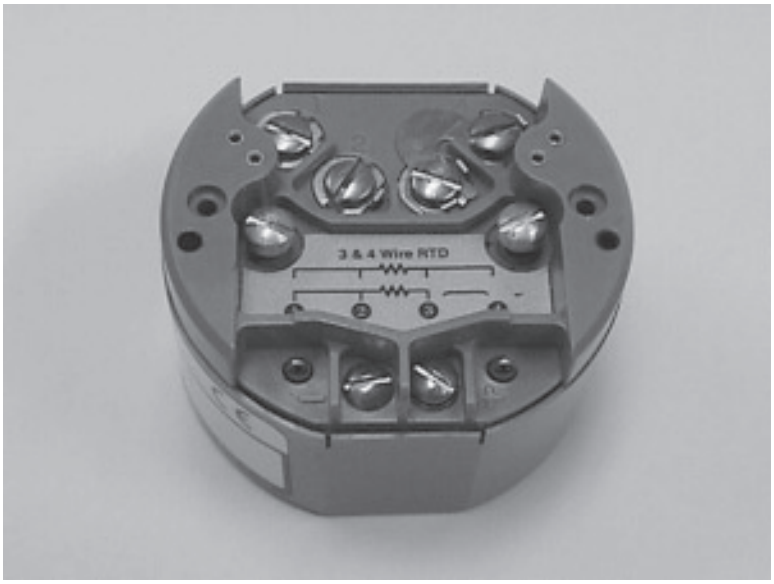
Model TX180
Temperature Transmitter
Installation and Operation Manual



Dynisco
Instruments

P/N 974083
04/02 Rev. B
ECO # 26721

CONTENTS

LIST OF ILLUSTRATIONS

PREFACE

NOTICE

Read this manual before working with these products. For personal and system safety, and for the optimum product performance, make sure you thoroughly understand the contents before using or servicing this product.

For technical assistance from the factory please contact:

DYNISCO INSTRUMENTS
38 Forge Parkway
Franklin, MA 02038

Telephone: (508) 541-9400 or 1-800-221-2201
Facsimile: (508) 541-9436
Internet Address: www.dynisco.com
E-mail: salesinst@dynisco.com

1. INTRODUCTION

The TX180 is a transmitter that accommodates any one of eleven types of thermocouples, six types of RTD's, millivolt or ohm inputs. The unit is precision linearized to the measured temperature over the entire usable range of the selected sensor. This transmitter is simple to set up and operates much like high performance analog transmitters.

The TX180 also has numerous advanced features that are achieved through the use of digital signal processing and micro-controller technologies. Typical of these features are the precision linearization, the independent zero and full scale settings, digital filtering, etc. Other advanced features, such as the automatic self diagnostics, and the exceptional stability are transparent to the user and are continuously active.

The TX180 transmitter can also accept one of two optional plug-in displays. The LI-1 is an inexpensive, single line display that is intended to give a low-cost, local indication of the measured temperature. The LI-2 two line display will give a local indication and functions as a very easy-to-use set-up tool. Both displays facilitate local configuration and ranging of the transmitter.

This manual is divided into several sections. After a brief INTRODUCTION, the section on UNPACKING AND INSTALLATION contains much useful information for the first time installer. The section called IN A HURRY? helps get the system operating provided the sensor and transmitter were purchased at the same time and thus most of the set up was completed at the factory. The next two sections explain the method of CONFIGURATION using either display. Finally, there is additional APPLICATION INFORMATION and the TECHNICAL SPECIFICATIONS included in the

sections under those headings.

The TX180 temperature transmitter does not have any potentiometers or switches to set and there are no user serviceable components inside the transmitter. Opening the enclosure will void the manufacturer's warranty. All reconfiguration, re-ranging and "calibration" can be done in the field using either one of the displays. Any of the communication methods provides reconfiguration and re-ranging capabilities without other external calibration tools.

2. UNPACKING AND INSTALLATION

2.1 UNPACKING

Remove the Packing List to check off the actual equipment received. If you have any questions on your shipment, please call DYNISCO Customer Service at (800) 332-2245. Upon receipt of shipment, inspect the container for any signs of damage in transit. Especially take note of any evidence of rough handling. Report any apparent damage immediately to the shipping agent.

NOTE: The carrier will not honor any claims unless all shipping material is saved for their examination. After examining and removing the contents, save the packing material and carton in the event reshipment is necessary.

2.2 MECHANICAL INSTALLATION

Proper installation of the transmitter will assure highest performance and minimize errors of the measured variable. The transmitter should be mounted in a location that minimizes temperature extremes, vibration and shock. It is important to survey the area to ascertain the best location for installation. Will the location be subjected to flooding? Is the location directly above, below or in proximity to a known high heat source? Does the location make the transmitter unserviceable?

The installation recommendations outlined in this section are provided to act as a guideline only and cannot cover all possible variations. The final installation must be made at the discretion and approval of the user.

2.2.1 WEATHER PROOF/EXPLOSION PROOF HOUSING

Several optional transmitter housings are available. The XP-FN is an Explosion Proof / Weatherproof housing that accommodates a transmitter when the local display option is not required. The XP-FG, with its glass window, may be used in hazardous and wet locations when the display option is desired. The XP-HEAD is a small electrical head that can be used without local indication in Explosion Proof environments. The WP-HEAD is a small aluminum Weatherproof head designed for head mounting the transmitter without local indication. These housings have appropriate mounting means in the bottom to attach the TX180 in any of four orientations 90° apart. Captive 8-32 machine screws are installed on the transmitter to facilitate installation and removal to either a housing bottom plate or to a mounting panel.

Please note that condensation often occurs inside conduit attached to Weather Proof or Explosion Proof housings. Care must be taken so that liquid condensation does not accumulate and fill the transmitter housing with liquid. While the transmitter is sealed, we do not recommend operating it immersed in liquid. Conductive liquids across the top of the transmitter will short the input and loop terminals. This installation problem can appear to a control system as a transmitter failure.

2.2.2 MOUNTING

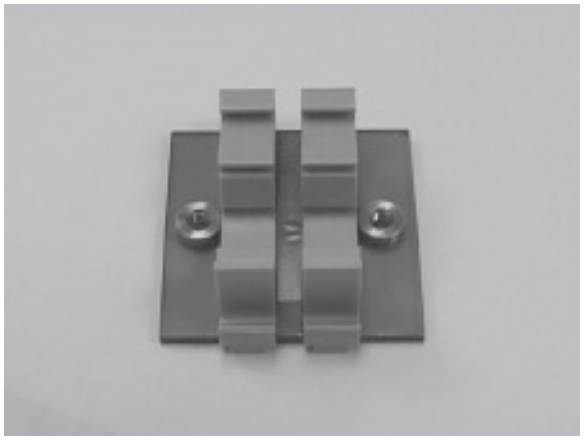
The TX180 transmitter may be mounted on a 2 inch pipe (vertical or horizontal), on a bulkhead, a panel, a DIN rail or other rigid support members utilizing the various mounting brackets and associated hardware available from Dynsico. These types of mounts provide greater flexibility in installation and removal of transmitter for service. In locations where extreme temperature variations are encountered, it is strongly recommended that enclosures be provided to maintain a somewhat constant temperature at the transmitter. Heaters or steam tracing should be provided if the ambient temperature variations are extreme.

Fig. 1 Optional Weather-Proof Housing

2.2.2.1 DIN RAIL MOUNTING

A bracket is available if DIN rail mounting of the TX180 is desired. See Figure 2.

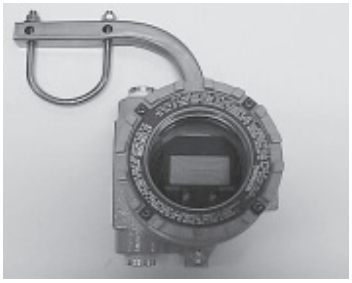
Fig. 2 Optional DIN Rail Mounting Bracket



2.2.2.2 HEAD MOUNTING

For head mounting, all the Explosion Proof / Weatherproof housings can be used for head mounting. All heads have two 1/2" female NPT conduit entries. One of these conduit entries can be used to mount directly onto a 1/2" male NPT extension of sensor. Alternatively, a 1/2" NPT union coupling can be placed between the weatherproof housing and the temperature sensor. These heads are shown in Figure 3. Note that the XP-HEAD and WP-HEAD cannot be used with a pipe mount bracket. For non-display pipe mount bracket installations, use the XP-FN Housing.

Fig. 3 The XP-FG with Bracket and WP-HEAD



2.2.2.3 SURFACE MOUNTING

The transmitter has two mounting holes through the body of the transmitter. These mounting holes allow the transmitters to be attached to any flat surface by means of two bolts or screws. The transmitter is provided with 8/32 captive screws already installed.

2.2.2.4 PIPE MOUNTING

A stainless steel bracket is available for pipe mounting. Use the PY-2 for mounting the XP-FN or XP-FG housing onto any 2" pipe. Note that the XP-HEAD and WP-HEAD are not suitable for Pipe Mounting. The housing is attached to the bracket as shown in Figure 3.

2.3 ELECTRICAL INSTALLATION

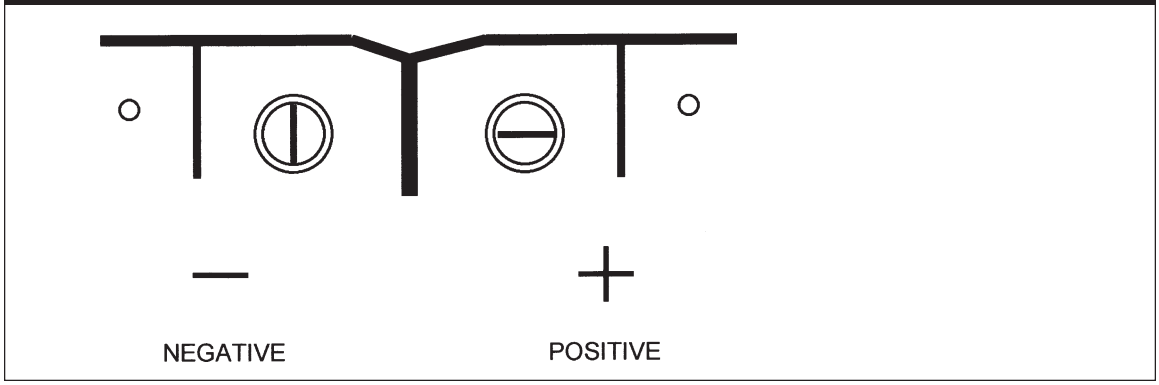
The TX180 has two groups of terminals. One terminal group is for the sensor input. The second terminal group is for transmitter output. The terminals labeled "+" and "-" are the 4 to 20mA output terminals. These are normally connected to the corresponding polarity terminals of the power supply of the current loop. Refer to Figure 4 for the arrangement of the output terminal connections.

Terminals labeled "1, 2, 3 and 4" are used in various connections to accommodate the different sensor inputs. Refer to Figure 5 for the arrangement of the input terminal connections.

2.3.1 OUTPUT TERMINALS

The output terminals, labeled "+" and "-", are generally connected to a power supply having a nominal 24 Volt DC voltage and capable of supplying 23mA for the TX180. The "+" and "-" terminals of the transmitter are connected to the corresponding polarity terminals of the power supply.

Fig. 4 Output Terminal Connections



A load resistor, typically 250 ohms, may be connected in series with either terminal of the transmitter. For Digital communications, 250 ohms must be connected in the loop. The maximum series resistance in the circuit (including wiring lead resistance) can be calculated using the formula:

$$Rs = \frac{Vs - 12}{0.023}$$

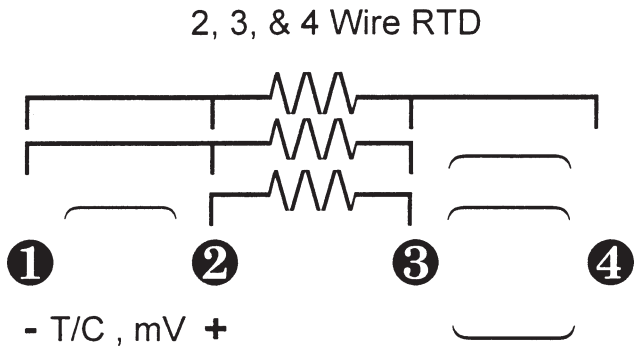
The following chart gives maximum series resistance:

Max. Series Resistance, Rs	Supply Voltage, Vs
1300 ohms	42.0 Volts
520 ohms	24.0 Volts
417 ohms	21.6 Volts
250 ohms	18.0 Volts
0 ohms	12.0 Volts

2.3.2 INPUT TERMINALS

See Figure 5 for sensor input connections. Be certain to include the proper jumpers for thermocouple sensors and for two or three wire RTD inputs. Any sensor other than the four-wire RTD requires at least one external jumper. A jumper is supplied with the unit and is attached to terminals 3 & 4.

Fig. 5 Input Terminal Connections



2.3.2.1 MILLIVOLT AND THERMOCOUPLE INPUT

Apply signal to terminals 1 and 2. Terminal 1 is the negative and terminal 2 is the positive. Terminals 3 and 4 must be jumpered together for proper operation as well as to prevent any build-up of electrostatic charge on these terminals which could affect the transmitter readings.

2.3.2.2 TWO-WIRE RTD INPUT

Apply signal to terminals 1 and 3. Jumpers must be installed on terminals 1 and 2 as well as on 3 and 4 for proper operation and to prevent any build-up of electrostatic charge on these terminals which could affect the transmitter readings.

2.3.2.3 THREE-WIRE RTD INPUT

Apply the common legs from the RTD (generally the same color RTD leads) to terminals 1 and 2. Apply the other signal lead to terminal 3. Terminals 3 and 4 must be jumpered together for proper operation and to prevent any build-up of electrostatic charge on these terminals which could affect the transmitter readings.

2.3.2.4 FOUR-WIRE RTD INPUT

Apply one set of the common legs from the RTD (generally the same color RTD leads) to terminals 1 and 2. Apply the other signal lead pair to terminals 3 and 4. No jumpers are necessary for a 4 wire RTD input.

3. TRANSMITTER OPERATION

3.1 IN A HURRY?

When in a hurry, this short set of instructions and references will help get the transmitter running.

3.1.1 FACTORY CONFIGURATION

Input	=	Type J Thermocouple
Output	=	Analog
4.00mA	=	40°F
20.00mA	=	200°F
Sensor Fail-safe	=	23.00mA (High)

On special request the factory will set the transmitter to any desired configuration. Special configurations are identified on a tag attached to the unit.

3.1.2 OPERATION WITHOUT A DISPLAY

If the unit was ordered with the standard factory configuration, the sensor required is a Type J thermocouple. The packing slip and a tag on the unit will indicate if the unit was set up to any other customer requested special configuration. If there is a need to change the configuration of the transmitter, or to re-range it, use either the LI-1 or LI-2 Display and refer to the procedures described in SECTIONS 4 (for LI-2), 5 (for LI-1).

NOTE: Even when "In a Hurry", the use of an appropriate power supply is important. A 24V DC supply having a current handling capacity of at least 0.1A is commonly used. Always use a DC (direct current) supply, or suitable size battery. **NEVER CONNECT THE TRANSMITTER DIRECTLY TO 115VAC.**

With the power supply off, connect the + side of the power supply to the + terminal of the

transmitter. Connect the - side of the power supply to the - terminal of the transmitter.

Connect a Type J thermocouple to the transmitter input.
Thermocouple high (+) (input terminal 2)
Thermocouple low (-) (input terminal 1)
Jumper terminals 3 & 4 together

Unlike conventional electrical wiring, **(on a J thermocouple the red lead is negative)**. This should be checked and verified with the particular sensor to be used.

To connect other sensors to the input refer to Section 2.3.2 for the proper sensor connections.

The output can be monitored by connecting a milliammeter in series with either of the two output terminals, or by connecting a high impedance voltmeter across the optional 250 ohm resistor. Now turn on the power supply. In about 5 seconds the TX180 loop current will settle to its normal value in the range of 4 to 20mA, unless the input terminals are open, in which case the output current will be 23.00mA. Note that for a Type J thermocouple, if 4mA = 40°F and 20mA = 200ºF, each additional 10°F increases the current by 1.0mA.

3.1.3 Operation With a Display

If the transmitter was ordered with either display option, it will have a small local LCD display module (with two integral buttons) plugged in to the top of the unit. Either display option can be ordered already installed on the TX180 transmitter. Alternately, either display can be ordered and field installed at any time.

Having the display option as part of the transmitter does not affect its operation in the analog mode and the description of the previous section applies. However, the display option does provide some very useful local indication of the measured temperature and other diagnostic functions. Figure 6 below indicates the arrangement of the display screen.

Fig. 6 Local Displays, LI-1 and LI-2

In operation, the LI-1 and LI-2 displays both give the process temperature.The LI-2 provides some additional information The LI-1 displays the process temperature and a minus sign if applicable. The temperature is displayed with a floating decimal point. For measured temperatures over 999.9 no decimal point will be displayed. Otherwise, the LI-1 will show one tenth degree increments. Unlike the more capable LI-2 display, the LI-1 does not show the units of measurement “C”, “F”, “R”, or “K”. If it is necessary to display the temperature units on the LI-1, note by hand or apply a separate label on the face of the display.

The LI-2 has more display capabilities. With the LI-2, the top display row shows the process temperature, the units of measurement, “C”, “F”, “R”, or “K” and a minus sign if applicable. The mid portion is an analog bar graph display showing the % of range based on the ZERO and FULL SCALE setting of the transmitter. When power is applied the leftmost segment of the bar graph, the 0% and the 100% become energized momentarily. If the measured temperature is below what the ZERO is set to (below LRV), then the left arrow is energized. If the measured temperature is above the FULL SCALE setting (above URV), then the right arrow becomes energized. The bottom portion of the LI-2 display is capable of displaying an alphanumeric message up to 7 characters long. In normal operation this row shows a label, which is factory set to display “TX180”.

Note that the process temperature displayed on the LI-1 and LI-2 is the actual temperature as measured by the transmitter, it is not affected by the analog output range settings. This is particularly useful in startup or operation where the measured temperature is temporarily outside the normal operating range.

When the unit is first turned on, the display will show the measured temperature. It is frequently the case that no sensor is connected when the transmitter is first turned on. In this case, the display will show a sensor failure. In the event of a sensor or transmitter failure, the indication on the L-1 display changes to read:

FAIL	**SAFE**

The words “FAIL” and “SAFE” will alternate in the display window to let you know that a failure condition has occurred.

In the event of a sensor failure, the indication on the bottom line of the LI-2 display changes to:

<0% ■ ■ ■ ■ ■ ■100%> **FAIL**	<0% ■ ■ ■ ■ ■ ■100%> **SAFE**

The words “FAIL” and “SAFE” will alternate in the display window to let you know that a failure condition has occurred. The Percent of Output Bar Graph will indicate the output level of the transmitter. If the transmitter Failsafe Report value is set to “Fail High” (23mA), the display will be as shown, at over 100% of output. If the Failsafe Report is set to “Fail Low” (3.8mA), the Percent of Output Bar Graph would indicate the output level at under 0% of output. See sections 4.8, 5.8 or

6.2 for further information on setting Failsafe Reporting.

Once the proper sensor is connected the fault message on the display should clear and the transmitter output should go to the proper value.

Both LCD displays take full advantage of the precision of these transmitters. The digital display of measurement does not include the small D/A error otherwise present in the analog output. It provides highly accurate local indication of the measurement, local fault diagnostics, and transmitter identification. The LCD continues to display the measured temperature even if it is beyond the zero and full scale limits set for the analog output.

If you should desire to change the sensor input or to re-range or reconfigure the transmitter, please refer to Sections 4, 5 or 6 of this manual, which show you how to set-up the transmitter with the LI-1 or LI-2 displays.

4. CONFIGURATION USING THE LI-2, TWO-LINE DISPLAY

To configure a transmitter using the **DISPLAY MODE**, either the LI-1 or LI-2 local LCD display is required. These displays are available as an option and can be plugged into the top of the TX180 transmitter. The transmitter can also be purchased with these options already installed. These inexpensive options make the reconfiguration, or re-ranging of the transmitter very simple and easy to follow. Without the use of a calibrator, or any other tools, the transmitter can be set up for a different sensor, or the new range limits can be set much like one would set the time on a digital watch.

In the event that the LI-1 or LI-2 Display / Keyboard are not purchased at the same time as the transmitter, the one piece display design allows for easy field installation by simply plugging the LI-1 or LI-2 into the top of the transmitter.

4.1 ENTERING THE DISPLAY MODE

To start the **DISPLAY MODE**, first connect the transmitter to an appropriate DC power supply. Typically a 24VDC supply is connected with the + side of the power supply connected to the transmitter's output "+" terminal and - side of the power supply connected to the transmitter's output "-" terminal. A sensor may be connected to the transmitter's input terminals, but this is not required for setting up the transmitter.

With the standard factory set-up and no sensor connected, the LI-2 display will give the following indication:

<0% ■ ■ ■ ■ ■ ■100%>
FAIL

<0% ■ ■ ■ ■ ■ ■100%>
SAFE

The transmitter is indicating **FAILSAFE**, since no sensor is connected, and the analog output is indicating greater than 100%, loop current at 23.00mA, which is the standard Failsafe report condition. Please note that the display / keyboards can be plugged into the transmitter while the transmitter is powered up. There is no need to disconnect power before plugging the LI-1 or LI-2 into the TX180.

Press the key marked **NEXT**. The display starts to alternate asking if the user wishes to return to the Operate Mode?

RETURN	TO	OPERATE	MODE?

To activate the **NEXT** and **ENTER**; keys a slow, deliberate push of the key is required. This prevents any casual, inadvertent activation of the transmitter into one of the configuration modes.

The answer would be "No", therefore, press the **NEXT** key. This will enter you into the **DISPLAY MODE** configuration menu. If you wish to answer a question "Yes", press the **ENTER** key. A flow chart summarizing the operation of the **DISPLAY MODE** appears at the end of this manual.

Note that when more than seven characters are required to describe a function, the display keeps sequencing through two or more screens or may use common abbreviations. In this manual, the sequencing of the display is indicated by placing the two or more parts of the message adjacently. With some functions, the LI-2 display indicates a numeric value and unit of measurement on the top line of the display in addition to the message on the lower display line.

4.2 Display Mode Configuration

The **DISPLAY MODE** will allow the user to do the following:

- Select a Sensor Input (Select Input)
- Select a desired temperature unit, such as ºF (Select Units)
- Change the 4mA Lower Range Value (Change Zero)
- Change the 20mA Full Scale Value (Change Full Scale)
- Change the Sensor Fail Safe detection (Select Sensor Fail Safe)
- Change the Fail Safe reporting (Select Fail Safe Report)
- Trim the 4.0mA output current (Trim 4 MA)
- Trim the 20.0mA output current (Trim 20 MA)
- Trim the display value (Trim Display)
- Change the Language of the display

Each of these functions is presented in sequence on the LCD display. If the indicated function need not be performed, press Next, and the next function is displayed on the screen. To perform any function press the Enter key. This will cause additional screens to be displayed which enable you to perform the function. These are described in detail below and summarized on the LI-2 Two-Line Display / Keyboard Flow Chart found in the rear of this booklet.

4.3 SELECT A SENSOR INPUT

The **SELECT SENSOR** is the first function in the sequence. Virtually any thermocouple, RTD or millivolt input can be selected. The display will read as follows to indicate this position on the menu:

SELECT	INPUT

If the sensor is set correctly, press **NEXT** and skip to Section 4.4 of this manual; otherwise press Enter. After pressing the **ENTER** key, the display will change to:

T/C J

Indicating that the transmitter is set to a Type J thermocouple input. If this is the desired sensor, then press **ENTER**, otherwise press **NEXT** repeatedly to sequence through the available sensors. Each time **NEXT** is pressed, the next available sensor selection is displayed.

T/C J

Press the **NEXT** key to go the next sensor.

T/C K

Press the **NEXT** key to continue through the different sensor selections.

T/C L
T/C N
T/C R
T/C S
T/C T
T/C U
T/C SPEC

NOTE: The T/C SPEC or Special Thermocouple input is reserved for a special thermocouple input,

should one be desired. This Special must be ordered from the factory.

2W OHMS

2W DINP

NOTE: This is the 100Ω Platinum DIN Curve with $\alpha = 0.00385$.

2W SAMP

NOTE: This is the 100 Ω SAMA Platinum Curve, known variously as the SAMA RC21-4 or SAMA PR-279. Constants are 98.13Ω @ 0°C, $\alpha = 0.003923$.

2W SPEC

NOTE: The 2W SPEC or Special 2 wire RTD input is reserved for a special RTD input, should one be desired. Any special 2-wire RTD curve must be ordered from the factory.

3W OHMS

3W DINP

NOTE: This is the 100Ω Platinum DIN Curve with $\alpha = 0.00385$.

3W SAMP

NOTE: This is the 100 Ω SAMA Platinum Curve, known variously as the SAMA RC21-4 or SAMA PR-279. Constants are 98.13Ω @ 0°C, $\alpha = 0.003923$.

3W SPEC

NOTE: The 3W SPEC or Special 3 wire RTD input is reserved for a special RTD input, should one be desired. Any special 3-wire RTD curve must be ordered from the factory.

4W OHMS

4W DINP

NOTE: This is the 100 Ω Platinum DIN with α = 0.00385. This sensor will give superior measurement results in most real-world situations where the measured temperature is under 1,000°F.

4W SAMP

NOTE: This is the 100 Ω SAMA Platinum Curve, known variously as the SAMA RC21-4 or SAMA PR-279. Constants are 98.13Ω @ 0°C, with α = 0.00385.

4W SPEC

NOTE: The 4W SPEC or Special 4 wire RTD input is reserved for a special RTD input, should one be desired. Any special 4-wire RTD must be ordered from the factory.

MV

HHTONLY

NOTE: The HHTONLY is for a Hand-Held set-up. This is used for Factory set-up only.

T/C B

T/C C

T/C E

Pressing **NEXT** key again returns you to the J thermocouple selection. Repeated pressing of **NEXT** key will again cycle you through the input selection submenu. You can stop at any one of the thermocouple, RTD or mV selections by pressing the **ENTER** key. This action changes the transmitter mode to that sensor. If no sensor change is desired, then, without sequencing through the various sensor options, but jus pressing the **ENTER** key will allow one to confirm the sensor selection and leave it unchanged. Assume that the sensor is left as T/C J. After pressing **ENTER** the display will return to the main menu entry of **SELECT INPUT**. Pressing the **NEXT** key then takes the transmitter to the next main menu selection.

4.4 SELECT UNITS

If the selected sensor is a thermocouple or RTD, the next menu entry is **SELECT UNITS**.

SELECT	**UNITS?**

Pressing the **ENTER** key displays the current units.

DEG F

By repeatedly pressing the Next key, the display will sequence through the following screens:

DEG R

DEG K

DEG C

These correspond to K=Kelvin, R=Rankine, C=Celsius and F=Fahrenheit. Stopping the selection at any one of these units and then pressing **ENTER** will set the transmitter to the corresponding new units. For the purposes of this example the units of measure can be left at DEG F by pressing **ENTER**. Advancing the menu selection with the **NEXT** key lets you change the zero.

4.5 CHANGE ZERO

The display will then alternate between the following screens to indicate that one may now change the zero, or 4mA output point. The numeric value seen on the upper portion of the screen is the ZERO value of the transmitter. One can now change this Zero, or LOWER RANGE VALUE, (LRV), totally independent of the FULL SCALE, or UPPER RANGE VALUE, (URV), without the use of any calibrators or external sensor inputs.

40.0°F CHANGE

40.0°F ZERO?

To change the zero, press **ENTER**. The display changes to read:

0040.0°F PLUS?

indicating that the existing zero is set to “plus” 0040.00ºF. The question mark “?” indicates a question asking if this value is to remain positive (PLUS ?). By repeatedly pressing the **NEXT** key the display will alternate

-0040.0°F MINUS

0040.0°F PLUS?

After deciding whether the zero value, LRV, is to remain positive (PLUS), press the **ENTER** key. In this example assume it is to remain positive. The display changes to read:

***0*040.0°F**
THOUSN?

and the left most digit position will start blinking (shown here in italics) asking if the thousands position needs to be changed. To change the thousands position, start pressing the **NEXT** key and the left most digit will increment through 1 2 3 4 5 6 7 8 9 0. Stop pressing the **NEXT** key at any of the numerals desired, then press Enter to accept the selection. If the numeral selected before pressing **ENTER** was 0, then the display would change to read:

0*0*40.0°F
HUNDRD?

and the second digit from the left will start blinking (shown here in italics) asking if the hundreds position needs to be changed. As before, to change the number in this digit position repeatedly press the **NEXT** key until the desired numeral is reached. Then press **ENTER** to go to the next lower significant digit position. Each time the **NEXT** key cycles through the ten choices for that digit position and the **ENTER** key enters the selected number. The digit position being changed is the one that is blinking. The legend on the display will change successively to read:

00*4*0.0°F
TENS?

004*0*.0°F
ONES?

0040.*0*°F
TENTHS?

After the tenth's digit position has also been changed to the desired value, the next pressing of the **ENTER** key returns the transmitter to the alternating display of **CHANGE ZERO**. Since changing of the zero has just been completed, press the **NEXT** key to proceed to the next menu selection, **CHANGE FULL SCALE**.

4.6 CHANGE FULL SCALE

200.0°F	**200.0°F**	**200.0°F**
CHANGE	**FULL**	**SCALE?**

To change the full scale value press **ENTER**. The procedure for selecting Plus or Minus is identical to that described for changing the zero. Similarly, the procedure for changing each of the digit positions is identical to that described for changing the zero. Once the steps of changing the Full Scale have been completed and the **ENTER** key is pressed at the end of the procedure, the display returns to **CHANGE FULL SCALE**. Press **NEXT** for the next function **SELECT SENSOR FAIL SAFE DETECTION**.

4.7 SELECT SENSOR FAIL-SAFE DETECTION

SELECT	SENSOR	FAIL	SAFE?

If you want to change the **SENSOR FAIL SAFE** detection press **ENTER**. The present status of the Sensor Fail Safe is displayed. It is recommended that one turns off the Sensor Fail Safe System when using the TX180 with an input simulator. It should then be turned on when reconnecting the transmitter to the actual sensor.

ON
OFF

When the desired Fail Safe condition is displayed, pressing the **ENTER** key will change to the new setting and the screen returns to the **SELECT SENSOR FAIL SAFE** display. Pressing the **NEXT** key will bring up the Fail Safe Reporting selection screen.

4.8 SELECT FAIL SAFE REPORTING

SELECT	FAIL	SAFE	REPORT?

Fail Safe reporting allows the transmitter to change the 4-20mA loop to indicate a failure condition. This failure may be a sensor failure or a transmitter failure. In any event, the user may select to drive the loop to 23.0mA, corresponding to the “HI” selection; or 3.6mA, corresponding to the “LO” selection or to turn the function “OFF”.

HIGH?
OFF?
LOW?

4.9 TRIM 4.0MA

TRIM	4 MA?

This allows trimming of the 4.00mA output current.

NOTE: This function is only for the purpose of adjusting the 4.00mA limit of the transmitter loop current to be exactly 4.00mA according to the plant's local standard. This is NOT for the purpose of ranging the transmitter!

If trimming the 4.00mA limit is still desired then press **ENTER**. The transmitter will now output a milliamp current equal to its internally set 4mA. This 4 mA value should be read on an external meter and compared to a local standard. It is advisable to use a very good voltmeter to make these comparisons. It is very possible that the transmitter will be more accurate than a great many voltmeters. In this case, trimming will make the transmitter less accurate rather than more accurate!

Once trimming the 4.00mA value has been selected, the display will alternate as follows:

RAISE	MA OUT?

By pressing the **NEXT** key the display then alternates as

LOWER	MA OUT?

When it is decided whether to raise or lower the output current, then press **ENTER** and the display changes to one of the following depending on whether the raise or lower function has been selected.

NEXT = +	NEXT = -

Now every time the **NEXT** key is pressed, the display blinks, and the 4.0mA output limit decreases (-), or increases (+). The decrease or increase is in approximately 3.5 micro ampere increments.

NOTE: The 4.00mA limit is factory calibrated to a precision standard. Using the Output Trim function voids the NIST traceability of calibration. Do not arbitrarily trim the output unless a qualified and accurate local standard is available to measure the adjusted 4.00mA output! Also note that the 4.0mA limit should not be trimmed by more than about 50A, or transmitter operation may be impaired.

Once the desired trim is reached, pressing **ENTER** will return to one of the corresponding **TRIM 4mA** screen. At this point one may still go back and do further trimming of the 4.0mA limit by

pressing the **ENTER** key, or pressing the **NEXT** key changes to the next function.

4.10 TRIM 20.0 MA

TRIM	20 MA?

Trimming of the 20.0mA current limit is done in exactly the same manner as was described for trimming the 4.0mA point. The same precautions apply. After completing the trim 20.0mA pressing the Next key brings up the display trim.

4.11 TRIM DISPLAY

The display trim allows the display to be trimmed by a desired offset amount. The transmitter display will display its value based upon its internal standards. It is often desirable to alter this display to make it agree with another external instrument at a critical measurement point. If this is desirable, the display can be trimmed. The display trim operates as a zero shift. It shifts the display readings by the same amount at every point.

You can enter a single point offset to the display. Be certain before making a display trim correction that you have made good electrical connections to the transmitter and the sensor. In the 2 or 3 wire RTD input, or thermocouple input modes, it is possible to produce an error of a few degrees with a fraction of an ohm in any one of the connections. Please be careful when tightening down the input connections. These can be easily broken if a lot of torque is applied. The idea is to make a good electrical connection without breaking the connections. When you press the **ENTER** key the display changes to

0.0°F TRIM	0.0°F DISPLY?

You can now enter an offset to the display. Suppose that the display reads 530°F, at a time when an external device that you want to agree with reads 525°F. You would then want to enter a -5°F offset in the display trim. This is done exactly the same way as setting the zero and full-scale values:

The numeric value seen on the upper portion of the screen is the existing Display Trim Value. Normally this is set to zero. One can now change this Offset totally independent of the ZERO, or LOWER RANGE VALUE, (LRV) or the FULL SCALE, or UPPER RANGE VALUE, (URV), without the use of any calibrators or external sensor inputs. To change the display offset, press **ENTER**. The display changes to

0.0°F PLUS?

indicating that the existing offset is set to "plus" 0000.0°F. The question mark "?" indicates a question asking if this value is to remain positive (PLUS ?). By repeatedly pressing the **NEXT** key the display will alternate

-0000.0°F **MINUS?**	**0000.0°F** **PLUS?**

After deciding whether the offset value is to become negative (MINUS), press the **ENTER** key. In this example the offset is assumed to be negative and a minus sign will be carried through this example. The display then changes to read:

_0_000.0°F
THOUSN?

and the leftmost digit position will start blinking (shown here in italics) asking if the thousand's position needs to be changed. To change the thousands position, start pressing the **NEXT** key and the leftmost digit will increment through 1 2 3 4 5 6 7 8 9 0. Stop pressing the **NEXT** key at any of the numerals desired, then press **ENTER** to accept the selection. If the numeral selected before pressing **ENTER** was 0, then the display would change to

0_0_00.0°F
HUNDRD?

and the second digit from the left will start blinking (shown here in italics) asking if the hundreds position needs to be changed. As before, to change the number in this digit position repeatedly press the **NEXT** key until the desired numeral is reached. Then press **ENTER** to go to the next lower significant digit position. Each time the **NEXT** key cycles through the ten choices for that digit position and the **ENTER** key enters the selected number. The digit position being changed is the one that is blinking. The legend on the display will change successively to

00_0_0.0°F
TENS?

000_0_.0°F
ONES?

0000._0_°F
TENTHS?

After the tenth's digit position has also been changed to the desired value, the next pressing of the **ENTER** key returns the transmitter to the alternating display of **TRIM DISPLAY**. Since changing of

the offset value has just been completed, press the **NEXT** key to proceed to the next menu selection. Note, if trimming the transmitter to external devices is desirable, it may be necessary to trim the 4 and 20mA output **after** setting the display offset.

4.12 SELECT LANGUAGE

The 2-line display provides the option of changing the language from English to French, German or Spanish.

To change the language of the unit.

SELECT	LANGUAGE
ENTER	

Sequence through the screen until you reach the language you would like, After selecting the language, press the **ENTER** Key to confirm.

English Deutsch French Espanol

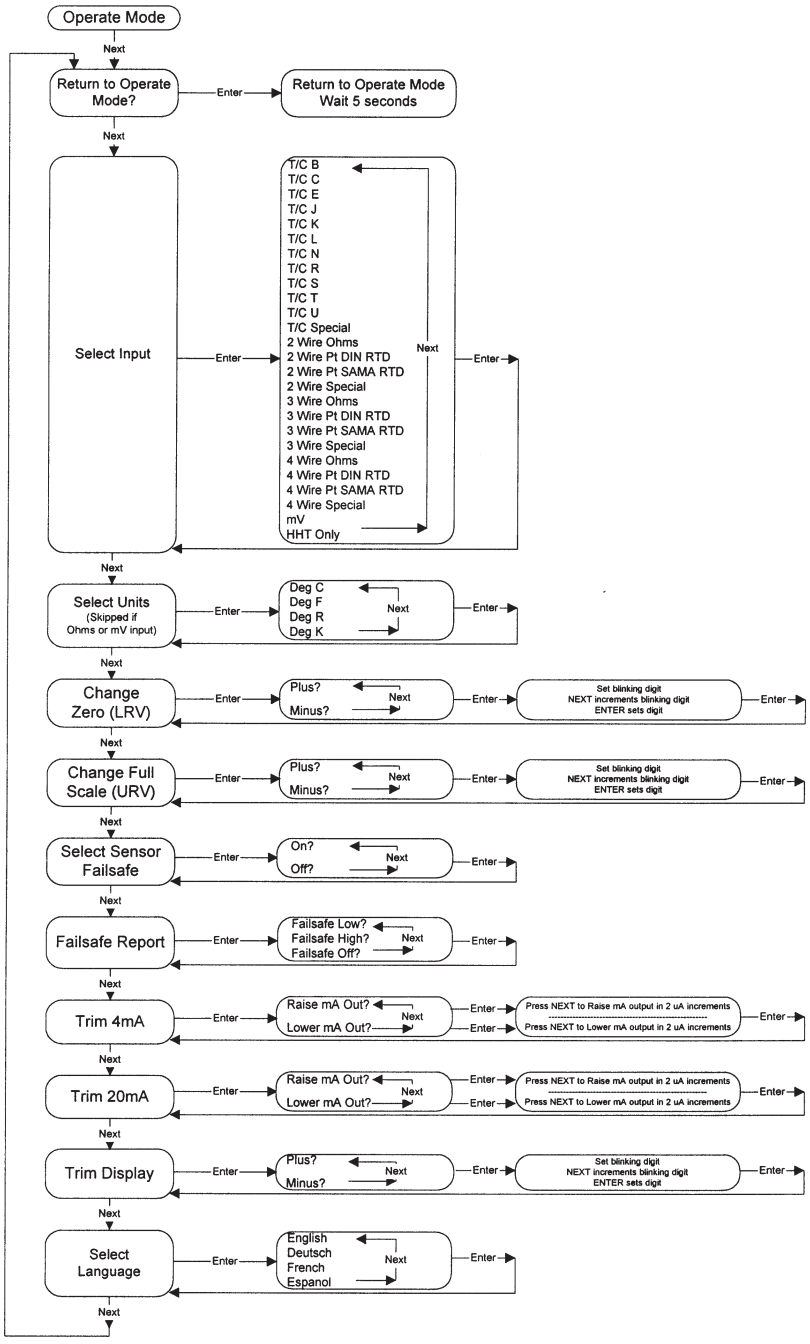
RETURN	TO	OPERATE	MODE?

If all of the set-up and re-ranging operations have been satisfactorily completed, then pressing **ENTER** will return the transmitter to the normal operate mode. Pressing the **NEXT** key at this point will return the display to the first screen in the sequence, Select Input.

Note again, that whenever the transmitter is in the display set-up mode, if no activation of the pushbuttons occur for approximately 2-1/2 minutes, the transmitter returns to the operate mode. One can also return to the operate mode at any point while in the **DISPLAY MODE** by removing power from the transmitter for about 10 seconds, then reapplying power.

NOTE: Pressing **ENTER** stores new values in transmitter. To expace at any point, or to retain original values (before pressing **ENTER** to accept new value): disconnect power and wait 30 seconds. Reconnect power & transmitter will start up in Operate Mode.

Fig. 7 Dynisco TX180/ITX190 Configuration Flowchart LI-2 Two-Line Display/Keypad



5. CONFIGURATION USING THE LI-1, ONE-LINE DISPLAY

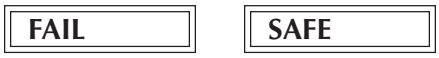
To configure a transmitter using the **DISPLAY MODE**, either the LI-1 or LI-2 local LCD display is required. These displays are available as an option and can be plugged into the top of the TX180 transmitter. The transmitter can also be purchased with these options already installed. These inexpensive options make the reconfiguration, or re-ranging of the transmitter very simple and easy to follow. Without the use of a calibrator, or any other tools, the transmitter can be set up for a different sensor, or the new range limits can be set much like one would set the time on a digital watch.

In the event that the LI-1 or LI-2 Display / Keyboard are not purchased at the same time as the transmitter, the one piece display design allows for easy field installation by simply plugging the LI-1or LI-2 into the top of the transmitter.

5.1 ENTERING THE DISPLAY MODE

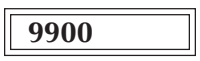
To start the **DISPLAY MODE**, first connect the transmitter to an appropriate DC power supply. Typically a 24VDC supply is connected with the + side of the power supply connected to the transmitter's output "+" terminal and - side of the power supply connected to the transmitter's output "-" terminal. A series resistor in the loop is optional. A sensor may be connected to the transmitter's input terminals, but this is not required for setting up the transmitter.

With the standard factory set-up and no sensor connected, the LI-1 display will give the following indication:



The transmitter is indicating a fault. This would be the proper indication, since there is no sensor connected. The analog output would indicate greater than 100% (loop current at 23.00mA), which is the standard over range condition. If the proper sensor were connected to the transmitter, the display would indicate the sensor's temperature. Please note that the display / keyboards can be plugged into the transmitter while the transmitter is powered up. There is no need to disconnect power before plugging the LI-1 or LI-2 into the TX180.

Press the key marked **NEXT** to begin scrolling through the Display Mode menus.



The **9900** code corresponds to the **RETURN TO OPERATE MODE** function. At this point, assuming one does not want to return to the operate mode, the answer should be no, therefore, press the key marked **NEXT**. Pressing the key marked Enter at this point will return the transmitter to the operate mode.

5.2 DISPLAY MODE OPERATION

The one-line, LI-1 display will allow the user to do the following in a manner similar to the two-line display.

- Select a Sensor Input (Select Input)
- Select a desired temperature unit, such as F or C (Select Units)
- Change the 4mA Lower Range Value (Change Zero)
- Change the 20mA Full Scale Value (Change Full Scale)
- Change the Sensor Fail Safe detection (Select Sensor Fail Safe)
- Change the Fail Safe reporting (Select Fail Safe Report)
- Trim the 4.0mA output current (Trim 4 mA)
- Trim the 20.0mA output current (Trim 20 mA)
- Trim the display value (Trim Display)

Each of these functions is presented with a code in a prescribed sequence on the LCD display. If the indicated function need not be performed, press **NEXT**, and the next function will be displayed on the screen. To perform any function press the **ENTER** key. This will cause additional screens to be displayed which enable you to perform the function. These are described in detail below and summarized in the LI-1 One-Line Display / Keyboard Flow Chart found at the rear of this manual.

5.3 SELECT A SENSOR INPUT

The **SELECT INPUT** is the first function in the sequence. Virtually any thermocouple, RTD or millivolt input can be selected. The display will read as follows to indicate this position on the menu:

9000

The factory default sensor input is a J thermocouple. If the sensor does not require changing, then press **NEXT**, and skip to Section 5.4 of this manual; otherwise press **ENTER**. After pressing the **ENTER** key, the display will change to:

9004

Indicating that the transmitter is set to a Type J thermocouple input. If this is the desired sensor, then press **ENTER**, otherwise press **NEXT** repeatedly to sequence through the available sensors. Each time **NEXT** is pressed, the next available sensor selection is displayed.

9004

The **9004** Code corresponds to a J thermocouple

9005

The **9005** Code corresponds to a K thermocouple

9006

The **9006** Code corresponds to an L thermocouple

9007

The **9007** Code corresponds to an N thermocouple

9008

The **9008** code corresponds to an R thermocouple

9009

The **9009** code corresponds to an S thermocouple

9010

The **9010** code corresponds to a T thermocouple

9011

The **9011** code corresponds to a U thermocouple

9012

NOTE: The **9012**, T/C SPEC or Special Thermocouple input is reserved for a special thermocouple input, should one be desired. This special curve must be ordered from the factory.

9013

The **9013** code corresponds to a 2-wire ohm input.

9014

The **9014** code corresponds to a 2-wire 100 Ω DIN curve platinum RTD with an = 0.00385

9015

The **9015** code is the 2-wire 100 Ω SAMA Platinum Curve, known variously as the SAMA RC21-4 or SAMA PR-279.

9016

The **9016** code is reserved for a Special 2 wire RTD, should one be desired. Any special 2-wire RTD curve must be ordered from the factory.

9017

The **9017** code is for 3-wire Ohms.

9018

The **9018** code is for a 3-wire 100 Ω DIN curve RTD with α = 0.00385. This is the most commonly used RTD in industrial applications.

9019

The **9019** code is the 3-wire 100 Ω SAMA Platinum Curve, known variously as the SAMA RC21-4 or SAMA PR-279.

9020

The **9020** code for the Special 3 wire RTD input is reserved for a special RTD input, should one be desired. Any special 3-wire RTD curve must be ordered from the factory.

9021

The **9021** code is for a 4 wire Ohm input.

9022

The **9022** code is for a 4-wire 100 Ω DIN curve Platinum RTD with α = 0.00385. This sensor will give superior measurement results in most real-world situations where the measured temperature is under 1,000°F.

9023

The **9023** code is the 4-wire 100 Ω SAMA Platinum Curve, known variously as the SAMA RC21-4 or SAMA PR-279.

9024

NOTE: The **9024** code is for Special 4 wire RTD input is reserved for a special RTD input, should one be desired. Any special 4-wire RTD curve must be ordered from the factory.

9025

The **9025** code corresponds to a millivolt input.

9026

The **9026** code corresponds to an input known as the "HHTONLY". This is reserved for a Hand-Held set-up at the factory only.

At this point, the menus recycle to the top and begin with the first sensor input.

9001

The **9001** code corresponds to a B type thermocouple.

9002

The **9002** code corresponds to a C type thermocouple.

9003

The **9003** code corresponds to an E type thermocouple.

You can stop at any one of the thermocouple or RTD or mV selections by pressing the **ENTER** key. This action changes the transmitter mode to that sensor. If no sensor change is desired, then, without sequencing through the various sensor options, but just pressing the **ENTER** key will allow one to confirm the sensor selection and leave it unchanged. Assume that the sensor is left as T/C J. After pressing **ENTER** the display will return to the main menu entry of **SELECT INPUT**. Pressing the **NEXT** key then takes the transmitter to the next main menu selection.

5.4 SELECT UNITS

If the selected sensor is a thermocouple or RTD, the next menu entry is **SELECT UNITS**. You will not see this selection if an ohms or mV input selection is made.

9100

The code **9100** corresponds to the Select Units entry in the main menu. Pressing the **ENTER** key takes you to this section of the menu. This screen indicates that the transmitter is currently set to degrees F. Pressing the **NEXT** key, the display will sequence through the following screens:

9133

The **9133** code corresponds to units of Degrees Fahrenheit.

9134

The **9134** code corresponds to units of Degrees Rankine.

9135

The **9135** code corresponds to units of Degrees Kelvin.

9132

The **9132** code corresponds to units of Degrees Centigrade.

Stopping the selection process on the LI-1 display at any one of these units and then pressing Enter will set the transmitter to the corresponding new units. For the purposes of this example the units of measure can be left at DEG F by pressing **ENTER**. Pressing **NEXT** key will bring you to the next section of the menu, changing the Zero.

5.5 CHANGE ZERO (LOWER RANGE VALUE)

The display will then indicate as follows to indicate that one may now change the zero, or 4mA output point.

9200

The code **9200** indicates that one can now **CHANGE ZERO**, or Lower Range Value (LRV), totally independent of the Full Scale, or Upper Range Value, (URV), without the use of any calibrators or external sensor inputs. To change the zero, press **ENTER**. The display changes to:

9201

The **9201** code indicates that a positive, or "plus", number is selected for the 4 mA (LRV) output point. By repeatedly pressing the **NEXT** key the display will alternate

9202 **9201**

the **9202** code corresponds to a negative number to be selected for the 4 mA output point. After deciding whether the Zero value, or LRV, is to remain positive (PLUS), press the **ENTER** key. In this example assume it is to remain positive. The display changes to read:

***0*040**

and the leftmost digit position will start blinking (shown here in italics) asking if the thousands position needs to be changed. To change the thousands position, start pressing the **NEXT** key and the leftmost digit will increment through 1 2 3 4 5 6 7 8 9 0. Stop pressing the **NEXT** key at any of the numerals desired, then press Enter to accept the selection. If the numeral selected before pressing **ENTER** was 0, then the display would change to read:

0*0*40

and the second digit from the left will start blinking (shown here in italics) asking if the hundreds position needs to be changed. As before, to change the number in this digit position repeatedly press the **NEXT** key until the desired numeral is reached. Then press **ENTER** to go to the next lower significant digit position. Each time the **NEXT** key cycles through the ten choices for that digit position and the **ENTER** key enters the selected number. The digit position being changed is the one that is blinking. The legend on the display will change successively to read:

0040

004*0*

After the one's digit position has also been changed to the desired value, the next pressing of the Enter key returns the transmitter to the alternating display of Change Zero. Since changing of the zero has just been completed, press the Next key to proceed to the next menu selection, Change Full Scale.

5.6 CHANGE FULL SCALE (UPPER RANGE VALUE)

9300

The code **9300** corresponds to selection **CHANGE FULL SCALE**, or Upper Range Value (URV). To change the full scale value press **ENTER**. The procedure for selecting Plus or Minus is identical to that described for changing the zero, with the code 9301 corresponding to a plus (+) number and the code 9302 corresponding to a minus (-) number. The procedure for changing each of the digit positions is identical to that described for changing the zero. Once the steps of changing the FULL SCALE have been completed and the **ENTER** key is pressed at the end of the procedure, the display returns to CHANGE FULL SCALE. Press **NEXT** for the next function **SELECT SENSOR FAIL SAFE DETECTION**.

5.7 SELECT SENSOR FAIL SAFE DETECTION

9400

The code **9400** corresponds to selecting the Sensor Fail Safe detection. If one desires to change the Sensor Fail Safe detection then press **ENTER**. The present status of the Sensor Fail Safe is displayed. It is recommended that one turns off the Sensor Fail Safe when using the TX180 with an input simulator. It should then be turned on when reconnecting the transmitter to the actual sensor.

9401

The code **9401** indicates that the Sensor Fail Safe detection is turned on.

9402

The code **9402** indicates that the Sensor Fail Safe detection is turned off. When the desired Fail Safe condition is displayed, pressing the **ENTER** key will change to the new setting and the screen returns to the **SELECT SENSOR FAIL SAFE** display, code 9400. Pressing the **NEXT** key will then

bring up the **FAIL SAFE REPORTING** selection screen.

5.8 SELECT FAIL SAFE REPORTING

The code **9500** indicates the main menu entry for setting the transmitter Fail Safe Reporting. Pressing the **ENTER** key will bring up the following code.

9501

The code **9501** corresponds to instructing the transmitter to output 3.6mA under a Fail Safe condition. Pressing the **ENTER** key at this point sets the Fail Safe **LOW**. Pressing the **NEXT** key brings up the following screen:

9502

The code **9502** corresponds to instructing the transmitter to output 23.0mA under a Fail Safe condition. Pressing the **ENTER** key at this point sets the Fail Safe **HIGH**. Pressing the **NEXT** key brings up the following screen:

9503

The code **9503** corresponds to instructing the transmitter to not report a Fail Safe condition. Pressing the **ENTER** key at this point turns off this reporting. Pressing the **NEXT** key brings up the following screen:

5.9 TRIM 4.0MA

9600

This allows trimming of the 4.00mA output current.

NOTE: The 4.00mA limit is factory calibrated to a precision standard. Using the Output Trim function voids the NIST traceability of calibration. Do not arbitrarily trim the output unless a qualified and accurate local standard is available to measure the adjusted 4.00mA output! Also note that the 4.0mA limit should not be trimmed by more than about 50μA, or transmitter operation may be impaired.

If trimming the 4.00mA limit is still desired then press Enter. The transmitter will now output a milliamp current equal to its internally set 4mA. This 4mA value should be read on an external meter and compared to the plant standard. It is advisable to use a very good voltmeter to make these comparisons. It is very possible that the transmitter will be more accurate than a great many

voltmeters. In this case, trimming will make the transmitter less accurate rather than more accurate!

Once trimming the 4.00mA value has been selected, the display will show:

9601

The code **9601** corresponds to selecting the function to raise mA output.

Pressing the **NEXT** key the display then shows:

9602

The code **9602** corresponds to selecting the function to lower the mA output. Comparing the transmitter output to the external device will allow you to decide whether to raise or lower the milliamp value. When it is decided whether to raise or lower the output current, then press **ENTER** and the display changes to one of the following depending on whether the raise or lower function has been selected.

9610	**9620**
(raises output)	(lowers output)

The code **9610** confirms that you are in the Raise 4mA output trim function. Each time the **NEXT** key is pressed, the display blinks, and the 4.0mA output limit increases (+). The increase is in approximately 3.5 micro-ampere increments. The code 9620 confirms that you are in the Lower 4mA output trim. Each time the **NEXT** key is pressed, the display blinks, and the 4.0mA output limit decreases (-). The decrease is in approximately 3.5 micro-ampere increments.

NOTE: The 4.00mA limit is factory calibrated to a precision standard. Using the Output Trim function voids the NIST traceability of calibration. Do not arbitrarily trim the output unless a qualified and accurate local standard is available to measure the adjusted 4.00mA output! Also note that the 4.0mA limit should not be trimmed by more than about 50μA, or transmitter operation may be impaired.

Once the desired trim is reached, pressing **ENTER** will return to one of the corresponding Trim 4mA screen. At this point one may still go back and do further trimming of the 4.0mA limit by pressing the **ENTER** key, or pressing the **NEXT** key changes to the next function.

5.10 TRIM 20MA

9700

Trimming of the 20.0mA current limit is done in exactly the same manner as was described for trimming the 4.0mA point. Similarly the same precautions apply. The code 9701 corresponds to selecting the function to raising the mA output. The code 9702 corresponds to selecting the function to lower the mA output. The code 9710 confirms raising the 20mA output by approximately 3.5 micro-ampere increments with each push of the **NEXT** key. The code 9720 confirms lowering the 20mA output by approximately 3.5 micro-ampere increments with each push of the **NEXT** key. After completing the trim 20.0mA pressing the **NEXT** key brings up the **TRIM DISPLAY** menu.

5.11 TRIM DISPLAY

The display trim allows the display to be trimmed to a desired point. The transmitter's LI-1 display will show its value based upon the transmitter's current settings. It is often desirable to alter the display to make the display agree with another instrument at a critical measurement point. If this is desirable, the display can be trimmed. The display trim operates as a zero shift and shifts the display readings by the same amount at every point.

You can enter a single point offset to the display. Be certain before making a display trim correction that you have made good electrical connections to the transmitter and the sensor. In the 2 or 3 wire RTD input, or thermocouple input modes, it is possible to produce an error of a few degrees with a fraction of an ohm in any one of the connections. Please be careful when tightening down the input connections. These can be easily broken if a lot of torque is applied. The idea is to make a good electrical connection without breaking the connections.

The display trim allows you to enter an offset correction. For example, suppose that the display reads 530°F, at a time when an external device that you want to agree with reads 525°F. You would then want to enter a -5°F offset in the display trim. This is done exactly the same way as setting the zero and full-scale values. Pressing the **NEXT** key at this point advances the menus and the display will now read:

9800

The **9800** code corresponds to the display trim.

One can set the display trim offset by pressing the **ENTER** key. The display changes to

9801

The **9801** code indicates that a "plus" number is selected for the display offset. By repeatedly pressing the **NEXT** key the display will alternate

9801		**9802**

the **9802** code corresponds to a negative number to be selected for the display trim point. After deciding whether the display trim value is to remain positive (PLUS), or negative (MINUS) press the **ENTER** key. In this example assume it is to be a negative offset. The display changes to

-*0*00

and the leftmost digit position will start blinking (shown here in italics) asking if the hundreds position needs to be changed. To change the hundreds position, start pressing the **NEXT** key and the leftmost digit will increment through 1 2 3 4 5 6 7 8 9 0. Stop pressing the **NEXT** key at any of the numerals desired, then press **ENTER** to accept the selection. If the numeral selected before pressing **ENTER** was 0, then the display would change to

-0*0*0

and the second digit from the left will start blinking (shown here in italics) asking if the tens position needs to be changed. Pressing the **ENTER** key will fix the tens digit and display the ones digit:

-00*0*

In this example, we want to enter a -5 degree offset, so we want to cycle the “ones” digit. As before, to change the number in this digit position repeatedly press the **NEXT** key until the desired numeral is reached. Then press **ENTER** to go to the next lower significant digit position. Each time the **NEXT** key cycles through the ten choices for that digit position and the **ENTER** key enters the selected number. The digit position being changed is the one that is blinking. The legend on the display will change successively to:

-005

After the ones digit position has been changed to the desired value, the next pressing of the **ENTER** key returns the transmitter to the 9800 code. Note that since the LI-1 will only display in whole degrees, the display trim is limited to whole degrees. If greater display precision is required, the two-line LI-2 display will give you precision to the tenths of degrees. Since changing of the zero has just been completed, press the **NEXT** key to proceed to the next menu selection, **RETURN TO OPERATE MODE**.

9900

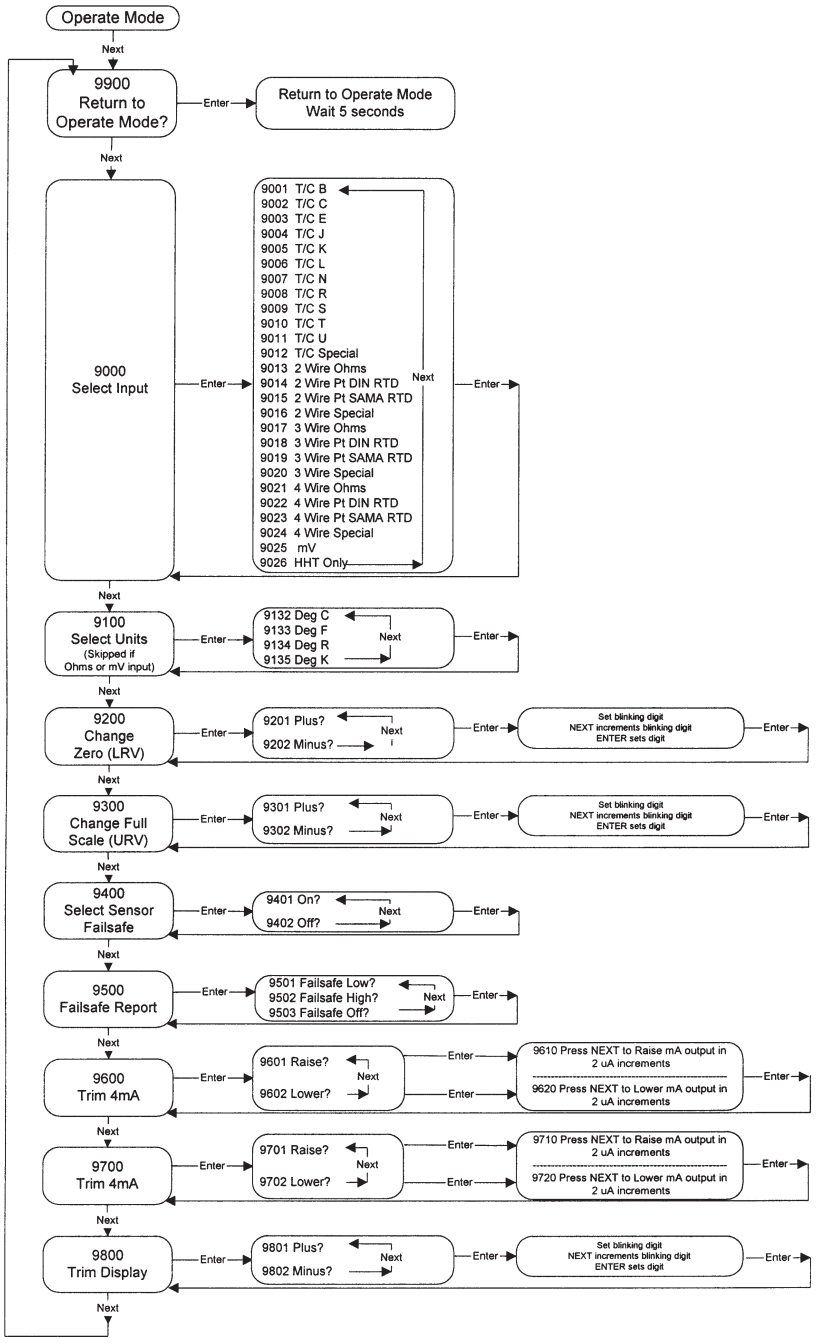
If all of the set-up and re-ranging operations have been satisfactorily completed, then pressing **ENTER** will return the transmitter to the normal operate mode. Pressing the **NEXT** key at this point will return the display to the first screen in the sequence, **SELECT INPUT** which corresponds to the

code 9000.

Note again, that whenever the transmitter is in the display set-up mode, if no activation of the keyboard occurs for approximately 2-1/2 minutes, the transmitter returns to the operate mode. One can also return to the operate mode at any point in the **DISPLAY MODE** by removing power from the transmitter for about 10 seconds and then reapplying power:

NOTE: Pressing **ENTER** stores new values in transmitter. To expace at any point, or to retain original values (before pressing **ENTER** to accept new value): disconnect power and wait 30 seconds. Reconnect power & transmitter will start up in Operate Mode.

Fig. 8 Dynisco TX180/ITX190 Configuration Flowchart LI-2 One-Line Display/Keypad



6. APPLICATIONS INFORMATION

6.1 SENSOR FAIL SAFE DETECTION

The TX180 detects a sensor failure condition by making various measurements across its sensor input terminals. As a result of these measurements, the unit can detect an open thermocouple or open RTD condition. In addition, the TX180 can detect if an RTD is short circuited, or if any of its terminal wires (2, 3, or 4-wire RTD's) are open. Any one of these conditions will cause a "FAIL SAFE" report indication.

In the process of performing these sensor failure checks, the unit periodically passes small pulses of current through the sensor and its connecting wires. The transmitter measures the resulting voltage drop. One of the conditions resulting in a FAIL SAFE reporting condition is if this voltage drop exceeds 180mV.

In the case of an RTD, the Fail Safe detection is part of the normal excitation for the RTD and therefore both the temperature measurement and some of the sensor Fail Safe detection routines are done simultaneously. In the case of a thermocouple, during the temperature measurement cycle, there is no open sensor test current in the thermocouple. Thermocouple open circuit is detected by making a second measurement with the test current through the thermocouple.

This method of testing for sensor failure has the following advantages:

1) In the case of thermocouples, there is no steady current through the sensor during measurement and therefore accuracy is not degraded.

2) During open sensor detection, the test current is sufficiently high that even if there is some leakage resistance between the sensor leads, an open sensor will be positively detected.

There are certain precautions to be observed when using this method of sensor failure detection. If the lead wire resistance is too great, then a false FAIL SAFE report could be generated. The maximum lead wire resistance is dependent on the type of sensor being used and the maximum temperature expected to be measured. The maximum lead resistance for an RTD is 50Ω in any one lead. For a thermocouple, the maximum allowable resistance is 1,000Ω for a non-grounded junction Thermocouple and 10Ω for a grounded junction T/C.

6.2 CONFIGURATION WITH AN EXTERNAL SOURCE USING DISPLAY MODE

With an external source, the basic procedure is to set the external source to the value you require for 4mA or 20mA. Next, read the transmitter value on the LI-1 or LI-2 display. Record these values. Then follow the display set-up procedure to set the 4mA and 20mA values to the values that you recorded with the external source.

When attempting to calibrate or check the calibration of the TX180 transmitter with an external

thermocouple or RTD calibrator, it is generally advisable to disable the “SENSOR FAIL SAFE” feature. The open sensor test periodically injects about 5μA of current into the input terminals, the millivolts generated by the calibration source is periodically disturbed and depending on the characteristics of the external calibration source used, erroneous voltages may be applied to the transmitter. The “SENSOR FAIL SAFE” can be disabled by turning it off in the configuration menus. After the calibration has been completed, this function can be re-enabled.

6.2.1 THERMOCOUPLE INPUT

Setting the ZERO and FULL SCALE with a thermocouple sensor requires some added steps because of the automatic cold-junction compensation. Thermocouple tables are normally available for a reference junction at the ice point of water. These table entries must be adjusted for the actual cold-junction temperature. In the case of the TX180 transmitter, the cold-junctions is measured with an internal calibrated thermometer.

It is generally good practice to operate the transmitter for 30 minutes or more prior to calibration to allow it to reach thermal equilibrium.

CALIBRATION USING A MILLIVOLT SOURCE

The procedure starts with the selection of the thermocouple type. Then determine the temperature of the thermocouple terminals on top of the transmitter. This can be done by measuring with a thermometer the temperature of the thermocouple terminals on the transmitter. Or one can assume that the terminals are approximately at room temperature and then determine the room temperature.

Next, locate the appropriate table of temperature versus mV for the selected thermocouple.

Find the table entry corresponding to the terminal block temperature, (mV @ TB°C)

Calculate the mV to be applied as follows:
(mV applied for LRV) = (mV @ LRV Table°C) -(mV @ TB°C)

Applying the millivolts (mV applied) to the transmitter and record the temperature displayed on the LI-1 or LI-2 display for the ZERO (LRV) or 4 mA value. Then record the FULL SCALE (URV) using a similar procedure. These recorded values will then be set into the transmitter as the zero and full-scale values using the display set-up procedure.

CALIBRATION USING A THERMOCOUPLE CALIBRATOR

Some of the thermocouple calibrators available on the market provide a means of measuring the temperature of the terminal block and automatically apply the corrected mV to the transmitter. This procedure is rather simple. However, there can be an appreciable difference between the temperature of the simulator and the transmitter terminals. With some thermocouple types, this error could be amplified 5 of 10 fold, resulting in large measurement errors. Use caution so as to not introduce these possible errors.

6.3 For Best Measurement Accuracy

The TX180 transmitter is a stable instrument, precision calibrated at the factory for any measurement range the user may select. However, the automatic cold-junction compensation requires certain precautions to obtain best accuracy when used with a thermocouple sensor.

The cold-junction compensation operates by attempting to measure accurately the temperature of the thermocouple terminals on top of the instrument. If these terminals are exposed to thermal radiation or convection, the cold-junction compensation will introduce an error. With certain types of thermocouples and temperature measurement ranges, the sensitivity of the cold-junction is greater than the sensitivity of the measurement couple. Under those conditions, a one degree error in the cold-junction temperature that the transmitter senses can result in a greater than one degree temperature measurement error.

For best measurement accuracy with thermocouple sensors, it is advisable to shield the top terminals by placing the transmitter into a housing or enclosure, such as the model XP-FN, XP-FG, XP-HEAD, or WP-HEAD. In addition, sufficient time should be allowed for the housing and the transmitter to reach equilibrium temperature in a given operating environment before best accuracy is reached.

For best accuracy with any sensor, or in the millivolt mode, it is advisable to allow the transmitter to operate with the desired fixed input signal for a period of 30 seconds before the reading is taken. The transmitter periodically measures certain internal references. These internal measurements and the external signal undergo digital averaging and the full accuracy of the instrument is only achieved after several readings have been averaged.

When using an RTD sensor, a four-wire connection is generally recommended. With a three-wire RTD the TX180 makes two separate measurements before calculating the temperature, whereas, only a single measurement is required when using a four-wire RTD. Conceptually, a better accuracy is possible using a single measurement as compared with calculating the difference of two separate measurements.

7. Accessories and Information

Other accessories available from Dynsico are:

LI-1	One-line Local Display
LI-2	Two-line Local Display
XP-HEAD	Explosion Proof Housing (No Display Option*)
WP-HEAD	Weather Proof Housing (No Display Option*)
XP-FN	Explosion / Weather proof Housing with mounting lugs
XP-FG	Explosion / Weather proof Housing with mounting lugs and Glass Window
PY-2	Pipe mount bracket to mount XP-FG or XP-FN on 2" pipe
PS-2412	Power Supply, 24/28 VDC, 1.2/0.8A
PS-2405	Power supply, 24 VDC, 0.5A

A variety of signal conditioners, thermocouples are also available.

* The LI-1 or LI-2 can be used for setup and configuration for transmitters installed in XP-HEAD or WP-HEAD housings, but cannot be installed permanently. The XP-HEAD and WP-HEAD will not close properly with either of these displays installed.

8. SPECIFICATIONS

THERMOCOUPLE SENSORS:
NIST Types B, C, E, J, K, N, R, S, & T; DIN Types L & U

RTD Resistance Sensors:

100 Ω	Pt DIN curve (α = 0.00385)	2, 3 or 4 Wire
100 Ω	Pt SAMA RC21-4 curve (α =0.003923)	2, 3 or 4 Wire
100 Ω	Ni DIN curve	2, 3 or 4 Wire
120 Ω	Ni MINCO curve	2, 3 or 4 Wire
10 Ω	Cu curve	2, 3 or 4 Wire
	Ni SAMA	2, 3 or 4 Wire

MILLIVOLT INPUT RANGE:
-15 to 115mVDC

THERMOCOUPLE AND RTD LINEARIZATION:
Linearization with temperature conforms to NIST & DIN curves within ±0.05°C.

OUTPUT:
Analog, Two wire 4 to 20mA; Digital via HART

OUTPUT RANGING ADJUSTMENTS:
Analog Zero {100% of sensor range, non-interacting}
Full Scale {Normal or reverse acting}

MINIMUM OUTPUT RANGE:
None

OUTPUT RESOLUTION:
Analog, 3.6μA

TRANSMITTER ACCURACY:
± 0.05% of the millivolt or ohm equivalent reading, or the accuracy from the table below, whichever is greater; plus the effect of cold junction measurement error or ± 0.5°C (±0.9°F), if using a thermocouple sensor; plus ± 0.05% of span.

Sensor Type		Accuracy
E, J, K, L, N, T	T/C's	± 0.3°C (± 0.5°F)
B, C, R, S, U	T/C's	± 0.8°C (± 1.5°F)
mV		± 0.01 mV
100 Ω Pt RTD		± 0.14°C (± 0.25°F)
100 Ω Pt SAMA		± 0.14°C (± 0.25°F)
Ohms		± 0.06 Ohm

Accuracy includes repeatability, hysteresis, load and ambient temperature.

TRANSMITTER REPEATABILITY:
One half of accuracy.

REFERENCE CONDITION ACCURACY:
Equal to transmitter repeatability, when set-up under reference conditions to an external source. The transmitter is then referenced to the prevailing conditions and transmitter accuracy at this reference condition will include repeatability, linearity, and hysteresis effects. If using a thermocouple add 0.05°F for reference condition accuracy cold junction effect. Reference condition accuracy is comparable in scope to the accuracy generally specified for analog based transmitters and is consistent with the ANSI/ISAS51.1-1979 definition of "Accuracy".

DYNAMIC RESPONSE:
Turn On Time: Less than 5 seconds after power up
Ambient Temperature Gradient: Automatic compensation to 20°C/Hour Change

Update Time: 0.15 Seconds

Response to Step Input: 0.25 Seconds, Typical

COLD JUNCTION COMPENSATION:
Self-correction to ±0.5°C

OPERATING TEMPERATURE RANGE:
-40°F to +185°F (-40°C to +85°C) Electronics
-4°F to +158°F (-20°C to +70°C) Display

STORAGE TEMPERATURE RANGE:
-58°F to +185°F (-50°C to +85°C)

AMBIENT TEMPERATURE STABILITY:
Self-correcting over the operating temperature range.

LONG TERM STABILITY:
Less than 0.05% of reading plus ±3.6μA per year.

AUTOMATIC DIAGNOSTICS:
Every 3 seconds the TX180 transmitter performs self-checks for zero, span, cold-junction temperature, open T/C, open RTD element, shorted RTD element, each open RTD lead and transmitter malfunction.

FAILSAFE:
User settable from 3.6mA to 23.0mA, or OFF

INTERCHANGEABILITY:
All units interchangeable without field calibration.

EMI/RFI IMMUNITY:
Less than 0.5% of reading (SAMA PMC 33.1c test method) 20KHz to 1000MHz, 10 V/meter.

ISOLATION:
250 VAC rms or 800VDC

COMMON MODE REJECTION:
120dB

REVERSE POLARITY PROTECTION:
42 VDC applied with either polarity

POWER AND LOAD:
Supply voltage (no load resistance); 12 to 42 VDC
(30 VDC for I/S version);

Supply voltage (with load resistance);
Vsupply=(12)+(Rload in Kohm) x (23mA)
Supply Voltage Effect: < +/-0.005% of Span per Volt

WEIGHT:
4 oz. Electronics only

STANDARD CONFIGURATION:
Factory configured for Type J thermocouple, 40°F=4.0mA, 200°F=20mA, with HI failsafes. Special configurations are available to suit your requirements. See Price List.

OPTIONS:
LI-1 One-Line Plug-In Display/Keyboard; LI-2 Two-Line Plug-In Display/Keyboard; Housings. See Price List.

9. REPAIR

Questions concerning warranty, repair cost, delivery, and requests for a RA# should be directed to the Dynisco Repair Department, 508-541-9400 or email: repair@dynisco.com. Please call for a return authorization number (RA#) before returning any product. Damaged products should be returned to:

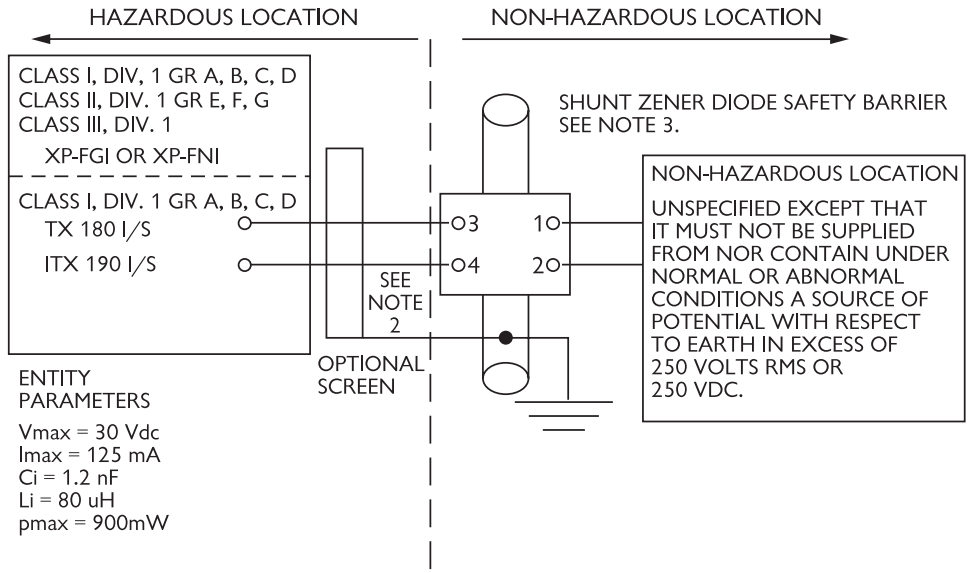
DYNISCO INSTRUMENTS
Attn: RA # _____
38 Forge Parkway
Franklin, MA 02038

For technical assistance please call 800-221-2201 or 508-541-9400 or fax 508-541-9436.

10. WARRANTY

This Dynisco product is warranted under terms and conditions set forth in the Dynisco Web Pages. Go to www.dynisco.com and click on “Warranty” at the bottom of any page for complete details.

Fig. 9 TX 180 1/S, ITX 190 I/S, XP-FNI, XP-FGI Factory Mutual and Canadian Standards Assoc. Approved Intrinsically Safe Installation Control Drawing



NOTES:

1) The electrical circuit in the hazardous area must be capable of withstanding an A.C. test voltage of 500 volts R.M.S. to earth or frame of the apparatus for one minute.

2) Cable capacitance and inductance plus the I.S. apparatus unprotected capacitance (Ci) and inductance (Li) must not exceed the allowed capacitance (Ca) and inductance (La) indicated on the associated apparatus.

3) Any positive polarity shunt zener diode safety barrier approved by FMRC or CSA for groups A, B, C, D, E, F and G whose output parameters are:

   Voc or Vt $\leq$ 30 Vdc
   Isc or It $\leq$ 125 mA
   Ca $\geq$ Ci + C cable
   La $\geq$ Li + L cable

4) The installation including the barrier earthing arrangements must comply with the installation requirements of the country of use, i.e. ANSI/ISA RP12.6 (installation of intrinsically safe systems for hazardous (classified) locations) and the national electrical code, ANSI/NFPA 70 or Canadian electrical code part 1. Installation must be in accordance with the manufacturer's guidelines.

5) Temp. Code T4 at maximum ambient temperature of 85°C
T6 at maximum ambient temperature of 40° C

6) Dust-tight conduit seal must be used when installed in Class II and III Environments.

NO REVISIONS WITHOUT PRIOR FACTORY MUTUAL OR CANADIAN STANDARDS ASSOCIATION APPROVAL.

NOTES:

WARRANTY REGISTRATION CARD

Dynisco Instruments

MODEL NUMBER _____

SERIAL NUMBER _____

DATE PURCHASED _____

PURCHASED FROM _____

NAME _____

COMPANY _____

DIVISION _____

STREET _____

CITY _____ STATE _____ ZIP _____

COUNTRY _____

TELEPHONE _____ FAX _____

My application is _____

Is this your first purchase from Dynisco? YES _____ NO _____

How did you first hear of Dynisco? ADVERTISING _____ REP _____

PREVIOUS USE _____ COLLEAGUE _____ DIRECTORY _____

I need further product information on _____

I need application help on _____

Please send complete catalog _____

Tel.: 508-541-9400 Fax: 508-541-9436 E-mail: www.dynisco.com

PLEASE FOLD AND STAPLE OR TAPE

Dynisco
Instruments

Place
Stamp
Here

DYNISCO INSTRUMENTS
38 FORGE PARKWAY
FRANKLIN, MA 02038

ATTN: MARKETING DEPT.