



**GCS**

**Global Control Solutions**

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**Basyx**

**Installation Standards**

**System Installation Standards**

INS-STD Revision 1.1

02/01/2015

## GLOBAL CONTROL SOLUTIONS - INSTALLATION STANDARDS

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## **GLOBAL CONTROL SOLUTIONS - INSTALLATION STANDARDS**

### **SECTION 1.0 GENERAL**

#### **1.1 GENERAL**

- 1.1.1 This Section applies to all Control Installation Standard sections. Conditions and materials are pertinent to other sections if repeated in those sections.
- 1.1.2 Contractor will provide all conduit, wiring, tubing, fittings etc. to make the connections as specified by the project specifications and engineering.
- 1.1.3 Contractor must sign the agreement to provide material and workmanship in compliance with all GLOBAL CONTROL SOLUTIONS engineering and installation standards.
- 1.1.4 Install all work in accordance with the National Electrical Code, State and Local Codes and Project Specifications.
- 1.1.5 If GLOBAL CONTROL SOLUTIONS is required to perform a startup, Contractor will supply at minimum one installer that was present for the entire job to assist every day of startup as requested.
- 1.1.6 Contractor must protect all materials supplied by GLOBAL CONTROL SOLUTIONS using job boxes, or secure enclosures.

#### **1.2 INSTALLATION COORDINATION**

- 1.2.1 The Contractor will keep a daily project log. The project log will contain the following information recorded daily:
  - 1.2.1.1 Installation activities
  - 1.2.1.2 Work force information
  - 1.2.1.3 Delays due to inclement weather
  - 1.2.1.4 Delays due to other contractors
  - 1.2.1.5 Delays due to equipment delivery schedule conflicts
  - 1.2.1.6 Project problems
  - 1.2.1.7 Scheduling changes: See the Daily Project Log Form [Section 8.3](#)
- 1.2.2 The Contractor will take the following steps when coordinating locations of the control enclosures and devices:
  - 1.2.2.1 In the job meeting and prior to mounting the enclosures, coordinate the enclosure and device locations with all affected trades present for approval.
  - 1.2.2.2 Submit device enclosures and location changes to GLOBAL CONTROL SOLUTIONS engineering for approval prior to panel mounting.
- 1.2.3 The Contractor will be responsible of informing GLOBAL CONTROL SOLUTIONS, in a timely fashion, of project and schedule changes resulting from project meetings, and discussions.

### 1.3 QUALITY CONTROL

1.3.1 Contractor will be required to perform Level I Commissioning – Pre-Functional Performance Testing. Refer to Section 5 Systems Checkout and Commissioning Standards - Level I

1.3.1.1 The Contractor will be required to complete the Pre-Functional Performance Testing document to verify that each point in the system is both present and installed correctly per the installation standards.

1.3.1.2 The Contractor will be required to submit the Pre-Functional Performance Testing document to GLOBAL CONTROL SOLUTIONS Quality Assurance for approval. Scheduling of additional start up will be contingent of proper execution of Level I Commissioning – Pre-Functional Performance Testing.

### 1.4 CONTRACTOR REQUIREMENTS

1.4.1 The Contractor will conform to the following standards:

1.4.1.1 The Contractor must have a Contracting License issued by the State Construction Licensing Board as required by the state the work is being performed.

1.4.1.2 The Contractor must obtain general liability insurance for the amount dictated by the contract documents.

1.4.1.3 The Contractor must have a worker's compensation program in place to comply with local, state and federal statutes.

1.4.1.4 The Contractor must have a drug free work environment program in effect.

1.4.1.5 The Contractor must provide copies of approved licenses and permits to GLOBAL CONTROL SOLUTIONS

1.4.1.6 The Contractor must have in place a Fall Safety program.

1.4.1.7 The Contractor must have in place a General Safety plan.

1.4.1.8 The Contractor must have in place a Confined Space Program.

1.4.1.9 The Contractor must have in place a Lockout/Tagout program.

1.4.1.10 The Contractor must complete and submit the Accident Investigation Report to GLOBAL CONTROL SOLUTIONS within one week of accident occurrence. See the *Accident Investigation Report* [Section 8.4](#).

## **SECTION 2.0 INSTALLATION METHODOLOGY**

### 2.1 RACEWAYS

2.1.1 Install raceways to meet the following standards:

2.1.1.1 Install raceways level, perpendicular, and parallel to building surfaces.

2.1.1.2 Check all raceways in exposed areas with a level for proper installation.

2.1.1.3 Support raceways installed within the ceiling spaces and on bar joists with approved devices as required by NEC. Hanger wire or wire ties are NOT acceptable.

2.1.1.4 The installer is responsible for installing Uni-Strut for mounting and hanging the raceway when more than three raceways run parallel to one another.

- 2.1.1.5 When using floor flanges, they must be supported with rigid conduit up to structure.
- 2.1.1.6 LB, LL, LR and LT conduit bodies will be used for going around corners and/or wall penetrations, which change directions. Splices with wire nuts and appropriate strain relief will be allowed in condulets.
- 2.1.1.7 Install all cabling in exposed areas in conduit.
- 2.1.1.8 Use liquid tight conduit with all cabling installed in mechanical equipment rooms or exterior areas.
- 2.1.1.9 Flexible conduit will be limited to 18inch in length.
- 2.1.1.10 Do not use flexible conduit as a primary raceway.
- 2.1.1.11 Use flexible conduit for vibration isolation when installing conduit on or in machines that utilize vibration isolators or flexible transitions.
- 2.1.1.12 Use PVC or rigid conduit on all cabling installed underground or in slabs.
- 2.1.1.13 Use rigid conduit at the point of entry for all raceway installed underground or in slabs.
- 2.1.2 The installing Contractor must not exceed the 60% amount of cables in conduit to adhere to GLOBAL CONTROL SOLUTIONS standards. See the *Conduit Maximum Fill Chart* [Section 8.1](#)
- 2.1.3 The installing Contractor must provide spare cable at a ratio of 5:1. Example: For every five cables to a device, there must be one spare cable provided. Accordingly, for every 10 cables to a device, there must be two spare cables provided.
- 2.1.4 The installing Contractor must provide pull strings in any conduit 1 ¼ inches or larger. Furthermore, to prevent inadvertent string loss, the installing Contractor must secure all pull strings at each end of the conduit.
- 2.1.5 As a minimum, strap and support all raceways per NEC. Install additional strapping to ensure the straps are within 8 inches of any enclosure or end device.
- 2.1.6 Conduit connectors must incorporate insulated bushings or insulated throat.
- 2.1.7 Interior conduit connectors will be screw type unless specified otherwise by job specifications.
- 2.1.8 Protect all cabling entering or leaving an enclosure or device with an insulated bushing or strain relief box connector.
- 2.1.9 Acceptable types of raceways include:
  - 2.1.9.1 Conduit – Rigid
  - 2.1.9.2 Conduit – EMT
  - 2.1.9.3 Conduit – Liquid Tight
  - 2.1.9.4 Conduit – Flexible
  - 2.1.9.5 Conduit – PVC
  - 2.1.9.6 All penetrations in walls will be made with the appropriate size drill or hole saw. The wall penetrations will be sleeved with conduit and sealed for both fire and weather. All floor penetrations larger than one inch will be made with a core boring drill. All roof penetrations must be supported to building structure.

## 2.2 JUNCTION BOXES

- 2.2.1 Junction boxes will be installed at a minimum of one box for every 100-foot run of raceway.
- 2.2.2 Use conduit bodies for routing around corners and/or wall penetrations that necessitate raceway change direction.
- 2.2.3 Junction boxes must be mounted in accessible areas.
- 2.2.4 All junction box knock out holes must be plugged.

## 2.3 PLENUM WIRING

- 2.3.1 NEC recommended fire rated plenum cable is acceptable for low voltage cabling in return or supply air spaces.
- 2.3.2 Sleeve all wall and floor penetrations, seal sleeves for fire and weather.
- 2.3.3 All cable installed in a plenum area will be routed along and strapped every six feet to building steel, raceways, etc. It is not acceptable to install plenum cable supported by ceiling grid or lying on the floor in a raised floor area.
- 2.3.4 Install all cabling in mechanical rooms or other exposed areas in a raceway.

## 2.4 EXTERIOR MATERIALS

- 2.4.1 Use exterior rated materials for all raceways and junction boxes.
- 2.4.2 Use exterior rated materials for all raceway connectors.
- 2.4.3 Seal all unused holes and knockouts to conform to NEMA rating.
- 2.4.4 Use exterior rated materials for all mounting systems.
- 2.4.5 Acceptable types of exterior raceways include:
  - 2.4.5.1 Conduit – Rigid
  - 2.4.5.2 Conduit – Liquid Tight
  - 2.4.5.3 Conduit – PVC

## **SECTION 3.0 CONTROL PANEL ENCLOSURES**

### 3.1 LOCATION

- 3.1.1 The engineering drawings depict general panel locations. The installer is responsible for coordination of exact panel mounting location.
- 3.1.2 Installer is responsible for providing exact coordinated panel locations to GLOBAL CONTROL SOLUTIONS engineering prior to mounting.

### 3.2 COORDINATION

- 3.2.1 Proper coordination of Control Panel locations includes the following steps:
  - 3.2.1.1 Initiate panel mounting exact location topic in formal job meeting ensuring that the discussion is included in the job meeting minutes.
  - 3.2.1.2 Obtain approval in writing (marked on floor plans) of exact panel locations as agreed upon with all effected trades and general contractor.

3.2.1.3 Submit exact coordinated panel locations in writing (marked on floor plans) to GLOBAL CONTROL SOLUTIONS engineering for approval prior to mounting.

3.2.2 Proper coordination of Control Panel terminations includes the following step:

If not defined in division 16 of the project specifications, obtain in writing from the contract chain which contractor is responsible for supplying power wiring circuits (greater than 30 VAC) from power distribution panels to control panels (FMP's) or other control devices as applicable.

### 3.3 ACCESSIBILITY

3.3.1 Install each panel to have a minimum of 6-inches clearance on each side and 3-foot clearance in front of the panel.

### 3.4 CONNECTIONS

3.4.1 Installer must install a wire trough raceway when two or more panels are adjacent to one another.

3.4.2 Installer must install a wire trough raceway when more than four raceways connect to one panel.

### 3.5 MOUNTING

3.5.1 Unless otherwise specified or coordinated, control panels will be:

3.5.1.1 Mounted to match the height of existing control panels installed on the site.

3.5.1.2 When no control panels exist on site, mount control panels 6'6" AFF to the top of panel.

3.5.2 Use Uni-Strut to mount control panels on dry wall.

3.5.3 Panels will be mounted level, perpendicular to floors and parallel to the building surfaces.

3.5.4 Check all panels with a level for proper installation.

3.5.5 Mounting fasteners

3.5.5.1 Use Toggle bolts to mount panel and strut on drywall and hollow block walls.

3.5.5.2 Use ¼-inch wedge anchors to mount panels and strut on concrete walls and floors.

### 3.6 EXTERIOR MOUNTING

3.6.1 Use exterior rated materials for all enclosures mounted outside the building.

3.6.2 Seal all unused holes and knockouts with exterior rated materials.

3.6.3 No penetrations are acceptable on the top of enclosures mounted exteriorly.

## **SECTION 4.0 FIELD CABLING**

### **4.1 CABLE SPECIFICATIONS**

4.1.1 All cables must be shown on GC project specific design & installation drawings.

### **4.2 CABLE LABELS**

4.2.1 Contractor will provide identical type cable labels at each cable termination point using an approved tagging system comparable to the Brady I.D. Pro Plus electronic labeling system or equivalent.

4.2.2 Cable label information is available on the most recent set of GLOBAL CONTROL SOLUTIONS Submittal/Shop drawings.

4.2.3 Install cable labels upon completion of Commissioning Standards -Level 1.

4.2.4 Label spare cables with “to” and “from” indication tags.

### **4.3 TERMINATION**

4.3.1 Installer is responsible to adhere to the following GLOBAL CONTROL SOLUTIONS cable stripping practices for multiple conductor cables:

4.3.1.1 When stripping multi-conductor cables, use only strippers specifically designed for removal of outer sheath insulation so as not to damage the shielding or insulation of the conductors. Use Ideal Catalog #45-514 or #45-165 data cable strippers or equivalent.

4.3.1.2 Do not strip outer jacket more than is required to expose adequate wire length for termination. For cables with shielding, isolate the cable's shield and apply “heat shrink” or electrical tape to the point where the outer jacket is removed from the cable.

4.3.1.3 Use the proper gauge wire strippers for stripping wires.

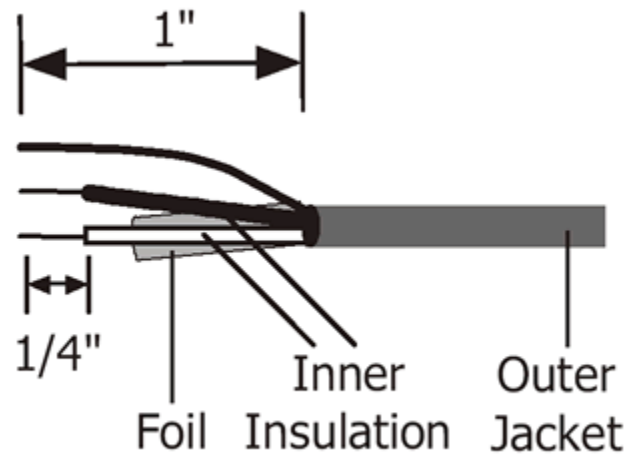
4.3.1.4 Remove enough inner insulation to ensure termination will have full contact with the conductor and not contact the inner insulation.

4.3.1.5 Do not remove excessive insulation from wire that may leave the potential for the conductor to be exposed to other conductors or ground.

4.3.1.6 When terminating multiple drain or shield wires to a common termination point, the installer is required to twist the drain or shield wire.

4.3.1.7 Trim excessive wire to ensure an aesthetically pleasing installation.





- 4.3.2 Installer is required to check each termination for proper contact of conductor and to ensure wire insulation is not in contact with termination point.
- 4.3.3 Check all terminations to ensure a securely fastened conductor to the terminal. The installer pulling on each conductor after termination is completed accomplishes this task.
- 4.3.4 Installer will ensure all strands of wire are secure under termination point. No loose strands of wire are acceptable.
- 4.3.5 Installer will install solder-less terminal (fork terminals) connectors when terminating to screw type connectors unless connector is specifically designed for termination of stranded wire.
- 4.3.6 All shields will be trimmed and isolated in the field and properly grounded in the control panel enclosure.

#### 4.4 SPLICING

- 4.4.1 Pull all cables and wires from point of origin to final termination point with no splices.
- 4.4.2 Splicing will be acceptable only in control panel enclosures with the use of terminal blocks.

### SECTION 5.0 CONTROL/MONITORING DEVICES

#### 5.1 MOUNTING

- 5.1.1 Securely mount devices per manufacturer specification.
- 5.1.2 Mount all devices in a location that is isolated from vibration.
- 5.1.3 Mounting location will be consistent with device NEMA rating. All devices mounted in areas that exceed the manufacturer NEMA rating for the device will require additional enclosures.
- 5.1.4 Installing contractor is responsible for coordination with the mechanical contractor for the temperature sensor well location installation. (See Installation Details Addendum of Drawing Set).
- 5.1.5 When Low Limit and Averaging sensors extend across areas greater than 5', they shall be supported in the middle using tie wraps or other securing devices. M68

capillary clips shall be used on the ends. Use insulating ¼" poly tubing when capillary comes in contact with dissimilar metals.

## 5.2 CONNECTION

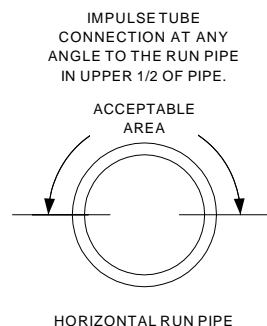
- 5.2.1 All conduit connected to end devices will have as a minimum flexible conduit 8 inches in length installed from the end of solid conduit to the end device to provide serviceability.
- 5.2.2 Install insulated bushings to protect all cabling entering or leaving a device.
- 5.2.3 Install a strain-relief box connector for all cabling entering or leaving end devices not installed in conduit.
- 5.2.4 It is not acceptable to use the termination enclosure of any end device as a junction box for any other device.
- 5.2.5 No wires other than wires terminated to a device are acceptable in a device termination enclosure.

## 5.3 WIRE TERMINATION

- 5.3.1 Refer to Section 4.3

## 5.4 PRESSURE SAMPLING TUBING CONNECTION

- 5.4.1 Connect impulse tubing per manufacturer specification.
- 5.4.2 Installer will use tubing as specified by project specifications and engineering.
- 5.4.3 Unless otherwise specified the installer will use hard copper tubing for all applications exceeding 30 inches in length or 30 PSI.
- 5.4.4 Unless otherwise specified the installer will use flame-retardant, stress crack resistant Polyethylene for flexible tubing applications.
- 5.4.5 Installer will install loops in rigid piping runs to alleviate expansion and vibration.
- 5.4.6 Liquid Sensing Impulse Tubing
  - 5.4.6.1 Installer will provide isolation valves at the pipe tap for all liquid sensing impulse tubes.
  - 5.4.6.2 All liquid sensing impulse tubes will be hard copper with compression or flare connections.
  - 5.4.6.3 All liquid sensing impulse tubing connections to main piping will be installed in the upper half of the pipe.



#### 5.4.7 Vapor Sensing Impulse Tubing

- 5.4.7.1 Installer will install an 8-inch minimum length flexible tubing from the end device to stationary tubing for vapor pressure sensing devices for serviceability.

### 5.5 DEVICE SPECIFIC INFORMATION

- 5.5.1 Refer to the Installation Details Addendum of Drawing Set for specific mounting and termination information.

## **SECTION 6.0 AS-BUILT DRAWINGS**

### 6.1 REQUIRED INFORMATION

- 6.1.1 The Contractor will provide to GLOBAL CONTROL SOLUTIONS the following information in regards to as-built drawings:
  - 6.1.1.1 Provide all field-coordinated as-built changes to the control system.
  - 6.1.1.2 Exact conduit routing for conduit routed in the ground or in the concrete pad.
  - 6.1.1.3 Exact panel locations.
  - 6.1.1.4 For field devices that have a change of location, show the exact revised location.
  - 6.1.1.5 All network address information, i.e. I.P. addresses, MAC address, Subnet Mask etc.
  - 6.1.1.6 All module address changes.
  - 6.1.1.7 Complete all termination information not shown on drawings.
  - 6.1.1.8 Provide accurate communication routing information if changes have occurred.

### 6.2 SUBMITTING

- 6.2.1 Contractor will submit As-Built drawings in the following manner.
  - 6.2.1.1 Drawings shall include only as-built information and no other marks
  - 6.2.1.2 Denote all as-built markings in red ink.
  - 6.2.1.3 All as-built markings must be clear and legible.
  - 6.2.1.4 Contractor will supply one set of as-built marked drawings with no duplicate pages.
  - 6.2.1.5 Contractor will keep one copy of as-built drawings at job site and available for review until completion of project.

## **SECTION 7.0 SPECIAL REQUIREMENTS FOR RENOVATION WORK**

### 7.1 DEMOLITION

- 7.1.1 Contractor will perform demolition work in a proper manner as detailed in job specifications.
  - 7.1.1.1 Loosen all screws and fasteners to remove panels and devices rather than using a prying tool.

7.1.1.2 Remove all unused existing equipment, wire and conduit from the job site unless otherwise specified per the contract document.

## 7.2 ABANDONED EQUIPMENT

7.2.1 Contractor will adhere to the following practices regarding abandoned equipment.

7.2.1.1 Secure unused conduit and boxes not removed with a cover and tag to identify area and date of abandonment.

7.2.1.2 Check for power source on abandon wire and remove termination to power source.

7.2.1.3 Isolate abandon cable and insulate the ends by taping, coiling, and securing.

7.2.1.4 Tag any cabling not removed to identify area and date of abandonment.

## 7.3 SCHEDULING

7.3.1 Contractor shall meet with Contractor and other appropriate parties before starting its work to agree on the start time, how to attain access permission, and other factors regarding access to occupied areas.

7.3.2 Contractor will schedule with all appropriate parties all utility service interruptions that may affect occupied areas of the building.

## 7.4 DEVICES

7.4.1 Any or all devices will be removed from the job site unless otherwise specified per the contract document or specified to be turned over to the parties designated by the Contractor.

## 7.5 USE OF INSTALLED WIRING AND DEVICES

7.5.1 If Sub-contract requires or permits the use of wiring and devices previously installed, Contractor will verify the integrity and proper operation of such devices and wiring prior to starting Level III Commissioning. Contractor will report in a timely manner any faults or defects in such wiring and devices to Contractor for disposition instructions. Failure to report such faults and defects to Contractor in a timely manner will result in Contractor being required to replace unreported defective wiring and devices at its own expense.

## 7.6 ADDITIONAL REQUIREMENTS

7.6.1 Contractor will refer to contract document for any additional requirements or specifications regarding demolition of existing equipment.

## SECTION 8.0 TABLES AND FORMS

### 8.1 CONDUIT MAXIMUM FILL CHART

<b>Conduit Maximum Fill Chart</b>									
Maximum quantities of cable recommended to prevent wire damage and meet electrical code.									
Cable Type	O.D."	Area"	40 % Fill			60% Fill			
			1/2"	3/4"	1"	1/2"	3/4"	1"	
	Useable conduit area		0.12	0.21	0.35	0.18	0.320	0.52	
1	12 AWG THHN	0.118	0.01	11	19	31	16	29	47
2	14 AWG THHN	0.102	0.01	15	26	43	22	39	64
3	16 AWG THHN	0.100	0.01	15	26	43	22	39	64
4	18/2 AWG Twisted Pair Unshielded Plenum	0.154	0.02	6	11	18	9	16	27
5	18/2 AWG Twisted Pair Shielded Plenum	0.154	0.02	6	11	18	9	16	27
6	18/3 AWG Twisted Unshielded Plenum	0.165	0.02	5	10	16	8	15	24
7	18/4 AWG Twisted Unshielded Plenum	0.185	0.03	4	7	12	6	11	19
8	22/2 AWG Twisted Shielded Pair Plenum	0.144	0.02	7	13	21	11	19	32
9	22/4 AWG -Multi-conductor Unshielded Plenum	0.137	0.02	8	14	23	12	21	34
10	18/4 AWG Twisted Shielded Double Pair Plenum	0.195	0.03	4	7	11	6	10	17
11	22/4 AWG -Twisted Shielded Double Pair Plenum	0.190	0.03	4	7	12	6	11	18
12	One pair 14AWG and 1 pair 22AWG Plenum	0.365	0.11	1	2	3	1	3	4
13	One pair 14AWG and 1 pair 22AWG Plenum	0.395	0.12	0	1	2	1	2	4
14	24/8 AWG CAT 5 Enhanced	0.180	0.03	4	8	13	7	12	20
15	Tight Buffered Tube cable 6, Multi-mode 63,5/125um	0.220	0.04	3	5	9	4	8	13

#### Wiring Standards

- The following wire types and colors will be used as specified:

##### Panel Wiring

Black #12awg THHN	120VAC Hot
White #12awg THHN	120VAC Neutral
Green #12awg THHN	Earth Ground
Red #12awg THHN	Switched AC Hot
Red #18awg THHN	24VAC Hot & Switched DO's
Black #18awg THHN	24VAC Common
White #18awg THHN	Analog Outputs (AO's)
Blue #18awg THHN	+24VDC
Black #18awg THHN	OVDC (Common)

##### Field Communication/Control Wiring

Control & Sensor Cable - #18-2 TSP (Red & Black), white jacket Metro Wire & Cable MWC-5190 or approved equal.

RJ485 Network Cable - #18-2 TSP (Black & White), green jacket Metro Wire & Cable MWC-5190 or approved equal.

24Vac Power - #14/2 or #16/2 UTP (red & Black), white jacket, Metro Wire & Cable MWC-5160-F, & MWC-5390-F or approved equal.

2. All 120 volt control wiring derived from 15 Amp circuits shall be #14 awg unless otherwise specified on the control drawings. All 120 volt control wiring derived from 20 Amp circuits shall be #12 awg unless otherwise specified on the control drawings. Where more than two (2) wires are running from one device or panel to another, these Wires will be identified by wire numbers or with the following color coding and ties or taped together for identification:

Black, white and green shall be used only for power circuits

Wire 1	Blue
Wire 2	Brown
Wire 3	Gray
Wire 4	Purple
Wire 5	Orange
Wire 6	Red
Wire 7	Yellow

3. All 24 volt control wiring will be 18 Ga. Awg standard unless otherwise specified on the control drawings and installed as described in Item 2 for 120v wiring using the same color coding. Wiring requiring more than two (2) conductors shall be in cable type as below or equivalent.

2 Conductor	MWC-5190
4 Conductor	MWC-5192
6 Conductor	MWC-5194
8 Conductor	MWC-5196
10 Conductor	MWC-5198

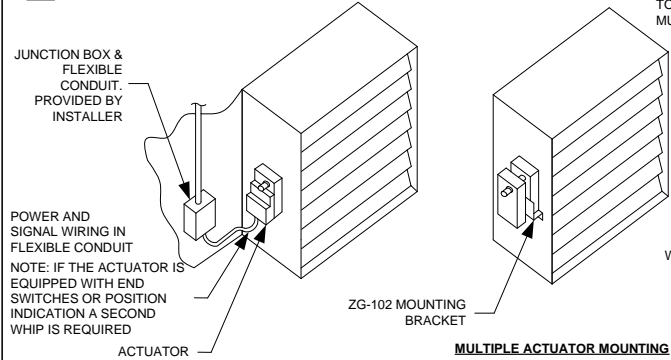




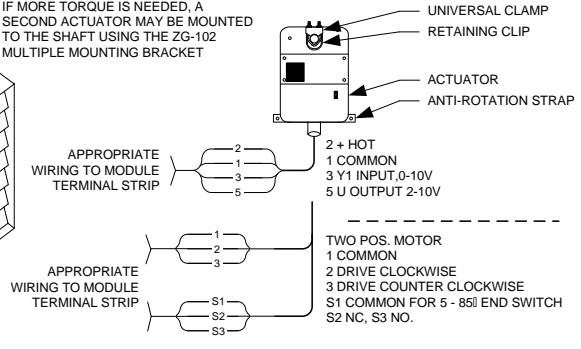




DM-3 DAMPER MOTOR - BELIMO GM & NM SERIES ACTUATORS



**GM SERIES ONLY**  
 IF MORE TORQUE IS NEEDED, A SECOND ACTUATOR MAY BE MOUNTED TO THE SHAFT USING THE ZG-102 MULTIPLE MOUNTING BRACKET



**STANDARD MOUNTING INSTRUCTIONS - BELIMO GM & NM SERIES ACTUATORS**

1. SLIP THE ACTUATOR'S UNIVERSAL CLAMP OVER THE DAMPER SHAFT. MAKE SURE THAT THE BOTTOM OF THE ACTUATOR (METAL SIDE) IS TOWARD THE DUCT AND THE CONTROLS ON THE COVER ARE ACCESSIBLE. PLACE THE ACTUATOR IN THE DESIRED MOUNTING POSITION.
2. TURN THE DAMPER SHAFT UNTIL THE BLADES ARE FULLY CLOSED.
3. HAND TIGHTEN THE (2) NUTS ON THE UNIVERSAL CLAMP.
4. SLIDE THE STUD OF THE ANTI-ROTATION BRACKET INTO THE SLOT IN THE BOTTOM OF THE ACTUATOR. BEND THE STRAP AS NEEDED TO SUPPORT THE REAR OF THE ACTUATOR.
5. FASTEN THE STRAP TO THE DUCT WITH (2) SCREWS (#8 SELF TAPPING SHEET METAL SCREWS).
6. LOOSEN THE (2) NUTS ON THE UNIVERSAL CLAMP. DISENGAGE THE ACTUATOR GEAR TRAIN BY PRESSING THE "MANUAL OVERRIDE BUTTON." KEEPING THE GEARS DISENGAGED, AND THE DAMPER FULLY CLOSED, ROTATE THE CLAMP UNTIL IT IS ABOUT 5 DEGREES FROM THE CLOSED POSITION.
7. TIGHTEN THE (2) NUTS ON THE CLAMP WITH A 10mm WRENCH. USE 9-11 ft-lb OF TORQUE.

**SHORT SHAFT MOUNTING INSTRUCTIONS - BELIMO GM & NM SERIES ACTUATORS**

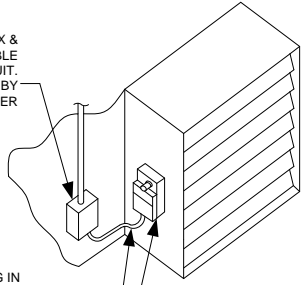
1. DISENGAGE THE GEARS WITH THE MANUAL RELEASE BUTTON ON THE CASING.
  2. TURN THE ACTUATOR CLAMP BACK TO 5 DEGREES BEFORE CLOSED POSITION AND ALLOW GEARS TO RE-ENGAGE.
  3. PULL OUT THE UNIVERSAL CLAMP AFTER REMOVING THE RETAINING CLIP.
  4. FIX THE UNIVERSAL CLAMP ONTO THE DAMPER SHAFT.
  5. MOVE THE DAMPER INTO THE CLOSED POSITION.
  6. POSITION THE ACTUATOR ONTO THE UNIVERSAL CLAMP.
  7. REFIT THE RETAINING CLIP.
  8. IF NECESSARY, BEND OR CUT THE ANTI-ROTATION STRAP ON EITHER SIDE TO FIT THE DAMPER FRAME.
  9. SLIDE THE STUD OF THE ANTI-ROTATION STRAP INTO THE SLOT ON THE ACTUATOR BASE AND FIX IT WITH THE SCREWS TO THE DAMPER FRAME.
- NOTE: ACTUATORS SHOULD BE MOUNTED INDOORS IN A DRY, CLEAN ENVIRONMENT FREE OF CORROSIVE FUMES. A PROTECTIVE ENCLOSURE MUST BE USED WHEN MOUNTED OUTDOORS. INSTALL FLEXIBLE CONDUIT FOR ALL CABLE OR WIRE BROUGHT TO END DEVICE FROM JUNCTION BOX. FLEXIBLE CONDUIT SHOULD NOT EXCEED 18 INCHES.

DM-4 DAMPER MOTOR - BELIMO AM & LM SERIES ACTUATORS

JUNCTION BOX & FLEXIBLE CONDUIT. PROVIDED BY INSTALLER

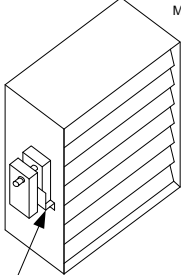
POWER AND SIGNAL WIRING IN FLEXIBLE CONDUIT

NOTE: IF THE ACTUATOR IS EQUIPPED WITH END SWITCHES OR POSITION INDICATION A SECOND WHIP IS REQUIRED



ZG-102 MOUNTING BRACKET

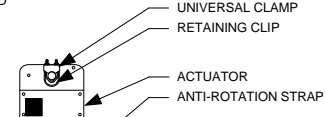
**MULTIPLE ACTUATOR MOUNTING**



**AM SERIES ONLY**  
IF MORE TORQUE IS NEEDED, A SECOND ACTUATOR MAY BE MOUNTED TO THE SHAFT USING THE ZG-102 MULTIPLE MOUNTING BRACKET

APPROPRIATE WIRING TO MODULE TERMINAL STRIP

APPROPRIATE WIRING TO MODULE TERMINAL STRIP



MODULATING MOTOR  
1 COMMON  
2 + HOT  
3 Y1 INPUT, 0-10V  
5 U OUTPUT 2-10V

TWO POS. MOTOR  
1 COMMON  
2 DRIVE CLOCKWISE  
3 DRIVE COUNTER CLOCKWISE  
S1 COMMON FOR 0 - 95° END SWITCH  
S2 NC, S3 NO.  
S4 COMMON FOR 0 - 95° END SWITCH  
S5 NC, S6 NO.

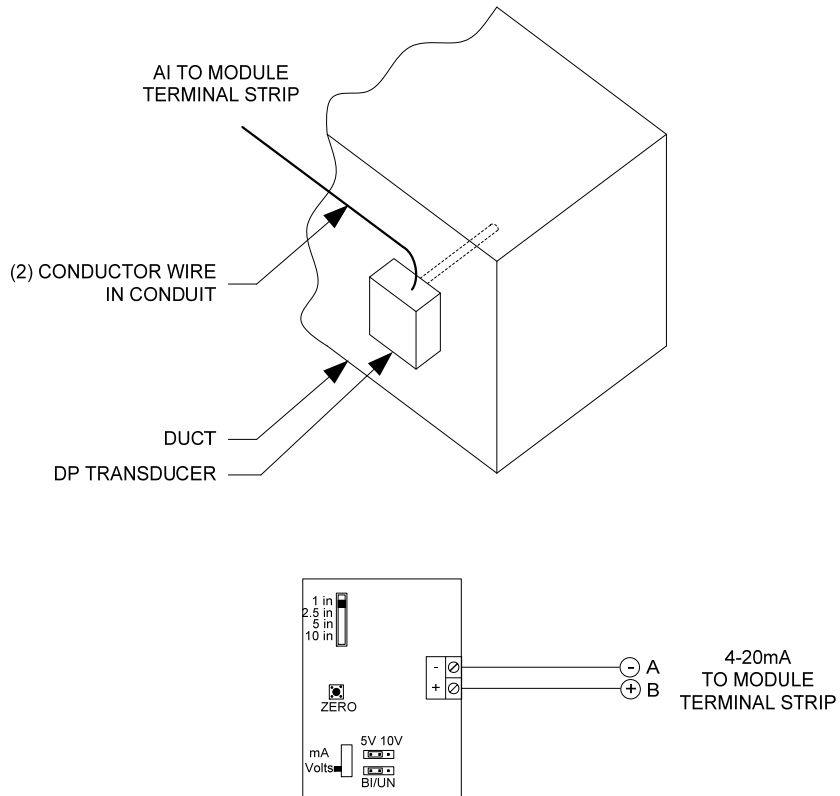
**STANDARD MOUNTING INSTRUCTIONS - BELIMO AM & LM SERIES ACTUATORS**

1. TURN THE DAMPER BLADE TO ITS FULLY CLOSED POSITION.
2. WITH THE MANUAL OVERRIDE BUTTON DEPRESSED, ROTATE THE ACTUATOR CLAMP TO APPROXIMATELY 1/16"-1/8" BETWEEN THE ACTUATOR STOP AND CLAMP, DEPENDING ON DAMPER SEAL DESIGN.
3. SLIDE THE ACTUATOR OVER THE SHAFT AND FINGER TIGHTEN THE NUTS.
4. USING A SCREWDRIVER, SELECT CLOCKWISE OR COUNTERCLOCKWISE ROTATION.
5. SLIDE THE ANTI-ROTATION BRACKET UP UNDER THE ACTUATOR, ENGAGING THE CENTER CUT-OUT ON THE ACTUATOR BACK.
6. SECURE THE BRACKET WITH SELF-TAPPING SCREWS.
7. TIGHTEN THE (2) NUTS ON THE UNIVERSAL CLAMP WITH A 10mm WRENCH, USING 6-8 ft-lb OF TORQUE.
8. IF REQUIRED, ADJUST THE END STOPS.

NOTE: ACTUATORS SHOULD BE MOUNTED INDOORS IN A DRY, CLEAN ENVIRONMENT FREE OF CORROSIVE FUMES. A PROTECTIVE ENCLOSURE MUST BE USED WHEN MOUNTED OUTDOORS. INSTALL FLEXIBLE CONDUIT FOR ALL CABLE OR WIRE BROUGHT TO END DEVICE FROM JUNCTION BOX. FLEXIBLE CONDUIT SHOULD NOT EXCEED 18 INCHES.

DPT-1

## DUCT MOUNTED AIR STATIC PRESSURE TRANSDUCER



### MOUNTING INSTRUCTIONS

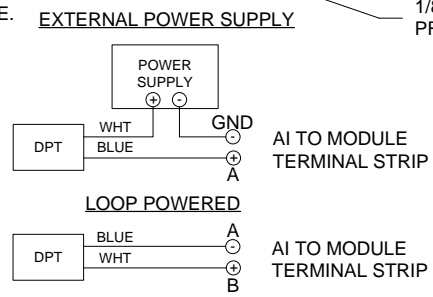
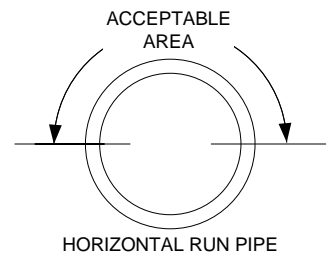
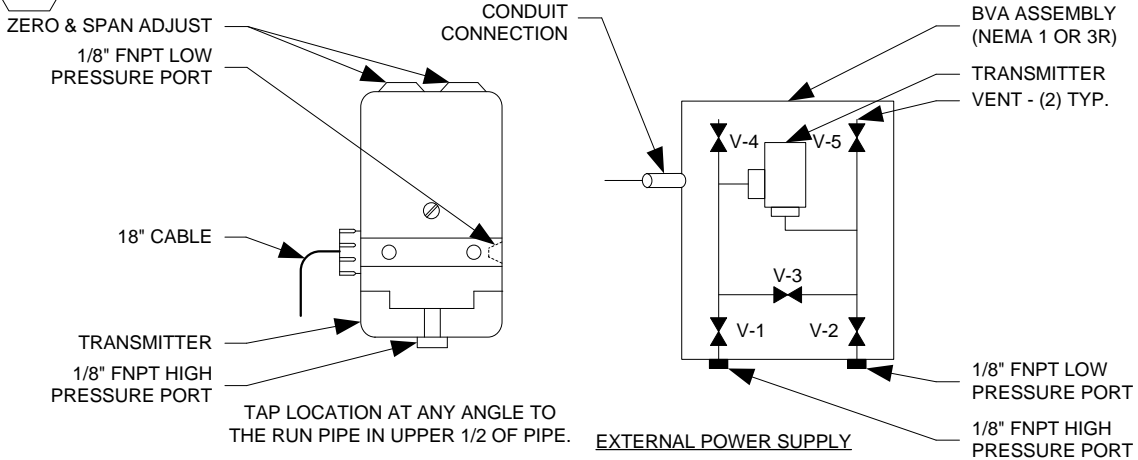
1. DRILL A 3/8" HOLE IN THE DUCT WALL FOR THE STATIC PRESSURE PROBE.
2. SECURE THE DEVICE TO THE DUCT USING SELF-TAPPING SHEET METAL SCREWS.
3. INSTALL STATIC PRESSURE PROBE HORIZONTALLY SO THE ENCLOSURE IS IN A VERTICAL PLANE AND THE NAMEPLATE AND LETTERING IS IN AN UPRIGHT POSITION.
4. CONNECT TRANSMITTER TO CONTROL SYSTEM.
5. CONFIGURE ALL JUMPERS AND SWITCHES TO APPROPRIATE POSITIONS.

### NOTE:

INSTALL FLEXIBLE CONDUIT FOR ALL CABLE OR WIRE BROUGHT TO END DEVICE FROM JUNCTION BOX. FLEXIBLE CONDUIT SHOULD NOT EXCEED 18 INCHES.

DPT-2

## LIQUID DIFFERENTIAL PRESSURE TRANSDUCER WITH BYPASS VALVE ASSEMBLY



**MOUNTING INSTRUCTIONS**

MOUNTING SHOULD BE IN THE VERTICAL POSITION WITH THE HIGH PRESSURE PORT DOWN. THE PRESSURE PORT REQUIRES A 1/8" NPT MALE FITTING, WHICH SHOULD BE INSTALLED USING THREAD SEALANT. CARE SHOULD BE TAKEN NOT TO OBSTRUCT THE HOLE IN THE LOW PRESSURE PORT IN DIFFERENTIAL OR GAUGE APPLICATIONS. GOOD GAUGE PRACTICES SHOULD BE OBSERVED. PRESSURE CONNECTIONS SHOULD BE MADE IN ACCORDANCE WITH APPROVED INDUSTRIAL PRACTICES. STRESS RELIEF OR EXPANSION LOOPS IN THE PRESSURE LINES ARE RECOMMENDED TO ELIMINATE TRANSMISSION OF STRAIN AND VIBRATION TO THE TRANSMITTER. PURGING AND CLEANING OF THE PRESSURE LINES BEFORE MOUNTING IS RECOMMENDED. INSTALL ISOLATION VALVE FOR IMPULSE TUBES AT TAP.

**BYPASS VALVE ASSEMBLY**

A BVA-5 BYPASS VALVE ASSEMBLY IS FOR USE ON SYSTEMS WITH A MAXIMUM PRESSURE OF 150psig AT 150 DEGREES F.

TO PLACE TRANSMITTER IN SERVICE: (1)OPEN V-3, (2)OPEN V-4 & V-5, (3)SLOWLY OPEN V-1 & V-2, (4)CLOSE V-4 & V-5 (5)OPEN V-1 & V-2 FULLY, (6)CLOSE V-3. YOU ARE NOW READING DIFFERENTIAL PRESSURE.

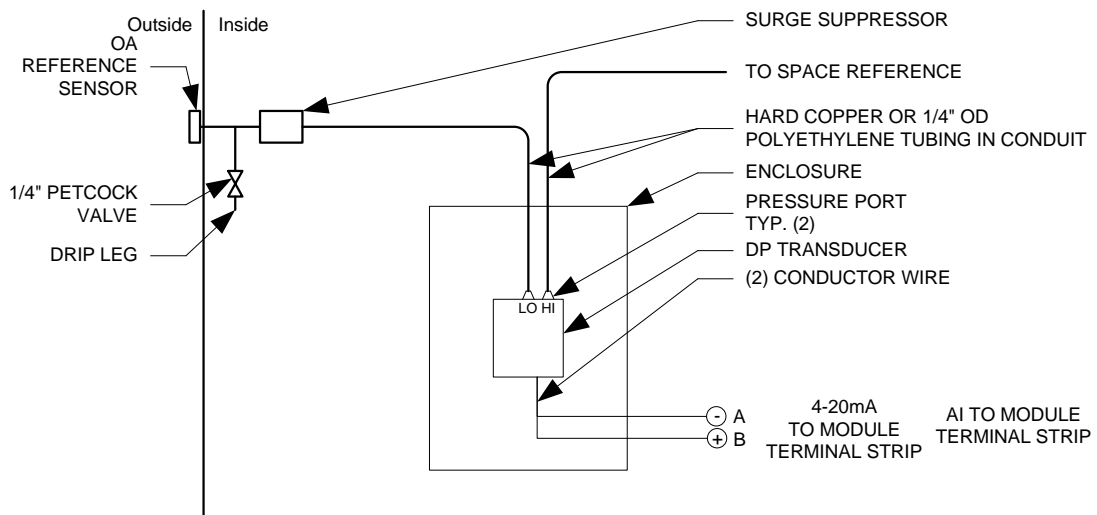
TO TAKE OUT OF SERVICE: (1)OPEN V-3. (2)CLOSE V-1 & V-2, (3)OPEN V-4 & V-5 TO RELEASE PRESSURE.

**NOTE:**

INSTALL FLEXIBLE CONDUIT FOR ALL CABLE OR WIRE BROUGHT TO END DEVICE FROM JUNCTION BOX. FLEXIBLE CONDUIT SHOULD NOT EXCEED 18 INCHES.

DPT-3

## AIR SPACE STATIC PRESSURE TRANSDUCER

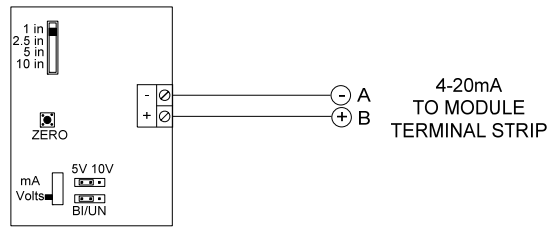
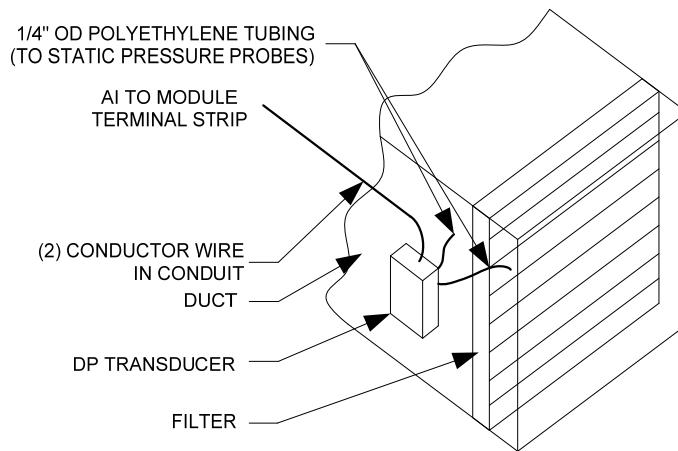


### MOUNTING INSTRUCTIONS - PANEL MOUNTED DP TRANSDUCER

1. CONNECT TRANSMITTER TO CONTROL SYSTEM AS INDICATED.
2. USE THE HI PRESSURE PORT FOR THE SPACE REFERENCE & THE LO PRESSURE PORT FOR OUTDOOR AIR REFERENCE. USE HARD COPPER OR 1/4" POLYETHYLENE TUBING IN CONDUIT.
3. INSTALL DRIP LEG JUST INSIDE THE BUILDING ENVELOPE FROM THE OUTDOOR AIR REFERENCE.
4. INSTALL SURGE DAMPENER FOR THE OUTDOOR AIR REFERENCE. USE THE LOW PRESSURE TUBING PORT ON THE SURGE DAMPENER.

DPT-4

## DUCT MOUNTED AIR DIFFERENTIAL PRESSURE TRANSDUCER



### MOUNTING INSTRUCTIONS

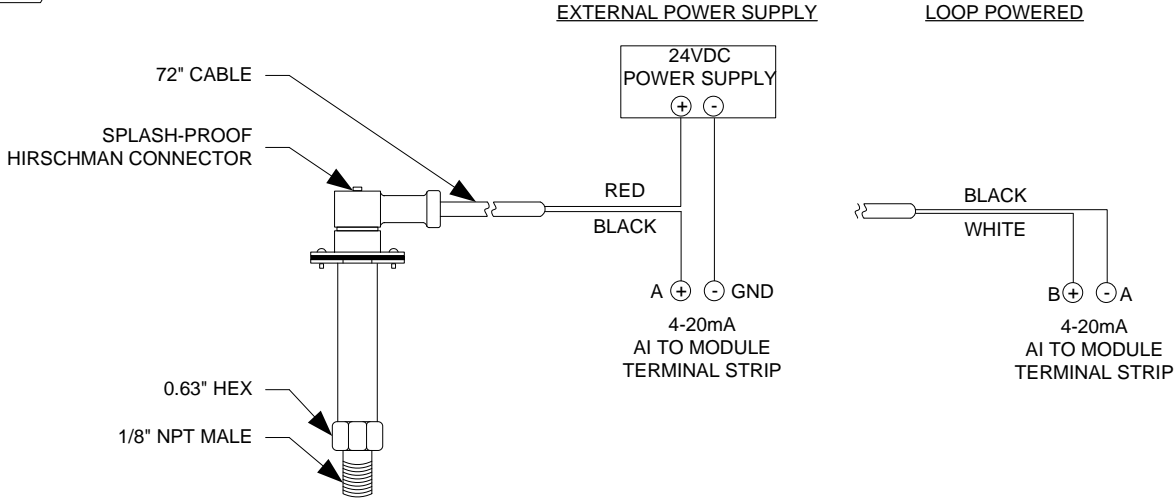
1. DRILL A 3/8" HOLE IN THE DUCT WALL FOR THE STATIC PRESSURE PROBE.
2. SECURE THE DEVICE TO THE DUCT USING SELF-TAPPING SHEET METAL SCREWS.
3. INSTALL STATIC PRESSURE PROBE HORIZONTALLY SO THE ENCLOSURE IS IN A VERTICAL PLANE AND THE NAMEPLATE AND LETTERING IS IN AN UPRIGHT POSITION.
4. CONNECT TRANSMITTER TO CONTROL SYSTEM.
5. CONFIGURE ALL JUMPERS AND SWITCHES TO APPROPRIATE POSITIONS.

### NOTE:

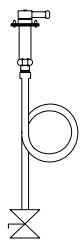
INSTALL FLEXIBLE CONDUIT FOR ALL CABLE OR WIRE BROUGHT TO END DEVICE FROM JUNCTION BOX. FLEXIBLE CONDUIT SHOULD NOT EXCEED 18 INCHES.

LPT-1

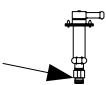
# MODEL PTX1 - PRESSURE TRANSMITTER



FOR STEAM APPLICATIONS INSTALL A STEAM PIGTAIL SIPHON WITH AN ISOLATION VALVE PROPERLY SIZED FOR THE PTX1, FOR SERVICE PURPOSES.



PRESSURE SNUBBERS PROPERLY SELECTED TO FIT THE PTX1 SHOULD BE USED WHERE A FREQUENT AMOUNT OF PULSATION OCCURS. THE PRESSURE SNUBBER HELPS TO "AVERAGE" OUT THE PULSES AND CAN GIVE EXTENDED LIFE TO THE TRANSDUCER. ONE FOR EACH PRESSURE SENSOR IS HIGHLY RECOMMENDED.



### MOUNTING INSTRUCTIONS

MOUNT THE MODEL PTX1 IN A MANNER THAT PROTECTS IT FROM STEAM OR TEMPERATURE OUTSIDE OF ITS OPERATING RANGE. A MODEL PT STEAM PIGTAIL SIPHON MUST BE INSTALLED ON ALL APPLICATIONS WHERE STEAM IS TO BE MONITORED. WHEN MONITORING THE PRESSURE OF 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"-12" OF BRASS TUBING IS USED, TEMPERATURES UP TO 400 DEGREES FAHRENHEIT CAN BE TOLERATED.

IF THE MODEL PTX1 IS TO BE SUBJECTED TO FLUID HAMMER, PRESSURE SURGES OR PULSATIONS, A MODEL 47 PRESSURE SNUBBER IS REQUIRED.

TEMPERATURE OPERATING RANGE: -40 TO 200 DEGREES FAHRENHEIT.

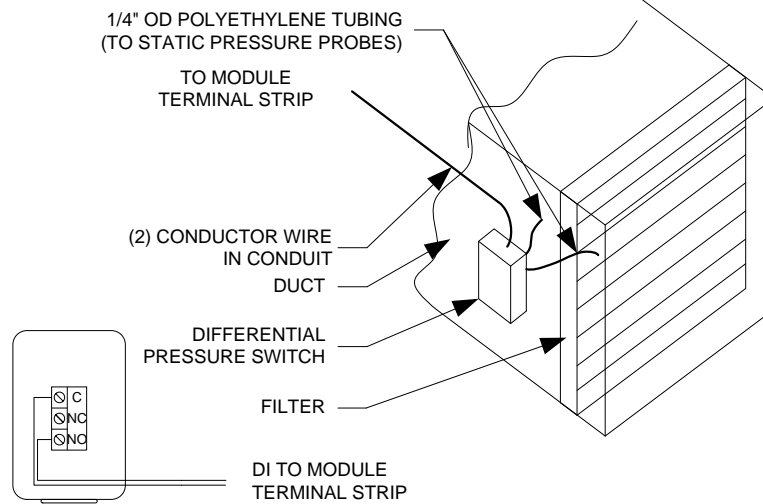
### NOTE:

INSTALL FLEXIBLE CONDUIT FOR ALL CABLE OR WIRE BROUGHT TO END DEVICE FROM JUNCTION BOX. FLEXIBLE CONDUIT SHOULD NOT EXCEED 18 INCHES.



DPS-1

## AIR DIFFERENTIAL PRESSURE SWITCH



### MOUNTING INSTRUCTIONS - DP SWITCH

1. **SELECT A LOCATION THAT IS FREE FROM VIBRATION, CORROSIVE ATMOSPHERE AND WHERE THE AMBIENT TEMPERATURE IS WITHIN THE LIMITS FOR THE SWITCH.**
2. MOUNT STANDARD SWITCHES WITH THE DIAPHRAGM IN A VERTICAL PLANE AND WITH SWITCH LETTERING AND NAMEPLATE IN AN UPRIGHT POSITION. SOME SWITCHES MAY NOT RESET PROPERLY IF MOUNTED IN THE WRONG POSITION.
3. CONNECT SWITCH TO SOURCE OF PRESSURE, VACUUM OR DIFFERENTIAL PRESSURE. POLYETHYLENE TUBING WITH 1/4" O.D. IS RECOMMENDED. CONNECT TO THE (2) 1/8" NPT FEMALE PRESSURE PORTS AS NOTED BELOW:
  - A. DIFFERENTIAL PRESSURES-CONNECT PIPES OR TUBES FROM SOURCE OF GREATER PRESSURE TO HIGH PRESSURE PORT MARKED HI-PR AND FROM SOURCE OF LOWER PRESSURE TO LOW PRESSURE PORT MARKED LO-PR.
  - B. PRESSURE ONLY-CONNECT TUBE FROM SOURCE OF PRESSURE TO HIGH PRESSURE PORT. THE LOW PRESSURE PORT IS LEFT OPEN TO ATMOSPHERE.
  - C. VACUUM ONLY-CONNECT TUBE FROM SOURCE OF VACUUM TO LOW PRESSURE PORT. THE HIGH PRESSURE PORT IS LEFT OPEN TO ATMOSPHERE.
4. ELECTRICAL CONNECTION TO THE SPDT SNAP SWITCH ARE PROVIDED BY MEANS OF SCREW TERMINALS.

### MOUNTING INSTRUCTIONS - STATIC PRESSURE PROBES

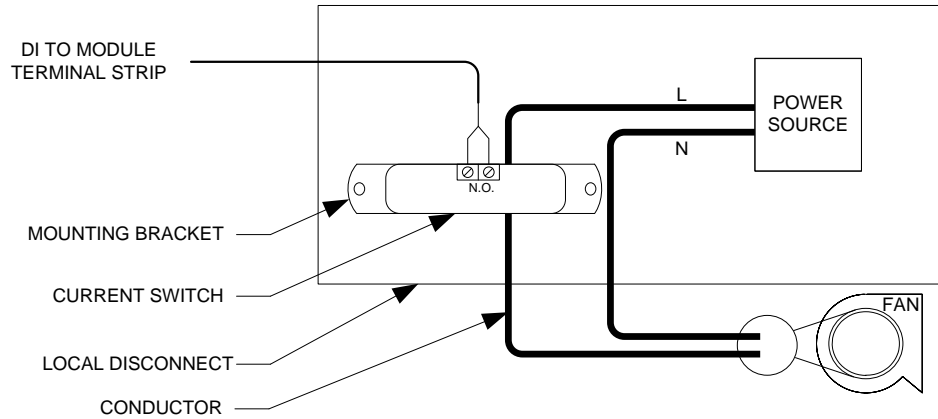
1. INSTALLATION IS COMPLETED BY DRILLING A 1/4" HOLE IN THE SHEET METAL, INSERTING THE PROBE AND SECURING THE ASSEMBLY BY USING THE MOUNTING FLANGE AS A TEMPLATE TO MARK AND DRILL (2) HOLES FOR THE SELF TAPPING SHEET METAL SCREWS.

### NOTE:

INSTALL FLEXIBLE CONDUIT FOR ALL CABLE OR WIRE BROUGHT TO END DEVICE FROM JUNCTION BOX. FLEXIBLE CONDUIT SHOULD NOT EXCEED 18 INCHES.

CTS-  
1

## CURRENT SWITCH SINGLE PHASE MOTOR



### MOUNTING INSTRUCTIONS

1. **ENSURE POWER CONDUCTOR TO BE MONITORED IS DISCONNECTED AND LOCKED OUT FROM THE POWER SOURCE.**
2. INSTALL THE ADJUSTABLE MOUNTING BRACKET TO THE BACK OF THE MOTOR CONTROL CENTER/STARTER. THE SENSOR MAY BE LOCATED AT ANY POINT ON THE CONDUCTOR BETWEEN THE MOTOR AND THE MOTOR STARTER.
3. ALIGN TO PERMIT THE CONDUCTOR TO FIT THROUGH THE HOLE. SLIDE THE CONDUCTOR THROUGH THE CENTER HOLE IN THE SENSOR AND CONNECT THE CONDUCTOR TO THE LUGS ON THE MOTOR STARTER.

NOTE: LOW AMPERAGE (<1.5A) AND HIGH AMPERAGE (>200A) APPLICATIONS MAY REQUIRE SPECIAL INSTALLATION:

- A. LOW AMPERAGE - TO PROVIDE ADEQUATE CURRENT, WRAP CONDUCTOR THROUGH THE CENTER HOLE AND AROUND THE SENSOR BODY TO PRODUCE MULTIPLE TURNS AND INCREASE CURRENT FLOW. EACH PASS THROUGH THE TRANSDUCER INCREASES THE AMPERAGE BY THE ORIGINAL VALUE.
- B. HIGH AMPERAGE - CURRENT FLOWS IN EXCESS OF 200A REQUIRE THE USE OF AN APPROPRIATELY SIZED EXTERNAL CURRENT TRANSFORMER (CT). INSTALL THE EXTERNAL CT ON THE CONDUCTOR AND RUN THE CT SECONDARY WIRE THROUGH CURRENT SENSOR.

**CAUTION:** CT'S CAN CONTAIN HAZARDOUS VOLTAGES. INSTALL CT'S IN ACCORDANCE TO MANUFACTURERS' SPECIFICATIONS AND INSTRUCTIONS.

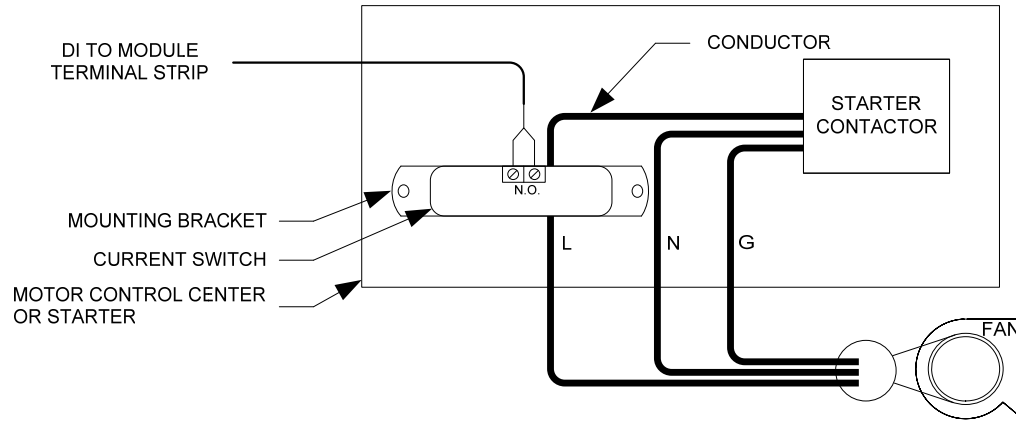
4. WIRE AS SHOWN ABOVE.

NOTE:

INSTALL FLEXIBLE CONDUIT FOR ALL CABLE OR WIRE BROUGHT TO END DEVICE FROM JUNCTION BOX. FLEXIBLE CONDUIT SHOULD NOT EXCEED 18 INCHES.

CTS-  
2

## CURRENT SWITCH THREE PHASE MOTOR



### MOUNTING INSTRUCTIONS

1. **ENSURE POWER CONDUCTOR TO BE MONITORED IS DISCONNECTED AND LOCKED OUT FROM THE POWER SOURCE.**
2. INSTALL THE ADJUSTABLE MOUNTING BRACKET TO THE BACK OF THE MOTOR CONTROL CENTER/STARTER. THE SENSOR MAY BE LOCATED AT ANY POINT ON THE CONDUCTOR BETWEEN THE MOTOR AND THE MOTOR STARTER.
3. ALIGN TO PERMIT THE CONDUCTOR TO FIT THROUGH THE HOLE. SLIDE THE CONDUCTOR THROUGH THE CENTER HOLE IN THE SENSOR AND CONNECT THE CONDUCTOR TO THE LUGS ON THE MOTOR STARTER.

NOTE: LOW AMPERAGE (<1.5A) AND HIGH AMPERAGE (>200A) APPLICATIONS MAY REQUIRE SPECIAL INSTALLATION:

- A. LOW AMPERAGE - TO PROVIDE ADEQUATE CURRENT, WRAP CONDUCTOR THROUGH THE CENTER HOLE AND AROUND THE

SENSOR BODY TO PRODUCE MULTIPLE TURNS AND INCREASE CURRENT FLOW. EACH PASS THROUGH THE TRANSDUCER INCREASES THE AMPERAGE BY THE ORIGINAL VALUE.

- B. HIGH AMPERAGE - CURRENT FLOWS IN EXCESS OF 200A REQUIRE THE USE OF AN APPROPRIATELY SIZED EXTERNAL CURRENT TRANSFORMER (CT). INSTALL THE EXTERNAL CT ON THE CONDUCTOR AND RUN THE CT SECONDARY WIRE THROUGH CURRENT SENSOR.

**CAUTION:** CT's CAN CONTAIN HAZARDOUS VOLTAGES. INSTALL CT's IN ACCORDANCE TO MANUFACTURERS' SPECIFICATIONS AND INSTRUCTIONS.

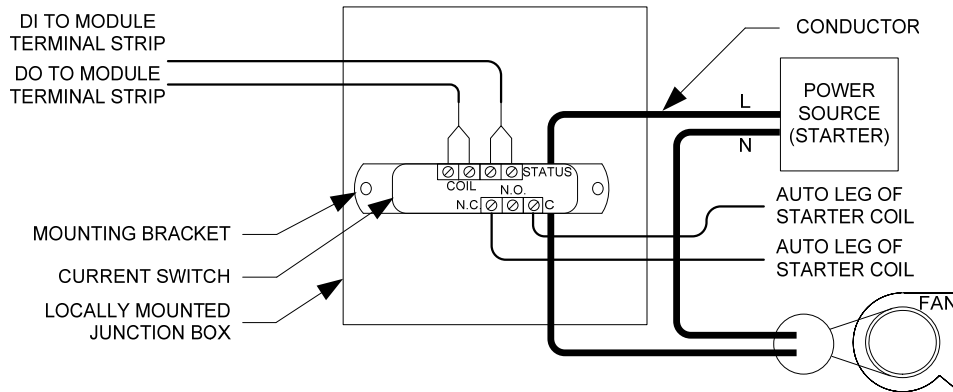
4. WIRE AS SHOWN ABOVE.

### NOTE:

INSTALL FLEXIBLE CONDUIT FOR ALL CABLE OR WIRE BROUGHT TO END DEVICE FROM JUNCTION BOX. FLEXIBLE CONDUIT SHOULD NOT EXCEED 18 INCHES.

CTR-1

## COMBO CURRENT SWITCH / RELAY SINGLE PHASE MOTOR (120VAC MAX.)



### MOUNTING INSTRUCTIONS

1. **ENSURE POWER CONDUCTOR TO BE MONITORED IS DISCONNECTED AND LOCKED OUT FROM THE POWER SOURCE.**
2. INSTALL THE ADJUSTABLE MOUNTING BRACKET TO THE BACK OF THE MOTOR CONTROL CENTER/STARTER. THE SENSOR MAY BE LOCATED AT ANY POINT ON THE CONDUCTOR BETWEEN THE MOTOR AND THE MOTOR STARTER.
3. ALIGN TO PERMIT THE CONDUCTOR TO FIT THROUGH THE HOLE. SLIDE THE CONDUCTOR THROUGH THE CENTER HOLE IN THE SENSOR AND CONNECT THE CONDUCTOR TO THE LUGS ON THE MOTOR STARTER.

NOTE: LOW AMPERAGE (<1.5A) AND HIGH AMPERAGE (>200A) APPLICATIONS MAY REQUIRE SPECIAL INSTALLATION:

- A. LOW AMPERAGE - TO PROVIDE ADEQUATE CURRENT, WRAP CONDUCTOR THROUGH THE CENTER HOLE AND AROUND THE

SENSOR BODY TO PRODUCE MULTIPLE TURNS AND INCREASE CURRENT FLOW. EACH PASS THROUGH THE TRANSDUCER INCREASES THE AMPERAGE BY THE ORIGINAL VALUE.

- B. HIGH AMPERAGE - CURRENT FLOWS IN EXCESS OF 200A REQUIRE THE USE OF AN APPROPRIATELY SIZED EXTERNAL CURRENT TRANSFORMER (CT). INSTALL THE EXTERNAL CT ON THE CONDUCTOR AND RUN THE CT SECONDARY WIRE THROUGH CURRENT SENSOR.

**CAUTION:** CT's CAN CONTAIN HAZARDOUS VOLTAGES. INSTALL CT's IN ACCORDANCE TO MANUFACTURERS' SPECIFICATIONS AND INSTRUCTIONS.

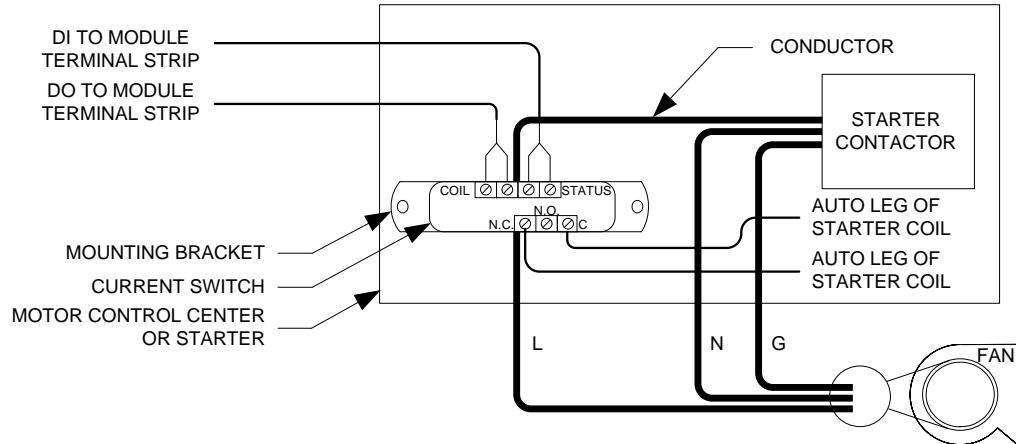
4. WIRE AS SHOWN ABOVE.

NOTE:

INSTALL FLEXIBLE CONDUIT FOR ALL CABLE OR WIRE BROUGHT TO END DEVICE FROM JUNCTION BOX. FLEXIBLE CONDUIT SHOULD NOT EXCEED 18 INCHES.

CTR-  
2

## COMBO CURRENT SWITCH / RELAY THREE PHASE MOTOR



### MOUNTING INSTRUCTIONS

1. **ENSURE POWER CONDUCTOR TO BE MONITORED IS DISCONNECTED AND LOCKED OUT FROM THE POWER SOURCE.**
2. INSTALL THE ADJUSTABLE MOUNTING BRACKET TO THE BACK OF THE MOTOR CONTROL CENTER/STARTER. THE SENSOR MAY BE LOCATED AT ANY POINT ON THE CONDUCTOR BETWEEN THE MOTOR AND THE MOTOR STARTER.
3. ALIGN TO PERMIT THE CONDUCTOR TO FIT THROUGH THE HOLE. SLIDE THE CONDUCTOR THROUGH THE CENTER HOLE IN THE SENSOR AND CONNECT THE CONDUCTOR TO THE LUGS ON THE MOTOR STARTER.

NOTE: LOW AMPERAGE (<1.5A) AND HIGH AMPERAGE (>200A) APPLICATIONS MAY REQUIRE SPECIAL INSTALLATION:

A. LOW AMPERAGE - TO PROVIDE ADEQUATE CURRENT, WRAP CONDUCTOR THROUGH THE CENTER HOLE AND AROUND THE

SENSOR BODY TO PRODUCE MULTIPLE TURNS AND INCREASE CURRENT FLOW. EACH PASS THROUGH THE TRANSDUCER INCREASES THE AMPERAGE BY THE ORIGINAL VALUE.

B. HIGH AMPERAGE - CURRENT FLOWS IN EXCESS OF 200A REQUIRE THE USE OF AN APPROPRIATELY SIZED EXTERNAL CURRENT TRANSFORMER (CT). INSTALL THE EXTERNAL CT ON THE CONDUCTOR AND RUN THE CT SECONDARY WIRE THROUGH CURRENT SENSOR.

**CAUTION:** CT'S CAN CONTAIN HAZARDOUS VOLTAGES. INSTALL CT'S IN ACCORDANCE TO MANUFACTURERS' SPECIFICATIONS AND INSTRUCTIONS.

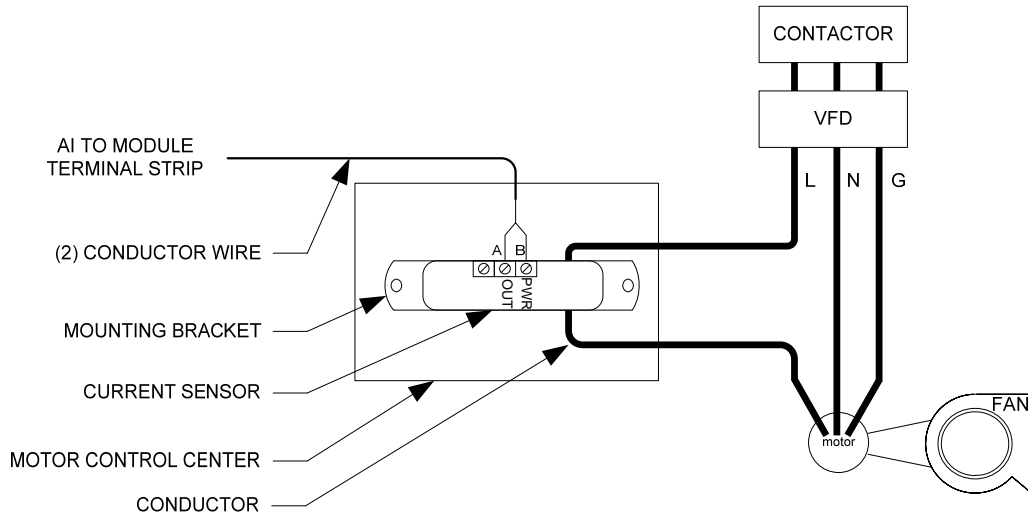
4. WIRE AS SHOWN ABOVE.

### NOTE:

INSTALL FLEXIBLE CONDUIT FOR ALL CABLE OR WIRE BROUGHT TO END DEVICE FROM JUNCTION BOX. FLEXIBLE CONDUIT SHOULD NOT EXCEED 18 INCHES.

CTT-1

## CURRENT TRANSDUCER



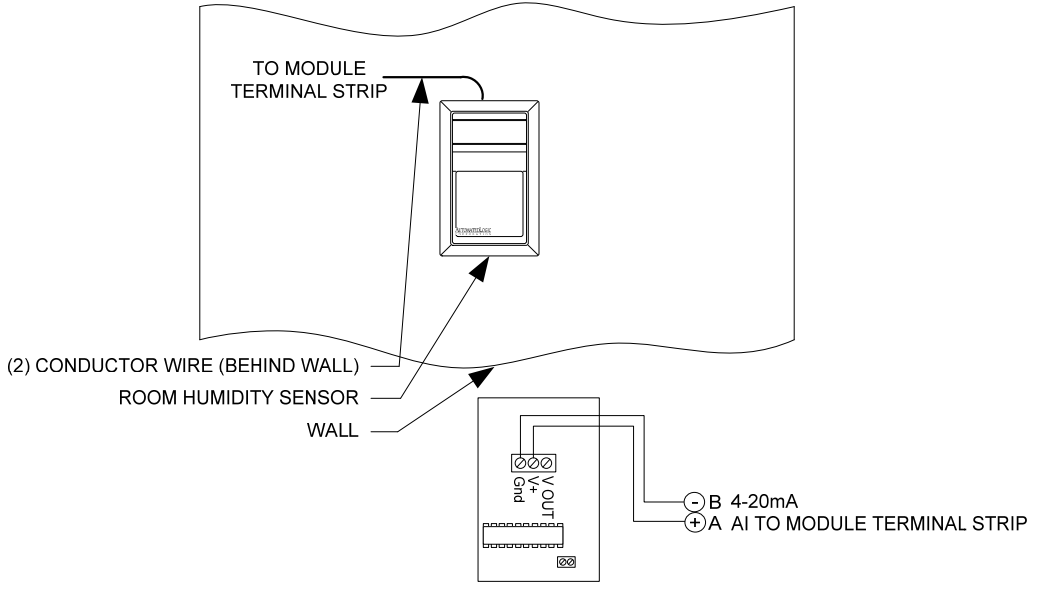
### MOUNTING INSTRUCTIONS - CURRENT SENSOR

1. ENSURE POWER CONDUCTOR TO BE MONITORED IS DISCONNECTED AND LOCKED OUT FROM THE POWER SOURCE.
2. INSTALL THE ADJUSTABLE MOUNTING BRACKET TO THE BACK OR FLOOR OF THE MOTOR CONTROL CENTER. THE SENSOR MAY BE LOCATED AT ANY POINT ON THE CONDUCTOR BETWEEN THE MOTOR AND THE MOTOR STARTER.
3. POSITION THE SENSOR BODY SUCH THAT THE HOLE IS ALIGNED TO PERMIT THE CONDUCTOR TO FIT THROUGH THE HOLE. SLIDE THE CONDUCTOR THROUGH THE CENTER HOLE IN THE SENSOR AND CONNECT THE CONDUCTOR TO THE LUGS OF THE MOTOR STARTER.
4. WIRE THE SENSOR AS SHOWN ABOVE.

NOTE: IF YOU DESIRE A 1-5VDC OUTPUT SIGNAL INSTEAD OF A 4-20mA, WIRE A 250 OHM RESISTOR IN PARALLEL BETWEEN THE SENSOR OUTPUT AND GROUND.

RHS  
-1

# ROOM HUMIDITY SENSOR



### MOUNTING INSTRUCTIONS

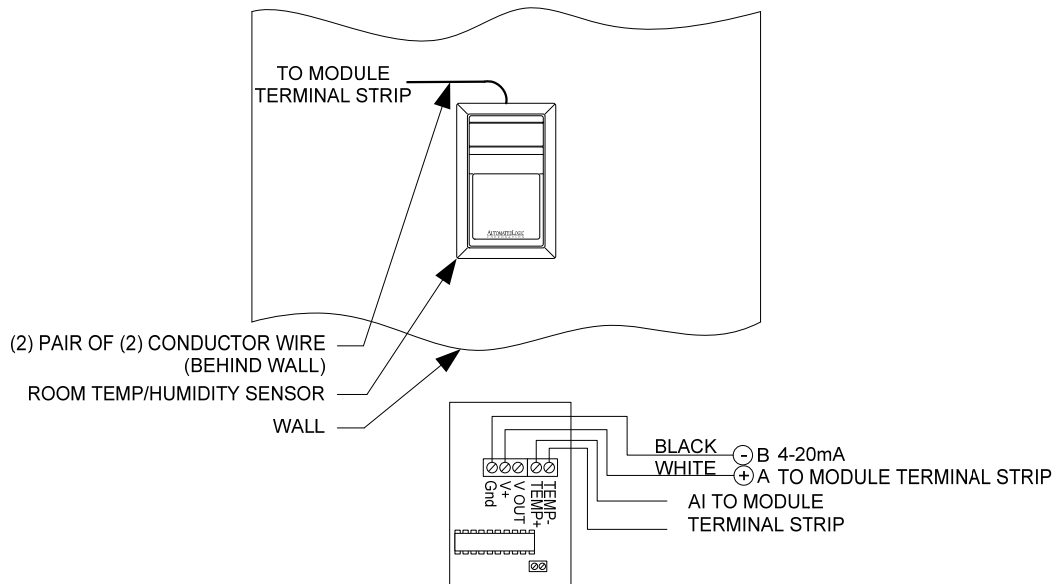
1. PULL THE WIRES THROUGH THE WIRE WAY HOLE IN THE BASE PLATE.
2. FOR JUNCTION BOX INSTALLATION, SECURE THE BASE TO THE BOX USING THE #6-32 X 1/2" MOUNTING SCREWS PROVIDED.
3. FOR DRYWALL INSTALLATION, PRE-DRILL (2) 3/16" HOLES 3.275" APART ON CENTER. INSERT THE DRYWALL ANCHORS AND SECURE THE BASE USING #6X1" SHEET METAL SCREWS.
4. TERMINATE THE UNIT FOLLOWING THE ABOVE DETAIL.
5. ATTACH THE COVER BY LATCHING IT TO THE TOP OF THE BASE, ROTATING THE COVER DOWN, AND SNAPPING IT INTO PLACE.
6. SECURE THE COVER BY BACKING OUT THE LOCK DOWN SCREWS USING A 1/16" ALLEN WRENCH UNTIL THEY ARE FLUSH WITH THE BOTTOM OF THE COVER.

NOTE: IN A WALL MOUNT APPLICATION, THE WALL TEMPERATURE AND THE TEMPERATURE OF THE AIR CONTAINED WITHIN THE WALL CAVITY CAN CAUSE ERRONEOUS READINGS. MOREOVER, THE MIXING OF ROOM AIR AND AIR FROM WITHIN THE WALL CAVITY CAN LEAD TO CONDENSATION AND PREMATURE FAILURE OF THE SENSOR. TO PREVENT THESE CONDITIONS, SEAL THE CONDUIT LEADING TO THE JUNCTION BOX AND SEAL THE HOLE IN THE DRYWALL BY USING AN ADHESIVE BACKED, FOAM INSULATED PAD. MOUNT IN A LOCATION THAT WILL NOT BE AFFECTED BY DIFFUSER AND HEAT EQUIPMENT.

NOTE: MOUNT THE SENSOR 48" A.F.F. AS PER THE AMERICANS WITH DISABILITIES ACT (ADA) UNLESS OTHERWISE NOTED IN JOB SPECIFICATION.

NOTE:  
INSTALL FLEXIBLE CONDUIT FOR ALL CABLE OR WIRE BROUGHT TO END DEVICE FROM JUNCTION BOX. FLEXIBLE CONDUIT SHOULD NOT EXCEED 18 INCHES.

## ROOM TEMPERATURE AND HUMIDITY SENSOR



### MOUNTING INSTRUCTIONS

1. PULL THE WIRES THROUGH THE WIRE WAY HOLE IN THE BASE PLATE.
2. FOR JUNCTION BOX INSTALLATION, SECURE THE BASE TO THE BOX USING THE #6-32 X 1/2" MOUNTING SCREWS PROVIDED.
3. FOR DRYWALL INSTALLATION, PRE-DRILL (2) 3/16" HOLES 3.275" APART ON CENTER. INSERT THE DRYWALL ANCHORS AND SECURE THE BASE USING #6X1" SHEET METAL SCREWS.
4. TERMINATE THE UNIT FOLLOWING THE ABOVE DETAIL.
5. ATTACH THE COVER BY LATCHING IT TO THE TOP OF THE BASE, ROTATING THE COVER DOWN, AND SNAPPING IT INTO PLACE.
6. SECURE THE COVER BY BACKING OUT THE LOCK DOWN SCREWS USING A 1/16" ALLEN WRENCH UNTIL THEY ARE FLUSH WITH THE BOTTOM OF THE COVER.

NOTE: IN A WALL MOUNT APPLICATION, THE WALL TEMPERATURE AND THE TEMPERATURE OF THE AIR CONTAINED WITHIN THE WALL CAVITY CAN CAUSE ERRONEOUS READINGS. MOREOVER, THE MIXING OF ROOM AIR AND AIR FROM WITHIN THE WALL CAVITY CAN LEAD TO CONDENSATION AND PREMATURE FAILURE OF THE SENSOR. TO PREVENT THESE CONDITIONS, SEAL THE CONDUIT LEADING TO THE JUNCTION BOX AND SEAL THE HOLE IN THE DRYWALL BY USING AN ADHESIVE BACKED, FOAM INSULATED PAD. MOUNT IN A LOCATION THAT WILL NOT BE AFFECTED BY DIFFUSER AND

HEAT

EQUIPMENT.

NOTE: MOUNT THE SENSOR 48" A.F.F. AS PER THE AMERICANS WITH DISABILITIES ACT UNLESS OTHERWISE NOTED IN JOB SPECIFICATION.

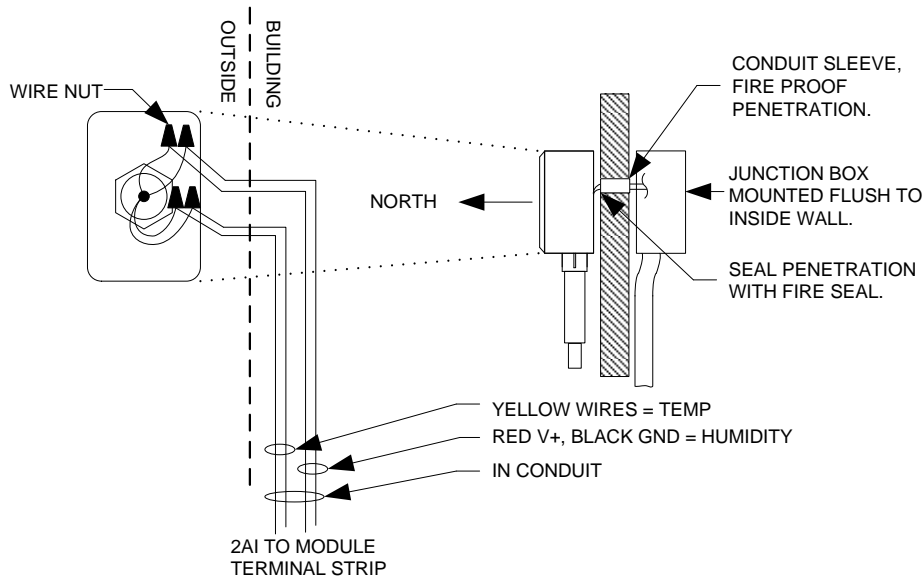
NOTE:

INSTALL FLEXIBLE CONDUIT FOR ALL CABLE OR WIRE BROUGHT TO END DEVICE FROM JUNCTION BOX. FLEXIBLE CONDUIT SHOULD NOT EXCEED 18 INCHES.



OAT/H-1

## OUTDOOR AIR TEMPERATURE AND HUMIDITY SENSOR



### MOUNTING INSTRUCTIONS

1. A SMALL WEEP HOLE (1/8" OR LESS) MUST BE DRILLED INTO THE BOTTOM (PROBE) SIDE OF THE ENCLOSURE TO ALLOW ANY CONDENSATION WITHIN THE ENCLOSURE TO ESCAPE. CAUTION MUST BE TAKEN TO AVOID NICKING THE LEAD WIRES AND ANY ELECTRICAL CONNECTIONS WHEN DRILLING THE WEEP HOLE.
2. ATTACH THE MOUNTING TABS TO OPPOSITE CORNERS OF THE BELL BOX WITH SELF TAPPING SCREWS.
3. MOUNT THE OUTSIDE AIR UNIT OUT OF DIRECT SUNLIGHT WITH THE PVC SENSOR COVER POINTING DOWN. MOUNT THE SENSOR ON THE WALL WITH THE NORTH MOST EXPOSURE.
4. TERMINATE THE UNIT AS SHOWN ABOVE. BE SURE TO INCORPORATE A "J-LOOP" INTO THE TERMINATION. A "J-LOOP" IS FORMED BY POINTING THE WIRE NUTS OF A TERMINATION UP CREATING A "J" IN THE CABLE IN ORDER TO REDUCE THE LIKELIHOOD OF CONDENSATION COLLECTING IN THE WIRE NUT.
5. ATTACH THE COVER. MAKE SURE THE GASKET SEALS ON ALL SIDES. **DO NOT OVER TIGHTEN THE COVER.** IF OVER TIGHTENED, THE BELL BOX WILL CUT THE GASKET AND ALLOW MOISTURE TO ENTER THE ENCLOSURE.
6. SEAL ALL CONDUIT HOLES WITH THE PLUGS PROVIDED AND AN APPROPRIATE SILICON SEALANT.

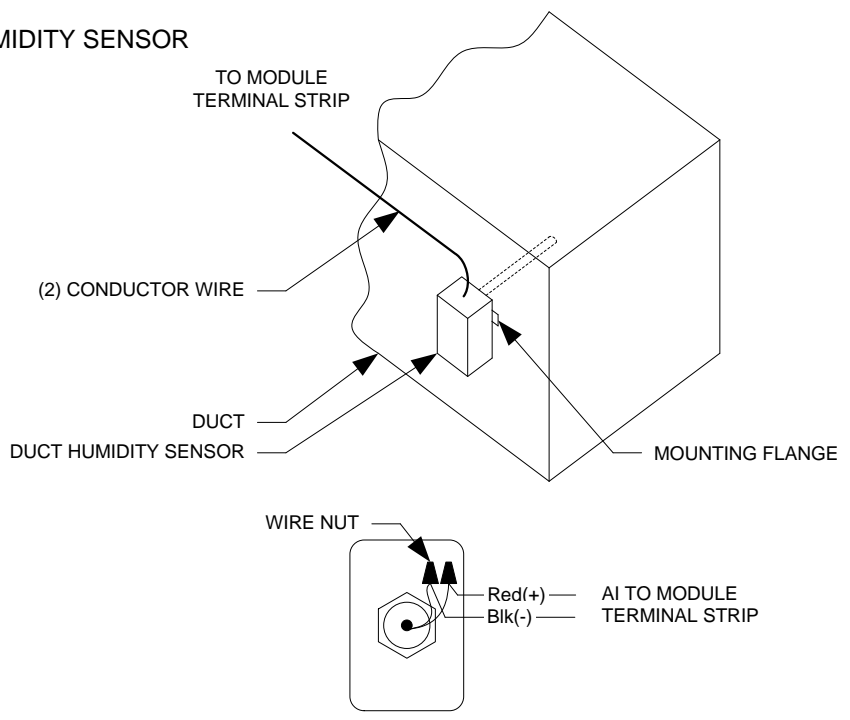
NOTE: IN A WALL MOUNT APPLICATION, THE WALL TEMPERATURE AND THE TEMPERATURE OF THE AIR CONTAINED WITHIN THE WALL CAVITY CAN CAUSE ERRONEOUS READINGS. MOREOVER, THE MIXING OF ROOM AIR AND AIR FROM WITHIN THE WALL CAVITY CAN LEAD TO CONDENSATION AND PREMATURE FAILURE OF THE SENSOR. TO PREVENT THESE CONDITIONS, SEAL THE CONDUIT LEADING TO THE JUNCTION BOX AND SEAL THE HOLE IN THE DRYWALL BY USING AN ADHESIVE BACKED, FOAM INSULATED PAD. MOUNT IN A LOCATION THAT WILL NOT BE AFFECTED BY DIFFUSER AND HEAT EQUIPMENT.

### NOTE:

INSTALL FLEXIBLE CONDUIT FOR ALL CABLE OR WIRE BROUGHT TO END DEVICE FROM JUNCTION BOX. FLEXIBLE CONDUIT SHOULD NOT EXCEED 18 INCHES.

DHS  
-1

## DUCT HUMIDITY SENSOR



### MOUNTING INSTRUCTIONS

1. A SMALL WEEP HOLE (1/8" OR LESS) MUST BE DRILLED INTO THE BOTTOM (PROBE) SIDE OF THE ENCLOSURE TO ALLOW ANY CONDENSATION WITHIN THE ENCLOSURE TO ESCAPE. CAUTION MUST BE TAKEN TO AVOID NICKING THE LEAD WIRES AND ANY ELECTRICAL CONNECTIONS WHEN DRILLING THE WEEP HOLE.
2. DUCT UNITS REQUIRE A 1 1/8" HOLE BE DRILLED IN THE DUCT WALL FOR THE PROBE.
3. ATTACH THE MOUNTING TABS TO OPPOSITE CORNERS OF THE BELL BOX WITH SELF TAPPING SCREWS.
4. TERMINATE THE UNIT FOLLOWING THE INSTRUCTIONS PROVIDED. BE SURE TO USE SEALANT FILLED CONNECTORS AND INCORPORATE A "J-LOOP". A "J-LOOP" IS FORMED BY POINTING THE WIRE NUTS OF A TERMINATION UP CREATING A "J" IN THE CABLE IN ORDER TO REDUCE THE PROBABILITY OF CONDENSATION COLLECTING IN THE WIRE NUT.
5. ATTACH THE COVER. MAKE SURE THE GASKET SEALS ON ALL SIDES. **DO NOT OVER TIGHTEN THE COVER.** IF OVER TIGHTENED, THE BELL BOX WILL CUT THE GASKET AND ALLOW MOISTURE TO ENTER THE ENCLOSURE.
6. SEAL ALL CONDUIT HOLES WITH THE PLUGS PROVIDED AND AN APPROPRIATE SILICON SEALANT.

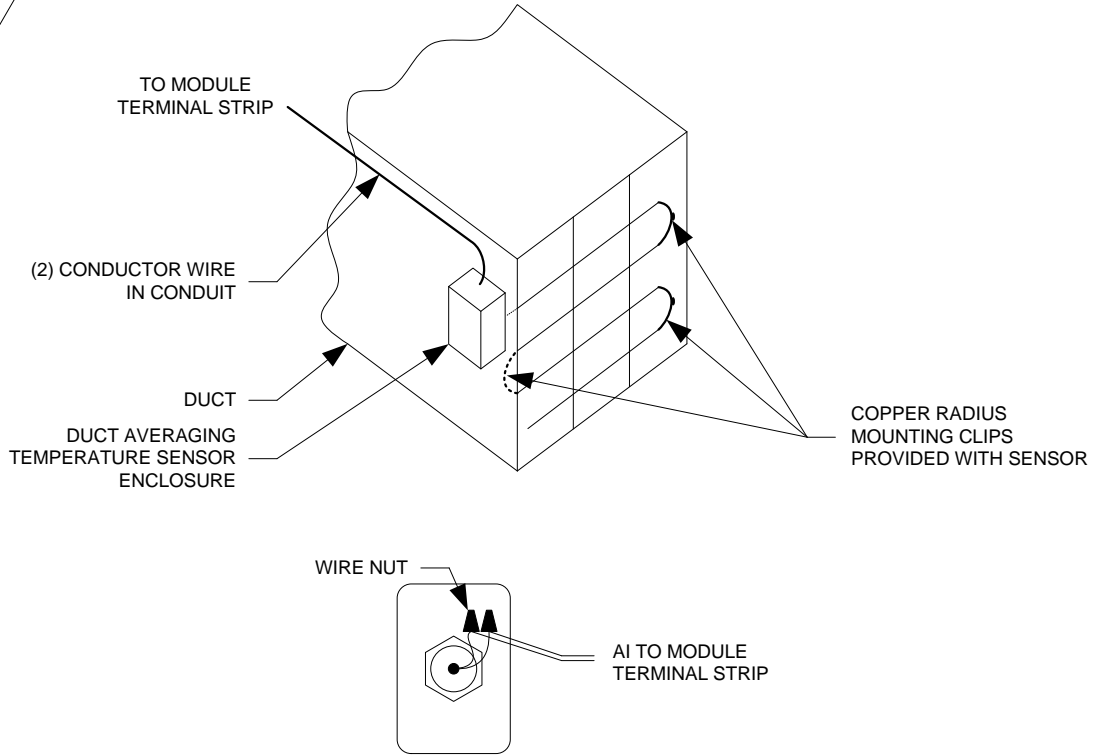
### NOTE:

DUCT UNITS COME WITH RED (+) AND BLACK (-) LEADS.

INSTALL FLEXIBLE CONDUIT FOR ALL CABLE OR WIRE BROUGHT TO END DEVICE FROM JUNCTION BOX. FLEXIBLE CONDUIT SHOULD NOT EXCEED 18 INCHES.

DAS-1

## DUCT AVERAGING SENSOR



### MOUNTING INSTRUCTIONS

1. SECURE THE MOUNTING FLANGE TO THE DUCT USING SELF-TAPPING SHEET METAL SCREWS.
2. INCORPORATE A "J-LOOP" INTO THE TERMINATION. A "J-LOOP" IS FORMED BY POINTING THE WIRE NUTS OF A TERMINATION UP CREATING A "J" IN THE CABLE IN ORDER TO REDUCE THE PROBABILITY OF CONDENSATION COLLECTING IN THE WIRE NUT.
3. EVENLY SPACE THE AVERAGING ELEMENT ACROSS THE AIR FLOW.
4. SECURE THE AVERAGING ELEMENT USING RADIUS MOUNTING CLIPS.

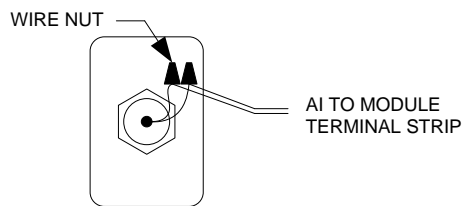
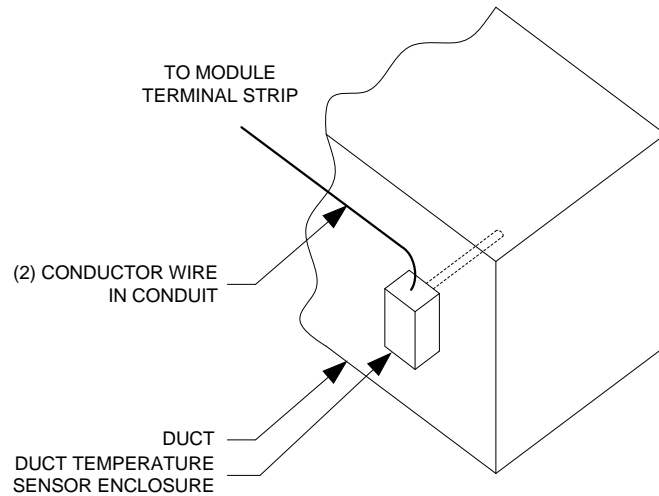
### NOTE:

WHEN FORMING THE AVERAGING ELEMENT TO THE DESIRED SHAPE, BE SURE THE BEND DIAMETER IS GREATER THAN 6". DO NOT USE SENSOR BOX AS A JUNCTION BOX FOR OTHER WIRING.

INSTALL FLEXIBLE CONDUIT FOR ALL CABLE OR WIRE BROUGHT TO END DEVICE FROM JUNCTION BOX. FLEXIBLE CONDUIT SHOULD NOT EXCEED 18 INCHES.

DTS-1

## DUCT TEMPERATURE SENSOR



### MOUNTING INSTRUCTIONS

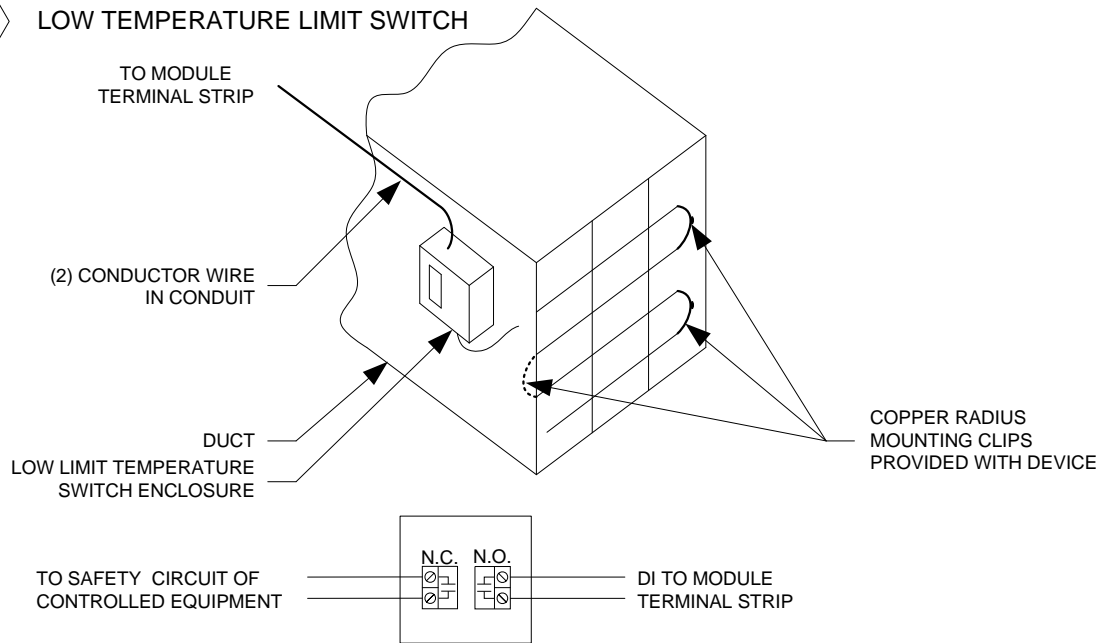
1. DRILL A 3/8" HOLE IN THE DUCT WALL FOR THE PROBE.
2. SECURE THE MOUNTING FLANGE TO THE DUCT USING SELF-TAPPING SHEET METAL SCREWS (NOT PROVIDED).
3. TERMINATE THE UNIT AS SHOWN ABOVE.
4. BE SURE TO USE SEALANT FILLED CONNECTIONS AND INCORPORATE A "J-LOOP" INTO THE TERMINATION. A "J-LOOP" IS FORMED BY POINTING THE WIRE NUTS OF A TERMINATION UP CREATING A "J" IN THE CABLE IN ORDER TO REDUCE THE PROBABILITY OF CONDENSATION COLLECTING IN THE WIRE NUT.
5. SEAL ALL CONDUIT HOLES WITH THE PLUGS PROVIDED AND APPROPRIATE SILICON SEALANT

### NOTE:

INSTALL FLEXIBLE CONDUIT FOR ALL CABLE OR WIRE BROUGHT TO END DEVICE FROM JUNCTION BOX. FLEXIBLE CONDUIT SHOULD NOT EXCEED 18 INCHES.

LLS-1

## LOW TEMPERATURE LIMIT SWITCH



### MOUNTING INSTRUCTIONS

1. LOW LIMIT MUST BE MOUNTED IN A VERTICAL POSITION. FOR THE LOW LIMIT SWITCH AND CAPILLARY TUBES, AVOID LOCATIONS SUBJECT TO EXCESSIVE VIBRATION.
2. ON MANUAL RESET MODELS, POSITION THE CONTROL TO PERMIT CONVENIENT ACCESS TO THE RESET BUTTON.
3. USE THE MOUNTING HOLES IN THE REAR OF THE CASE FOR FLUSH MOUNTING TO THE DUCT OR FLAT SURFACE.
4. DRILL A 3/8" HOLE IN THE DUCT WALL FOR THE CAPILLARY ELEMENT.
5. SECURE THE MOUNTING FLANGE TO THE DUCT USING SELF-TAPPING SHEET METAL SCREWS.
6. INSTALL CAPILLARY ELEMENT IN A HORIZONTAL SERPENTINE PATTERN ACROSS THE DUCT AS SHOWN ON THE ABOVE DETAIL  
SO IT IS EXPOSED TO AREAS TO PROTECT THE COIL. DO NOT KINK OR APPLY EXCESSIVE FORCE TO THE CAPILLARY ELEMENT.
7. INSTALL RADIUS MOUNTING CLIPS AT EVERY BEND.
8. THE LOW TEMPERATURE LIMIT SWITCH MUST BE MOUNTED IN A MANNER WHICH PROVIDES PROTECTION TO THE ENTIRE SURFACE OF COIL WITH A MAXIMUM OF 1.5' BETWEEN CAPILLARY PASSES. USE MULTIPLE DEVICES IF COIL IS NOT SUFFICIENTLY COVERED.
9. THE CONTROL ENCLOSURE SHALL BE COMPLETELY MOUNTED ON THE EXTERIOR OF THE AIR HANDLING UNIT AND THE CONTROL ENCLOSURE SHALL NOT BE MOUNTED LOWER THAN THE CAPILLARY TUBING.

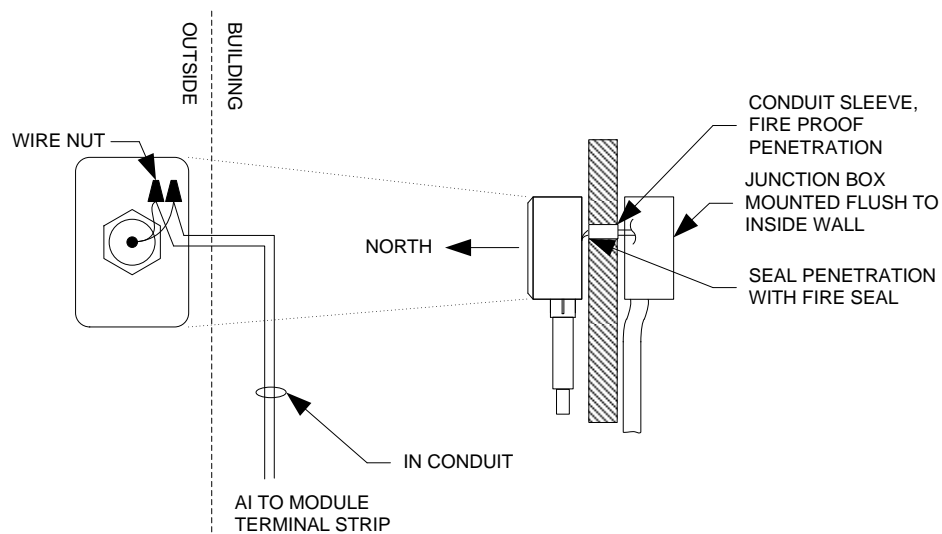
### NOTE:

DO NOT USE SENSOR BOX AS A JUNCTION BOX FOR OTHER WIRING.

INSTALL FLEXIBLE CONDUIT FOR ALL CABLE OR WIRE BROUGHT TO END DEVICE FROM JUNCTION BOX. FLEXIBLE CONDUIT SHOULD NOT EXCEED 18 INCHES.

OAT-1

## OUTDOOR AIR TEMPERATURE SENSOR



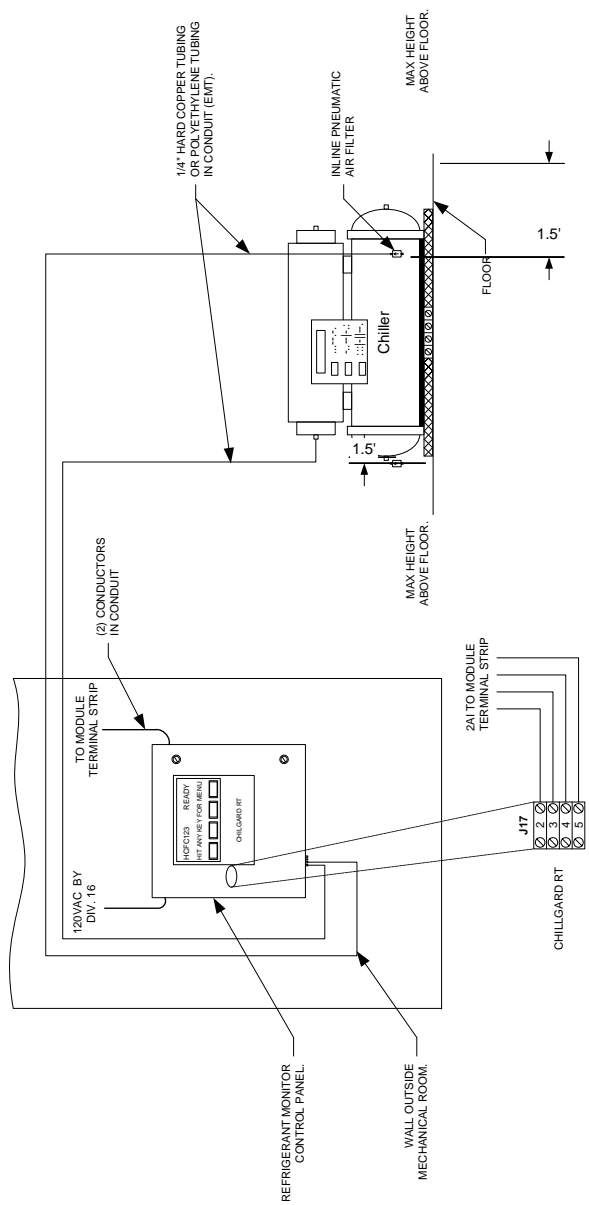
### MOUNTING INSTRUCTIONS

1. A SMALL WEEP HOLE (1/8" OR LESS) MUST BE DRILLED INTO THE BOTTOM (PROBE) SIDE OF THE ENCLOSURE TO ALLOW ANY CONDENSATION WITHIN THE ENCLOSURE TO ESCAPE. CAUTION MUST BE TAKEN TO AVOID DAMAGING THE LEAD WIRES AND ANY ELECTRICAL CONNECTIONS WHEN DRILLING THE WEEP HOLE.
2. ATTACH THE MOUNTING TABS TO OPPOSITE CORNERS OF THE BELL BOX WITH SELF TAPPING SCREWS.
3. MOUNT THE OUTSIDE AIR UNIT OUT OF DIRECT SUNLIGHT WITH THE PVC SENSOR COVER POINTING DOWN. MOUNT THE SENSOR ON THE WALL WITH THE NORTH MOST EXPOSURE.
4. TERMINATE THE UNIT AS SHOWN ABOVE. BE SURE TO INCORPORATE A "J-LOOP" INTO THE TERMINATION. A "J-LOOP" IS FORMED BY POINTING THE WIRE NUTS OF A TERMINATION UP CREATING A "J" IN THE CABLE IN ORDER TO REDUCE THE PROBABILITY OF CONDENSATION COLLECTING IN THE WIRE NUT.
5. ATTACH THE COVER. MAKE SURE THE GASKET SEALS ON ALL SIDES. **DO NOT OVER TIGHTEN THE COVER.** IF OVER TIGHTENED, THE BELL BOX WILL CUT THE GASKET AND ALLOW MOISTURE TO ENTER THE ENCLOSURE.
6. SEAL ALL CONDUIT HOLES WITH THE PLUGS PROVIDED AND AN APPROPRIATE SILICON SEALANT.

### NOTE:

INSTALL FLEXIBLE CONDUIT FOR ALL CABLE OR WIRE BROUGHT TO END DEVICE FROM JUNCTION BOX. FLEXIBLE CONDUIT SHOULD NOT EXCEED 18 INCHES.

REFRIGERANT MONITORING SENSOR



PLACE THE END OF THE SAMPLE LINE IN A LOCATION MOST LIKELY TO BE AFFECTED BY REFRIGERANT LEAKS OR SPILLS SUCH AS NEAR THE REFRIGERANT FITTINGS AND TO CHILLER ITSELF. ALSO, MONITOR ANY REFRIGERANT STORAGE LOCATION. IT IS GOOD PRACTICE TO KEEP ALL SAMPLING LINES AS SHORT AS POSSIBLE.

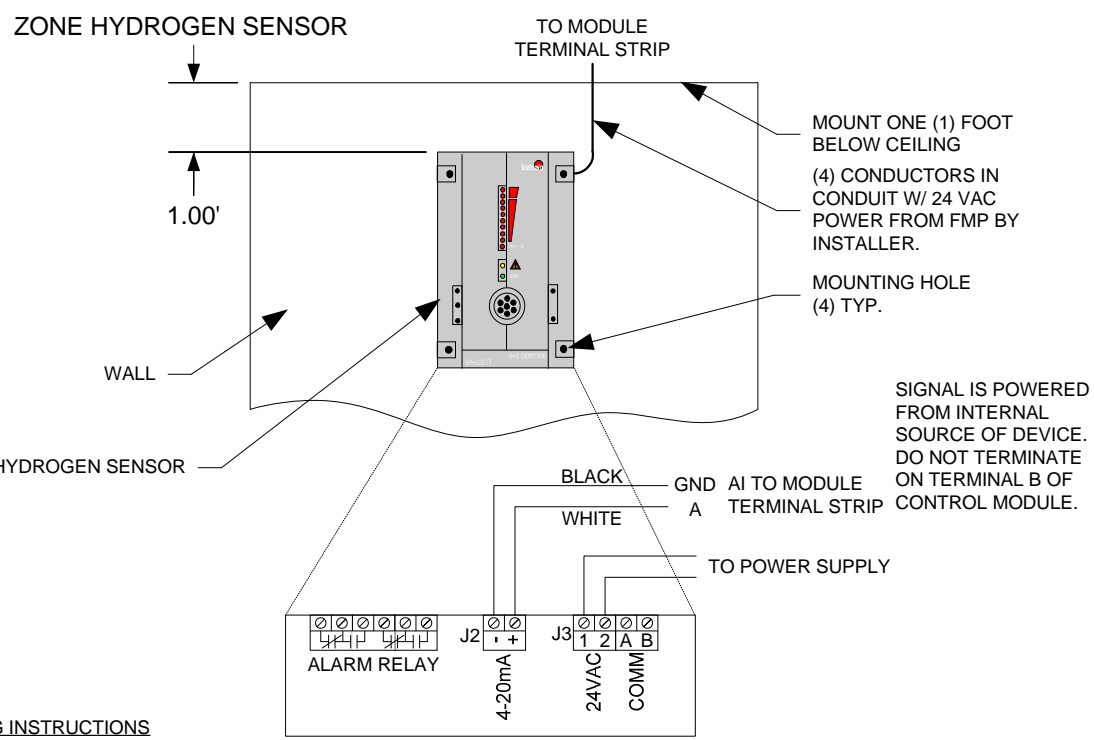
MAXIMUM SAMPLED POINTS: 8  
 MAXIMUM SAMPLE TUBING LENGTH: 150' EACH STANDARD  
 MAXIMUM SAMPLE TUBING I.D.: 0.188" (1/4" O.D., 5/16" I.D. TUBING)

MONITOR GASES THAT ARE HEAVIER THAN AIR CLOSE TO THE FLOOR. ANY PITS, STAIRWELLS OR TRENCHES ARE LIKELY TO FILL WITH REFRIGERANT GAS BEFORE THE MAIN SPACE. IT MAY BE NECESSARY TO MONITOR THESE LOCATIONS FOR REFRIGERANT GAS.

THE CHILLGARD RT REFRIGERANT MONITOR MUST BE PLACED JUST OUTSIDE THE DOORWAY OF THE MONITORED AREA. PERSONNEL CAN CHECK THE STATUS OF THE INSTRUMENT BEFORE ENTERING THE AREA.

CALIBRATE PER MANUFACTURERS RECOMMENDATIONS.

GMT  
-2



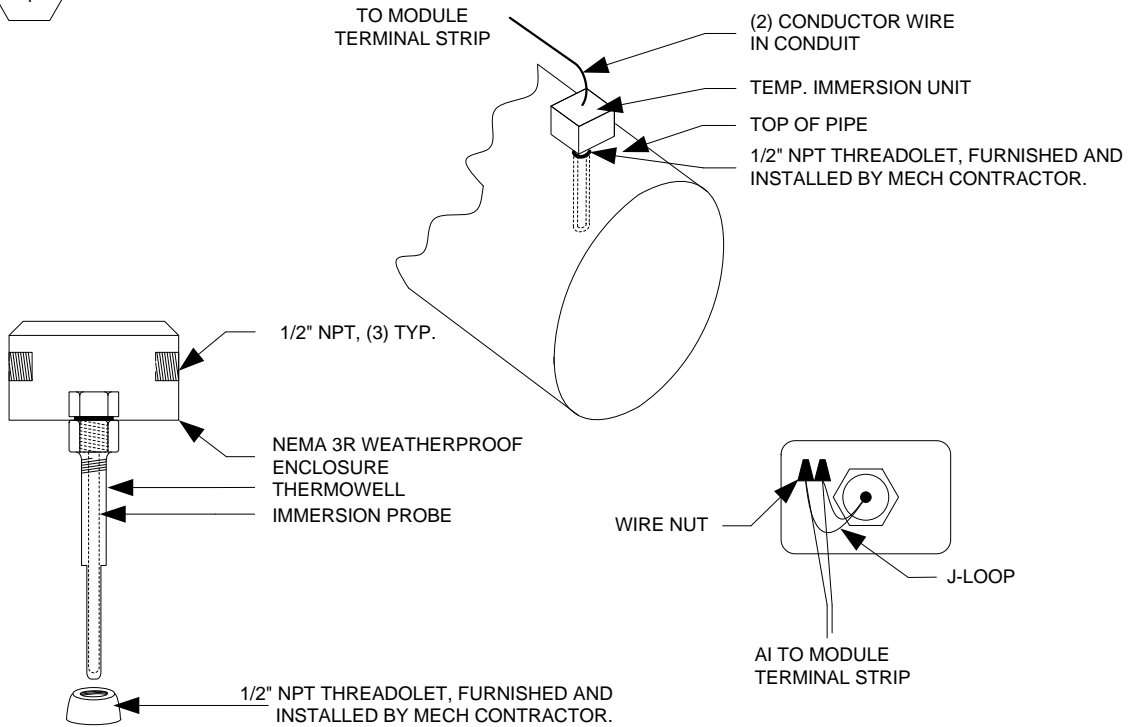
**MOUNTING INSTRUCTIONS**

1. MOUNT THE SENSOR SECURELY, IN A LOCATION FREE FROM EXCESSIVE VIBRATION. THE RECOMMENDED MOUNTING HEIGHT IS 1' BELOW THE CEILING. CHOOSE A LOCATION THAT IS REPRESENTATIVE OF THE AREA TO BE MONITORED. AVOID PLACING THE SENSOR IN SUPPLY AIR STREAMS OR NEAR DRAFTY OPENINGS THAT MAY DILUTE THE ATMOSPHERE.
  2. IF A REMOTE SENSOR OPTION IS APPLIED, THE MAXIMUM DISTANCE FROM SENSOR TO TRANSMITTER IS 25'.
  3. IF THE EXPLOSION PROOF VERSION IS USED, CONDUIT AND CABLE SEALS MUST BE APPLIED WITHIN 18" OF THE ENCLOSURE. ALL WIRING METHODS MUST COMPLY WITH THE NATIONAL ELECTRICAL CODE AND ANY LOCALLY ENFORCED CODES AND ORDINANCES FOR THE TYPE OF HAZARDOUS ATMOSPHERE TO BE ENCOUNTERED.
  4. EACH SENSOR IS TO HAVE A DEDICATED POWER SOURCE IF THE INTERNALLY POWERED ANALOG OUTPUT IS USED. SENSORS MAY BE COMBINED ON A SINGLE POWER SUPPLY IF THE ANALOG OUTPUT IS EXTERNALLY POWERED.
  5. TURN THE INTERNAL POWER SWITCH "ON" (STANDARD UNIT ONLY).
  6. CHECK THE UNIT FOR PROPER OPERATION BY OBSERVING LED'S.
  7. CALIBRATE PER MANUFACTURERS RECOMMENDATIONS.
- NOTE: ON A STANDARD UNIT, THE SINGLE GREEN LED INDICATES THAT THE UNIT IS OPERATIONAL. THE COLUMN OF 10 RED LED'S GIVES A GRAPHICAL REPRESENTATION OF THE CONCENTRATION OF THE GAS IN QUESTION, FROM 0-100% OF SPAN (EACH LED REPRESENTS A 10% STEP). RANGE OF DEVICE IS 0 - 2% LOWER EXPLOSIVE LIMIT (LEL). INSTALL FLEXIBLE CONDUIT FOR ALL CABLE OR WIRE BROUGHT TO END DEVICE FROM JUNCTION BOX. FLEXIBLE CONDUIT SHOULD NOT EXCEED 18 INCHES.



TIS-1

## TEMPERATURE IMMERSION SENSOR AND THERMOWELL W/WP ENCLOSURE



### MOUNTING INSTRUCTIONS - IMMERSION UNIT

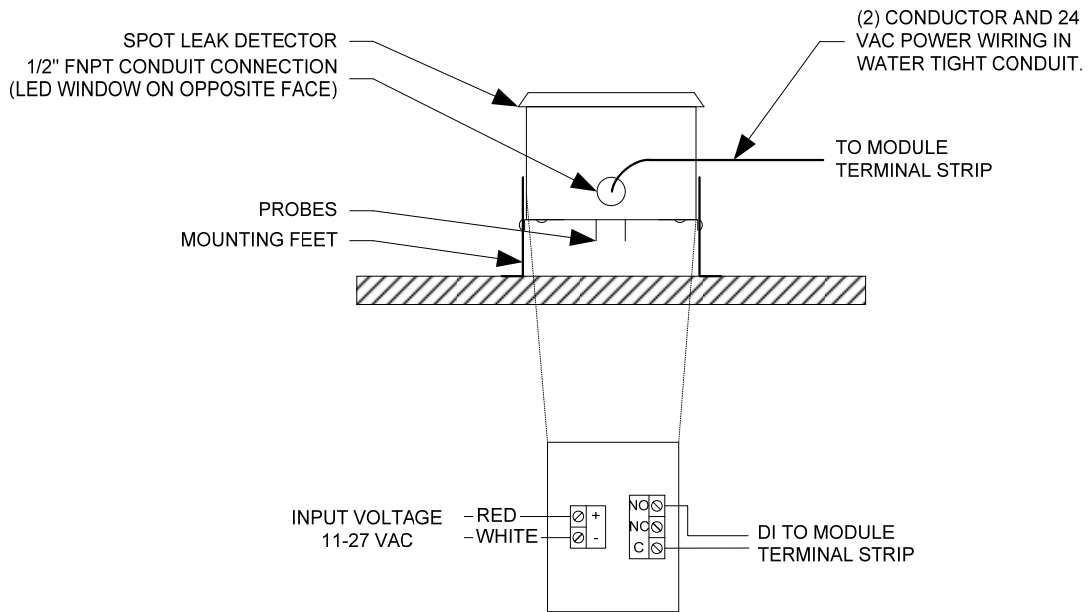
1. THE THERMOWELL THREADS INTO A 1/2" FNPT THREADOLET FURNISHED AND INSTALLED BY THE MECHANICAL CONTRACTOR.
2. THE IMMERSION UNIT THREADS INTO A 1/2" FNPT THERMOWELL, NO EXTERNAL HARDWARE IS NEEDED. THERMALLY CONDUCTIVE GREASE MUST BE APPLIED TO THE PROBE PRIOR TO INSERTION TO OPTIMIZE HEAT TRANSFER.  
NOTE: THE THERMOWELLS ARE DESIGNED TO CONNECT THE 1 1/8" HEX NUT TO THE IMMERSION FITTING ON THE UNIT, DO NOT OVER TIGHTEN OR DAMAGE TO THE FITTING MAY OCCUR.
3. TERMINATE THE UNIT AS SHOWN ABOVE.
4. INCORPORATE A "J-LOOP" INTO THE TERMINATION. A "J-LOOP" IS FORMED BY POINTING THE WIRE NUTS OF A TERMINATION UP CREATING A "J" IN THE CABLE IN ORDER TO REDUCE THE PROBABILITY OF CONDENSATION COLLECTING IN THE WIRE NUT.
5. USE LIQUID TIGHT FITTINGS WITH THE NEMA 3R WEATHERPROOF ENCLOSURE.

### NOTE:

INSTALL FLEXIBLE CONDUIT FOR ALL CABLE OR WIRE BROUGHT TO END DEVICE FROM JUNCTION BOX. FLEXIBLE CONDUIT SHOULD NOT EXCEED 18 INCHES.

SLD-1

### SPOT LEAK DETECTOR SENSOR (PART NUMBER WD-1B)



#### MOUNTING INSTRUCTIONS

SECURE BY APPLYING A SILICONE ADHESIVE TO THE MOUNTING FEET AND PLACING THE SENSOR IN THE AREA TO BE PROTECTED. FOR MORE PERMANENT INSTALLATIONS, FASTEN THE SENSOR USING THE HOLES PROVIDED IN THE MOUNTING FEET. THE LEGS ARE ADJUSTABLE FOR PRECISE WATER LEVEL SIGNALING.

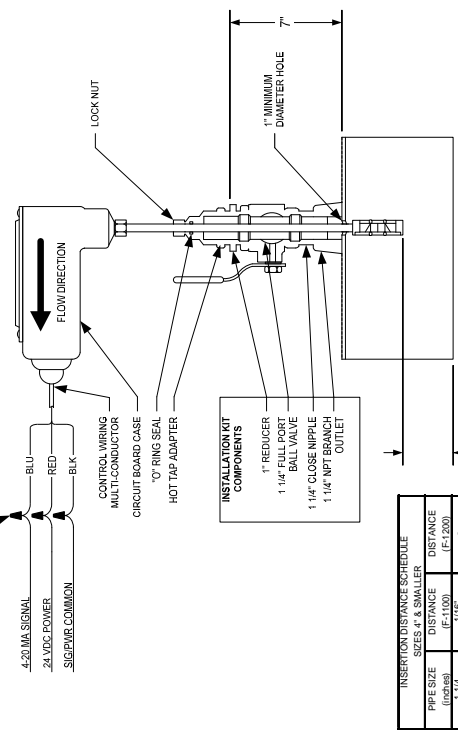
IF GROUNDED AC POWER IS USED, THE GROUNDED POWER SUPPLY LEAD MUST BE CONNECTED TO THE WHITE LEAD ON THE WD-1B, OR THE UNIT MAY FAIL TO OPERATE.

#### NOTE:

INSTALL FLEXIBLE CONDUIT FOR ALL CABLE OR WIRE BROUGHT TO END DEVICE FROM JUNCTION BOX. FLEXIBLE CONDUIT SHOULD NOT EXCEED 18 INCHES.

**ONICON F-1200 & FB-1200 SERIES DUAL TURBINE FLOW METER**

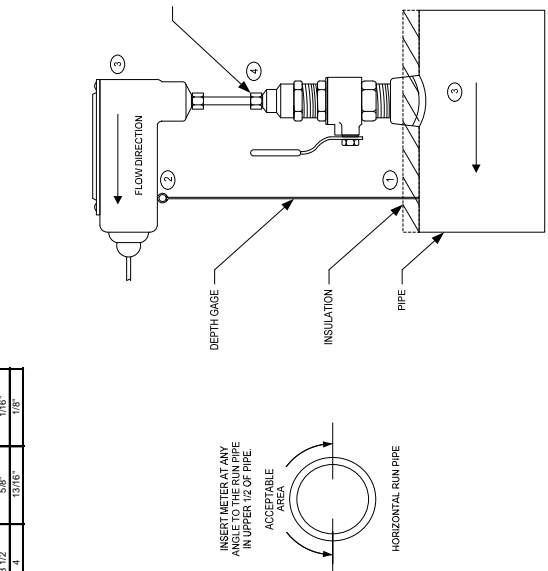
**HOT TAP INSTALLATION DETAIL  
SERIES F-1100 & F-1200 FLOW METERS**



**INSERTION DISTANCE SCHEDULE**

PIPE SIZE (OD)	DISTANCE (IN)	DISTANCE (FT-1200)
1/4"	1 1/8"	-
1/2"	1 3/8"	-
3/4"	1 7/8"	-
1"	2 1/8"	-
1 1/2"	2 7/8"	1 1/8"
2"	3 7/8"	1 7/8"
3"	4 7/8"	2 1/8"
4"	5 7/8"	2 7/8"

**INSERTION TURBINE FLOW METERS**



**STANDARD MOUNTING INSTRUCTIONS**  
**BEFORE BEGINNING, CLEAN THE EXTERNAL SURFACES OF ALL PIPES AT THE INSTALLATION SITES SO THEY ARE FREE OF DEBRIS OR FOREIGN MATTER. THE ENTIRE SYSTEM MUST HAVE BEEN FLUSHED BY THE MECHANICAL CONTRACTOR SO THAT IT IS FREE OF ANY FLUX, SOLDER, PIPE AND TUBE CUTTINGS, WELDING SLAG AND ANY OTHER FREE MOVING PARTICLES.**

**WORKING ENVIRONMENT**  
 THE F-1200 SERIES INSERTION FLOW METERS ARE DESIGNED FOR INSTALLATION AND USE IN TYPICAL INDUSTRIAL ENVIRONMENTS THAT ARE FREE OF CORROSIVE LIQUIDS AND FUMES, DIRECT LIQUID EXPOSURE OR HEAVY CONDENSATION, TEMPERATURE EXTREMES AND VIBRATIONS.  
 THE OPERATING AMBIENT AIR TEMPERATURE RANGE IS 5 - 140 DEGREES FAHRENHEIT WITH WEATHER TIGHT ELECTRONICS ENCLOSURE.

THE ELECTRICAL POWER SHOULD BE RELATIVELY CLEAN, FREE OF HIGH FREQUENCY NOISE AND LARGE VOLTAGE TRANSIENTS, AND PROTECTED FROM POWER SURGES AND BROWN OUTS.

**SITE SELECTION**  
 FOR DUAL TURBINE METERS USE 10 STRAIGHT PIPE DIAMETERS UPSTREAM AND DOWNSTREAM. SINGLE TURBINE METERS REQUIRE 20 STRAIGHT PIPE DIAMETERS UPSTREAM AND 10 STRAIGHT PIPE DIAMETERS DOWNSTREAM. NEITHER TYPE OF FLOWMETER SHOULD BE INSTALLED IN OR NEAR ELBOWS OR TEES.  
 CHOOSE A SECTION OF PIPE THAT IS WELL SUPPORTED AND FREE OF HARMONIC MOTION AND VIBRATION.  
 THE LOCATION MUST ALLOW CONVENIENT ACCESS AND CLEARANCE FOR EASY REMOVAL FOR CLEANING, REPLACEMENT, AND PREVENTIVE MAINTENANCE.  
 PLACE THE FLOW METER SO IT CAN BE USED WITH ONICON'S STANDARD HOT TAP ADAPTER AND A VALVE NIPPLE ASSEMBLY.  
 A FULL 1" OPENING IS REQUIRED TO CLEAR THE TURBINE ASSEMBLY. MAKE SURE THAT YOUR VALVES AND FITTINGS ARE FULL PORT AND AT LEAST 1" IN ACTUAL INTERNAL DIAMETER.  
 LIMIT THE OVERALL HEIGHT FROM THE PIPE'S OUTSIDE DIAMETER TO THE TOP OF THE VALVE TO 5 1/2" - 6".  
 THE FLOW METER MUST ALWAYS BE PERPENDICULAR TO THE PIPE.

**PLUMBING INSTALLATION**  
 ALL PLUMBING INSTALLATIONS SHOULD BE DONE ONLY IN PIPES WHICH HAVE READILY ACCESSIBLE SHUT-OFF VALVES SO THE FLOW MAY BE TURNED OFF IN CASE OF AN EMERGENCY. ONCE YOU CHOOSE THE INSTALLATION SITE FOR THE FLOW METER, CLEAN THE MOUNTING SURFACE. NEXT, RELIEVE ALL PRESSURE WITHIN THE FLUID SYSTEM AND REDUCE THE FLUID LEVEL TO THE HEIGHT WHERE NO LIQUID WILL ESCAPE WHEN THE INSTALLATION HOLE IS DRILLED IN THE PIPE. TO USE THE ONICON HOT TAP FEATURE, THE FLOWMETER MUST BE INSTALLED THROUGH AN ISOLATION VALVE.

**DRAINED, NON-PRESSURIZED SYSTEM**  
 THIS IS SPILLED AND PRESSURIZED. THE FLOW METER CAN NOW BE INSERTED OR REMOVED BY HAND WITHOUT HAVING TO DRAIN THE SYSTEM AGAIN.

**HOT TAP INSTALLATION**  
 THE FLOW METER CAN NOW BE INSERTED OR REMOVED BY HAND WITHOUT HAVING TO DRAIN THE SYSTEM AGAIN.

**HOT TAP INSTALLATION**  
 HOLE THROUGH THE VALVE, WITHOUT SHUTTING DOWN OR DRAINING THE PIPE.

WHEN INSTALLATIONS ARE MADE IN SMALL PIPE SIZES, A TEE MAY BE AVAILABLE. HOWEVER, THE INSIDE DIAMETER OF MOST TEES IS LARGER THAN THAT OF THE PIPE. ALSO, A TEE CREATES MORE IMBALANCE AND CAN BE A SOURCE OF VIBRATION. NECESSARY CUTTING, DRILLING AND FINISHING OF THE TEE SHOULD BE COMPLETED BEFORE THE FLOW METER IS MOUNTED. PREPARE TO INSTALL THE FLOW METER BY LOOSENING THE CLAMPING NUT AND WITHDRAWING THE TURBINE ASSEMBLY ENTIRELY INTO THE HOT TAP ADAPTER. NEXT, THREAD THE ADAPTER INTO THE BALL VALVE USING A PASTE TYPE THREAD SEALANT. DO NOT USE TEFLON TAPE BECAUSE TORN STRANDS OF THE TAPE MAY WIND AROUND THE TURBINE, SLOWING DOWN OR EVEN DAMAGING THE TURBINE. IF THERE ARE ANY LEAKS AROUND THE CLAMPING NUT OR STEEL DO NOT ATTEMPT TO STOP THE LEAKAGE BY OVER TIGHTENING THE CLAMPING NUT. DAMAGE TO THIS NUT OR THE CLAMPING RING UNDER THE NUT MAY PREVENT THE ASSEMBLY FROM PROPERLY HOLDING THE METER IN THE PIPE. THE CLAMPING NUT IS NOT PART OF THE SEALING MECHANISM. ANY LEAKS IN THIS AREA INDICATE THE 'O' RING IS NOT SEALING PROPERLY AND YOU MUST CONTACT THE FACTORY FOR ASSISTANCE.

WHEN YOU ARE READY TO REFILL THE SYSTEM, MAKE SURE THAT ALL LINES ARE FILLED WITH WATER BEFORE INSERTING THE TURBINE INTO THE STREAM. IF THE LINES ARE NOT FILLED, AIR MAY INTERRUPT THE FLOWING STREAM AND DAMAGE THE TURBINE ASSEMBLY. A GREATER DANGER IS THAT IF THIS IS A HOT WATER SYSTEM, SOME WATER MAY FLASH INTO STEAM AND DAMAGE THE TURBINE AND ITS MECHANICAL ASSEMBLY. THE ASSEMBLY COULD FAIL TO HOLD THE PRESSURE AND ALLOW STEAM AND HOT WATER TO ESCAPE, CAUSING SERIOUS INJURY OR DEATH.

**INSERTION OF THE METER**  
 1. PIERCE THE INSULATION WITH THE DEPTH GAGE UNTIL THE TIP TOUCHES THE EYE OF THE DEPTH GAGE.  
 2. OPEN THE VALVE COMPLETELY, LOOSEN THE LOCK NUT, AND INSERT THE METER UNTIL THE BOTTOM OF THE ELECTRONICS CASE TOUCHES THE PIPE.  
 3. TIGHTEN THE LOCK NUT.

**REMOVAL OF THE METER**  
 THE METER MUST BE UNDER HIGH PRESSURE. CARE MUST BE TAKEN TO ENSURE THE METER IS SUPPORTED AGAINST THE PIPE PRESSURE BEFORE THE POSITION CLAMPING NUT IS LOOSENED. FAILURE TO DO THIS WILL ALLOW THE PRESSURE TO SUDDENLY AND RAPIDLY FORCE THE METER FROM THE PIPE. THE HAND EFFORT TO SUPPORT THE METER WILL BE 0.11 TIMES THE PIPE PRESSURE. IF THE METER IS NOT SUPPORTED PROPERLY DAMAGE TO THE METER OR SERIOUS PERSONAL INJURY MAY RESULT.

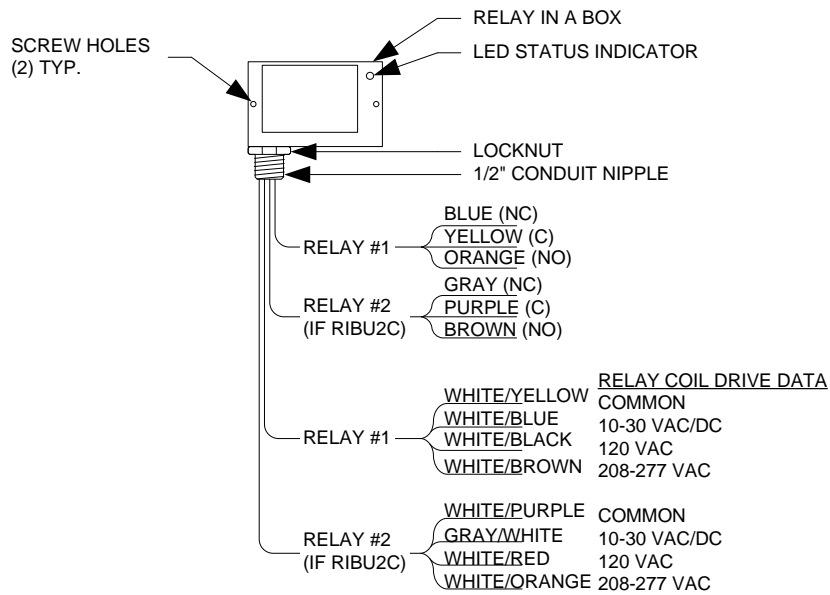
**PRIOR TO REMOVAL OF THE METER, MAKE SURE YOU ARE STANDING ON A SECURE PLATFORM AND HAVE BOTH HANDS AVAILABLE TO MANIPULATE THE FLOW METER.**

FIRST SUPPORT THE FLOWMETER AGAINST THE PIPE PRESSURE BY HOLDING THE CIRCUIT BOARD ENCLOSURE FIRMLY BY HAND BEFORE LOOSENING THE POSITION CLAMPING NUT. SLOWLY LOOSEN THE POSITION CLAMPING NUT. THE POSITION CLAMPING NUT IS NOT PART OF THE SEALING MECHANISM. IF THE POSITION CLAMPING NUT IS LOOSENED, YOU MAY CLOSE THE VALVE AFTER THE VALVE IS COMPLETELY CLOSED. YOU CAN SAFELY UNSCREW THE HOT TAP ADAPTER FROM THE VALVE.

**NOTE:**  
 FLOW METER FEATURES A NON-ISOLATED OUTPUT. THIS IS NOT A LOOP-POWERED DEVICE. DO NOT CONNECT POWER TO ANY OF THE SIGNAL OUTPUT WIRES.

RIB-1

## RELAY IN A BOX - PILOT SERIES (RIBU1C & RIBU2C)



### MOUNTING INSTRUCTIONS:

THE RIB PILOT SERIES HAS A 1/2" NPT NIPPLE FROM WHICH ALL WIRES EXIT.

### JUNCTION BOX OR EQUIPMENT MOUNTING INSTRUCTIONS

REMOVE A 1/2" CONDUIT KNOCKOUT IN THE EQUIPMENT, INSERT THE WIRES & NIPPLE THROUGH THE HOLE, TIGHTEN THE LOCKNUT, AND CONNECT THE WIRES.

### SURFACE MOUNTING INSTRUCTIONS

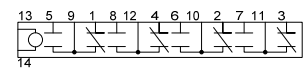
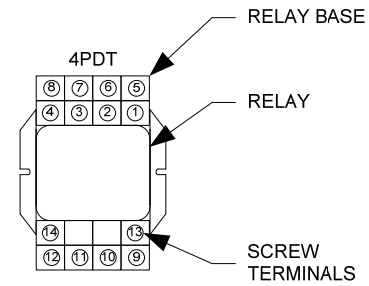
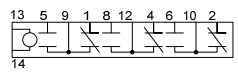
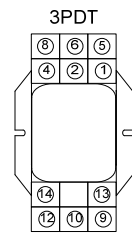
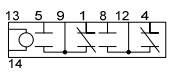
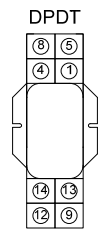
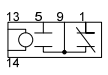
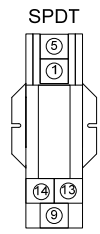
FASTEN THE RELAY TO THE DESIRED LOCATION USING THE (2) SCREW HOLES IN THE HOUSING.

### NOTE:

INSTALL FLEXIBLE CONDUIT FOR ALL CABLE OR WIRE BROUGHT TO END DEVICE FROM JUNCTION BOX. FLEXIBLE CONDUIT SHOULD NOT EXCEED 18 INCHES.

REL-1

IDEC GENERAL PURPOSE RELAYS



SCREW TERMINAL DESIGNATION

- 13 (-) & 14 (+) - COIL
- 5 & 9 - NO CONTACT 1
- 1 & 9 - NC CONTACT 1
- 8 & 12 - NO CONTACT 2
- 4 & 12 - NC CONTACT 2
- 6 & 10 - NO CONTACT 3
- 2 & 10 - NC CONTACT 3
- 7 & 11 - NO CONTACT 4
- 3 & 11 - NC CONTACT 4

PANEL MOUNTING INSTRUCTIONS

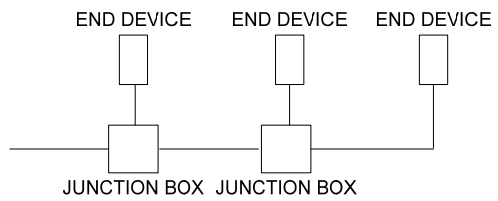
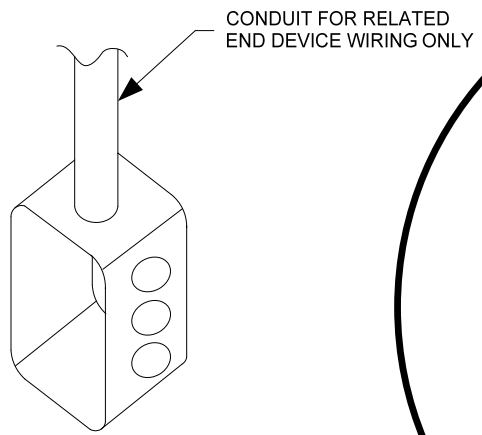
SNAP THE RELAY BASE ONTO THE DIN RAIL IN THE DESIRED LOCATION. PART NUMBER FOR 35 mm DIN RAIL: DIN-3F OR DIN 6F ( 3 OR 6 FOOT LENGTHS RESPECTIVELY).

SURFACE MOUNTING INSTRUCTIONS

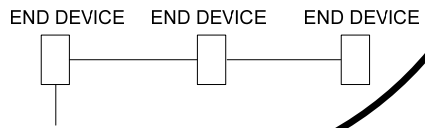
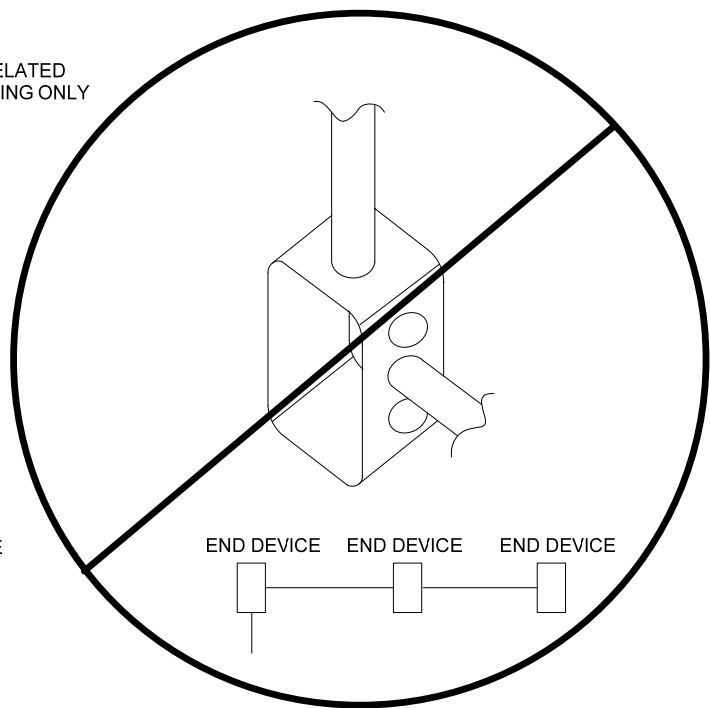
FASTEN THE RELAY BASE TO THE DESIRED LOCATION USING THE (2) SCREW HOLES IN THE RELAY BASE.

JB-1

END DEVICE TERMINATION BOX DETAIL



ACCEPTABLE INSTALLATION PRACTICE.



UNACCEPTABLE INSTALLATION PRACTICE.

**NOTE**  
DO NOT USE AN END DEVICE ENCLOSURE AS A RACEWAY FOR OTHER WIRING.

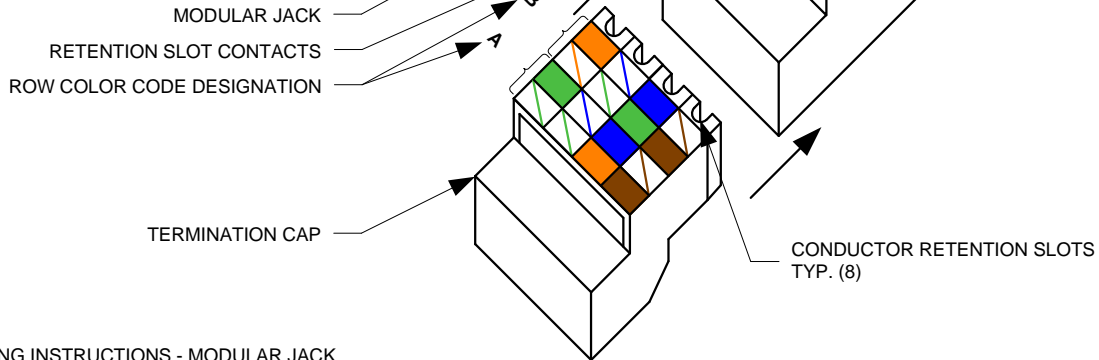
JCK-1

## MINI-JACK TX-5e MODULAR JACK

### COLOR CODE

(IF USING A, REFER TO THE COLOR CODE ON ROW 3 & 4)  
 (IF USING B, REFER TO THE COLOR CODE ON ROW 1 & 2)

		COLUMN			
		1	2	3	4
B	ROW 1	Orange	Blue	Green	Brown
	ROW 2	Green	Blue	Orange	Brown
A	ROW 3	Green	Blue	Orange	Brown
	ROW 4	Orange	Blue	Green	Brown



### MOUNTING INSTRUCTIONS - MODULAR JACK

- FOR MAGNUM CABLE CORPORATION P/N A50089BLU (24/8 CAT5e WIRE), USE ROWS 1 & 2 (B). USE SOLID CONDUCTOR CABLE.
- ROUTE THE CONDUCTORS THROUGH THE SLOT IN THE TERMINATION CAP. DO NOT UNTWIST THE PAIRS PRIOR TO INSERTING INTO THE TERMINATION CAP. PUSH THE CABLE JACK INTO THE CAP AS FAR AS POSSIBLE.
- UNTWIST PAIRS, ONE AT A TIME STARTING WITH THE OUTSIDE PAIRS, AND PLACE INTO THE APPROPRIATE RETENTION SLOT BASED ON THE COLOR CODE. UNTWIST EACH PAIR ONLY AS FAR AS REQUIRED TO PLACE THE CONDUCTORS IN THE SLOTS.

#### IF USING A, TERMINATE:

- GREEN ON BOTTOM SLOT OF COLUMN 1
- GREEN / WHITE ON TOP SLOT OF COLUMN 1
- BLUE / WHITE ON BOTTOM SLOT OF COLUMN 2
- ORANGE / WHITE ON TOP SLOT OF COLUMN 2
- BLUE ON BOTTOM SLOT OF COLUMN 3
- ORANGE ON TOP SLOT OF COLUMN 3
- BROWN / WHITE ON BOTTOM SLOT OF COLUMN 4
- BROWN ON TOP SLOT OF COLUMN 4

#### IF USING B, TERMINATE:

- ORANGE ON BOTTOM SLOT OF COLUMN 1
- ORANGE / WHITE ON TOP SLOT OF COLUMN 1
- BLUE / WHITE ON BOTTOM SLOT OF COLUMN 2
- GREEN / WHITE ON TOP SLOT OF COLUMN 2
- BLUE ON BOTTOM SLOT OF COLUMN 3
- GREEN ON TOP SLOT OF COLUMN 3
- BROWN / WHITE ON BOTTOM SLOT OF COLUMN 4
- BROWN ON TOP SLOT OF COLUMN 4

**NOTE:** ROWS 1&3 CORRESPOND TO THE BOTTOM ROW OF RETENTION SLOT CONTACTS WHILE ROWS 2&4 CORRESPOND TO THE TOP ROW.

- TRIM THE CONDUCTORS FLUSH WITH THE CAP USING THE WIRE SNIPPING TOOL. ENSURE ALL CONDUCTORS ARE SEATED.
- SLIDE THE TERMINATION CAP ONTO HOUSING AND PUSH FORWARD. COMPLETE THE TERMINATION WITH A PAIR OF SMOOTH JAW SLIP LOCK PLIERS.