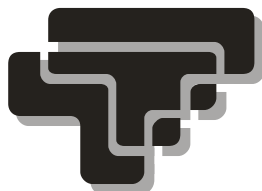


SST

SMART SENSOR TRANSMITTER

PLUG AND PLAY IEEE 1451.4 COMPLIANT

OPERATOR MANUAL



Transducer
Techniques®

TABLE OF CONTENTS

1.	TEDS IEEE 1451.4 INTRODUCTION	3
2.	SST TRANSMITTER INTRODUCTION.....	4
3.	RECEIVING & UNPACKING YOUR TRANSMITTER	5
4.	SAFETY CONSIDERATIONS	5
5.	TRANSMITTER FIELD WIRING	6
6.	READOUTS IN TEDS MODE	7
7.	PROGRAMMING YOUR TRANSMITTER.....	8
	- COMMUNICATIONS.....	9
	- SIGNAL & CONTROL INPUTS.....	11
	- SCALING.....	12
	- FILTERING	13
	- RELAY ALARMS	14
	- ANALOG OUTPUT	15
	- ADDITIONAL PROGRAMMABLE FEATURES.....	15
8.	OPENING YOUR TRANSMITTER CASE	18
9.	MAIN BOARD JUMPER SETTINGS	19
10.	LOAD CELL SIGNAL CONDITIONER BOARD JUMPER SETTINGS	20
11.	TRANSMITTER CALIBRATION	20
12.	DUAL RELAY OPERATION	21
13.	MODBUS PROTOCOL TRANSMITTER COMMUNICATIONS.....	24
14.	CUSTOM ASCII PROTOCOL TRANSMITTER COMMUNICATIONS	29
15.	SST TRANSMITTER SPECIFICATIONS.....	34
16.	ACCESSORIES	36
17.	WARRANTY	38

REVISED 11/2019

1. TEDS IEEE 1451.4 INTRODUCTION

Model SST is a TEDS IEEE 1451.4 Plug and Play Smart Transmitter for TEDS IEEE 1451.4 compliant Load Cell / Torque Sensors. Such sensors incorporate an EEPROM which specifies the type of sensor, its interface, and technical information such as sensitivity, bridge type, excitation, etc. TEDS, or Transducer Electronic Data Sheet, is a set of electronic data in a standardized format defined by the IEEE 1451.4 Standard.

The SST transmitter automatically detects when a TEDS IEEE 1451.4 compliant Load Cell / Torque Sensor has been connected to it by using a built-in EEPROM detector. It then reads the Sensor EEPROM, stores the information in its memory, and performs an automatic configuration. The EEPROM may be of any of the following types: DS1973/DS2433, DS2431 or DS1971/ DS2430A. The automatic system configuration function performs all steps needed to calibrate the TEDS IEEE 1451.4 compliant Load Cell / Torque Sensor and SST Transmitter as a system. This includes the configured precision of either 32 bits, 19 bits or 11 bits and the configured excitation voltage. Interfacing the SST Transmitter to a TEDS IEEE 1451.4 compliant Load Cell / Torque Sensor is as easy as plugging a mouse into a computer, making it a true plug-and-play experience.

2. SST TRANSMITTER INTRODUCTION

The **SST Transmitter** is an extremely accurate and versatile DIN rail transmitter for Load Cell / Torque Sensors. Standard features include:

- **Accuracy** of 0.01% of full scale ± 1 count.
- Update rate to 60/sec in 60 Hz noise environments or 50/sec in 50 Hz noise environments.
- Full-scale range from 20.000 mV full scale (1 μ V resolution) to 500.00 mV full scale (10 μ V resolution).
- **Isolated transducer excitation output.** 5V at 100mA or 10V at 120mA as selected by TEDS. In non-TEDS operation, the excitation is always 10V.
- **Isolated 4-20 mA, 0-20 mA, 0-10V or -10V to +10V analog output.** The signal types are selectable via jumpers. The output tracks the transmitter's internal digital reading, is scaled in software, and is generated by an ultra-linear 16-bit digital-to-analog converter.
- **Isolated serial data transmitter output.** The transmitter serial port is default jumpered for RS232 or full-duplex RS485 (same jumper settings). Half-duplex RS485 is also selectable either via internal or external jumpers. Three serial protocols are software selectable: **Modbus RTU, Modbus ASCII** and **Custom ASCII**. Modbus allows devices by different manufacturers to be addressed on the same data line. The simpler Custom ASCII protocol is recommended when there are no devices by other manufacturers on the data line.
- **Dual solid state relays** rated 120 mA at 140 Vac or 180 Vdc.
- **Isolation to 250V rms** is provided for power, signal input, analog output, relay outputs, and communications. Isolation adds safety and avoids possible ground loops. The transducer excitation output is isolated to **50V** from signal ground.
- **Internal jumpers** are used to select the signal range, communication type, and excitation level. The transmitter configuration is specified by the model number on the transmitter label. A user can reconfigure the transmitter by opening the case and moving jumpers.
- **Transmitter setup** is via serial connection to a PC using MS Windows based Instrument Setup Software plus TEDS IEEE 1451.4 when detected. The setup software can be downloaded at no charge from <http://www.transducertechniques.com/online-manuals.aspx>. The required transmitter to PC interface cable is available for purchase. With a TEDS IEEE 1451.4 compliant Load/Torque Sensor, the transmitter and sensor are calibrated as a system.

3. RECEIVING & UNPACKING YOUR TRANSMITTER

Your transmitter was carefully tested and inspected prior to shipment. Should the transmitter be damaged in shipment, notify the freight carrier immediately. In the event the transmitter is not configured as ordered or is inoperable, please contact Transducer Techniques.

4. SAFETY CONSIDERATIONS



Warning: Use of this transmitter in a manner other than specified may impair the protection of the device and subject the user to a hazard. Do not attempt to operate if the unit shows visible damage.

Cautions:

- This unit may be powered from 95-240 Vac $\pm 10\%$ or with the worldwide voltage power supply option, or from 12-30 Vac or 10-48 Vdc with the low voltage power supply option. Verify that the proper power option is installed for the power to be used.
- The 95-240 Vac $\pm 10\%$ power connector (P1 Pins 1-3) is colored **Green** to differentiate it from other input and output connectors. The 12-30 Vac or 10-48 Vdc power connector is colored **Black**. This transmitter has no power switch. It will be in operation as soon as power is applied.
- To avoid dangers of electrocution and/or short circuit, do not attempt to open the case while the unit is under power.
- To prevent an electrical or fire hazard, do not expose the transmitter to excessive moisture. Do not operate the transmitter in the presence of flammable gases or fumes, as such an environment constitutes an explosion hazard.

Symbols used:



Caution (refer to accompanying documents)



Caution, risk of electric shock.



Equipment protected throughout by double insulation or reinforced insulation.



Earth (ground) terminal.

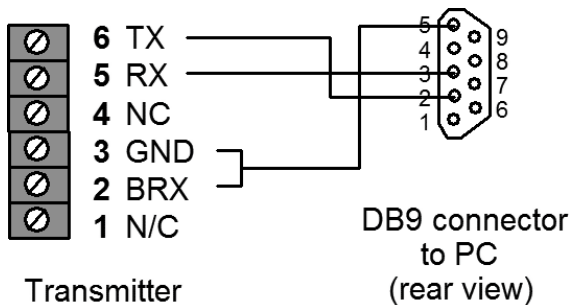
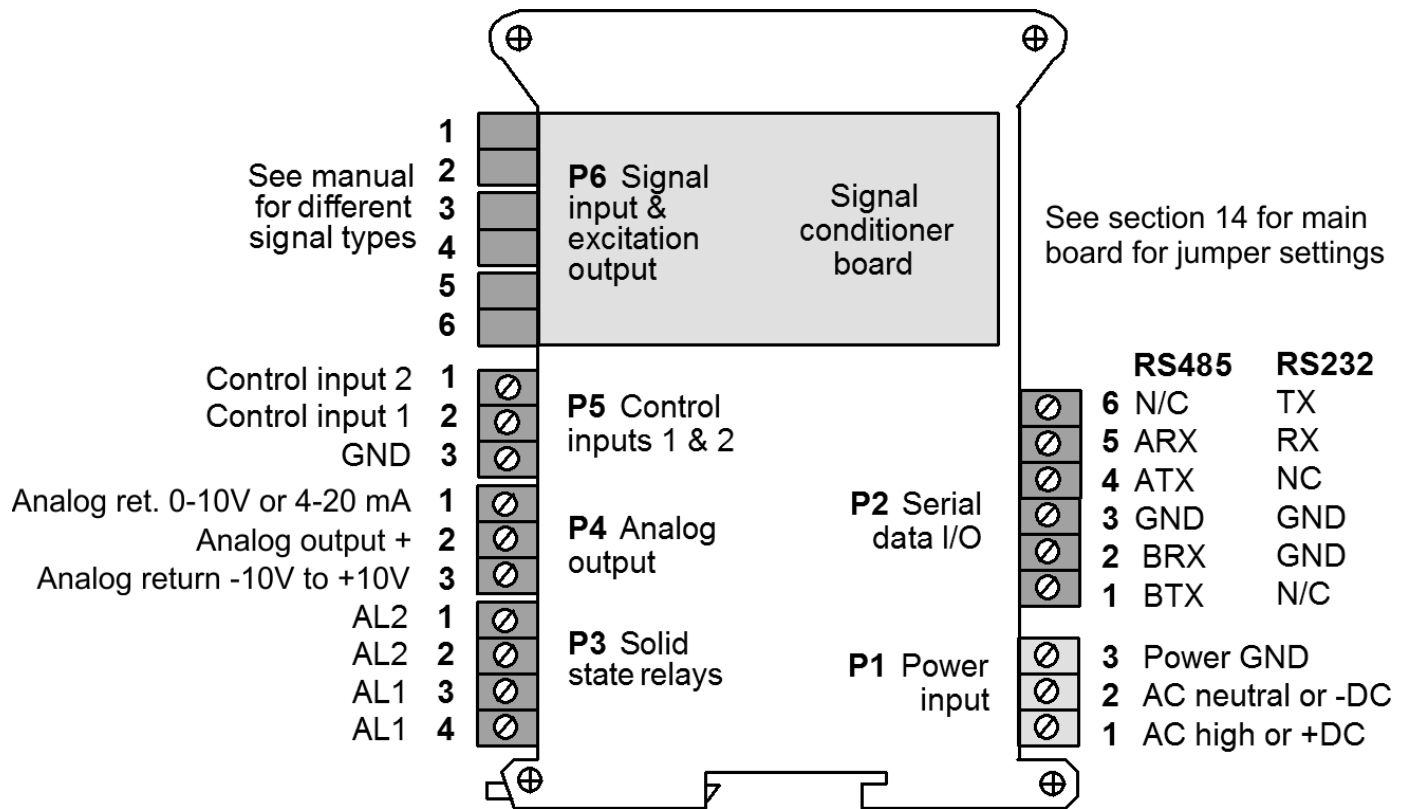


Both direct and alternating current.

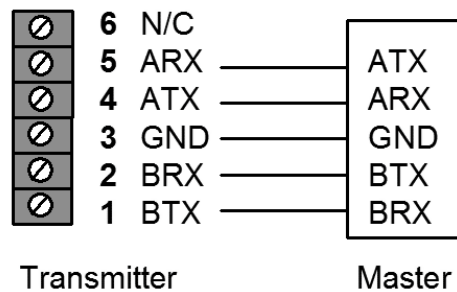
Operating environment:

Transmitter Class II (double insulated) equipment designed for use in Pollution degree 2.

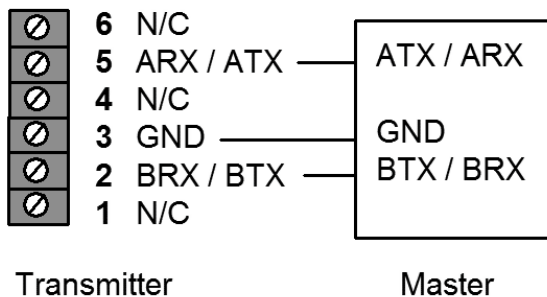
5. TRANSMITTER FIELD WIRING



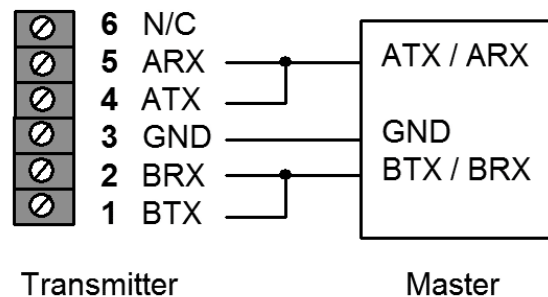
RS232 wiring



RS485 wiring, full duplex

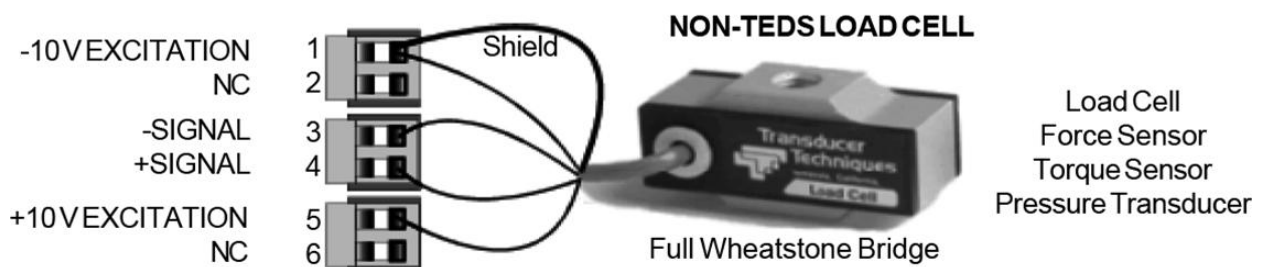
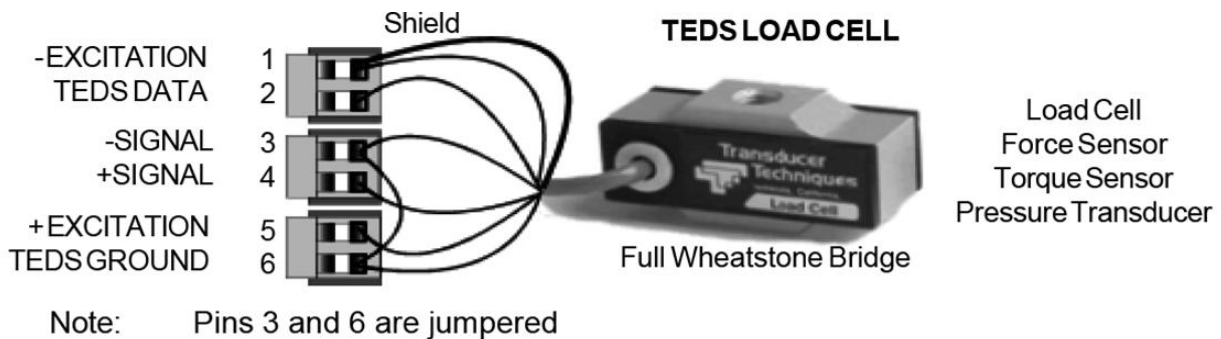


RS485 wiring, half duplex with internal jumpers.



RS485 wiring, half duplex with external jumpers.

P6 Wiring Detail



Note: Refer to Load Cell Calibration Certificate for wiring color code or www.TransducerTechniques.com/wiring-color-code.aspx

6. READOUTS IN TEDS MODE

When a SST Transmitter connected to a TEDS transducer is powered on, the transmitter reads the data stored in the transducer. The excitation supply is automatically set to the correct value, and the SST then calculates the correct scaling to calibrate the SST and transducer as a system. The jumper on the signal conditioner board must be set for the 50 mV range. See Section 10. If the Maximum Physical Value of the TEDS sensor exceeds 100,000, the calculated scale and offset are divided by 10, and the reading is in 10's of units.

DPM-3-TRES Reader_Editor Software, which is available from Transducer Techniques as an Accessory (see Section 17), allows the electronic data sheet for the transducer to be read through the RS232 port of the transmitter and be displayed on a computer screen. The values can be then be modified (e.g., to display kilograms instead of pounds) and be written back into the transducer.

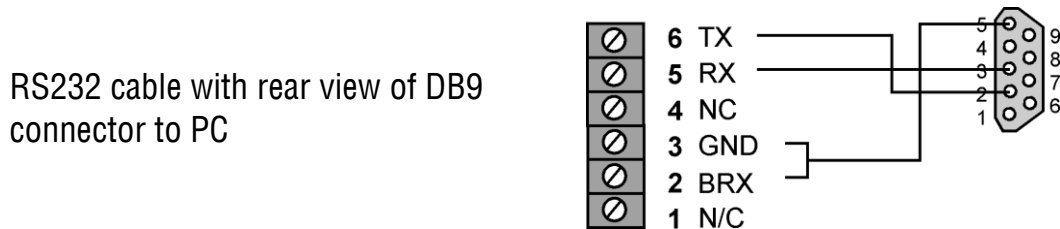
Instrument Setup (IS) Software can be used to further scale the reading or change decimal points. For example, if the full scale of the transducer is 50 pounds, the transmitter can be programmed to transmit 50, 50.0, 50.00, or 50.000 at full scale output – or an equivalent value in kilograms. Please see the next section of this manual.

7. PROGRAMMING YOUR TRANSMITTER

OVERVIEW

The SST Transmitter is easily programmed using a PC with an RS232 port and **Instrument Setup (IS) software**, which provides a graphical user interface. This software is downloadable at no charge from <http://www.transducertechniques.com/online-manuals.aspx>. It allows uploading, editing, downloading and saving of setup data, execution of commands under computer control, listing, plotting and graphing of data.

If your PC has an RS232 port, the transmitter and PC can be connected via the 3-wire RS232 cable SST-RS232-AD9, whose wiring is shown below:

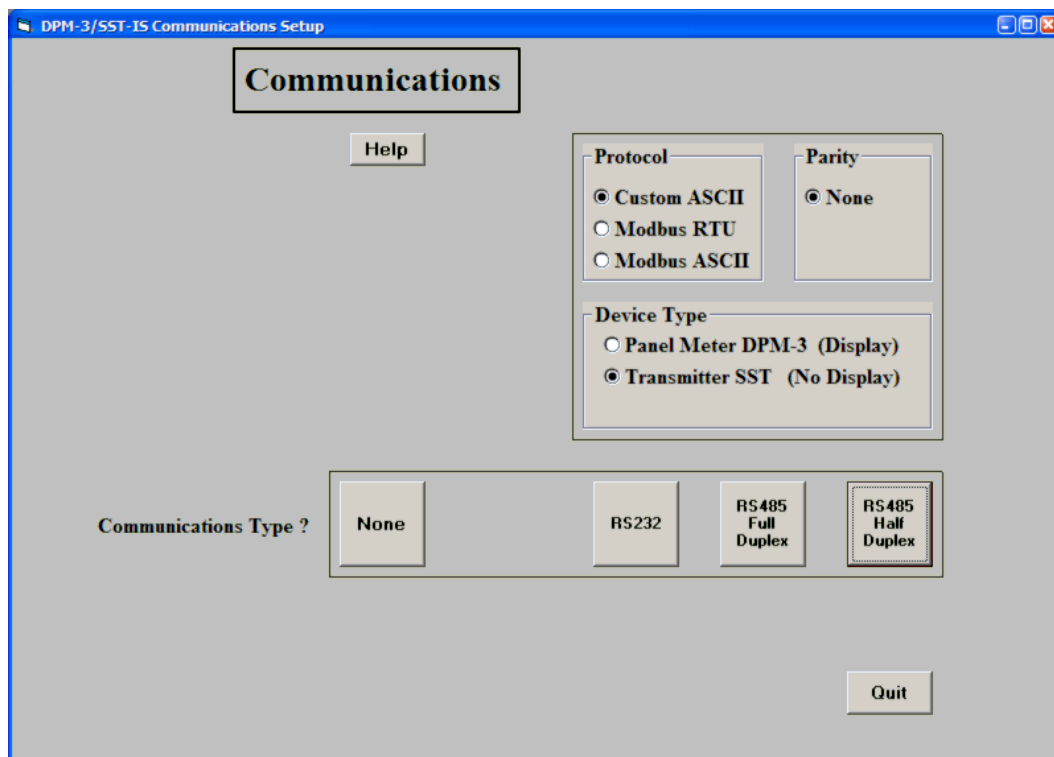
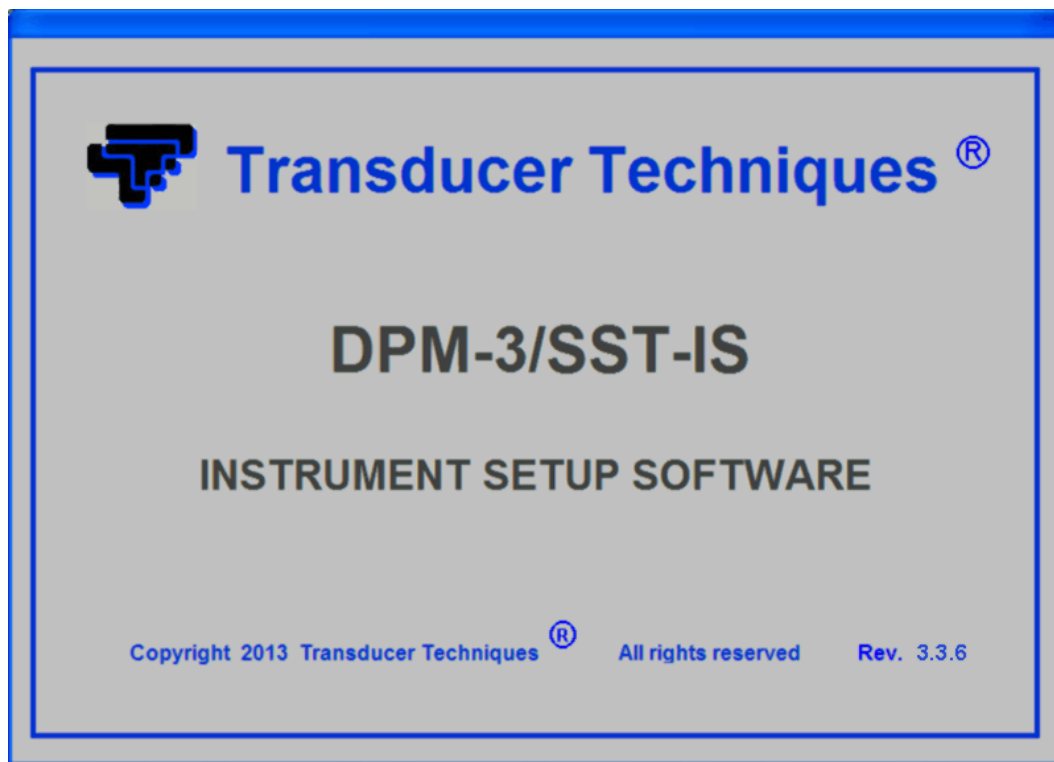


If your PC only has a USB port but no RS232 port, connect the 3-wire RS232 cable SST-RS232-AD9 to the RS232 to USB adapter cable SST-USB-AD9. This adapter cable is recommended because it contains an FTDI chip, which is compatible with all versions of Windows, including Windows 7 and 10.

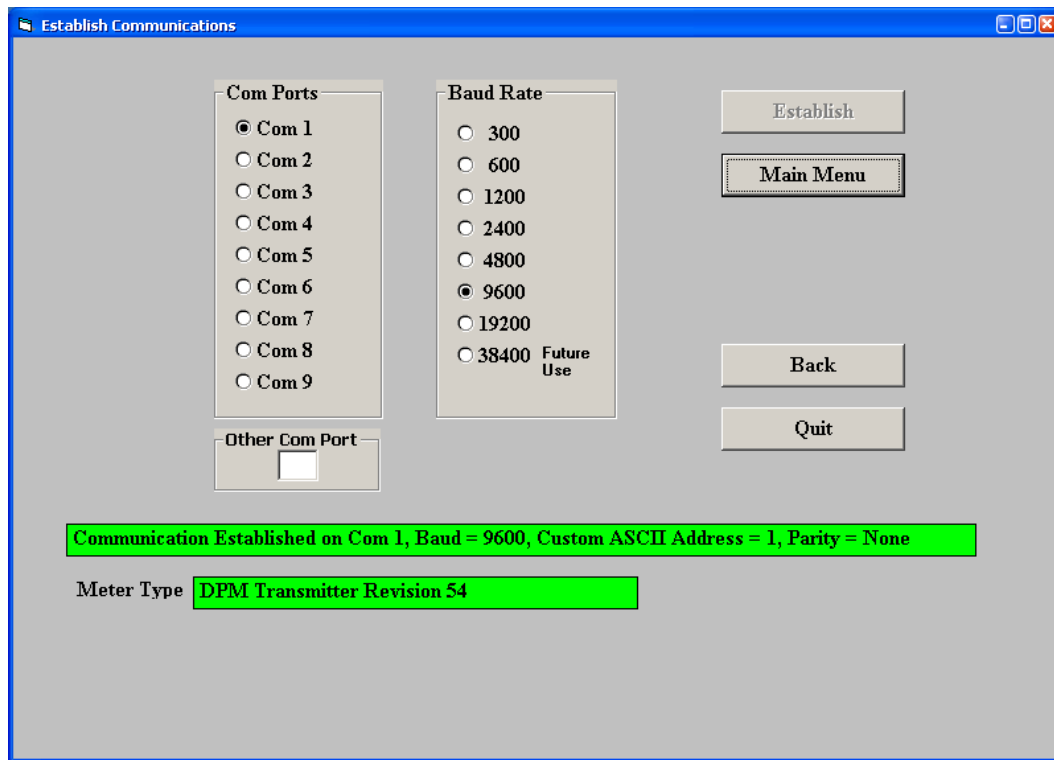
GETTING STARTED WITH IS SOFTWARE

As a first step, temporarily set User Account Control (UAC) of Windows to “Never notify” so that installation of “DPM-3/SST Instrument Setup” software can create directories. Use Google for instructions on how to change UAC settings for your version of Windows. Following installation, return UAC to its previous setting.

To install IS software, download the file dpm-3-is.exe from our website and double-click on the file name. Click on “Install Instrument Setup Software” and follow the prompts. To launch IS software, press on Start => Programs => DPM-3 Digital Panel Meter => DPM-3 Instrument Setup. The splash screen below will appear:



The Communications Setup screen will automatically appear a few seconds after the splash screen. Use this screen to select your communications Protocol, Device Type, and Communications Type. Selecting "None" for Communications Type allows you develop a setup file without being connected to an actual transmitter.



In the Establish Communications screen, select your Com Port and 9600 and the Baud Rate. You will be able to change your protocol and baud rate later under the Communication setup tab. Click on Establish, and the two fields at the bottom of the screen should turn green. Click on the Main Menu button to open the Main Menu screen.

From the Main Menu screen, click on DPM => Get Setup to retrieve (or get) the existing setup data from your DPM transmitter. Click on View => Setup to bring up screens which allow you to easily edit the setup file using pull-down menus and other selection tools. You can download (or put) your edited file into the transmitter by clicking on DPM => Put Setup. You can save your setup file to disk by clicking on File => Save Setup and retrieve a previously saved file from disk by click on File => Open.

The best way to learn IS software is to experiment with it.

For context-sensitive help for any data entry field under any tab, select that field and press the F1 key.

Input+Display Scaling Filter Relay Alarms Communication Analog Out

☐ BASIC ☒ EXTENDED Option Boards Sig Cond Option: Load Cell

Signal Input

Mode: Strain Range: 50.0mV Custom Curve: Disabled Rate: Disabled 50/60 Hz Line Freq: 60 Hz

Display

Resolution: 4.5 Digits Decimal Point: ddddd. Auto Tare: Disabled

 Read

Control Inputs

Control Input 1	Control Input 2	Both Ctrl 1,2
Tare	Meter Reset	Meter Reset
DP2 (Neither = DP1)	DP3 (Both = DP4)	None
DP3 (Neither = DP2)	DP4 (Both = DP5)	None
Function Reset	Display Blanking	Meter Reset
Meter Hold	Display Blanking	Meter Reset
Peak Display	Display Blanking	Function Reset
Tare	Display Blanking	Meter Reset
Valley Display	Peak Display	Function Reset
Tare	Tare Reset	Meter Reset

To get to the Input+Display tab, click on DPM => Get Setup to retrieve the current setup information from your DPM transmitter, then on View => Setup. Use the Input+Display screen to set up Signal Input, Display, and Control Inputs. The software reads the signal conditioner type, but not the range, which is set by jumpers. The “Sig Con Option” should be shown as “Load Cell”. The “50/60 Hz Line Freq” selection is used to optimize filtering to reject 50 or 60 Hz electrical noise.

Clicking on the Control Inputs field opens a pull-down menu which allows selection of the functions of Control Input 1, Control Input 2, and simultaneous Control Inputs 1 and 2. For example, with a Load Cell signal conditioner board and the highlighted selection, grounding Control Input 1 executes a Tare function, grounding Control Input 2 executes a Tare Reset, and grounding both Control Inputs 1 and 2 causes a Meter Reset, which resets Peak, Valley and latched alarms.

Clicking on Read displays the current digital reading. The red background of the read field will then change from red to green.

For detailed help on any data entry field, select that field and press the F1 key.

Input+Display **Scaling** Filter Relay Alarms Communication Analog Out

Scaling

☐ Scale, Offset >
 ☐ **Coordinates >**
☐ Reading Coord>

Scale: +1.0000 Offset: +00000.
 Low In: +00.000 Low Read: +00000. High In: +50.000 High Read: +50000.

Tare

☒ Front Panel Tare
 ☒ Auto-Tare
 ☒ TEDS LED Indicator
 ☒ TEDS Plug and Play

TEDS Data (Read Only)

Min Electrical Value 0.00000000	Min Physical Value 0.	Max Electrical Value 0.00200000	Max Physical Value 20000.
Serial Number 99999	Measure Units lb	Calib Date 050214	Calib Initials L F J
		Calib Period 365	Measure ID Brdg-A

Click on the Scaling tab to scale your transmitter. If a TEDS transmitter is detected, you can enable or disable three items: Auto-Tare, TEDS LED indicator, and TEDS Plug and Play operation. Front Panel Tare does not apply to transmitters. The section “TEDS Data (Read Only)” displays data stored in EEPROM of the TEDS transducer.

Input+Display **Scaling** Filter Relay Alarms Communication Analog Out

Scaling

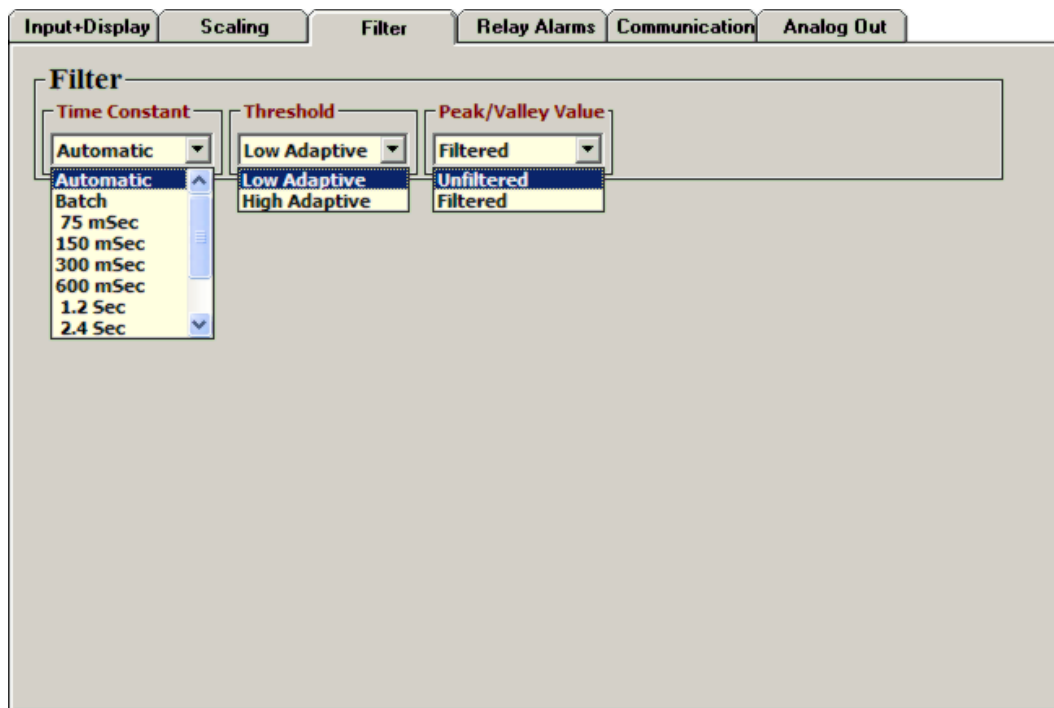
☐ Scale, Offset >
 ☒ **Coordinates >**
☐ Reading Coord>

Scale: +1.0000 Offset: +00000.
 Low In: +00.000 Low Read: +00000. High In: +50.000 High Read: +50000.

Tare

☒ Front Panel Tare
 ☒ Auto-Tare
 ☒ TEDS LED Indicator
 ☒ TEDS Plug and Play

Three scaling methods are selectable if a non-TEDS transmitter is detected or if TEDS Plug and Play operation has been turned off: 1) Scale and Offset method, 2) Coordinates of 2 points method where (Low In, Low Read) and (High In, High Read) data points are entered numerically, and 3) Reading Coordinates of 2 points method, which uses actual readings.



Click on the Filter tab to set to set up filtering for your readings. The adaptive threshold modifies the time constant in response to noise.

Under Time Constant, the filter time constant can be automatic, be set to batch, be specified in seconds, or be turned off. Automatic selects the time best filter time constant for the encountered noise level. Batch averages 16 consecutive measurements, which are taken at 60/sec with 60 Hz power and 50/sec with 50 Hz power. Eight equivalent RC filter time constants can also be selected manually. The longer time constants provide superior noise filtering at the expense of fast response time.

Adaptive moving average filtering allows the transmitter to reduce its time constant temporarily to reach a new value when filtering is not set to Batch or to No Filter. A Low Adaptive threshold allows a small change in signal to trigger a time constant reduction and is recommended for normal low noise. A High Adaptive threshold requires a large change in signal to trigger a time constant reduction and is recommended for high noise environments.

Peak/Valley values can be associated with either Unfiltered or Filtered readings.

For detailed help on any data entry field, select that field and press the F1 key.

Input+Display **Scaling** **Filter** **Relay Alarms** **Communication** **Analog Out**

Alarm 1

Setpoint 1: +38576.

Deviation 1: +00000.

Alarm State 1: Active Low

Relay1 Alarm State: Active On

Deviation 1 Type: Split Hysteresis

Alarm 1 Type: Non-Latching

Alarm 2

Setpoint 2: +38576.

Deviation 2: +00000.

Alarm State 2: Active High

Relay2 Alarm State: Active On

Deviation 2 Type: Split Hysteresis

Alarm 2 Type: Non-Latching

Alarms 1,2 No. Rdgs to Alarm: 1 Reading

☐ Filtered Alarm Source

Click on the Relay Alarms tab to set up your transmitter's two solid state relays, which are standard. For a complete explanation of Dual Relay Operation, see page 21. For detailed help on any data entry field, select that field and press the F1 key.

Input+Display **Scaling** **Filter** **Relay Alarms** **Communication** **Analog Out**

Serial Communications

Baud Rate: 9600

Custom Address: 1

Output Items: Reading

Output Source: Filtered

Output Rate: 0.017 Seconds

Output Mode: Command

☐ Incl Alarm Data

☐ Include LF

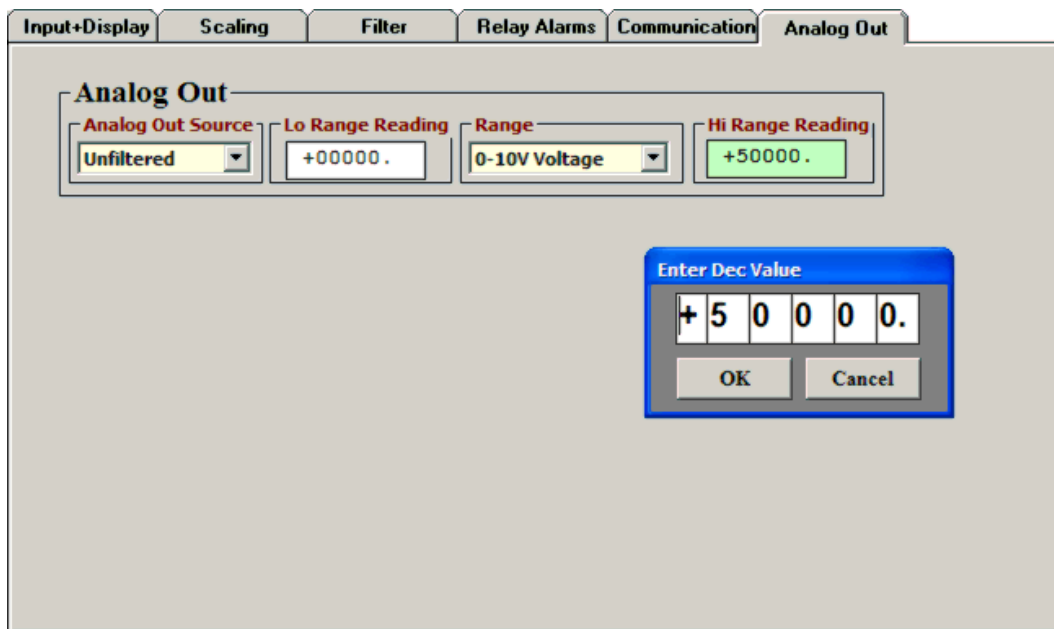
CR (LF): At End of All

Full/Half Duplex: Full Duplex

Serial Protocol: Custom ASCII

Transmission Chars: No Special Char

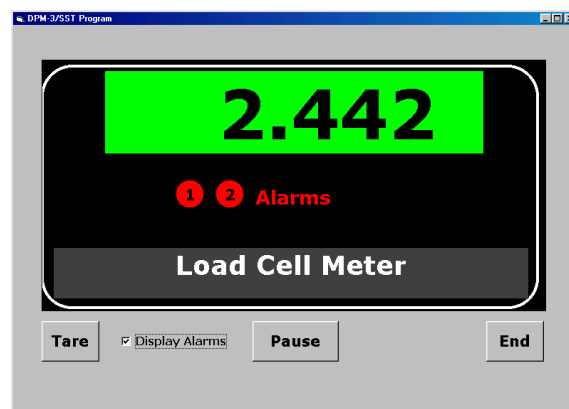
Click on the Communication tab to view the communication parameters that you used to establish default communications with your transmitter. You can reselect Baud Rate, Device Address, Serial Protocol, and Full/Half Duplex, even though you may have selected different values to establish initial communications with your PC. For detailed help on any data entry field, select that field and press the F1 key.



Click on the Analog Out tab to scale your analog output. Under Range, select 4-20 mA, 0-20 mA, 0-10V or -10V to +10V. To create the two endpoints of your analog output range, type in your Lo Range Reading and Hi Range Reading. For detailed help on any data entry field, select that field and press the F1 key. To change jumpers, see Section 9, Main Board Jumper Settings (page 19).

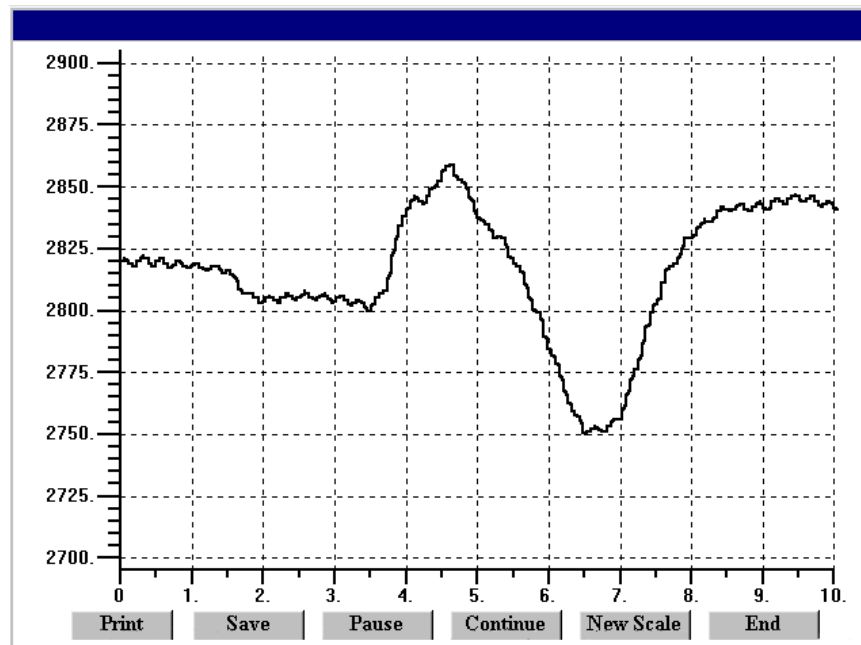
ADDITIONAL INSTRUMENT SETUP PROGRAM FEATURES

- **The Commands pull-down menu** allows you to execute certain functions by using your computer mouse. This menu will be grayed out unless a Get Setup has been executed.
- **The Readings pull-down menu** provides four formats to display input data on your PC monitor. Press Pause to temporarily pause data collection.

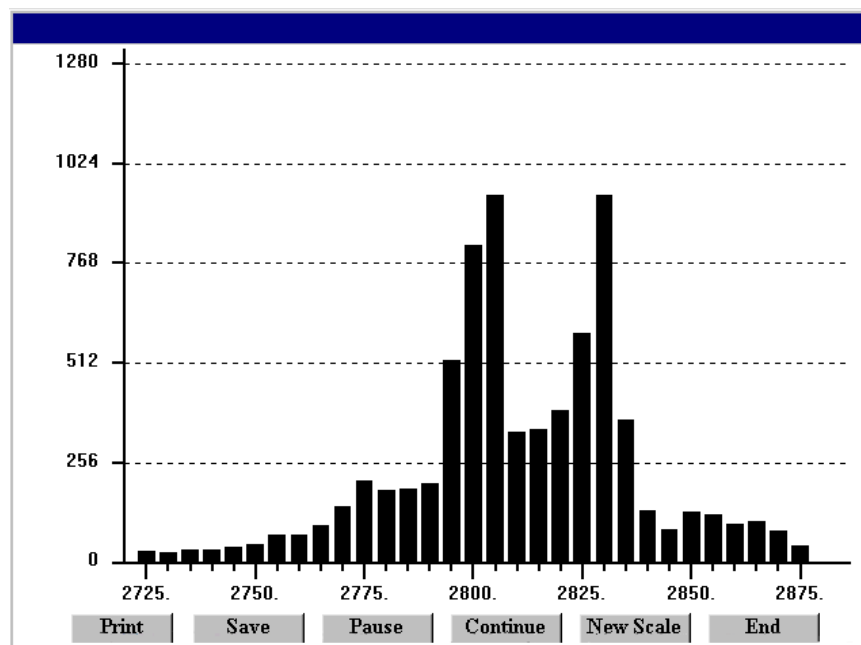


- **Display** presents the reading in large digit format. Press Tare to subtract the latest reading. Check Display Alarms to also show alarm status. Press End to return to Main Menu.

- **List** presents the latest internal readings in a 20-row by 10-column table. Press Pause at any time to freeze the display. Press Print for a hardcopy.
- **Plot** generates a plot of internal readings vs. time in seconds. It effectively turns the transmitter-PC combination into a printing digital oscilloscope.
- **Graph** generates a histogram, where the horizontal axis is the internal reading, and the vertical axis is the number of occurrences of readings. The display continually resizes itself as the number of readings increases.

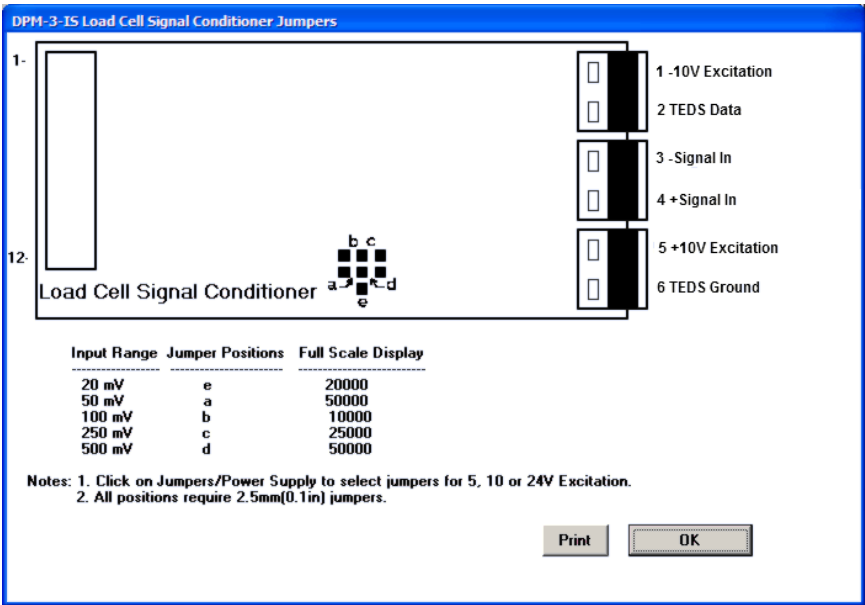


Plot



Graph

- **The Jumpers pull-down menu** shows jumper positions for the load cell signal conditioner board and the main board, duplicating information in this manual.



Jumpers

8. OPENING YOUR TRANSMITTER CASE

WHEN TO CHANGE JUMPERS

Depending on your desired setup, the internal jumpers of the transmitter may need to be moved from their default positions to meet your needs. This will require opening the case. Note that while Instrument Setup Software senses the circuit board type, it does not sense jumper settings, and the corresponding information has to be entered manually. Jumpers are used for the following:

- 1) **On the signal conditioner board** to set the signal type (e.g., voltage or current) and the range. For details, please see the next five sections of this manual. Note that all ranges of all signal conditioner boards are factory calibrated, with calibration factors stored in EPROM on the board.
- 2) **On the main board** to set the serial communication signal (RS232 or RS485), termination resistor for long cable runs, analog output signal (current or voltage), and sensor excitation output (5V, 10V or 24V). Default factory settings are voltage output, RS232, no termination resistor, and 10V excitation.

HOW TO OPEN & CLOSE THE CASE

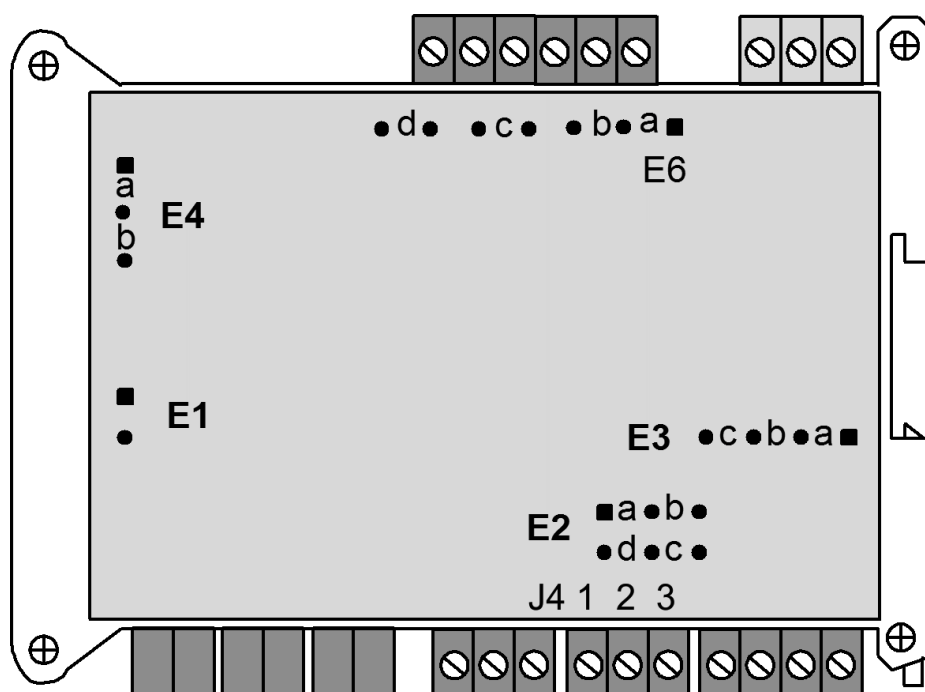


The two clamshell halves of the case are held together with a bolt and a nut at each of the four corners. Use a Phillips screwdriver to remove the four bolts. The nut will then drop off, and the clamshell halves will separate. When closing the case, make sure that the ventilation grills are properly aligned.



Caution: The nuts at each corner are not captive and are black. Take precautions so that the nuts do not get lost.

9. MAIN BOARD JUMPER SETTINGS



Serial Signal	Duplex	Jumpers	Termination Resistor*
RS485	Full	None	E6 a = Transmit E6 c = Receive
	Half	E6 b + d**	E6 c
RS232	Full	None	None

* The termination resistor jumper settings should only be selected if the transmitter is the last device on an RS485 line longer than 200 feet (60 m).

** Or connect external BTX to BRX and ATX to ARX (same effect as internal jumpers).

To reset communications to 9600 baud, command mode, Custom ASCII protocol, and Address 1, place a jumper at E1 and power up the transmitter.

Analog Output	J4 Pins	Jumpers
Current, 4-20 mA	1 Lo, 2 Hi	E2 a + d
Voltage, 0-10V	1 Lo, 2 Hi	E2 b + c
Voltage, -10V to +10V	3 Lo, 2 Hi	E2 b + c

Excitation Output*	Jumpers
5V, 100 mA	E3 a + c; E4 a
10V, 120 mA	E3 a + c; E4 b
24V, 50 mA	E3 b, E4 none

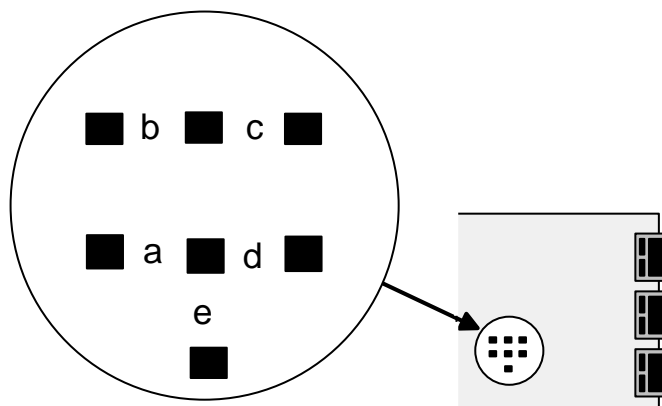
Jumper settings are for DPM main board Rev L

* Attempting to draw more than the rated excitation output current will shut down the output.

10. LOAD CELL SIGNAL CONDITIONER BOARD JUMPER SETTINGS

Load Cell & Microvolt Ranges

FS Input	Jumpers
±20.000 mV	e
±50.000 mV	a
±100.00 mV	b
±250.00 mV	c
±500.00 mV	d



11. TRANSMITTER CALIBRATION

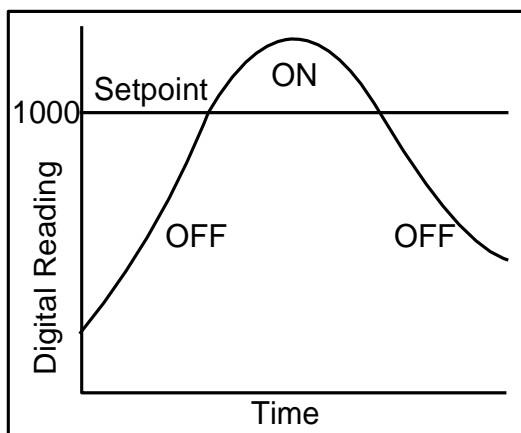
All analog input and analog output ranges of the transmitter have been digitally calibrated at the factory prior to shipment using calibration equipment certified to NIST standards. Calibration constants are stored digitally in non-volatile memory in EEPROM on the signal conditioner board and main board. This allows signal conditioner boards to be changed without requiring transmitter recalibration.

Annual meter recalibration by the factory is recommended. Please contact Transducer Techniques for an RMA number.

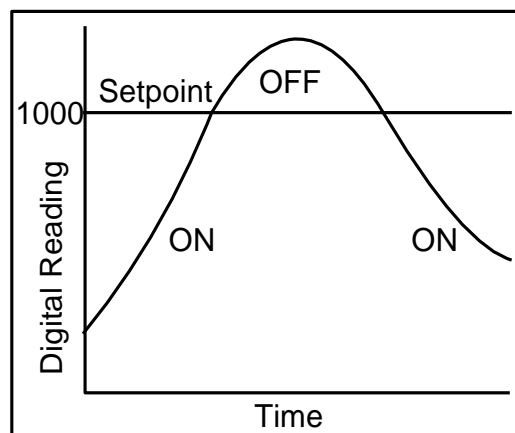
12. DUAL RELAY OPERATION

Dual AC/DC solid state relays rated 120 mA are standard for alarm or setpoint control and are independently set up via the “Relay Alarms” tab of Instrument Setup Software. For online help with any data entry field, press the **F1** key.

- Setpoint.** The number to which the current reading is compared if deviation is set to zero. The reading is the count in engineering units that is transmitted digitally and is also used for analog output. For example, if the transmitted reading is in gallons/minute, the setpoint will be referenced to that reading, not to the raw pulse rate sent from a turbine flow meter.

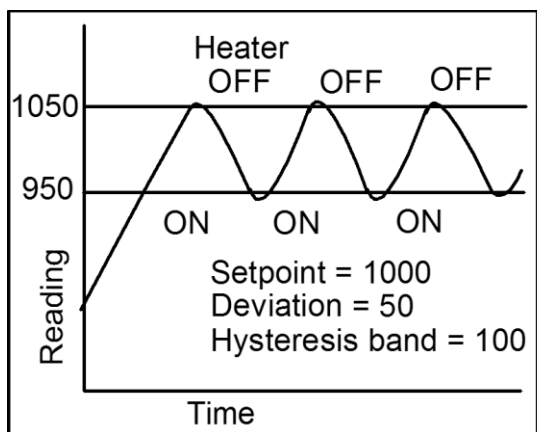


*“Active High” On/Off setpoint control
with deviation = 0*

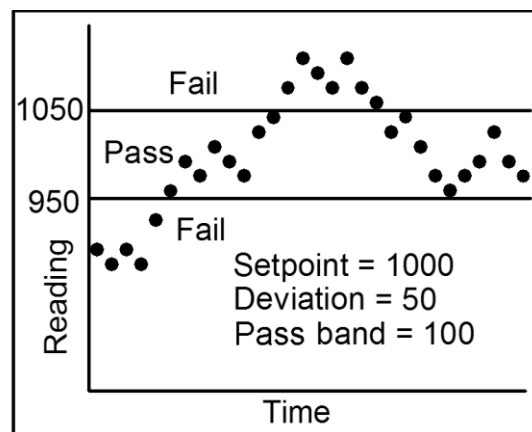


*“Active Low” On/Off setpoint control
with deviation = 0*

- **Deviation.** A positive number that can be added or subtracted from the setpoint, depending on the Deviation Type, to determine when an alarm becomes Active or Inactive.
- **Alarm State.** If “Active High” is selected, the Active Alarm State is defined as being above the setpoint. If “Active Low” is selected, the Active Alarm State is defined as being below the setpoint. If “Disabled” is selected, the Alarm State is always inactive.
- **Relay State.** A setting which ties the Relay State to the Alarm State. If “Active On” is selected, the relay will be closed when the Alarm State is 1. If “Active Off” is selected, the relay will be open when the Alarm State is 1.
- **Deviation Type.** Three choices are offered: Band Deviation, Split Hysteresis, and Span Hysteresis. These define how Setpoint and Deviation are to be combined to set Alarm State.



Split Hysteresis for heater control



Band Deviation for component testing

In Band Deviation, the relay opens (or closes) when the reading falls within the deviation band, and closes (or opens) when the reading falls outside. Two deviation limits lie symmetrically around the setpoint to create the deviation band. Passbands around a setpoint are often used for go-no-go component testing.

In Split Hysteresis, the relay opens (or closes) when the reading goes above the Setpoint plus one Deviation, and closes (or opens) when the reading falls below the Setpoint less one Deviation. Two Deviation limits lie symmetrically around the Setpoint to create a deviation band. A narrow hysteresis band is often used to minimize relay chatter. A wide band can be used for on-off control.

In Span Hysteresis, operation is as for Split Hysteresis, except that the Setpoint is always on the high side, and a single Deviation lies below the Setpoint to create the hysteresis band. Span Hysteresis is considered by some to be more intuitive than Split Hysteresis.

- **Alarm Type.** Selections are Non-Latching and Latching. Under Non-Latching, the relay is only closed (or open) while the Alarm State is Active. Under Latching, the activated relay remains closed (or opens) until reset regardless of the Alarm State. Resetting is normally achieved by

temporarily grounding one of the transmitter's control inputs, which has been set to Function Reset under the "Input+Display" tab.

- **Alarms 1,2 No. Rdgs to Alarm.** Selections are binary steps from 1 to 128. This is the number of consecutive alarm readings that must occur to create an Active alarm. Numbers higher than 2 provide some Alarm filtering so that 1 or 2 noisy readings do not cause an Active Alarm. The Alarm becomes Inactive if one of the consecutive readings fails to be an Alarm reading. The Alarm readings counter then resets to 0.

13. MODBUS PROTOCOL TRANSMITTER COMMUNICATIONS

1.0 GENERAL

The Modbus capability conforms to the Modbus over Serial Line Specification & Implementation Guide, V1.0. Both the Modbus RTU and Modbus ASCII protocols are implemented. This 5-page manual section provides some of the key programmable Modbus features.

Modbus RTU

Baud Rate..... 300, 600, 1200, 2400, 4800, 9600 or 19200
Data Format 1 start bit, 8 data bits, 1 parity bit, 1 stop bit (11 bits total)
Parity..... None, Odd, Even (if None, then 2 Stop bits for 11 total)
Address..... 0 for broadcast, 1-247 for individual meters

Modbus ASCII

Baud Rate..... 300, 600, 1200, 2400, 4800, 9600 or 19200
Data Format 1 Start bit, 7 Data bits, 1 Parity bit, 1 Stop bit (10 bits total)
Parity..... None, Odd, Even (if None, then 2 Stop bits for 10 total)
Address..... 0 for broadcast, 1-247 for individual meters

2.0 FRAMING

Modbus RTU. Message frames are separated by a silent interval of at least 3.5 character times. If a silent interval of more than 1.5 character times occurs between two characters of the message frame, the message frame is considered incomplete and is discarded. Frame Check = 16 bit CRC of the complete message excluding CRC characters.

Modbus ASCII. The message begins immediately following a colon (:) and ends just before a Carriage Return/ Line Feed (CRLF). All message characters are hexadecimal 0-9, A-F (ASCII coded). The system allowable time interval between characters may be set to 1, 3, 5 or 10 seconds. Frame Check = 1 byte (2 hexadecimal characters) LRC of the message excluding the initial colon (:) and trailing LRC and CRLF characters.

3.0 ELECTRICAL INTERFACE

RS232, two-wire half-duplex RS485, or four-wire full-duplex RS485 signal levels are selectable via jumpers on the transmitter main board and a the connector. Please see Section 9. The RS485 selection provides a jumper selection for insertion of a line termination resistor. In case of a long line (greater than 500 ft) to the first device, a termination resistor should be selected for the first device. In case of a long line between the first and last devices, a termination resistor should be selected for the first and last devices. Never add termination resistors to more than two devices on the same line.

4.0 COMMUNICATIONS SETUP

Parameters selectable via Instrument Setup software, which is downloadable from our website:

Serial Protocol Custom ASCII, Modbus RTU, Modbus ASCII
Modbus ASCII Gap Timeout..... 1 sec, 3 sec, 5 sec, 10 sec
Baud Rate..... 300, 600, 1200, 2400, 4800, 9600, 19200
Parity No parity, odd parity, even parity
Device Address 0 to 247

5.0 SUPPORTED MODBUS FUNCTION CODES, TM TRANSMITTERS W/ ANALOG INPUT

FC03: Read Holding Registers

Reads internal registers containing setup parameters (Scale, Offset, Setpoints, etc.)

FC10: Write Multiple Registers (FC10 = 16 dec)

Writes internal registers containing setup parameters (Scale, Offset, Setpoints, etc.)

FC04: Read Input Registers

Reads measurement values and alarm status. Returns values in 2's Complement Binary Hex format without a decimal point. The displayed system decimal point can be read with FC03 at address 0057. Use only **odd** Register Addresses and an **even** number of Registers.

Register Addr. TM Transmitter Response

-----	-----
00 01	Returns Hi word of Alarm status
00 02	Returns Lo word of Alarm status
00 03	Returns Hi word of Measurement value
00 04	Returns Lo word of Measurement value
00 05	Returns Hi word of Peak value
00 06	Returns Lo word of Peak value
00 07	Returns Hi word of Valley value
00 08	Returns Lo word of Valley value

FC05: Write Single Coil

Action command to meter

Output Address	Output Value	Action Command
-----	-----	-----
00 01	FF 00	Transmitter Reset (No Response)
00 02	FF 00	Function Reset (Peak, Valley)
00 03	FF 00	Latched Alarm Reset
00 04	FF 00	Peak Reset
00 05	FF 00	Valley Reset
00 0C	FF 00	Tare Command (00 00 resets Tare)

FC08: Diagnostics

Checks communications between the Master and Slave, and returns the count in the Modbus Slave counters (which are reset when the meter is reset).

Hex Sub Function Code	Data Send	Response Data	Description
00 00	Any	Same as sent	Returns Query Data (N x 2 bytes). Echo Request.
00 01	FF 00 00 00	FF 00 00 00	Restarts Communications. If in the Listen-Only mode, no response occurs. Takes Slave out of the Listen-Only mode and one of the following: Clears communications event counters. Does not clear communications event counters.
00 04	00 00	None	Forces Listen-Only. All addressed and broadcast Messages are monitored and counters are incremented, but no action is taken or response sent. Only Sub-Function 00 01 causes removal of this Listen-Only state.
00 0A	00 00	00 00	Clears all Modbus slave counters.
00 0B	00 00	Total Message Count	Returns total number of messages detected on the bus, including those not addressed to this Slave. Excludes bad LRC/CRC, parity error or length < 3.
00 0C	00 00	Checksum Error Count	Returns total number of messages with bad LRC/ CRC, parity or length < 3 errors detected on the bus including those not addressed to the Slave.
00 0D	00 00	Exception Error Count	Returns total number of Exception responses returned by the Addressed Slave or that would have been returned if not a broadcast message or if the Slave was not in a Listen-Only mode.
00 0E	00 00	Slave Message Count	Returns total number of messages, either broadcast or addressed to the Slave. Excludes bad LRC/CRC, parity or length < 3 errors.
00 0F	00 00	No Response Count	Returns total number of messages, either broadcast or addressed to the Slave, for which Slave has returned No Response, neither a normal response nor an exception response. Excludes bad LRC/CRC, parity or length < 3 errors.
00 11	00 00	Slave Busy	Returns total number of Exception Code 6 (Slave Busy) responses.

6.0 SUPPORTED EXCEPTION RESPONSE CODES

Code	Name	Error Description
01	Illegal Function	Illegal Function Code for this Slave. Only hex Function Codes 03, 04, 05, 08, 10 (dec 16) are allowed.
02	Illegal Data Address	Illegal Register Address for this Slave.
03	Illegal Data Value	Illegal data value or data length for the Modbus protocol.
04	Slave Device Failure	Slave device failure (eg. Transmitter set for external gate).

7.0 MESSAGE FORMATTING

MA = Meter Address	DD = Data (Hex)	CL = CRC Lo Byte
FC = Function Code	WW = Data (On/Off)	CH = CRC Hi Byte
RA = Register Address	SF = Sub-Function	CR = Carriage Return
NR = Number of Registers	EC = Error Code	LF = Line Feed
NB = Number of bytes	LRC = ASCII Checksum	

Modbus RTU Format

FC	Action	> 3.5 Char	Byte Number										
			1	2	3	4	5	6	7	8	9	10	11
03	Request	NoTx	MA	FC	RA	RA	NR	NR	CL	CH			
03	Response	NoTx	MA	FC	NB	DD*	DD*	CL	CH				
04	Request	NoTx	MA	FC	RA	RA	NR	NR	CL	CH			
04	Response	NoTx	MA	FC	NB	DD*	DD*	CL	CH				
05	Request	NoTx	MA	FC	RA	RA	WW	WW	CL	CH			
05	Response	NoTx	MA	FC	RA	RA	WW	WW	CL	CH			
08	Request	NoTx	MA	FC	SF	SF	WW	WW	CL	CH			
08	Response	NoTx	MA	FC	SF	SF	DD	DD	CL	CH			
10	Request	NoTx	MA	FC	RA	RA	NR	NR	NB	DD*	DD*	CL	CH
10	Response	NoTx	MA	FC	RA	RA	NR	NR	CL	CH			
Exception Response		NoTx	MA	FC +80	EC	CL	CH						

DD* = (DD DD) times NR (Number of Registers)

Modbus ASCII Format

FC	Action	Byte Number												
		1	2	3	4	5	6	7	8	9	10	11	12	13
03	Request	:	MA	FC	RA	RA	NR	NR	LRC	CR	LF			
03	Response	:	MA	FC	NB	DD*	DD*	LRC	CR	LF				
04	Request	:	MA	FC	RA	RA	NR	NR	LRC	CR	LF			
04	Response	:	MA	FC	NB	DD*	DD*	LRC	CR	LF				
05	Request	:	MA	FC	RA	RA	WW	WW	LRC	CR	LF			
05	Response	:	MA	FC	RA	RA	WW	WW	LRC	CR	LF			
08	Request	:	MA	FC	SF	SF	WW	WW	LRC	CR	LF			
08	Response	:	MA	FC	SF	SF	DD	DD	LRC	CR	LF			
10	Request	:	MA	FC	RA	RA	NR	NR	NB	DD*	DD*	LRC	CR	LF
10	Response	:	MA	FC	RA	RA	NR	NR	LRC	CR	LF			
Exception Response		:	MA	FC +80	EC	LRC	CR	LF						

DD* = (DD DD) times NR (Number of Registers)

8.0 MESSAGE EXAMPLES

All examples are for Transmitter Address = 01 and No Parity.

Ser_4 -> Addr ->	Action	Modbus RTU 010 001	Modbus ASCII 020 001
Restart Com- munications	Request Response*	010800010000B1CB 010800010000B1CB	:010800010000F6crlf :010800010000F6crlf
Meter Reset	Request Response	01050001FF00DDFA None	:01050001FF00FAcrlf None
Digital Reading * * * *	Request Response	01040003000281CB 010404000009D67C4A	:010400030002F6crlf :010404000009D618crlf
Write Setpoint 1 = +37.00***	Request Response	0110000100020400000E743624 01030400000E74FE74	:0110000100020400000E7466crlf :011000010002ECcrlf
Read Setpoint 1 = +37.00***	Request Response	01030001000295CB 01030400000E74FE74	:010300010002F9crlf :01030400000E7476crlf

* Suggested as first message after power-up. If transmitter is in Listen-Only mode, no response is returned. ** Example while reading +25.18 *** Decimal point is ignored.

9.0 INTERNAL REGISTERS: Please refer to the full Modbus Protocol Communications Manual.

14. CUSTOM ASCII PROTOCOL TRANSMITTER COMMUNICATIONS

1.0 SERIAL COMMUNICATION FORMAT

The Custom ASCII serial communication format for both RS232 and RS485 is the following:

Mode Full Duplex (Separate transmit and receive lines) and Half Duplex (RS485 only)
Baud Rate 300, 600, 1200, 2400, 4800, 9600, 19200 selectable with Instrument Setup software.
Parity None
Word length 8 data bits
Stop bit 1

This 5-page manual section provides some of the key programmable Custom ASCII protocol features. Our detailed Serial Communications manual can be downloaded from

www.transducertechniques.com/online-manuals.aspx.

2.0 MEASUREMENT DATA FORMAT

The basic measurement data format consists of 8 ASCII characters for analog input “DPM” transmitters, such as +999.99<CR>, where <CR> is the carriage return character. The first character is always a plus or minus sign. A decimal point is always furnished, even when it follows the last digit.

Adding a Line Feed Character to the Basic Format. Printers and other devices that receive the data may require a line feed character <LF> following the <CR>. The line feed character <LF> may be selected using Instrument Setup software.

Adding a Coded Data Character to the Basic Format. A coded character from A to H may be added to the data string according to the table below to indicate the alarm and overload status of the device. If used, this character precedes the <CR>, so that it is the last printable character in the string. With the optional <LF> and coded character selected, the data string will consist of 10 characters for analog input “DPM” transmitters, such as +999.99A<CR><LF>.

Alarm Status	No Overload	Overload
Neither Alarm set	A	E
Alarm 1 set only	B	F
Alarm 2 set only	C	G
Both Alarms set	D	H

For example, a coded character “G” indicates that Alarm 2 only is set and that the transmitter is in the overload condition. This information is useful when data is supplied to a computer for listing and analysis, or when data is supplied to a Remote Display in a Master-Slave configuration.

Values are transmitted in a continuous string with no intervening spaces. If the 5th digit in is set to 1 using Instrument Setup software, the termination characters of <CR> and optional <LF> appear after each value. If the 5th digit is set to 0, the termination characters appear only once at the end of the string. In either case, if included, the coded character appears at the end of the last value only.

3.0 NETWORK CONFIGURATIONS

Using the Custom ASCII protocol, TM Series transmitters can operate in a point-to-point mode using RS232 or RS485, or in a multi-point mode using RS485.

The point-to-point mode is a direct connection between a computer (or other digital device) and the transmitter. An device address can be selected; however, it is suggested that address 1 be selected as a standard for the point-to-point mode.

The multi-point mode is a connection from a host computer to a multiplicity of transmitters bused together with their inputs and outputs connected in parallel. For long cable runs, the last device should have a termination resistor installed. It is necessary to set up each device on the bus with a different address from 1 to 31. To command a particular device, its address is used in conjunction with the command, and only that device responds. The outputs of all of the devices on the bus are set to a high impedance state, except the device being addressed. The device addresses range from 1 to 31, with 0 being a special address to which a meter responds only internally (e.g. Reset), but does not transmit any response on the output lines. All devices may be commanded simultaneously with a 0 address, and there will not be any output response contention. Addressing of transmitters can be set with Instrument Setup software.

4.0 COMMAND MODE OVERVIEW

Using the Custom ASCII protocol, SST transmitters operate in the Command Mode only. In this mode, the device does not send data automatically, but responds to commands received from a host computer. These commands can be:

- To transmit the latest or peak measurement
- To reset the meter completely or just the peak value and/or latched alarms
- To display a value sent from the computer
- To transmit present setup parameters
- To receive new setup parameters,
- To monitor or alter data in selected memory locations of the meter.

5.0 COMMAND MODE FORMAT

CHAR 1 - Command Identifier

All commands begin with “*” followed by the meter address, then a command letter followed by a sub-command number or letter. Additional characters may be appended. All commands terminate with <CR> (<LF> ignored).

Char #	Character	Description
1	*	Command Identifier. Recognition Character.
2	0-V	Device Address. 0 addresses all devices, 1-V specific devices.
3	A-Z	Command Function
4	0-U	Sub-command. Number of Bytes of RAM or Words (2 Bytes) of non-volatile memory data being transferred.

CHAR 2 - Address Codes

A Serial Communications Address Code from 1 to V follows the “*” to indicate the device address number from 1 to 31.

Device #	Address Code	Device #	Address Code	Device #	Address Code
1	1	12	C	23	N
2	2	13	D	24	O
3	3	14	E	25	P
4	4	15	F	26	Q
5	5	16	G	27	R
6	6	17	H	28	S
7	7	18	I	29	T
8	8	19	J	30	U
9	9	20	K	31	V
10	A	21	L		
11	B	22	M		

CHARS 3 & 4 - Commands and Subcommands

The examples below use a default address of 1 following the “*”. Substitute the desired address from the above table of Serial Comm Address Codes. All command sequences shown must terminate with <CR>, followed by an optional <LF>.

Request DPM Values

Get reading** *1B1

Peak reading *1B2

Valley reading *1B3

** The meter transmits the output items selected with Instrument Setup software.

Reset Functions, DPM Transmitter

Cold reset *1C0 Reads NVMEM into RAM locations after RAM is zeroed.

Latched alarms reset *1C2

Peak value reset	*1C3
Remote display reset	*1C4
Valley reset	*1C9
Tare function	*1CA
Tare reset	*1CB

6.0 READING AND WRITING TO RAM AND NONVOLATILE MEMORY

CHAR 1, 2

The Recognition character and Meter Address Code are the same as shown in previous table.

CHAR 3

Command character:

G	Read bytes from RAM Memory
F	Write bytes to RAM Memory (DPM and Scale meter only)
R	Read bytes from Upper RAM Memory
Q	Write bytes to Upper RAM Memory
X	Read words from Non-Volatile Memory
W	Write words to Non-Volatile Memory

CHAR 4

Command character. Sub-command. Number of Bytes of RAM or Words (2 Bytes) of non-volatile memory data being transferred.

Code #	Number
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
A	10

Code #	Number
B	11
C	12
D	13
E	14
F	15
G	16
H	17
I	18
J	19
K	20

Code #	Number
L	21
M	22
N	23
O	24
P	25
Q	26
R	27
S	28
T	29
U	30

CHAR 5, 6

See tables for the RAM MEMORY ADDRESSES and NONVOLATILE MEMORY ADDRESSES with their respective data definitions.

General, Reading and Writing Ram Memory Data

RAM memory data is read and written as a continuous string of bytes consisting of 2 hex characters (0-9,A-F) per byte. Included in the command are the total number of bytes to be transferred and the most significant address in RAM of the continuous string of bytes. The format is:

Read lower RAM data *1Gnaa
Write lower RAM data *1Fnaa<data>
Read upper RAM data *1Rnaa
Write upper RAM data *1Qnaa<data>

where:

n is the number of bytes to be read or written.

aa is the most significant address in RAM of the bytes to be read or written.

<data> is n bytes of 2 hex characters per byte in order from the most to the least significant byte.

The number of bytes n consists of a single code character representing values from 1 to 30 as shown above under CHARACTER 4. The most significant address aa consists of 2 hex characters as shown below under RAM MEMORY ADDRESSES AND DATA DEFINITIONS.

General, Reading and Writing Nonvolatile Memory Data

Nonvolatile data is read and written as a continuous string of words consisting of 2 bytes or 4 hex characters (0-9,A-F) per word. Included in the command is the total number of words to be transferred and the most significant address in nonvolatile memory of the continuous string of words. The format is:

Read nonvolatile memory data *1Xnaa (followed by Meter reset)
Write non-volatile memory data *1Wnaa <data> (followed by Meter reset)

where:

n is the number of words to be read or written.

aa is the most significant address in nonvolatile memory of the words to be read or written.

<data> is n words of 2 bytes or 4 hex characters per word in order from the most to the least significant address.

The coded number of words n consists of a single character representing values from 1 to 30 as shown under CHARACTER 4. The most significant address aa consists of 2 hex characters as shown under NONVOLATILE MEMORY ADDRESSES.

15. SST TRANSMITTER SPECIFICATIONS

Load Cell & Microvolt Input Signal Conditioner

Full scale ranges 20.000 mV, 50.000 mV, 100.00 mV, 250.00 mV, 500.00 mV
Input resistance 1 Gohm
Input accuracy at 25°C $\pm 0.01\%$ of full span ± 2 counts
Max applied voltage 35V

Transducer Excitation Output (standard)

Excitation level (factory default) 10 Vdc $\pm 5\%$, 120 mA
Other excitation levels (jumper selectable) 5 Vdc $\pm 5\%$, 100 mA; 24 Vdc $\pm 5\%$, 50 mA
Output Isolation 50 Vdc to meter ground

Analog to Digital Conversion)

Conversion rate 60/sec at 60 Hz power, 50/sec at 50 Hz power
Input resolution 16 bits (65,536 steps)

Input Signal Noise Rejection

CMV, DC to 60 Hz 250V RMS
CMR, DC to 60 Hz 130 dB
NMR at 50/60 Hz 90 dB with no digital filtering
Input filtering User-selectable digital time constants from 80 ms to 9.6 s

Transmitter Setup

Selection of signal ranges Jumpers on signal conditioner board
Selection of serial format, excitation output, analog output Jumpers on main board
Programming Via PC using Instrument Setup software and serial cable

TEDS Compliance

Standards compliance TEDS IEEE 1451.4
Software support TEDS Reader_Editor Software (available as an accessory)

Analog Output (standard)

Output levels 4-20 mA, 0-20 mA, 0-10V, -10V to +10V (user selectable)
Compliance at 20 mA 10V (0 to 500 ohm load)
Compliance at 10V 2 mA (5 kohm or higher load)
Output resolution 16 bits (65,536 steps)
Output accuracy $\pm 0.02\%$ of full span
Output isolation Safety rated to 250 Vrms, 4.2 kV per High Voltage Test

Serial I/O (standard)

Serial formats RS232 or RS485 (half or full duplex), user selectable
Serial protocol Custom ASCII or Modbus (RTU or ASCII)

Modbus Compliance Modbus over Serial Line Specification V1.0 (2002)
 Serial connector Detachable screw terminal plugs
 Baud rates 300, 600, 1200, 2400, 4800, 9600, 19200 baud
 Output isolation Safety rated to 250 Vrms, 4.2 kV per High Voltage Test

Dual Relay Output (standard)

Relay type Two solid state relays, SPST, normally open, Form A
 Load rating 120 mA at 140 Vac or 180 Vdc, 28 ohms series resistance

Power & Electrical

Power to Transmitter (standard power) 85-264 Vac or 90-300 Vdc
 Power to Transmitter (low voltage power option) 12-32 Vac or 10-48 Vdc
 Power Isolation Safety rated to 250 Vrms, 4.2 kV per High Voltage Test

Mechanical

Case dimensions 120 x 101 x 22.5 mm
 Case mounting 35 mm DIN rail per EN 50022
 Electrical connections Detachable screw plug connectors

Environmental

Operating temperature 0°C to 70°C
 Storage temperature -40°C to 85°C
 Relative humidity 95% from 0°C to 40°C, non-condensing

16. ACCESSORIES

DPM-3-AD9

Adapter Connector



INSTALLATION INSTRUCTIONS

1. Remove the three (3) connectors from the J5 location at the rear of the DPM-3 meter (See DPM-3 Operator Manual, Page 6, Section 5.1 for illustration of J5 location)
2. Install the **DPM-3-AD9** Adapter Connector at the J5 location

Wiring Diagram / Schematic

Figure 1 NON-TEDS Load Cell / Torque Sensor

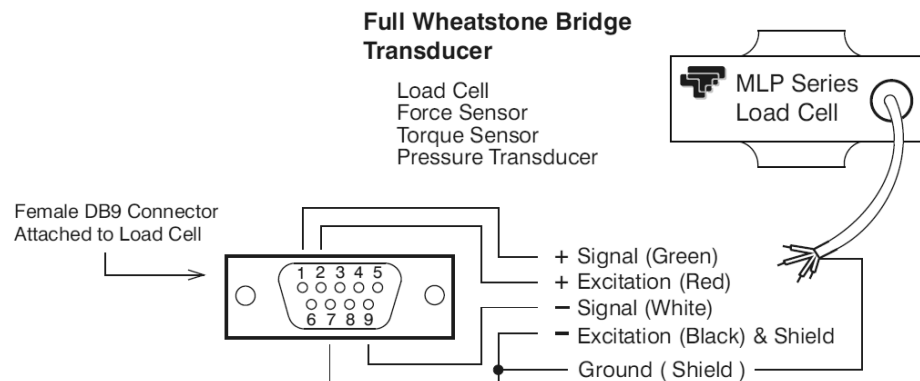
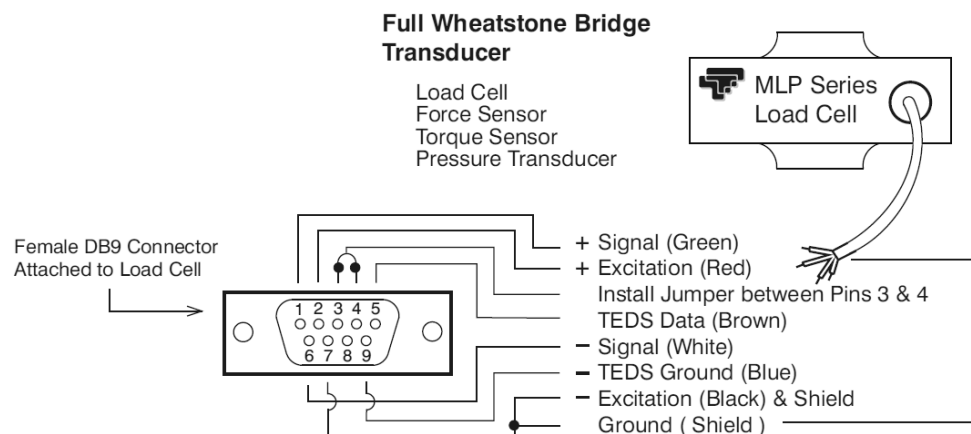


Figure 2* TEDS IEEE 1451.4 Smart Load Cell / Torque Sensor



* Compatible for use with IEEE 1451.4 compliant National Instruments devices

DPM-3-PC6 & DPM-3-PC12

Transmitter Power Cable. Also usable with TTI DPM-3 digital panel meters.



SST-RS232-AD9

Serial Output Cable to PC COM Port



SST-USB-AD9

Serial to USB Adapter Cable & Disk.
Can be connected to SST-RS232-AD9.



DPM-3-DLS

Data Logging Software

DPM-3-TRES

TEDS Reader_Editor Software



17. WARRANTY & REPAIR POLICY

Limited Warranty on Products

Any of our products which, under normal operating conditions, proves defective in material or in workmanship within one (1) year from the date of shipment by Transducer Techniques, will be repaired or replaced free of charge provided that you obtain a return material authorization from Transducer Techniques and send the defective product, transportation charges prepaid with notice of the defect, and establish that the product has been properly installed, maintained, and operated within the limits of rated and normal usage. Replacement product will be shipped F.O.B. our plant. The terms of this warranty do not extend to any product or part thereof which, under normal usage, has an inherently shorter useful life than one year. The replacement warranty detailed here is the Buyer's exclusive remedy, and will satisfy all obligations of Transducer Techniques, whether based on contract, negligence, or otherwise. Transducer Techniques is not responsible for any incidental or consequential loss or damage which might result from a failure of any Transducer Techniques' product. This express warranty is made in lieu of any and all other warranties, expressed or implied, including implied warranty of merchantability or fitness for particular purpose. Any unauthorized disassembly or attempt to repair voids this warranty.

Obtaining Service Under Warranty

Advance authorization is required prior to the return to Transducer Techniques. Before returning the item(s), either write to the Repair Department c/o Transducer Techniques, 42480 Rio Nedo, Temecula, CA 92590, or call (951) 719-3965 with: 1) a part number; 2) a serial number for the defective product; 3) a technical description of the defect; 4) a no-charge purchase order number (so products can be returned to you correctly); and, 5) ship to and bill to addresses. Shipment to Transducer Techniques shall be at Buyer's expense, and repaired or replacement items will be shipped F.O.B. our plant in Temecula CA. Non-verified problems or defects may be subject to a \$75 evaluation charge. Please return the original calibration data with the unit.

Obtaining Non-Warranty Service

Advance authorization is required prior to the return to Transducer Techniques. Before returning the item(s), either write to the Repair Department c/o Transducer Techniques, 42480 Rio Nedo, Temecula, CA 92590, or call (951) 719-3965 with: 1) a model number; 2) a serial number for the defective product; 3) a technical description of the malfunction; 4) a purchase order number to cover Transducer Techniques' repair cost; and 5) ship to and bill to addresses. After the product is evaluated by Transducer Techniques, we will contact you to provide the estimated repair costs before proceeding. The minimum evaluation charge is \$75. Shipment to Transducer Techniques shall be at Buyer's expense, and repaired items will be shipped to you F.O.B. our plant in Temecula, CA. Please return the original calibration data with the unit.

Repair Warranty

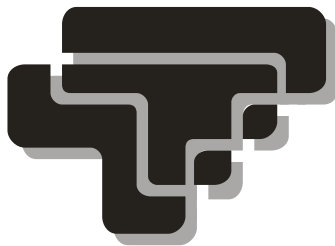
All repairs of Transducer Techniques' products are warranted for a period of 90 days from the date of shipment. This warranty applies only to those items which were found defective and repaired; it does not apply to products in which no defect was found and returned as is, or merely re-calibrated. Out of warranty products may not be capable of being returned to the exact original specifications or dimensions.

FOR TECHNICAL SUPPORT, CALL (800) 344-3965 OR FAX (951) 719-3900

Load Cells Force/Torque Sensors™

(800) 344-3965

***E-mail: tti@ttloadcells.com
www.transducertechniques.com***



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Techniques®**

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