CIDRA CYCLONEtrac™ PST

Installation Manual
P/N 21464-01-EN Rev. 06

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CIDRA Corporate Services
Tel: 203.265.0035

50 Barnes Park North
Fax: 203.294.4211

Wallingford, CT 06492
www.cidra.com

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1. INTRODUCTION

1.1 Introduction

CYCLONEtrac™ PST (**P**article **S**ize **T**racking system) is an individual hydrocyclone performance monitoring system that provides on-line particle size measurement of material in the overflow. This allows optimization of the grind line and hydrocyclone battery.

This manual covers the basic installation and setup of the CYCLONEtrac PST Junction Box, Power Entry Box, and Sensor Head Assembly.

In all cases, local safety and operating practices take precedence over the information contained within this document.

1.2 Junction Box, Power Entry Box and Sensor Head Assembly Description

CYCLONEtrac PST has 2 possible configurations:

1. AC-powered Junction Box - Refer to section 6 for installation instructions.
2. AC-powered Power Entry Box providing 24VDC to DC-powered Junction Box - Refer to section 7 for installation.

The second configuration eliminates any hazardous voltages in the Junction Box.

The Junction Box interfaces to a maximum of 16 Sensor Head Assemblies. It provides RS485 communication to the Sensor Head Assembly and converts the RS485 signals to Ethernet for Laptop connection.

The Sensor Head Assembly (aka “Sensor”) attaches to the pipe and varies in size according to pipe size. The Sensor Head Assembly detects particles impinging or striking its probe which extends into the pipe through a hole drilled in the pipe wall. The Sensor Head assembly then converts the particles impinging to electric signals and sends this information to the Junction Box.

1.3 Intellectual Property Notices

Hydrocyclone Performance Monitoring Products may be covered by one or more of the following granted U.S. Patent(s): 7,032,432; 7,058,549; 7,062,976; 7,086,278; 7,110,893; 7,121,152; 7,127,360; 7,134,320; 7,139,667; 7,146,864; 7,150,202; 7,152,003; 7,152,460; 7,275,421; 7,359,803; 7,363,800; 7,437,946; 7,529,966; 7,657,3927,810,400; 8,739,637; 9,057,635; 9,645,001; 9,921,092;

10,309,887; 10,394,207; 10,814,339; 10,830,623; 10,989,635; 11,125,593; 11,260,399.

Other patents are pending; see www.cidra.com for the latest listing of patents.

1.4 Warranty

The terms and conditions, including warranty, of the purchase of CYCLONEtrac PST Hydrocyclone Monitoring System are given in the document titled “CiDRA’s Terms and Conditions of Sale”.

1.5 CiDRA Contact Information

CiDRA Minerals Processing Inc.
50 Barnes Park North
Wallingford, CT, USA 06492

Telephone: 1-203-265-0035
1-877-243-7277 (US and Canada)

Email: www.cidra.com

Sales Support: sales@cidra.com

Customer and Technical Support: customersupport@cidra.com

1.6 CYCLONEtrac PST EU Declaration of Conformity

The EU Declaration of Conformity provides the justification for the CE marking of a product. It identifies all the EU Directives that apply to the product along with the Standards that the product was designed to or tested against to demonstrate compliance with those directives. CE marking is a requirement only for products sold in the European community. The EU Declaration of Conformity is for CYCLONEtrac PST product in Ordinary Location.

The Declaration of Conformity is shipped with the CYCLONEtrac PST and can also be found on www.cidra.com in Resource Center/Certification.

2. EQUIPMENT SAFETY COMPLIANCE

2.1 Safety

This equipment is listed with TÜV Rheinland of North America, Inc., a nationally recognized testing laboratory, and certified for ordinary location use per the following US, and Canadian standards: IEC / EN 61010-1, UL 61010-1 and CSA C22.2 No 61010-1.

2.2 North American Emissions

This equipment is compliant with Class A limits for radiated and conducted radio noise emissions, as defined in Subpart A of Part 15 of the FCC rules, as well as the requirements defined in ICES-003 for Canada.

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

For Electromagnetic Compatibility (EMC) requirements, this product is categorized as Group 1, Class A ISM equipment. This categorization applies to Industrial, Scientific or Medical equipment that intentionally generates or uses conductively coupled (but not intentionally radiated) radio-frequency energy that is necessary for the internal functioning of the equipment. The level of EMC compliance is consistent with industrial use but not for domestic purposes.

2.2.1 European Emissions and Immunity

This equipment is compliant with the requirements set forth in EN 61326-1, Laboratory Use - EMC requirements as well as EN 55011 Industrial, Scientific, and Medical (ISM) Radio Frequency Equipment - Radio Disturbance Characteristics - Limits and Methods of Measurement.

CAUTION

Class A equipment is intended for use in an industrial environment. There may be potential difficulties in ensuring electromagnetic compatibility in other environments, due to conducted as well as radiated disturbances.

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3. GENERAL SAFETY GUIDELINES

3.1 Introduction

This manual is intended to be a general installation guide for the CYCLONEtrac PST process monitoring systems. It is not intended to cover the installation details for every process due to the wide variety of applications and processes on which the system can be used. In all cases, local safety and operating practices should take precedence over instructions contained within this manual.

The installer must fully read this manual prior to installing and operating the CYCLONEtrac PST process monitoring system.

3.2 Safety Precautions

The following style of Warnings and Cautions are used throughout the manual to draw attention to information regarding personnel safety and equipment care. They are intended to supplement but not replace local or plant safety procedures.

	**WARNING** **Situation has the potential to cause bodily harm or death.**

	**CAUTION** **Situation has the potential to cause damage to property or equipment.**

3.3 Definitions of Symbols

The following terms and symbols are used in this document and on the process monitoring system where safety related issues occur.

3.3.1 General Warning or Caution

Figure 1: General Warning or Caution Symbol

The Caution Symbol in Figure 1 appears in Warning and Caution tables throughout this document. This symbol designates an area where personal injury or damage to the equipment is possible.

This symbol is also used on the equipment. Documentation needs to be consulted in all cases where this symbol is used.

On the AC Junction box, this symbol is found on the certification label (on the box exterior) next to the AC electrical ratings, and on labels inside the box drawing attention to the AC power cable (one on the inside of the door and another near the power entry board where the AC power terminals are). In addition to the information on those interior labels about the minimum temperature rating for the AC power cable, other important information is to be found in section 6, and especially 6.2 and 6.2.1.

On the Power Entry box, this symbol is found on the certification label (on the box exterior) next to the AC electrical ratings, and on a label inside the box drawing attention to the AC power cable (below the DIN-rail-mounted AC power terminals). In addition to the information on that interior label about the minimum temperature rating for the AC power cable, other important information is to be found in section 7, and especially 7.2 and 7.2.1.

On the Power Entry box, this symbol is also found on a label or labels inside the box below the DIN-rail-mounted 24VDC output power terminals. In addition to the information on that interior label about the minimum temperature rating, minimum wire gauge, and maximum cable length for the DC output power cable, other important information is to be found in section 7, and especially 7.3.

3.3.2 Grounding

Figure 2: Grounding Symbol

The Grounding Symbol in Figure 2 appears on labels affixed to the CYCLONEtrac PST system. This symbol identifies components that are part of the protective earth circuit. See sections 6 or 7 for instructions for wiring this protective earth circuit to a local earth ground.

3.3.3 Electric Shock Hazard

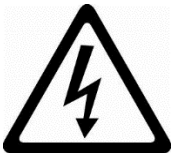

Figure 3: Electric Shock Hazard

The Electric Shock Hazard warning symbol in Figure 3 appears on labels near the mains power connections inside the Power Entry Box and the AC Junction Box and also in this manual in conjunction with warnings about the hazard of electric shock. Those mains power terminals and the associated wires and fuses are the primary risks of electric shock in the CYCLONEtrac™ PST system. The electronic circuitry, itself, does not generate voltages higher than nominal 24VDC. This symbol is used where AC wiring is exposed at terminals on circuit boards, DIN rails, or Power Supply modules and at fuses. In systems that include a Power Entry box, the DC Junction box is powered by non-hazardous 24VDC and so no electric shock warning symbols are used inside the DC Junction box. Similarly, the Sensors in both types of systems are powered by non-hazardous 24VDC and so there are no electric shock warnings associated with the Sensors. For the boxes that are powered by AC mains voltages, electric shock safety is ensured by depowering the box prior to opening it. Whenever the box is open with AC power applied, to avoid electric shock keep hands and tools away from those areas where AC wiring exists (identified with the electric shock warning symbol).

3.4 General Warnings and Cautions

Observe these rules when operating or servicing this equipment:

- The safety of any system incorporating this CYCLONEtrac™ PST system as an element is the responsibility of the assembler of that system.
- If the equipment is used in a manner not specified by manufacturer, the protection provided by the equipment may be impaired.
- Prior to operation of this equipment, personnel should read the instruction manual thoroughly.
- Trained personnel must carry out service on this equipment.
- Follow all warnings on the unit and in the operating instructions.
- Follow static sensitive device precautions when servicing.

- Do not wear rings or wristwatches when servicing this equipment.
- To preserve the safety of this product, use only manufacturer specified replacement parts and do not perform unauthorized substitutions or modifications.
- Prior to servicing, lockout all electrical power sources.
- This product should only be powered as described in the manual. Read the instructions for proper input voltage range selection.
- This equipment is grounded through the grounding conductor of the power cord.
- Ensure all power cords, Junction Box cables, Power Entry Box cables, and Sensor Head Assembly signal cables are properly routed to eliminate damage to them. Cable conduit may be desirable to minimize potential damage.
- Do not run power and signal wires in a common conduit.
- Fuse replacement must be performed by trained service personnel.
- Disconnect power to Junction Box or Power Entry Box prior to replacing fuse(s).

WARNING

Electrical shock hazard. Always disconnect power source prior to removing fuses. Failure to remove power source may result in injury or death.

- Use only the specified fuse(s) with the correct type number, voltage and current ratings as referenced in Appendix A and on the labels on the equipment.
- CiDRA performs a leak test (pipe to Saddle/Sensor Head Assembly) at maximum pressure of 30 PSI prior to shipment of the assembly. This verifies non-leakage of Sensor and improves safety risk factor.
- The only moving parts in the CYCLONEtrac^{TM} PST system are the hinged covers of the Power Entry and Junction boxes. Use caution to avoid pinching wiring or fingers when closing the covers.

4. PREPARATION FOR INSTALLATION

4.1 Introduction

The Sensor Head Assemblies (Figure 4: Sensor Head Assembly Mounted to Pipe) process the Sensor data for output to the CYCLONEtrac PST data acquisition and reporting system.

Figure 4: Sensor Head Assembly Mounted to Pipe

4.2 Installation Considerations

4.2.1 Preparation

Prior to installing the CYCLONEtrac PST system, verify that the system is rated for the area where it will be installed. Consider the available power, the ambient temperature, and the installation area classification. If the markings on the Junction Box, Power Entry Box and Sensor Head Assembly received are not consistent with the conditions of the area in which it is be installed, contact Customer Support.

Note: The CYCLONEtrac PST system is rated for use only in non-hazardous locations.

⚠	**Warning** **Explosion hazard – Install only in Non-Hazardous locations.**

In addition to the warnings and cautions in this section, refer also to the General Safety Guidelines in section 3.

4.2.2 Power Requirements

The CYCLONEtrac PST system requires an input voltage of 100 – 240 volts AC, 50/60 Hz applied to the Power Entry box (for systems which include a Power Entry box) or to an AC Junction Box. The power rating is 200W per Junction box, or 400W for systems wherein a Power Entry box powers 2 Junction boxes.

WARNING

Electrical shock hazard. Always disconnect power source prior to removing fuses. Failure to remove power source may result in injury or death.

Each Sensor Head Assembly requires 24VDC and 6 watts of power, which is provided by the Junction Box.

4.2.3 System Environmental Conditions

See Appendix A for the System Environmental Conditions.

4.2.4 Restriction of Access to Power Entry Box and Junction Box

Access to opening the cover to the Junction Box and Power Entry Box must be restricted to properly trained service personnel only. The Power Entry and Junction Box enclosures have their hinged cover held closed with 4 screw-down door clamps and there is also a hasp and staple for padlocking to further prevent unauthorized access if necessary. Note: It should never be necessary to open the Sensor Head Assembly anywhere other than at the factory.

4.3 Suggested Power Entry Box and Junction Box Installation

The envelope drawings of the Power Entry box and Junction box are shown in Appendix A in sections A10 and A11, respectively, along with their mounting hole locations. The tabs on the top have two holes that are 0.44” (11mm) in diameter, and the tabs on the bottom have two slots of the same width. It is suggested to mount each box to 2 vertical strut channels. and to use two adjustable pipe strut mount clamps inserted into each strut channel which can be then be used to mount the box to a railing. These drawings and others include those suggested struts and clamps even though they are not provided as part of the CYCLONEtrac PST kit. Allow at least 6-inch [15.3cm] clearance on all sides of boxes.

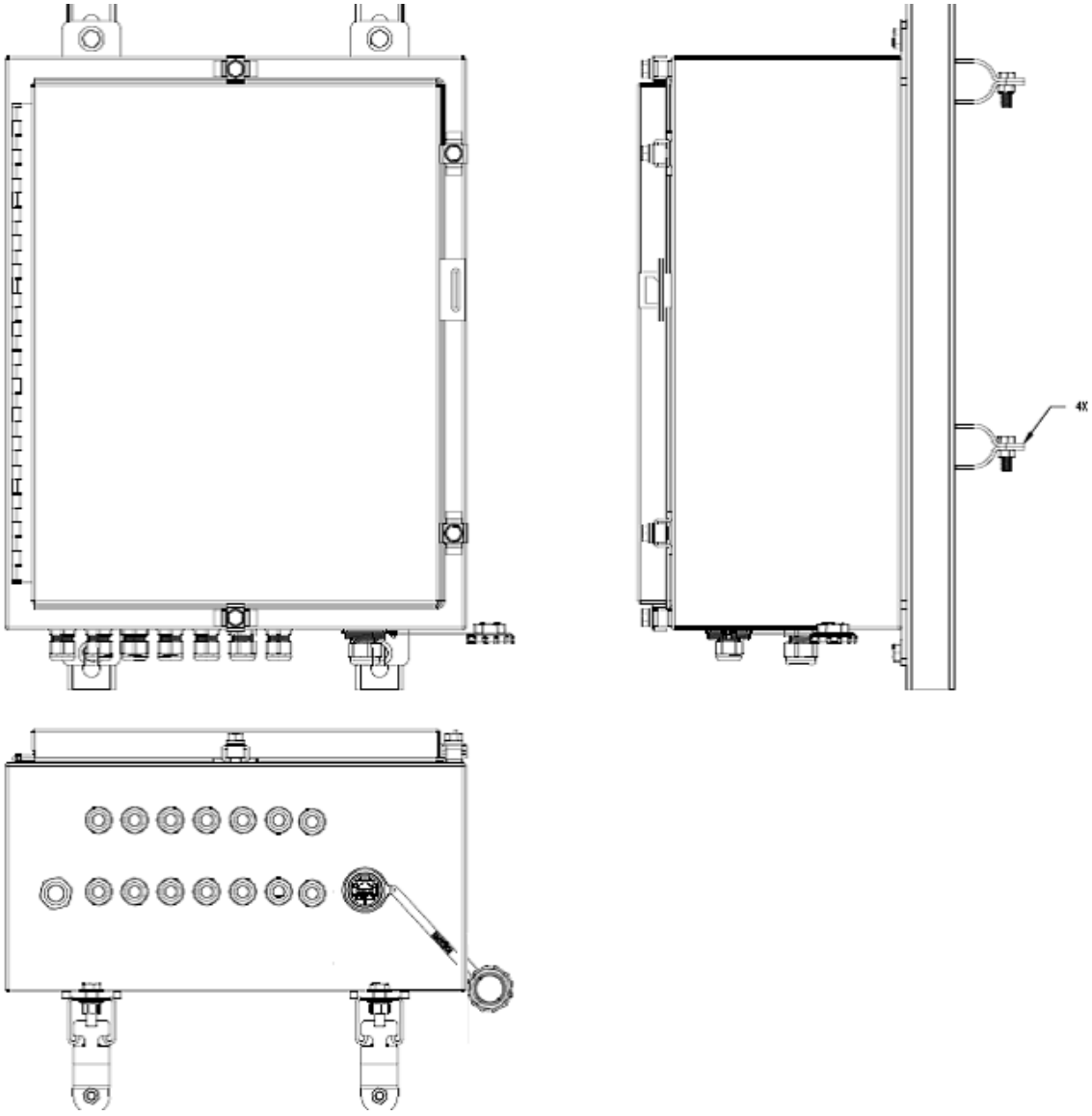

Figure 5: Junction Box Mounting

5. SENSOR HEAD ASSEMBLY MOUNTING

5.1 Pipe Modification Procedure

The following figure illustrates a typical hydrocyclone battery

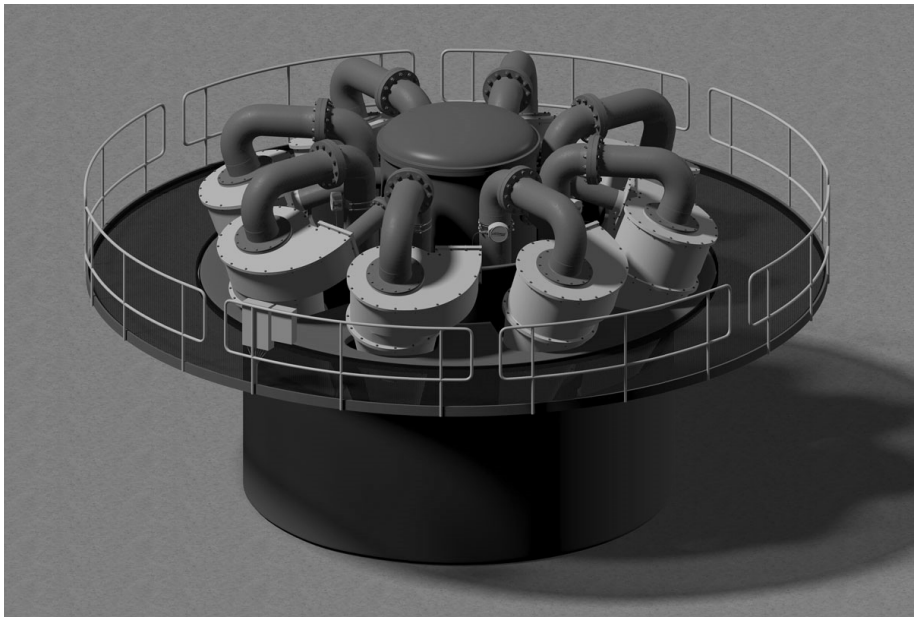

Figure 6: Hydrocyclone Battery

To install the PST system, the hydrocyclone overflow pipes must have a through-hole on the pipe to admit the Sensor's probe. The exact size of the hole will be specified by CiDRA. The following example shows a 2" (5.1cm) hole installed in a hydrocyclone overflow pipe.

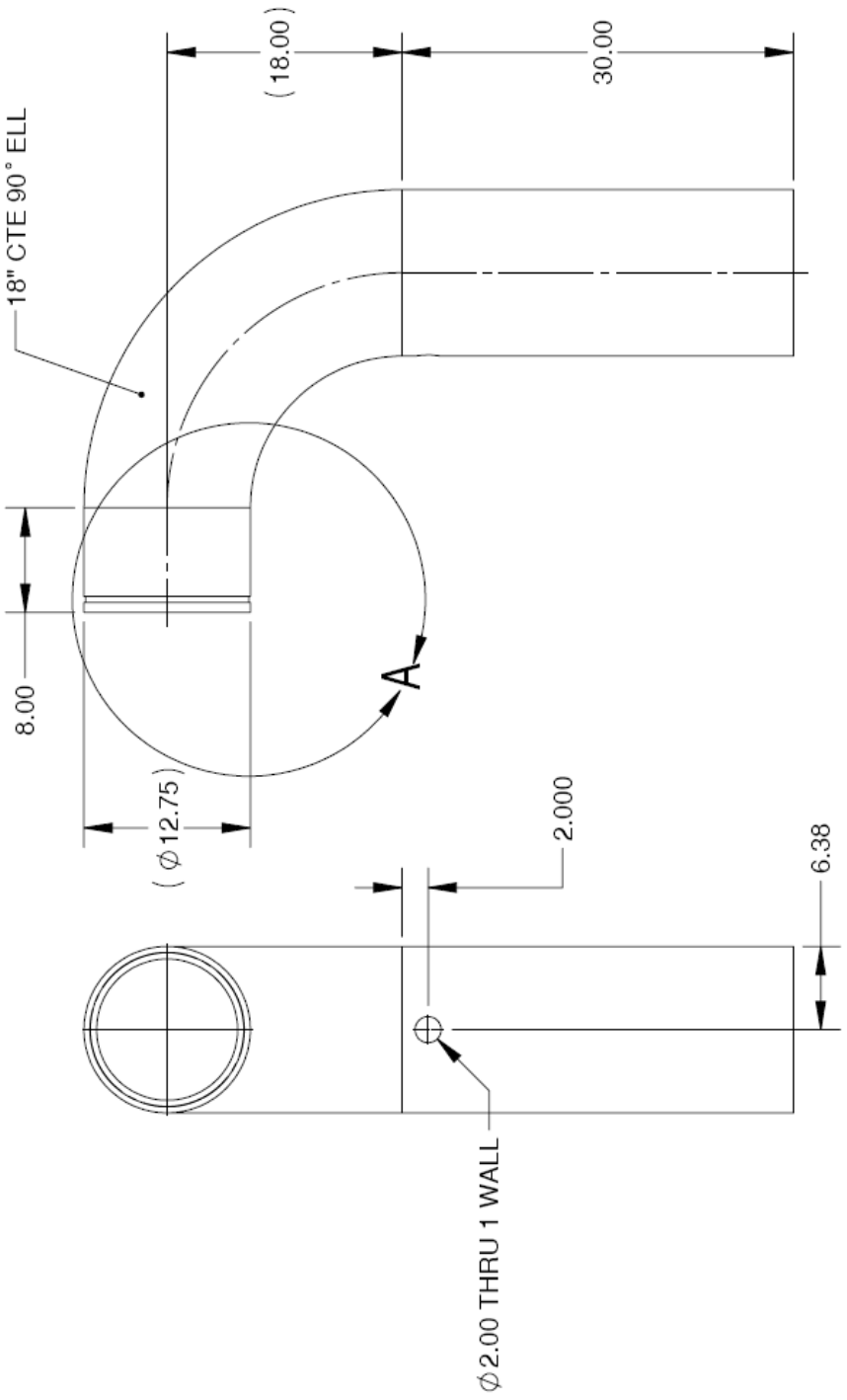

Figure 7: Hole Placement

The modified overflow pipes will then be installed in preparation for the CYCLONEtrac PST Sensor Head. The pipe with installed Sensor Head is shown in the following figure.

Figure 8: Mounted Sensor Head Assembly

Often, temporary plugs are installed prior to installation of the Sensor Head as shown below.

Figure 9: Temporary Plug

The following is a suggested procedure for preparing and modifying the overflow pipes.

1. Inspect the rubber liner. If large tears exist, consult with engineering to determine if replacement is required.
2. Clean the outside of the overflow pipe using water and a wire brush. Pay special attention to the CYCLONEtrac PST band area.
3. Rotate the overflow pipe so that the drill location is facing up. Block the sides of the pipe to prevent it from rolling.
4. Use a tape measure and marker to mark the drill point location and tooling plate location.
5. Mount the magnetic drill tooling plate.
6. Mount the magnetic drill on the tooling plate. Engage the electromagnet.
7. Use the fine adjustment feature on the magnetic drill to align the drill point.
8. Drill the hole.

CAUTION

Always wear eye protection when drilling.

9. Remove the magnetic drill and tooling plate.
10. Inspect the liner to be sure the rubber did not separate from the pipe wall.

5.1.1 Sensor Head Assembly Installation

1. Insert the saddle/Sensor Head assembly into the hole for the Sensor's probe.
2. Install the lower U-bolts. Insert the threaded sections of the U-bolts through the mating holes in the saddle assembly.
3. Install the four (4) washers and nuts on the threaded sections of the U-bolts to secure the saddle assembly onto the pipe.
4. Evenly tighten the 4 nuts a couple of turns at a time to ensure the saddle assembly is tightened to the pipe and the Sensor's probe is centered in the hole.
5. Install thread covers on the threaded sections of the U-bolts.

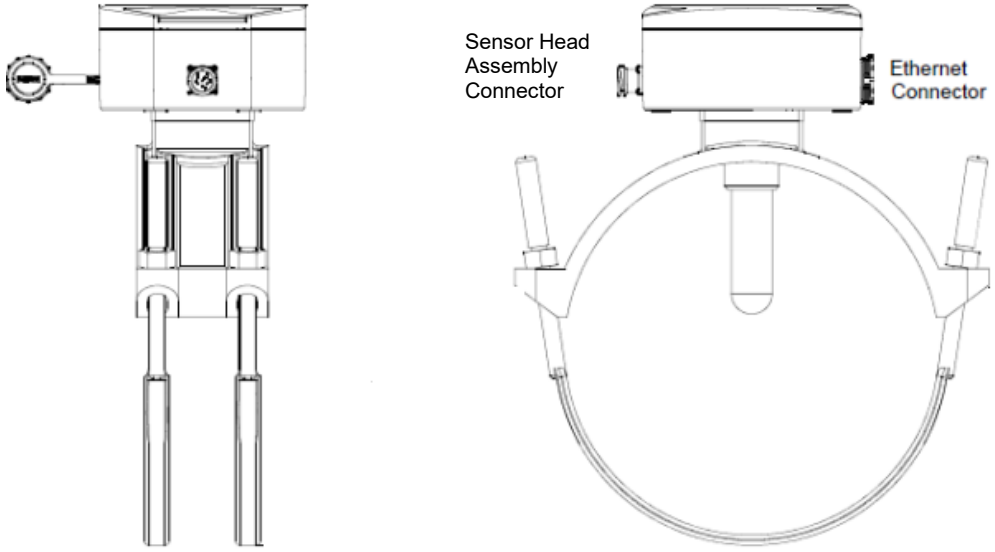

Figure 10: Saddle Assembly

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6. ELECTRICAL CONNECTIONS TO AC JUNCTION BOX

This Junction Box configuration has no Power Entry Box so the AC mains connections are made within the Junction box. Portions of the Junction Box will be pre-wired at the factory prior to shipment. Those connections where field wiring is required are discussed in the following sections.

6.1 Junction Box Cable Entries

Power and interconnections between Sensor Head Assembly, and control system are made in the Junction Box shown in the following figure.

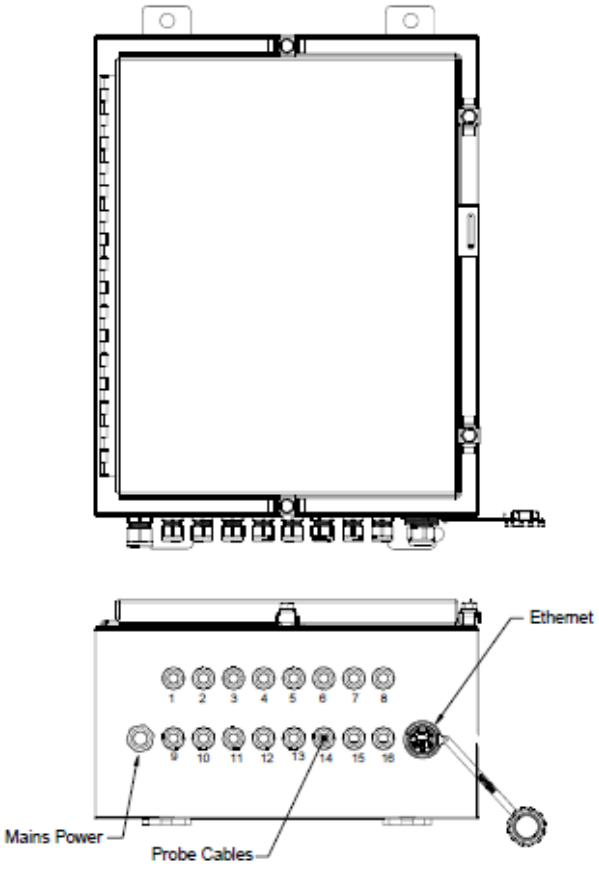

Figure 11: Junction Box Connections

Installer may remove Mains Power gland and connect conduit with minimum IP66 seal.

Note: There may be less than 16 Sensor connections on a box. However, the numbering pattern will remain the same.

6.1.1 AC Junction Box Cable Connections

- Mains Power Terminal Connections – see section 6.2
- Sensor Cable Terminal Connections (up to 16 Sensor cables) – see section 6.3
- Ethernet Connector connection - see section 6.4

6.2 AC Power for AC Junction Box

The Mains Power in the Junction Box brings electrical power into the box, and transfers power out to the Sensor Head Assemblies. The holes are sized for ¾-inch NPT fittings (1-$^{1}/_{16}$ inch / 27mm diameter). Refer to Figure 11.

The service personnel must have a way to remove power from the AC Junction Box prior to opening the enclosure, the ability to see that the power has been removed, and a way to quickly remove power in the case of emergency. [Note: Properly assembled and fully-functioning Junction boxes have an LED on the upper-left of their covers that indicate whether they are powered.] To be fully-compliant with the 61010-1 safety standard, the following method of meeting this requirement must be followed. The system installation should include a marked and appropriately rated switch near the Junction Box and within easy reach of the operator. The function of this switch is to provide a safe means for electrical power to be shut off. The Junction Box must not be installed in a position that makes it difficult to operate the switch . The switch must be marked as the disconnecting device for the CYCLONEtrac PST system. The switch shall disconnect all current-carrying conductors (i.e. Line and Neutral).

The switch shall have a minimum current rating of 13A.

In addition to the switch, an over-current protection device must be installed on the supply side of the Mains Power Input to the system. The over-current protection device shall have a maximum current rating of 20A.

A circuit breaker may be used as both a switch and over-current protection device. The circuit breaker rating shall be between 13A and 20A.

6.2.1 Mains Power connection to AC Junction Box

The CYCLONEtrac PST hydrocyclone monitoring system will accept 100 – 240 VAC 50/60 Hz power. Use only power cables with copper conductors size 18 AWG minimum to 10 AWG maximum (0.82mm^2 to 5.26mm^2) with a ground conductor. Use AC mains cable rated 167°F (75°C) or higher.

	**WARNING** **Always use a non-current-carrying safety ground. Failure to use a non-current-carrying safety ground could result in injury or death.**
	**CAUTION** **Always use a non-current carrying safety ground attached to the ground terminal on the input power terminal blocks. Failure to do so could result in poor system operation.**

Insert the electrical power cable through the fitting on the bottom side of the enclosure shown in the previous figure.

Referring to Figure 12, connect:

- Ground Wire (green/yellow) to ⏚ (left terminal)
- Neutral Wire (white – US, blue - Eur) to **N** (-) center terminal)
- Line Wire (Hot) (black – US, brown - Eur) to **L** (+) (right terminal)

The recommended torque for the terminal screws is 5 to 6 inch-lbs. (0.6 to 0.7 Nm).

Note that there is an ON/OFF switch on the board shown in Figure 12 that can disconnect the AC Mains power from virtually everything in the AC Junction box and will also turn off the 24V DC power to all Sensor Head Assemblies powered by that AC Junction box.

Figure 12: Mains Power Connection (NO POWER ENTRY BOX)

6.3 Sensor Cables 1 thru 16 max Connection

Sensor Head Assembly Interconnects all have the same signal types:

Sensor Power:	+24V Current Limited Power out from Junction Box
Communication:	RS-485 for communications between Sensor Head Assembly and Junction Box

See section 8 for connection details.

6.4 Ethernet Connection

The Ethernet connection is for standard 10/100Base-T CAT5 (or better) cables with RJ-45 connectors and T568A or T568B standard wire connections. It is an IP68 connector with retained dustcap located on the bottom of the enclosure. To maintain the IP68 rating of the connector and the IP66 rating of the enclosure, use the mating IP68 connector/cable assembly from the Samtec SCPE family (http://suddendocs.samtec.com/catalog_english/scpe.pdf).

7. ELECTRICAL CONNECTIONS TO POWER ENTRY BOX

This Junction Box configuration includes a Power Entry Box where the AC mains connections are made, and then the 24VDC created by the Power Entry box is used to power the DC Junction box. Portions of the Power Entry Box and Junction Box will be pre-wired at the factory prior to shipment. Those connections where field wiring is required are discussed in the following sections.

7.1 Power Entry Box Cable Entries

Power Entry Box Connections shown in Figure 13.

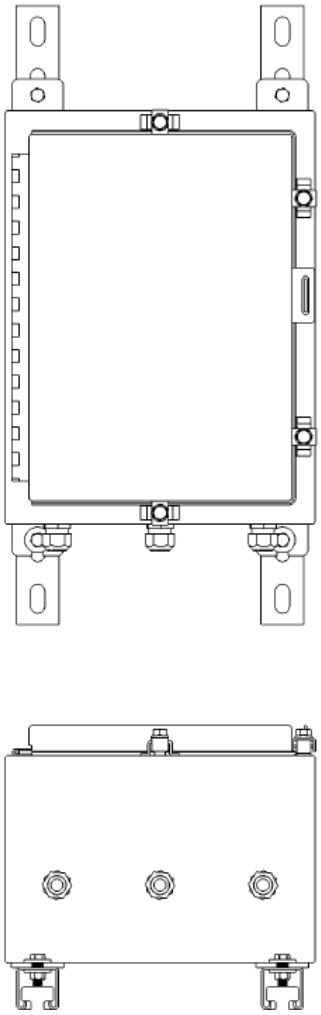

Figure 13: Power Entry Box Connections

Note that some Power Entry box enclosures containing only a single 24V power supply may include only two cable entry holes. Installer may remove Mains power gland and connect conduit with minimum IP66 seal.

7.1.1 Power Entry Box Cable Connections

- Mains Power Terminal Connections – see section 7.2
- 24VDC Output Power Terminal Connections – see section 7.3

7.1.2 DC Junction Box Cable Connections

Note: Cable entry holes are same as shown in Figure 11.

- 24VDC Input Power Terminal Connections – see section 7.4
- Sensor Cable Terminal Connections (up to 16 Sensor cables) – see section 7.5
- Ethernet Connector connection see section 7.6

7.2 AC Power for Power Entry Box

The Main Power for the Power Entry Box is used to bring electrical power into the Power Entry Box and transfer power out to the Junction Box and Sensor Head Assemblies. The holes are sized for ¾-inch NPT fittings (1-$^{1}/_{16}$ inch / 27mm diameter). Refer to Figure 13.

The service personnel must have a way to remove power from the Power Entry Box prior to opening the enclosure, the ability to see that the power has been removed, and a way to quickly remove power in the case of emergency. [Note: Properly assembled and fully-functioning Power Entry boxes have an LED on the upper-left of their covers that indicate whether they are powered.] To be fully-compliant with the 61010-1 safety standard, the following method of meeting this requirement must be followed. The system installation should include a marked and appropriately rated switch within proximity to the Power Entry Box and within easy reach of the operator. The function of this switch is to provide a safe means for power to be shut off. The Power Entry Box must not be installed in a position that makes it difficult to operate the switch or breaker. The switch must be marked as the disconnecting device for the CYCLONEtrac PST system. The switch shall disconnect all current-carrying conductors (i.e. Line and Neutral).

The switch shall have a minimum current rating of 13A.

In addition to the switch, an over-current protection device must be installed on the supply side of the Mains Power Input to the system. The over-current protection device shall have a maximum current rating of 20A.

A circuit breaker may be used as both a switch and overcurrent protection device. The circuit breaker rating shall be between 13A and 20A.

7.2.1 Mains Power connection to Power Entry Box

The CYCLONEtrac PST hydrocyclone monitoring system will accept 100 – 240 VAC 50/60 Hz power. Use only power cables with copper conductors size 18 AWG minimum to 10 AWG maximum (0.82mm^2 to 5.26mm^2) with a ground conductor. Use AC mains cable rated 167°F (75°C) or higher.

	**WARNING** **Always use a non-current-carrying safety ground. Failure to use a non-current-carrying safety ground could result in injury or death.**
	**CAUTION** **Always use a non-current carrying safety ground attached to the ground terminal on the input power terminal blocks. Failure to do so could result in poor system operation.**

Insert the electrical power cable through the AC fitting on the bottom side of the enclosure shown in Figure 13.

Referring to Figure 14, connect:

- Ground Wire (green/yellow) to ⏚ (TB3, left terminal)
- Neutral Wire (white – US, blue - Eur) to **N** (-) TF2, center terminal)
- Line Wire (Hot) (black – US, brown - Eur) to **L** (+) (TF1, right terminal)

Terminal blocks TF1 and TF2 are also fuse blocks, Refer to the fuse labels in the Power Entry Box or Appendix A for input power fuse ratings.

The recommended torque for the terminal screws is 5 to 6 inch-lbs. (0.6 to 0.7 Nm).

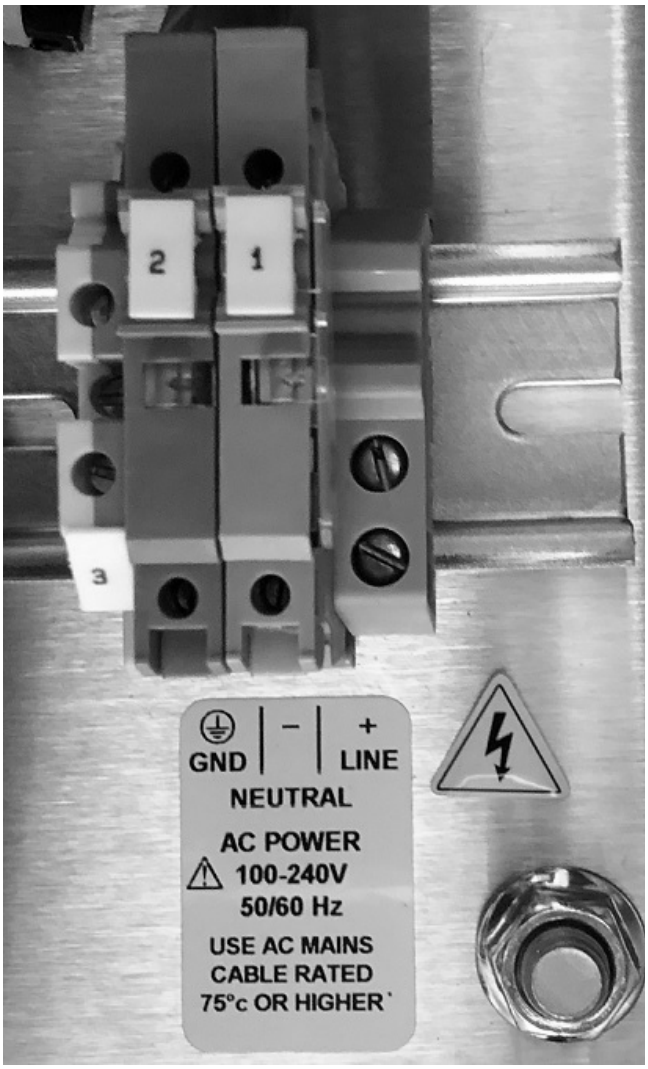

Figure 14: Mains Power Connection

7.3 24VDC Power Output from Power Entry Box

24VDC Power created by the Power Entry Box is used to power the Junction Box and the Sensor Head Assemblies.

Figure 15 shows 2 DC and 1 AC connection in the Power Entry Box. When Dual Junction boxes are required both DC outputs are required. When One junction box is required only one DC output is available.

Maximum cable length from Power Entry Box to Junction Box is 20 ft (6 m) with minimum16 AWG Wire Gauge.

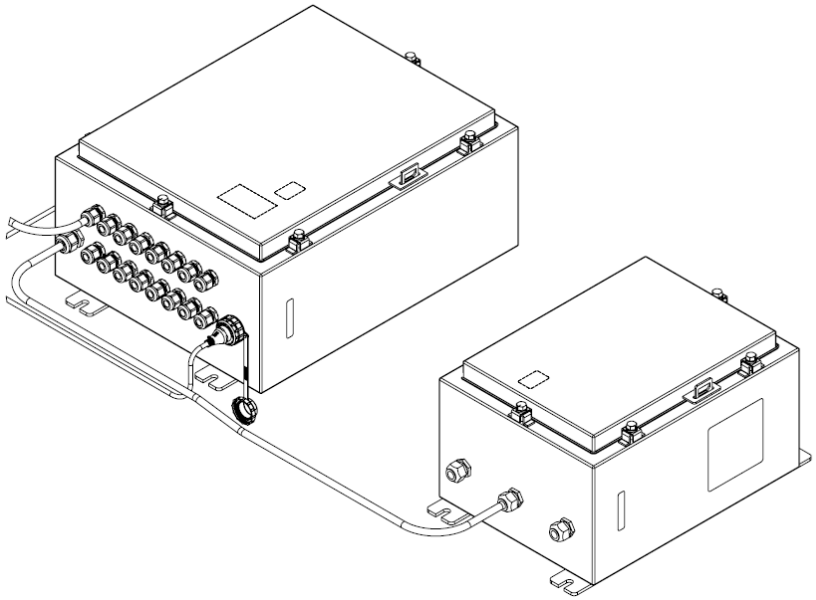

Figure 15: 24VDC Power to Junction Box

The holes in the Power Entry box are sized for ¾-inch NPT fittings (1-$^{1}/_{16}$ inch / 27mm diameter).

Use only power cables with copper conductors size 16 AWG minimum to 10 AWG maximum (0.82mm^2 to 5.26mm^2) with a ground conductor. Use cable rated 167°F (75°C) or higher.

⚠	**CAUTION** **Always use a non-current carrying safety ground attached to the ground terminal on the input power terminal blocks. Failure to do so could result in poor system operation.**

Insert the electrical power cable through the fitting on the bottom side of the Power Entry box as shown in Figure 15.

Refer to Figure 16, connect:

- Ground Wire (green/yellow) to ⏚ (TB6, left terminal)
- Lo Wire (black) to (-) TB5, center terminal)
- Hi Wire Hot (red (+) (TB4, right terminal)

The recommended torque for the terminal screws is 5 to 6 inch-lbs. (0.6 to 0.7 Nm).

If 2nd Junction Box (see Figure 17) connect:

- Ground Wire (green/yellow) to ⏚ (TB9, left terminal)
- Lo Wire (black) to (-) TB8, center terminal)
- Hi Wire Hot (red (+) (TB7, right terminal)

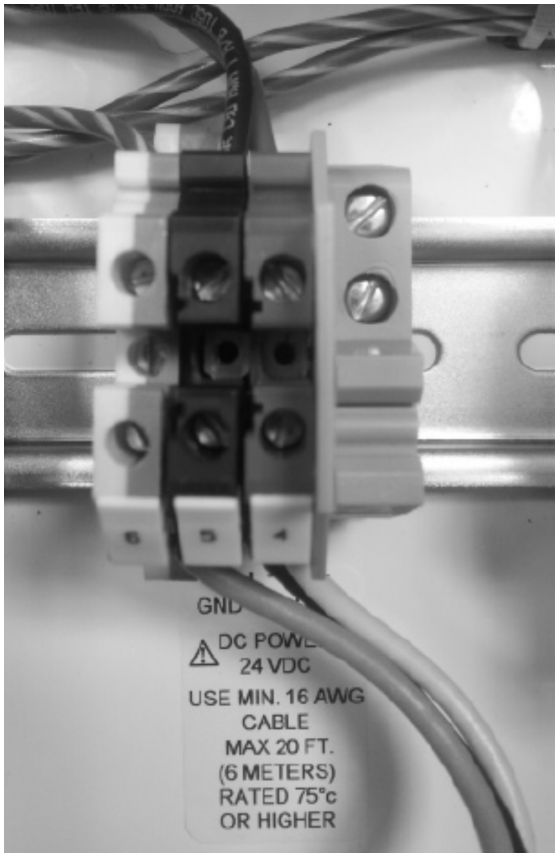

Figure 16: DC Power Connection, Power Entry Box

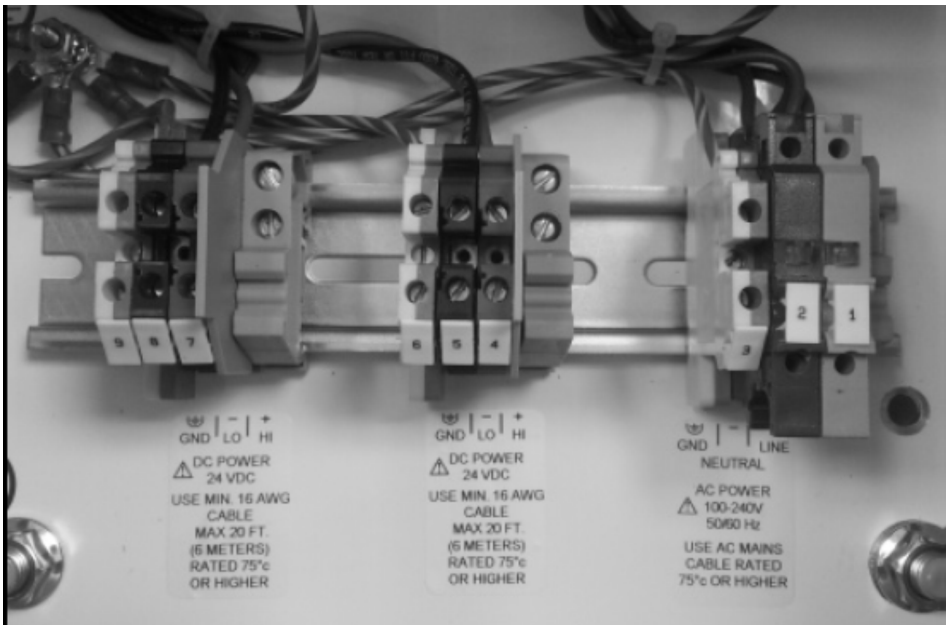

Figure 17: Mains and DC Power Connections

7.4 DC Junction Box Power Connections

The holes on the DC Junction Box are sized for ¾-inch NPT fittings (1-1/16 inch / 27mm diameter).

⚠	**CAUTION** **Always use a non-current carrying safety ground attached to the ground terminal on the input power terminal blocks. Failure to do so could result in poor system operation.**

Insert the electrical DC power cable through the fitting on the bottom side of the enclosure (see Figure 15).

Junction Box Power: +24VDC Power from Power Entry Box

Refer to Figure 18, connect.

- Ground Wire (green/yellow) to ⏚ (left terminal)
- Lo Wire (black) to (-) center terminal)
- Hi Wire Hot (red) (+) (right terminal)

The recommended torque for the terminal screws is 5 to 6 inch-lbs. (0.6 to 0.7 Nm).

Note that there is an ON/OFF switch on the board shown in Figure 18 that can disconnect the 24VDC power from virtually everything in the DC Junction box and from all Sensor Head Assemblies powered by that DC Junction box. The LED on the upper-left of the front of the

cover of the DC Junction Box will be OFF if that ON/OFF switch is OFF or if there is no 24VDC power being supplied to the DC Junction Box.

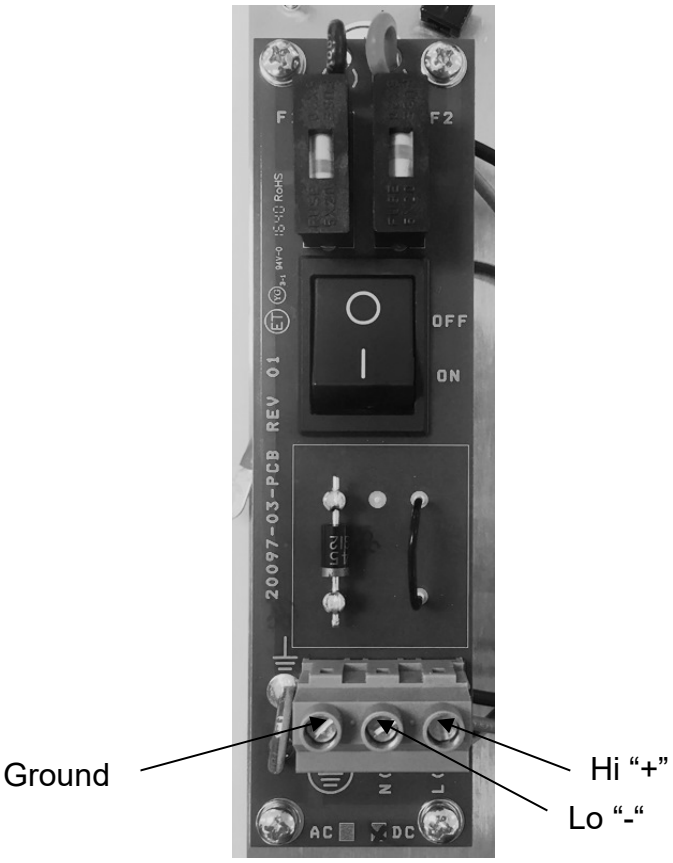

Figure 18: Junction Box DC Power connection

7.5 Sensor Cables 1 thru 16 max Connection

Sensor Head Assembly Interconnects all have the same signal types:

Sensor Power:	+24V Current Limited Power out from Junction Box
Communication:	RS-485 for communications between Sensor Head Assembly and Junction Box

See section 8 for connection details.

7.6 Ethernet Connection

The Ethernet connection is for standard 10/100Base-T CAT5 (or better) cables with RJ-45 connectors and T568A or T568B standard wire connections. It is an IP68 connector with retained dustcap located on the bottom of the enclosure. To maintain the IP68 rating of the connector and the IP66 rating of the enclosure, use the mating IP68 connector/cable assembly from the Samtec SCPE family (http://suddendocs.samtec.com/catalog_english/scpe.pdf).

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8. SENSOR HEAD ASSEMBLY TO JUNCTION BOX CONNECTION

The Junction Box to Sensor Head Assembly Interconnect Cable is used to provide power and transmit data between the Sensor Head Assembly and the Junction Box. The Figure 19 shows the connector. Note that the mating connector on the Sensor Head Assembly has a dust cap on a chain which should remain connected and protecting that connector from contamination until the cable connector is attached. Once the dust cap is disconnected and left hanging, it is susceptible to accumulating water and dirt. If ever the cable is disconnected the dust cap should be re-connected to protect that connector on the Sensor Head – but only after first cleaning and drying the dust cap. In contrast, there is no dust cap provided for this cable connector. Take care to protect the cable connector from contamination while running the cable and attach it to the Sensor Head soon after running the cable. Ideally, once attached, this cable connector will not need to be disconnected from the Sensor Head. If for some reason the cable connector does need to be disconnected from the Sensor Head, take care to protect the cable connector from contamination while it is disconnected.

Figure 19: Junction Box to Sensor Head Assembly Connector

8.1 Sensor Head Assembly Connector Attachment

Once the cable is run, attach the Sensor Head Assembly connector to the Sensor Head Assembly. If the circular connector on the Sensor Head Assembly is not pre-mated, align the keyway on the Sensor connector and latch in place by hand (no tools), verify latching. The connector will make a slight “click“ when the the locking ring is fully tightened. Refer to Figure 20.

Figure 20: Sensor Head Assembly Mounted to Pipe

8.1.1 Sensor Head to Junction Box Cable

The new standard for cabling from the Sensor Head to Junction Box requires 2 cables in series. This provides an easy inline disconnect to the Sensor Head (the shorter cable remains with the Sensor Head). The inline cable connection is made easier due to the swing lock latch. The swing side of the inline connector is connected to the Sensor Head connector, as shown below. Note: when inline connectors are mated also mate *Dust covers so they stay clean inside.

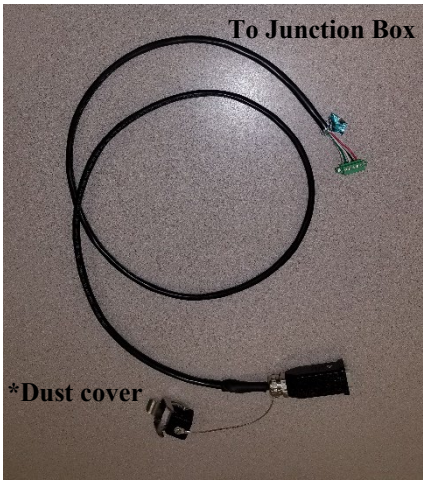


Figure 21: Sensor Head to Junction Box Cable

8.1.2 Ethernet Sensor Head Assembly Connection

The Sensor Head includes a connector with dustcap for direct ethernet connection. This interface is used strictly for re-programming and hardware test purposes and is not part of the normal cable connections in the CYCLONEtrac PST system setup. It should be left without a cable connection and with its dust connector snugly in place. Access to the Sensor Head Assembly Ethernet connection is restricted to properly trained service personnel.

8.1.3 Sensor Head Assembly Cable End Connection

Note: It may be helpful to install each of the 16 sets of cables (2 pairs and a shield) with number markers for identification. Note: There may be less than 16 Sensor Head Assemblies per installation. Figure 22 shows the numbering of the terminal blocks in the Junction Box.

If not previously removed, remove 3 inches (7cm) of outer jacket from the Junction Box end of the cable. Remove the over-foil, being careful not to damage the drain wire, to expose the 2 pairs of conductors. Strip 3/8 inch (8mm) of insulator from each conductor.

Install the gland nut and gland around the cable; tighten the gland nut to secure the cable sheathing.

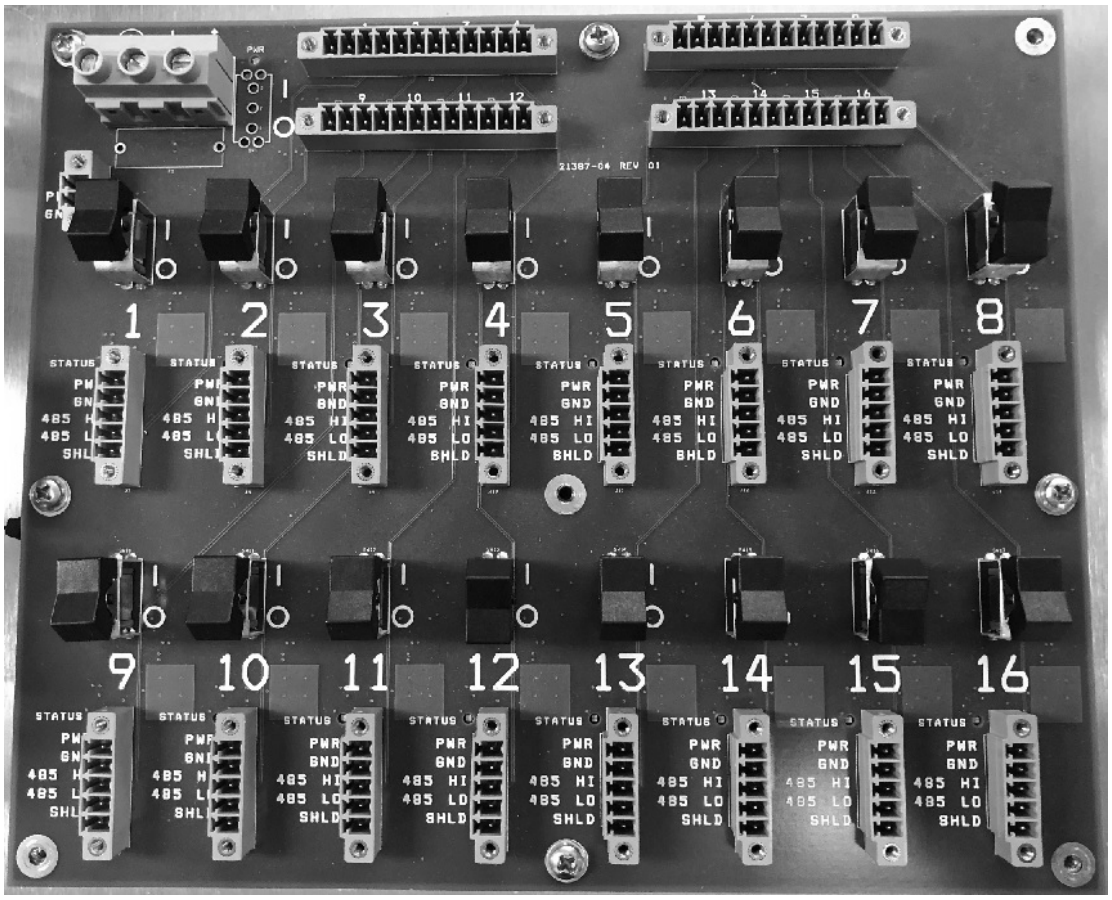


Figure 22: Terminal Block Numbering 1-8, 9-16

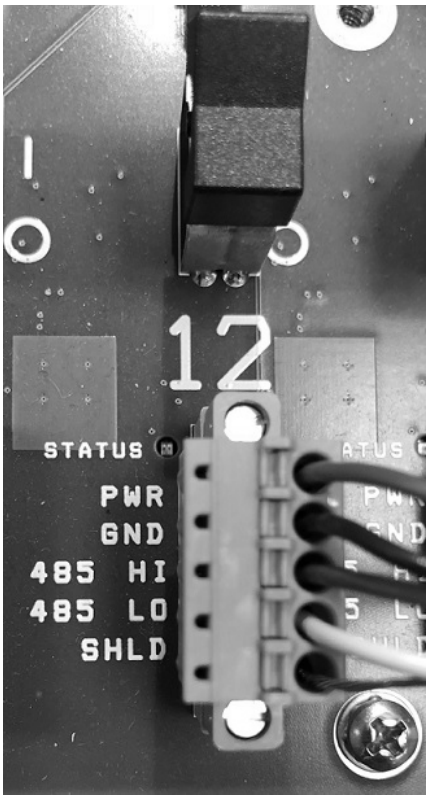


Figure 23: Sensor Cable Connection to Junction Box Terminals

Refer to Figure 23, above, for wire color connections from Sensor Head Assembly to Junction Box terminals:

- Power wire pairs: PWR (RED), ground wire GND (BLACK)
- 485 pairs: 485 HI (GREEN or BLACK), 485 LO (WHITE)
- SHLD (BARE WIRE).

Strip 3/8-inch (8mm) of insulation from each wire. Insert the stripped portion of each wire into the corresponding terminal block location. To connect wire, push down on the orange tab next to wire with a small flat headed screw driver to open the clamping contacts. Push stripped wire into hole and lift screw driver to release the orange tab. Tug on wire to verify wire is locked in place. The cable shield is attached to the bare wire in the cable. Note that the black rocker switch above each terminal block switches Power ON or OFF for that channel.

Once all wires are installed, bundle them together using a tie wrap. This will keep them separated from other wires in the Junction Box.

Each Sensor cable connection has an indicator LED that shows the individual Sensor status per the following table.

LED Indication	Status
LED Off	No Power (expected when the channel's rocker switch is in the Power OFF state)
LED Green	Power On, Sensor drawing current (Expected Normal Operation condition)
LED Red	Fault: Power On, Sensor shorted
LED Orange (Both Red and Green LED ON)	Fault: Power On, Sensor Disconnected

Table 1: Cable Connection Status LED Indication

9. SAFETY ISSUES of IMPROPER CYCLONEtrac PST INSTALLATION

Sensor Head
Failure to follow the instructions in the manual can lead to sub-optimal performance or in some cases damage to the Sensor Head. As regards safety, there are virtually no ways in which improper installation of the Sensor Head could cause a safety hazard to personnel (fire or electric shock) because of the low voltages, current, and power going from the Junction Box to the Sensor Head. Note that the Sensor Head electronic enclosure is never to be opened in the field and is therefore expected to remain always IP66 with clean and dry circuitry inside. The cable connector is expected to be protected from contamination when there is no cable attached. Similarly, it is expected that the dust cap will remain undamaged and properly secured to the ethernet connector of the Sensor Head as a critical part of maintaining that IP66 rating.

AC Junction Box or Power Entry Box
The main safety issues of improper installation with the AC Junction Box are issues which compromise the IP66 rating of the enclosure, or issues involving improper wiring of the terminals. These issues can increase the risk of electric shock or fire. Note that wiring should always be performed with the power OFF. Improper wiring can include:

- Inadequately secured wires that can come out of their terminals. Loose wires can short to other wires or terminals.
- Secured wires with excessive insulation removed exposing the bare wire beyond the terminals. Increases the risk of electrical contact with personnel or with loose wires.
- Secured wires installed in the wrong terminals. Care must be taken to avoid this. Depending on the miswire, the result could range from a safe but temporarily non-functional state to an unsafe state and/or permanent damage to the circuitry.
- Wire gauges or number of wires or type of wires inserted into a terminal that are beyond the ratings of the terminal.
- Applying voltages or currents that are beyond the ratings permitted by this manual.
- Not assuring that the Protective Earth terminal is adequately tied to earth potential.
- Replacing fuses with ones of an improper rating.

DC Junction box

Failure to follow the instructions in the manual can lead to sub-optimal performance or in some cases damage to the circuitry in the DC Junction Box. As regards safety, there are virtually no ways in which improper installation of the DC Junction box could cause an electric shock hazard to personnel because of the 24VDC input voltage and the low voltages produced. However, an increased risk of fire could occur from improper installation that leads to compromise of the IP66 rating of the enclosure.

Compromise of the IP66 ratings of the Junction Box or Power Entry enclosures can include:

- Failure to protect the enclosure from precipitation and dust EVERY time the enclosure cover is open (and failure to quickly clean it up and thoroughly dry it out– with the power OFF – on the rare occasions that it accidently gets polluted inside despite the attempt at protection).
- Failure to properly close the enclosure cover.
- Allowing foreign objects to be trapped in the gasket seals of the enclosure cover or allowing those seals to become damaged.
- Failure to use seals (e.g. cable glands) with the appropriate ratings (including IP ratings to maintain the IP66 rating of the enclosure) that are designed for the entering cable and the cable entry hole diameters and which are properly installed with all their appropriate sealing components.
- Failure to use an adequately rated hole plug to seal unused cable entry holes.

10. SYSTEM OPERATION

This section is intended to be a high-level overview of the basic system operation sufficient for determining whether the key components of the system are operating normally. More detailed instruction is required for system commissioning and that information is separately available from CiDRA Technical Support.

10.1 Junction Box Operation

10.1.1 Instruction for Use

Once the Power Entry Box and Junction Box are installed and operational, no operator intervention is required. The access door should remain closed. Only trained service personnel should access the Power Entry and Junction Boxes.

10.1.2 Operating Controls

The Power Entry Box and Junction Boxes do not contain any operator controls other than ON/OFF switches. The access door should remain closed. Only trained service personnel should access the Power Entry and Junction Boxes.

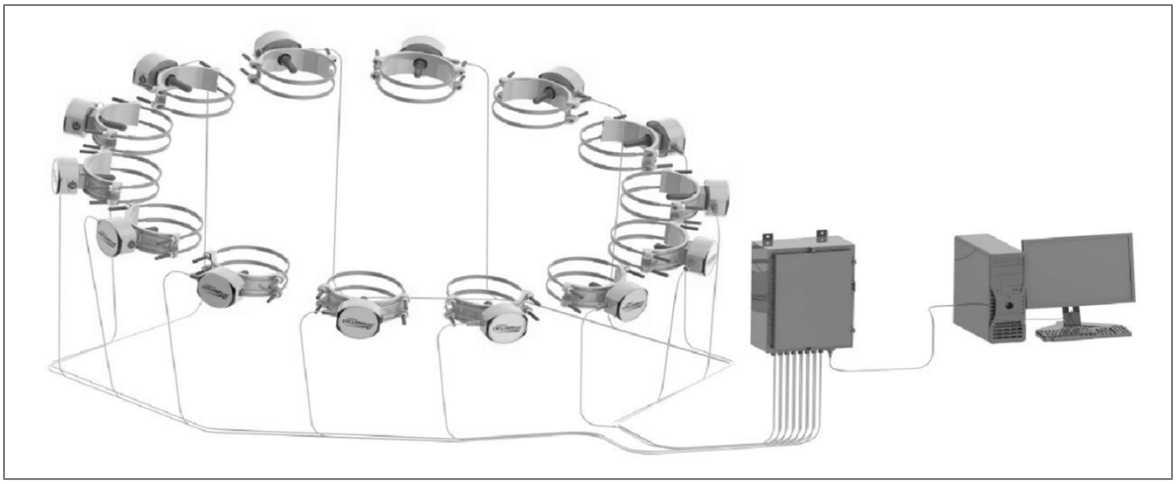
10.2 CYCLONEtrac PST Sensors

The CYCLONEtrac PST system is equipped with either standard Sensors (“Basic” or “EDP” Sensors) or with SMARTsensors™.

The primary difference is that the standard Sensor requires periodic inspection to determine the amount of wear on its probe. The SMARTsensors™ contain enhanced diagnostic features that automatically notify the user when the Sensor needs replacement either due to Sensor probe wear or other type of Sensor fault.

10.3 System connection to computer with OPTIGrind application

A typical CYCLONEtrac PST installation is shown in the following figure. It shows a large number of Sensors powered by and



communicating with a Junction box via RS-485, while the Ethernet output of the Junction box (which consolidates all of those individual Sensor communications) goes to a computer running the OPTIGrind application software to process that data and make it available to other data consumers, and also to show status information from the Sensors.

Figure 24: Typical CYCLONEtrac PST Array

10.4 OPTIGrind application

10.4.1 Main OPTIGrind GUI DIsplay

The following figure illustrates a user screen in the OPTIGrind PST™ Management software.

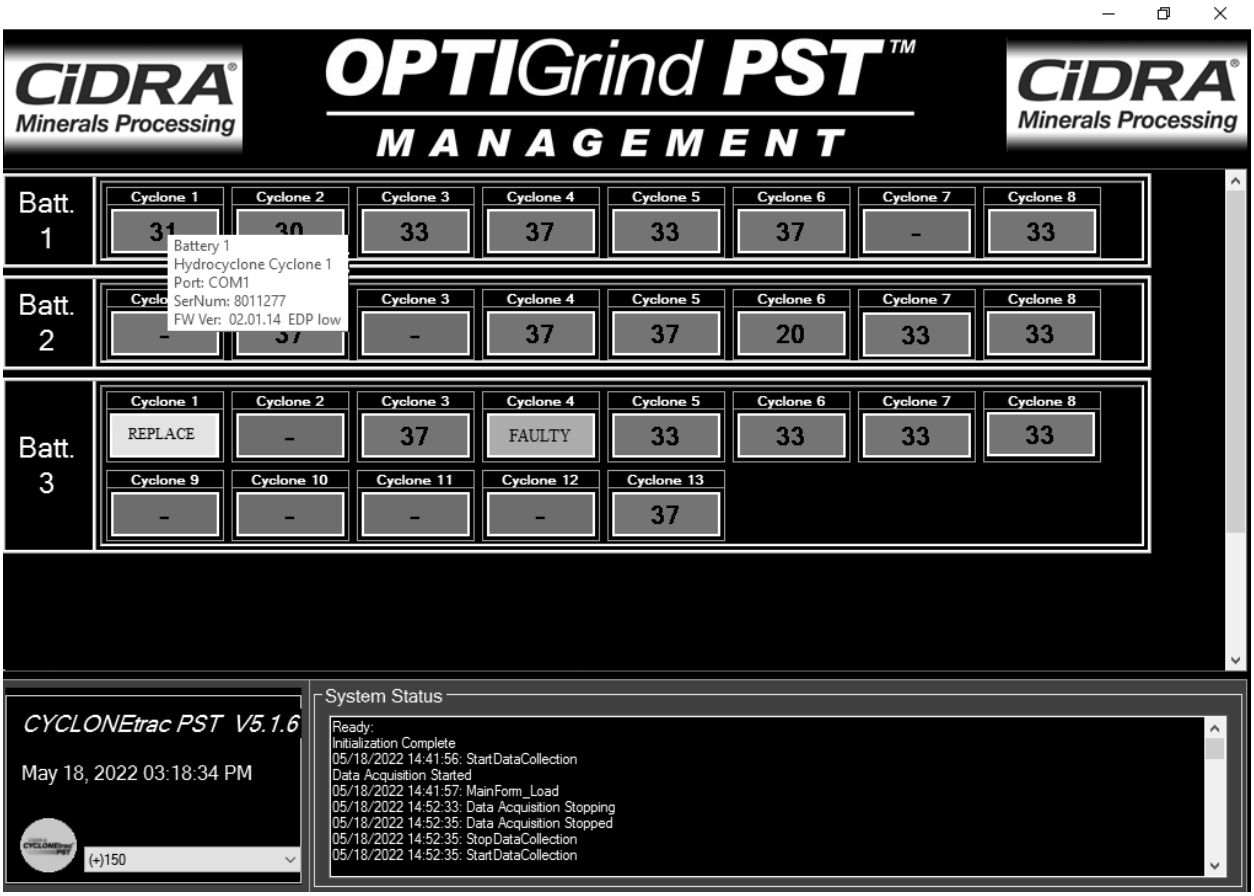


Figure 25: Example OPTIGrind PST Display for version 5.01.06

The Batteries are listed by Battery number along the left-hand edge of the GUI and the Sensors (hydrocyclones) associated with each are listed to the right in the corresponding row. Each Sensor is indicated by a rectangular box with a hydrocyclone name above it, a fill color that indicates the status, and text that varies with the operating mode and status. In this example, the text in each box indicates the percentage of particles larger than 150um measured by those Sensors/hydrocyclones that are in the ON state (typically a number between 0 and 100), and a pop-up is shown with the additional Sensor information that appears when the cursor hovers over a box (in this

example, the box for Battery 1/Cyclone 1). The colors used to indicate status are user-selectable (see 10.4.1.2, below).

The “(+)150” in the drop-down on the lower-left of the GUI indicates that what will be displayed is percentage of particles GREATER than 150 um. Other particle sizes MAY be available in the drop-down and functional if the OPTIGrind software has been properly configured for them. Note that if it had said “(-)150”, that would have meant that the number displayed was the percentage of particles LESS than 150 um.

10.4.1.1 Right-Click Pop-Up Window

To configure the GUI and the CYCLONEtrac PST status and options, start by right-clicking anywhere in the GUI and this pop-up GUI will appear.

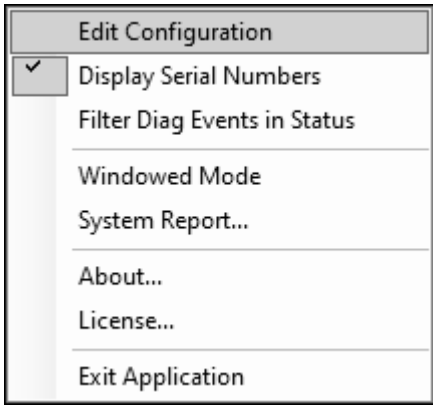


Figure 26: Right-click pop-up window

Note that in the Figure 26 example, the checkbox for “Display Serial Numbers” is checked. When checked, the number in the colored rectangles for the Sensors/hydrocyclones is the associated Sensor serial number (typically 7 digits) instead of the particle size information.

10.4.1.2 Background Colors

To check the meaning of the Sensor background colors on the Main OPTIGrind GUI Display or to change them, select the Edit Configuration option in the pop-up window of Figure 26, then select

the Appearance tab in the CYCLONEtrac PST Configurations Settings pop-up window (see Figure 27, below).

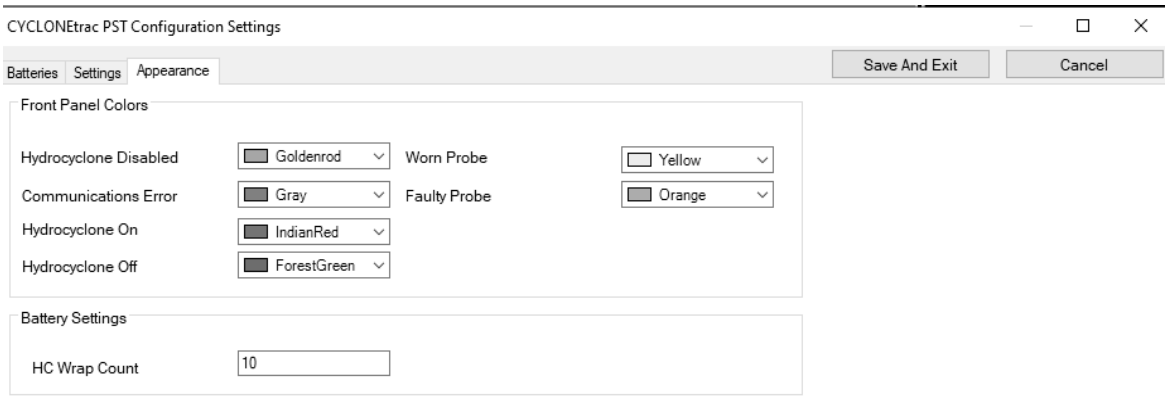


Figure 27: Configuration Settings - Appearance tab

The definition of the statuses indicated by the 6 user-selectable fill colors are:

Hydrocyclone Disabled - The Sensor for this hydrocyclone has been disabled by the user - meaning that data from it is intentionally not being collected and stored. Note that if an entire battery of Sensors/hydrocyclones has been disabled, this same background color will be used for that entire battery. When disabled, typically no text related to particle size will be shown.

Communication error - This background color will be accompanied by an "X". The Sensor is not responding to data requests. This could be due to the power switch for this Sensor being turned off in the Junction box, a problem with the wiring between Sensor cable and Junction box, problems with the circuitry in the Sensor or the Junction box, or possibly a configuration error.

Hydrocyclone On - The Sensor is detecting signals in the hydrocyclone overflow pipe consistent with a normally operating hydrocyclone and its on/off algorithm has determined that the hydrocyclone is in operation. If a hydrocyclone with this background color shows a dash (-), it is because the calculated percentage result is outside the range of 0% to 100%.

Hydrocyclone Off - The Sensor is not detecting signals in the hydrocyclone overflow pipe consistent with a normally operating hydrocyclone and its on/off algorithm has determined that the hydrocyclone is NOT in operation. When in this hydrocyclone Off state, a dash (-) will be displayed instead of particle size information.

Worn Probe - This background color will only ever be observed with a SMARTsensor™ in conjunction with wear detection. When a SMARTsensor™ first senses a threshold level of probe wear has occurred, the rectangular box background will change to this color and will otherwise operate normally, but a clock will start for a grace period between when this threshold level of wear has occurred and when the Sensor is required to be replaced. When the grace period has expired, the text in the rectangle will change to "REPLACE" and the Sensor will cease to report particle data.

Faulty Probe - This background color will be accompanied by the word "FAULTY". Either the OPTIGrind software has found that the Sensor's firmware version is not compatible as defined in the license, or the Sensor has detected that it has been opened and improperly tampered with. When in this mode, no particle size results will be displayed.

Note that the user can assign battery numbers, assign Sensors/hydrocyclones to batteries, name the Sensors/hydrocyclones, and enable or disable batteries or individual Sensors/hydrocyclones using the "Batteries" tab in the CYCLONEtrac PST Configuration Settings pop-up, above.

10.4.1.3 Hover Pop-Up Window

Using the mouse pointer/cursor to "hover over" any given Sensor's rectangular box will provide a short-duration pop-up of that Sensor's status. See Figure 25, above. The Sensor information in that pop-up includes:

Battery Number As assigned in the "Batteries" tab of the "CYCLONEtrac PST Configuration Settings" window.

Hydrocyclone name As assigned in the “Batteries” tab of the “CYCLONEtrac PST Configuration Settings” window.

Port The COM port assigned to the Sensor depending on how it is connected to the Junction box. This COM port is used to assign Sensors/hydrocyclones to Batteries in the “Batteries” tab of the “CYCLONEtrac PST Configuration Settings” window.

Serial Number This is factory-programmed in the Sensor and matches the serial number on the labels of the Sensor (see Figure 28).

Firmware version The version of the firmware programmed into the Sensor.

“Type” (the first of 2 fields after “FW Ver:” and on the same line) – Either “Ssr” which indicates a SMARTsensor™; or “Basic” which indicates a standard Sensor; or “EDP” which indicates a standard Sensor, but with tamper-detection.

“Freq” (the second of 2 fields after “FW Ver:” and on the same line) – Either “high” or “low” which indicates one of two frequency ranges that the Sensor is hard-wired to produce and which must be known by the OPTIGrind software to properly calculate the particle size result from the Sensor data.

10.4.1.3.1 Sensor Serial Number

The Sensor serial number (S/N) can be found on a sticker on the side of the Sensor Enclosure right above its main cable connector. The serial number is also on a different sticker found on the top of the cover of the Sensor Enclosure. See Figure 28, below.

Figure 28: Sensor Serial Number labels

Note that the Settings tab of the “CYCLONEtrac PST Configuration Settings” pop-up (see Figure 29, below) is used during commissioning. Making any subsequent changes on this tab can have significant performance implications and should only be done by trained and authorized personnel. However, the Settings tab also includes information about the file names and locations of files which can be useful for diagnostic purposes that do not require actually changing those settings.

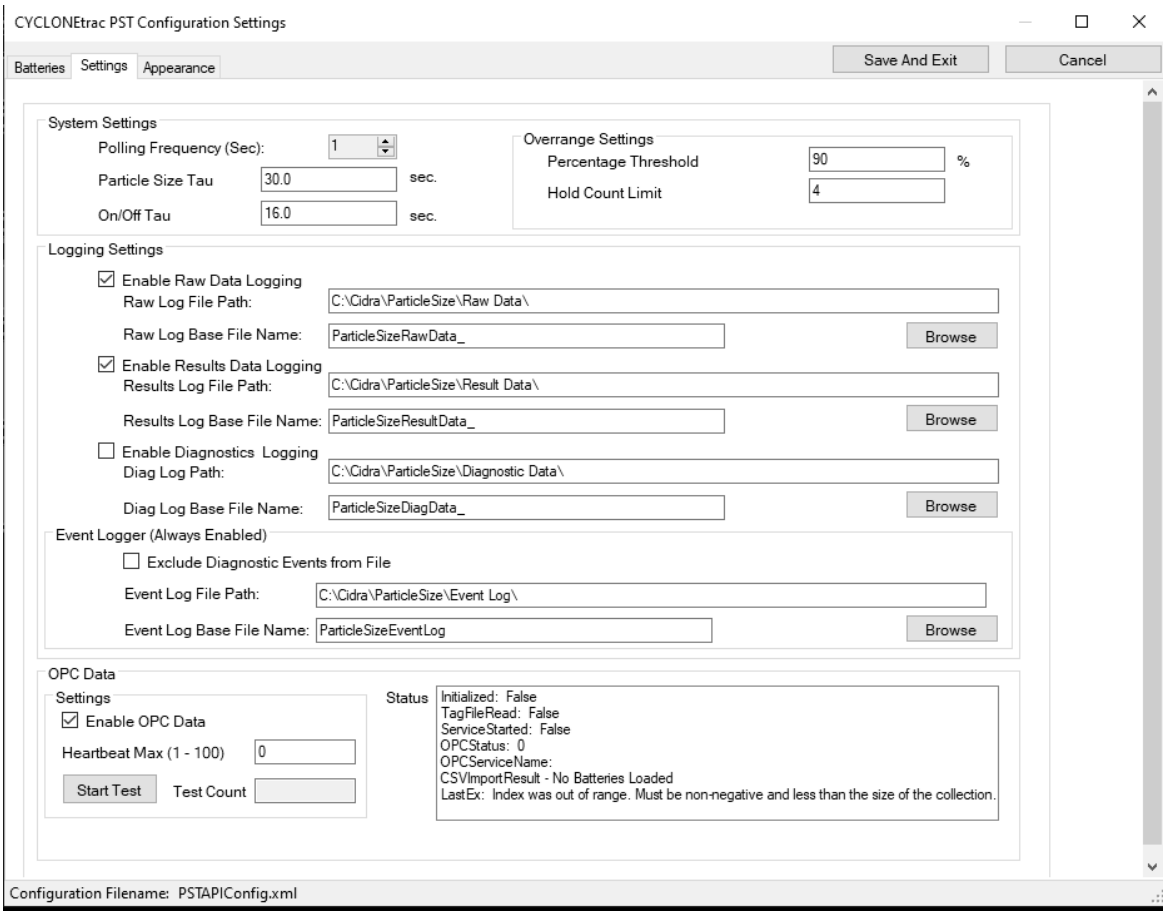


Figure 29: Configuration Settings – Settings tab

10.4.2 Checking Sensor Status in the logged Results Data

An additional check of the Sensor status can be done by looking at status info embedded with the logged Results Data. Right-click on the GUI, choose “Edit Configuration”, and then go to the Settings tab of the pop-up window (see Figure 29). The 2nd item in the Logging Settings section concerns the Results Data Log Files. Verify that the checkbox is checked and record the path to the folder of Results Data (e.g. C:\Cidra\ParticleSize\Result Data). Use Windows Explorer to go to that folder wherein there should be separate files for each battery and probably multiple such files. Find the most recent file for the battery containing the Sensor whose recent status you want to check. Note that the file names will start with the Results Log Base File Name indicated in that Settings tab, followed by the Battery number, followed by year, month, day, hour, minute, and second of the first row in the log file in format “yyyy_mm_dd_hh_mm_ss”. Make a copy of the file so as not to interfere with normal OPTIGrind access to that file. Open that copy in Excel and find the columns with the Sensor/hydrocyclone

of interest. The column headings start with “Cyc_” followed by the Sensor/hydrocyclone name. The most recent info is in the bottom row of data. Confirm that the column with heading ending with “Ser#” has a value that matches the serial number corresponding to the Sensor of interest (see Figure 28). In the next column to the right is the Device Status. A normally functioning new Sensor should show “0x4” for Device Status. In the next column to the right is the Software Status. Ideally it will read “0x1” which is good. Any of the following are less good, but MAY not actually be the fault of the Sensor or Junction Box hardware: 0x3, 0x5, 0x7, 0x9, 0xB, 0xD, 0xF, 0x11, 0x13, 0x15, 0x17, 0x19, 0x1B, 0x1D, 0x1F. Any other number is likely to be a fault of the Sensor or Junction Box hardware. [Note that to make the example in Figure 30, below, more readable, older upper rows below the column headings were hidden as were columns between the Date Time column and the column for the serial number of the Sensor of interest.] Though the previous statement about 0x4 and 0x1 being the expected good Device Status and Software Status values is applicable to the Sensor firmware versions in use as of this writing, future firmware versions may add or change status bit assignments and lead to different expected values for Sensors in good working order. To mitigate for that possibility, compare the Device Status and Software Status of the Sensor of interest with the corresponding Status values of one or more other Sensors which you have reason to believe are good.

22	Date Time (MM/dd/yyyy HH:mm:ss)	Cyc_Cyclone 1_Ser#	Cyc_Cyclone 1_Device Status	Cyc_Cyclone 1_Software Status
21520	5/18/2022 16:52:49 PM	8011277	0x4	0x1
21521	5/18/2022 16:52:53 PM	8011277	0x4	0x1
21522	5/18/2022 16:52:57 PM	8011277	0x4	0x1
21523				
21524				

Figure 30: Sensor Status Info in logged Results Data

11. MAINTENANCE & WEEE

11.1 Instructions for Cleaning

The Power Entry and Junction Box enclosures (NEMA 4) are certified to an IP66 rating. This indicates that water jets through a 12.5mm diameter nozzle with a pressure of 14.5psi (100kPa) at a distance of 9.8ft (3m) and a volume of 100 liters per minute are allowed for up to 3 minutes. The Sensor Head Assembly is also certified to IP66.

11.2 Inspection and Maintenance

The major reason for periodic inspection is Sensor probe wear. Sensor probe wear, itself, is not a safety hazard to personnel, but the disassembly and reassembly operations involved in probe inspection and in Sensor replacement do present safety risks to personnel. In that regard, SMARTsensors™ could be considered to be safer than standard Sensors in that for SMARTsensors™ the probe wear detection is automated which eliminates the periodic probe inspections and the associated safety risks.

Removal of the Sensor

The procedure for either probe inspection or Sensor replacement starts with removal of the Sensor from its hydrocyclone overflow pipe per the following steps:

- Lockout/tagout the hydrocyclone associated with the Sensor being removed so that there will be no flow in the overflow pipe during the removal operation.
- If local safety rules require additional steps beyond the lockout/tagout of the specific hydrocyclone being worked on, then do those additional steps.
- Consider “disabling” the Sensor in the OPTIGain software during this operation so as not to generate confusing data in the database during this time (though if not disabled, the data is likely just to show “Hydrocyclone Off”).
- Turn off power to the Sensor. This can be done using the rocker switch inside the Junction Box for the channel to which the Sensor is connected. The LED next to the switch should go dark. Note the issues associated with opening the Junction box enclosures discussed in other parts of this manual (an electric shock hazard when opening the AC Junction box – especially near where AC power wiring and internal shock hazard symbols are located; the need to keep the inside of the Junction boxes clean and dry so open

only when conditions near the box are clean and dry and quickly re-close the box snugly as soon as possible).

- Disconnect the cable from the Sensor. If the cable features an in-line connector not far from the Sensor, it is recommended that that is where the disconnection is made. When doing so, use the associated lanyarded covers to protect each half of the unmated in-line connectors. [Those 2 covers should have previously been mated to keep them clean and dry inside prior to use, but inspect and clean them, if necessary, prior to using them to protect the unmated in-line connectors.]
    - If the cable does not include the in-line connectors, then if the cable is to be disconnected, that must happen right at the circular connector at the Sensor. Disconnecting (and later re-connecting) the circular connector right at the Sensor can be difficult if it has become encrusted with contaminants over time. It might be desirable for inspection (versus replacement) to plan on leaving the cable mated during removal from the pipe and just being extra-careful to avoid damage to the cable during the inspection. There is no protective cover for the cable-side circular connector, so if this connection is unmated, take care to prevent contamination of this connector (e.g. wrap it in plastic wrap) during the time that it remains un-mated. The circular connector directly on the Sensor has a lanyarded cover, but nothing protects it from contamination during the time it is not connected to the connector. If used to protect the unmated Sensor circular connector, it will first need to be cleaned of contaminants inside it and probably also the grooves associated with locking it to the connector. For short-duration periods of unmating, alternate means of protecting the circular connector on the Sensor from contamination can be used (e.g. tape). The use of tools for disconnection and connection of the circular connector is discouraged because of the possibility of damage to the connector.
- Remove the thread covers from the threaded section of the U-bolts. (These last steps are those of the section 5.1.1 Assembly instructions – in reverse.)
- Clean the threaded section of the U-bolts with a wire brush.
- Remove the 4 sets of washers and nuts from the U-bolts (making sure that neither the U-bolts nor saddle/Sensor assembly are at risk of falling as those nuts are removed).
- Remove the U-bolts and set them aside.
- Lift the Sensor Head assembly (which includes the saddle) off the pipe, pull the Sensor's probe out of the hole in the pipe, and carefully set that assembly aside. [Note: In cases of extreme wear,

the probe may have completely worn off, so do not count on the probe in the hole to prevent the saddle/Sensor assembly from falling off the pipe.]

Probe Inspection

For Probe inspection of other than SMARTsensor™ Sensors, follow the steps, below. Note: CiDRA Field Support can separately provide more detailed – and possibly different - instructions for the Probe Inspection step.

- Clean the Sensor with shop towels and remove any foreign material from the metal probe with a scraper or wire brush.
- Using a digital caliper, measure the probe diameter at its thinnest (most worn) location. If measurement is less than 1.2625" (32.1mm), then the non-SMARTsensor™ Sensor must be replaced.
- If the probe wear is not excessive, inspect the Sensor Head for damage to its box, box seal, connector, and cable. If damage is found, replace damaged items.
- If the cable disconnect was performed at the circular connector right at the Sensor, then inspect and clean the circular connector on the Sensor (including the grooves associated with the locking of the 2 mating connectors) in advance of the subsequent re-connection step.

Cable Inspection

If the existing mating circular connector/cable is going to be re-used, then it also needs to be inspected and cleaned (including the grooves associated with the locking of the 2 mating connectors) in advance of the subsequent re-connection step. What is typically being referred to here is the single long cable between the Sensor and the Junction box and not the two-piece cable with the in-line connectors. Generally, with the two-piece cable, the short length of cable remains attached to the Sensor and there's no need to inspect the mated circular connectors.

Sensor Re-installation

For re-installation of an inspected Sensor or installation of a replacement Sensor, follow the Assembly steps in 5.1.1, set the rocker switch in the Junction box for that channel to ON, and then re-enable the Sensor in the OPTIGain software and remove the lockout/tagout of the hydrocyclone. Note that the newer replacement Sensors often are delivered with the short length of cable and an in-line connector pre-attached and with the circular connector connection protected with heat-shrink.

Post-Maintenance Testing
After re-installation of an inspected Sensor or installation of a replacement Sensor, the normal operation of that Sensor may be confirmed via the status information available via the OPTIGain GUI and the status information stored in the Results Data log file per the instruction provided in section 10.

"**Warning**", always disconnect hydrocyclone, lockout/tagout prior to Sensor inspection.

WARNING

Hydrocyclone hazard. Always disconnect power source (Lockout / tagout) prior to Sensor inspection. Failure to remove power source may result in injury or death.

When performing periodic inspection, take note of:

- Damage to the Sensor Head Assembly and Junction Box enclosures,
- Enclosure gaskets,
- Insulation on cables and cable accessories

If the enclosure or cables are damaged take appropriate corrective action to eliminate the problem. This may include removal of the CYCLONEtrac PST product from service until repairs have been performed.

Contact CiDRA Customer Support regarding service, repairs and spare parts.

11.3 Fuse Replacement

If an electrical fault causes a fuse to open, the operator should summon trained service personnel to assess the cause of the fault. Fuse replacement is not intended to be performed by the operator and should be performed only by trained service personnel.

WARNING

Electrical shock hazard. Always disconnect power source prior to removing fuses. Failure to remove power source may result in injury or death.

The service personnel may, after removing power from the CYCLONEtrac, replace the fuse using the proper replacement fuse as specified in enclosure label or in Appendix A.

11.4 Directive 2012/19/EU on Waste Electrical and Electronic Equipment (WEEE) recast

The CYCLONEtrac PST system is exempt from WEEE Directive 2012/19/EU because the exclusions in Article 2 section 3 (b) and Article 2 section 4 (b) apply.

The CYCLONEtrac PST was specifically designed for and installed as part of a large-scale stationary hydrocyclone battery which itself is exempt from WEEE. Professionally trained personnel install, de-install, and maintain the CYCLONEtrac PST system.

End-of-life recycle of CYCLONEtrac PST Sensors and /or system should follow established local laws and/or hydrocyclone battery process.

If there are any questions, contact customer support.

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APPENDIX A - CYCLONEtrac PST SPECIFICATIONS

A1 Power Requirements

Power Entry Box (Single): 100 to 240 Volts AC ±10%, 50/60 Hz, 200 Watts

Power Entry Box (Dual): 100 to 240 Volts AC ±10%, 50/60 Hz, 400 Watts

AC Junction Box: 100 to 240 Volts AC ±10%, 50/60 Hz, 200 Watts

The Power Entry Box and AC Junction Box are certified for transient Overvoltage Category II.

DC Junction Box: 24VDC, 200 Watts (Power supplied from Power Entry box)

Sensor Head Assembly unit (Power supplied from Junction Box): 24VDC, 6 Watts

A2 Fuse Protection

Fuse replacement should be performed only by trained service personnel using the proper replacement fuse (defined below) and only after removing power.

WARNING

Electrical shock hazard. Always disconnect power source prior to removing fuses. Failure to remove power source may result in injury or death.

- Power Entry Box for mains power includes two 5mm x 20mm cartridge fuses within terminal blocks TF1 and TF2. The fuse information is included on a label inside the Power Entry Box enclosure.
- DC Junction Box for DC 24VDC power includes two 5mm x 20mm cartridge fuses on the Power Entry board next to the terminal block connections. The fuse information is included on a label inside the DC Junction Box enclosure.

- AC Junction Box for mains power includes two 5mm x 20mm cartridge fuses on the Power Entry board next to the terminal block connections. The fuse information is included on a label inside the AC Junction Box enclosure.

Power Entry / Junction Box Model #	Rating	Part Number	Vendor P/N	Notes
Power Entry Box PE-01-11-XX -X-XX-XX-XX	T6.3A 250VAC (1500A breaking)	E50382-15	Littelfuse 21506.3	1
DC Junction Box PSTJB-01-11-XX-XX-XX-X-XX-XX-XX	T6.3A 400VDC (500A breaking)	E50616-063	Littelfuse 047706.3	2
AC Junction Box PSTJB-01-21-XX-XX-XX-X-XX-XX-XX	T5.0A 250VAC (1500A breaking)	E50382-14	Littelfuse 215005.	3

Where “x” = any alphanumeric character

Or other 5x20mm time-delay fuse with an appropriate(*) minimum breaking capability and …:

Notes:

1) rated 6.3A 250VAC, by UL, CSA, and VDE per IEC 60127-2.

2) rated 6.3A 400VDC, by UL and CSA per IEC 60127-2 OR per UL-248, CSA-C22.2 No.248-1-00, and CSA-C22.2 No.248-14-00.

3) rated 5.0A 250VAC by UL, CSA, and VDE per IEC 60127-2, UL-248, CSA-C22.2 No.248-1-00, and CSA-C22.2 No.248-14-00.

(*) The appropriate minimum breaking capability of the fuse is at least 1.7 times the nominal current rating of the external circuit breaker or over-current protection device in the AC Mains circuit supplying the CYCLONEtrac PST system. For example, if the AC Mains circuit is protected by a 20A circuit breaker, then the minimum breaking capability of the fuses in the Power Entry box or AC Junction box must be 35A @ 250VAC. For the DC Junction box, since the 24V Power Supply sourcing it has a current limit of 15A max, use a fuse with a 30A minimum breaking capability @ 24VDC.

A3 Operating Temperature Range

Power Entry Box	-4°F to +140°F (-20°C to +60°C)
Junction Box	-4°F to +140°F (-20°C to +60°C)
Sensor Head Assembly	14°F to +130°F (-10°C to +55°C)

A4 Storage Temperature Range

Power Entry Box	-40°F to +185°F (-40°C to +85°C)
Junction Box	-40°F to +185°F (-40°C to +85°C)
Sensor Head Assembly	-40°F to +185°F (-40°C to +85°C)

A5 Altitude Limits

Power Entry Box, Junction Box and Sensor Head Assembly are rated for installations up to an altitude of 4,850m (15,912ft).

There are two major Altitude effects. The safety certification is based on the lower air pressures at higher altitudes increasing the risk of electric arcing and especially the electric shock risk of that arcing. That risk is highest for the equipment powered by the AC Mains voltages. Because of safety margins in the spacings of circuitry operating at AC Mains voltages, the CYCLONEtrac PST has been certified safe for altitudes up to 4850 meters. Another effect of increased altitude is decreased convection cooling effectiveness. To address this issue, a good rule of thumb is to reduce the allowed maximum ambient temperature by 1°C per each additional 305m (1,000 ft) above 2,000m (6,562 ft) altitude. For example, if the equipment is nominally rated for a 60°C max ambient, then for altitudes up to 2,000m (6,562 ft) it is good for a 60°C max ambient, but at an altitude of 4,850m (15,912ft) consider limiting the max ambient to 50°C.

A6 Humidity Limits

Power Entry Box, Junction Box and Sensor Head Assembly: 0 – 95%, non-condensing

A7 Pollution Degree

Pollution Degree 2 is an environment where there is no pollution or else only dry non-conductive pollution that is occasionally and temporarily conductive due to condensation. Pollution degree 4 is where conductive dust, rain, or other wet conditions can produce long-term or continuous conductivity (i.e. outdoors). Pollution degree 3 is an intermediate condition wherein the equipment is typically protected from direct sunlight, precipitation, and full wind pressure, but is not in a temperature-controlled or humidity-controlled space.

The safety of CYCLONEtrac PST was evaluated for a Pollution Degree 2 micro-environment inside the closed enclosures. If CYCLONEtrac PST is installed in a Pollution Degree 3 or 4 macro-environment, then it is assumed that the enclosures remain closed to preserve the Pollution Degree 2 micro-environment inside. On the rare occasions when the enclosures are briefly opened, it is assumed that extra care will be taken to prevent wet or dry pollutants from entering the enclosure during that time and that the enclosure will be clean and dry inside when the cover is closed again.

The primary concern about Pollution Degree is increased risk of electric shock. That is primarily a risk that exists in the Power Entry box and the AC Junction box where AC mains voltages are present. To mitigate this risk, turn off power before opening those boxes, and be sure that the metal enclosure is properly earthed to protect personnel when the box is again closed and powered. Pollution can also degrade circuit performance and can increase the risk of fire inside any of the enclosures, so take care to keep even the DC Junction box pollution-free. Note that the safety certification expects the properly-closed metal enclosures to limit the spread of a fire inside regardless of the cause of that potential fire.

A8 Ingress Protection, Outdoor Use, and Wet Locations

The Ingress Protection rating applies to enclosures with covers tightly closed and with cables, cable glands, and connectors properly installed. The Power Entry Box and the Junction Box enclosures are IP66 (and NEMA 4X). The Transmitter enclosure rating is maintained only if the cable glands and fittings have equivalent or better IP ratings. The Sensor Head Assembly Enclosure is IP66. IP66 testing involves both a dust test and a water jet test with water jets spraying the enclosures from every direction.

The CYCLONEtrac PST equipment is rated for installation and use OUTDOORS where it will be exposed to sunlight, wind, dust, temperature swings, humidity, and precipitation WITH THE ENCLOSURE COVERS TIGHTLY CLOSED AND THE INTENDED FITTINGS PROPERLY INSTALLED IN ALL ENCLOSURE OPENINGS (e.g. cable entry holes).

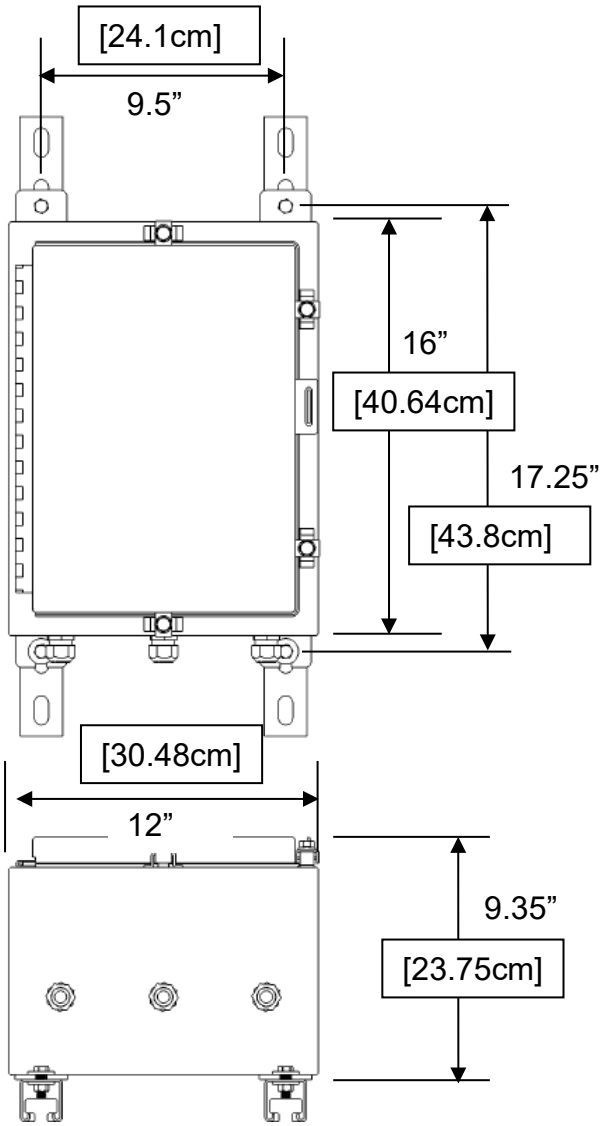
The CYCLONEtrac PST equipment can be safely located in Dry and in Wet Locations. Wet Locations are defined here as environments with the possibility of water or other conductive liquids on surfaces or personnel such that the resistance from the equipment to earth through a person touching the equipment will be lowered due to the presence of that liquid at the contact points between the person and the equipment and/or between the person and earth. The greatest risk of electric shock in either dry or wet locations is due to the AC mains power cable entering an enclosure. Consequently, internal labels that warn of the electric shock risk have been placed near the AC power terminals of the Power Entry box and the AC Junction box. There are no AC terminals nor electric shock warning labels in the DC Junction box nor any associated with the Sensor Head Assembly. The primary mitigation of the electric shock risk is the proper earth-grounding of the metal enclosures – primarily through the protective earth terminal and the associated protective earth wire in the AC power cable.

NOTE: It is assumed that the user will take appropriate precautions whenever the Power Entry Box or Junction Box covers are opened for installation, maintenance, or commissioning to be certain that the inside of the electronics enclosures always remain clean and dry.

A9 Area Classification

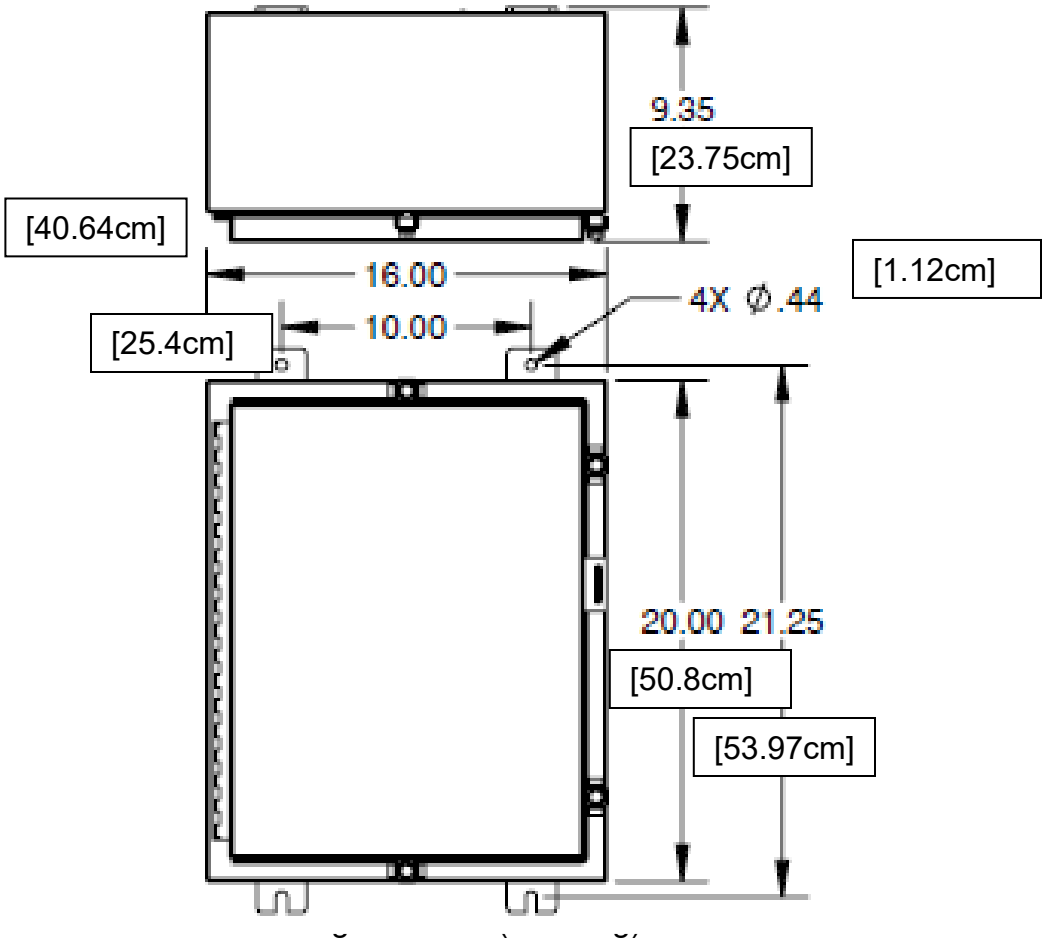
CYCLONEtrac PST System is rated for use in non-hazardous areas only. Non-hazardous areas are areas without the presence of explosive gasses, vapors, or dusts.

A10 Power Entry Box Dimensional Envelope

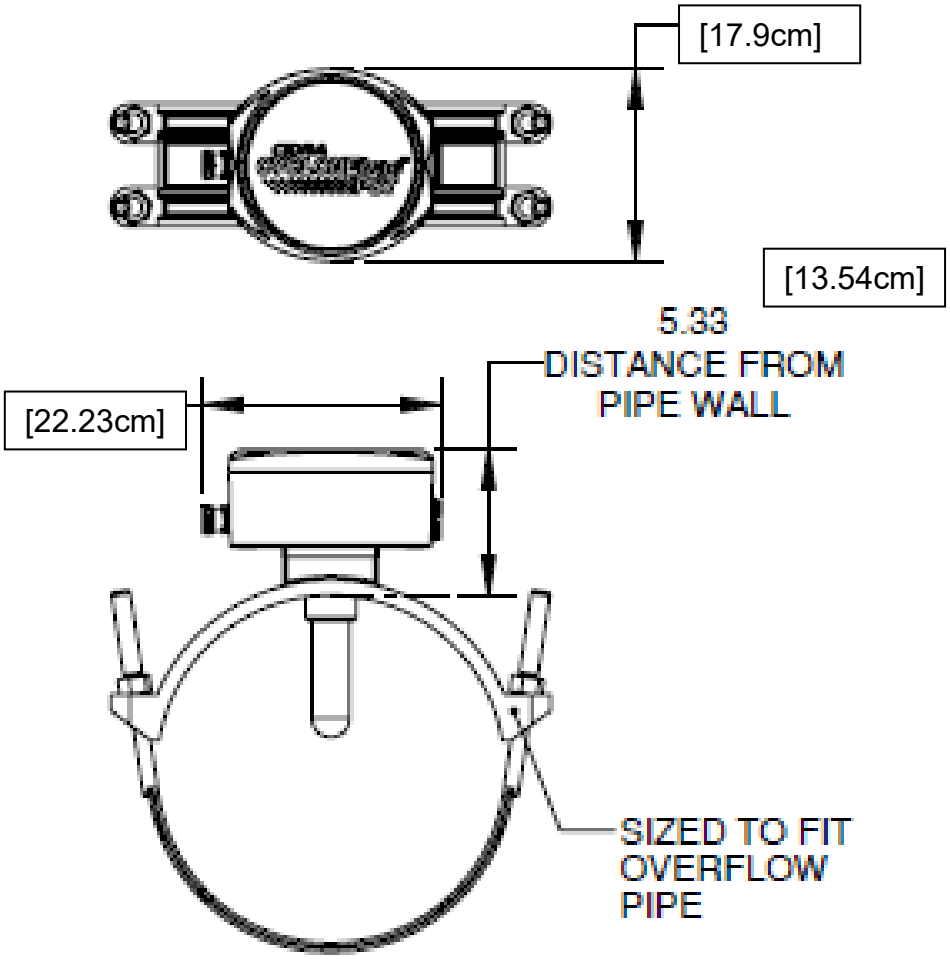


Weight: 30 lbs. (13.6 kg)

A11 Junction Box Dimensional Envelope



A12 Sensor Head Assembly Dimensional Envelope



Weight size dependent

Note: A RANGE OF DIFFERENT PIPE CLAMP SIZES TO FIT NUMEROUS PIPE AND TUBE DIAMETERS.