Dwyer Instruments, Inc.
Series 664, 667 and Model 658
PROGRAMMABLE TRANSMITTERS
INTRODUCTION

Dwyer’s programmable transmitters feature unique technology. These are state-of-the-art, microprocessor and flash memory based high-performance 2-wire transmitters. These transmitters provide new highs in measurement accuracy and stability. The unique and user friendly configuration software facilitates logical and speedy set-up of the transmitters. The serial port programming adapter provides isolated power to the transmitter’s circuitry and enables full unit configuration using JUST-a-PC. No power supply, calibrator or meter are required!!!!

The transmitters are supplied with input and output reference parameters fully factory calibrated. For actual operation all that is required is to perform the simple and easy input configuration procedure.

SOFTWARE INSTALLATION

CAUTION: Before installing the new PCS1 configurator software, it is always advisable to close all other applications including virus scanners and office suites. This is especially important for users running either Windows® 3.1 or Windows® 3.11. Failure to do so may result in the corruption of certain common files.

Application 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 PCS1 software is provided on a 3.5” diskette. It may be installed on Windows 3.1, 3.11 or Windows 95 based systems. To install, insert the diskette into the proper drive on your computer and run “setup.exe”. Follow the on screen instructions for complete installation.

For proper operation of your programming adapter, first identify the serial 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 Figure 1)
Figure 1.

Figure 2.
CONFIGURATION

1. Connect the programming adapter into the proper serial port of the PC.

2. Click on the configurator icon to start the program.

3. Connect the plug on the transmitter side to the 6-pin jack inside the transmitter.

4. When the connection is made and the program recognizes that a transmitter is connected to the serial port, 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)

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.
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 screen will now be presented. (See Figure 5)
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.
7. Next the "Engineering Units" when appropriate from a pull-down menu. The choices will be °F, °C or °K. (See Figure 7)

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 transmitter's high input range. (See Figure 8)
9. TAB to the "Burnout" mode and select from the pull down menu either Upscale or Downscale. (See Figure 9)

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

11. Next Click on the "Set to Optimal" button to enable the computer to calculate and select the optimal values for the damping factor and the damping filter band. (See page 12 for more information on this function)
12. You may now TAB over to the **I.D. Tag:** and type in up to eight 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 sixteen characters. (See Figure 11)

![Figure 11.](image)

13. 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.

**DOCUMENTATION**

**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.
Any transmitter configuration information can be retrieved at any time just by clicking on the “UPLOAD” icon.

**Saving configuration information**

Each transmitter’s specific 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 “DISKETTE” icon in the tool bar and specify a file name and directory location to which the file is to be saved.

Should the user have many transmitters that will be configured with the exact same parameters you may use

**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:** 667-0D
- **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 16, 1998, 12:06:17
INPUT FILTERING - THE SMART WAY

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.

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.

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 configurator 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.
**USER DEFINED TABLES**

Two methods are being 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)

![User Defined Table File Name](image)

**Figure 12.**

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. The conversion table must contain numerical values only!! No letters, symbols or other characters are allowed. (See Table 2)
**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 *

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

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 related 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.

The table’s first (leftmost) column must be monotonously increasing and increment values must be identical. Thus, each number must be smaller than the next one by the same amount. The second (right) column must also be monotonous, but in either increasing or decreasing order.

Table 1. was imported into the configurator 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.

**TEMPERATURE**

A user defined table consists of two columns of numbers. The first column is a list of numbers representing the input temperatures for which the table is defined. The temperature values should always be defined in ° C !!! The second column represents the sensor’s output at these temperatures.

**GENERAL PURPOSE INPUTS**

The first column should display the values of the actual sensor output in mV, mA, Volts, Ohms, or % (for potentiometers). The second column should display the corresponding values in engineering units.

**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.

**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 is now ready to apply the function.

**CALLENDOR-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.

\[ \alpha \] alpha is the nominal coefficient for the RTD, which, for most standard elements will be in the vicinity of 0.00385 (DIN curve).

\[ \beta \] Beta is zero (0) for temperatures >0 degrees C. It is the significant constant for <0 ranges.

\[ \delta \] Delta is the significant coefficient for the higher temperature ranges.

(See 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 Degrees 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 100Ω (@ 0 Degrees 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 the numbers, the configurator 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 resistance's found by the element's tests, or visa versa.

TROUBLESHOOTING

The configurator software will not load on my computer?
• There have been no problems reported under Windows 95. Under Windows 3.1 and 3.11 empty the start-up directory, reboot, install the configurator software reboot, and then move things back into the startup directory and reboot again.

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.

When I try to print my calibration and configuration reports, they look scrunched?
• On some laser printers, the printer settings need to be adjusted to 75 dpi.

How do I print the Calibration and Configuration reports to a file?
• Install another printer with the same driver: “copy2”.

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