



Operating Instructions
for
Integrated Temperature Transmitter

Model: TST





TST Version 2.0

USER’S GUIDE

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INTRODUCTION

General Description

The **Temperature Sensor Transmitter (TST)** is a temperature sensor based on a **Resistive Temperature Detector (RTD)** coupled to an electronic circuit with an on board microprocessor. It gives a linear current output (4 to 20 mA) proportional to the temperature detected by the sensing element. The RTD element and the electronics are all integrated in the same mechanical assembly in order to reduce wiring and installation cost. The TST can be fully re-calibrated and re-scaled over its entire range of operation via the digital communication link and the user friendly TST software. Those features make the TST very versatile, easy to use and able to fulfill all your application requirements.

Models Available

The TST is available in many different mechanical configurations and two temperature limits.

- -328 to 1112 °F (-200 to 600 °C)
- -58 to 392 °F (-50 to 200 °C)

Consult the catalog information for permutation of the different mechanical assemblies.

INSTALLATION

Unpacking

The TST comes as a stand-alone version or with the calibration accessories kit. In the stand-alone version, the TST is delivered, pre-scaled and calibrated, with the user's guide only. In the calibration version, the complete package includes:

- The TST sensor (pre-scaled and calibrated).
- The Calibration interface module.
- The Wall adapter (24 VDC – 200 mA).
- The TST Windows calibration software (CD-ROM).
- User's guide.

Please verify that no parts are missing and do a visual inspection of the TST and accessories to ensure that none of the components have been damaged during transportation. If you notice something not normal please immediately advise your distributor and do not proceed with the installation.

Mechanical Installation

This will vary according to the assembly type. The same standard installation practices should be observed as with a standard RTD assembly. Care should be taken so the transition, housing the electronics, is maintained within the specified temperature limits (-40°C to 80°C).

Electrical Wiring

The TST is a loop power device that comes with four wires. Two of them (Black and Red) are for the loop power and the two others (Green and White) are for communication.

*** IMPORTANT ***

If the TST is not connected with the communication module, the two communication wires (Green and White) have to be shorted or left isolated from each other and isolated from any voltages or ground.

The TST can be connected in stand-alone mode or with the communication module. Figure #2 shows the electrical connection in stand-alone mode and Figure #3 in the communication mode.

Stand-alone Mode Connection:

- Connect the Red wire (or terminal #1) from the TST to the positive side of the power supply.
- Connect the Black wire (or terminal #2) from the TST to the positive side of the current indicator or measurement device.
- Connect the negative side of the current indicator or measurement device to the negative side of the Power Supply in order to close the series current loop.

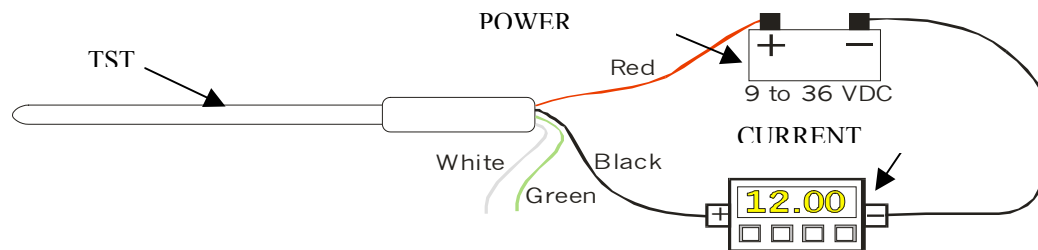


FIGURE #2

Communication mode connection :

- **Do not connect power until all of the steps below have been completed in order, making sure the last connection made is power to the interface module.**
- Connect the Red wire from the TST to the terminal #1 (i+) of the communication module.
- Connect the Black wire from the TST to the positive side of the current indicator.
- Connect the negative side of the current indicator to the terminal #2 (I-) of the communication module.
- Connect the White wire from the TST to the terminal #3 (Tx) of the communication module.
- Connect the Green wire from the TST to the terminal #4 (Rx) of the communication module.
- Connect the RS-232 (DB9-Female) to the serial port of the computer.
- Power the communication module by plugging the Wall Adapter to the 120 VAC first, then connect it to the interface module. In this arrangement, the TST is powered by the communication module.

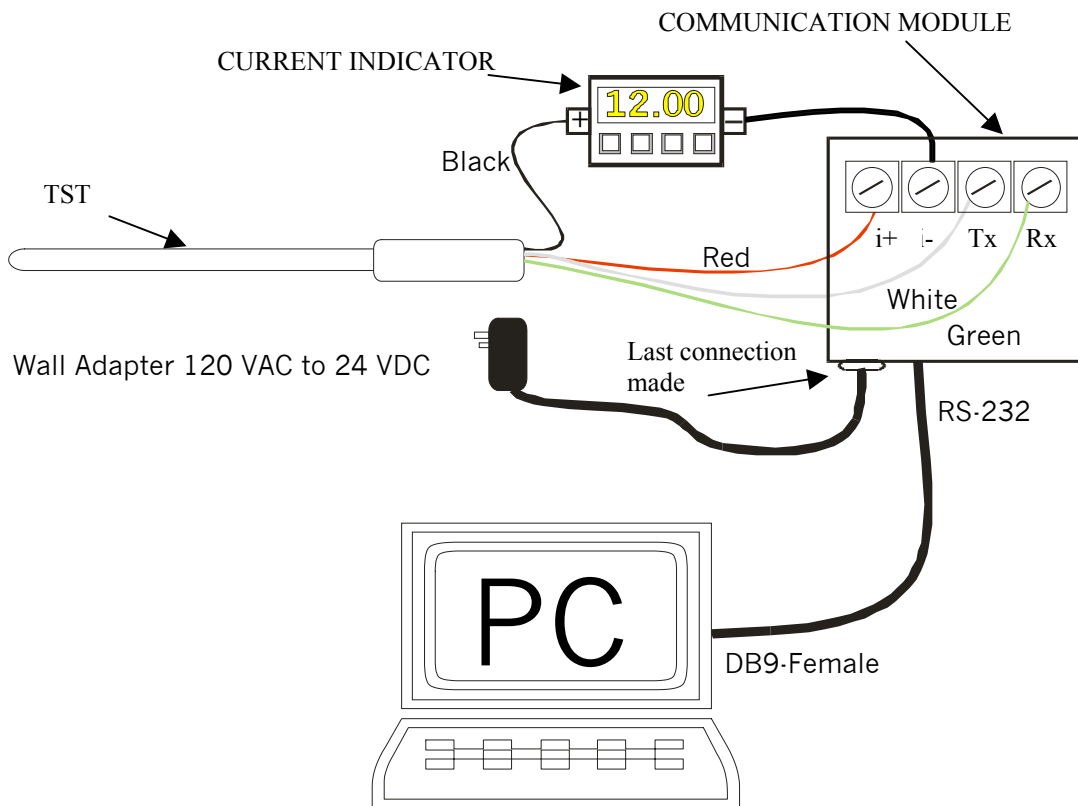


FIGURE #3

CONFIGURATION AND CALIBRATION WITH THE OPTIONAL TST SOFTWARE :

General Description

The TST can be re-scaled and re-calibrated over its entire operating range. To perform re-scaling and re-calibration you need to have the TST Software installed on your computer and the TST connected in communication mode configuration (see Figure #3).

System Requirements

To install the TST Software, you need these minimum system requirements:

- Pentium I – 300 MHz or better
- 5 MB of Hard Disk space
- 16 MB of RAM
- Windows 95, 98, NT 4.0 or 2000
- 1 serial port

Installing the Software

***** IMPORTANT *****

If you already have an old version of the TST Software on your computer you must first uninstall it. To do so, use the Windows *Add/Remove Program* utility in the *Control Panel*.

Window 95 :

- Copy all the files from the WIN95 directory located on the CD-ROM to a temporary directory on you computer.
- Run the “*SETUP.EXE*” program located in the temporary directory.
- The TST-Setup program will automatically start.
- By default, the TST Software will be installed in the “*Program Files\TST*” directory. You can change the installation directory by clicking on the “*Change Directory*” button during the setup procedure.
- To complete the installation, click on the graphical button, showing a computer, located in the upper left part of the TST Setup window.
- After the installation is complete, the TST Software will be accessible via the Start-Program menu of Windows.
- You can delete the installation files copied in the temporary directory after the installation is complete.

Windows 98, NT, 2000 :

To install this version you need to have *Microsoft Installer* configured on your computer. If this is not the case, you will not be able to run the “*TST.MSI*” file. You have to download Microsoft Installer from the Microsoft Web Site or use the Windows 95 version of the TST installation program.

- Copy all the files from the WIN2000 directory located on the CD-ROM to a temporary directory on you computer.
- Run the “*TST.MSI*” program located in the temporary directory.
- The TST Setup program will automatically start.
- By default, the TST Software will be installed in the “*Program FilesTST*” directory. You can change the installation directory by clicking on the “*Change Directory*” button during the setup procedure.
- After the installation is complete, the TST Software will be accessible via the Start-Program menu of Windows.
- You can delete the installation files copied in the temporary directory after the installation is complete.

Uninstalling the Software

To uninstall the software, use the “*Add/Remove Program*” utility in the *Control Panel* of Windows. The program and all its associated files will be automatically deleted from your computer.

Read the TST configuration

By launching the TST Software, the configuration of the TST connected to the communication module will be automatically read by the computer and the main window of the TST software will appear on the screen (Figure #4).

If there is no TST connected or if the communication module is not powered, a communication error message will appear before the opening of the main Window. You must then make the appropriate connection (see the **Electrical Wiring** section) and click on the “Read” button to download the information.

By default, the TST Software is configured to read on the COM1 serial port. If the communication module is connected to another communication port, a communication error will be generated during the startup. Once the main window appears, you can then select, in the **Configuration** section of the main window (upper left corner), the port on which the device is connected (COM1 to COM4) and click on the “Read” button to download the information.

The second section of the main window, called **TST**, contains the buttons “Read” and “Program”. The “Read” button activates the download of the information from the TST. The “Program” button launches the Calibration and programming window.

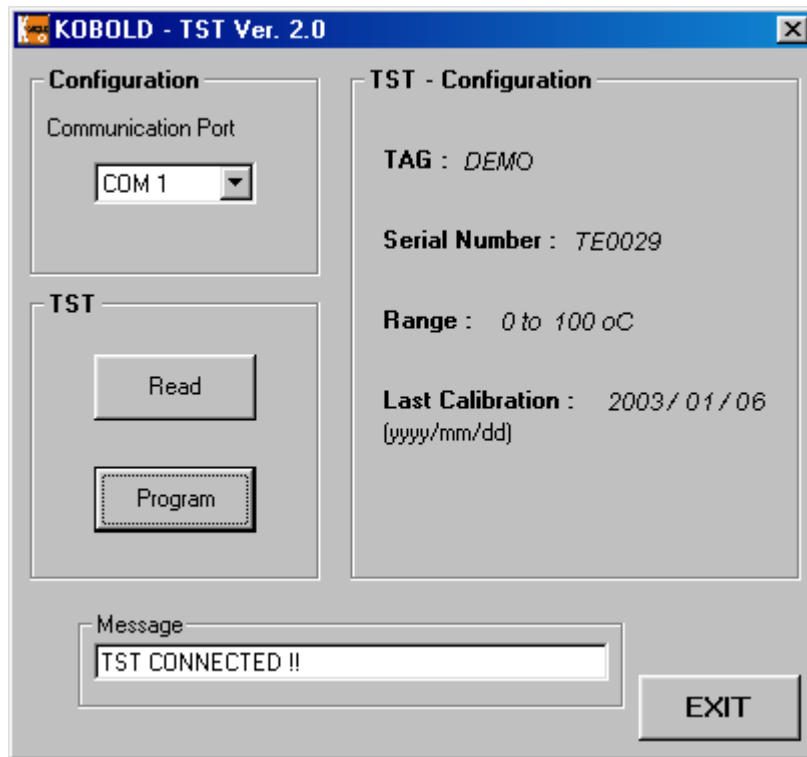


FIGURE #4

The right section of the main window, called “TST Configuration”, contains all the information downloaded from the device connected to the communication module. The downloaded information consist of the TAG identification, the serial number, the temperature range for which the device is set and the last calibration date.

At the bottom of the main window, a text box called “Message” shows the error or status messages.

Programming the TST

To access the programming window, simply click on the “Program” button located in the **TST** section of the main window. The programming window (FIGURE #5) allows you to change the TST configuration, the operating range and re-calibration of the device.

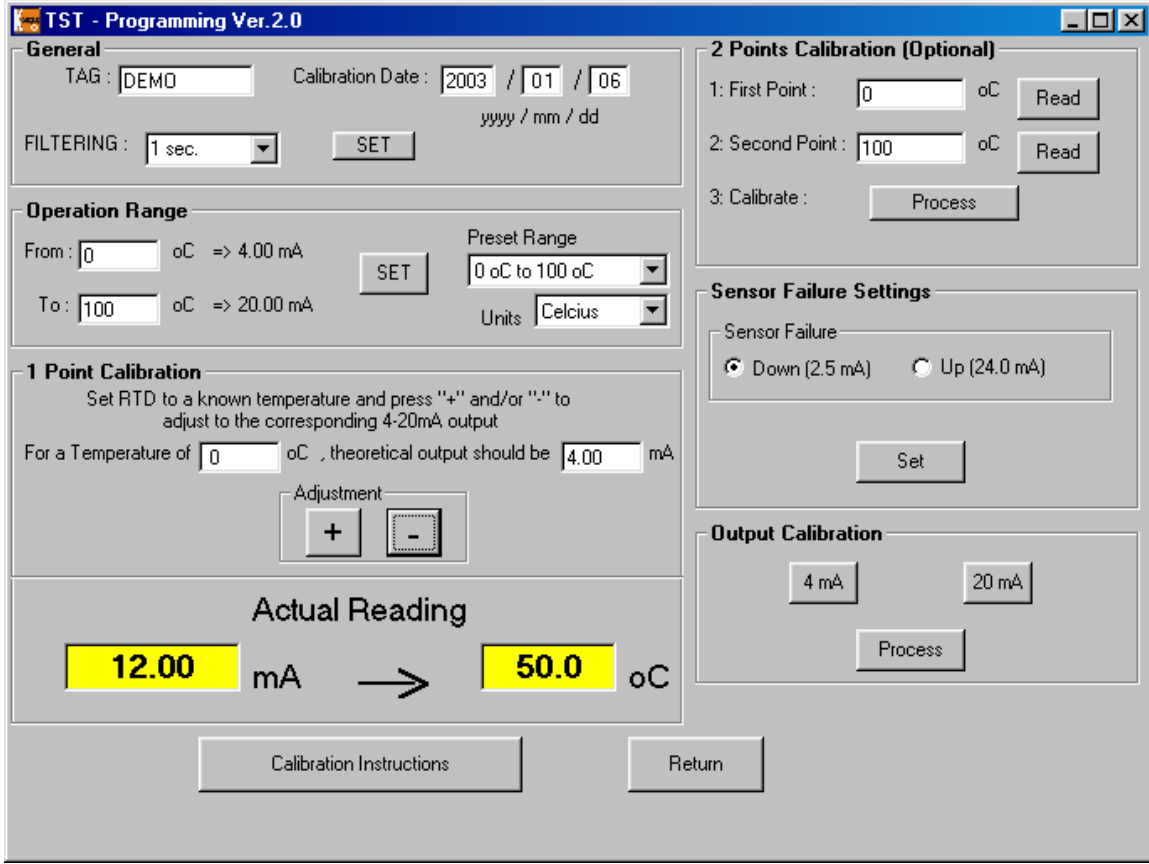


FIGURE #5

Changing the TST configuration :

The TST configuration includes the TAG name, the last calibration date, the filtering option and the failed output mode.

TAG Name :

The TAG name is used to identify the device. It can contain a maximum of eight (8) alphanumeric characters. To set or change the TAG name simply enter the value in the text box called TAG in the GENERAL section of the programming window (upper left corner). If the name entered is more than eight characters only the first eight will be saved. To download the TAG name to the TST, click on the “SET” button in the GENERAL section. The “SET” button also updates the calibration date as well as the filtering option.

Calibration Date :

To modify the last calibration date value, simply enter the new date in the text boxes called “Calibration Date”, located in the GENERAL section of the programming window. The date has to be entered under the format Year/Month/Day. Once the date is entered correctly, click on the “SET” button, located in the GENERAL section, to download the value to the TST. The “SET” button also updates the TAG name as well as the filtering option.

Filtering :

The filtering option allows the user to set the time response of the digital filter implemented in the TST. There are four (4) different settings. The first one is “none” which means the response time of the output is almost instantaneous. The other settings are 1, 3 and 5 seconds. To change the filter response time, simply click on the selection box called “Filtering”, choose the appropriate setting and click on the “SET” button located in the GENERAL section. It is recommended to set filtering to 1 sec. The “SET” button will also update the TAG name as well as the calibration date.

Failed Value :

The failed value represents the output value at which the transmitter will be set if a failure is detected on the **Resistive Temperature Detector**. The two available choices are “Down”, which correspond to an output of 2.5 mA, and “Up”, which correspond to an output of 24 mA. To set the failed value click on the radio button, in the SENSOR FAILURE SETTINGS section, corresponding to your choice and then click on the “SET” button, located in the same section, to update the setting in the TST.

Changing Operating Range and Units

The TST can be re-scaled within its operating range at any time. The user can choose among a list of thirteen (13) different preset ranges or enter the values manually and retain standard factory accuracy over any range. This section of the software, called OPERATION RANGE, allows also the user to change the engineering units from Celsius to Fahrenheit and vice versa.

To change the engineering units, simply click on the selection box called “Units” and select the desired value. Once it is selected, click on the “SET” button located in the OPERATION RANGE section.

NOTE : Changing the engineering units or the range of operation will reset any high precision 1 point or 2 point calibration previously made but default factory accuracy of ± 0.25 °C + 0.40% of reading, is retained.

Each time you click on the “SET” button of the OPERATION RANGE section, a warning message will appear on the screen, telling you that the calibration parameters will be lost. You can then choose to proceed or not with the new settings. When the units are changed, the operation range is also changed to the same numerical values but in different engineering units. (Ex. If a TST is configured as a 0 to 100 °C and the units are changed to Fahrenheit then the device will become configured as a 0 to 100 °F). When the units are changed, the “Preset Range” values are also automatically changed to match the new engineering units.

To re-scale the TST to one of the pre-defined range, simply click on the “Preset Range” selection box, choose the appropriate range and then click on the “SET” button located in the OPERATION RANGE section. Once the new range is set, the “Actual Reading”, located in the bottom of the Programming window, will be updated with the new values.

To re-scale the TST in a range that is not included in the “Preset Range”, simply enter the value, in the current engineering units, that correspond to a reading of 4 mA and 20 mA, in their respective text boxes. To apply this new range, click on the “SET” button located in the OPERATION RANGE section. Once the new range is set, the “Actual Reading”, located in the bottom of the “Programming” window, will be updated with the new values.

If the selected range is out of the construction limit of the TST an error message will appear on the screen and the TST will not accept this new setting. Be aware also that changing the range of operation or engineering units will reset all the calibration values.

Calibration

Three types of calibration are available through the TST software. The first one is the output calibration, which allows the user to calibrate the output of the TST against a current indicator. The second type is the “One point” calibration, which allows the user to calibrate the TST against one known temperature value in the operating range. Finally, the third type is the “Two point” calibration,

which allows the user to calibrate the TST against two known points in the operating range.

Output Calibration

The output calibration feature permits a calibration of the current output against a current loop indicator independent of sensor temperature. All the TSTs are already output calibrated at the factory against a high accurate current indicator. If the user wants a perfect match between a current loop indicator and the TST, he can re-calibrate the output. This is performed by first clicking on the “4 mA” button located in the OUTPUT CALIBRATION section of the “Programming” window. This will force the TST output to the theoretical value of 4.00 mA. Once the button is pressed, a small dialog box appears on the screen (**Figure 6**) allowing the user to set the output current to exactly 4.00 mA by clicking on the “+” or “-” button. When the output is perfectly at 4.00 mA, as measured on reference loop indicator, then click on the “Set” button to record the new value in the TST

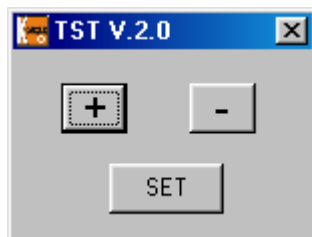


Figure 6

The next step is the calibration of the 20 mA. To perform that operation, simply click on the 20 mA button located in the OUTPUT CALIBRATION section of the “Programming” window. This will force the TST output to the theoretical value of 20.00 mA. Once the button is pressed, a small dialog box appears on the screen (**Figure 6**) allowing the user to set the output current to exactly 20.00 mA by clicking on the “+” or “-” button. When the output is perfectly at 20.00 mA, as measured on reference loop indicator, then click on the “Set” button to record the new value in the TST.

The last step is the calculation and recording of the output calibration parameters. This is performed by clicking on the “Process” button located in the OUTPUT CALIBRATION section of the “Programming” window. The TST program then reads the 4.00 mA and 20.00 mA values that have been set earlier in the TST,

calculates the output calibration parameters and downloads the new values in the TST memory.

The output calibration can be performed at any time and not necessarily in order (i.e. the 20 mA output adjustment can be performed before the 4 mA adjustment). If necessary, only one of the 4 mA or 20 mA can be performed. When the output calibration parameters are calculated, the values are taken from the TST memory.

“One Point” Calibration

The “One point” calibration allows the user to offset the output of the TST to match perfectly a known temperature to which the TST is set.

To perform this calibration, a known and stable temperature reference is required. Set the TST to this known reference temperature and wait for 5 minutes to be sure that the reading is stabilized. To establish what the output current should be at this reference temperature, the user can enter the value of the reference temperature (in the current engineering units) in the corresponding text box (“*For a Temperature of*”) located in the “1 POINT CALIBRATION” section of the “Programming” window. The theoretical output current will then be automatically calculated and displayed in the corresponding text box (“*theoretical output should be*”). If the current indicated by the loop current indicator does not match the theoretical value, then click on the “+” or “-” button of the “Adjustment” section to adjust the output reading to the correct value. Every time the “+” or “-” buttons are clicked, the new value is downloaded and saved in the TST memory.

NOTE : The “Actual Reading” section located on the bottom of the 1 POINT CALIBRATION section displays values calculated by the TST program. This calculation is based on the digital reading (via the RS232) and may not correspond exactly to the current output read by the loop indicator. For better accuracy, use the reading from a calibrated loop indicator to make the adjustments.

“Two Point” Calibration

The “Two point” calibration allows the user to calibrate the TST against two known reference temperatures in the operation range. This calibration is performed in three steps.

The first step is the “First Point” reading. The TST has to be at a known and stable reference temperature inside its operating range. The first point must be at a lower value than the “Second Point”. Once the output reading from the TST is stable, enter the temperature value in the text box called “First Point:” located in the 2 POINTS CALIBRATION section, and click on the corresponding “Read” button. The input value is then saved in the TST memory as well as the temperature reference for the first point.

The second step is the “Second Point” reading. The TST has to be at a known and stable reference temperature inside its operating range. The second point must be at a higher value than the “First Point”. Once the output reading from the TST is stable, enter the temperature value in the text box called “Second Point:” located in the 2 POINTS CALIBRATION section, and click on the corresponding “Read” button. The input value is then saved in the TST memory as well as the temperature reference for the second point.

The third and last step is to perform the calculation of the calibration parameter. This is done by clicking on the “Process” button located in the 2 POINTS CALIBRATION section. This action causes the TST software to upload the first and second points values from the TST and calculates the calibration parameters from a linear extrapolation between the two points recorded. The new calibration parameters are then downloaded and saved in the TST memory. The output of the TST is automatically recalculated without having to re-initialized it.

NOTE :

The reading of the first and second calibration points do not have to be performed at the same time or in the order indicated.



TECHNICAL SPECIFICATIONS

Input :	RTD, type Pt100 class B
Sensor Temperature Ranges :	See TST catalog datasheet for standard ranges, Customer re-scalable between -200°C to 600°C, no re-calibration required
Output :	4-20 mA loop powered, linear to temperature
Power Supply :	9-48 VDC, polarity protected
Supply Effect :	0.01%/V
Accuracy :	±(0.25°C + 0.4% of reading) largest error, normally less
Maximum Loop Resistance :	(Vsupply – 7) * 40 ohms
Sensor Open Circuit :	Upscale 24 mA or Downscale 2.5 mA
Warmup :	30 seconds
RFI Effect :	1% or less typical
Isolation :	500 VDC Input/Output
Temp. Effects :	≤ 0.01% FS/°C
Long Term Drift :	≤ 0.1% FS

Mechanical Properties

Probe Material:	316 Stainless Steel
Probe Finish :	Ra 32 typical
Probe and Housing Material :	316 Stainless Steel, welded to probe
Cable Material :	PVC, PTFE or Stainless Steel armored over PTFE. Custom material available.
Enclosure:	Many types available, see catalog
Protection:	NEMA 6P, hermetically sealed
Storage Temp. Range:	-40°C to 80°C
Operating Temp. Range:	-40°C to 80°C (Transition only)
Maximum Operating Pressure:	Threaded Version :1500 PSIG Max Clamp Version : Per clamp rating (500 PSIG Max.)