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CONAX TECHNOLOGIES
2300 WALDEN AVENUE, BUFFALO, NY 14225

INSTALLATION AND MAINTENANCE MANUAL

FOR

CONAX

PC PROGRAMMABLE TRANSMITTERS

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REVISION RECORD				
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H	PTH-400 to PTH40X throughout, TOC, 2.7, 5.1, Appendix A	Revised per E.O. QP-5036	1/16/04	W. Parker
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INSTALLATION AND MAINTENANCE MANUAL

FOR

CONAX

PC PROGRAMMABLE TRANSMITTERS

Conax TECHNOLOGIES

TABLE OF CONTENTS

1.0 SCOPE

This manual provides instructions on setup and use of Conax PC Programmable Transmitters, Models PTH-400 and PDT-400.

2.0 APPLICABLE DOCUMENTS

2.1 Conax Technologies (CT) Sales Order.

2.2 Customer Purchase Order (specified in CT Sales Order).

2.3 CT Part Number 318996-001, Programmable Software for PC Programmable Transmitters.

2.4 CT Part Number 318997-001, Programmable Adaptor Cable, Model No. PA-400 (RS-232).

2.5 CT Part Number 318997-002, Programmable Adaptor Cable, Model No. PA-400 (USB).

2.6 CT Drawing No. 10-0110; Transmitter, Model No. PTH-400.

2.7 CT Drawing No. 10-0282; Transmitter, Model No. PDT-400.

2.8 CT Drawing No. 10-0514; Transmitter, Model No. PDT-401.

3.0 GENERAL DESCRIPTION AND STANDARD FEATURES

The PTH-40X and PDT-400 are state-of-the-art micro-processor based, smart 2 wire transmitters. Both models can be fully configured using the user friendly configuration software. This combination eliminates the need for jumpers, calibrators, screw drivers, hand-held programmers, or power supplies for calibration.

Conax PC Programmable Transmitters are fully software driven. All input types and range parameters are easily configurable with the user friendly software, which requires no power supply for configuration using the PA-400 programming adaptor and the Graphic User Interface programming software under most Windows® operating systems through the PC's RS-232 serial port or USB port.

Conax PC Programmable Transmitters can be configured for either single or dual sensor input. In dual input mode, two sensors (two thermocouples or two 2-wire RTDs) can be connected to a single transmitter. The user can software select one of seven available math or logic functions including addition, subtraction, averaging, high (A or B), low (A or B), or selecting one of the two sensors (A or B) for output.

4.0 SPECIFICATIONS

4.1 SENSOR INPUT TYPES

THERMOCOUPLE: Most standard types and all special types using customer defined tables and polynomials.

RTDs (2, 3 or 4 wire configuration): Pt-100, Ni-110, and other RTDs (includes Callander-Van-Dusen adaption and custom sensor linearization with user defined tables and polynomials).

MINIMUM RANGE:	2 mV, limited mostly by input signal quality.
OUTPUTS:	4-20 mA, isolated loop powered.
SUPPLY VOLTAGE:	9-40 VDC (@ no load). Reverse polarity. Protected.
OPERATION TEMPERATURE:	-40 to 85°C.
STORAGE TEMPERATURE:	-55 to 125°C.
HUMIDITY:	0-95% RH, non-condensing.
RESPONSE TIME:	0.3 seconds to 90% of reading (>3 updates per second).
DAMPING FACTOR:	Programmable 0.0 to 64.0 seconds, or 0 – 120% of input range, using software interface.
LONG TERM STABILITY:	Better than ±0.1% of span for 12 months.
I/O ISOLATION:	2000 VDC or peak AC.
RFI PROTECTION:	< 1% effect of span at 20 – 1000 Mhz and at field strength of 20 V/m. CE marked.

4.2 PERFORMANCE SPECIFICATIONS

OUTPUT RESOLUTION: 0.015% of span (2.5 uA).

OUTPUT (D/A) LINEARITY: Better than 0.02% of output span.

SENSOR LINEARIZATION: Better than 0.1°C for RTD.
Better than 0.2°C for Thermocouple.

COLD JUNCTION COMPENSATION:
Automatically corrected to within ±0.7°C (PTH-400) or ±0.5°C (PDT-400) for all T/C types.

TEMPERATURE STABILITY:
0.015% / °C combined Zero and Span (PTH-400).
0.012% / °C combined Zero and Span (PDT-400).

SUPPLY VOLTAGE EFFECTS: < ±0.003% per Volt (PTH-400).
< ±0.002% per Volt (PDT-400).

INPUT LINEARITY: Better than 0.01% of span (mV input).

5.0 INSTALLATION

5.1 PTH-40X Series

The PTH-40X may be mounted using the two .15” holes, 1.3” apart on the center-line of the unit as shown in Appendix A or mounted to a standard 3.5 mm din rail using the supplied plastic mounting adapter. Wiring instructions for the unit are illustrated in Appendix A.

5.2 PDT-400

The PDT-400 is designed to be mounted directly to a standard 3.5 mm din rail. Dimensional information for the unit along with wiring instructions are provided in Appendix B.

6.0 CALIBRATION AND OPERATION

CALIBRATION: AUTOMATIC.
Unit includes all of the calibration parameters. It performs periodic “Zero”, “Span”, Self-Test, and Auto Calibration.

REQUIREMENTS:
(1) PC Calibration Software Media (Appendix C)
CT P/N 318996-001
(2) PA-400 Programming Adapter
CT P/N 318997-001 (RS-232 Interface)
CT P/N 318997-002 (USB Interface)

7.0 SOFTWARE INSTALLATION AND CONFIGURATION

7.1 SOFTWARE INSTALLATION

CAUTION

BEFORE INSTALLING THE NEW CONFIGURATION SOFTWARE, IT IS ALWAYS ADVISABLE TO CLOSE ALL OTHER APPLICATIONS INCLUDING VIRUS SCANNERS AND OFFICE SUITES. FAILURE TO DO SO MAY RESULT IN THE CORRUPTION OF CERTAIN COMMON FILES.

Programming software may be launched automatically when a computer is started up in three ways; **autoexec.bat** file, the **config.sys** file and by Windows® in its startup directory/folder.

The Configuration software may be installed on Windows 95, 98, 98SE, NT, 2000, and XP systems. To install, insert the software media into the proper drive on your computer and run “install.exe”. Follow the onscreen instructions for complete installation.

If required, identify the port to which it is connected. From the menu bar, select the “Options” menu, click on “Communication” and enter the correct COM port designation from the pull-down menu. (See Figures 1 and 2)

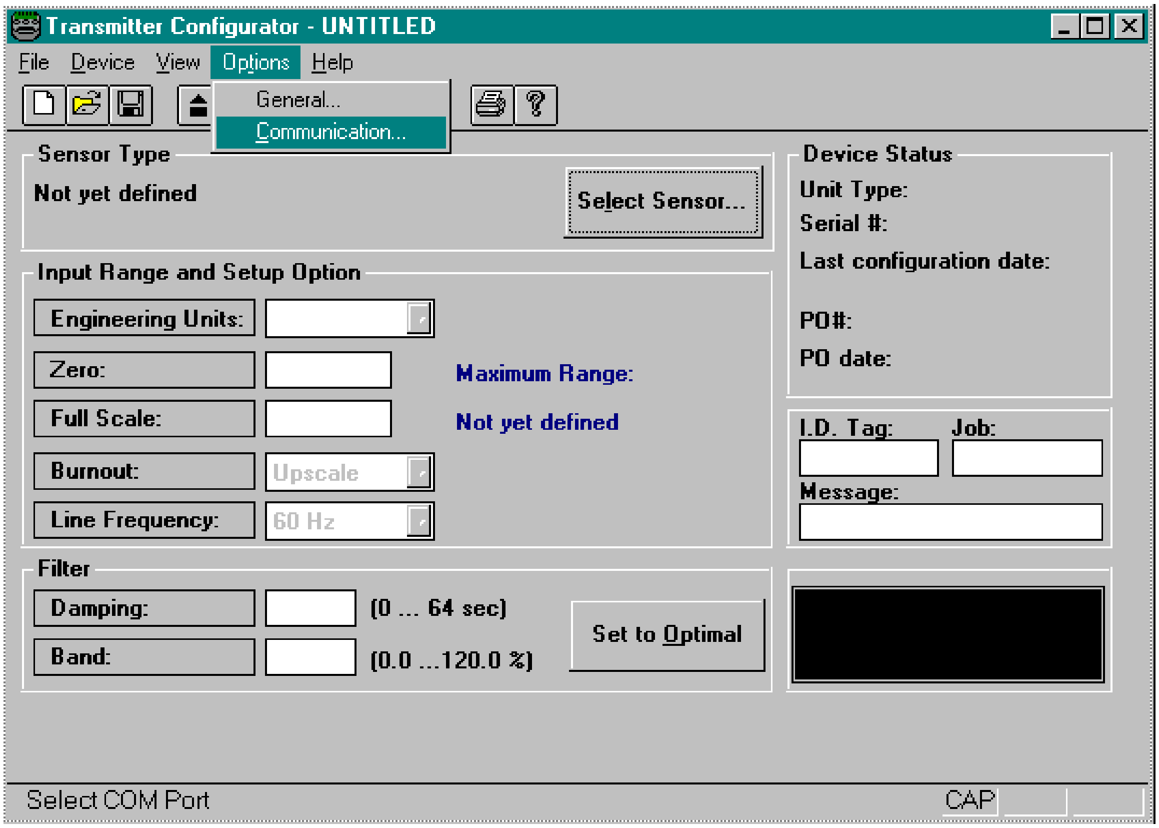
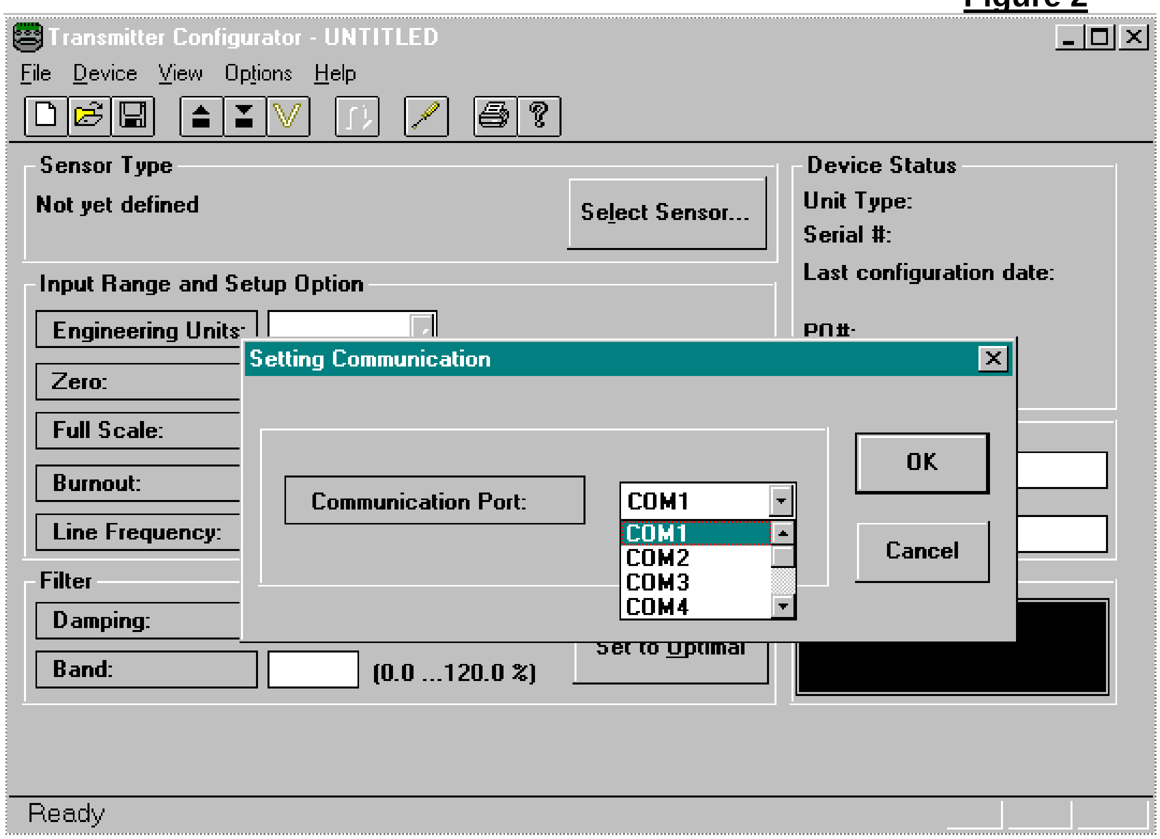


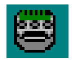
Figure 1

Figure 2



7.2 CONFIGURATION

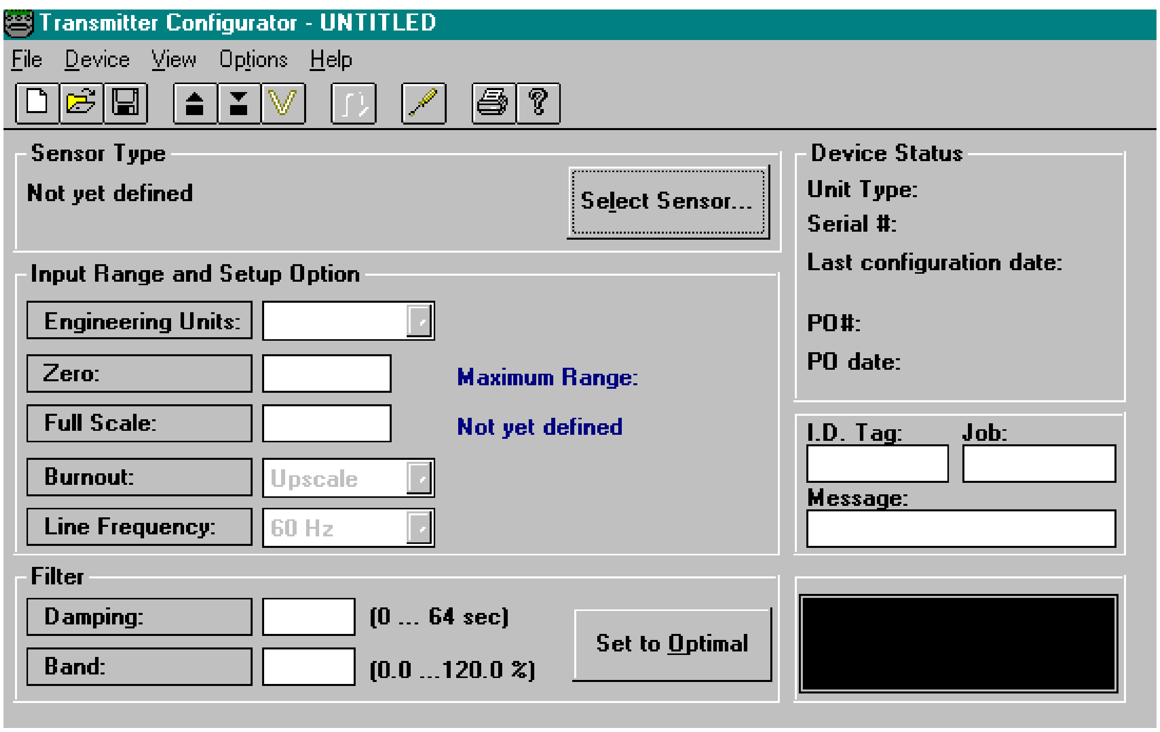
7.2.1 Connect the PA-400 programming adapter into the appropriate port (RS-232 or USB) of the PC.

7.2.2 Click on the Configuration  icon to start the program.

7.2.3 Connect the plug on the transmitter side of the PA-400 to the 6-pin jack inside the transmitter.

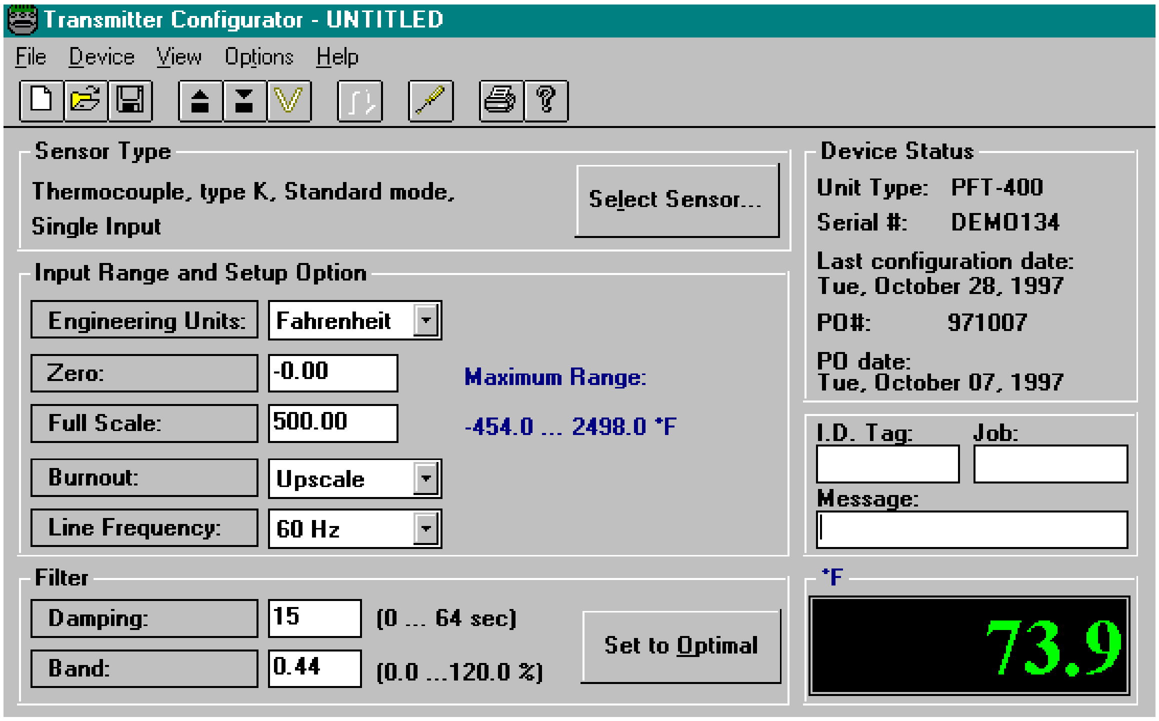
7.2.4 When the connection is made and the program recognizes that a transmitter is connected, the toolbar icons will become highlighted. Click on the **"UPLOAD"** icon.  This will begin the communication process between the transmitter and your PC. Once completed, the transmitter's calibration and configuration settings will be loaded into your PC. (See Figure 3)

<u>Figure 3</u>



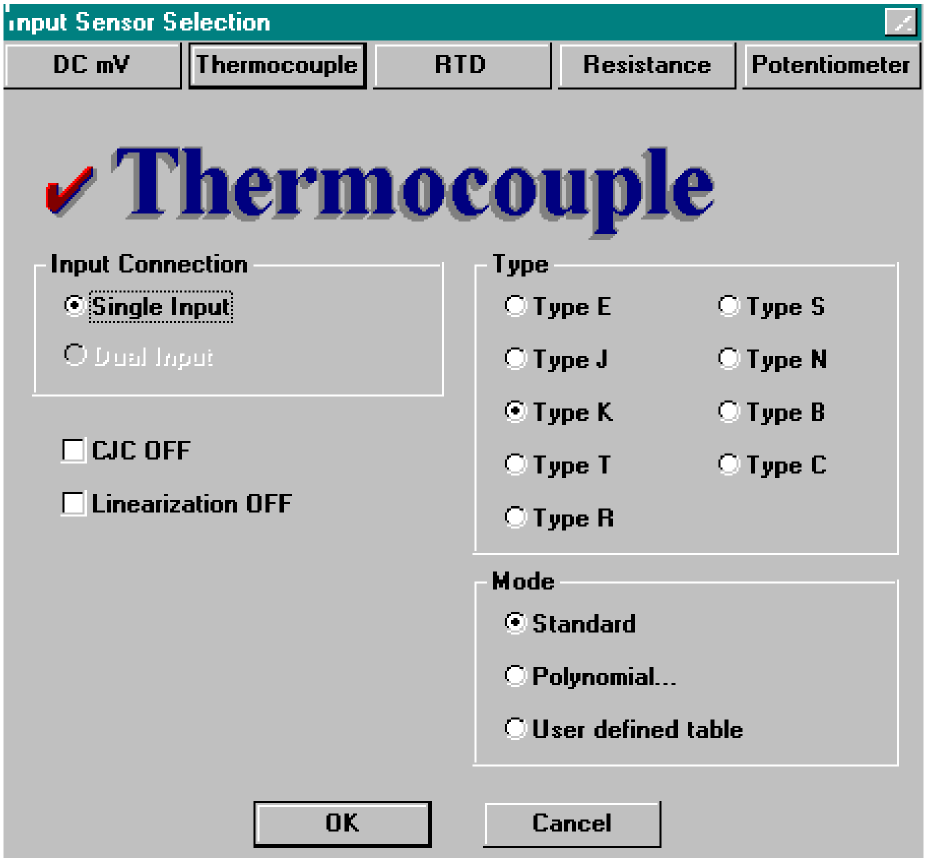
(Figure 3 is an example of the screen that will be displayed when the user opens the program. From this point you must plug-in the transmitter to the computer for the next screen (See Figure 4) to appear.)

Figure 4



7.2.5 Select the input sensor type by clicking on the **"Select Sensor"** box. From the sensor selection screen choose the proper **"TAB"** at the top of the screen for the sensor of your choice. The specific sensor screen will now be presented. (See Figure 5)

Figure 5

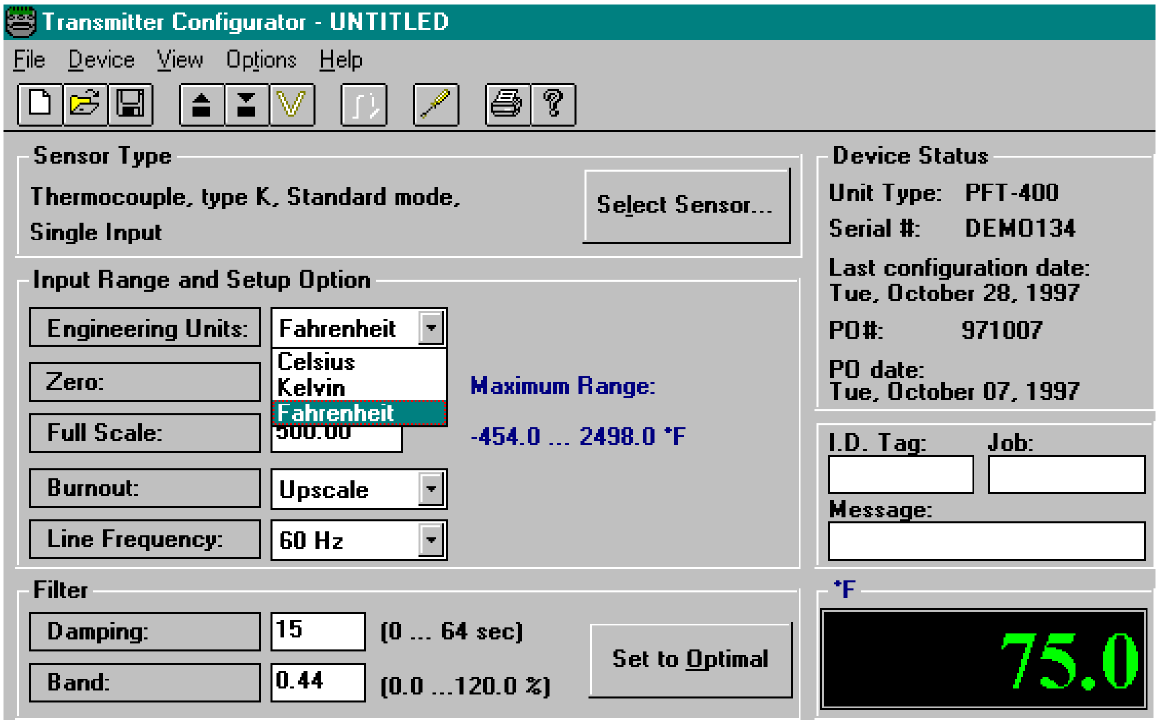


7.2.6 Click on the various selection boxes which best define your sensor's parameters. Click the **OK** button to return to the main screen. On the main screen next to the **"Select Sensor"** box, you will see the **Sensor Type** that has been selected (See Figure 6). This is to confirm the selection made on the previous screen.

Figure 6.

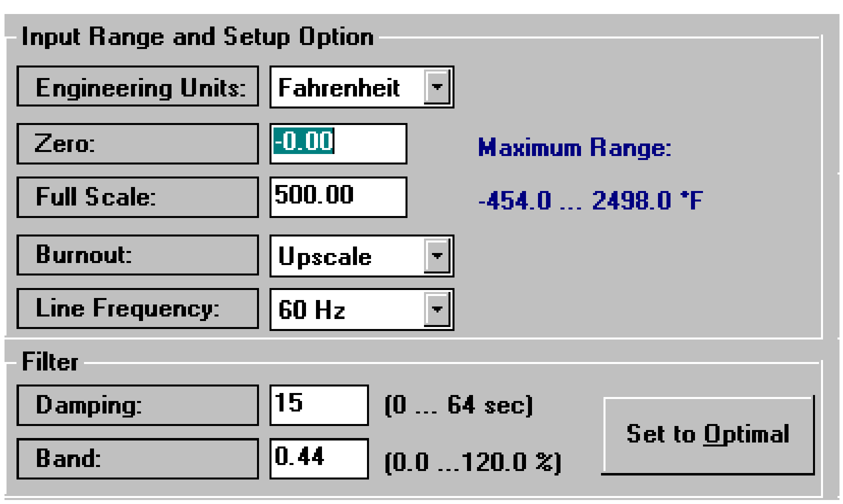
7.2.7 Next select the **"Engineering Units"** when appropriate from a pull-down menu. The choices will be °F, °C or °K. (See Figure 7)

Figure 7



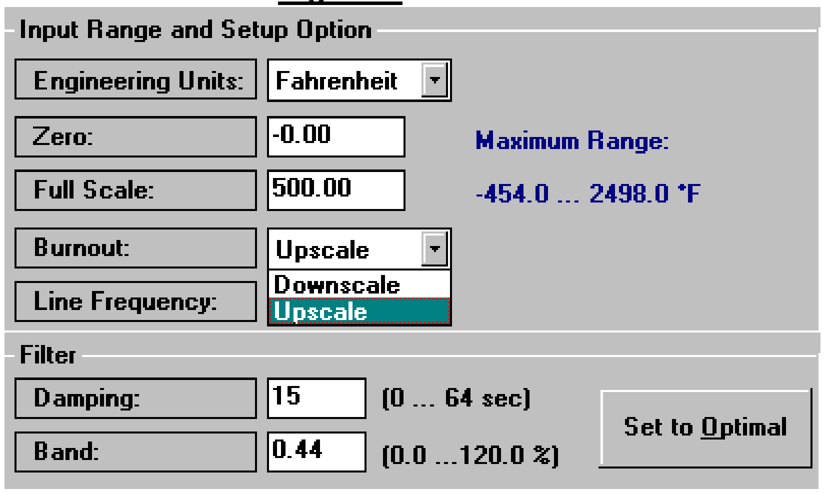
7.2.8 TAB down to the next box which is **"Zero"**. Just to the right of the **"Zero"** box in blue type is the maximum allowable measurement range for the selected sensor. Enter the **"Zero"** value to define the specific low input range. Next TAB down to the **"Full Scale".** Enter the **"Full Scale"** value that defines the transmitters high input range. (See Figure 8)

Figure 8



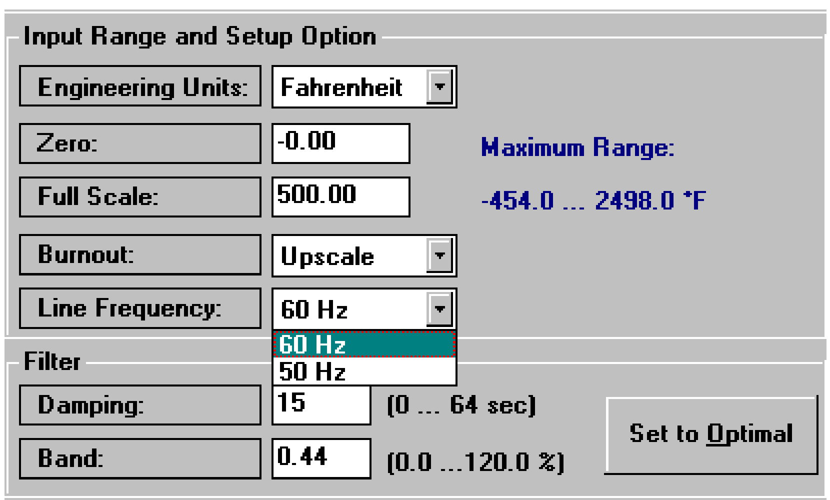
7.2.8.1 TAB to the **“Burnout”** mode and select from the pull down menu either Upscale or Downscale. (See Figure 9)

Figure 9



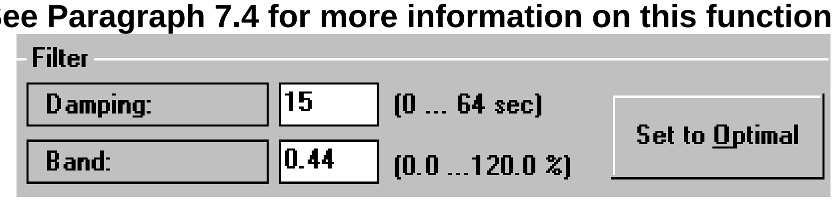
7.2.8.2 Next TAB to the **“Line Frequency”** and select from the pull-down menu and select 50Hz or 60Hz as appropriate. (See Figure 10)

Figure 10



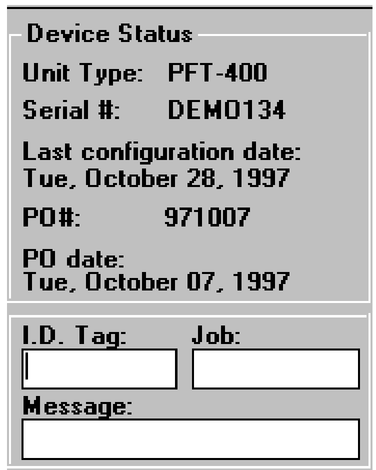
7.2.9 Next Click on the 

button to enable the computer to calculate and select the optimal values for the damping factor and the damping filter band. **(See Paragraph 7.4 for more information on this function.)**



7.2.10 You may now TAB over to the **I.D. Tag:** and type in up to 8 alpha-numeric characters for a description to be saved in the transmitter's memory. You may do the same for the **Job:** and **Message:** boxes and type in information in these boxes. Message will store up to 16 characters. (See Figure 11)

Figure 11



7.2.11 You may now click on the **"DOWNLOAD"** icon. This will instruct the PC to calculate the new reference parameters and download the new configuration values into the transmitter.

7.3 TRANSMITTER USER IDENTIFICATION

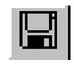
The transmitters contain several fields, which may be used to specifically identify that individual unit. These include:

I.D. Tag: Up to 8 alphanumeric characters
Job: Up to 8 alphanumeric characters
Message: Up to 16 alphanumeric characters

These fields can be changed or modified at any time. Just click on the appropriate field and enter the text. To conclude and save this information, click on the **"DOWNLOAD"** icon. The information will be downloaded and stored in the transmitter's memory. Transmitter configuration information can be retrieved at any time just by clicking on the **"UPLOAD"** icon.

7.3.1 Saving Configuration Information

Each transmitter configuration may be saved into a standard file. This information may be used for future references, re-loading, archiving, statistical comparative analysis, and records.

To **SAVE**, click on the **“Software Media”**  icon in the tool bar and specify a file name and directory location to which the file is to be saved.

7.3.2 Printing Configuration and Calibration Information

Click on the **“PRINTER”**  icon on the tool bar to initiate the printing of the transmitter’s configuration and calibration information. The report will include the values of the unit’s own input and output calibration reference codes, configuration reference codes, current time and date, the date of last configuration, and the date of the last calibration. The printed information can provide invaluable data in the system’s performance research, error corrections, and “before” and “after” analysis. (See Table 1)

Table 1
Configuration and Calibration Information

Device Status	
Unit Type:	PTH-400
Serial Number:	DEMO133
Tag:	970911
Message:	Product Intake
Job:	Chiller
PO Number:	971210MES
PO Date:	Wed, December 17, 1997
Last Configuration Date:	Fri, January 16, 1998
Sensor Type	
	Thermocouple, type K, Standard Mode, Single Input
Input Range and Setup Option	
Engineering Units:	Fahrenheit
Zero:	0.00
Full Scale:	500.00
Burnout:	Upscale
Line Frequency:	60 Hz
Filter	
Damping:	15 sec.
Band:	0.44%
Calibration References	
Output 4mA:	1782
Output 20mA:	8948
Input mV:	91.289
Input Ohms:	301.023
CJ Temperature:	296.768
Last Calibration Date:	Wed, November 19, 1997
Device Program I.D. :	31977.2

Printed on: Friday, January 16, 1998, 12:06:17

7.4 INPUT FILTERING

Input filtering is of great importance in measurement application with a low level signal. The effect of low pass filtering is to average out small transients of the input parameter resulting from process and sensor noise, as well as externally generated electrical noises. To overcome the sluggish response, associated with long filter settings, the transmitter uses a **Selective Filtering** technique. This method allows the transmitter to achieve a fast response for significant variation, yet to provide a stable, smooth and noise free output.

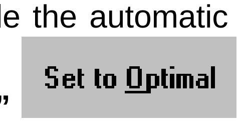
7.4.1 Damping Factor

The **Damping Factor** provides a measure of the time (in seconds) over which the input signal will be averaged. The greater the **Damping Factor,** the smoother the output (and the slower the measurement). **Selective Filtering** implies that **Damping** is only applied over a limited input **Band** around the input levels where noise is most likely to be found. This is the **Filter Band**.

7.4.2 Damping Filter Band

The **Filter Band** is defined as the band (in % of the input span) over which **Damping** is applied. A 1% **Band** for a transmitter with a measurement input span of 500° C means that **Damping** will apply to input variations of 0.5° C or less. However, changes in the input of greater than 0.5° C will be directly reflected in the transmitter's output without a delay.

Since noise levels do not vary largely between most applications, it is sensible to assume that wide input spans would require low band settings and narrow spans would require large band settings. The Configuration software provides for a calculated optimal filter setting suitable for the majority of applications, accounting for the specific transmitter input span.

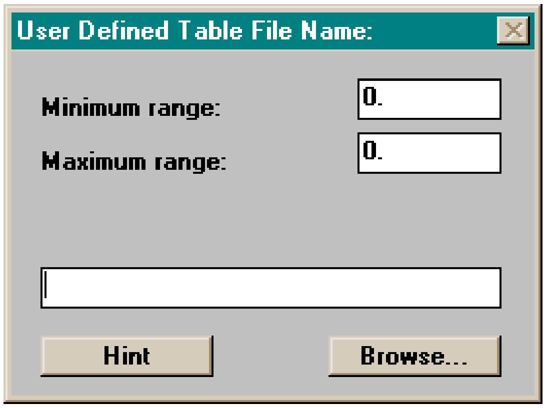
To enable the automatic application of this function, simply click on the **"Set to Optimal"** 

button. The settings may be changed at any time for applications where a high level of noise is known to exist, or in a slow responding system where a very smooth output signal is imperative.

7.5 USER DEFINED TABLES

Two methods are used for creating “User Defined Tables”. One is for temperature sensors such as thermocouples and RTDs. The other is for inputs such as mV, Volts, mA, resistance, and potentiometers. (See Figure 12)

Figure 12



Enter the minimum range, maximum range, and filename and location as illustrated in Figures 12 and 13.

The tables must be made in simple text (ASCII) files. These text files may be written in, or transferred to, any standard text editor. Lines containing notes, memos, comments, and descriptions must be preceded with an asterisk (*). The * signifies to the software that this line is not a part of the conversion table. No letters, symbols or other characters are allowed (See Table 2).

The conversion table should be formatted to contain two columns of numerical values only. No letters, symbols or other characters are allowed (See Table 2). The first column is designated as the input column and should list the temperature values (in °C) in increasing order with the increment values being identical (Each subsequent number should be larger than the previous by the same amount). The second column should be separated by a single space or (TAB) and should list the corresponding sensor output values (in mV for thermocouples and Ohms for RTDs).

It is recommended to apply the simulator function (Reference Para. 8.0) in order to verify that the input and output parameters correspond to the required values.

Table 2

*User defined table for
*IRt/c.xxx-K-80F/27C
*Minimum range -70 degrees Celsius
*Maximum range 200 degrees Celsius
*First column degrees Celsius
*Second Column mV
*Delta 10 degrees
*Use with Thermocouple Sensor Type, User defined table
*Created November 7, 1997

-70.00	-2.59
-60.00	-2.26
-50.00	-1.92
-40.00	-1.57
-30.00	-1.20
-20.00	-0.82
-10.00	-0.42
0.00	0.00
10.00	0.44
20.00	0.90
30.00	1.38
40.00	1.90
50.00	2.44
60.00	3.01
70.00	3.62
80.00	4.26
90.00	4.95
100.00	5.67
110.00	6.45
120.00	7.28
130.00	8.16
140.00	9.09
150.00	10.07
160.00	11.09
170.00	12.16
180.00	13.27
190.00	14.40
200.00	15.55

The table’s Input (left) and Output (right) values should be separated by at least a single space or (TAB).

It is a good practice to include a description, references, dates, and other notes relating the specific application of the conversion table as a heading to the table.

It may also be useful to open up a special directory for storing such tables in order to facilitate easy access in future use. We also recommend using a .tbl file extension in order to distinguish these special files from others.

Figure 13

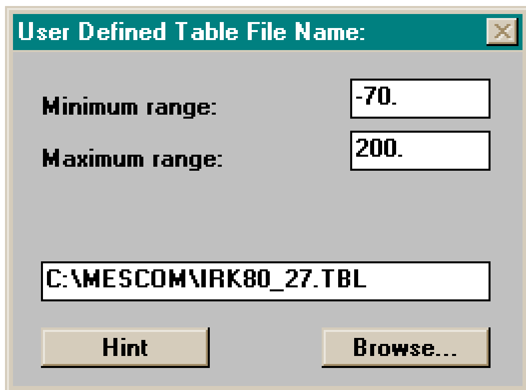


Table 2 was imported into the Configuration software and will be used for the specific application. Every time the transmitter that has been configured for this table, it will look for the specific location for this table (See Figure 13).

7.5.1 CREATING A TABLE FROM A MATH FUNCTION

If your sensor's transfer function can be described in a mathematical (trigonometric, log, etc.) equation, it is an easy task to convert it into a table. Use any commercial spreadsheet software program, under Windows, such as Excel or Lotus, in order to generate a table as above. Use **"COPY"** and **"PASTE"** commands to transfer the table section to any text editor such as "Notepad" and edit the table and text according to the above instructions.

7.5.2 APPLYING THE "USER DEFINED TABLE" FUNCTION

1. Select the input sensor for the application.
2. From the "Transfer Function" or "Mode" selection box, select the "User Defined Table" button.
3. Enter the minimum and maximum table input range.
4. Enter the table's complete file name.
5. Select the "OK" button.

The transmitter device is now ready to apply the function.

7.5.3 CALLENDAR -VAN-DUSEN APPLICATIONS

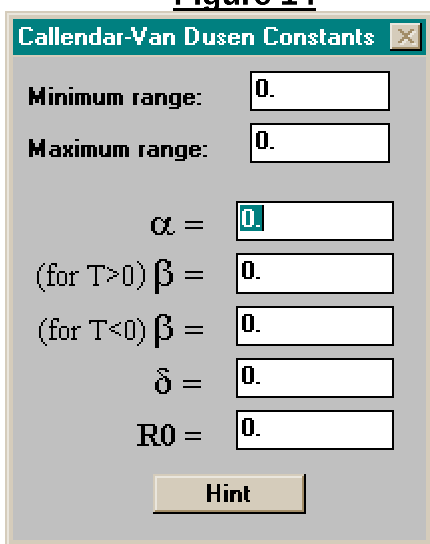
The Callendar-Van-Dusen formula provides constants for a third order polynomial equation, which then approximates the actual Pt-100 RTD's resistance to a high degree of precision. Of course, the specific RTD needs to be precisely characterized by exact temperature testing, and the coefficients should then be calculated. (See Figure 14)

α Alpha is the nominal coefficient for the RTD, which, for most standard elements will be in the vicinity of 0.00385 (DIN curve).

β Beta is zero (0) for temperatures >0 °C. It is the significant constant for <0 °C ranges.

δ Delta is the significant coefficient for the higher temperature ranges.

Figure 14



The minimum and maximum values are the temperatures within the values for which the sensor was supposed to be defined and tested for. The units are always in °C. If the sensor was tested and defined between -50°C and +450°C, you may enter any values up to and including -50°C for the minimum value and +450°C for the maximum value.

You MUST enter a value for Delta or else the program will request it. Typical values will run in the order of 1.40 to 1.60 for 100 Ω (@ 0°C) elements. For units with the 0.000385 curve, the typical values are in the order of 1.45 to 1.47.
Once you enter all of the numbers, the Configuration software will generate the linearization table for the particular range of the unit. Upon downloading, this table will be entered into the transmitter's memory.

Please Note: The values may be verified by using the device simulation function (Alt + S) and seeing that the device indeed provides the proper temperatures (and/or output values in mA) for the resistances found by the element's tests, or vice versa.

8.0 DUAL INPUT MODE

Conax PC Programmable transmitters can be configured to accept dual sensor inputs. In dual input mode, two sensors (either two thermocouples or two 2-wire RTD's) are connected to a single transmitter and the user can software select one of seven available math/logic functions including: addition (A+B), subtraction (A-B), averaging ([A+B]/2), high sensor (A or B), low sensor (A or B), or selecting one of the two sensors (A or B) for output.

When using the "A+B", "A-B", or "(A+B)/2" functions in dual input mode, the transmitter should be ranged based on the function, not the actual temperature being measured. For example, when using the differential "A-B" function, the output is proportional to the difference in temperatures between the two sensors. (That is, if the unit is ranged for 0-100ºC in the differential mode, it will correlate to a 4 mA output at 0ºC difference and 20 mA output at 100ºC difference). The sensors themselves may be at higher or lower temperatures and an "Underscale" or "Overscale" indication is only related to the difference, not to the actual operating temperatures.

The remaining dual input functions are ranged in the same manner as that for a single sensor input.

9.0 SIMULATION FUNCTION

The simulation function allows the user to check the relationship between the transmitter's configured input – in basic electrical units (such as mV or Ohms, etc.) to the scaled or engineering units (such as °F or °C) – and to its output – (in mA and %).

The simulation function also is useful for testing a "Sensor vs. Output" transfer function when using nonstandard sensor transformations, such as Calender-Van-Dusen, Polynomial or any other User Defined Table.

The simulation function is only available in the single sensor input mode and can be accessed from the main menu by selecting "DEVICE" and then selecting "SIMULATION." Simulation may be either Off-line or On-line. If no transmitter is connected to the PC, the simulation is Off-line. Enter any one of the four values in the simulation dialog box and the other three will automatically be calculated.

If communication between the transmitter and the PC is enabled, On-line simulation will be performed. As with Off-line simulation, enter any one of the four values and the other three will be calculated. Click "APPLY" and the transmitter's output will be driven to the indicated value. For a continuous dynamic update of the output, the "DYNAMIC LINK" box must be checked.

The scroll bar may be used to increase or decrease the transmitter's output by fixed amounts. Clicking on the arrows at the ends of the scroll bar changes the output by 1%. Clicking inside the scroll bar changes the output by 10%.

Note: Allow for a 2-3 seconds delay for a change of an indicated value to be effected at the output.

10.0 TROUBLESHOOTING

I am unable to communicate to my transmitter from my PC?

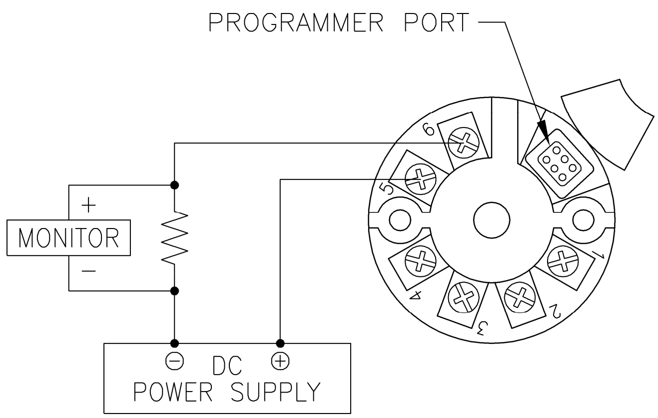
- From the menu bar, select the "Options" menu, click on "Communication" and enter the correct COM port designation from the pull-down menu.
- Exit and re-enter the program to implement the changes.

How do I print the Calibration and Configuration reports to a file?

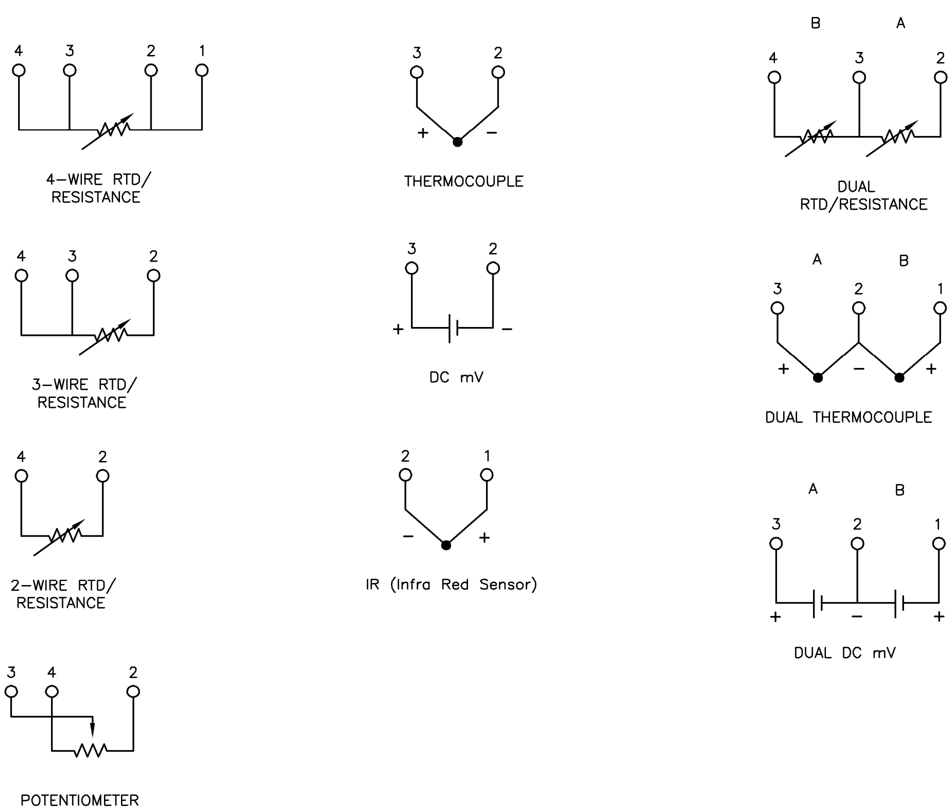
- Install another printer with the same driver: "copy2".

APPENDIX A

PTH-40X TERMINAL ASSIGNMENT



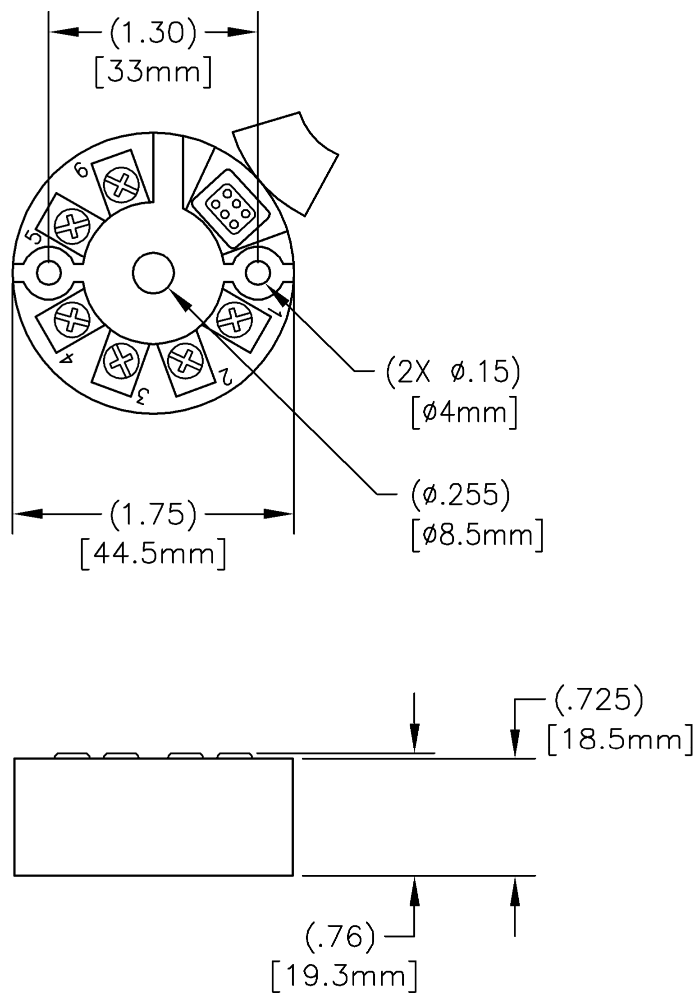
SAMPLE LOOP
SHOWING
THE PTH−400



Potentiometer input is not suggested for use with a PTH-401

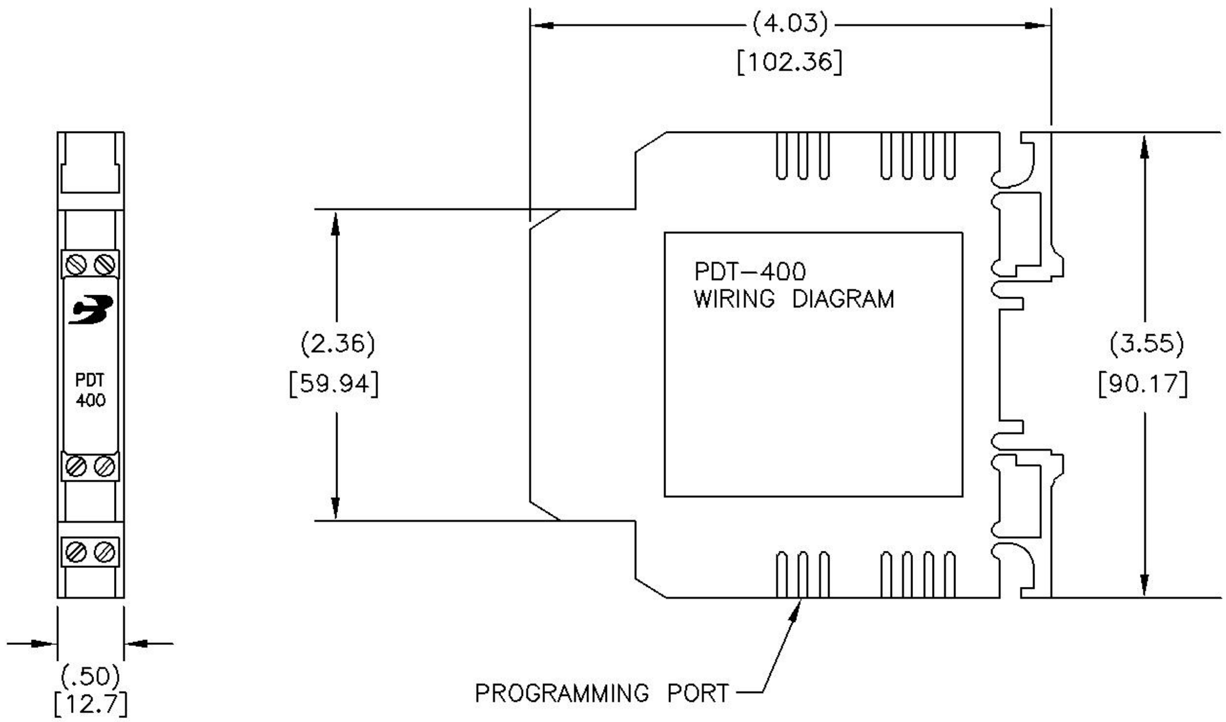
APPENDIX A

PTH-40X DIMENSIONS



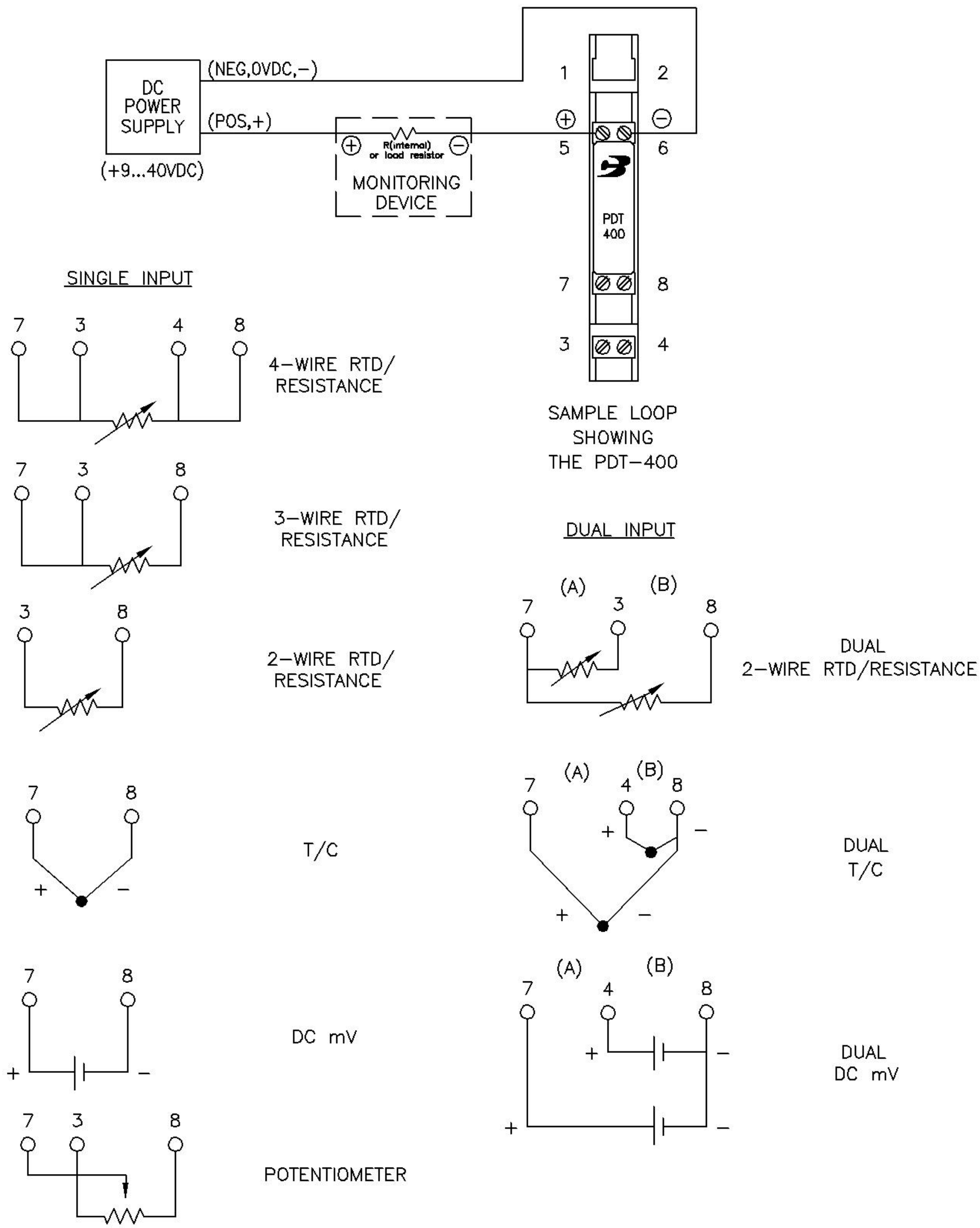
APPENDIX B

PDT- 400 DIMENSIONS



APPENDIX B

PDT-400 TERMINAL ASSIGNMENTS



APPENDIX C

PROGRAMMING SOFTWARE

MEDIA & MEDIA POCKET HERE

END OF DOCUMENT