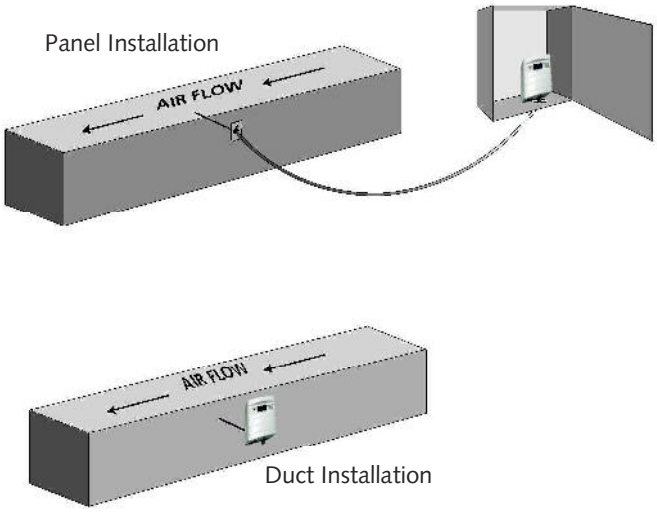


FIGURE 3 - STATIC PRESSURE

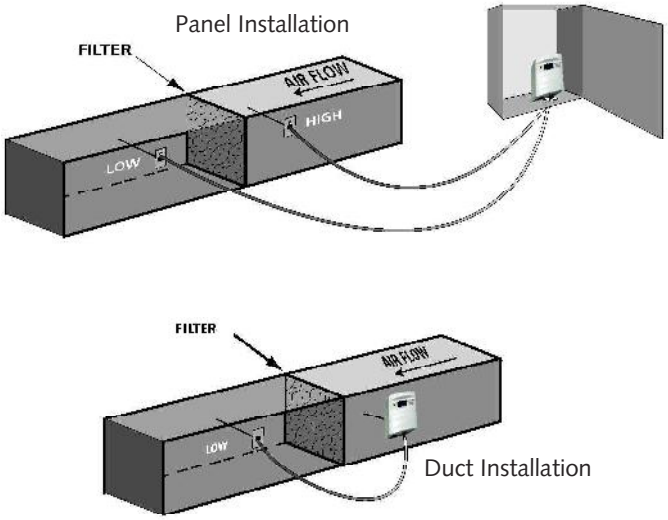


FIGURE 4 - DIFFERENTIAL PRESSURE

WIRING & CONFIGURATION

1. Connect transmitter to control system and power supply as indicated in Figures 5 and 6.
   Options: Connect ZERO terminals to digital output (contact closure) of control system.
2. Use switch to select voltage (V) or current (mA) mode.
3. Set jumpers.
   Jumper JP4: Select 0-10V or 0-5V output span. (Voltage mode only).
   Jumper JP5: Select birectional or unidirectional mode.
   Jumper JP7: Select inches W.C. or Pascal scale.
   Jumper JP8: Select fast or standard response time.
4. Align the arrow (not the slot) on the rotary switch to desired full-scale range. LCD models will momentarily indicate selected range.

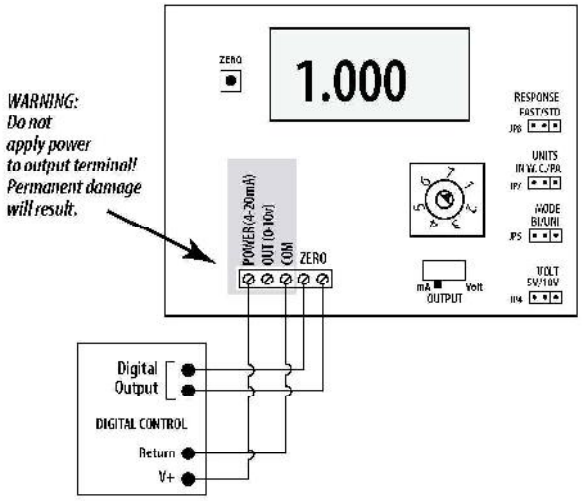


FIGURE 5 -TWO-WIRE, 4 TO 20 MA,WIRING DIAGRAM

OPERATION

IMPORTANT: EPD/EPU Series employ ceramic capacitive sensors and sophisticated temerature compensation circuitry. Sensor achieves best accuracy after initial warm-up period. During the first few minutes of operation, readings at zero pressure and lowest pressure ranges will erroneous. Following this initial warm-up period, PX Series will maintain specified accuracy and stability.

LCD DISPLAY: Display momentarily indicates range "SET" when selection is made. Pressure is normally indicated on display. Units are in inches water column (W.C.), Pascals (Pa) or kilopascals (kPa) as indicated on the display. Display shows OVER when pressure is over range.

ZERO: Press and hold the ZERO pushbutton for 2 seconds or provide contact closure on "AUX ZERO" terminal to automatically reset output and display to zero pressure. To protect the unit from accidental zero, this feature is enabled only when detected pressure is within about 0.1 W.C. (25Pa) of factory calibration.

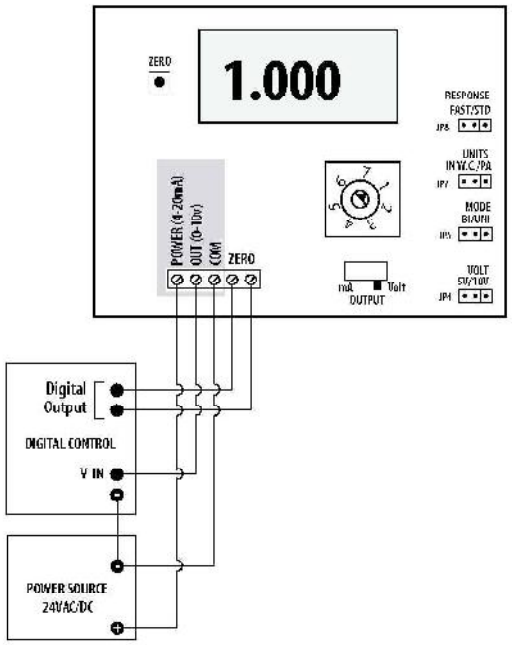


FIGURE 5 -THREE-WIRE, 0-5V/0-10V,WIRING DIAGRAM

RANGE SELECTION GUIDE

	EPP101/ EPD101		EPP102/EPD102		EPU105	
Rotary Switch Position	**Inches W.C.**	**Pascal**	**Inches W.C.**	**Pascal**	**Inches W.C.**	**Pascal**
0	0.1	25	1	250	0.1	25
1	0.25	50	1	250	0.25	50
2	0.5	100	1	250	0.5	100
3	1	250	1	250	1	250
4	1	250	2.5	0.5 kPa	2.5	0.5 kPa
5	1	250	5	1 kPa	5	1 kPa
6	1	250	10	2.5 kPa	10	2.5 kPa
7	1	250	10	2.5 kPa	10	2.5 kPa

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

PRESSURE

STAINLESS STEEL PRESSURE TRANSMITTER

PSS2 SERIES

DESCRIPTION

The Kele **PSS2 Series Stainless Steel Pressure Transmitter** is highly accurate and compact, which makes it ideal for HVAC, building automation, and process gauge pressure applications. A splash-proof Packard-type electrical connector is provided for ease of installation. Eleven standard ranges are available for a wide variety of applications.

PSS2

PSS2

PSS2 with optional enclosure and gauge

FEATURES

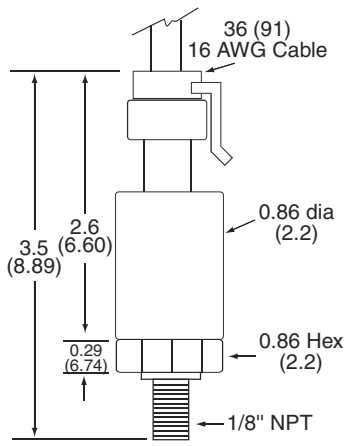
- ***Splash-proof, plug-in electrical connector***
- ***For steam, water, glycol, refrigerant, and more***
- ***4-20 mA output***
- ***304L/316L stainless steel wetted parts***
- ***Wide range of pressures***
- ***High overpressure capability***

SPECIFICATIONS

Supply Voltage	8-30 VDC
Signal Output	4-20 mA
Maximum Output Impedance	800Ω @ 24 VDC
Accuracy	Models > 75 psi <0.5% of span Models < 50 psi <1.0% of span
Stability	<0.25% of span/year
Thermal Effect	-40° to 221°F (-40° to 105°C), <0.5% FS
Overpressure	3x range
Burst Pressure	5x range
Measurement Range	0-15 psi to 0-1000 psi
Media Compatibility	Fluids compatible with brass, 304L and 316 stainless steel
Response Time	<1 ms
Operating Temperature	-40° to 221°F (-40° to 105°C)
Process Connection	1/8" MNPT, 316 stainless steel
Wiring Terminations	Splash-proof Packard connector, 16 AWG cable, 36" length
Dimensions	Enclosure: 5.11"H x 5.11"W x 2.95"D (13.0 x 13.0 x 7.5 cm)
Weight	4.4 oz (125 g) with 36" cable
Warranty	1 year

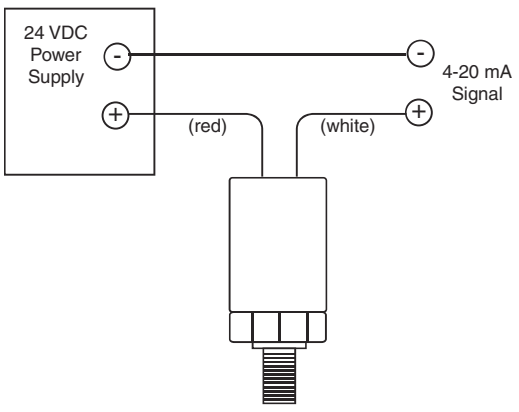
DIMENSIONS

in
(cm)



WIRING

in
(cm)



INSTALLATION

Mount the **PSS2 Series** in a manner that protects it from steam or temperatures outside of its operating range. A Model PT steam pigtail syphon must be installed in all applications where steam is to be monitored. When monitoring the pressure of a medium that is above or below the temperature operating range of the transmitter, the sensor should be isolated by a length of tubing. If 6" to 12" (15.2 to 30.5 cm) of brass tubing is used, temperatures up to 400°F (204°C) can be tolerated. See the Technical Reference section for information on Steam Isolation and Temperature Protection.

If the **PSS2 Series** is to be subjected to fluid hammer, pressure surges, or pulsations, a Model 47 pressure snubber is recommended.

CAUTION: Not for use with ammonia. The PSS2 can be used with media that is compatible with 304L and 316L stainless steel.

ORDERING INFORMATION

MODEL	DESCRIPTION	
PSS2	Stainless steel 4-20 mA pressure transmitter	
	PRESSURE RANGE psig (kPa)	
	15	0-15 (0-103.4)
	30	0-30 (0-206.9)
	50	0-50 (0-344.8)
	75	0-75 (0-517.1)
	100	0-100 (0-689.5)
	150	0-150 (0-1034)
	200	0-200 (0-1379)
	300	0-300 (0-2068)
	500	0-500 (0-3497)
	750	0-750 (0-5171)
	1000	0-1000 (0-6895)
	OPTIONS (leave blank for no options)	
	E	Watertight enclosure (with stainless steel bulkhead fitting)
	G*	Enclosed with pressure gauge (watertight with transparent cover, brass fittings)
	LCD*	Model LPI-1C LCD display with enclosure (not watertight, brass fittings)
	RED*	Model LPI-1CR red digital display with enclosure (not watertight, brass fittings)

PSS2 – 100 – G

Example: **PSS2-100-G** Stainless steel pressure transmitter with a 4-20 mA output over the range of 0-100 psig, with pressure gauge, installed in a watertight enclosure with a transparent cover

* Brass wetted parts option is only for those mediums compatible with brass.

RELATED PRODUCTS		PAGE
250R-3-1	250 OHM 3 WATT 1% Resistor Long Leads	**89**
47B-1	Brass piston style snubber	**899**
47S-1	Stainless steel piston style snubber	**899**
PT	1/4" pigtail syphon with fittings	**390**

I

Control Damper Actuator Sizing

Project: NASA Infrared Telescope Facility
System: Schneider Electric
Actuator Type: Schneider Electric
Date: Tuesday, December 11, 2012

*Size and Velocity Approximated

Torque Loading factor (in-lb/ft^2)			
Damper Blade	**<1000 ft/min. 2 in.h_2o**	**ft/min 1000-2500**	**ft/min 2500-3500**
Parallel blade/edge seals	7	10.5	14
Opposed blade/edge seals	5	7.5	10
Parallel blade/no edge seals	4	6	8
Opposed blade/no edge seals	3	4.5	6
Round	10	14	20

	(Selected)	(Selected)	(Calculated)	(Selected)	(Calculated)	(Selected)	(Selected)	(Calculated)	(Calculated)	(Calculated)	(Selected)	(Calculated)	(Calculated)	(Calculated)	(Select)	(Select)	(Select)	(Calculated)
Damper Tag	***Size (H) in.**	***Size (V) in.**	**Area (ft^2)**	***Flow (ft^3/min)**	**Realized Velocity (ft/min.)**	**Max Velocity (ft/min.)**	**Torque Loading Factor (in-lb/ft^2)**	**Realized Torque Load. Fact. (in-lb/ft^2)**	**Calculated Torque (in-lb)**	**Realized Torque (in-lb)**	**Torque Requirement Safety Factor**	**Realized Torque Requirement Safety Factor**	**Max Required Torque (in-lb)**	**Realized Required Torque (in-lb)**	**Actuator Size (in-lb)**	**Actuator Qty**	**Actuator Part Number**	**Torque Supplied (in lb)**
AHU-4 Bypass	30.0	16.0	3.3	1000.0	300.0	1000.0	5.0	1.5	16.7	5.0	1.25	5.6	20.8	6.3	35.0	1.0	MA40-7043	35.0
AHU-4 Sply	36.0	18.0	4.5	1000.0	222.2	1000.0	5.0	1.1	22.5	5.0	1.25	5.6	28.1	6.3	35.0	1.0	MA40-7043	35.0
AHU-4 Rtn	38.0	16.0	4.2	1000.0	236.8	1000.0	5.0	1.2	21.1	5.0	1.25	5.6	26.4	6.3	35.0	1.0	MA40-7043	35.0

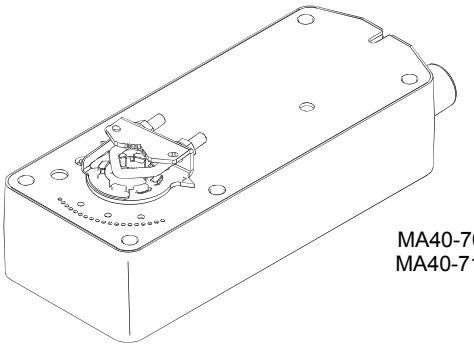
MA40-704X Series, MA4X-707X Series, MA4X-715X Series

DuraDrive Series Spring Return Two-Position Actuators General Instructions

Application

DuraDrive ™ Direct Coupled Actuators are designed to be used in both damper and valve control applications. The follow general instructions are for damper applications, refer to the Applicable Literature table for valve literature.

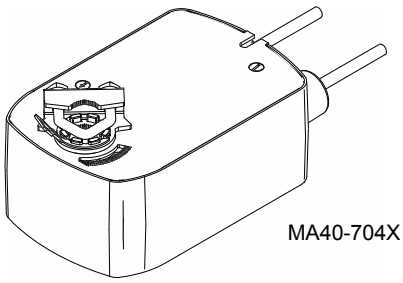
The MA40-704X, MA4X-707X and MA4X-715X series spring return actuators are used for the on-off, fail safe control of dampers and valves in HVAC systems.



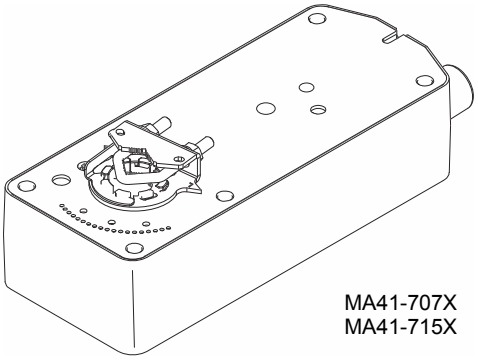
MA40-707X
MA40-715X

Features

- Two-position actuator controlled by SPST controller
- 133 lb-in (15 N-m), 60 lb-in (7 N-m), and 35 lb-in (4 N-m) torque models
- 24 Vac/DC, 120 Vac, and 230 Vac models
- Rugged die cast housings rated for NEMA 2 / IP54
- Overload protection throughout rotation
- Optional built-in auxiliary switch to provide for interfacing or signaling
- Provides 95° of rotation
- Visual position indicator provided
- Provides true mechanical clockwise or counterclockwise spring return operation for reliable fail safe application and positive close-off in air tight damper applications
- Direct mount to round or square damper shafts
- Rotation limiting available
- MA4X-7153 series actuators can be double-mounted (gang mounting) to accommodate high torque application requirements
- Five year warranty
- MA41-707X-XXX and MA41-715X-XXX equipped with manual override



MA40-704X



MA41-707X
MA41-715X

Applicable Literature

F-Number	Description	Audience	Purpose
F-26750	MX40-6XXX-2XX, MX4X-7XXX-2XXSeries Actuator/Linkage Assemblies General Instructions	– Sales Personnel – Application Engineers – Installers – Service Personnel – Start-up Technicians	Describes the globe valve actuator/linkage assembly's features, specifications, and possible applications. Provides step-by-step mounting instructions.
F-26751	VX-2000 Series Ball Valve Assembly Installations Instructions	– Sales Personnel – Application Engineers – Installers – Service Personnel – Start-up Technicians	Describes the actuator/linkage/ball valve assembly's features, specifications, and possible applications. Provides step-by-step mounting instructions.
F-26646	MX4X-7XXX, MX40-6XXX Series TAC DuraDrive Actuator Selection Guide	– Sales Personnel – Application Engineers – Installers – Service Personnel – Start-up Technicians	Provides actuator specifications and part number cross referencing of phased out actuators with the new TAC direct-coupled actuators.
F-26752	VX-2000, VX-7000 Series Ball/Linked Globe Linked Valve Assemblies Actuator/Linkage Assemblies Selection Guide	– Sales Personnel – Application Engineers – Installers – Service Personnel – Start-up Technicians	Provides part number cross referencing of phased out globe and ball valve assemblies with the new TAC direct-coupled actuators.
F-26080	EN-205 Water System Guidelines	– Application Engineers – Installers – Service Personnel – Start-up Technicians	Describes TAC approved water treatment practices.
F-13755	CA-28 Control Valve Sizing	– Application Engineers – Installers – Service Personnel – Start-up Technicians	Provides charts, equations, and diagrams to assist in the configuration of valve system applications. TOOL-150, valve sizing slide rule may be purchased separately.
F-11080	Valve Selection Chart Water		
F-11366	Valve Selection Chart Steam (two-way valves only)		

SPECIFICATIONS

Actuator Inputs

Control Signal: On-off, spring return. SPST control contacts or Triacs (500 mA rated).
Power Input: See Table-1. All 24 Vac circuits are Class 2. All circuits 30 Vac and above are Class 1.
Connections: 3 ft. (91 cm) appliance cables, 1/2 in. conduit connector. For M20 Metric conduit, use AM-756 adaptor.

Actuator Outputs

Electrical:
Auxiliary Switches,
MA4X-715X-502 and MA4X-707X-502 Two SPDT 7A (2.5A) @250 Vac, UL listed; one fixed @ 5° and one adjustable 25 to 85°.
MA40-7040-501 and MA40-7041 -501 One SPDT 6A (1.5A) @250 Vac, UL listed; adjustable 0 to 95° (0 to 1 scale).
MA40-7043-501 One SPDT 6A (1.5A) @24 Vac, UL listed; adjustable 0 to 95° (0 to 1 scale).
Mechanical:
Stroke, Angle of rotation 95° ± 5° maximum. Adjustable 30° to 95° with AM-689 installed on MA4X-715X or MA4X-707X series. Stroke limiter is standard on MA40-704X series.
Damper Shaft Clamp,
MA40-704X The factory installed universal clamp is used for shafts up to 5/8" (15 mm) diameter or up to 1/2" (13 mm) square. AM-710 accessory clamp is required when mounting actuators to shafts up to 3/4" (19 mm) diameter or up to 1/2" (13 mm) square.
MA4X-715X or MA4X-707X The factory installed universal clamp is used for shafts up to 3/4" (19 mm) diameter or up to 1/2" (13 mm) square. AM-687 accessory clamp is required when mounting actuators to shafts up to 1.05" (27 mm) in diameter or up to 5/8" (15 mm) square.
Position Indicator, Visual indicator.
MA4X-715X and MA4X-707X, -5 to 90° (-5° is spring return position).
MA40-704X, 0 to 1 (0 is spring return position).
Nominal Damper Area, Actuator sizing should be done in accordance with damper manufacturer's specification.
Direction of Rotation, Clockwise or counterclockwise rotation determined by actuator mounting.
Manual Override, MA41-707X and MA41-715X rotation is adjustable from -5° to 85° using manual override crank.

Environment

Ambient Temperature Limits:
Shipping & Storage, -40 F to 160°F (-40 to 71°C).
Operating, -22 to 140°F (-30 to 60°C).
Humidity: 15 to 95% RH, non-condensing.
Location:
MA4X-715X and MA4X-707X, NEMA 1 (IEC IP30). NEMA 2 (IEC IP54) with conduit connector in the down position.
MA40-704X, NEMA 2 (IEC IP54) no restrictions.

Agency Listings

UL 873: Underwriters Laboratories (File # E9429 Category Temperature-Indicating and Regulating Equipment).
CUL: UL Listed for use in Canada by Underwriters Laboratories. Canadian Standards C22.2 No. 24.
European Community: EMC Directive (89/336/EEC). Low Voltage Directive (72/23/EEC).
Australia: This product meets requirements to bear the C-Tick Mark according to the terms specified by the Communications Authority under the Radiocommunications Act 1992.

Table-1 Model Chart.

Part Numbers	Actuator Power Input								Auxiliary Switch	Approximate Timing in Seconds @ 70° (21°C)[a]		Output Torque Rating lb-in (N-m)[b]		
	Voltage	VA		Watts						Powered	Spring Return	Minimum	Maximum Stall	Manual Override
		50 Hz	60 Hz	Running		DC Amps	Holding							
				50 Hz	60 Hz		50 Hz	60 Hz						
MA40-7153	24 Vac ± 20% 22-30 Vdc	9.8	9.7	7.5	7.5	0.29	2.8	2.8	No	<190	<30	133 (15)	350 (40)	No
MA40-7153-502									Two[c]					No
MA41-7153									No					Yes
MA41-7153-502									Two[c]					Yes
MA40-7150	120 Vac ±10%	11.7	10.0	8.8	8.4	—	3.6	5.0	No					No
MA40-7150-502									Two[c]					No
MA41-7150									No					Yes
MA41-7150-502									Two[c]					Yes
MA40-7151	230 Vac ±10%	15.5	10.6	9.5	8.5	—	4.6	3.3	No					No
MA40-7151-502									Two[c]					No
MA41-7151									No					Yes
MA41-7151-502									Two[c]					Yes
MA40-7073	24 Vac ± 20% 22-30 Vdc	4.8	4.8	3.2	3.2	0.13	0.8	0.8	No	<80	<40	60 (7)	250 (28)	No
MA40-7073-502									Two[c]					No
MA41-7073									No					Yes
MA41-7073-502									Two[c]					Yes
MA40-7070	120 Vac ±10%	10.7	5.6	4.2	3.6	—	2.0	1.2	No					No
MA40-7070-502									Two[c]					No
MA41-7070									No					Yes
MA41-7070-502									Two[c]					Yes
MA40-7071	230 Vac ±10%	17.0	8.0	5.1	4.0	—	2.7	1.4	No					No
MA40-7071-502									Two[c]					No
MA41-7071									No					Yes
MA41-7071-502									Two[c]					Yes
MA40-7043	24 Vac ± 20% 22-30 Vdc	4.4	4.4	2.9	2.9	0.11	0.8	0.8	No	<50	<26	35 (4)	150 (17)	No
MA40-7043-501									One[d]					No
MA40-7040	120 Vac ±10%	6.4	4.3	3.8	3.4	—	1.6	1.2	No					No
MA40-7040-501									One[d]					No
MA40-7041	230 Vac ±10%	5.8	4.6	4.1	3.9	—	1.5	1.2	No					No
MA40-7041-501									One[d]					No

[a] Timing was measured with no load applied to the actuator.
[b] De-rating is required at low temperatures.
[c] One adjustable from 25 to 85° rotation and one set to operate @ 5° fixed.
[d] One adjustable from 0 to 95° rotation (0 to 1 scale).

ACCESSORIES

For use with MA4X-7XXX:

AM-671	Universal Mounting Bracket, AM-693 is required
AM-672	Universal Mounting Bracket, AM-693 is required
AM-673	Mounting Bracket
AM-674	Weather Shield
AM-675	Base Mounting Plate for AM-674
AM-676	Universal Shaft Extension
AM-714	Weather Shield (polycarbonate)
AM-756	Metric Conduit Adapter M20 x 1.5 to 1/2" NPT
AM-761	7-inch Anti-rotation Bracket
AM-762	9-inch Anti-rotation Bracket

For use with MA40-7043:

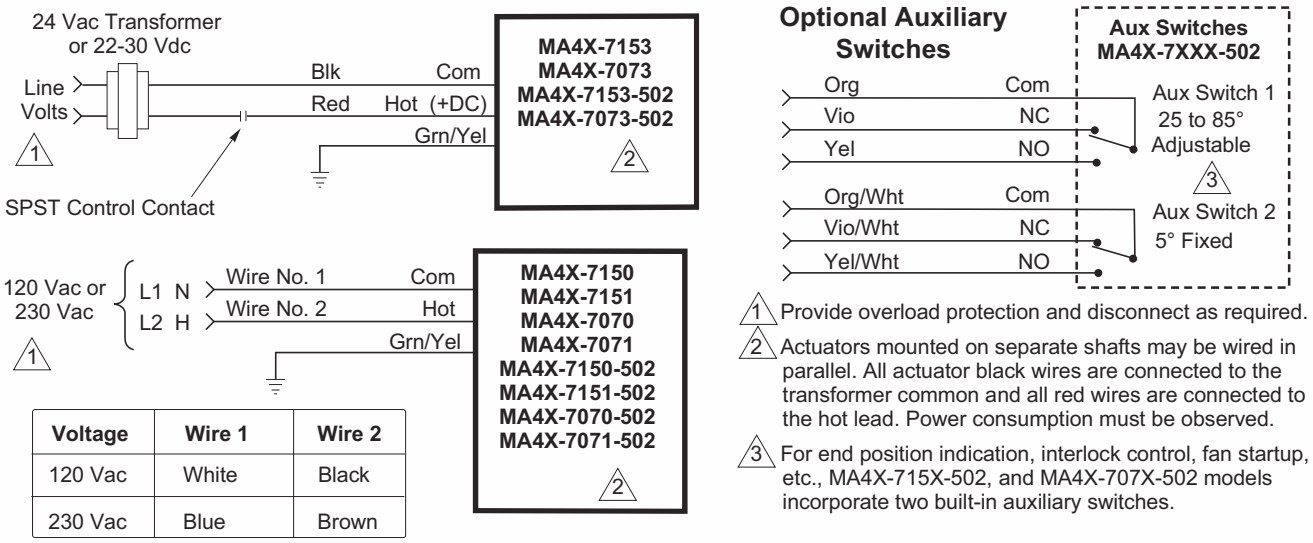
AM-709	Position Indicator and Stroke Limiter
AM-710	Universal Clamp for up to 3/4" diameter shafts
AM-711	Crankarm for up to 1/2" round shaft
AM-712	Crankarm Adapter Kit
AM-713	Mounting Bracket for Honeywell Mod IV, M6415 type actuators and new installations
AM-715	Crankarm Adapter Kit for Honeywell Mod IV, M6415 type actuators and new installations

For use with MX4X-7073, MX4X-7153

AM-686	Damper Position Indicator
AM-687	Universal Clamp for up to 1.05" (27 mm) diameter shafts
AM-688	Replacement Universal Clamp
AM-689	Rotation Limiter
AM-690	Crankarm for round shafts up to 3/4" (19 mm)
AM-691	Crankarm for jackshafts up to 1.05" (27 mm)
AM-692	V-bolt Kit for AM-690 and AM-691 Crankarm
AM-693	Damper Linkage Kit
AM-758	Short "U" Mounting Bracket
AM-759	Tall "U" Mounting Bracket
AM-760	Slotted "L" Mounting Bracket
AM-763	1/8" Hex Crank for Manual Override

TYPICAL APPLICATIONS (wiring diagrams)

Figure-1 through Figure-3 illustrate typical wiring diagrams for spring return floating actuators. See Table-1 for model selection.



Voltage	Wire 1	Wire 2
120 Vac	White	Black
230 Vac	Blue	Brown

1 Provide overload protection and disconnect as required.

2 Actuators mounted on separate shafts may be wired in parallel. All actuator black wires are connected to the transformer common and all red wires are connected to the hot lead. Power consumption must be observed.

3 For end position indication, interlock control, fan startup, etc., MA4X-715X-502, and MA4X-707X-502 models incorporate two built-in auxiliary switches.

MX40-707X-502 and MX40-715X-502 units manufactured prior to the date code 0141 (October 6, 2001) used the following color coding for the auxiliary switches:

Auxiliary Switch 1

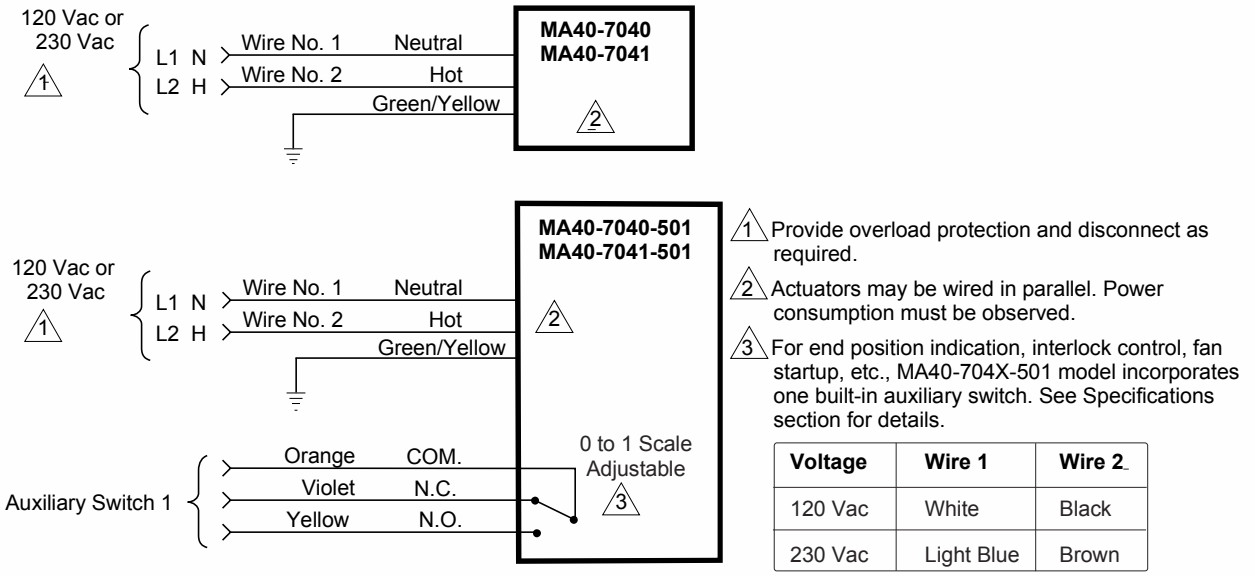
Orange:	Fixed auxiliary switch common (com)
Yellow:	Fixed auxiliary switch normally closed (NC)
Violet:	Fixed auxiliary switch normally open (NO)

Auxiliary Switch 2

Orange/white:	Adjustable auxiliary switch common (com)
Violet/white:	Adjustable auxiliary switch normally closed (NC)
Yellow/white:	Adjustable auxiliary switch normally open (NO)

The label information on these units is incorrect. If replacing these units, the auxiliary switch operation of the replacement actuator will be per the product label.

Figure-1 Typical Wiring Diagram for 24 Vac Basic and Double Auxiliary Switch Models.



Voltage	Wire 1	Wire 2
120 Vac	White	Black
230 Vac	Light Blue	Brown

Figure-2 Typical Wiring Diagram for 120 Vac or 230 Vac Basic and Single Auxiliary Switch Models.

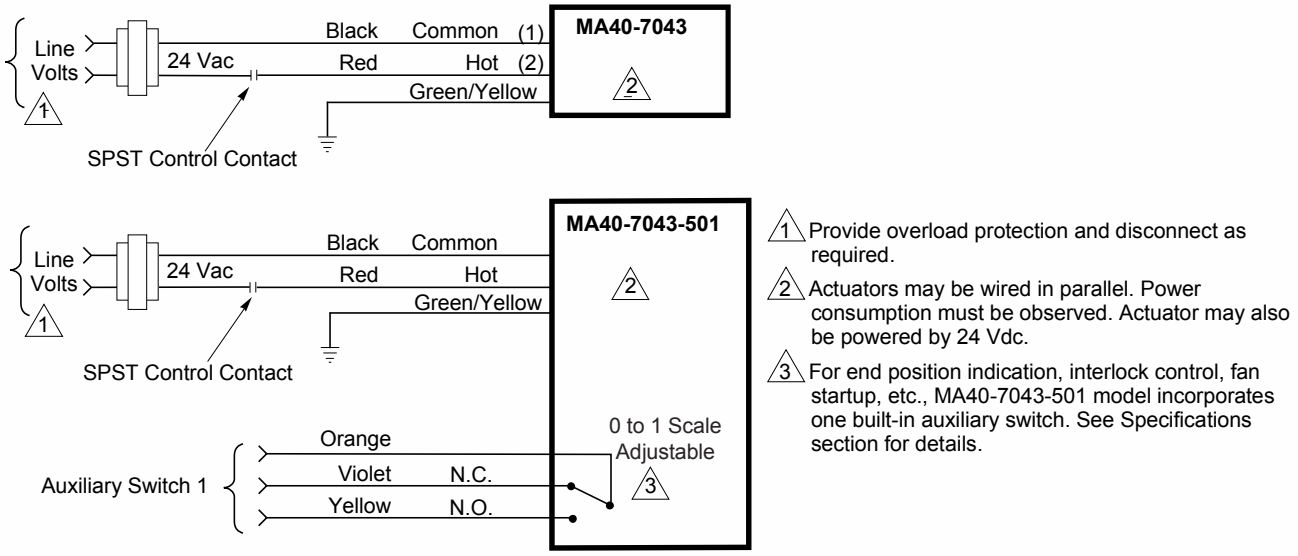


Figure-3 Typical Wiring Diagram for 24 Vac Basic and Single Auxiliary Switch Models.

INSTALLATION

Inspection

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

Requirements

- Job wiring diagrams
- Tools (not provided):
  - #8 sheet metal screws
  - 10mm open end wrench or socket wrench
  - 7/16 inch, open end wrench or socket wrench
  - 1/8 inch, allen wrench
  - Appropriate screwdriver(s)
- Appropriate accessories
- Training: Installer must be a qualified, experienced technician

Precautions

General

Warning:

- Electrical shock hazard! Disconnect the power supply (line power) before installation to prevent electric shock and equipment damage.
- Make all connections in accordance with the job wiring diagram and in accordance with national and local electrical codes. *Use copper conductors only.*

Caution:

- Avoid electrical noise interference. Do not install near large contactors, electrical machinery, or welding equipment.
- Do not drill holes in actuator body. Six pre-drilled holes are located on each side, under the label, to accept #10-24 thread-forming screws for mounting accessories.

Caution: The MX41-707X and MX41-715X actuators are equipped with a manual override.

- The manual override is to be used only when power is not applied to the unit.
- If the universal clamp is not set to 0° on the position indicator, manually wind the actuator in the direction indicated with hex wrench from -5° to 0° and lock with a screwdriver.
- When operating manual override, back off 5° from full open mechanical stop to ensure proper release.
- Do not attempt to use the manual override with actuators mounted in tandem. Damage to the gear train may occur.

Federal Communications Commission (FCC)

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in residential installations. This equipment generates, uses, and can radiate radio frequency energy and may cause harmful interference if not installed and used in accordance with the instructions. Even when instructions are followed, there is no guarantee that interference will not occur in a particular—Which can be determined by turning the equipment off and on—the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/television technician for help.

Canadian Department of Communications (DOC)

Note: This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numerique de la classe B respecte toutes les exigences du Reglement sur le material broilleur du Canada.

European Standard EN 55022

Warning: This is a Class B digital (European Classification) product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Location

Caution: Avoid locations where excessive moisture, corrosive fumes, vibration, or explosive vapors are present.

Mounting

Caution: To remain in NEMA 2/IP54 compliance, the MA4X-715X and MA4X-707X series actuators should be mounted with conduit end down.

Mount the TAC DuraDrive Actuator directly on the damper shaft in locations that clear the maximum dimensions of the actuator case and allow the actuator to be mounted flush to the surface of the terminal box and perpendicular to the damper shaft.

Note: Some terminal boxes have sheet metal screw heads or other protrusions near the damper shaft. In these cases, a spacer or shim may be added under the anti-rotation bracket of the actuator to make the actuator perpendicular to the shaft.

Damper Actuator Sizing

Correct sizing of the actuator is necessary for proper control of dampers. The area of damper that can be controlled by a given actuator is dependent upon the type of damper, the quality of the damper, the pressure drop across the damper in the closed position, and the velocity of the air flow through the damper. To obtain actual damper torque requirements, contact the damper manufacturer.

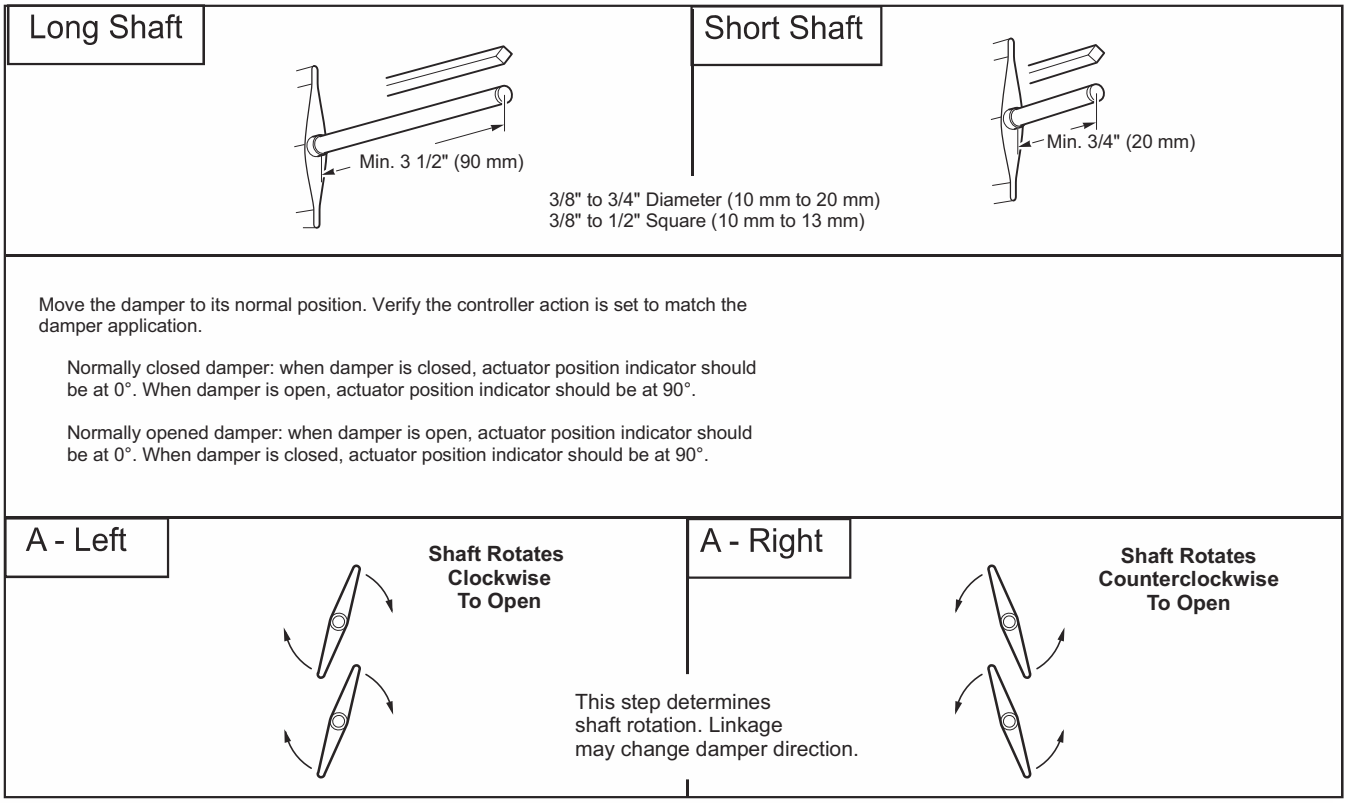
Damper Shaft Sizing

Use the “Long Damper Shaft” mounting instructions if the damper shaft is at least 3-1/2" (90 mm) long.

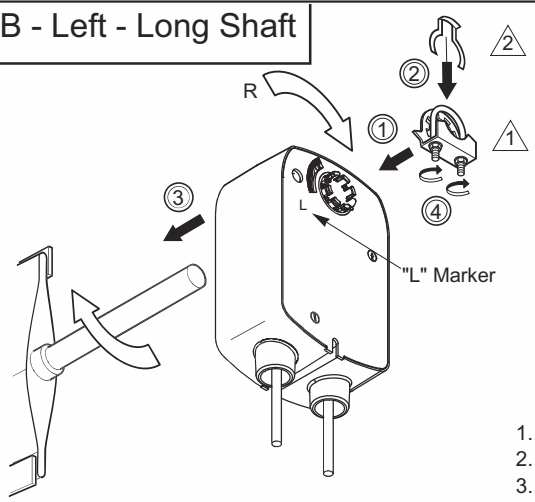
Use the “Short Damper Shaft” mounting instructions if the damper shaft is shorter than 3-1/2" (90 mm) or the area around the damper shaft is too narrow to allow standard mounting, as described in the “Short Damper Shaft” mounting section.

MA40-704X Series Installation

Note: The MA40-704X series actuator comes equipped with standard universal mounting clamp. For damper shafts larger than 5/8" (16 mm) in diameter, the AM-710 universal mounting clamp is required (order separately). The AM-710 clamp accommodates shafts sizes up to 3/4" (19 mm) diameter shafts.

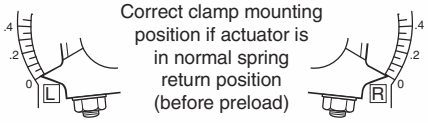


B - Left - Long Shaft

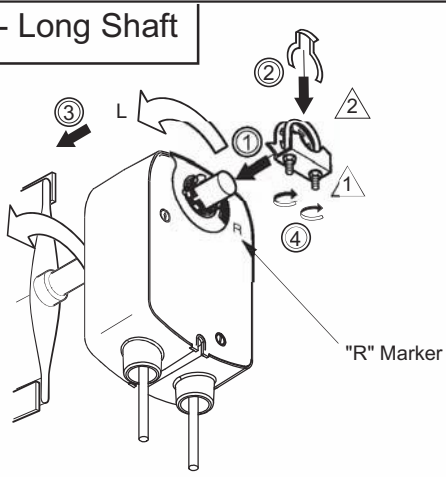


1. Universal mounting clamp.
2. Retaining clip.

1. Assemble mounting clamp.
2. Assemble retaining clip.
3. Place actuator over shaft.
4. Hand tighten clamp nuts.

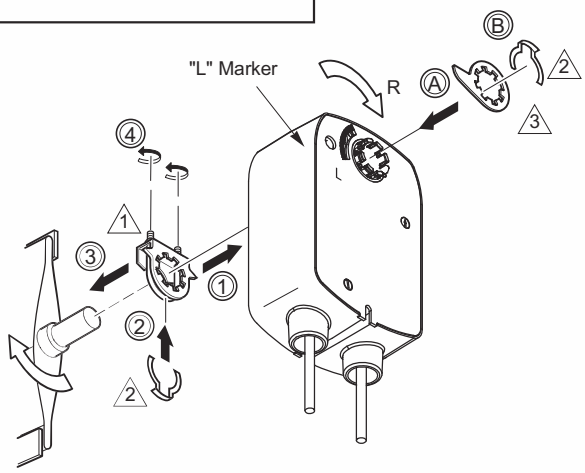


B - Right - Long Shaft



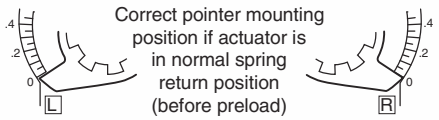
1. Universal mounting clamp.
2. Retaining clip.

B - Left - Short Shaft

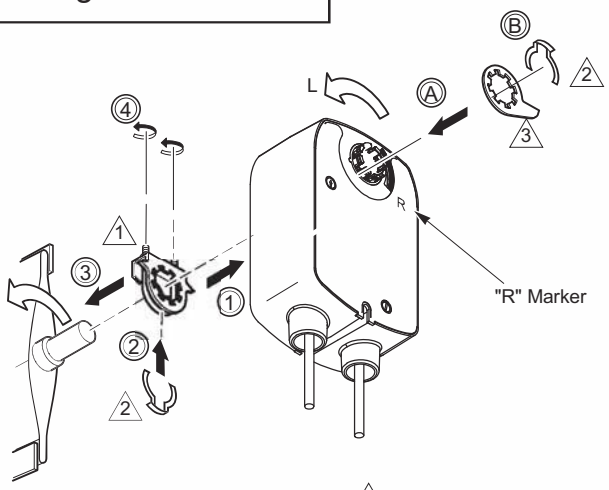


1. Universal clamp.
2. Retaining clip.
3. Damper position indicator.

A. Assemble damper position indicator.
B. Assemble retaining clip.
1. Position mounting clamp.
2. Assemble retaining clip.
3. Slide actuator over shaft.
4. Hand tighten clamp nuts.

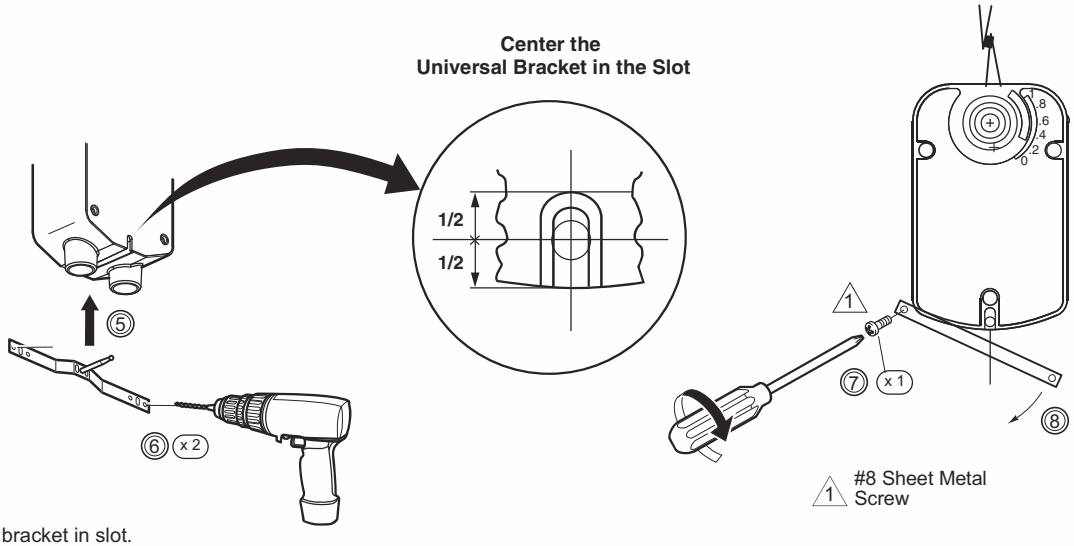


B - Right - Short Shaft



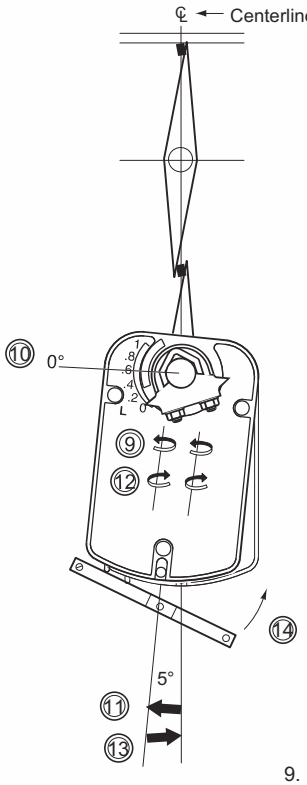
1. Universal clamp.
2. Retaining clip.
3. Damper position indicator.

C - Left and Right

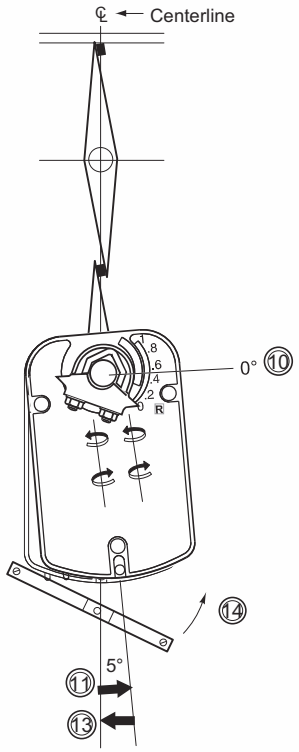


5. Center bracket in slot.
6. Drill two holes.
7. Start one screw.
8. Swing bracket down.

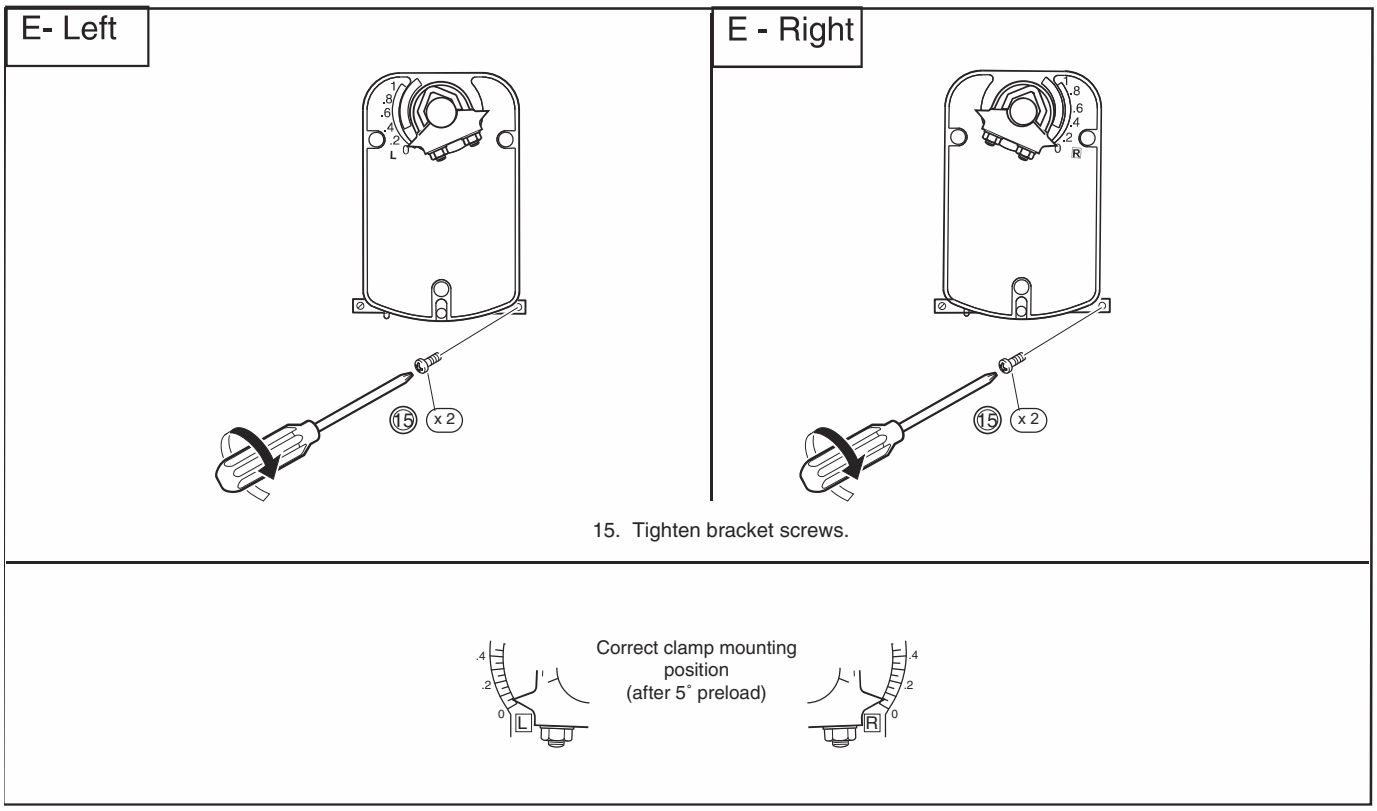
D- Left



D- Right



9. Loosen clamp nuts.
10. Check that the shaft is in full zero position.
11. Swing actuator 5° in the direction of travel. Do not move shaft.
12. Tighten clamp nuts to 4 to 6 lb-ft (5.4 to 8.2 N-m) of torque.
13. Move bottom of actuator back into position.
14. Pivot bracket back into position.



MA4X-707X and MA4X-715X Series Installation

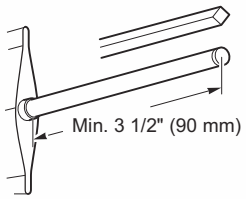
Caution: Do not drill additional holes in the actuator body. Six pre-drilled holes are located on each side, under the label, to accept #10-24 thread-forming screws for mounting accessories.

Note: The MA40-707X and MA40-715X series actuators come equipped with standard universal mounting clamp installed. For damper shafts larger than 3/4" (19 mm) in diameter, the AM-687 universal mounting clamp is required (order separately). The AM-687 clamp accommodates round shaft sizes up to 1.05" (27 mm) in diameter or 5/8" (16 mm) square shafts.

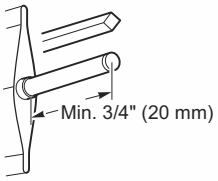
Caution: The MA41-707X and MA41-715X actuators are equipped with a manual override.

- The manual override to be used only when power is not applied to the unit.
- If the universal clamp is not set to 0° on the position indicator, manually wind the actuator in the direction indicated with hex wrench from -5° to 0° and lock with a screwdriver.
- When operating manual override, back off 5° from full open mechanical stop to ensure proper release.
- Do not attempt to use the manual override with actuators mounted in tandem. Damage to the gear train could occur.
- Using power tools to adjust the manual override will cause damage to the gears.
- To unlock manual override without power, crank the manual override in the direction indicated a minimum of 5°.

Long Shaft



Short Shaft



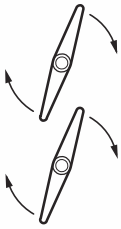
3/8" to 3/4" Diameter (10 mm to 20 mm)
3/8" to 1/2" Square (10 mm to 13 mm)

Move the damper to its normal position. Verify the controller action is set to match the damper application.

Normally closed damper: when damper is closed, actuator position indicator should be at 0°. When damper is open, actuator position indicator should be at 90°.

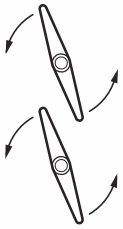
Normally opened damper: when damper is open, actuator position indicator should be at 0°. When damper is closed actuator position indicator should be at 90°.

A - Left



Shaft Rotates Clockwise To Open

A - Right



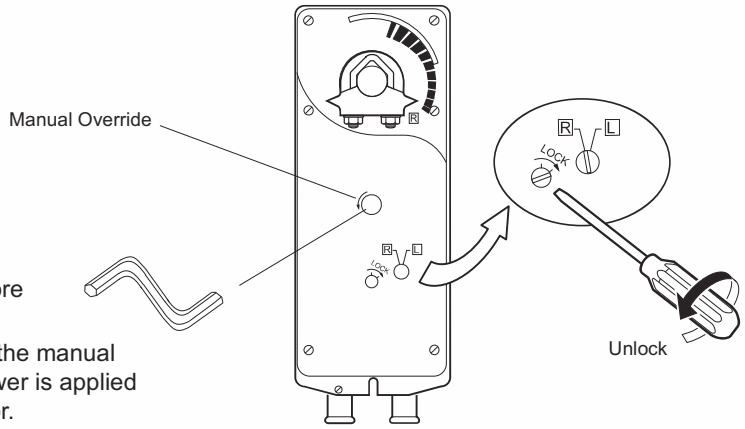
Shaft Rotates Counterclockwise To Open

This step determines shaft rotation. Linkage may change damper direction.

B

For MA41-707X and MA41-715X only (manual override).
For MA40-707X and MA40-715X, proceed to step C.

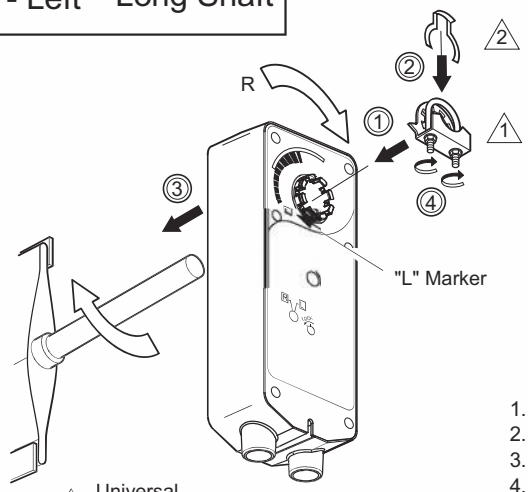
If position indicator does not point to zero: Unlock the actuator.
Insert hex wrench into manual override.
Crank the actuator so the indicator points to 0°.
Lock the actuator.



Fully engage hex wrench into manual override before winding.

Caution: Do not crank the manual override if power is applied to the actuator.

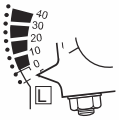
C - Left - Long Shaft



1. Universal mounting clamp.
2. Retaining clip.

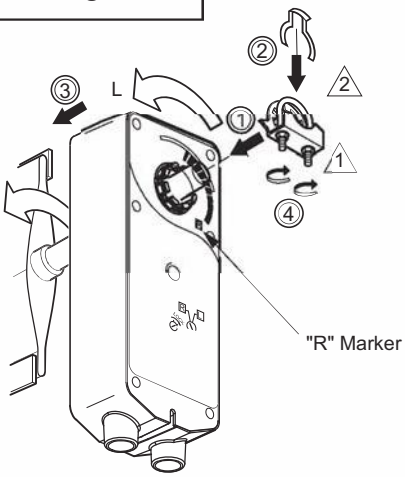
1. Assemble mounting clamp.
2. Assemble retaining clip.
3. Place actuator over shaft.
4. Hand tighten clamp nuts.

For MA40-707X and MA40-715X actuators:



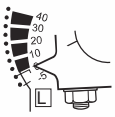
Correct clamp mounting position if actuator is in normal spring return position

C - Right - Long Shaft



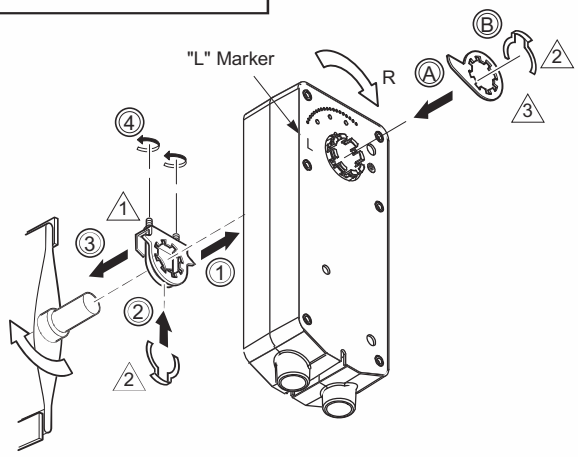
1. Universal mounting clamp.
2. Retaining clip.

For MA41-707X and MA41-715X actuators:



Correct clamp mounting position if actuator is locked with 5° preload.

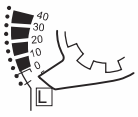
C - Left - Short Shaft



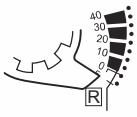
1. Universal clamp.
2. Retaining clip.
3. Damper position indicator.

A. Assemble damper position indicator.
B. Assemble retaining clip.
1. Position mounting clamp.
2. Assemble retaining clip.
3. Slide actuator over shaft.
4. Hand tighten clamp nuts.

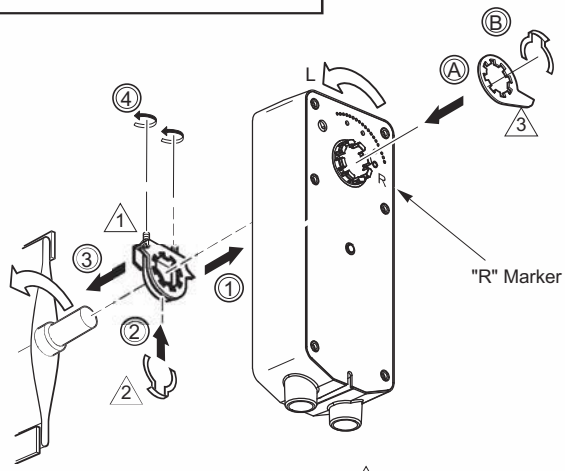
For MA40-707X and MA40-715X actuators:



Correct pointer mounting position if actuator is in normal spring return position

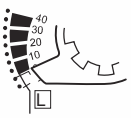


C - Right - Short Shaft

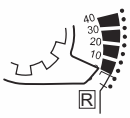


1. Universal clamp.
2. Retaining clip.
3. Damper position indicator.

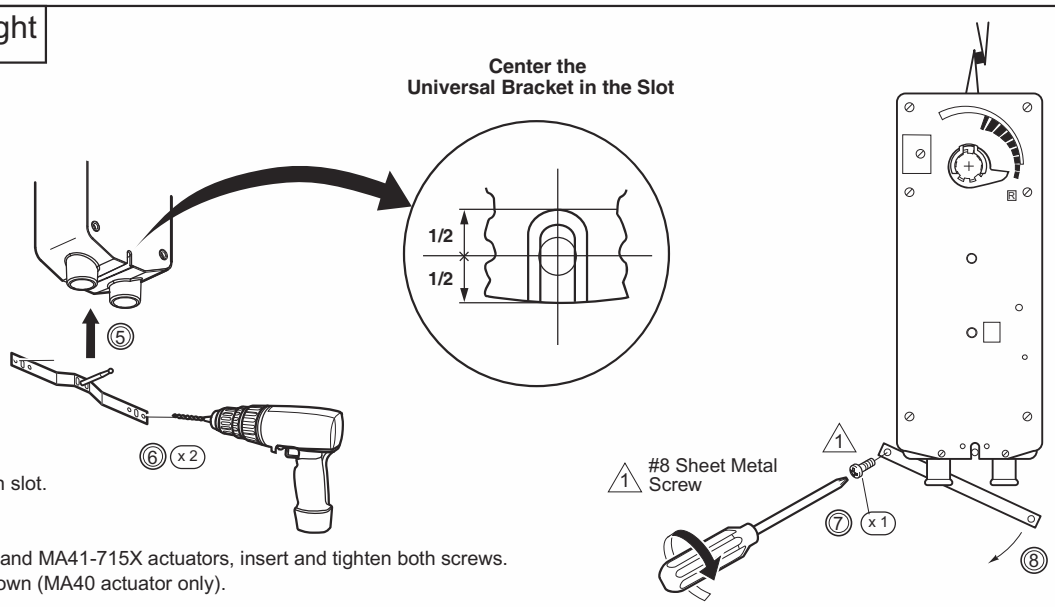
For MA41-707X and MA41-715X actuators:



Correct pointer mounting position if actuator is locked at 5° preload.

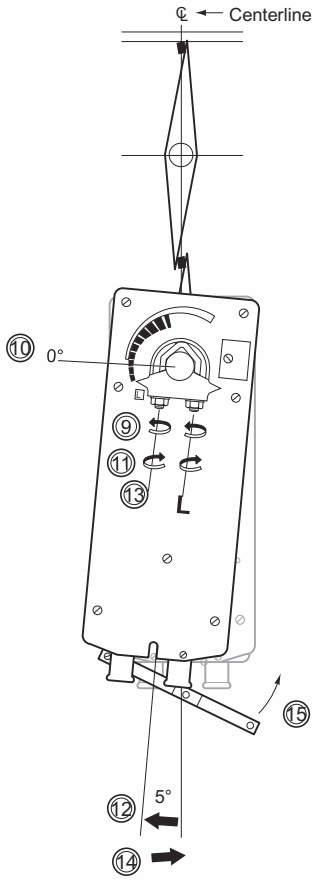


D - Left and Right

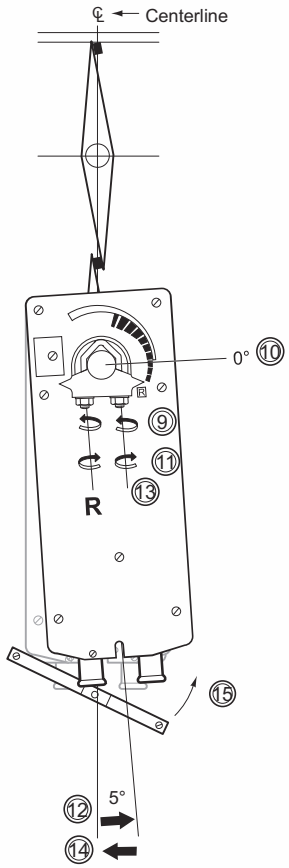


5. Center bracket in slot.
6. Drill two holes.
7. Start one screw.
   For MA41-707X and MA41-715X actuators, insert and tighten both screws.
8. Swing bracket down (MA40 actuator only).

E- Left



E- Right



9. Loosen clamp nuts.
10. Check that the shaft is in full zero position.

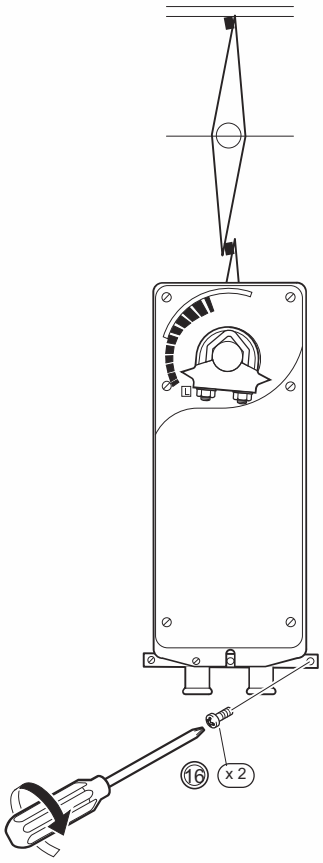
For MA41-707X and MA41-715X only:

11. Tighten clamp nuts to 8 - 10 ft-lb (11 - 14 Nm). This completes the installation for MA41-704X and MA41-715X.

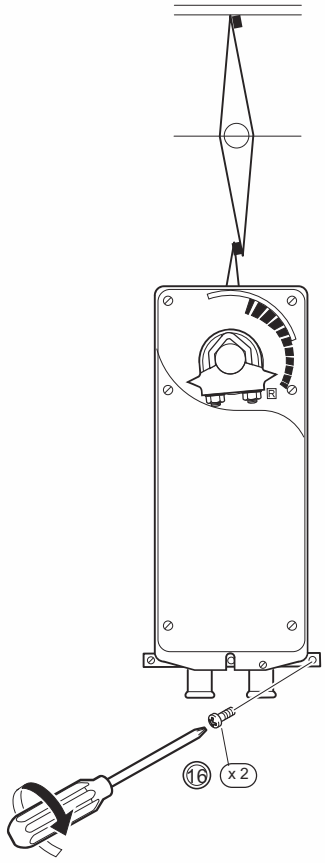
For MA40-707X and MA40-715X only:

12. Swing actuator 5° in the direction of travel. Do not move shaft.
13. Tighten clamp nuts to 8 - 10 ft-lb (11 - 14 Nm).
14. Move bottom of actuator back into position.
15. Pivot bracket back into position.

F- Left



F- Right



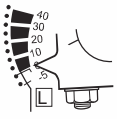
For MA40-707X and MA40-715X only:

16. Tighten bracket screws.

For MA40-707X and MA40-715X actuators:

Correct pointer position after mounting.

For MA41-707X and MA41-715X actuators:



Correct pointer position after mounting.

The lock on MA41-707X and MA41-715X will release on first power-up.

Jackshaft Installation

(MA40-704X Series)

The MA40-704X actuator is designed for use with jackshafts up to 3/4" (19 mm) in diameter. In most applications, the MA40-704X actuator may be mounted in the same manner as a standard damper shaft application. If the jackshaft diameter is larger than 5/8" (16 mm) in diameter, the optional AM-710 universal clamp must be used.

(MA4X-715X and MA4X-707X Series)

The MA4X-715X and MA4X-707X actuators are designed for use with jackshafts up to 1.05" (27 mm) in diameter. In most applications, the actuator may be mounted in the same manner as a standard damper shaft application. If the jackshaft diameter is larger than 3/4" (19 mm) in diameter, the optional AM-687 universal clamp must be used.

Multiple Actuator Mounting

If more torque is required than one actuator can provide a second actuator may be mounted to the damper shaft, using the AM-673 multiple mounting bracket. See Figure-4.

Multiple actuators may be powered from one transformer provided the following rules are followed:

- The total current draw of the actuators (VA rating) is less than or equal to the rating of the transformer and less than the rating of the control circuit.
- Polarity on the secondary of the transformer is strictly followed.
  - All L2 wires from all actuators are connected to the common lead on the transformer.
  - All L1 wires from all actuators are connected to the hot lead.

Caution: Mixing the L2 and L1 wires on one lead of the transformer may result in erratic operation or failure of the actuator and/or controls.

Caution: Do not attempt to use the manual override with actuators mounted in tandem. Damage to the gear train may occur.

Multiple actuators positioned by the same control signal may be powered from multiple transformers provided the following rules are followed:

- The transformers are properly sized.
- All L2 wires from all actuators are tied together and tied to the negative lead of the control signal.

Table-2 Power Wiring Color Code.

Part Number	L1	L2
MA4X-7XX3 MA4X-7XX3-502	Red	Black
MA4X-7XX0 MA4X-7XXX-502	Black	White
MA4X-7XX1 MA4X-7XXX-502	Brown	Light Blue

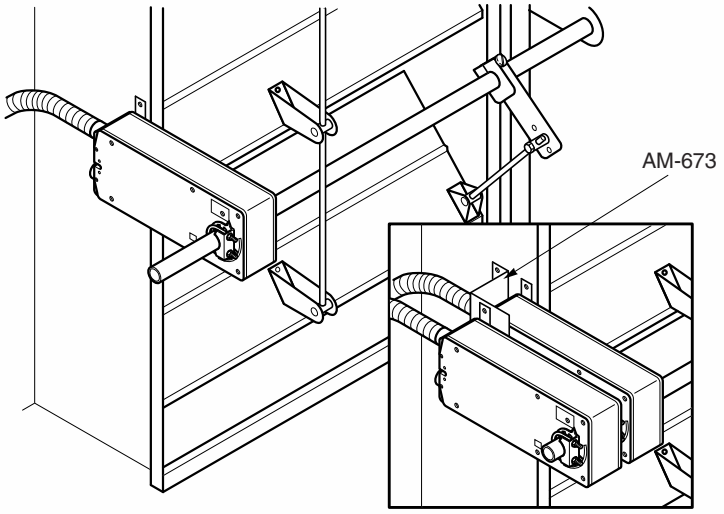


Figure-4 Mounting Multiple Actuators.

Wiring Requirements

Control and Power Leads

See Table-3 for power wiring data. Refer to Figure-1 through Figure-3 for typical wiring applications.

Note: Class 2 control and power lead wiring must be routed separately from line voltage wiring and any other non-class 2 circuits. Line voltage, auxiliary switch, and auxiliary switch leads must be connected to a class 1 circuit.

Table-3 Power Wiring Data.

Actuator Voltage	Part Number	Maximum Wire Run in ft. (m) (5% Voltage Drop)		
		14 AWG	16 AWG	18 AWG
24 Vac 22-30 Vdc	MA4X-7153	330 (101)	200 (61)	130 (40)
	MA4X-7153-502			
24 Vac 22-30 Vdc	MA40-7043	1100 (335)	700 (213)	440 (134)
	MA40-7043-501			
24 Vac 22-30 Vdc	MA4X-7073	600 (183)	500 (152)	254 (77)
	MA4X-7073-502			

Auxiliary Switches

The MA40-704X-501 series actuators include one built-in SPDT auxiliary switch which can be used for interfacing or signaling (e.g., for fan start-up). The switch is adjustable between 0° and 95° of rotation (0 to 1 scale).

The MA4X-715X-502 and MA4X-707X-502 series actuators include two built-in SPDT auxiliary switches which can be used for interfacing or signaling (e.g., for fan start-up). The switch position near the normal (spring return) position is fixed at 5°. The other is adjustable between 25° and 85° of rotation.

Adjusting the Switching Point

Refer to Table-4 for auxiliary switch rating.

Adjusting the switching point for MA40-704X-501

1. The actuator must be in its normal (spring return) position.
2. Use a flat screw driver to rotate the switch pointer until it is at the desired switch position on the 0 to 1 scale.

Adjusting the switching point for MA4X-715X-502 or MA4X-707X-502

1. The actuator must be in its normal (spring return) position.
2. Insert a 1/8" allen wrench into the hex hole located in the center of the adjustable switch pointer.
3. Rotate the wrench until the switch pointer is at the desired switch position in degrees, from 25 to 85°.

Table-4 Auxiliary Switch Rating.

Part Number	Voltage	Resistive Load	Inductive Load
MA40-7043-501	24 Vac	6A	1.5A
MA40-7040-501	250 Vac	6A	1.5A
MA40-7041-501			
MA4X-707X-502	250 Vac	7A	2.5A
MA4X-715X-502			

Rotation Limitation

Rotation Limitation for MA40-704X Series

The Stop Block is used in conjunction with the tab on the universal clamp or the AM-709 position indicator. In order to function properly, the clamp or indicator must be mounted correctly.

The Stop Block controls the rotational output of the MA40-704X and MF40-704X-501 actuators. It is used in applications where a damper has a designed rotation that is less than 90°, for example with a 45° or 60° rotating damper.

1. Determine the amount of damper rotation required. The actuator stop block provides limited rotation from 40° to 95°.
2. Loosen the screw securing the stop block to the actuator.

Note: The actuator is shipped with the Stop Block mounted to the “L” side. If the damper application requires the “R” side face the installer, simply remove the Stop Block and screw and move it to the new location.

---

3. Slide the stop block into position, so that its edge lines up with the degree graduation on the actuator face which corresponds with the required rotation. See Figure-5.
4. Secure the stop block in place.
5. Test the damper rotation by applying power. Re-adjust if necessary.

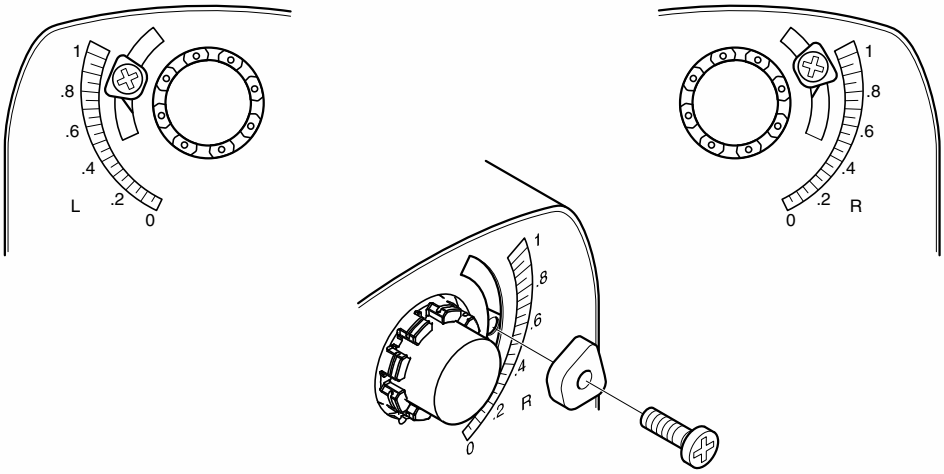


Figure-5 Adjusting Stop Block for Limited Rotation.

Rotation Limitation for MA4X-715X and MA4X-707X Series

The AM-689 rotation limiter is used in conjunction with the tab on the universal clamp or the AM-686 position indicator which comes with the AM-689. In order to function properly, the clamp or indicator must be mounted correctly.

The AM-689 rotation limiter controls the rotational output of the MA4X-715X, MA4X-715X-502, MA4X-707X, and MA4X-707X-502 actuators. It is used in applications where a damper has a designed rotation that is less than 90°, for example with a 45° or 60° rotating damper.

1. Determine the amount of damper rotation required.
2. Locate the AM-689 rotation limiter on the actuator so that its edge lines up with the degree graduation on the actuator face which corresponds with the required rotation. See Figure-6.
3. Find the appropriate cross-hair location through the slot of the rotation limiter. This is the mounting location for the retaining screw.
4. Pierce through the label material to allow easy fastening of the retaining screw.
5. Position the rotation limiter back to the desired position, making sure the locating “teeth” on the rotation limiter are engaged into the locating holes on the actuator.
6. Fasten the rotation limiter to the actuator using the self-tapping screw provided.
7. Test the damper rotation by applying power. Re-adjust if necessary.

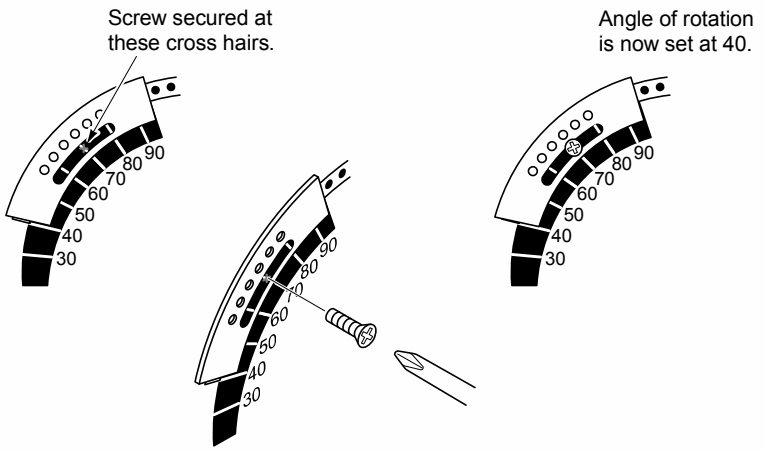


Figure-6 Securing the AM-689 Rotation Limiter.

CHECKOUT

After the entire system has been installed and the actuator has been powered up, the following check can be made for proper system operation. Check for correct operation of the damper while actuator is being stroked.

1. Apply power to the actuator. Actuator and damper should be driven to their powered position.
2. On the MA4X-7XXX-50X models, check for correct auxiliary switch operation.
3. Break power to the actuator. Actuator and damper should return to their normal, or spring return position.

Table-5 Power Wiring Color Code.

Part Number	L1	L2
MA4X-7XX3 MA4X-7XX3-502	Red	Black
MA4X-7XX0 MA4X-7XXX-502	Black	White
MA4X-7XX1 MA4X-7XXX-502	Brown	Light Blue

THEORY OF OPERATION

The actuators are mounted directly onto a damper shaft using a universal V-clamp. When power is applied, the actuator rotates 95° to its powered position, at the same time tensing the spring return safety mechanism. When power is removed, the spring returns the actuator to its normal position. The actuators provide true mechanical spring return operation for reliable, positive close-off on air tight dampers.

The MA4X-707X, MA4X-707X-502, MA4X-715X, and MA4X-715X-502 actuators are equipped with a graduated position indicator showing -5° to 90°. The MA40-704X and MA40-704X-501 are equipped with a graduated position indicator showing 0 to 1.

The MA40-704X-501 models are provided with 1 built in auxiliary switch. The SPDT switch is provided for interfacing or signaling, for example, fan start-up. The switching function is adjustable between 0° to 95° rotation (0 to 1 scale).

The MA4X-715X-502 and MA4X-707X-502 models are provided with 2 built in auxiliary switches. The SPDT switches are provided for interfacing or signaling, for example, fan start-up. The switching function is adjustable on one switch between 25° to 85° rotation and the other switch is fixed at 5°.

The MA41-707X-XXX and MA41-715X-XXX actuators are equipped with a manual override mechanism. This allows the actuator to be manually positioned at any point between -5o and 85o. This mechanism is accessible on both sides of the actuator and can be used to ensure tight close-offs for valves and dampers. The manual override should not be used while a unit is powered or on units that are mounted in tandem.

MAINTENANCE

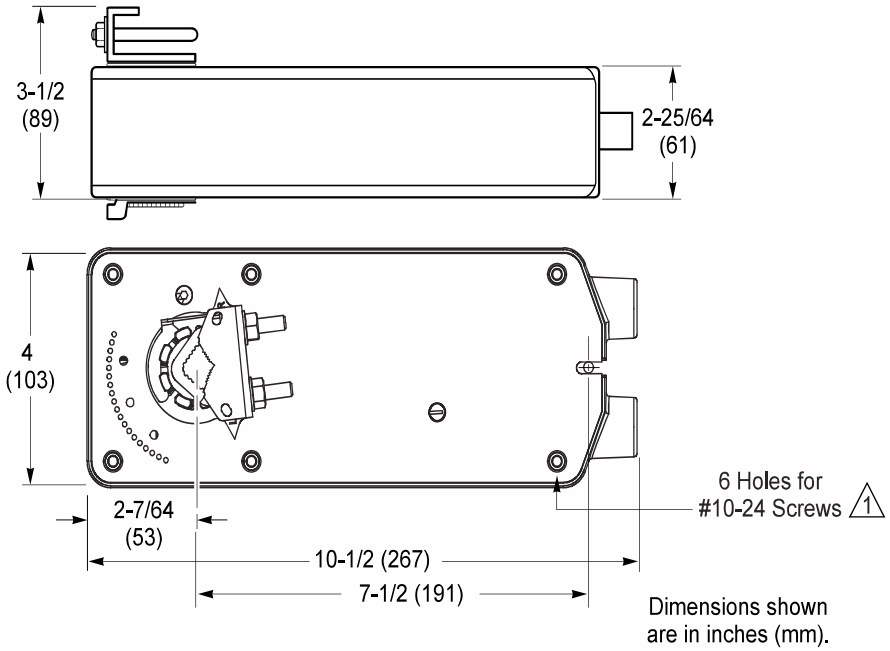
Regular maintenance of the total system is recommended to assure sustained optimum performance. The actuators are maintenance free.

FIELD REPAIR

None. Replace with a functional actuator.

DIMENSIONAL DATA

Figure-7 and Figure-8 dimensions are in inches (mm).



1 Note: These are not through holes. Use hardware supplied in TAC approved AM kits.

Figure-7 MA4X-707X or MA4X-715X Series Mounting Dimensions.

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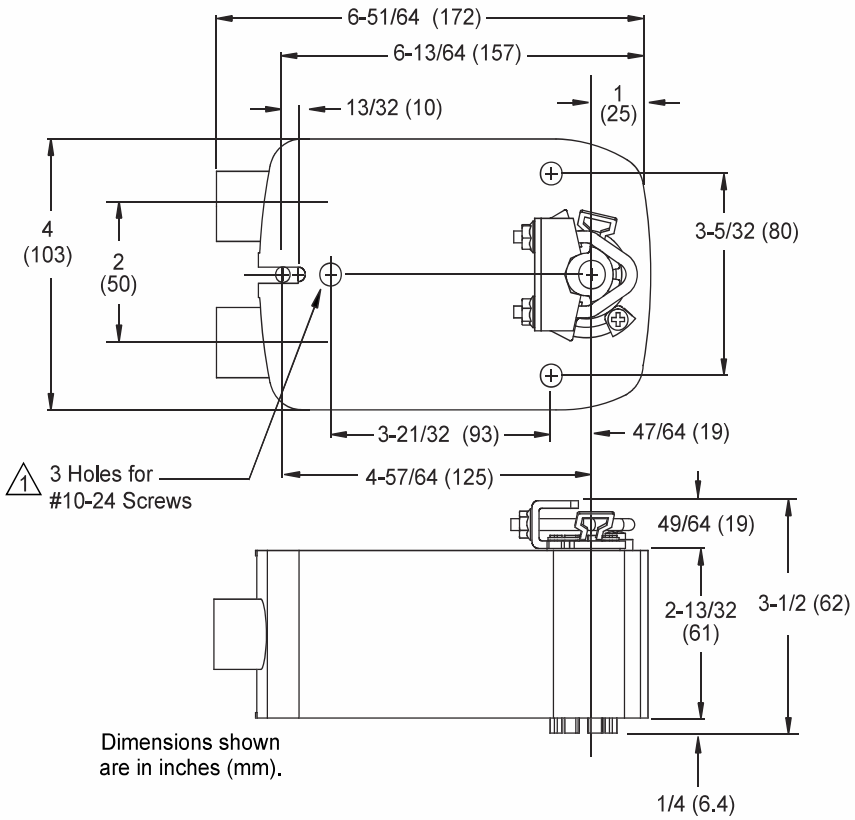


1 Note: These are not through holes. Use hardware supplied in TAC approved AM kits.

Figure-8 MA40-704X Series Mounting Dimensions.

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

F-26642-8

Schneider Electric
1354 Clifford Avenue
P.O. Box 2940
Loves Park, IL 61132-2940

www.schneider-electric.com/buildings

J

Valve & Actuator Sizing Schedule

Project:	NASA Infrared Telescope Project
System:	Schnieder Electric
Actuator Type:	Belimo
Date:	Tuesday, August 13, 2013

Mark	Qty	Pattern	(Scheduled) Flow Rate (GPM)	(Calculated) Cv	(Selected) Cv	(Calcualted) Press. Drop w/ Sched Flow	(Calculated) Head Pressure (FT)	(Selected) Press. Drop (PSI)	(Selected) Port Size	(Schedule) Line Size	Valve Part No.	Actuator Part No.	Control Signal	Direction of Rotation	Notes:
AHU-4	1	3-way	17.5	9.83	10	3.06	7.3	3.17	0.50		B338	AFRB24-SR	2-10 VDC	Normal	Proportional, Spring Return, Fail Open

*Added per RFI Response No. 20.

VBB/VBS Series Ball Valves with Proportional Actuators

Installation

Inspection

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

Requirements

Tools (not provided)

- Wrench 1 to 1-5/8”
- Pipe wrench according to pipe size
- Volt-ohm multimeter
- Philips Head screwdriver (for cover)

Training— Installer must be a qualified, experienced technician

Other accessories as appropriate

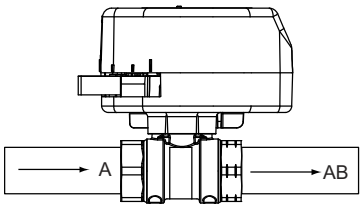
Warning	Electrical shock hazard! Disconnect power before installation to prevent electrical shock or equipment damage. Make all connections in accordance with the electrical wiring diagram and in accordance with national and local electrical codes. Use copper conductors only. All conductors shall be provided with insulation rated for the highest voltage motor and end switch circuits.
Caution	Avoid locations where excessive moisture, corrosive fumes, explosive vapors, or vibration are present. Avoid electrical noise interference. Do not install near large conductors, electrical machinery, or welding equipment. When making lead connections within the actuator, use caution not to put leads or connectors below the motor.

Piping

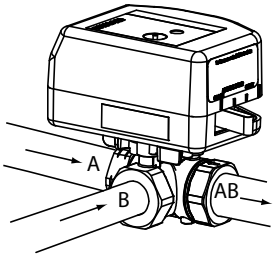
These valves must be piped according to the flow diagram below Two-Way valve flow should go A to AB. Three-Way valves should only be applied as mixing valves (see diagram).

Caution

Use in systems which have substantial make-up water (open systems) is not recommended. Follow proper water treatment practices and system procedures. Refer to document EN-205, F-26080.



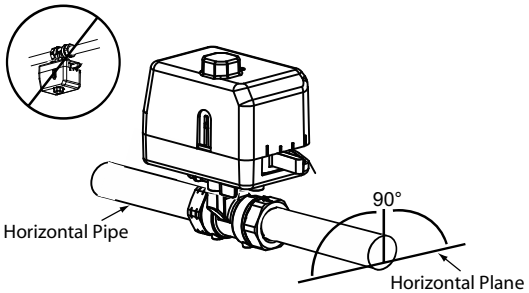
Two-Way Valve: Flow A to AB

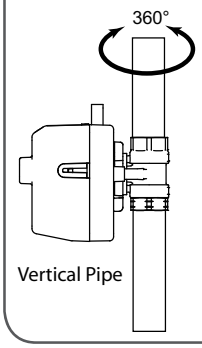


Three-Way Valve: Mixing Only A and/or B to AB.

Mounting

The valves can be mounted in horizontal or vertical piping. When installed in horizontal piping, the actuator must be above the valve body. It can be tilted left or right but it must not be tilted below 90° from vertical.

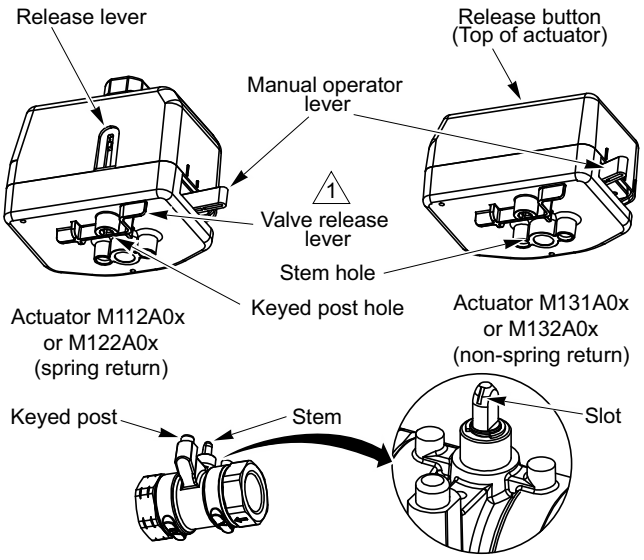




Installation Notes

- Make certain there is no overhead water source that may drip onto valve actuator.
- In normal service, some condensation may occur on or around the valve. A drip pan may be necessary or the valve body may be insulated.
- Do not cover the actuator or obstruct the manual operator lever.
- Reference product label and Product Datasheet F-27395 for additional product specifications.
- When using flexible conduit, the conduit should not place a load on the actuator.

Schneider Electric



1 Parts on bottom of both actuators are identical.

Installing the Valve Body

Apply Teflon* tape to the male pipe thread. Hand screw the pipe into the valve, turning it as far as it will go. Use a wrench to fully tighten the valve to the pipe. Do not over tighten or strip the threads.

Installing the Actuator on the Valve Body

1. Turn the valve stem so that the slot on the top of the stem is pointing towards the large keyed post.
2. Do one of the following.
   a.On the spring return actuator, press the red lever down and rotate the manual operating lever to align the stem hole with the valve stem. Then slide the red lever up to lock the manual lever in place.
   b. On the non-spring actuator, press and hold the red release button on the top of the actuator and rotate the manual operating lever to align the stem hole with the valve stem. Then release the red button.
3. Align the valve body with the actuator to ensure the stem lines up with the large stem hole and the large keyed post lines up with the post hole on the bottom of the actuator.
4. Press the valve and actuator together to firmly lock into place.
5. The first time the valve is operated electrically, the manual operating lever of the actuator will move to the automatic position. The manual operating lever can be used to allow flushing of the system after installation.

Removing the Actuator

1. Press and hold the valve release lever inward, towards the valve.
2. Lift the actuator from the valve.

Caution:

- Do not use the valve body to manually open the actuator as damage to the valve actuator will result.

* Teflon is a registered trademark of Dupont.

Checkout

1. Make sure the valve stem rotates freely before and after installing the actuator.
2. If the stem does not operate freely it may indicate that the stem was damaged and may require that the valve be replaced.
3. After the piping is under pressure, check the valve body and the connections for leaks.
4. After the valve and actuator are installed, power the actuator and check the operation by varying the control signal. On spring return models, the valve should return to its normal position when power is removed.

Theory of Operation

DuraDrive VBB/VBS Series are proportional valve actuator assemblies designed to make incremental adjustments to flow based on the control signal input. This actuator is not intended for continuous use in zero dead band control systems.

When power is removed for more than two seconds, spring return valves return to their normal position. Non-spring return valves remain at their last position when power is removed.

The control signal input and action is selected by means of the input signal jumper on the actuator circuit board. All actuators are shipped with the input signal jumper set for a 0 to 10 Vdc control signal and the control action jumper set for direct action (DA; valves opens with increasing control signal). Multiple actuators may be connected to a single controller. Do not exceed the maximum current draw of the controller or transformer. When using a 4 to 20 mAdc control signal, a separate isolation transformer must be used with each valve.

Proportional Actuators perform a self-calibration cycle on power-up. The actuator will run to the open direction for approximately 20 seconds and then closed direction for approximately 2 ½ min (60 Hz) or 3 ½ min (50Hz). Once this cycle is complete, the actuator will then accept and respond to the control signal.

Caution

Do not use the manual operator while power is applied to the actuator. Manual positioning of the actuator while power is applied is NOT recommended. If the actuator is manually positioned while power is applied, the calibration cycle will need to be completed again for the actuator to function properly. To recalibrate the actuator, cycle power off for more than 6 seconds.

Power/Failure Action

	Control Signal	Position upon loss of power		
		Non-Spring Return Actuator	Spring Return Open Actuator - Fail Open	Spring Return Closed Actuator - Fail Closed
Proportional	DA jumpered - increase in control signal will open A to AB	Maintain last position	Will spring A to AB open	Will spring A to AB closed
	RA jumpered - increase in control signal will close A to AB	Maintain last position	Will spring A to AB open	Will spring A to AB closed

* Two-Way valve operation described. For a Three-Way valve, A to AB operation is the same. B to AB operation is opposite that of A to AB operation.

Wiring

Make all connections according to job wiring diagrams and in compliance with local and national electrical codes. Refer to diagrams below for typical wiring.

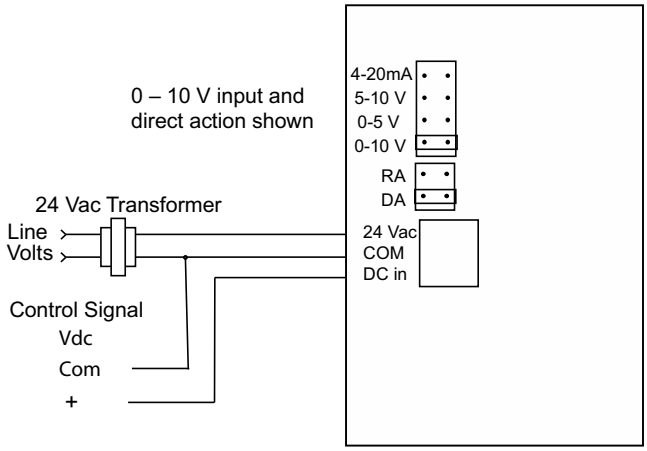
Notice

- Multiple actuators may be connected to a single controller. Do not exceed the maximum current draw of the controller.
- Use only one spring return actuator per 10 VA transformer.
- Use of a properly sized, inherently limited, Class 2 transformer is recommended.
- Use only 18 to 24 AWG copper wire for all connectors. When using multiple conductors under one terminal do not exceed 2 wires of 20 AWG.
- For 4 to 20 mAdc control, a separate isolation transformer must be used with each valve.

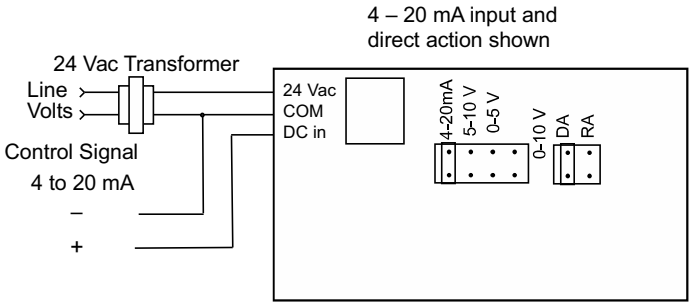
Control Signal and Action Selection

The control signal input is selected by means of the input signal jumper on the actuator circuit board. Control action is also selectable with the control action jumper. All actuators are shipped with the input signal jumper set for a 0 to 10 Vdc control signal and the control action jumper set for direct action (DA; valve opens with increasing control signal).

For more information see Guidelines for Powering Multiple Actuators EN-206 (F-26363).



Typical Wiring with M113A0x or M123A0x Spring Return Actuator



Typical Wiring with M133A0x Non-Spring Return Actuator

Maintenance

The ball valve assembly itself requires no maintenance. The stem and packing design eliminates the need for packing adjustment for the life of the valve. However, regular maintenance of the total heating and cooling system is recommended to ensure sustained optimum performance.

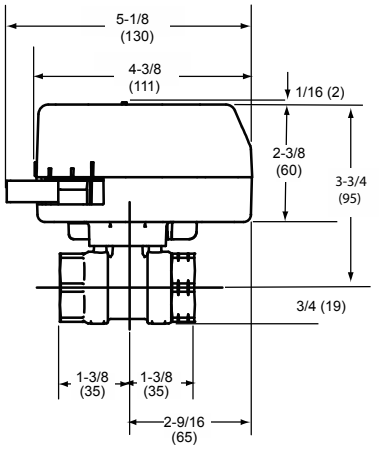
Field Repair

Neither valve nor actuator are field repairable. Replace entire unit as necessary.

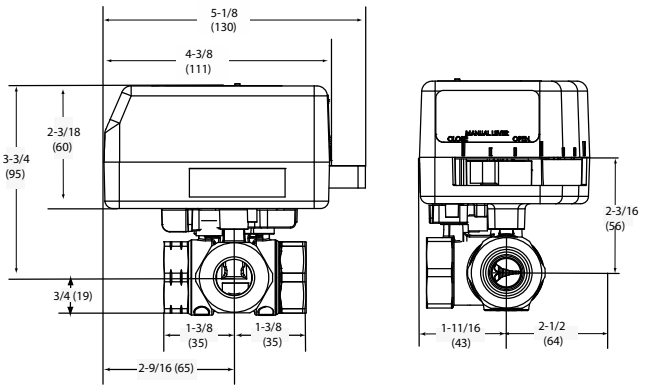
Agency Listings

UL873: Underwriters laboratories (File #E9429 Category Temperature Indicating and Regulating Equipment) CUL: Listed for use in Canada by Underwriters Laboratory. Canadian Standards C22.2 No. 24. European Community: EMC Directive (89/336/EEC). Low Voltage Directive (72/23/EEC). Australia: This product meets requirements to bear the C-Tick Mark according to the terms specified by the Communications Authority under the Radio Communications Act of 1992.

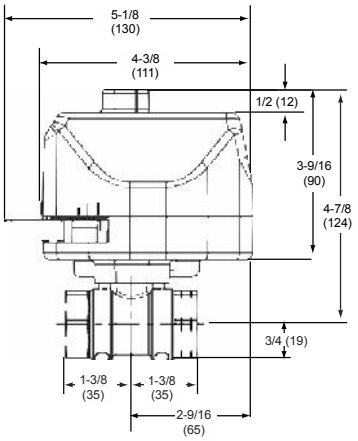
Dimensions



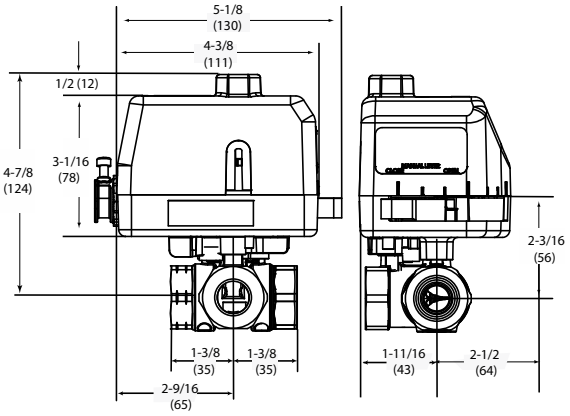
Two-Way Non-Spring Return
Shipping Weight: 2.07 lbs (940 g)



Three-Way Non-Spring Return
Shipping Weight: 2.34 lbs (1060 g)



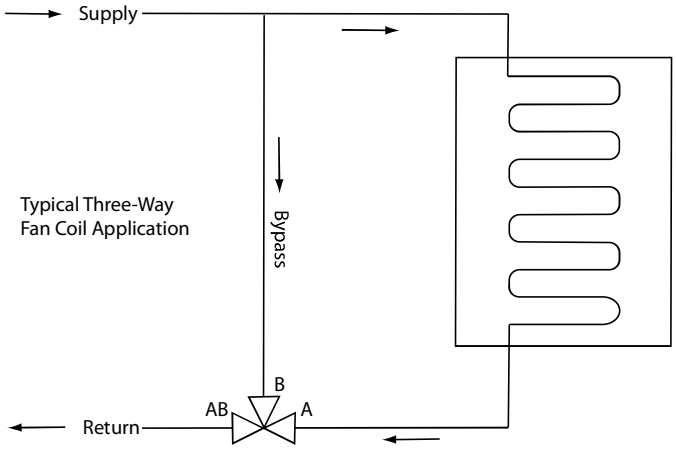
Two-Way Spring Return
Shipping Weight: 2.25 lbs (1020 g)

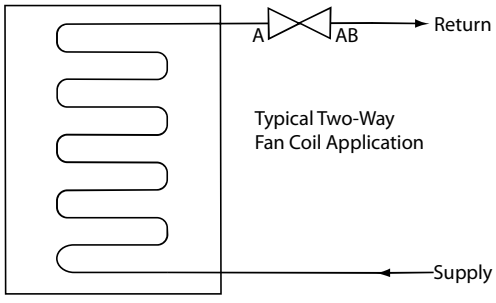


Three-Way Spring Return
Shipping Weight: 2.51 lbs (1140 g)

All dimensions shown in inches (mm) format and are rounded to the nearest 1/16".
An additional 1 in (25 mm) is required to remove the actuator from the valve.

Application Drawing





Note: Typical applications. For simplicity, balancing valves and control devices not shown.

K

Enclosed Victory Relays: 10A SPDT

Great For External Mount Applications


V100


V200D

DESCRIPTION

Victory 100 and 200 Series 10A enclosed relays are pilot-duty relays in an easy-to-use nipple mount enclosure. The V100/V200 Series provide quick relay mounting without a dedicated field enclosure, making them ideal for retrofit projects. Field-selectable high and low voltage coil inputs provide on-site versatility.

APPLICATIONS

- Command contactors
- Control motors
- Isolation
- Device interlocking
- Relay logic
- Sense voltages for alarm conditions

FEATURES

- Sleek field enclosure reduces the need for panel space
- The nipple mount feature allows the Victory Series to be mounted to any electrical enclosure
- Flexible tinned stranded wire...fits easily in tight spaces & provides secure connections to wire nuts
- UL508 Listed...designed and approved for field installation...makes electrical inspection a snap
- Run low voltage instead of line voltage...eliminate conduit in some applications

TYPICAL COIL PERFORMANCE

Pull in Voltage	AC	DC
10-30V	8	9
120V	78	
208-277V	154	
Drop Out Voltage	**AC**	**DC**
10-30V	2	3
120V	18	
208-277V	36	
Voltage	**Coil Current**	
	AC	**DC**
10V	25mA	14mA
12V	25mA	14mA
24V	31mA	16mA
30V	39mA	18mA
120V	22mA	-
208V	19mA	
277V	25mA	

CONTACT RATINGS

Resistive	10A@277VAC, 28VDC
Motor	120VAC, 1/3HP N.O. & 1/6HP N.C.
	240VAC, 1/3HP N.O. & 1/6HP N.C.
	277VAC, 1/4HP N.O. & 1/8HP N.C.
Pilot Duty	277VAC, (1.7A), 480VA N.O.
Ballast	277VAC, 1.7A
Tungsten	120VAC, TV3 N.O. TV2 N.C.
Gold Flash	Yes

SPECIFICATIONS

5 Year Warranty

Operating Temperature:

V100, V100DC, V200	-34° to 60°C (-29° to 140°F)
V100D, V200D	-40° to 55°C (-40° to 131°F)
Operating Humidity	10-90% RH non-condensing
Expected Relay Life	Electrical (@ rated current) 100,000 cycles; Mechanical (unpowered) 10,000,000 cycles
Relay Status	LED ON=energized

Wire Specifications:

Lead Length	14" (356 mm) min.
Gauge	UL1015; Coil: 18 AWG; Contacts: 16 AWG
Insulation Class	600VAC RMS

UL 508 enclosed device listing

800.354.8556 +1 503.598.4564 www.veris.com

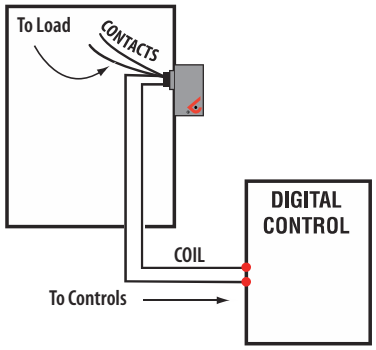
HQ0001833.A 01121

VERIS INDUSTRIES

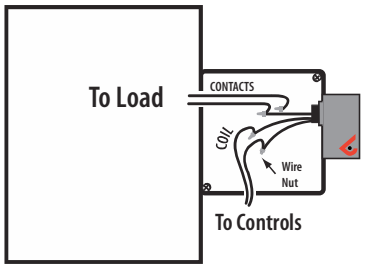
VERIS INDUSTRIES

APPLICATION/WIRING EXAMPLES

Nipple mount directly to a panel

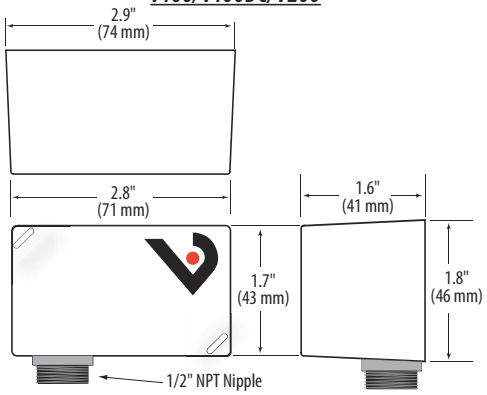


Nipple mount to any 2x or 4x electrical box

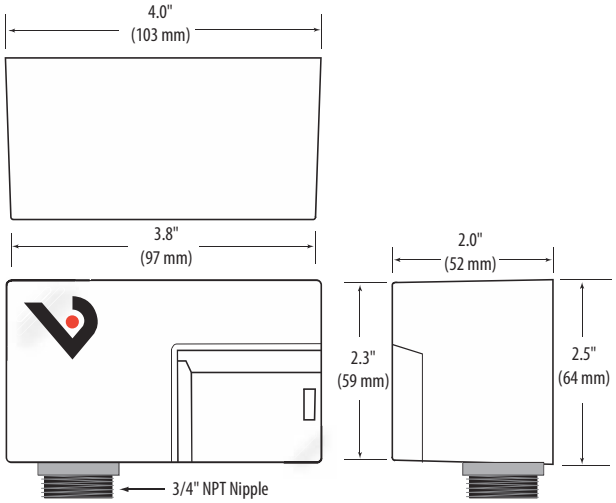


DIMENSIONAL DRAWINGS

V100/V100DC/V200

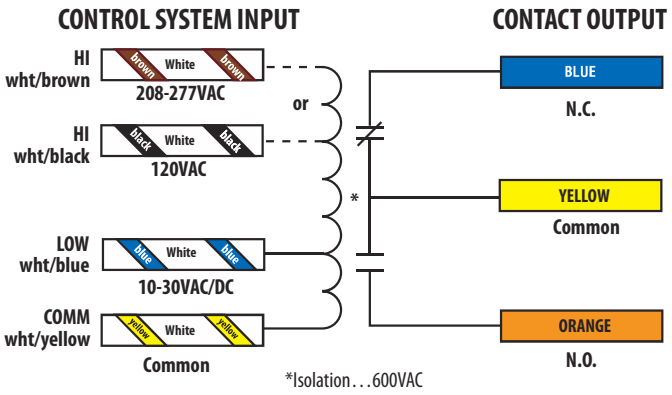


V100D/V200D

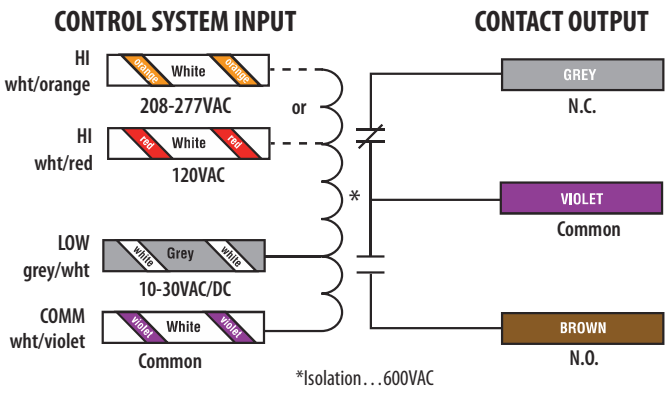


WIRE COLOR CODES

Primary



Relay 2 on V100D and V200D only



ORDERING INFORMATION

LISTED 3T60 UL 508 E150462

MODEL	RELAY	COIL	AMPERAGE RATING	RELAY POWER LED	UL
V100*	SPDT	10-30VAC/DC, 120VAC	10A	●	●
V100D	2x SPDT	10-30VAC/DC, 120VAC		●	●
V100DC	SPDT	10-30VDC		●	●
V200	SPDT	10-30VAC/DC, 208-277VAC		●	●
V200D	2x SPDT	10-30VAC/DC, 208-277VAC		●	●

Some devices are Plenum rated per UL 1995...see White Paper VWP01 at veris.com for details.
** Optional domestic version available.*

RELAYS

Socket DPDT Relays

Socket Relays In A Wide Range Of Coil Voltages

DESCRIPTION

Veris **VMD2B Series** are DPDT blade-style relays for socket/DIN mounting. Both the full-featured and standard DIN rail sockets are compatible with all VMD2B relays.

The **VMD2B-F** is the full-featured model in a slim housing. The LED, the flag indicator, and the test button allow for worry-free operation and easy troubleshooting with minimal downtime. Never wonder where the problem is!

TYPICAL COIL PERFORMANCE

	Power Consumption
AC Coils.....	1.2VA
DC Coils.....	0.9W

CONTACT RATINGS

Standard (F & C Series)

Resistive.....	10A@120VAC
	10A@277VAC
	10A@28VDC
Motor.....	1/4 HP@120VAC
	1/3 HP@240VAC
Pilot Duty.....	B300

Hybrid (S Series, Bifurcated)

	Low Side	High Side
Resistive.....	3A@120VAC	10A@120VAC
	3A@277VAC	8A@277VAC
	3A@30VDC	8A@28VDC
Motor.....	1/16 HP@120VAC	1/3 HP@120VAC
	–	1 HP@277VAC
Pilot Duty.....		B300

CSA

Resistive.....	10A@277VAC

FEATURES

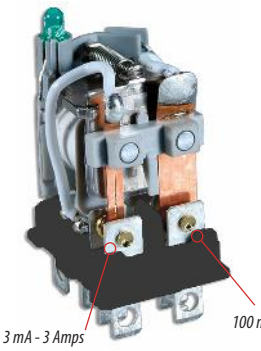
Full featured model:

- Color-coded push button...allows manual operation of relay. AC coils red or DC coils blue
- Removable override lever...when activated, locks push button and contacts in the powered position
- Flag indicator...shows contact status in manual or powered condition
- LED status lamp...shows coil "ON" or "OFF" status
- I.D. tag/write-on plastic label...used for identification of relays in multi-relay circuits
- 2-Way side or DIN rail mounting system...retrofits existing panel mounting and 35 mm DIN rail
- Mating hold-down clip...secures relay to socket (-F sockets)

Low level bifurcated model:

- All of the above full featured benefits
- Bifurcated contacts for high reliability at extremely low current levels
- Perfect for HVAC applications when you need to switch and hold low loads for long periods of time
- Hybrid relay, good for both logic switching and power switching

VMD2B-S has a hybrid design - great for installations where one pole is switching a dry circuit and the other pole is switching a motor starter!



Dual (bifurcated) contacts for optimum wiping & contact performance.

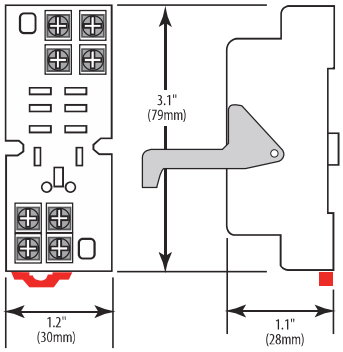
SPECIFICATIONS

5 Year Warranty

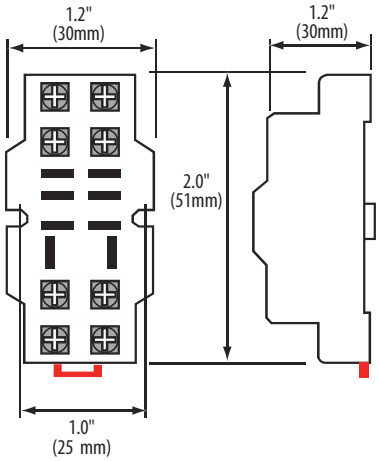
Operating Range	85% to 110% of rated voltage
Drop-out Voltage Threshold	15% of rated voltage
Expected Relay Life	Electrical (@ rated current) 100,000 cycles; Mechanical (unpowered) 10,000,000 cycles
Operating Time	20 msec typical
Dielectric Strength	1500VAC (RMS)
Operating Temperature	-40° to 55°C (-40° to 131°F)

DIMENSIONAL DRAWINGS

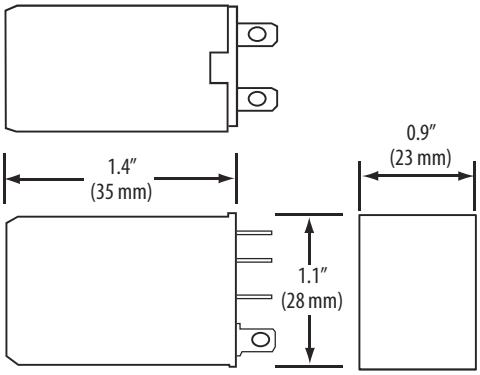
VBD2B-F Socket



VBD2B-C Socket



VMD2B Relays

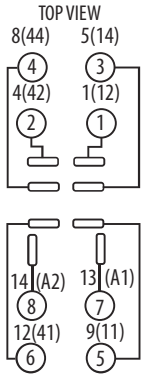


APPLICATION/WIRING EXAMPLE

VBD2B Sockets

Function	Terminal	NEMA (IEC)
Coil (+)**	8	14 (A2)
Coil (-)**	7	13 (A1)
COMM1	5	9 (11)
N.O.1	3	5 (14)
N.C.1	1	1 (12)
COMM2	6	12 (41)
NO.2	4	8 (44)
N.C.2	2	4 (42)

*** Observe polarity for relays with DC coil voltages only*



ORDERING INFORMATION

MODEL	RELAY TYPE	AMPERAGE RANGE	COIL VOLTAGE	MIN. SWITCHING CURRENT	FULL FEATURED	UL	CE
VMD2B-C12D	DPDT	15A	12VDC	100mA@5VDC		●	●
VMD2B-C24D		15A	24VDC	100mA@5VDC		●	●
VMD2B-C24A		15A	24VAC	100mA@5VDC		●	●
VMD2B-C120A		15A	120VAC	100mA@5VDC		●	●
VMD2B-F12D		15A	12VDC	100mA@5VDC	●	●	●
VMD2B-F24D		15A	24VDC	100mA@5VDC	●	●	●
VMD2B-F24A		15A	24VAC	100mA@5VDC	●	●	●
VMD2B-F120A		15A	120VAC	100mA@5VDC	●	●	●
VMD2B-F240A		15A	240VAC	100mA@5VDC	●	●	●
VMD2B-24SVAC		3A/10A	24VAC	3mA@17VDC/100mA@5VDC	●	●	●
VMD2B-120SVAC		3A/10A	120VAC	3mA@17VDC/100mA@5VDC	●	●	●

*These relays are **UL Listed**, when used with the Veris sockets.*

ACCESSORIES

DIN Rail, Stop Clip (AV01, AV02)

SOCKET ORDERING INFORMATION

MODEL	AMPERAGE RATING	VOLTAGE RATING	FINGER SAFE	HOLD DOWN CLIP	UL	CE
VBD2B-F	20 A	300 V	●	●	●	●

When relays and sockets are used together, amperage rating is the lesser of the two ratings.

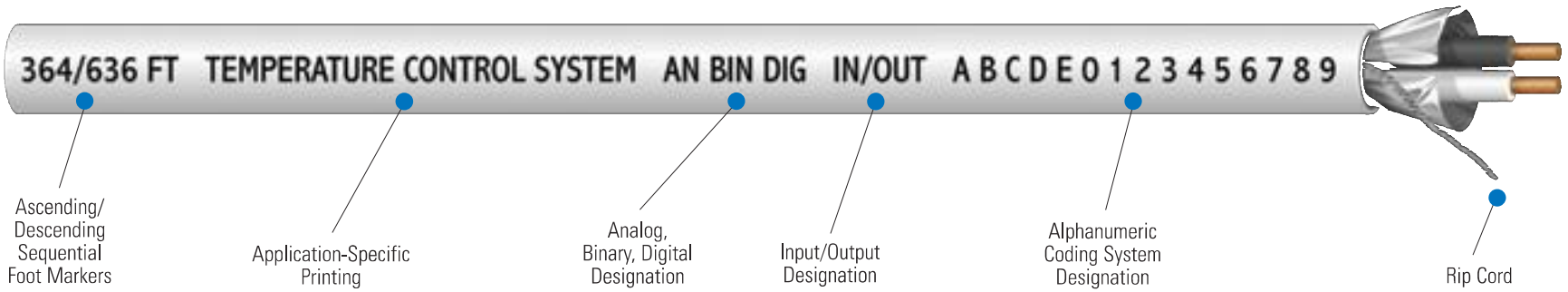
RELAYS

L

Temperature Control

SMART WIRE

WINDY CITY WIRE: SMARTWIRE TEMPERATURE CONTROL SYSTEM CABLE



WCW is proud to introduce our new and improved SmartWire Temperature Control System Cable

- This cable was designed and created for you, the temperature control contractor — to save you time and money.
- This is accomplished by utilizing our exclusive product SmartWire to replace or work in conjunction with your current labeling system or methods.
- Simply mark your application or identification points on our pre-configured jacket print legend with a permanent marker and pull your cable — it's that simple.
- Eliminate labels that fall off or that get tangled during cable pulls.
- Minimize or eliminate the testing, toning and ringing out that are needed to confirm or identify a non-labeled cable.
- Do away with the confusion and uncertainty that result when labels disappear or get destroyed after your cables have been roughed, but not yet terminated.
- If your job requires all cables to be labeled, it couldn't be easier to tag your point of termination or identification by pre-marking a WCW SmartWire cable.

SmartWire Temperature Control System Cable Features Include:

– Ascending and descending sequential foot markers not only let you see how much cable you pulled, but also how much cable remains in your box or on your reel.

– The Temperature Control System Cable application-specific printing allows you to distinguish your cable from other low-voltage cabling systems.

– The AN BIN DIG designation markers allow you to identify the Analog, Binary and Digital signals. Simply mark "AN" for Analog, "BIN" for binary and "DIG" for digital. Make your pull — and when the time comes to terminate, you have an identified application point at a fraction of the time it takes to apply or tag your cable with a label.

– The IN/OUT designation is used for inputs and outputs. Using this with the AN BIN DIG designation markers allows for tagging analog inputs, analog outputs, binary inputs, binary outputs, digital inputs and digital outputs.

– To maximize this cable's versatility, utilize our exclusive alphanumeric coding system. With an endless combination of possibilities, you can customize your own labeling scheme even in the largest of installations.

– A rip cord, the easiest way to strip your jacket and get to your conductors, is also included in most cables.

– Pre-mark your cable to identify zones, inputs and outputs, bus and communication lines. Designate thermostats, dampers, temperature sensors, or other applications or devices needed.

– And WCW SmartWire Temperature Control System Cable is available with different jacket colors and stripes. Using multiple jacket colors in conjunction with our pre-marked labeling scheme will give you the competitive edge that will eliminate confusion and aggravation, saving you time … and money.

If you use temperature control systems, then shouldn't SmartWire by Windy City Wire be your cable choice?

For more information regarding SmartWire or to order our product directly, contact one of our Sales Representatives toll free at 1-800-379-1191.

SmartWire — the wire that saves you time and money!

WINDY CITY WIRE

1-800-379-1191

WINDY CITY WIRE
CABLE & TECHNOLOGY PRODUCTS, LLC

386 Internationale Drive Suite H, Bolingbrook, Illinois 60440
Tel: (630) 633-4500 Toll Free: (800) 379-1191 Fax: (630) 296-8100

Temperature Control SmartWire™

P/N 042007 - Lo-Capacitance, 24 AWG, 1 Pair Shielded, 12.5 pF, Non-Plenum

Cable Specifications

Description:	1 Pair, 24 AWG Tinned Copper Shielded RS-232, RS-422 Low-Capacitance Communication, Instrumentation and Special Application Non-Plenum Cable
Conductor Description:	24 AWG (7/32) Tinned Copper
Insulation:	Foam PE; .017"
Color Code:	Black/White
Shield:	Aluminum Mylar
Drain Wire:	24 AWG Stranded Tinned Copper
Jacket:	PVC .015"
Marking:	TEMPERATURE CONTROL SYSTEM LOW CAP 12.5 PF ZONE BUS / COMM A B C D E 0 1 2 3 4 5 6 7 8 9 24AWG 2C SHLD (UL) CM C(UL)US 75 C ROHS
Overall Diameter:	.150" Nom.
Conductor DCR:	25.7 Ohms/Mft. Max.
Capacitance:	12.5 pF/ft. Nom.
Impedance:	100 Ohms Nom.
Velocity of Propagation:	78%
Temperature and Voltage Rating:	75 C / 300 Volts
Cable Weight:	11 Lbs/Mft.

Flame Rating:
N/A

Agencies Approvals:
UL Subject 444 and NEC Article 800 Type CM Communication Cable, C(UL), RoHS Compliant

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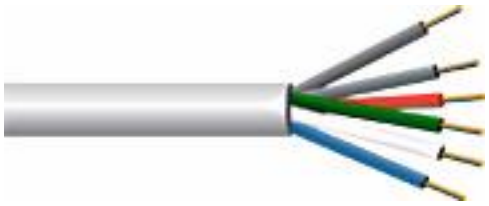
Temperature Control SmartWire™

UL Listed and Rated Type CMP
Multi-Conductor Non-Shielded Plenum Cable

P/N 004360 - 22 AWG 2 Conductor Non-Shielded Plenum

Cable Specifications	
Description:	22 AWG 2 Conductor Bare Copper, Non-Shielded Plenum, UL Subject 444, Type CMP, C(UL)
Conductor Description:	22 (7/30 Bare Copper)
Insulation:	Low-Smoke PVC .008"
Color Code:	Black/White
Jacket:	Low-Smoke PVC .018"
Marking:	TEMPERATURE CONTROL SYSTEM AN BIN DIG IN / OUT A B C D E 0 1 2 3 4 5 6 7 8 9 22 AWG UL C (UL) CMP ROHS MADE IN THE USA
Overall Diameter:	.126" Nom.
Conductor DCR:	N/A
Capacitance:	30 pF/ft.
Impedance:	N/A
Temperature and Voltage Rating:	75 C / 300 Volt
Cable Weight:	9 Lbs/Mft.



Flame Rating:
Approved For Plenum Use Without Conduit Per NEC Article 800, NFPA 262 Flame Test

Agencies Approvals:
NEC Article 800, 725; UL CMP, C(UL), RoHS Compliant, Made in the USA

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Temperature Control SmartWire™

UL Listed and Rated Type CMP
Multi-Conductor Non-Shielded Plenum Cable

P/N 004370 - 22 AWG 3 Conductor Non-Shielded Plenum

Cable Specifications	
Description:	22 AWG 3 Conductor Bare Copper, Non-Shielded Plenum, UL Subject 444, Type CMP, C(UL)
Conductor Description:	22 (7/30 Bare Copper)
Insulation:	Low-Smoke PVC .008"
Color Code:	Black/White/Red
Jacket:	Low-Smoke PVC .018"
Marking:	TEMPERATURE CONTROL SYSTEM AN BIN DIG IN / OUT A B C D E 0 1 2 3 4 5 6 7 8 9 22 AWG UL C (UL) CMP ROHS MADE IN THE USA
Overall Diameter:	.134" Nom.
Conductor DCR:	N/A
Capacitance:	N/A
Impedance:	N/A
Temperature and Voltage Rating:	75 C / 300 Volt
Cable Weight:	13 Lbs/Mft.

Flame Rating:
Approved For Plenum Use Without Conduit Per NEC Article 800, NFPA 262 Flame Test

Agencies Approvals:
NEC Article 800, 725; UL CMP, C(UL), RoHS Compliant, Made in the USA

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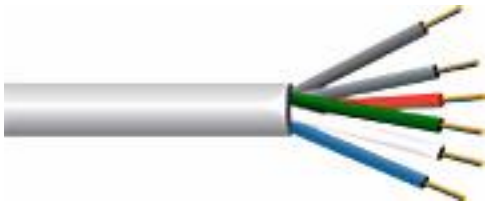
Temperature Control SmartWire™

UL Listed and Rated Type CMP
Multi-Conductor Non-Shielded Plenum Cable

P/N 004380 - 22 AWG 4 Conductor Non-Shielded Plenum

Cable Specifications

Description:	22 AWG 4 Conductor Bare Copper, Non-Shielded Plenum, UL Subject 444, Type CMP, C(UL)
Conductor Description:	22 (7/30 Bare Copper)
Insulation:	Low-Smoke PVC .008"
Color Code:	Black/White/Red/Green
Jacket:	Low-Smoke PVC .018"
Marking:	TEMPERATURE CONTROL SYSTEM AN BIN DIG IN / OUT A B C D E 0 1 2 3 4 5 6 7 8 9 22 AWG UL C (UL) CMP ROHS MADE IN THE USA
Overall Diameter:	.145" Nom.
Conductor DCR:	N/A
Capacitance:	N/A
Impedance:	N/A
Temperature and Voltage Rating:	75 C / 300 Volt
Cable Weight:	16 Lbs/Mft.



Flame Rating:
Approved For Plenum Use Without Conduit Per NEC Article 800, NFPA 262 Flame Test

Agencies Approvals:
NEC Article 800, 725; UL CMP, C(UL), RoHS Compliant, Made in the USA

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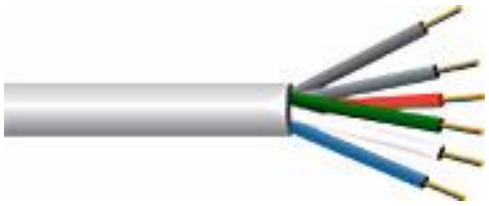
Temperature Control SmartWire™

UL Listed and Rated Type CMP
Multi-Conductor Non-Shielded Plenum Cable

P/N 004391 - 22 AWG 6 Conductor Non-Shielded Plenum

Cable Specifications	
Description:	22 AWG 6 Conductor Bare Copper, Non-Shielded Plenum, UL Subject 444, Type CMP, C(UL)
Conductor Description:	22 (7/30 Bare Copper)
Insulation:	Low-Smoke PVC .008"
Color Code:	Black/White/Red/Green/Brown/Blue
Jacket:	Low-Smoke PVC .018"
Marking:	TEMPERATURE CONTROL SYSTEM AN BIN DIG IN / OUT A B C D E 0 1 2 3 4 5 6 7 8 9 22 AWG UL C (UL) CMP ROHS MADE IN THE USA
Overall Diameter:	.163" Nom.
Conductor DCR:	N/A
Capacitance:	N/A
Impedance:	N/A
Temperature and Voltage Rating:	75 C / 300 Volt
Cable Weight:	23 Lbs/Mft.



Flame Rating:
Approved For Plenum Use Without Conduit Per NEC Article 800, NFPA 262 Flame Test

Agencies Approvals:
NEC Article 800, 725; UL CMP, C(UL), RoHS Compliant, Made in the USA

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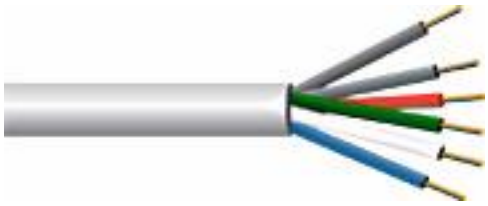
Temperature Control SmartWire™

UL Listed and Rated Type CMP
Multi-Conductor Non-Shielded Plenum Cable

P/N 002360 - 18 AWG 2 Conductor Non-Shielded Plenum

Cable Specifications

Description:	18 AWG 2 Conductor Bare Copper, Non-Shielded Plenum, UL Subject 444, Type CMP, C(UL)
Conductor Description:	18 (7/26 Bare Copper)
Insulation:	Low-Smoke PVC .008"
Color Code:	Black/White
Jacket:	Low-Smoke PVC .018"
Marking:	TEMPERATURE CONTROL SYSTEM AN BIN DIG IN / OUT A B C D E 0 1 2 3 4 5 6 7 8 9 18 AWG UL C (UL) CMP ROHS MADE IN THE USA
Overall Diameter:	.158" Nom.
Conductor DCR:	N/A
Capacitance:	N/A
Impedance:	N/A
Temperature and Voltage Rating:	75 C / 300 Volt
Cable Weight:	18 Lbs/Mft.



Flame Rating:
Approved For Plenum Use Without Conduit Per NEC Article 800, NFPA 262 Flame Test

Agencies Approvals:
NEC Article 800, 725; UL CL3P/CMP, (UL), RoHS Compliant, Made in the USA

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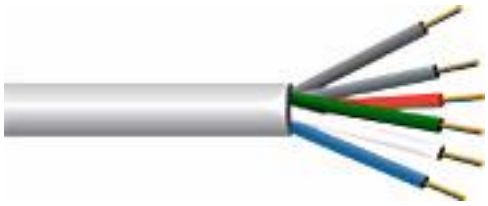
Temperature Control SmartWire™

UL Listed and Rated Type CMP
Multi-Conductor Non-Shielded Plenum Cable

P/N 002370 - 18 AWG 3 Conductor Non-Shielded Plenum

Cable Specifications

Description:	18 AWG 3 Conductor Bare Copper, Non-Shielded Plenum, UL Subject 444, Type CMP, C(UL)
Conductor Description:	18 (7/26 Bare Copper)
Insulation:	Low-Smoke PVC .008"
Color Code:	Black/White/Red
Jacket:	Low-Smoke PVC .018"
Marking:	TEMPERATURE CONTROL SYSTEM AN BIN DIG IN / OUT A B C D E 0 1 2 3 4 5 6 7 8 9 18 AWG UL C (UL) CMP ROHS MADE IN THE USA
Overall Diameter:	.168" Nom.
Conductor DCR:	N/A
Capacitance:	N/A
Impedance:	N/A
Temperature and Voltage Rating:	75 C / 300 Volt
Cable Weight:	23 Lbs/Mft.



Flame Rating:
Approved For Plenum Use Without Conduit Per NEC Article 800, NFPA 262 Flame Test

Agencies Approvals:
NEC Article 800, 725; UL CMP, C(UL), RoHs Compliant, Made in the USA

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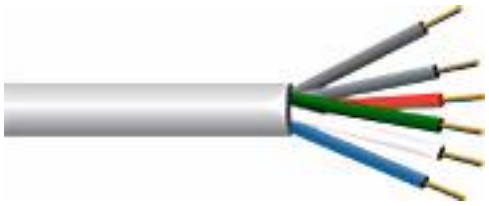
Temperature Control SmartWire™

UL Listed and Rated Type CMP
Multi-Conductor Non-Shielded Plenum Cable

P/N 002380 - 18 AWG 4 Conductor Non-Shielded Plenum

Cable Specifications	
Description:	18 AWG 4 Conductor Bare Copper, Non-Shielded Plenum, UL Subject 444, Type CMP, C(UL)
Conductor Description:	18 (7/26 Bare Copper)
Insulation:	Low-Smoke PVC .008"
Color Code:	Black/White/Red/Green
Jacket:	Low-Smoke PVC .018"
Marking:	TEMPERATURE CONTROL SYSTEM AN BIN DIG IN / OUT A B C D E 0 1 2 3 4 5 6 7 8 9 18 AWG UL C (UL) CMP ROHS MADE IN THE USA
Overall Diameter:	.184" Nom.
Conductor DCR:	N/A
Capacitance:	N/A
Impedance:	N/A
Temperature and Voltage Rating:	75 C / 300 Volt
Cable Weight:	32 Lbs/Mft.



Flame Rating:
Approved For Plenum Use Without Conduit Per NEC Article 800, NFPA 262 Flame Test

Agencies Approvals:
NEC Article 800, 725; UL CMP, C(UL), RoHS Compliant, Made in the USA

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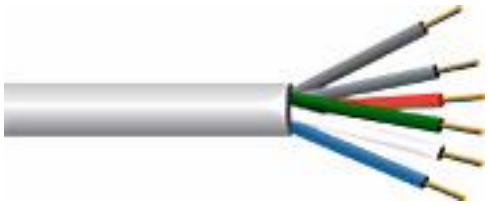
Temperature Control SmartWire™

UL Listed and Rated Type CMP
Multi-Conductor Non-Shielded Plenum Cable

P/N 002391 - 18 AWG 6 Conductor Non-Shielded Plenum

Cable Specifications

Description:	18 AWG 6 Conductor Bare Copper, Non-Shielded Plenum, UL Subject 444, Type CMP, C(UL)
Conductor Description:	18 (7/26 Bare Copper)
Insulation:	Low-Smoke PVC .008"
Color Code:	Black/White/Red/Green/Brown/Blue
Jacket:	Low-Smoke PVC .018"
Marking:	TEMPERATURE CONTROL SYSTEM AN BIN DIG IN / OUT A B C D E 0 1 2 3 4 5 6 7 8 9 18 AWG UL C (UL) CMP ROHS MADE IN THE USA
Overall Diameter:	.208" Nom.
Conductor DCR:	N/A
Capacitance:	N/A
Impedance:	N/A
Temperature and Voltage Rating:	75 C / 300 Volt
Cable Weight:	46 Lbs/Mft.



Flame Rating:
Approved For Plenum Use Without Conduit Per NEC Article 800, NFPA 262 Flame Test

Agencies Approvals:
NEC Article 800, 725; UL CMP, C(UL), RoHS Compliant, Made in the USA

M

Control Transformers

5 Year Warranty

X020AAA

1 Hub and Foot Mount

X050BAB

2 Hub and Foot Mount

X100CBE

Plate Mount

X375DAC

Foot Mount

X075CBA

1 Hub and Foot Mount with Separated Secondary Wires

Veris X Series Control Transformers are a convenient source of control power for HVAC control and building automation applications. A wide variety of UL-listed transformers are available with single and dual threaded hub mounting options. Multiple current limiting options are available, including a circuit breaker in some models. Save ordering time and purchase order costs when buying other Veris sensors by including transformers in your order.

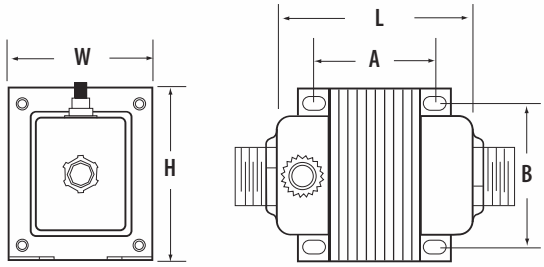
Versatile UL Listed transformers...simplify product selection and installation

- UL Listings for all models simplify panel building requirements
- Threaded hub options maximize installation flexibility
- One stop shopping...save time by ordering along with other Veris products

APPLICATIONS

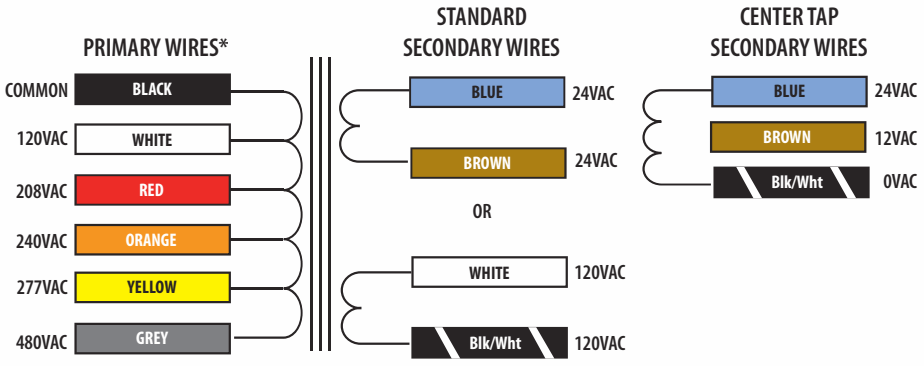
- Controller power
- Switching relays and other digital I/O circuits
- Powering sensors

DIMENSIONAL DRAWINGS



** See ordering table for dimensions.*

WIRE COLORS



**Primary of 24V isolation transformers= Red/Red*

SPECIFICATIONS

Frequency	50/60 Hz
Operating Temperature	-40° to 65°C (-40° to 149°F)
No Load Voltage	27 to 28VAC
Hub Style	Fits 1/2" electrical k.o.
Wire	UL 1015, 18 AWG*
Wire Length	8 inches

**X085AAA, X375DAC have 14AWG, Secondary wires*

ORDERING INFORMATION

CE cULus

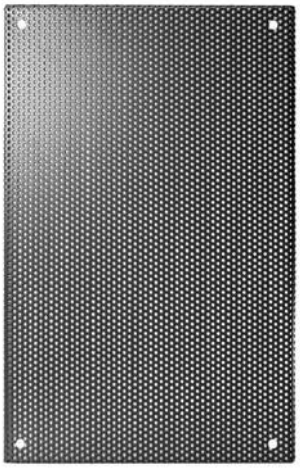
DIMENSIONS (inches)

MODEL	VA	PRIMARY VOLTAGE (VAC)	SECONDARY VOLTAGE (VAC)	CURRENT LIMITING METHOD	CLASS	MOUNTING	SEPARATED PRIMARY & SECONDARY WIRES	UL	CE	SPECIAL ORDER ONLY *	L	W	H	A	B
STANDARD															
X020AAA	20	120		Inherent	II, III	1HUB+FT		●	●		2.3	1.9	2.6	1.59	1.69
X020ACA		277		Inherent	II, III	1HUB+FT		●	●		2.3	1.9	2.6	1.59	1.69
X020ADA		24		Inherent	General	1HUB+FT		●	●		2.3	1.9	2.6	1.59	1.69
X020ADB		24		Inherent	General	2HUB+FT	●	●	●		2.3	1.9	2.6	1.59	1.69
X040AAA	40	120		Inherent	II, III	1HUB+FT		●	●		2.7	2.2	2.9	1.98	1.81
X040AAB		120		Inherent	II, III	2HUB+FT	●	●	●		2.7	2.2	2.9	1.98	1.81
X040ACA		277		Inherent	II, III	1HUB+FT		●	●	●	2.7	2.2	2.9	1.98	1.81
X040ADA		24		Inherent	II, III	1HUB+FT		●	●		2.7	2.2	2.9	1.98	1.81
X040AMB		120/208/240/277		Fuse	II, III	2HUB+FT	●	●	●	●	2.7	2.2	2.9	1.98	1.81
X040BNA		120/208/240	24	Fuse	II, III	1HUB+FT		●	●	●	2.7	2.2	2.9	1.98	1.81
X050BAA	50	120		Fuse	II, III	1HUB+FT		●	●		2.8	2.2	2.9	2.06	1.81
X050BAB		120		Fuse	II, III	2HUB+FT	●	●	●		2.8	2.2	2.9	2.06	1.81
X050BCA		277		Fuse	II, III	1HUB+FT		●	●		2.8	2.2	2.9	2.06	1.81
X050BCB		277		Fuse	II, III	2HUB+FT	●	●	●		2.8	2.2	2.9	2.06	1.81
X050BGB		208/240		Fuse	II, III	2HUB+FT	●	●	●	●	2.8	2.2	2.9	2.06	1.81
X050CAA		120		Circuit Breaker	II, III	1HUB+FT		●	●		3.5	2.5	3.1	1.91	2.03
X050CBA		120/240/277/480		Circuit Breaker	II, III	1HUB+FT		●	●		3.5	2.5	3.1	1.91	2.03
X050CBB		120/240/277/480		Circuit Breaker	II, III	2HUB+FT	●	●	●		3.5	2.5	3.1	1.91	2.03
X050CCA		277		Circuit Breaker	II, III	1HUB+FT		●	●	●	3.5	2.5	3.1	1.91	2.03
X050CEB		208/240/277/480	120	Circuit Breaker	General	2HUB+FT	●	●	●	●	3.5	2.5	3.1	1.91	2.03
X050CEG		208/240/277/480		Circuit Breaker	General	Plate, 90° Sec	●	●	●	●	3.5	4.0	4.0	3.38	3.38
X050CGG		208/240	24	Circuit Breaker	II, III	Plate, 90° Sec	●	●	●	●	4.0	4.0	4.0	3.38	3.38
X050CHA		120/208/240/480		Circuit Breaker	II, III	1HUB+FT		●	●	●	3.5	2.5	3.1	1.91	2.03
X050CHB		120/208/240/480		Circuit Breaker	II, III	2HUB+FT	●	●	●	●	3.5	2.5	3.1	1.91	2.03
X050CNA		120/208/240		Circuit Breaker	II, III	1HUB+FT		●	●	●	3.5	2.5	3.1	1.91	2.03
X050CNB		120/208/240		Circuit Breaker	II, III	2HUB+FT	●	●	●	●	3.5	2.5	3.1	1.91	2.03
X050COA		120/208/240/277/480		Circuit Breaker	II, III	1HUB+FT		●	●	●	3.5	2.5	3.1	1.91	2.03
X050DLB		220		None	II, III	2HUB+FT	●	●	●	●	2.8	2.2	2.9	2.06	1.81
X075CAA	75	120		Circuit Breaker	II, III	1HUB+FT		●	●		3.9	2.5	3.1	2.31	2.03
X075CAB		120		Circuit Breaker	II, III	2HUB+FT	●	●	●		3.9	2.5	3.1	2.31	2.03
X075CBA		120/208/240/480		Circuit Breaker	II, III	1HUB+FT	●	●	●		3.9	2.5	3.1	2.31	2.03
X075CCA		277		Circuit Breaker	II, III	1HUB+FT		●	●		3.9	2.5	3.1	2.31	2.03
X075CHA		120/208/240/480		Circuit Breaker	II, III	1HUB+FT		●	●	●	3.9	2.5	3.1	2.31	2.03
X085AAA	85	120		Inherent	General	1HUB+FT		●	●		3.2	3.8	3.2	2.2	3.14
X100CAA	99	120		Circuit Breaker	II, III	1HUB+FT		●	●		4.1	2.5	3.1	2.51	2.03
X100CAB		120		Circuit Breaker	II, III	2HUB+FT	●	●	●		4.1	2.5	3.1	2.51	2.03
X100CBA		120/240/277/480		Circuit Breaker	II, III	1HUB+FT		●	●		4.3	2.5	3.1	2.70	2.03
X100CBB		120/240/277/480		Circuit Breaker	II, III	2HUB+FT	●	●	●		4.3	2.5	3.1	2.70	2.03
X100CBE		120/208/277/480		Circuit Breaker	II, III	Plate		●	●	●	4.3	4.0	4.0	3.38	3.38
X100CHB		120/208/240/480		Circuit Breaker	II, III	2HUB+FT	●	●	●	●	4.3	2.5	3.1	2.70	2.03
X100CKB		480	120	Circuit Breaker	General	2HUB+FT	●	●	●	●	4.1	2.5	3.1	2.51	2.03
X100CLB		220	24	Circuit Breaker	II, III	2HUB+FT	●	●	●	●	4.1	2.5	3.1	2.51	2.03
X150CAA	150	120		Circuit Breaker	General	1HUB+FT		●	●		3.5	3.8	3.2	2.08	3.26
X175BAB	175	120		Fuse	General	2HUB+FT	●	●	●		4.1	3.8	3.2	3.19	3.14
X175BLB		220		Fuse	General	Foot	●	●	●	●	3.8	3.8	3.2	3.05	3.14
X175CAB		120		Circuit Breaker	General	2HUB+FT	●	●	●		4.1	3.8	3.2	3.19	3.14
X175CLB		220		Circuit Breaker	General	Foot	●	●	●	●	3.8	3.8	3.2	3.05	3.14
X175DGC		208/240		None	General	Foot	●	●	●		4.1	3.8	3.2	3.19	3.14
X240DAA	240	120		None	General	1HUB+FT	●	●	●		3.7	3.8	4.5	3.24	3.18
X375DAC	375	120		None	General	Foot	●	●	●		4.3	3.8	4.5	3.83	3.18
CENTER TAP															
X020APC	20	24	12/24	Inherent	II, III	Foot	●	●	●	●	2.3	1.9	2.6	1.59	1.69
X020AQC		120/208/240		Inherent	II, III	Foot	●	●	●	●	2.3	1.9	2.6	1.59	1.69
X040BPC	40	24		Fuse	II, III	Foot	●	●	●	●	2.7	2.2	2.9	1.98	1.81
X040BQC		120/208/240		Fuse	II, III	Foot	●	●	●	●	2.7	2.2	2.9	1.98	1.81
X050CIA	50	120		Circuit Breaker	II, III	1HUB+FT	●	●	●	●	2.8	2.2	2.9	2.06	1.81
X100CRC	100	120/240		Circuit Breaker	II, III	1HUB+FT	●	●	●	●	4.3	2.5	3.1	2.70	2.03

** Special orders are not kept in stock, and may require some additional lead time. Call the factory for more details.*

Recessed Cover Enclosures

Gray Powder Coated with Perforated Back Panel



Perforated Back Panel

RC

UL LISTED

Catalog #	UPC 761515	Size W"xH"xD"	STD CTN	WGT	List Price, $
13186RC**	39100	13x18x6	1	20	256.89
181810RC	39110	18x18x10	1	30	416.18
242410RC	39120	24x24x10	1	50	436.71
243610RC	39130	24x36x10	1	65	667.91
303610RC	39140	30x36x10	1	80	760.40
304810RC	39150	30x48x10	1	100	965.91

**Enclosure does not have recessed cover

Application

- Designed to enclose electrical and electronic controls, components and instruments which do not require a dust, oil or water tight environment
- Perforated back panel facilitates many applications and configurations

Specifications

- Cold rolled steel
- UL listed
- Continuous hinge
- Perforated back panel, 1/8" holes, 1/4" staggered centers
- Keyed cam action quad lock

Specials

- Custom sizes and modifications available
- Optional powder coat colors available
- Custom silk-screening

Prices subject to change without notice
Replaces all previous prices

P

Schneider Electric

EH Series

Humidity Sensors

Data Sheet

DESCRIPTION

The EH Series Room, Duct and Outside hunidity sensors are a universal Relative Humidity transmitter that can be powered with either a +15 to 36 Vdc or 24 Vac supply voltage. The EH series sensors are designed with a field selectable 4-20 mA, 0-5 VDC, or 0-10 Vdc output signal that is equivalent to 0 to 100% RH. The EH Series is used in building automation systens, humidity chambers, and OEM applications and is compatible with Vista, Continuum, I/Net and I/A Systens.

EH Series

FEATURES

- Single point Field Calibration
- Field selectable output signals
- ±2% Accuracies
- Low Drift
- Highly Repeatable
- Integral Temperature Sensor

SPECIFICATIONS

Supply Voltage	250 Ohm Load: +15 to 36 Vdc / 21.6-26.4 Vac 0-5VDC: +15-36 Vdc / 21.6-26.4 Vac 500 Ohm Load: +18 to 36 Vdc / 21.6-26.4 Vac 0-10VDC: +18-36 Vdc / 21.6-26.4 Vac
Power Consumption	1VA maximum
RH Measurement Range	0 to 100%
RH Output	2-wire, 4 to 20mA (Factory Standard) 3-wire, 0-5, 0-10 Vdc or 4 to 20mA
Accuracy at 77° F (25° C)	+/- 2% from 20 to 95%
Long-term Stability	Less than 2% drift / 5 years
Hysteresis	Less than 0.4% RH
Repeatability	0.5% RH
Sensitivity	0.1 % RH
Response Time	110 seconds for 63% Step
Storage Temperature Range	41 to 95°F (5°C to 35°C) < 75% RH
Operating Temperature Range	-10 to 122°F (-23.3 to 50°C)
Operating Humidity Range	0 to 95 % RH non-condensing
Saturation Response Time	10 minutes for 63% Step
Temperature Sensor output at 77° F (25° C)	1.8K ohm (Vista), 10K ohm Type II (I/Net), 10K ohm Type III (Continuum), 10K ohm with 11K ohm shunt (I/A)

Printed in the U.S.A 6-10

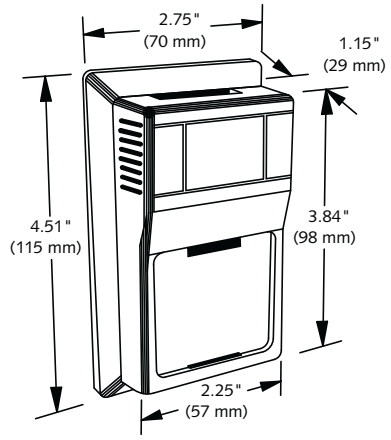
ORDERING INFORMATION

Description	Vista	I/Net	Continuum	I/A
Room-Humidity Only	EHR110			
Room-Humidity and Temperature	EHR110-100	EHR110-200	EHR110-500	EHR110-800
Duct-Humidity Only	EHD110			
Duct-Humidity and Temperature	EHD110-100	EHD110-200	EHD110-500	EHD110-800
Outdoor-Humidity Only	EHO110			
Outdoor-Humidity and Temperature	EHO110-100	EHO110-200	EHO110-500	EHO110-800

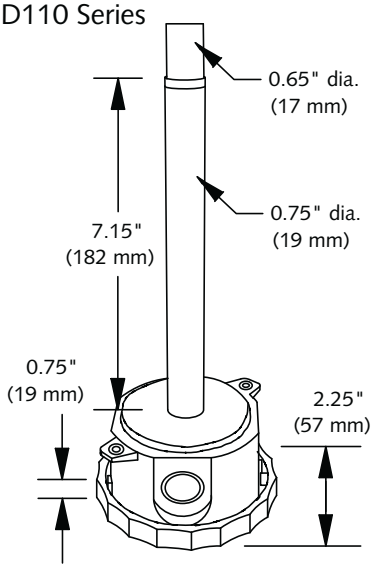
Miscellaneous Option	Code
LCD Display (Room Units Only. LCD displays humidity value.)	-LCD

DIMENSIONS

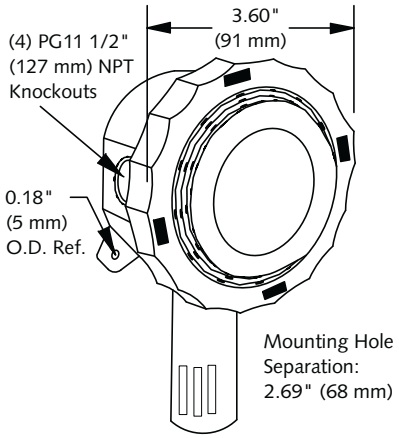
EHR110 Series



EHD110 Series



EHO110 Series



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

Schneider Electric
1354 Clifford Avenue
P.O. Box 2940
Loves Park, IL 61132-2940
www.schneider-electric.com/buildings

Q

AIR PRODUCTS AND CONTROLS

You in Control

SL-2000 SERIES

DUCT SMOKE DETECTORS

Hi-Temp, Low-Flow & No-Tools

PRODUCT APPLICATION

The SL-2000 Series Smoke Duct Detector is the latest innovation for early detection of smoke and products of combustion present in air moving through HVAC ducts in Commercial, Industrial, and Residential applications. The unit is designed to prevent the recirculation or spread of smoke by air handling systems, fans, and blowers. Complete systems may be shut down in the event of smoke detection. The SL-2000 is designed and built to meet all local code requirements, as well as the NFPA and ICC standards regarding HVAC supply and return duct smoke detectors. Output terminals are provided for a wide range of remote accessories such as horns, strobes, remote status indicators, and test/reset key switches or push buttons.

PRODUCT DESCRIPTION

The SL-2000 includes many features that represent true innovations from current generation duct smoke detectors. Our traditional installer/servicer-friendly approach has been closely followed and expanded throughout the SL-2000. This philosophy provides a new level of efficiency in after-purchase value to both the installer/servicer and end-user. Our attention to detail has yielded a host of "No-Tools Required" features, as well as a multi-application performance level as yet unmatched in the industry. The key features below detail many of the customer-driven innovations incorporated in the SL-2000 Series. Innovative product combined with unsurpassed customer service equals the right combination for all of your projects.

c UL us LISTED

CSFM LISTED

MEA ACCEPTED

FEATURES

- Low-Flow Technology: Both Ionization and Photoelectric models listed for velocities between 100-4000 ft./min
- Both models listed for high-temperature applications
- Operating voltages: 230VAC, 115VAC, 24VAC, 24VDC
- Interconnect up to 30 units for common functions
- Patent pending "No-Tools Required" front or rear loading and removing sampling/exhaust tubes
- Patent pending "Test Port Valve" allows for aerosol smoke testing without cover removal
- Clear cover fitted with four captive "No-Tools Required" thumbscrews
- Instantaneous cover removal trouble indication
- Staggered terminal blocks for easier wiring
- Flashing LED on detector head indicates normal operation
- Magnet test capability (magnet included)
- More wiring space than competitive models
- Footprint allows easy retrofit in many applications without additional drilling
- Over 15 remote accessories available
- Duct wall gaskets on back of enclosure are pre-installed
- Compatible with the WP-2000 weatherproof enclosure
- Reset switch is also an alarm test switch - competitive models require a magnet or cover removal to test at unit
- Unit includes green pilot and red alarm visual indicators
- External mounting tabs do not require cover removal to install
- Colored cover gasket indicates proper cover seal
- UL, CUL, CSFM, and MEA Listed
- Compact, lightweight size means easy handling, lower shipping costs
- Two sets of 10A form "C" alarm contacts
- One set of 2A form "A" alarm contacts
- One set of 10A form "C" trouble contacts
- Large terminal connection screws
- Standard interchangeable "plug-in" UL268 photoelectric or ionization heads
- Advanced detector head design yields internal dust filtering
- No additional screens or filters to clean
- Compatible with building automation and fire alarm systems
- Ionization and Photoelectric versions available
- Complete wiring details permanently attached to unit

Air Products and Controls Inc.
1749 E. Highwood
Pontiac, MI 48340
(248) 332-3900 Phone
(888) 332-2241 Toll free
(248) 332-8807 Fax
www.ap-c.com

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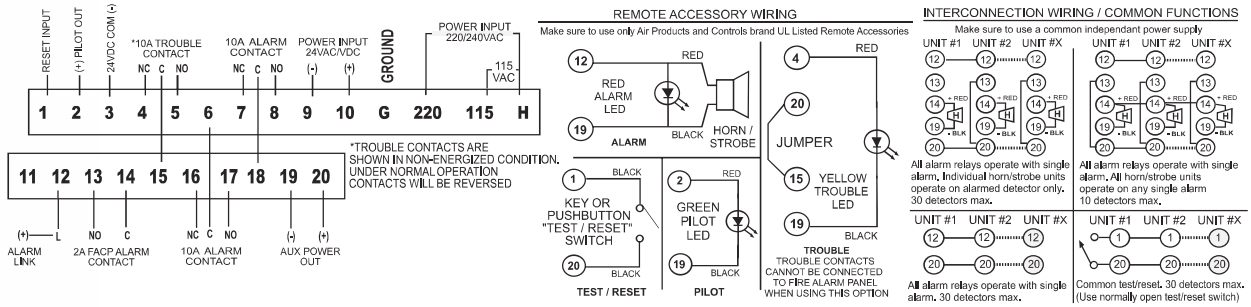
WIRING



PRODUCT SPECIFICATIONS

MODEL NUMBER:	**SL-2000-N**	Ionization: 230VAC, 115VAC, 24VAC, 24VDC
	SL-2000-P	Photoelectric: 230VAC, 115VAC, 24VAC, 24VDC
DETECTOR MODEL NUMBER:	**SL-2000-N**	55000-225APO
	SL-2000-P	55000-328APO
SAMPLING TUBES:	**STN-1.0**	Sampling tube for 12" or less duct width
	STN-2.5	Sampling tube for 6" to 2.5' duct width
	STN-5.0	Sampling tube for 2.5' to 5.0' duct width
	STN-10.0	Sampling tube for 5.0' to 10.0' duct width
ACCESSORIES:	MS-Series remote accessories, WP-2000 weatherproof enclosure, TG-2000 aerosol test gas, and T-PB power supplies (All available from Air Products and Controls Inc.)	
POWER REQUIREMENTS: (without accessories)	230VAC	7.9 mA
Standby:	115VAC	13.8 mA
	24VAC	39.4 mA
	24VDC	13.5 mA
Alarm:	230VAC	16.0 mA
	115VAC	27.0 mA
	24VAC	59.3 mA
	24VDC	128.7 mA
RELAY CONTACT RATING:		
Alarm Contacts:	Resistive load: 2 sets form "C" rated at 10 Amps @ 115VAC Resistive load: 1 set form "A" rated at 2 Amps	
Trouble Contacts:	Resistive load: 1 set form "C" rated at 10 Amps @ 115VAC	
AIR VELOCITY:	100 to 4,000 ft./min.	
AMBIENT TEMPERATURE:	**SL-2000-N**	32ºF to 158ºF (0ºC to 70ºC)
	SL-2000-P	32ºF to 140ºF (0ºC to 60ºC)
HUMIDITY:	85 ±5 % RH (@32 ±2°C; 86 ±3.6°F) Non-Condensing / Non-Freezing	
WIRING:	Solid or stranded: #12 to #22 AWG terminals	
APPROVALS:	UL & CUL Listed (UL268A, UROX, UROX7) File # S2829 CSFM Listed (3240-1004:105) MEA Accepted (73-92-E; VOL. 27)	
MATERIAL:	Grey plastic backbox, clear plastic cover (Makrolon 94V-0)	
DIMENSIONS:	13 1/2" L x 4 1/2" W x 2 1/4" H	
MAX. NET WT.:	2 1/2 lbs.	
RADIOACTIVE ELEMENT:	For **SL-2000-N** (Ionization) Americium 241; 0.9 Micro-Curie Do not expose to corrosive atmospheres	
HARDWARE:	7" exhaust tube, sampling tube end cap, mounting template, test magnet, and mounting hardware included	

ENGINEERS & ARCHITECTS SPECIFICATIONS

- Air duct smoke detectors shall be Air Products and Controls Inc. SL-2000 Series. For ionization detectors the model number is **SL-2000-N**.
- For photoelectric detectors the model number is **SL-2000-P**. The detectors shall be listed by Underwriters Laboratories per UL 268A.
- The detectors shall operate at air velocities from 100 feet per minute to 4,000 feet per minute and at temperatures of no greater than 140°F (60°C).
- Visual indication of alarm and power must be provided on the detector front.
- A manual reset switch shall be located on front of the device.
- Detector head shall not require additional filters or screens which must be maintained, and shall include both a standby and alarm visual indication.
- The housing shall contain a detector base which will accept photoelectric or ionization detector heads.
- Terminal connections shall be of the screw type, a minimum of #6 screw (#12 to #22 AWG compatible). Terminals shall be provided for remote pilot, remote alarm indications, strobe/horn, and remote test/reset switch. All wiring must comply with local codes and regulations.
- A method of testing the alarm function with a magnet must be provided.
- A method of smoke testing the detector without removing the cover must be provided.
- All unit, remote accessory, and common function connection designations must be permanently affixed to the unit.
- Cover and sampling/exhaust tube installation or removal must not require the use of tools.
- Capability for interconnection of up to 30 units shall be provided for common functions.
- Sample and exhaust tubes shall be capable of removal/installation from the front and/or rear of the detector for inspection/maintenance.

R

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The Stack-On All Steel 2 Door Wall Cabinet includes two adjustable steel shelves that can be adjusted in 2" increments. It comes with fastening hardware, and pre-drilled holes are provided in the back of the cabinet to allow for easier mounting. The wall storage cabinet allows for hanging storage with its steel pegboard side panels. It is also a fully lockable unit that comes with a 2-point locking bar, as well as a cylinder lock that is key-coded for additional security.

Stack-On All Steel 2 Door Wall Center:

- Pre-drilled holes in the back of cabinet allow for easy wall-mounting
- Fastening hardware is included with the steel wall cabinet
- Steel, pegboard side panels allow for hanging storage
- Fully lockable with 2-point locking bar and key-coded cylinder lock for added security

Tqf djgjdbujpot

Battery Type:	Does Not Contain a Battery
Multi Pack Indicator:	No
Model No.:	SGO-1250
Shipping Weight (in pounds):	37.0
Product in Inches (L x W x H):	15.5 x 29.63 x 33.25

S

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Unleash workforce productivity with performance features that fit specific needs. Users can power through their day with the latest Intel® Core™ i processors, high-speed memory options, and Intel HD graphics.

Users can connect and communicate with colleagues around the world with wireless connectivity options, front microphone and headset mini-jacks for voice-over-IP, and Microsoft Unified Communications support for optimal video conferencing.

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Confidently safeguard data with Dell Data Protection tpgux bsf -!Usvtuf e!Qmbugpsn !N pevmf!)UQN *[3]-!f odszqu f e! i bse!esjwf !pqujpot-!boe!pqujpobm!cjpn f usjd!bvui f oujdbujpo! qf sjqi f sbmt/!Qi ztjdbm!mpdl !tmpu!boe!mpdl bcmf!qpsu!dpwf s!boe! ef tl !n pvou!gvsui f s!i f mq!qspuf du!zpvs!tztuf n /

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Finally, rely on Dell Services to configure, deploy, manage, and support your OptiPlex desktops for their entire lifecycle, including reselling or recycling when they reach end of life.

Jouf hsbuf e!Tpmvujpot

Dell offers tailored solutions for cost effective security, n bobhf n f ou-!boe!f oe.vtf s!qspevdujwjuz/

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Dell Desktop Virtualization Solutions provide a datacenter infrastructure to improve data security, streamline management, and speed time to value with purpose-built hardware, software and services for client virtualization. Dell's services and flexible delivery models help define and implement the right solution for your needs.

Dell systems management solutions help you centralize management, automate processes, and reduce support costs. Each client system comes with a complete set of utilities to enable industry-leading consoles, like Microsoft System Center tools, to better deploy, configure, manage, and update those devices. Dell also offers KACE[1] appliances to help seamlessly manage endpoints or Dell Services to help define and implement the right client management solution for your unique needs.

Dell Cloud Solutions help you offload select IT workloads and adopt an on-demand, pay-as-you-go model that scales with your organization. Automate manual or resource intensive tasks such as email management and crisis management and alerting.

Feature	Technical Specification
Processors[1, 12]	Intel® 3rd generation Core™ i7/i5 Quad Core, i3 Dual Core (Post launch) and Pentium® Dual Core (Post launch); Intel® 2nd generation Core™ i3 Dual Core, Pentium® Dual Core and Celeron® Dual/Single Core; Intel vPro™ Technology available on select processors
Chipset	Intel® Q77 Express Chipset
Operating System Options[1]	Microsoft® Windows 7® Home Basic (32/ 64 bit) (select countries), Microsoft® Windows 7® Home Premium (32/64 bit), Microsoft® Windows 7® Professional (32/64 bit), Microsoft® Windows 7® Ultimate (32/64 bit) Ubuntu® Linux (select countries)
Graphics Options[4, 12]	Integrated Intel® HD Graphics 2500/4000 (3rd generation Core i3/i5/i7 CPUs); Integrated Intel® HD Graphics 2000/3000 (2nd generation Core i3 CPUs); Integrated Intel® HD Graphics (Celeron®/Pentium® Dual Core CPU);Optional discrete 1GB AMD RADEON HD 7570; Optional discrete 1GB AMD RADEON HD 7470
Memory[5]	Up to 4 DIMM slots (2 for USFF); Non-ECC dual-channel 1600MHz DDR3 SDRAM, up to 16GB
Networking	Integrated Intel® 82579LM Ethernet LAN 10/100/1000; optional Broadcom® NetXtreme® 10/100/1000 PCIe card; optional Dell Wireless 1530 PCIe (MT/DT/SFF) WLAN card (802.11n); optional Dell Wireless 1530 half-mini PCIe (USFF) WLAN card (802.11n)
I/O Ports[12]	4 External USB 3.0 ports (2 front, 2 rear) and 6 External USB 2.0 ports (2 front, 4 rear, except USFF – 4 rear only) and 2 Internal USB 2.0 (MT/DT only); 1 RJ-45; 1 Serial; 1 VGA; 2 DisplayPort; 2 PS/2 (MT/DT/SFF only); 2 Line-in (stereo/microphone), 2 Line-out (headphone/speaker), optional Parallel/Serial port support (MT/DT/SFF only), optional 1394a PCI card (MT/DT only)
Removable Media Options	DVD+/-RW; DVD-ROM; Dell 19 in 1 Media Card Reader (MT & DT only)
Hard Drives[6] Options	3.5″ Hard Drives: up to 1TB 7200 RPM SATA; 2.5″ Hard Drives: up to 500GB 7200 RPM SATA; 500GB Hybrid; 320GB 7200 RPM Opal SED, 128GB Solid State Drive; Supports Dell's Flexible Computing Solution diskless option

Chassis		Minitower (MT)	Desktop (DT)	Small Form Factor (SFF)	Ultra Small Form Factor (USFF)
	Dimensions (H x W x D) Inches/(cm)	14.2 x 6.9 x 16.4 / (36.0 x 17.5 x 41.7)	14.2 x 4.0 x 16.1 / (36.0 x 10.2 x 41.0)	11.4 x 3.7 x 12.3 / (29.0 x 9.3 x 31.2)	9.3 x 2.6 x 9.4 / (23.7 x 6.5 x 24.0)
	Min. Weight (lbs/kg)	20.68 / 9.4	17.38 / 7.9	13.2 /6.0	7.26 / 3.3
	Number of Bays	2 internal 3.5″ 2 external 5.25″	1 internal 3.5″ 1 external 5.25″	1 internal 3.5″ 1 external 5.25″ (slimline)	1 internal 2.5″ 1 external 5.25″ (slimline)
	Expansion Slots	1 full height PCIe x16 1 full height PCIe x16 (wired x 4) 1 full height PCIe x1 1 full height PCI	1 half height PCIe x16 1 half height PCIe x16 (wired x 4) 1 half height PCIe x1 1 half height PCI	1 half height PCIe x16 1 half height PCIe x16 (wired x 4)	1 miniPCIe connector
	Power Supply[7] Unit (PSU)	Standard 275W PSU Active PFC or optional 275W up to 90% Efficient PSU (80 PLUS Gold); ENERGY STAR 5.2 compliant, Active PFC	Standard 250W PSU Active PFC or optional 250W up to 90% Efficient PSU (80 PLUS Gold); ENERGY STAR 5.2 compliant, Active PFC	Standard 240W PSU Active PFC or optional 240W up to 90% Efficient PSU (80 PLUS Gold); ENERGY STAR 5.2 compliant, Active PFC	200W up to 90% Efficient PSU (80 PLUS Gold); ENERGY STAR 5.2 compliant, Active PFC

Feature	Technical Specification
Peripherals Options[1]	Monitors[1]: Dell Entry Standard and Widescreen Flat Panel Analog: Dell E170S, E190S, E1911, E1912H, E2011H, E2210, E2211H, E2311H Dell Professional Digital Standard and Widescreen Flat Panel: Dell P170S, P190S, P1911, P2012H, P2210, P2212H, P2312H, P2412H, P2712H Dell UltraSharp Digital Standard and Widescreen Flat Panel, Adjustable Stand: Dell 2007FP, U2212HM, U2312HM, U2410, U2412M, U2711, U3011
	Keyboards: Dell USB Entry Keyboard, Dell Multimedia Pro Keyboard, Dell Smartcard Keyboard
	Mouse: Dell USB Optical Mouse, Dell Laser Mouse
	Audio Speakers: Internal Dell Business audio speaker, Dell AX210 2.0 Desktop Speakers; Dell AX510 and AX510PA Sound Bar
Security Options[1]	Trusted Platform Module[2] (TPM) 1.2, Dell Data Protection Access, Dell Data Protection Encryption, Chassis lock slot support, Chassis Intrusion Switch, Setup/BIOS Password, I/O Interface Security, optional Smart Card keyboard, Intel® Trusted Execution Technology, Intel® Identity Protection Technology, Intel® Anti-Theft Technology, Dell Secure Works, BIOS support for optional Computrace[8]
Systems Management Options[9]	Intel® vPro Technology (iAMT 8.0)) including Dell unique vPro extensions; Intel® Standard Manageability; No Out of Band Systems Management
Environmental & Regulatory Standards	Environmental Standards (eco-labels): ENERGY STAR 5.2, EPEAT Registered[13], CECP, WEEE, Japan Energy Law, South Korea E-standby, South Korea Eco-label (for DT/SFF/USFF only), EU RoHS, China RoHS Other Environmental Options: Carbon Off-set; Asset Resale and Recovery Service
Warranty ans Service	Limited Hardware Warranty[10]; Standard 3-year Next Business Day On Site Service after Remote Diagnosis[11] (3-3-3); Optional 3-year Dell ProSupport™; 4 year and 5 year service and support options[3]
Configuration Services	Factory Image load. BIOS Customization. Hardware Customization, Asset Tagging and Reporting.

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1. Offering may vary by region.
3/!UQN;!UQN!jt!opu!bwbjmbcmf!jo!bmm!sfhjpot/
4/!Bwbjmbcjmjuz!boe!ufsnt!pg!Efmm!Tfswjdft!wbsz!cz!sfhjpo/!Gps!npsf!jogpsnbujpo-!wjtju!xxx/efmm/dpn0tfswjdfeftdsjqujpot/
4. System Memory and Graphics: Significant system memory may be used to support graphics, depending on system memory size and other factors.
6/!5HC!ps!Hsfbufs!Tztufn!Nfnpsz!Dbqbcjmjuz;!B!75.cju!pqfsbujoh!tztufn!jt!sfrvjsfe!up!tvqqpsu!5HC!ps!npsf!pg!tztufn!nfnpsz/
7/!Ibse!Esjwf;!HC!nfbot!2!cjmmjpo!czuft!boe!UC!frvbmt!2!usjmmjpo!czuft<!bduvbm!dbqbdjuz!wbsjft!xjui!qsfmpbefe!nbufsjbm!boe!pqfsbujoh!fowjsponfou!boe!xjmm!cf!mftt/
8/!PSU: This form factor utilizes a more efficient Active Power Factor Correction (APFC) power supply. Dell recommends only Universal Power Supplies (UPS) based on Sine Wave output for APFC PSUs, not an approximation of a Sine Wave, Square Wave, or quasi-Square Wave (see UPS technical specifications). If you have questions please contact the manufacturer to confirm the output type.
8 Computrace: Not a Dell offer. Certain conditions apply. For full details, see terms and conditions at www.lojackforlaptops.com.
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- Jnufm®!wQsp!Ufdiopmphz!.!Gvmm!wQsp.dbqbcmf!bu!qpjou!pg!qvsdibtf<!uif!wQsp!tztufnt!nbobhfnfou!pqujpo!sfrvjsft!wQsp!qspdfttpst/!!Jodmveft!tvqqpsu!gps!Jnufm!Bewbodfe!Nbobhfnfou!Ufdiopmphz!)BNU*!9/y/
- Jnufm®!Tuboebse!Nbobhfbcjmjuz!.!Gvmmz!fobcmfe!bu!qpjou!pg!qvsdibtf-!uif!Jnufm!Tuboebse!Nbobhfnfou!pqujpo!jt!b!tvctfu!pg!uif!BNU!gfbuvsft/!!JTN!jt!opu!vqhsbefbcmf!up!wQsp!ufdiopmphz!qptu.qvsdibtf/
- Op!Pvu.pg.Cboe!Tztufnt!Nbobhfnfou!.!Uijt!pqujpo!foujsfmz!sfnpwft!Jnufm!pvu.pg.cboe!tztufnt!)PPC*!nbobhfnfou!gfbuvsft/!Uif!tztufn!dbo!tujmm!tvqqpsu!jo.cboe!nbobhfnfou/!PPC!nbobhfnfou!tvqqpsu!uispvhi!BNU!dboopu!cf!vqhsbefe!qptu.qvsdibtf/

21/!Mjnjufe!Ibsexbsf!Xbssbouz;!Gps!dpqz!pg!Mue!Ibsexbsf!Xbssbouz-!xsjuf!Efmm!VTB!MQ!Buuo;!Xbssboujft-!Pof!Efmm!Xbz-!Spvoe!Spdl-!UY!89793!ps!tff!xxx/efmm/dpn0xbssbouz/
22/!Ofyu!Cvtjoftt!Ebz!Potjuf!Tfswjdf!bgufs!Sfnpuf!Ejbhoptjt;!Sfnpuf!Ejbhoptjt!jt!efufsnjobujpo!cz!pomjof0qipof!ufdiojdjbo!pg!dbvtf!pg!jttvf<!nbz!jowpmwf!dvtupnfs!bddftt!up!jotjef!pg!tztufn!boe!nvmujqmf!ps!fyufoefe!tfttjpot/!Jg!jttvf!jt!dpwfsfe!cz!Mjnjufe!Ibsexbsf!Xbssbouz!)xxx/efmm/dpn0xbssbouz*!boe!opu!sftpmwfe!sfnpufmz-!ufdiojdjbo!boe0ps!qbsu!xjmm!cf!ejtqbudife-!vtvbmmz!xjuijo!2!cvtjoftt!ebz!gpmmpxjoh!dpnqmfujpo!pg!Sfnpuf!Ejbhoptjt/!Bwbjmbcjmjuz!wbsjft/!Puifs!dpoejujpot!bqqmz/
23/!4se!hfofsbujpo!DQVt!obujwfmz!tvqqpsu!4!ejtqmbzt!xjui!uif!joufhsbufe!DQV!hsbqijdt/!Uisff!tjnvmubofpvt!ejtqmbz!pvuqvut!sfrvjsft!pof!EQ!qpsu!xjui!b!nbyjnvn!sftpmvujpo!pg!3671y2711!bu!71I{!sfgsfti!sbuf!boe!b!EQ!boe!WHB!qpsu!xjui!b!nbyjnvn!sftpmvujpo!pg!2:31y2311!bu!71I{!sfgsfti!sbuf/
13. Please refer to www.epeat.net for specific country registration rating and participation.

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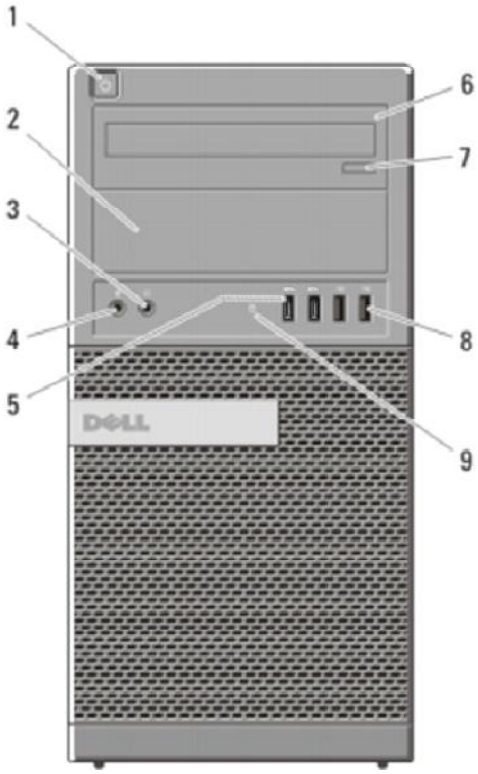
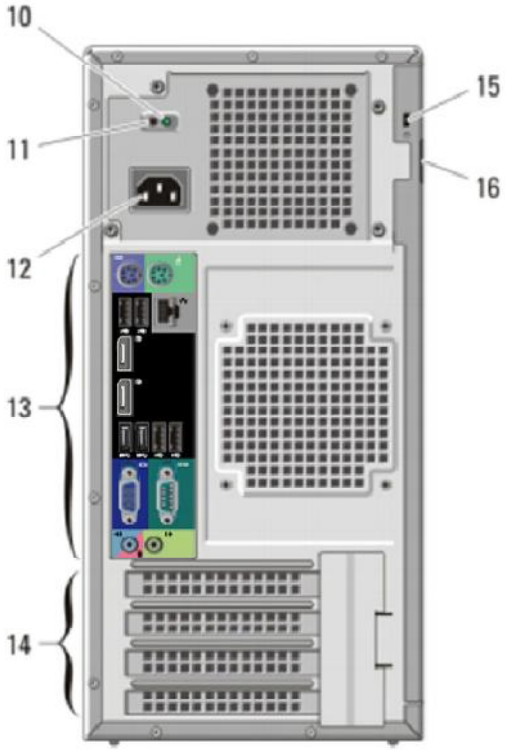
MINI TOWER COMPUTER (MT) VIEW

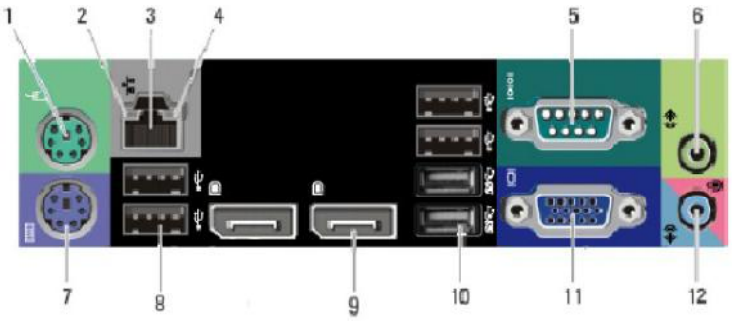


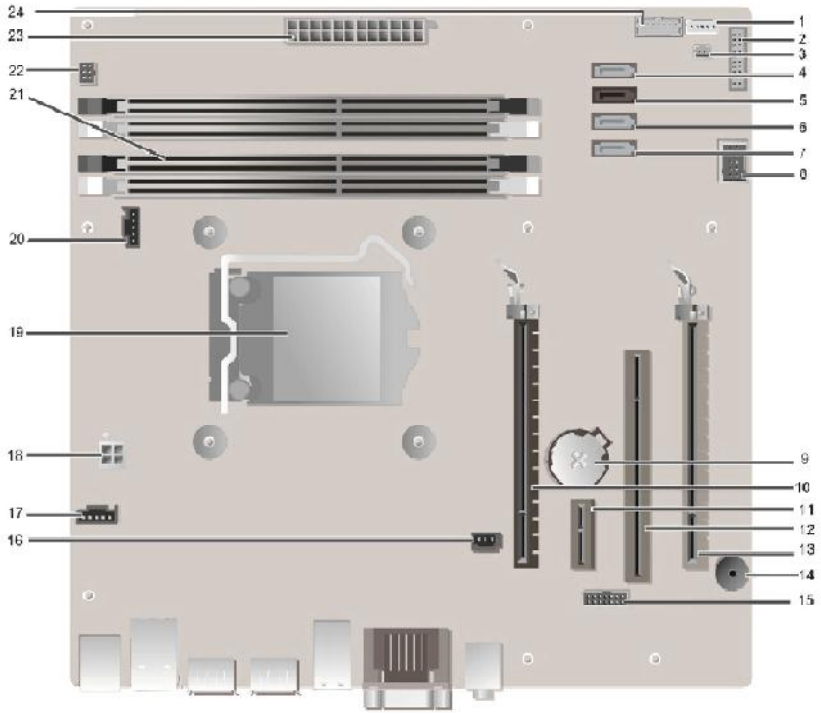


FRONT VIEW			
1	Power Button, Power Light	6	Optical Drive (optional)
2	Optical Drive Bay (optional)	7	Optical Drive Eject Button
3	Headphone Connector	8	USB 2.0 Connectors (2)
4	Microphone Connector	9	Drive Activity Light
5	USB 3.0 Connectors (2)		

BACK VIEW			
10	Power Supply Diagnostic Light	14	Expansion Card Slots (4)
11	Power Supply Diagnostic Button	15	Kensington / Noble Security Cable Slot
12	Power Connectors	16	Padlock Ring
13	Back Panel Connectors		

BACK PANEL CONNECTORS			
1	PS2 Mouse Connector	7	SP2 Keyboard Connector
2	Link Integrity Light	8	USB2.0 Connectors (2)
3	Network Connector	9	DisplayPort Connector (2)
4	Network Activity Light	10	USB2.0 Connectors (2) USB3.0 Connectors (2)
5	Serial Connector	11	VGA Connector
6	Line-out Connector	12	Line-in/Microphone Connector





MT System Board Components

Number	Name	Number	Name
1	Internal Speaker Connector (INT_SPKR)	13	PCI-e x16 (wire x4) Connector (SLOT4)
2	Front IO Connector (FRONTPANEL)	14	Buzzer (BEEP)
3	Thermal Sensor Connector (THRM_2)	15	LPC Debug Connector (LPC_DEBUG)Ť
4	SATA 0 Connector (SATA0)	16	Intrusion Switch Connector (INTRUDER)
5	SATA 1 Connector (SATA1)	17	System Fan Connector (FAN_HDD)Ť
6	SATA 2 Connector (SATA2)	18	P2 Power Connector (12V_PWRCONN)
7	SATA 3 Connector (SATA3)	19	Processor Socket (N/A)
8	Internal USB Connector (INT_USB)	20	CPU fan Connector (FAN_CPU)Ť
9	Battery Connector (BATTERY)	21	Memory Connectors (DIMM1, DIMM2, DIMM3, DIMM4)
10	PCI-e x16 Connector (SLOT1)	22	Power Switch Connector (PWR_SW)Ť
11	PCI-e x1 Connector (SLOT2)	23	P1 Power Connector (POWER)
12	PCI Connector (SLOT3)	24	Front USB3.0 Connector (Front _USB)

MARKETING SYSTEM CONFIGURATIONS

NOTE: Offerings may vary by country. For more information regarding the configuration of your computer, click Start>Help and Support and select the option to view information about your computer.

OPERATING SYSTEM

	MT	DT	SFF	USFF
Windows Operating System	Microsoft® Windows 7® Home Basic SP1 (32 and 64 bit), Microsoft® Windows 7® Home Premium SP1 (32 and 64 bit), Microsoft® Windows 7® Home Premium w/MUI dSP1 (32 and 64 bit), Microsoft® Windows 7® Professional w/MUI SP1 (32 and 64 bit), Microsoft® Windows 7® Professional SP1 (32 and 64 bit), Microsoft® Windows 7® Ultimate SPI (32 and 64 bit),			
Other	Ubuntu (N-Series DIB) (32bit)dĭ Ubuntu (32bit)dĭ			
OS Media Support	Optional			

CHIPSET

	MT	DT	SFF	USFF
Chipset	Intel Q77 Express Chipset			
Non-volatile memory on chipset				
BIOS Configuration SPI (Serial Peripheral Interface)	64Mbit (8MB) &32Mbit(4MB) located at SPI_FLASH on chipset			
TPM 1.2 Security Device (Trusted Platform Module)[1]	4KB located at TPM1.2 on chipset			
Non-TPM	Available in select countries			
NIC EEPROM	LOM configuration contained within SPI_FLASH – no dedicated LOM EEPROM			

PROCESSOR[1]

NOTE: Global Standard Products (GSP) are a subset of Dell's relationship products that are managed for availability and synchronized transitions on a worldwide basis. They ensure the same platform is available for purchase globally. This allows customers to reduce the number of configurations managed on a worldwide basis, thereby reducing their costs. They also enable companies to implement global IT standards by locking in specific product configurations worldwide. The following GSP processors identified below will be made available to Dell customers.

NOTE: Processor numbers are not a measure of performance. Processor availability subject to change and may vary by region/country.

	MT	DT	SFF	USFF
Intel® Quad Core Processors				
Intel® Core™ i7 3770 / 3.10GHz, 8M, VT-x, VT-d, TXT (vPro™), 77W	GSP	GSP	GSP	
Intel® Core™ i7 3770S / 3.40GHz, 8M, VT-x, VT-d, TXT (vPro™), 65W				GSP
Intel® Core™ i5 3570 / 3.40GHz, 6M, VT-x, VT-d, TXT (vPro™), 77W[2]	GSP	GSP	GSP	
Intel® Core™ i5 3570S / 3.10GHz, 6M, VT-x, VT-d, TXT (vPro™), 65W[2]				GSP
Intel® Core™ i5 3470 / 3.20GHz, 6M, VT-x, VT-d, TXT (vPro™), 77W[2]	GSP	GSP	GSP	
Intel® Core™ i5 3475S / 2.90GHz, 6M, VT-x, VT-d, TXT (vPro™), 65W[2]	GSP	GSP	GSP	GSP
Intel® Core™ i5 3470S / 2.90GHz, 6M, VT-x, VT-d, TXT (vPro™), 65W[2]				GSP
Intel® Core™ i5 3550 / 3.30GHz, 6M, VT-x, VT-d, TXT (vPro™), 77W[3]	X	X	X	
Intel® Core™ i5 3550S / 3.00GHz, 6M, VT-x, VT-d, TXT (vPro™), 65W[3]				X
Intel® Core™ i5 3450 / 3.10GHz, 6M, 77W[3]	X	X	X	
Intel® Core™ i5 3450S / 2.80GHz, 6M, 65W[3]				X
Intel® Dual Core Processors				
Intel® Core™ i3 2130 / 3.40GHz, 3M, VT-x, 65W	X	X	X	X
Intel® Core™ i3 2125 / 3.30GHz, 3M, VT-x, 65W	X	X	X	X
Intel® Core™ i3 2120 / 3.30GHz, 3M, VT-x, 65W	X	X	X	X
Intel® Core™ G860 / 3.0GHz, 3M, VT-x, 65W[2]	X	X	X	X
Intel® Core™ G850 / 2.9GHz, 3M, VT-x, 65W[3]	X	X	X	X
Intel® Core™ G640 / 2.8GHz, 3M, VT-x, 65W[2]	X	X	X	X
Intel® Core™ G630 / 2.7GHz, 3M, VT-x, 65W[3]	X	X	X	X
Intel® Celeron Processors				
Intel® Core™ G540 / 2.5GHz, 2M, VT-x, 65W[2]	X	X	X	X
Intel® Core™ G530 / 2.5GHz, 2M, VT-x, 65W[3]	X	X	X	X
Intel® Core™ G460 / 1.8GHz, 1.5M, VT-x, 35W	X	X	X	X

[1] 3rd generation CPUs natively support 3 displays with the integrated CPU graphics. Three simultaneous display output requires one DP port with a maximum resolution of 2500x1600 at 60Hz refresh rate and a DP and VGA port with max resolutions of 1920x1200 at 60Hz refresh rates.

[2] Post launch CPU, available from June for G860, G540; July for G640, i5 3470/S, i5 3570/S, i5 3475S.

[3] Available at launch, will be replaced in June or July, i5 3470/S replace i5 3450/S; i5 3570/S replace i5 3550/S; G860 replace G850;G640 replace G630;G540 replace G530.

MEMORY

NOTE: Memory modules should be installed in pairs of matched memory size, speed, and technology. If the memory modules are not installed in matched pairs, the computer will continue to operate, but with a slight reduction in performance. The entire 16GB memory range is available to 64-bit operating systems.

	MT	DT	SFF	USFF
Type: DDR3 Synch DRAM Non-ECC Memory	1600MHz[2]			
DIMM Slots	4	4	4	2
DIMM Capacities	Up to 8GB	Up to 8GB	Up to 8GB	Up to 8GB
Minimum Memory	2GB	2GB	2GB	2GB
Maximum System Memory	16GB[1]	16GB[1]	16GB[1]	16GB[1]
Memory configurations				
16GB[1] DDR3, 1600MHz[2], (4 x 4GB)	X	X	X	
16GB[1] DDR3, 1600MHz[2], (2 x 8GB)				X
8GB[1] DDR3, 1600 MHz[2], (2 x 4GB)	X	X	X	X
6GB[1] DDR3, 1600MHz[2], (2GB + 4GB)	X	X	X	X
4GB[1] DDR3, 1600 MHz[2], (2 x 2GB)	X	X	X	X
4GB[1] DDR3, 1600MHz[2], (1 DIMM)	X	X	X	X
2GB DDR3, 1600MHz[2], (1 DIMM)	X	X	X	X

[1] To fully utilize 4GB or more of memory requires a 64-bit enabled processor and 64-bit operating system. With 32-bit OS, the total amount of available memory will be less than 4GB. The amount less depends on the actual system configuration.

[2] 1600MHz memory will only perform as 1600MHz memory when 3rd generation CPUs are used. It will perform as 1333MHz memory if 2nd generation i3 2130, i3 2125, i3 2120, G860, G850 CPUs are installed in the system. It will perform as 1066MHz memory if 2nd generation G640, G630, G540, G530, G460 CPUs are installed in the system.

DRIVES AND REMOVABLE STORAGE

	MT	DT	SFF	USFF
Bays:				
5.25-inch Optical Bay Supported (External)	2	1	1	1
Optical Drives Supported (maximum)	2	1	1 (slim-line)	1 (slim-line)
Hard Drive Bay Supported (Internal)	2	1	1	1
Hard Drives Supported 3.5"/2.5" (maximum)	2/2	1/2	1/2	0/1
Interface:				
SATA 2.0	2	1	1	0
SATA 3.0	2	2	2	2
3.5" Hard Drives:				
1TB[1] SATA 7200 RPM HDD	X	X	X	
500GB[1] SATA 7200 RPM HDD	X	X	X	
250GB[1] SATA 7200 RPM HDD	X	X	X	
2.5" Hard Drives:				
500GB[1] SATA 7200 RPM HDD	X	X	X	X
320GB[1] SATA 7200 RPM HDD	X	X	X	X
320GB[1] SATA 7200 RPM OPAL SED w/FIPS HDD	X	X	X	X
500GB[1] SATA 7200 RPM Hybrid HDD	X	X	X	X
128GB[1] SATA Solid State drive	X	X	X	X
Optical Drive: (SFF/USFF require slim-line optical drive)				
DVD+/-RW[2] SATA	X	X	X	X
DVD-ROM[3] SATA	X	X	X	X
Media Card Reader:				
Dell 19 in 1 Media Card Reader[4]	X	X		

[1] For hard drives, GB means 1 billion bytes; actual capacity varies with preloaded material and operating environment and will be less.
[2] Discs burned with this drive may not be compatible with some existing drives and players; using DVD+R media provides maximum compatibility.
[3] DVD-ROM drives may have write-capable hardware that has been disabled via firmware modifications.
[4] Dell 19 in 1 Media Card Reader (MCR) is supported via a F5 to F3 bay converter on the MT and DT and requires a slim line optical drive.

SYSTEM BOARD CONNECTORS

NOTE: See Detailed Engineering Specifications for maximum card dimensions.

	MT	DT	SFF	USFF
PCI Slot(s)[1]	1	1		
PCIe x16 Slot(s) [2]	1	1	1	
PCIe x16 (wired x4)Slot(s) [3]	1	1	1	
PCIe x1 Slot(s) [3]	1	1		
miniPCIe connector(s) [3]				1
Serial ATA (SATA) [4]	4	3	3	2

[1] PCI Slots (Support Standard Rev 2.3)
[2] PCIe x16 Slots (Support Standard Rev 3.0)
[3] PCIe x16 (wired x 4), PCIe x1 Slots, miniPCIe (Support Standard Rev 2.0)
[4] Serial ATA (2 ports Support Standard Rev 3.0, the rest of ports Support Standard Rev 2.0)

GRAPHICS/VIDEO CONTROLLER

NOTE: MT supports full height (FH) cards and DT and SFF supports low profile (LP) cards.

	MT	DT	SFF	USFF
Integrated Intel® HD Graphics 2500/4000 (3rd generation Core i3/i5/i7 CPUs); Integrated Intel® HD Graphics 2000/3000 (2nd generation Core i3 CPUs); Integrated Intel® HD Graphics (Pentium® Dual Core / Celeron® CPU);	Integrated on CPU			
Enhanced Graphic/Video Options				
1GB AMD RADEON HD 7570	Optional card			
1GB AMD RADEON HD 7470	Optional card			

EXTERNAL PORTS/CONNECTORS

	MT	DT	SFF	USFF
USB 2.0 (Front/Rear/Internal)	2/4/2	2/4/2	2/4/0	0/2/0
USB 3.0 (Front/Rear/Internal)	2/2/0	2/2/0	2/2/0	2/2/0
Serial	1 Rear			
Network Connector (RJ-45)	1 Rear			
PS/2	2 Rear			
1394 Controller via optional PCI card	Optional FH card	Optional LP card		
Video:				
VGA	1 Rear			
DisplayPort	2 Rear			
Audio:				
Line in for microphone	1 Front			
Line in for microphone or stereo	1 Rear			
Line out for headphones or speakers	1 Front, 1 Rear			

COMMUNICATIONS - NETWORK ADAPTER (NIC)

NOTE: MT supports full height (FH) cards and DT and SFF supports low profile (LP) cards.

	MT	DT	SFF	USFF
Intel® 82579LM Gigabit[1] Ethernet LAN 10/100/1000 (Remote Wake Up, PXE support and Intel Active Management Technology support)	Integrated on system board			
Broadcom NetXtreme 10/100/1000 PCIe Gigabit Networking Card	Optional card			

[1] This term does not connote an actual operating speed of 1 Gb/sec. For high speed transmission, connection to a Gigabit Ethernet server and network infrastructure is required.

COMMUNICATIONS – WIRELESS

NOTE: MT supports full height (FH) cards and DT and SFF supports low profile (LP) cards.

	MT	DT	SFF	USFF
Dell Wireless 1530 PCIe WLAN card (802.11n)	Optional card			
Dell Wireless 1530 half miniPCIe WLAN card (802.11n)				Optional

AUDIO AND SPEAKERS

	MT	DT	SFF	USFF
Realtek ALC269Q High Definition Audio Codec	Integrated on system board			
Dell AX210 USB Stereo speakers	Optional			
Dell AX510/AX510PA Flat Panel Soundbar Speakers	Optional			

KEYBOARD AND MOUSE

	MT	DT	SFF	USFF
Dell USB Entry Keyboard with optional palmrest	Optional			
Dell Multimedia Pro Keyboard	Optional			
Dell Smart Card Keyboard	Optional			
Dell USB Optical Mouse	Optional			
Dell Laser Mouse	Optional			

SECURITY

	MT	DT	SFF	USFF
Trusted Platform Module (TPM) 1.2[1]	Integrated on system board			
Chassis Intrusion Switch	Optional			
Dell Smartcard Keyboard	Optional			
Chassis lock slot and loop support	Standard			
Dell Data Protection | Hardware Encryption Engine	Optional			

[1]TPM is not available in all countries. Depending on your country regulations, no-TPM system boards may be available.

SOFTWARE

	MT	DT	SFF	USFF
Dell Client Manager	Available via Dell.com			
Dell Data Protection | Access (DDPA)	Standard			
Dell Data Protection | Encryption (DDPE)	Optional			

ENVIRONMENTAL

NOTE: For more details on Dell Environmental features, please to go to Environmental Attributes section. See your specific region for availability.

	MT	DT	SFF	USFF
Sustainable packaging	X	X	X	
MultiPack packaging	Optional, US only			
Energy Efficient Power Supply	Optional			Standard

ALL-IN-ONE STANDS AND MOUNTS

	MT	DT	SFF	USFF
Small Form Factor AIO Stand			Optional	
Ultra Small Form Factor AIO Stand				Optional
Ultra Small Form Factor Wall Mount / Desk Mount				Optional

SERVICE AND SUPPORT

NOTE: For more details on Dell Service Plans please to go to: www.dell.com/service/service_plans

	MT	DT	SFF	USFF
3 Year Warranty[1] Next Business Day On-site[2] (3-3-3)	Standard			
ProSupport	Optional			

[1] For a copy of our guarantees or limited warranties, please write Dell USA L.P., Attn: Warranties, One Dell Way, Round Rock, TX 78682. For more information, visit www.dell.com/warranty.

[2] Service may be provided by third-party. Technician will be dispatched if necessary following phone-based troubleshooting. Subject to parts availability, geographical restrictions and terms of service contract. Service timing dependent upon time of day call placed to Dell. U.S. only.

DETAILED ENGINEERING SPECIFICATIONS

SYSTEM DIMENSIONS (PHYSICAL)

NOTE: System Weight and Shipping Weight is based on a typical configuration and may vary based on PC configuration. A typical configuration includes: integrated graphics, one hard drive, one optical drive.

	MT	DT	SFF	USFF
Chassis Volume (liters)	26.27	15.06	8.38	3.70
Chassis Weight (pounds/kilograms)	20.68 / 9.4	17.38 / 7.9	13.2 / 6.0	7.26 / 3.3
Chassis Dimensions: (HxWxD)				
Height (inches/centimeters)	14.17 / 36	14.17 / 36	11.42 / 29	9.32 / 23.67
Width (inches/centimeters)	6.89 / 17.5	4.02 / 10.2	3.65 / 9.26	2.56 / 6.5
Depth (inches/centimeters)	16.42 / 41.7	16.14 / 41	12.28/31.2	9.44 / 24
Shipping Weight (pounds/kilograms - includes packaging materials)	24.57 / 11.17	20.75 / 9.43	15.82/7.19	9.63 /4.375
Packaging Parameters (HxWxD)				
Height (inches/centimeters)	21.31/54.13	21.31 / 54.13	19.25/48.90	19.13/48.59
Width (inches/centimeters)	18.75/47.63	18.75/47.63	15.81/40.16	14.38/36.53
Depth (inches/centimeters)	14.09 / 35.79	10.84/27.53	10.19/25.88	9.63/24.46

SYSTEM BOARD CONNECTOR MAXIMUM ALLOWABLE DIMENSIONS

	MT	DT	SFF	USFF
PCI Slot (Voltage supported 3.3V/5V/12V/-12V)	1	1		
Height (inches/centimeters)	4.376 / 11.115	2.731 /6.89		
Length (inches/centimeters)	6.6 / 16.765	6.6/16.765		
Maximum Wattage	25W	25W		
PCIex16 Slot (BLUE) (Voltage supported 3.3V/12V)	1	1	1	
Height (inches/centimeters)	4.376 / 11.115	2.731 /6.89	2.731 /6.89	
Length (inches/centimeters)	6.6/ 16.765	6.6 /16.765	6.6 /16.765	
Maximum Wattage	75W	50W	50W	
PCIex16 wired as x4 Slot (BLACK) (Voltage supported 3.3/12V)	1	1	1	
Height (inches/centimeters)	4.376 / 11.115	2.731 /6.89	2.731 /6.89	
Length (inches/centimeters)	6.6 / 16.765	6.6 /16.765	6.6/16.765	
Maximum Wattage	25W	25W	25W	
PCIe x1 Slot (Voltage supported 3.3V/12V)	1	1		
Height (inches/centimeters)	4.376 / 11.115	2.731 / 6.89		
Length (inches/centimeters)	4.5 / 11.44	4.5 / 11.44		
Maximum Wattage	10W	10W		
Mini PCIe x1 Slot				1

SYSTEM LEVEL ENVIRONMENTAL AND OPERATING CONDITIONS

	MT	DT	SFF	USFF
Temperature				
Operating	10°C to 35°C (50°F to 95°F)			
Non-Operating (Storage)	-40°C to 65°C (-40°F to 149°F)			
Relative Humidity	20% to 80% (non-condensing)			
Maximum vibration				
Operating	0.25 G at 3 to 200 Hz at 0.5 octave/min			
Non-Operating	0.5 G at 3 to 200 Hz at 1 octave/min			
Maximum Shock				
Operating	Bottom half-sine pulse with a change in velocity of 50.8 cm/sec (20 inches/sec)			
Non-Operating	27-G faired square wave with a velocity change of 508 cm/sec (200 inches/sec)			
Maximum Altitude				
Operating	–15.2 to 3048 m (–50 to 10,000 ft)			
Non-Operating	–15.2 to 10,668 m (–50 to 35,000 ft)			

AUDIO

INTEGRATED REALTEK ALC269Q HIGH DEFINITION AUDIO	MT	DT	SFF	USFF
High Definition Stereo support	X	X	X	X
Number of channels	2			
Number of Bits / Audio resolution	16, 20, and 24-bit resolution			
Sampling rate (recording/playback)	Support 44.1K/48K/96K/192 kHz sample rates			
Signal to Noise Ratio	98 dB DAC outputs, 90 dB for ADC inputs			
Analog Audio	X	X	X	X
Dolby Digital				
THX				
Digital out (S/PDIF)				
Audio Jack Impedance				
Microphone	40K ohm~60K ohm			
Line-In	40K ohm~60K ohm			
Line-Out	100~150 ohm			
Headphone	1~4 ohm			
Internal Speaker Power Rating	2Watt (peak) / 1Watt (average)d			

COMMUNICATIONS - INTEGRATED LAN

INTEGRATED INTEL® 82579 GIGABIT[1] ETHERNET LAN 10/100/1000	MT	DT	SFF	USFF
External Connector Type	RJ45			
Data Rates supported	10/100/1000 Mbps			
Controller Details				
Controller bus architecture	PCIe-based interface for S0 state, SMBus for Sx low power state			
Integrated memory	N/A			
Data transfer mode (example Bus-Master DMA)	N/A			
Power consumption (full operation per data rate connection speed)	711mW (Max.)			
Power consumption (standby operation)	227mW (Max.)			
IEEE standards compliance (example 802.1P)	802.3			
Hardware Certifications (example FCC, B, GS mark…)	N/A			
Boot ROM Support	EEPROM (located in SPI)			
Network Transfer Mode (example Full Duplex, Half Duplex)				
Network Transfer Rate (example 10BASE-T (half-duplex) 10 Mbps 10BASE-T (full-duplex) 20 Mbps 100BASE-TX (half-duplex) 100 Mbps 100BASE-TX (full-duplex) 200 Mbps 1000BASE-T (full-duplex) 2000 Mbps	10 Mb (full/half-duplex) 100 Mb (full/half-duplex) 1000 Mb (full-duplex)			

COMMUNICATIONS - INTEGRATED LAN (CONT.)

INTEGRATED INTEL® 82579 GIGABIT[1] ETHERNET LAN 10/100/1000 (CONT.)	MT	DT	SFF	USFF
Environmental				
Operating temperature	0°C to 85°C (32° F to 185° F)			
Operating humidity	20% to 80% (non- condensing)			
Operating System Driver Support	Windows 7 32/64, Windows XP 32/64, Vista 32/64			
Manageability (examples WOL, PXE)	WOL, PXE 2.1			
Management Capabilities Alerting	Intel® Standard Manageability, 3rd generation i5/i7 processors with vPro Technology			

[1] This term does not connote an actual operating speed of 1 Gb/sec. For high speed transmission, connection to a Gigabit Ethernet server and network infrastructure is required.

GRAPHICS/VIDEO CONTROLLER

NOTE: MT supports full height (FH) cards and DT and SFF supports low profile (LP) cards.

Onboard Graphics[1,2,3,4] Integrated Intel® HD Graphics 2500/4000 (3rd generation Core i3/i5/i7 CPUs); Integrated Intel® HD Graphics 2000/3000 (2nd generation Core i3 CPUs); Integrated Intel® HD Graphics (Pentium® Dual Core CPU);	**MT**	**DT**	**SFF**	**USFF**
Bus Type	Integrated			
GPU core clock	Gen6 Core Intel® HD Graphics /HD Graphics 2000 @ 850MHz Gen7 Core Intel® HD Graphics 2500 / 4000 @ 650MHz			
Frame Buffer Memory (onboard and shared) Size and Speed	Depends on available system memory (Up to 1.7GB with 4GB system Memory)			
Overlay Planes	Yes			
Maximum Color Depth	32 bit			
Maximum Vertical Refresh Rate	75 Hz			
Multiple Display Support	Yes			
Operating Systems Graphics/ Video API Support	OpenGL 3.1/OpenCLv1.1 /DirectX 11			
Supported Resolutions and Max Refresh Rates (Hz) (Note: Analog and/or digital)	Up to 2560x1600 @ 60Hz (DP) Up to 1920x1200 @ 60Hz (VGA only)			
External Connectors	VGA, 2 DisplayPort			
DisplayPort				
Bus Type	DDPC			
DisplayPort Audio Support	Yes			
VGA				
Bus Type	CRT			
VGA Audio Support	No			

[1] Up to 1.7 GB of system memory may be allocated to support integrated graphics, depending on operating system, system memory size and other factors.
[2] 3rd generation CPUs natively support 3 displays with the integrated CPU graphics. Three simultaneous display output requires one DP port with a maximum resolution of 2500x1600 at 60Hz refresh rate and a DP and VGA port with max resolutions of 1920x1200 at 60Hz refresh rates.
[3] Display output from both onboard and discrete simultaneously if multi display option in BIOS is enabled and OS used is Win7.
[4] For dual graphics card configuration in PCIex16 and PCIex16 (wire as 4), Bios will disable multi display option automatically and display output only from graphics cards.

HARD DRIVES[1]

3.5" 1TB SATA 7200 RPM HDD	
Capacity	1TB
Dimensions inches (W x D x H)	Approximately (4.00 x 5.787 x 1.028 inches)
Interface type and Maximum speed	Up to 6Gb/s (SATA 3.0)
Internal buffer size	32 MB
Rotational Speed	7200 rpm
Logical Blocks	1,953,525,168
Power Source	
Power Consumption (reference only)	Idle 5.0W, Active 10.0W(running IOmeter utility)
Spin Up Current (reference only)	5V (1A) ,12V (2A)
Environmental Operating Conditions (Non-Condensing):	
Temperature Range	5°C to 60°C
Relative Humidity Range	20% to 80% non-condensing
Maximum Wet Bulb Temperature	29°C
Altitude Range	-50 ft to 10000 ft
Environmental Non-Operating Conditions (Non-Condensing):	
Temperature Range	-40°C to 65°C
Relative Humidity Range	10% to 90% non-condensing
Maximum Wet Bulb Temperature	38°C
Altitude Range	-50 ft to 35000 ft

[1] For hard drives, GB means 1 billion bytes ; actual capacity varies with preloaded material and operating environment and will be less.

OPTICAL DRIVES

DVD +/- RW[1]	MT	DT	SFF	USFF
External Dimensions inches/centimeters (Without Bezel – W x H x D)	148.2mm(6in)/42mm (2in)/ 171 (max)	148.2mm(6in)/42mm (2in)/ 171 (max)	128.0 mm (5.04)/ 12.7mm (0.5 in)/ 126.1mm (4.97in)	128.0 mm (5.04)/ 12.7mm (0.5 in)/ 126.1mm (4.97in)
Weight (max) pounds/ kilograms	700g	700g	170g	170g
Interface type and speed	SATA 1.5Gbit/s	SATA 1.5Gbit/s	SATA 1.5Gbit/s	SATA 1.5Gbit/s
Disc Capacity	Standard	Standard	Standard	Standard
Internal buffer size	supplier dependent	supplier dependent	supplier dependent	supplier dependent
Access Times (typical)	supplier dependent	supplier dependent	supplier dependent	supplier dependent
Maximum Data Transfer Rates				
Writes	16x DVD/48x CD	16x DVD/48x CD	8x DVD/ 24x CD	8x DVD / 24x CD
Reads	16x DVD/48x CD	16x DVD/48x CD	8x DVD/ 24x CD	8x DVD/ 24x CD
Power Source				
DC Power Requirements	12V, 5V	12V, 5V	5V	5V
DC Current	1200mA (12V)/ 900mA (5V)	1200mA (12V)/ 900mA (5V)	1000mA	1000mA
Environmental Operating Conditions (Non-Condensing):				
Operating Temperature Range	5°C to 50°C	5°C to 50°C	5°C to 50°C	5°C to 50°C
Relative Humidity Range	20% to 80% RH	20% to 80% RH	20% to 80% RH	20% to 80% RH
Maximum Wet Bulb Temperature	29°C	29°C	29°C	29°C
Altitude Range	-200 to 3048	-200 to 3048	-200 to 3048	-200 to 3048
Environmental Non-Operating Conditions (Non-Condensing):				
Operating Temperature Range	-40°C to 65°C	-40°C to 65°C	-40°C to 65°C	-40°C to 65°C
Relative Humidity Range	5% to 95% RH	5% to 95% RH	5% to 95% RH	5% to 95% RH
Maximum Wet Bulb Temperature	38°C	38°C	38°C	38°C
Altitude Range	-200 to 10600m	-200 to 10600m	-200 to 10600m	-200 to 10600m

[1] Discs burned with this drive may not be compatible with some existing drives and players; using DVD+R media provides maximum compatibility.

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Big Island Air Conditioning

Formally EMC and Custom Aire

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Kailua Kona, HI 96740
CT-31753
(808)-329-7672 fax (808)-329-6462

t'nɒ-╠šl'Ċwśźś'rś■l'śl

5ĂĠś June 14, 2013

t'nɒ-╠šl'Ċ NASA Infrared Telescope Facility

Maryl

Contact: Momi McCarter
Phone: 808-334-0891
Fax: 808-334-0895
Email: momi.mccarter@maryl.com
Project: American Savings Bank
Location: North Kona, HI
Year Installed: 2012
Dollar Value: $101,428.55

Honolulu Builders

Contact: Les Pederson
Phone: 808-935-5938
Fax: 808-936-7691
Email: lpedersen@honolulubuilders.com
Project: Hale Aloha
Location: Hilo, HI
Year Installed: 2013
Dollar Value: $715,500

Phillips Exeter Academy

Contact: Joe Malerba
Phone: 603-777-4459
Fax: 603-777-4392
Email: jmalerba@exeter.edu
Project: Phillips Exeter Academy
Location: Exeter, NH
Year Installed: 2009 - 2011
Dollar Value: Various

CJBD!

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X i p!X f!Bsf;!Cjh!Jtmboe!Bjs!Dpoejujpojoh!

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- MJhi ujoh!Dpousprn
- DDUW!
- Joepps!Bjs!Rvbmjuz!
- Dsjujdbm!N pojupsjoh!
- Tztuf n t!Jouf hsbujpo!

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Ui jse.Qbsuz!Jouf sqpdf t!ò!Gjsf-!WGE ît-!Jouf sdpn -!Di jmmfst-!Qpx fs-!fud/!Vtvbmm!qpjou up.qpjou
Pqfo!Tuboebset!ò!I UN M!YN M!CBDof u!MPO-!N pecvt-!PQD-!TON Q!PECD/!

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X jsf rnft t!Ofux psl t/!
Bddf tt!Dpousprnò!Dbse!Bddf tt-!DDUW!Frnwbups!Dpousprn!Dbn f sbt-!!Ejhjubm!Wjef p!Sf dpsejoh-!
Cbehjoh-!Jouf hsbujpo!up!I WBD!Dpousprn/!
Fof shz!Tbwjoht!ò!Gpt tjnhGvf nboe!Frnfdusjd!Fof shz!Tbwjoht!wjb!Dvtupn j{fe!I WBD!Dpousprn!
Sf dpn n jttjpojoh-!Tvcn f ufsjoh/!
Dvtupn !Jouf hsbujpo!ò!X f c!Jouf sgbdf t-!Dvtupn !Brnbsn joh-!CBDof u!Mpox psl t-!QMDît-!N pecvt-!
Kpi otpo!Dpousprn-!BMD-!Ef mb-!Brnfsupo!boe!n psf/!
Qf sjqi f sbmEf wjdf t!ò!X jsf rnft t!Tf otpst-!Gpx !N f bt vsf n f ou!Uf n qf sbuvsf !boe!I vn jejuz/!
Joepps!Bjs!Rvbmjuz!ò!DP 30DP!boe!Tqf djbmz!Hbt!Tf otjoh-!N pojupsjoh!boe!Dpousprn!
MJhi ujoh!Dpousprnò!Dvtupn !MJhi ujoh!Dpousprn!Joepps!boe!Pvuepps!MJhi ujoh!Dpousprn!MJhi uJMf wf rh
Tf otjoh/!
Usbjojoh!ò!Tf swjdf !boe!Jotubmmbujpo-!Qsphsbn n joh-!Pqf sbujpo-!UBD-!Dpsqpsbuf !Usbjojoh-!
Dvtupn fs!Tjuf !Usbjojoh/!
VM!Qbof rnò!VMDf sujgjf e!Qbof rnCvjmejoh!Ti pq-!Cvjmejoh!pgVMMjtuf e!Qbof rnò!
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DI BO	UZQF	QPJOU!OBNF	!EFTDSJQUPO	RUZ	EJTUSJCVUPS	QBSU!$
2	BDDUFNQ	DI 2` TVQQMZ` UFNQ	DI JMMFS!2!TVQQMZ!UFNQFSBUVSF	2	NBNBD	UF.814.D.8.B.2
3	BDDUFNQ	DI 2` SFUVSO` UFNQ	DI JMMFS!2!SFUVSO!UFNQFSBUVSF	2	NBNBD	UF.814.D.8.B.2
4	WPMUBHF	DI 2` TVQQMZ` QSFTT	DI JMMFS!2!TVQQMZ!QSFTTVSF	2	LFMF	QTT3.211
5	WPMUBHF	DI 2` SFUVSO` QSFTT	DI JMMFS!2!SFUVSO!QSFTTVSF	2	LFMF	QTT3.211
6	WPMUBHF	DI 2` GMPX	DI JMMFS!2!GMPX	2	POJDPO	POJG.2221
7	!	!	!	!	!	!!
8	WPMUBHF	HQ2` JO` QSFTT	HMZDPMQVNQ!JOMFU!QSFTTVSF	2	LFMF	QTT3.211
9	WPMUBHF	HQ2` PVU` QSFTT	HMZDPMQVNQ!PVUMFU!QSFTTVSF	2	LFMF	QTT3.211
:	BDDUFNQ	JX 3` TVQQMZ` UFNQ	JDF!X BHPO!3!TVQQMZ!UFNQFSBUVSF	2	NBNBD	UF.814.D.8.B.2
21	BDDUFNQ	JX 3` SFUVSO` UFNQ	JDF!X BHPO!3!SFUVSO!UFNQFSBUVSF	2	NBNBD	UF.814.D.8.B.2
22	WPMUBHF	JX 3` TVQQMZ` QSFTT	JDF!X BHPO!3!TVQQMZ!QSFTTVSF	2	LFMF	QTT3.211
23	WPMUBHF	JX 3` SFUVSO` QSFTT	JDF!X BHPO!3!SFUVSO!QSFTTVSF	2	LFMF	QTT3.211
24	EJHJUBM	FG7` TUT	FYI BVTU!GBO!7!TUBUVT	2	WFSJT	WFS.I 411
25	EJHJUBM	FG8` TUT	FYI BVTU!GBO!8!TUBUVT	2	WFSJT	WFS.I 411
26	EJHJUBM	FG9` TUT	FYI BVTU!GBO!9!TUBUVT	2	WFSJT	WFS.I 411
27	EJHJUBM	FG:` TUT	FYI BVTU!GBO!: !TUBUVT	2	WFSJT	WFS.I 411

NPEVF!TMPU$; VJ27!Npe!5

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2	BDDUFNQ	BI V3`SPPN	BI V!3!SPPN!UFNQFSBUVSF	2	UBD	FUS611
3	BDDUFNQ	BI V3`EBU	BI V!3!EJTDI BSHF!BJS!UFNQFSBUVSF	2	NBNBD	UF.813.C.8.E
4	BDDUFNQ	BI V3`SBU	BI V!3!SFUVSO!BJS!UFNQFSBUVSF	2	NBNBD	UF.813.C.8.E
5	BDDUFNQ	BI V3`DMH`TVQQMZ	BI V!3!DPPMJOH!DPJMTVQQMZ!UFNQFSBUSVF	2	NBNBD	UF.814.D.8.B.2
6	BDDUFNQ	BI V3`DMH`SFUVSO	BI V!3!DPPMJOH!DPJMSFUVSO!UFNQFSBUSVF	2	NBNBD	UF.814.D.8.B.2
7	WPMUBHF	BI V3`DMH`GMPX	BI V!3!DPPMJOH!DPJMMRVJE!GMPX !)FYJTUJOH*	2	FYJTUJOH	FYJTUJOH
8	WPMUBHF	BI V3`DPJM EQ	BI V!3!DPPMJOH!DPJMEJGGFSFOUJBMQSFTTVSF	2	UBD	FQQ213.MDE
9	WPMUBHF	BI V3`GJMUFS`EQ	BI V!3!GJMUFS!EJGGFSFOUJBMQSFTTVSF	2	UBD	FQQ213.MDE
:	BDDUFNQ	BI V4`SPPN	BI V!4!SPPN!UFNQFSBUVSF	2	UBD	FUS611
21	BDDUFNQ	BI V4`EBU	BI V!4!EJTDI BSHF!BJS!UFNQFSBUVSF	2	NBNBD	UF.813.C.8.E
22	BDDUFNQ	BI V4`SBU	BI V!4!SFUVSO!BJS!UFNQFSBUVSF	2	NBNBD	UF.813.C.8.E
23	BDDUFNQ	BI V4`DMH`TVQQMZ	BI V!4!DPPMJOH!DPJMTVQQMZ!UFNQFSBUSVF	2	NBNBD	UF.814.D.8.B.2
24	BDDUFNQ	BI V4`DMH`SFUVSO	BI V!4!DPPMJOH!DPJMSFUVSO!UFNQFSBUSVF	2	NBNBD	UF.814.D.8.B.2
25	WPMUBHF	BI V4`DMH`GMPX	BI V!4!DPPMJOH!DPJMMRVJE!GMPX !)FYJTUJOH*	2	FYJTUJOH	FYJTUJOH
26	WPMUBHF	BI V4`DPJM EQ	BI V!4!DPPMJOH!DPJMEJGGFSFOUJBMQSFTTVSF	2	UBD	FQQ213.MDE
27	WPMUBHF	BI V4`GJMUFS`EQ	BI V!4!GJMUFS!EJGGFSFOUJBMQSFTTVSF	2	UBD	FQQ213.MDE

NPEVF!TMPU$; VJ27!Npe!6

QBOFM!EJO!SBJM; Nbdi !SN!21:

$	KPC!SFGFSFODF!$
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TYX !VJ27!

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DI BO	UZQF	QPJOU!OBNF	!EFTDSJQUJPO	RUZ	EJTUSJCVUPS	QBSU!$
2	BDDUFNQ	BI V5`SPPN	BI V!5!SPPN!UFNQFSBUVSF	2	UBD	FUS611
3	BDDUFNQ	BI V5`EBU	BI V!5!EJTDI BSHF!BJS!UFNQFSBUVSF	2	NBNBD	UF.813.C.8.E
4	BDDUFNQ	BI V5`SBU	BI V!5!SFUVSO!BJS!UFNQFSBUVSF	2	NBNBD	UF.813.C.8.E
5	BDDUFNQ	BI V5`DMH`TVQQMZ	BI V!5!DPPMOH!DPJMTVQQMZ!UFNQFSBUSVF	2	NBNBD	UF.814.D.8.B.2
6	BDDUFNQ	BI V5`DMH`SFUVSO	BI V!5!DPPMOH!DPJMSFUVSO!UFNQFSBUSVF	2	NBNBD	UF.814.D.8.B.2
7	WPMUBHF	BI V5`DMH`GMPX	BI V!5!DPPMOH!DPJMMRVJE!GMPX	2	POJDPO	POJG.2221
8	WPMUBHF	BI V5`DPJM EQ	BI V!5!DPPMOH!DPJMEJGGFSFOUJBMQSFTTVSF	2	UBD	FQQ213.MDE
9	WPMUBHF	BI V5`GJMUFS`EQ	BI V!5!GJMUFS!EJGGFSFOUJBMQSFTTVSF	2	UBD	FQQ213.MDE
:	BDDUFNQ	BI V5`FEI `UFNQ	BI V!5!FMFDUSJD!EVDU!I FBUFS!UFNQFSBUVSF	2	NBNBD	UF.813.C.8.E
21						
22						
23						
24						
25						
26						
27						

NPEVF!TMPU$; EJ27!Npe!7

QBOFM0EJO!SBJM; Nbdi !SN!21:

$	KPC!SFGFSFODF!$
2	
3	
4	
5	

TYX !EJ27!

JOQVUT

DI BO	UZQF	QPJOU!OBNF	!EFTDSJQUJPO	RUZ	EJTUSJCVUPS	QBSU!$
2	EJHJUBM	DI 2` DPNQ2` TUT	DI JMMFS!2!DPNQSFTTPS!2!TUBUVT	2	WFSJT	WFS.I 411
3	EJHJUBM	DI 2` DPNQ3` TUT	DI JMMFS!2!DPNQSFTTPS!3!TUBUVT	2	WFSJT	WFS.I 411
4	EJHJUBM	DI 2` GBO` TUT	DI JMMFS!2!DPOEFOTPS!GBO!TUBUVT	2	WFSJT	WFS.I 411
5	EJHJUBM	DI 2` BMBSN	DI JMMFS!2!BMBSN	2	DI 2!UFSNJOBM	DI 2!UFSNJOBM
6	EJHJUBM	DI 2` TNPLF	DI JMMFS!2!TNPLF!EFUFDUPS!TUBUVT	2	BQBD	M475.Q
7	EJHJUBM	HQ2` TUT	HZMDPMQVNQ!TUBUVT	2	WFSJT	WFS.I 411
8	EJHJUBM	HQ2` BMBSN	HZMDPMQVNQ!BMBSN	2	HQ2!UFSNJOBM	HQ2!UFSNJOBM
9	EJHJUBM	BI V3` GBO` TUT	BI V!3!GBO!TUBUVT	2	WFSJT	WFS.I 411
:	EJHJUBM	BI V3` TNPLF	BI V!3!TNPLF!EFUFDUPS	2	BQBD	M475.Q
21	EJHJUBM	BI V4` GBO` TUT	BI V!4!GBO!TUBUVT	2	WFSJT	WFS.I 411
22	EJHJUBM	BI V4` TNPLF	BI V!4!TNPLF!EFUFDUPS	2	BQBD	M475.Q
23	EJHJUBM	BI V5` GBO` TUT	BI V!5!GBO!TUBUVT	2	WFSJT	WFS.I 411
24	EJHJUBM	BI V5` TNPLF	BI V!5!TNPLF!EFUFDUPS	2	BQBD	M475.Q
25	EJHJUBM	JX 2` TUT	JDF!X BHPO!2!DPOEFOTPS!GBO!TUBUVT	2	WFSJT	WFS.I 411
26	EJHJUBM	JX 3` TUT	JDF!X BHPO!3!DPOEFOTPS!GBO!TUBUVT	2	WFSJT	WFS.I 411
27	EJHJUBM					

NPEVF!TMPU$; $SFG"

QBOFM0EJO!SBJM; Nbdi !SN!21:

$	KPC!SFGFSFODF!$
2	
3	
4	
5	

TYX !EP.23

PVUQVUT						
DI BO	UZQF	QPJOU!OBNF	!EFTDSJQUJPO	RUZ	EJTUSJCVUPS	QBSU!$
2	EJHJUBM	FG7`DNE	FYI BVTU!GBO!7!DPNNBOE	2	BQBD	Q.QBN.2
3	EJHJUBM	FG8`DNE	FYI BVTU!GBO!8!DPNNBOE	2	BQBD	Q.QBN.2
4	EJHJUBM	FG9`DNE	FYI BVTU!GBO!9!DPNNBOE	2	BQBD	Q.QBN.2
5	EJHJUBM	FG:`DNE	FYI BVTU!GBO!: !DPNNBOE	2	BQBD	Q.QBN.2
6	EJHJUBM	BI V5`FEI `DNE`T2	BI V!5!FMFDUSJD!EVDU!I FBUFS!DPNNBOE!T2	2	WFSJT	W211
7	EJHJUBM	BI V5`FEI `DNE`T3	BI V!5!FMFDUSJD!EVDU!I FBUFS!DPNNBOE!T3	2	WFSJT	W211
8						
9						
:						
21						
22						
23						

NPEVF!TMPU$; $SFG"

QBOFM0EJO!SBJM; Nbdi !SN!21:

$	KPC!SFGFSFODF!$
2	
3	
4	
5	

TYX !EP.GD.9.I

PVUQVUT

DI BO	UZQF	QPJOU!OBNF	!EFTDSJQUPO	RUZ	EJTUSJCVUPS	QBSU!$
2	EJHJUBM	DI 2`DNE	DI JMMFS!2!FOBCMF	2	BQBD	Q.QBN.2
3	EJHJUBM	HQ2`DNE	HMZDPMQVNQ!DPNNBOE	2	BQBD	Q.QBN.2
4	EJHJUBM	BI V3`DNE	BI V!3!GBO!DPNNBOE	2	BQBD	Q.QBN.2
5	EJHJUBM	BI V4`DNE	BI V!4!GBO!DPNNBOE	2	BQBD	Q.QBN.2
6	EJHJUBM	BI V5`DNE	BI V!5!GBO!DPNNBOE	2	BQBD	Q.QBN.2
7	EJHJUBM	BI V5`EFGSPTU	BI V!5!EFGSPTU!EBNQFS!DPNNBOE	3	UBD	NB51.8154
8	EJHJUBM					
9	EJHJUBM					

JOUFSMPDLT

EFTDSJQUPO	EFWJDFT!JOUFSMPDLFE	RUZ	EJTUSJCVUPS	QBSU!$
TNPLF!EFUFDUPS!	DI 2`FOBCMF-!)DPOEFOTPS!GBO*	2	WFSJT	WFS.DLJJ.WNE3C.G35B

NPEVF!TMPU$; VJ9!BP.5!Npe!:

QBOFM!0EJO!SBJM; Nbdi !SN!21:

$	KPC!SFGFSFODF!$
2	
3	
4	
5	

TYX !VJ9!0BP.5

JOQVUT						
DI BO	UZQF	QPJOU!OBNF	!EFTDSJQUJPO	RUZ	EJTUSJCVUPS	QBSU!$
2	BDDUFNQ	PTB`UFNQ`ESZ	PVUTJEF!BJS!UFNQFSBUVSF!ESZ	2	UBD	FUP611
3	BDDUFNQ	PTB`UFNQ`XFU	PVUTJEF!BJS!UFNQFSBUVSF!XFU	2	UBD	FUP611
4	BDDUFNQ	SN`213`UFNQ	SPPN!213!UFNQFSBUVSF	2	WFSJT	UF.I .2.1
5	WPMUBHF	TUBUJD`QSFTT	TUBUJD!QSFTTVSF	2	UBD	FQQ!213
6	WPMUBHF	DI JMMFS`2`TUT	DI JMMFS!2!TUBUVT	2	WFSJT	WFS.I 411
7	WPMUBHF	DI JMMFS`3`TUT	DI JMMFS!3!TUBUVT	2	WFSJT	WFS.I 411
8	WPMUBHF	DI JMMFS`GBVMU	DI JMMFS!GBVMU	2		
9	EJHJUBM	DI JMMFS`QPXFS	DI JMMFS!QPXFS	2		

PVUQVUT						
DI BO	UZQF	QPJOU!OBNF	!EFTDSJQUJPO	RUZ	EJTUSJCVUPS	QBSU!$
2	WPMUBHF	BI V3`DMH`DPJM	BI V!3!DPPMJOH!DPJM3!X BZ!WBMWF	2	UBD	WCC4O17, N224B11
3	WPMUBHF	BI V4`DMH`DPJM	BI V!4!DPPMJOH!DPJM3!X BZ!WBMWF	2	UBD	WCC4O18, N224B11
4	WPMUBHF	BI V5`DMH`DPJM	BI V!5!DPPMJOH!DPJM4!X BZ!NJYJOH!WBMWF	2	UBD	WCC4O18, N224B11
5	WPMUBHF					

Tfdujpo!5;!Tfr vfodf!pgP qfsbujpot!!

!

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Sequence of Operations

Cvjmejoh!I WBD!Tzt uf n !

!

Bjs!Dpprfhe!Di jmfns!DI .2!

!

!

Ef t dsjqujpo!pgFr vjqn f oul

!

- ! Bjs!Dpprfhe!Di jmfns!

!

!

Tdi f evrh!pgpqf sbujpo!

!

- ! Di jmfns!$2!ti bmmcf !f of shj{ f e!x i f o!tf ot ps!joejdbuf t!gpx !pgdi jmfhe!x buf s/!
  !

!

Dpouspmh Tf r vf odf !

!

- ! Ui f !Fr vjqn f oult i bmmtubsuljo!ui f !gpmpx joh!tf r vf odf !x ju !b!21!tf dpoe!ef mbz!cf ux f f o!f r vjqn f oul hspvqt ;!
- ! Bjs!I boerjoh!VojuBI V.3-!4-!boe!5!ti bmmcf !f obcmfhe!cz!tubsujoh!tf r vf odf /!
- ! Fyi bvtulgpo!FG.7!boe!FG.8/!
- ! Hmzdpmh Qvn q!HQ.2/!
- ! Di jmfns!DI .2!Ti bmmcf !f obcmfhe!cz!tubsujoh!tf r vf odf /!!Di .2!ti bmmcf !f of shj{ f e!jgdi jmfhe!x buf s! tf ot ps!joejdbuf t!di jmfhe!x buf sljt !gpx joh/!
- ! Cvjmejoh!i pvst!pgpqf sbujpo!bsf !gspn !: ;11!BN !up!5;11!QN !N poebz!ui spvhi !Gsjebz/!
- ! Bgufs!b!qpx f s!pvubhf !sf tubsut i bmmcf !epof !n bovbmz/!Pqf sbups!t i bmmwf sjgz!ui bufr vjqn f oul i bt !opu t vtubjof e!ebn bhf !up!qpx f s!pvubhf !cz!pct f swjoh!f r vjqn f oulbgufs!sf tubsu/!
- ! Di jmfhe!x buf slmfbwjoh!tf ulqpjoulpg21≤G/!

NASA Rnfrared Telescope Facility
Mauna Kea
NAVFAC, Hawaii

! !

Sequence of Operations

Cvjmejoh!I WBD!Tztufn !

!

Bjs!I boemfs!Voju!BI V.5!

!

!

Eftdsjqujpo!pg!Frvjqnfou!

!

- Bjs!I boemfs!BI V.5!

!

Tdifevmf!pg!pqfsbujpo!

!

- Efgspt!Tfrvfodf!pg!Dpouspmh

!

Dpouspm!Tfrvfodf!

!

- Efgspt!Dzdmf!ïPoñ
  !
- BI V!dppmjoh!dpjm!ejggfsfoujbm!qsfttvsf!txjudi!epxotusfbn!pg!dpjm!tfotft!bjs!gmpx!cmpdlbhf!evf!up jdf!bddvnvmbujpo!boe!jojujbuft!uif!gpmmpxjoh!tfrvfodf;!
- Dijmmfe!xbufs!cz.qbtt!wbmwf!pqfot!tupqqjoh!xbufs!gmpx!uisv!uif!dpjm/!
- Cz.qbtt!evdu!npups!{fe!ebnqfst!pqfot!bmmpxjoh!bjs!gmpx/!
- Tvqqmz!bjs!evdu!npups!{fe!ebnqfst!dmptft!tupqqjoh!bjs!gmpx/!
- Cz>qbtt!fmfdusjd!evdu!ifbufs!jt!fofshj{fe!gps!ifbujoh/!
- Fmfdusjd!evdu!ifbufs!nbyjnvn!svo!ujnf!sftfu!boe!tubsut!dpvoujoh/!
- BI V!tvqqmz!gbo!sfnbjot!po!evsjoh!uif!efgspt!dzdmf/!
- I fbufs!Nbyjnvn!svo!ujnf!sf!I jmmt!ifbufs!qpxfs!jg!nbyjnvn!svo!ujnf!jt!fydffefe!evf!up!gbjmfe! ufnqfsbuvsf!tfotps/!
  !
- Efgspt!Dzdmf!ïPggñ
  !
- BI V!dppmjoh!dpjm!ufnqfsbuvsf!txjudi!tfotft!dpjm!ibt!cpwf!gsff{joh!joejdbujoh!jdf!bddvnvmbujpo! nfmufe!boe!jojujbuft!uif!gpmmpxjoh!tfrvfodf;!
- Cz.qbtt!fmfdusjd!evdu!ifbufs!ef.fofshj{fe/!
- Tvqqmz!Bjs!evdu!npups!{fe!ebnqfst!pqfot!bmmpxjoh!bjs!gmpx/!
- Cz.qbtt!evdu!npups!{fe!ebnqfst!dmptft!tupqqjoh!bjs!gmpx/!
- Dijmmfe!xbufs!Cz.qbtt!wbmwf!pqfot!bmmpxjoh!xbufs!gmpx!uisv!uif!dpjm/!
- Fmfdusjd!evdu!ifbufs!nbyjnvn!svo!ujnf!sf!ef.fofshj{fe/!
- Bgufs!b!qpxfs!pvubhf!sftubsu!tibmm!cf!epof!nbovbmmz/!Pqfsbups!tibmm!wfsjgz!uibu!frvjqnfou!ibt!opu tvtubjofe!ebnbhf!up!qpxfs!pvubhf!cz!pctfswjoh!frvjqnfou!bgufs!sftubsu/!
- BI V.5-!Pctfswbujpo!Epnf!Sppn!233!tfuqpjou!pg!81≤G/!
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Sequence of Operations

Cvjmejoh!I WBD!Tztufn !

!

Bjs!I boernfs!VojuBI V.3-4!

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!

Efdsjqujpo!pgFrvjqnfou

!

- ! Bjs!I boernfs!BI V.3-4!
  !

Tdifevrn!pgpqfsbujpo!

!

- ! Efgsptu!Tfrvfodf!pgDpousprn

!

Dpousprn!Tfrvfodf!

!

- ! Efgsptudzdrn!ïPofl
  !
- ! BI V!dppsjoh!dpjmejggfsfoujbrnqsfttvsf!txjudi!epxotusfbn!pgdpjmfnfotf t!bjs!gpx!cmpdl bhf!evf!up jdf!bddvn vmujpo!boe!jojujbuf t!ui f!gpmpx joh!tfrvfodf ;!
- ! Di jmfne!xbufs!cz.qbtt!wbwf!pqfot!tupqqjoh!xbufs!gpx!ui sv!ui f!dpjmfl
- ! Cz.qbtt!evdun pupsj{fe!ebn qfst!pqfot!bmpx joh!bjs!gpx /!
- ! Tvqqnz!bjs!evdun pupsj{fe!ebn qfst!dmptf t!tupqqjoh!bjs!gpx /!
- ! Cz>qbtt!frndusjd!evduifbufs!jt!fofshj{fe!gpsifbujoh/!
- ! Frndusjd!evduifbufs!n byjn vn!svo!ujn fsfsf tfut!boe!tubsut!dpvoujoh/!
- ! BI V!tvqqnz!gpo!sfn bjot!po!evsjoh!uifef gsptudzdrn/!
- ! Ifbufs!N byjn vn!svo!ujn fs!jmnl!ifbufs!qpxfsljgn byjn vn!svo!ujn f!jt!fydffef e!evf!up!gpjmfne! ufn qfsbuvsf!tfotps/!
  !
- ! Efgsptu!Dzdrn!ïPggfl
  !
- ! BI V!dppsjoh!dpjmfufn qfsbuvsf!txjudi!tfotf t!dpjmfbcpwf!gsff{joh!joejdbujoh!jdf!bddvn vmujpo! n fnfe!boe!jojujbuf t!ui f!gpmpx joh!tfrvfodf ;!
- ! Cz.qbtt!frndusjd!evduifbufs!ef.fofshj{fe/!
- ! Tvqqnz!Bjs!evdun pupsj{fe!ebn qfst!pqfot!bmpx joh!bjs!gpx /!
- ! Cz.qbtt!evdun pupsj{fe!ebn qfst!dmptf t!tupqqjoh!bjs!gpx /!
- ! Di jmfne!xbufs!Cz.qbtt!wbwf!pqfot!bmpx joh!xbufs!gpx!ui sv!ui f!dpjmfl
- ! Frndusjd!evduifbufs!n byjn vn!svo!ujn fsfef .fofshj{fe/!
- ! Bgfsb!qpxfsljpvubhf!sftubsuti bmfcf!epof!n bovbmz/!Pqfsbupsti bmfwfsjgz!ui bufr vjqnfou!i bt!opu tvtubjofe!ebn bhf!up!qpxfsljpvubhf!cz!pctfswjoh!frvjqnfoubgfsfsftubsu!
- ! BI V.3-4!tfuqpjoupg81≤G/!

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Sequence of Operations

Cvjmejoh!I WBD!Tztufn !

!

Jdf !X bhpo!Fyi bvtuGbot !FG.9!boe!FG.: ;!

!

- ! FG.9!boe!FG.: !pqfsbuf!dpoujovpvtmz!35!ipvs!08!ebzt!qfs!xffl/!
  !
- ! Fyi bvtugbo!FG.9!tfswjoh!ïTpvui ñJdf !X bhpo.2!)JX .2*;!
- ! Qspwjef !I boe.PggBvup!Txjudi /!!Bvup!ti bmmcf !jouf smpdl fe!xju !JX .2!dpoefotfs!gbo/!!FG.9!ti bmm fof shj{f!xi fo!JX .2!dpoefotfs!gbo!jt!fof shj{fe/!
  !
- ! Fyi bvtugbo!FG.: !tfswjoh!ïOpsui ñJdf !X bhpo!.3!)JX .3*;!!Qspwjef !I boe.PggBvup!Txjudi /!!Bvup! ti bmmcf !jouf smpdl fe!xju !JX .3!dpoefotfs!gbo/!!FG.: !ti bmmfi of shj{f!xi fo!JX .3!dpoefotfs!gbo!jt! fof shj{fe/!
- ! Qspwjef !FG.: !Fyi bvtu!tztufn !xju !b!n bovbmfebn qfs!tx judi /!!Ui f !ebn qfs!tx judi !ti bmmdmpt f ! n pupsj{fe!ebn qfst!)NE*!buJX .3!boe!pqfo!NE!buOFTMBC!di jmfns!fyi bvtu!evdu/!

!

Fyjtujoh!Jdf !X bhpo!Gvodujpo;!!

!

- ! ïTpvui ñJdf !X bhpo.2!)JX .2*!Qspwjef t!di jmfne!xbufs!up!i f bu!fydi bohfst!n pvouf e!po!ui f !ufmfnt dpqf ! xi jdi !dppmf!fmfduspojdt!sbdl t/!!X i fo!ui fsf!jt!b!gbjmvsf!pgui f !JX .2!vtfs!sf n pwf t!ui f !dpwfst!gspn ! ui f !fmfduspojdt!sbdl t!boe!bmpx t!ui f !sppn !bjs!up!dppmui f !fr vjqn fou!vojmfsf qbjst!bsf!dpn qmfuf e/! !
- ! ïOpsui ñJdf !X bhpo.3!)JX .3*!Qspwjef t!di jmfne!xbufs!up!dppmdszp!dpn qsf t tpst!jo!ui f !n bdi jof !sppn ! xi jdi !jo!uvso!qspwjef t!dppmjoh!up!jotusvn fout/!!Ui fsf!bsf!ux p!fyjtujoh!CFTMBC!I Y411!hmzdpmh di jmfnst!ui bu!tfswf!bt!cbdl vq!up!JX .3!pomz/!!X i fo!ui fsf!jt!b!gbjmvsf!pgJX .3!vtfs!wbmwf t!pgui f !JX . 3!boe!tx bq!i pt f t!gspn !ui f !ux p!OFTMBC!I Y411!hmzdpmdi jmfnst!boe!dpoof dut!up!ui f !dszp! dpn qsf t tpst!x i jdi !dpoof dutup!JX .3!di jmfne!xbufs!qjqjoh!i pt f !foe!wbmwf t!boe!qspwjef t!dppmjoh!up! jotusvn fout/!!B!tf qbsbuf mz!wbmwf !di jmfne!xbufs!csbodi !mjof !gspn !of x !di jmfns!DI .2!di jmfne!xbufs! tztufn !dpoof dut!up!JX .3!qjqjoh!boe!tfswf t!bt!bo!beejujpobmfi n fshf odz!cbdl .vq/!

!

Tqbdf!I fbujoh!Dpouspm!

!

- ! Dpoefotfs!Bjs!WBW!Ufsn jobmVojut!UV.B2!boe!UV.C2!xjmmcf !dpouspmfne!cz!fyi bvtu!bjs! ufn qfsbuvsf!tfotps!buFG.7!boe!FG.8!sft qfdujwf mz/!!Tfuufn qfsbuvsf!tfotps!bu81!G/!!Ui f ! n jojn vn !DGN!gps!fbdi !ufsn jobmVojut!i bmmcf !tfugps!41&!eftjho!DGN/!
- ! Ui f !Cz.qbtt!dpoefotfs!bjs!WBW!ufsn jobmVojut!UV.C3!boe!UV.C4!xjmmcf !dpouspmfne!cz!ui f !EEDT/!! Bt!mpoh!bt!ui f !hmzdpmdi jmfns!jt!fobcmfne!ui f !EEDT!xjmmdpoujovpvtmz!n pojups!boe!upubmj{f!ui f !UV.B2! boe!UV.C2!DGN/!!Efevdu!ujt!gspn !ui f !ui f !di jmfns!dpoefotfs!gbo!upubmDGN!boe!ejtdi bshf!ui f ! fydftt!bjs!ui spvhi !fyufsjps!mpvwfst!po!ui f !opsui !tjef !pgui f !cvjmejoh!wjb!UV.C3!boe!UV.C4/!
- ! Gps!Tn pl f !Efufdups!)TNE*!tfft!tdi fn bujd!joufsmpdl !ejbhsbn !B50N.715/!
- ! Dbcjof!I fbufs!Tfrvfodf!pgP qfsbujpo;!
- ! Tfu!Dbcjof!I fbufs!ui fsn pt ubu4!efhsfft!mpxfs!ui bo!ui f !dpoefotfs!bjs!i fbujoh!tztufn /!!Fof shj{f! fmfdusjd!dbcjof!ui fbufs!pomz!xi fo!dpoefotfs!bjs!i fbujoh!tztufn !jt!opu!dbqbcmf!pgn bjoubjojoh!tfu qpjou!ufn qfsbuvsf!)81!G*/!
- ! UV!dpppjoh!tfu!qpjou!pg81≤G!
- ! Wfmpdjuz!tfu!qpjout<UV.B2!n jo!3641!dgn -!n by!4771!dgn ! !!!!!UV.C20C3!n jo!631106586!dgn -!n by!7111!dgn /!! !!!!!UV.C4!n jo!4771!dgn -!n by!7111!dgn /!