Honeywell Precision Pressure Transducer 2



PPT2 User's Manual



ADS-14221 Rev. 10/16

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1.0 Product Overview

The Honeywell Model PPT2 Precision Pressure Transducers provide high accuracy pressure readings in both digital and analog form. The first-time user will be able to use the PPT2 within minutes, yet capability exists to configure the PPT2 to optimize performance in the User's specific applications. Throughout this User's Manual, the PPT2 may be referred to as Precision Pressure Transducer.

The heart of the PPT2 measuring system is a silicon piezoresistive sensor which contains both pressure and temperature-sensitive elements. Digital signals representing temperature and pressure are processed by the PPT2 microprocessor to produce calibrated, temperature-compensated pressure readings over the entire operating temperature and pressure range.

Both the analog and digital outputs are internally corrected over the full operating range. The PPT2 has a digital accuracy of 0.075% of full scale (FS). Note that full scale for a 20 psig and a 20 psia is 20 psi, but for a 20 psid it is 40 psi, the sum of + Full scale and – Full Scale. This is important to note when determining the accuracy allowance.

The PPT2 receives commands and sends digital data using either an RS-232 serial port or a multi-drop RS-485 serial port of a computer. (Note: many newer computers will have only USB ports, no RS-232 or RS-485 ports. A USB converter can be used to provide the required RS-232 or RS-485 port.)

Using the RS-232 type PPT2, up to 89 units can be connected in a ring configuration to a single serial port of a computer. The RS-485 type PPT2 allows up to 89 PPT2's to be connected to a two-wire multi-drop bus. Group (multicast) addressing allows up to nine groups of PPT2's to be addressed with a single command. Global (broadcast) addressing will send a command to all PPT2's on the serial bus.

Any computer having a serial port and terminal emulation software can be connected to the PPT2 to allow the user to set baud rates, reading rates, reading resolution, units of pressure and other choices. (User modified functions must be set through the digital interface, using a computer with a serial port). The user-modified functions may either be used temporarily, until the PPT2 is powered down, or may be stored in the PPT2 internal EEPROM to automatically configure the PPT2 each time power is applied.

Analog output from the PPT2 16-bit digital-to-analog converter may be obtained without a host computer.

2.0 Getting Started

2.1 OVERVIEW

The first-time user should approach the PPT2 in a manner analogous to using a word processor program; i.e., many features are available but one may begin by using only those of interest at the moment.

As shipped from the factory, the default settings provide a pressure transducer that will be usable for many applications. Once the user is familiar with the performance and command structure, changes may be made and stored using the 'Store Parameters' (SP) command. Once stored, the user-defined settings are activated each time the PPT2 is powered up. This tailors the performance of the PPT2 to meet the needs of a particular application.

2.2 EQUIPMENT NEEDED

To prepare the PPT2 for operation, three items are needed:

• A mating connector with proper wiring connections (see connector part number and wiring diagrams in Section 6);

- A DC power supply;
- A source of pressure that is properly matched to the range and type of the PPT.

To operate the PPT2 in the analog output mode, one additional item is needed:

• *Voltage Output* - A five digit voltmeter with 0-5 volt range connected between Analog Out and Signal Common. A computer is not required to read the Analog output.

To operate the PPT2 in the digital output mode, one additional item is needed:

• A computer, or host processor, having an RS-232 or RS-485 serial port (or suitable USB adapter) and terminal emulation program.

The wiring diagram designates which PPT2 pins must connect to the computer "send", "receive" and "common" pins for proper communications.

2.3 TERMINAL PROGRAM SETTINGS

• Enter the following settings in the terminal program:

Baud Rate:	9600
Start Bits:	1
Data Bits:	8
Stop Bits:	1
Parity:	None

- Attach a line feed to the carriage return.
- Turn the local echo ON.

When shipped from the factory, the PPT2 is set to a baud rate of 9600, 1 start bit, 8 data bits with no parity and 1 stop bit. If the baud rate has been subsequently changed, and is unknown, it will be necessary to search all baud rate values to reestablish communication. See the BP command description in Section 5 of this manual for possible settings.

2.4 INITIAL TURN-ON RESPONSE

Analog Output

The factory default analog output will provide a voltage (range 0-5V) which, when ambient pressure is applied to the PPT2, reads:

Pressure Type	Voltage Output (@ zero applied pressure)
Gauge units	0 volt
Differential units	2.5 volts
Absolute units	A voltage representing atmospheric pressure

Digital Output

Once the wiring connections and terminal program settings are complete, the PPT2 will automatically send the following response (or similar to) when power is applied. This reply will be generated any time power to the PPT2 is cycled off and on.

Typical Reply:

?00PPT2___10__psid

The "?00" indicates a default address device called a "null address". This PPT2 has not yet been assigned an ID number by the user, so it assumes the null address. The "PPT2___10__psid" indicates a 10 psi differential device.

2.5 COMMAND FORMAT

Any command interaction with the PPT2 requires electrical connection to the RS-232 or RS-485 serial communications pins. There are two basic types of commands – action directing commands and information requesting commands. These are described in Commands – Section 5.

Typical PPT2 commands have the form *ddcc = nnn <cr>

Where:

* is the command header character

dd is the integer address of the PPT (00 - 89)

cc is a command (refer to Commands – Section 5 for a complete description of commands)

= equal sign (required in some commands)

nnn additional characters (required in some commands)

<cr> carriage return is required to end all commands (do not type "<cr>", press the ENTER/RETURN key)

2.6 STEP-BY-STEP EXAMPLES (For a single PPT2 connection, default 00 address)

READ A SINGLE PRESSURE

Once the PPT2 is powered up and connected to a computer, enter the following command: (do not type "<cr>", press the ENTER/RETURN key)

User Types on the keyboard:

*00P1 <cr>

PPT2 Response:

?00CP=14.4582

Where

*	indicates the start of a command
00	is the null address of the PPT2 (see note below)
P1	is the command to read the most current pressure

Note: The "?" indicates the response from a null addressed PPT2– one which has not been assigned a device ID. A null address, 00, is coded into each PPT2 at the factory. Refer to the ID command in Section 5 for a description of addresses and responses.

The "CP=14.4582" indicates a compensated pressure of 14.4582 psi. (Your unit may not show this specific reading, depending on the applied pressure it is measuring.)

SET DEVICE ID

To give the PPT2 an assigned address of 01 up to 89, enter the following commands:

*00WE<cr> This enables the PPT2 to change a parameter in RAM

*00ID=01<cr> This sets the null addressed PPT2 to device ID=01.

Note: The new device ID is now used in subsequent commands

*01S=<cr>

Response: #01S=00052036 (serial number)

The "#" now replaces the "?" in the header and indicates the PPT2 response is from an addressassigned unit.

READ PRODUCTION DATE

To read the production date, enter the following command:

*01P=<cr>

Response: #01P=04/13/11

READ CONTINUOUS PRESSURE

For continuous pressure readings (factory default rate = 5 per second) enter the following command:

- *01P2<cr> This enables a continuous stream of compensated pressure readings to flow into the terminal program.
- \$*99IN<cr> This is the best way to stop the continuous pressure reading commands. The '\$' character temporarily stops, or suspends, the digital output of the PPT2. The *99IN command stops the continuous pressure or temperature readings.

CHANGE TO A NEW READING RATE

Enter the following command:

- *01WE <cr> This enables the PPT2 RAM to accept a changed parameter.
- *01I=M200<cr> This sets the integration time to value M200, which corresponds to an output reading every 2 seconds.

The reading rate will change to one every 2 seconds. I= is an abbreviation for Integration time, which determines how long to accumulate corrected pressure values between readings. Each integration period gathers the data for one pressure reading output (see Section 4.2 What is integration?). The range of integration times can be set by specifying readings per second (I=R50 for 50 readings/sec) or in 10 millisecond intervals (I=M600 for 6 seconds). The factory-set integration time is 200 milliseconds or 5 readings per second (I=M20).

The output data rate can also be altered by use of the idle count (IC) command or by changing the operating mode (OP) command. See Section 5 for description of these commands.

REPEAT THE READ CONTINUOUS PRESSURE STEP ABOVE

Notice the slower output rate of one reading every 2 seconds.

TRY OTHER COMMANDS

Experiment with other commands to become familiar with the command structures. A short overview of each command with input and response examples is shown in Section 3 Command Summary. See Section 5— Commands for complete command descriptions. Until an SP=ALL command is executed, no changes will be stored in the PPT2 EEPROM. Re-apply the power or send an IN=RESET command to revert to the settings last saved in EEPROM.

3.0 PPT2 Command Summary

The PPT2 command set is summarized in Table 1.0 – Command List. A more detailed description of each command can be found in the subsequent command descriptions in Section 5.

Table heading explanations for Table 1.0 – Command List:

Command Code:	Two-character code (cc) in the command format (see Section 2.5). The command code characters may be one letter followed by an '=' equal sign, two letters, or a letter and a number. The letters are not case sensitive; i.e. either upper case or lower case may be used. (The PPT2 internally converts all lower case characters to upper case.)
Action Directing Command:	Does this command change the PPT2 configuration?
	Yes – The command changes the PPT2 configuration as an action directing command.
	No – The command is only an Information Request Command.
Information Request Command	: The command initiates a response (output) from the PPT2, with the output content being specific to that particular PPT2.
Sequential Response with Grou	up or Global Address:
	Commands that begin with a group or global address (ID=90-99), are passed through the PPT2 ring configuration network from one device to the next and eventually end up back at the host computer. The PPT2 response is sent with the command through the network.
	Before – The PPT2 response is sent <u>before</u> the group or global command is repeated.
	After – The PPT2 response is sent <u>after</u> the group or global command is repeated.
	No – The PPT2 just passes the command through the network with <u>no</u> response.
Input or Output:	Is information input to the PPT2 or output from the PPT2?
	In – Command is only used to input (action direct command) to the PPT2.
	Out – Command is only used to request output (Information Request Command) from the PPT2.
	Both – Command can be used for either IN or OUT purposes.
Requires Write Enable:	Is a WE command required before for this command?
	Yes – When sent as an action directed command, it must be preceded by a WE command.
	No – Never requires a WE command beforehand. These are Information Request Commands.
Terminates Continuous Comma	ands:
	Will this command stop the PPT2 digital output flow?

Yes – This command will end the continuous flow of the P2, P4, or T2 replies.

No – Command will not stop the continuous digital output flow.

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Write to EEPROM:	Can this command have parameters stored in EEPROM?
	Yes – Parameter values associated with this command may be stored in EEPROM.
	No – Cannot store anything from this command in EEPROM.
	All – Cause all parameters to be stored in EEPROM.
Write to DAC:	Can this command be written to the DAC?
	Yes – Command may be directed to the DAC.
	No – Command is not associated with the DAC.

Table 1.0 – Command List, Grouped by Function See previous page for descriptions of the table headings.

,	Command Code	Action Directing Command	Sequence of Response with (90-99) Addresses	Input or Output Type	Requires Write Enable	Terminates Continuous Commands	Can Write to EEPROM?	Can Write to DAC?	Command Description
Pressu	re Read	ings							
	<u>P1</u>	No	Before (5)	Out	No	No	No	No	Pressure, Single, ASCII Format
	<u>P2</u>	No (3)	After	Out	No	Yes (8)	No	No	Pressure, Continuous, ASCII Format
	<u>P3</u>	No	Before (5)	Out	No	No	No	No	Pressure, Single, Binary Format
	<u>P4</u>	No (3)	After	Out	No	Yes (8)	No	No	Pressure, Continuous, Binary Format
Pressu	re Units	•							
	DU	Yes	Before	Both	Yes (6)	No	Yes (9)	No	Display Units Control
	<u>U=</u>	Yes	After (4)	Both	Yes (6)	No	Yes (9)	No	User Supplied Display Units
Pressu	re Sens	or Tem	perature R	leading	<u>js</u>				
	<u>T1</u>	No	Before (5)	Out	No	No	No	No	Sensor Temperature, Single, °C
	<u>T2</u>	No (3)	After	Out	No	Yes (8)	No	No	Sensor Temperature, Continuous, °C
Transd	ucer Inf	ormatio	on						
	<u>ID</u>	Yes	Before	Both	Yes (6)	No	Yes (9)	No	Identification Number
	<u>M=</u>	Yes	After (4)	Out	No	No	No	No	Maximum Full Scale Pressure
	<u>P=</u>	No	After (4)	Out	No	No	No	No	Production Date
	<u>S=</u>	No	After (4)	Out	No	No	No	No	PPT2 serial number
	<u>V=</u>	No	After (4)	Out	No	No	No	No	PPT2 Firmware Version
Pressu	re Read	ing Mo	difiers						
	<u> =</u>	Yes	After (4)	Both	Yes (6)	No	Yes (9)	No	Integration Time
	<u>IC</u>	Yes	Before	Both	Yes (6)	No	Yes (9)	No	Idle Count Parameter
	<u>CM</u>	Yes	Before	Both	Yes (6)	No	Yes (9	No	Compatibility Mode (new command)
	<u>DS</u>	Yes	Before	Both	Yes (6)	No	Yes (9)	No	Deadband and Sensitivity Control
Pressu	re Wind	ow Cus	stomizatio	n, Calil	oration	, and Co	ontrol		
	<u>F=</u>	Yes	After (4)	Both	Yes (6)	No	Yes (9)	No	Customized Full Scale Pressure Range
	<u>T=</u>	Yes	After (4)	Both	Yes (6)	No	Yes (9)	No	Set Tare Value
	<u>TC</u>	Yes	Before	Both	Yes (6)	No	Yes (9)	No	Tare Control Switch
	<u>X=</u>	Yes	After (4)	Both	Yes (6)	No	Yes (9)	No	Slope 1, User Compensation Control
	<u>Y=</u>	Yes	After (4)	Both	Yes (6)	No	Yes (9)	No	Slope 2, User Compensation Control
	<u>Z=</u>	Yes	After (4)	Both	Yes (6)	No	Yes (9)	No	Offset, User Compensation Control
Analog	Custor	nizatior	n, Calibrati	on, an	d Cont	rol		I	L
	<u>AN</u>	Yes	Before	Both	Yes (6)	No	Yes (9)	No	Analog Range Setting
	<u>DX</u>	Yes	After (4)	Both	Yes (6)	No	Yes (9)	No	DAC Slope Compensation Control (new command)
	<u>DZ</u>	Yes	After (4)	Both	Yes (6)	No	Yes (9)	No	DAC Offset Compensation Control (new command)
	<u>H=</u>	Yes	After (4)	Both	Yes (6)	No	Yes (9)	Yes (11)	Highest Analog Voltage

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<u>L=</u>	Yes	After (4)	Both	Yes (6)	No	Yes (9)	Yes (11)	Lowest Analog Voltage
<u>0=</u>	Yes	After (4)	Both	Yes (6)	No	Yes (9)	Yes (11)	Offset Pressure Window (analog output)
<u>W=</u>	Yes	After (4)	Both	Yes (6)	No	Yes (9)	Yes (11)	Width of Analog Window
<u>N=</u>	No (3)	After (4)	Both	No (7)	No	No	Yes (11)	Send Number to DAC (force analog output)

Diagnostic and Reset Control

<u>ск</u>	No	After (4)	Out	No	No	No	No	Check Memory
<u>IN</u>	No (2)	No	In	No	Yes	No	No	Initialize PPT2 Microprocessor
<u>RS</u>	No	Before (5)	Out	No	No	No	No	Read Status

Operating Parameters

0								
<u>BP</u>	Yes	After (4)	In	Yes	Yes	Yes (9)	No	Baud Rate and Parity Setting
<u>DA</u>	Yes	Before	Both	Yes (6)	No (12)	Yes (9)	Yes (10)	Digital and Analog Control
DO	Yes	Before	Both	Yes (6)	No	Yes (9)	No	Default Operating Parameters
MO	Yes	Before	Both	Yes (6)	No	Yes (9)	No	Power-up Mode
<u>OP</u>	Yes	Before	Both	Yes (6)	No	Yes (9)	No	Operating Mode Parameters
<u>T0</u>	Yes	Before	Both	Yes (6)	No	Yes (9)	No	Transceiver Operating Parameters

Utility

<u>A=</u>	No	After (4)	Both	Yes	No	Yes (9)	No	Data string A
<u>B=</u>	No	After (4)	Both	Yes	No	Yes (9)	No	Data string B
<u>C=</u>	No (1)	After (4)	Both	Yes				
<u>D=</u>	No (1)	After (4)	Both	Yes	No	Yes (9)	No	Data string D
<u>FD</u>	Yes	No	In	Yes	No	No	No	Restore Factory Defaults (new command)
<u>NE</u>	No	No	In	No	No	Yes (9)	Yes	Analog Output Enable
<u>SP</u>	Yes	No	In	Yes	No	All	No	Store RAM parameters in EEPROM
<u>WE</u>	Yes	No	In	No	No	No	No	Write enable for RAM/EEPROM
<u>\$</u>								Suspend Continuous Readings

COMMAND LIST NOTES

- (1) The **C=** and **D=** commands do not change the mode of operation but do provide a user supplied power-up message if configured using the **MO** command.
- (2) The IN command does not change the operating parameters stored in RAM, but it does stop continuous readings (P2, P4, T2 commands). If the IN=RESET command is sent, then any parameters that were stored in RAM, and were not stored in the EEPROM with a SP command, will default to the last stored EEPROM value. This may cause a change in the operational parameters as well as a configuration change.
- (3) The **P2**, **P4**, and **T2** commands do not change the operating parameters, only activate continuous readings. The **N=** command does not change any operating parameter values only the DAC analog output voltage.
- (4) When this information request command is sent to a group or global address, the PPT2s do not immediately respond with their output. The command is repeated from PPT2 to PPT2 in a ring configuration network, and eventually returned to the host processor. Each PPT2 appends its own response as it forwards the command. Also, this command requires more time for execution, of EEPROM reads, so responses from more than one PPT2 are not received in any guaranteed order. During the execution of one of this command, if another command is received that is an "After" type, whether globally, group, or individually addressed, the received command is rejected and the command read status error (see **RS** command) is set.
- (5) These commands may cause sequential responses from any, all or none of the addressed units. A sequential response is when the PPT2 reply is sent before the global or group command through the network. See the individual command descriptions for detailed information.
- (6) These commands only require a write enable (WE) when used in the action directing form. For these commands the WE command provides a single occurrence write enable for RAM update. That is, only the next instruction is written to RAM. The WE=RAM command provides continuous write enables for RAM for multiple command updates. The continuous RAM enable is active until a WE is sent.
- (7) The N= command requires an NE command enable when used to send information. The NE command provides single occurrence write enable for analog control. The NE=DAC command can be used to provide continuous write enable for analog control.
- (8) These commands terminate an active continuous reading command (**P2**, **P4**, **T2**) and initiate the new one.
- (9) These commands can be used to change RAM contents which can then be written to the EEPROM using the **SP=ALL** command.
- (10) The **DA** command does not write to the DAC but it does allow the DAC to be controlled by the PPT2 input pressure value or by a digital value applied by the **N**= command.
- (11) These commands only write to the DAC when used in the action directing form.
- (12) A P2 mode will be cancelled when a DA= A, C, F, G or N parameter is selected. A P4 mode can be cancelled when a DA=A, E, M or N parameter is selected.

COMMAND FORMAT

W

Communication between the host or control processor and a PPT2 is accomplished by message transfers, or commands and replies. Communications initiated by the host processor to one or more PPT2s are called commands and must begin with an '*' header character. (For RS-485 PPT2s, alternate header characters are available, using the **MO** command.) All commands must be terminated by a <cr> (carriage return or ENTER key). Communications initiated by a PPT2 to the host are called responses or replies, and begin with one of ten unique header characters (2 for ASCII responses, 8 for binary format responses).

Commands may request information from one or more PPT2s such as read pressure, or direct action to one or more PPT2s such as change a command value or operating mode.

Typical PPT2 command format: *ddcc = nnn <cr>

here: *	is the command header character
dd	is the decimal address of the command message (00-99)
СС	is the command code. Command code characters sent to the PPT2 are not case sensitive; i.e.,
	either an upper case or lower case may be used. Responses from the PPT2 will have capitalized command code characters. Example: #01CP=14.2426
=	equal sign (required in some commands)
nnn	additional characters (required in some commands)
<cr></cr>	carriage return (the ENTER key on a standard keyboard)

Note: For RS-485 mode, alternate headers are available. (see MO command)

In an RS-232 network, when manually applying commands to one or more PPT2s which are in the continuous send mode (**P2, P4, T2,**), the special header character '\$' should be used to suspend all PPT2 transmissions while the command message is being typed. The '\$' is immediately followed by the normal command format.

In the case of an RS-232 network, if an erroneous command is sent to the PPT2, it is echoed back to the host as soon as the PPT2 recognizes it as an invalid command. For example, if the user tries to enter *01S2=15 (S2 is not a valid command for the PPT2), *01S2 would immediately be echoed back. The other instance of an echoed command is when a group or global address command (ID = 90 to 99) is sent, such as *99I=R15<cr>. Group/global addresses will <u>always</u> echo the command back to the host processor after being read by all PPT2s in the network.

PRESSURE READING DECIMAL POSITION

The table below shows the number of decimal place variations with respect to PPT2 full scale - the number of digits to the right and left of the decimal place. This is valuable when converting a binary format number so that the proper decimal position can be determined.

If CM=ON (PPT Compatibility Mode), subtract 1 from the "Digits to Right" column of the table below.

Full Scale *	Digits	Digits	Digit to Left if	Negative Values
(current Display Units)	to Left	to	-1< reading < 1	_
		Right	_	
≥ 9,000,000	8	1	0, padded w/ leading spaces	"-" inserted after "="
≥ 900,000 and <	7	1	0, padded w/ leading spaces	"-" inserted after "="
9,000,000				
≥ 90,000 and <	6	1	0, padded w/ leadings	"-" inserted after "="
900,000			spaces	
≥ 9,000 and < 90,000	5	1	0, padded w/ leading spaces	"-" inserted after "="
≥ 900 and < 9000	4	2	0, padded w/ leading spaces	"-" inserted after "="
≥ 90 and < 900	3	3	0, padded w/ leading spaces	"-" inserted after "="
≥ 9 and < 90	2	4	0, padded w/ leading space	"-" inserted after "="
≥ 0.9 and < 9	1	5	0	"-" inserted after "="
≥ 0.09 and < 0.9	1	6	0 or "-"	Leading zero replaced with "-"
≥ 0.009 and < 0.09	1	7	0 or "-"	Leading zero replaced with "-"
≥ 0.0009 and < 0.009	1	8	0 or "-"	Leading zero replaced with "-"
< 0.0009	1	9	0 or "-"	Leading zero replaced with "-"

* For differential units, when determining decimal point position the Full Scale is the maximum positive pressure (5 psid = 5, 20 psid = 20, etc)

Whether OP=E (extended) or OP=F (fixed) also has an impact upon how the data is displayed.

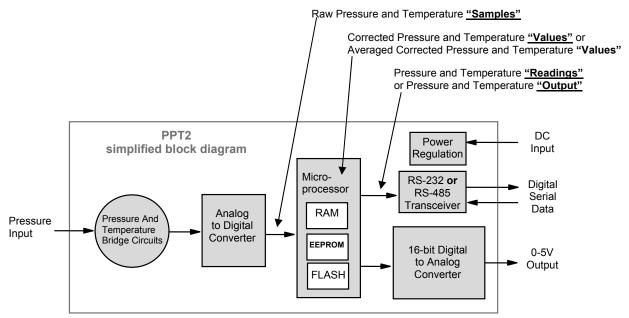
Example readings:

5 psid, OP=E, F=O (5 psi)		
<pre>?00CP=-0.00141 ?00CP=0.02373 ?00CP=-3.00537 ?00CP=2.36973</pre>	(positive (negative	<pre>reading > -1) reading < 1) reading < -1) reading > 1)</pre>
5 psid, OP=F, F=O (5 psi)		
<pre>?00CP=-0.01442 ?00CP= 0.00454 ?00CP=-4.37939 ?00CP= 3.80066</pre>	(positive (negative	<pre>reading < -1) reading < 1) reading < -1) reading > 1)</pre>
5 psid, OP=E, F=0.8 psi		
?00CP=551017 ?00CP=0.804965	(negative (positive	=
5 psid, OP=F, F=0.8 psi		
?00CP=779264 ?00CP=0.733452	(negative (positive	2

DA={O S T U}	Digital and Analog Control
DO=N P	Noise Protection in P4 mode
NE=ZER[O,V]	NE Command Extension
RR	Reading Rate
S2	Speed Shift x2
S5	Speed Shift at 50msec Intervals
SI	Synchronize Integration Cycles
ТЗ	Temperature, Single, °F
T4	Temperature, Continuous, °F
TO=R M	Special Ring and Multi-drop protocol functionality
TO=C A S H	Synchronization functionality
TO=N P	Normal and Prompted RS-485 group/global read operations
~	Command Header for Binary DAC Values

PPT Commands/Parameters Not Implemented in PPT2

4.0 Terminology



4.1 WHAT IS INTEGRATION?

The input pressure is converted to an analog electrical signal at the pressure sensor. This signal feeds into a delta-sigma analog-to-digital (A/D) converter where it is changed into a digital signal representing the pressure value. During the A/D conversion cycle, the signal is integrated over time. That is, the pressure reading is averaged (integrated) over the A/D conversion cycle so the resultant digital value is the summation of the average pressures observed during the cycle. This conversion cycle is controlled by the user with the Deadband and Sensitivity (DS), Idle Count (IC), and Integration (I=) commands.

4.2 PRESSURE READING CONTROL

The PPT2 commands allow considerable flexibility in tailoring pressure acquisition times, reading windows, thresholds, and output rates. These are controlled by 4 commands: Deadband and Sensitivity (**DS**), Integration (**I=**), Idle Count (**IC**), and OPerating mode (**OP**). The user may control these attributes in three ways:

First, the internal integration time may be controlled over a range of 1 reading every 10 seconds up to 1000 readings per second. This is controlled using the 'Integration' (I=) command. Pressure values are calculated every millisecond. The integration time is used to control the amount of averaging of these pressure values to create each pressure value. The integration time can be set within a range of 1 to 1000 readings/sec using the **I=Rn** form, or a range of 10 msec to 10 sec/reading using the **I=Mn** form. The values for 'n' range from 1 to 1000 for both the rate (**Rn**) form and the millisecond (**Mn**) form.

Second, the integration cycles may be spaced with idle periods that cause pressure reading times to increase to as long as one every 42.67 minutes. The Idle Count (**IC**) command will insert, or skip, from 0 to 255 idle periods equal to the integration time. If the integration time is set to the maximum, 10 sec/reading, and an idle count of 255 is selected, then the time between readings = 10 sec. x 256 = 42 minutes, 40 seconds.

Third, the reading rate may be controlled so pressure readings are obtained only when pressure changes occur. The OPerating mode command (**OP**) can be set to output every reading (**OP=A**) or to only output changes (**OP=U**). The Deadband setting in the **DS** command can filter a small pressure change by not allowing the pressure output reading to vary as long as it remains within the

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deadband limits. This controls the **OP** command mode's sensitivity to pressure change when the 'output only when pressure changes' (**OP=U**) option is selected.

4.3 PPT2 ADDRESSING

The PPT2 provides three levels of addressing. The lowest level of address is the individual unit address, or **device ID**. This address level is used to address any single PPT2. The next level is **group address**, which is separate from the device ID. All PPT2 units with the same group address will respond to a command sent to this level address. The last is a **global address**, which is read by all PPT2s on a network. The device ID can be assigned by direct command or assigned automatically based on its position from the host processor in PPT2 network. The **null address** (00) is simply a default device ID that the PPT2 automatically assumes until one is assigned. That is, upon power-up, if there is no ID assigned, and an ID has not been stored in the EEPROM, then the PPT2 will assign itself the "00" null address.

The individual unit address, or **device ID**, has an assigned range from 01-89. The null address 00 is the factory default address for unassigned PPT2s. A unit with the null address, replies with a 'null address' header. The null address header characters are '?' for ASCII format (standard keyboard alphanumeric characters) or '^, &, |, or %' for binary format (fewer data bytes that are encoded for computer translation.) A unique device ID allows the host processor to send commands to specific units on a bus.

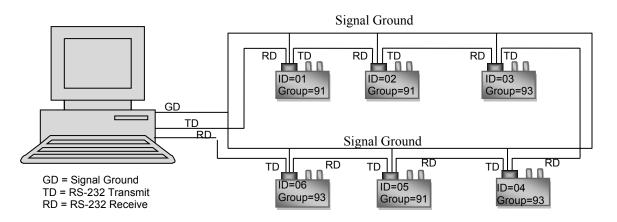
The second level of addressing is a multicast, or **group**, address in the range of 90-98. Each unit can be assigned a group address by the ID command. A unit responds to its group address in the same manner as it does to its global address described below. The group addressing allows the host processor to send commands to several units having the same group address. The factory default group address is 90.

The highest level of addressing is the broadcast, or **global**, address 99. All units receive global addressed commands. All RS-232 units respond to global commands. Only RS-485 units with assigned addresses will respond to global commands. An RS-485 unit with a null address will not reply to any global command. Global addresses are not assigned but are built into the PPT2.

RS-232 Ring Network

The RS-232 network consists of a three-wire bus (TD, RD, and GD) that begins and ends at the host processor. In general, the RS-232 electrical standard requires that the distance *between* units not exceed 60 feet (18 meters). An advantage of the RS-232 network is that it interfaces directly to the serial COM port of most personal computers (or USB to serial adaptor). The maximum number of PPT2s with assigned device IDs on a network is 89.

A PPT2 ring network connection of six units is shown below. In this example, the Device IDs are sequential, starting from 01, from the transmit port of the host processor around the loop. There are two address groups, 91 and 93; each have 3 PPT2 units assigned.



Each PPT2 on a communication ring must have a unique address in order to *individually* receive commands from the host processor. For example, if more than one PPT2 on a ring has a null address, and a 00 address command is transmitted by the host, only the first null address PPT2 will receive the command and the command is not passed on. This is the same for any address on an RS-232 ring network.

Another advantage of the RS-232 ring network is the ability to automatically assign device IDs to every PPT2 on the network. Since commands flow through every PPT2 on the ring, a single ***99ID=01** command will assign ID=01 to the first unit, and each in the ring will assign itself the next number. As the command is passed along, each unit adds one to the ID command. For the example network shown above, the command will read ***99ID=07** when it returns to the host processor. The form of self-addressing will indicate the PPT2 position in the communication ring relative to the host processor.

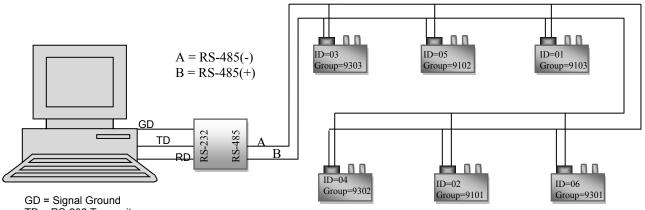
Every unit in the RS-232 ring network has an assigned group address. When the host processor sends a group addressed (***90** to ***98**) command, that command cycles through every PPT2 and is passed to the next one in the loop. Those units having that group address read the command, then pass the command and reply to the next unit in the ring. Some responses pass the string of PPT2 replies before the group command while others pass the string of PPT2 replies after the group command. See Table 1.0 for specific command types and the order of repeating the group command.

Every unit in the RS-232 ring network receives a global addressed (***99**) command. All units read the command and pass the command and their response to the next unit in the ring.

RS-485 Multi-drop Network

The RS-485 network consists of a two-wire bus (A and B) that begins at the host processor and ends at the far end from the processor. A star network configuration can also be used where each unit is connected directly to the A and B terminals at the host processor. An advantage of the RS-485 network is that it can extend up to 4,000 feet (1,220 meters) and units can be added and removed without breaking the network connection. The maximum number of addressable PPT2's on a network is 89.

A PPT2 multi-drop network connection of six units is shown below. In this network, the device IDs are not in order from one end of the network to the other. Looking at all the units on the bus, the device IDs are sequential beginning with ID=01 and without duplication. This is an important setup condition if global command operation (*99) is desired.



TD = RS-232 Transmit RD = RS-232 Receive

5.0 Command Descriptions (alphabetical order)

COMMA	ND CODE	COMMAND DESCRIPTION						
A=		Data String A						
Action Directing	Sequential Response with (90-99) address	Input or Output Type	Requires Write Enable	Terminates Continuous Commands	Can Write to EEPROM	Can Write to DAC		
No	After (4)	Both	Yes	No	Yes (9)	No		
the <cr> (EN the PPT2 ev range pressu</cr>	ITER key) char en after the po	acter. If this st wer is turned c	ring is stored ir off. Example us	n EEPROM wit	th the SP=ALL es for mainten	nessage is terminated with command, it will remain in nance checks, over/under on. (Default: A= <empty>)</empty>		
NOTE: EXAMPLES:	:							
Inquiry: *dd A	\ =							
Actio	n: *dd WE			EEPRO	OM Store: *do	d WE		
	*ddA=Yo	our_msg			*do	SP=ALL		
Yo	ter cha sta	minated with th aracters betwe	ne <cr> charac en the 'space' Other characte</cr>	eter. The legal (SP) and lowe ers outside this	characters for er case 'z' inclu range are rep	naracter. The message is Your_msg include all usive, except the '*', in laced with the "space"		
-	ES FROM LE							
now required	before the val	lue is written to	EEPROM.			e. The SP=ALL command i		
The PPT sto required for 1		for each pair o	of ASCII charac	cters stored in	the 8 characte	er A= register. This is not		
The PPT res	ponse is alway	s 8 characters	with trailing sp	oaces if require	ed. The PPT2	responds only with the		

0.01.01.01.0		1		CCTODER, 2016			
COMMAND	CODE		0.41	COMMAND L	DESCRIPTION		
AN		Analog Rang		T			
Directing F	Sequential Response <i>v</i> ith (90-99) address	Input or Output Type	Requires Write Enable	Terminates Continuous Commands	Can Write to EEPROM	Can Write to DAC	
Yes B	efore	Both	Yes (6)	No	Yes (9)	Yes	
established with commands. Whe 5V is active. Wh reduced. For exa 7+ bit resolution use of analog wi (Default: AN=OI NOTE:	the H= and en AN is O nen custom ample, the Ranges b indow limits N)	d L= command N, the customiz H= and L= ran full 5 volt range etween these t s O= and W= c DX and DZ sett	Is. Analog wind zed settings are e has a 15+ bit wo values wou an increase the tings are alway	low settings ar e activated; wh e used, the res resolution. A ild result in a r e volts/pressur vs active. AN c	re established hen OFF , the f solution of the a range reductio resolution betw re resolution of	e analog range setting is with the O= and W= factory default range of 0V t analog signal will be n to 2.5 volts will result in a yeen 7+ and 15+ bits. The f the analog signal.	
	*dd WE			EEPRO	DM Store: *do	WE	
Inquiry:*dd AN		ON OFF ON-I	OFF-}	EEPRO		IWE ISP=ALL	
EXAMPLES: Inquiry:*dd AN Action:	*dd AN={ ON Th wir	e analog outpu	ut will adjust to =, W=). The hig	the high and lo	*do ow limits (H= , I produces the		
Inquiry:*dd AN Action:	*dd AN={ ON Th wir an OFF Th	e analog outpu ndow limits (O= d the lowest pr	ut will adjust to =, W=). The hig ressure produc ut will set to 5 v	the high and loghest pressure thest pressure the low (L= rolts for the FS	*do ow limits (H= , l produces the) voltage. pressure (F=)	ISP=ALL L=) and the offset and	
Inquiry:*dd AN Action:	*ddAN={ ON Th win an OFF Th pre ON- Sa	e analog outpundow limits (O= d the lowest pr e analog outpu essure - or neg me function as	ut will adjust to =, W=). The hig ressure produc ut will set to 5 v ative FS press s ON , but outpu	the high and log thest pressure es the low (L= rolts for the FS ure for differen ut scale is reve	*do ow limits (H= , I produces the) voltage. pressure (F=) ntial. ersed. i.e. The	I SP=ALL L=) and the offset and high (H=) output voltage	

COMMA	ND CODE			COMMAND D	DESCRIPTION	
B=		Data String B				
Action Directing	Sequential Response with (90-99) address	Input or Output Type	Requires Write Enable	Terminates Continuous Commands	Can Write to EEPROM	Can Write to DAC
No	After (4)	Both	Yes	No	Yes (9)	No
command me the <cr> (EN the PPT2 even</cr>	ust have 1 to 8 TER key) char en after the po	characters im acter. If this sto wer is turned o	mediately follo ring is stored ir ıff. Example us	wing the ['] =' ch n EEPROM wit ses include dat	aracter. The m th the SP=ALL es for mainten	s in the EEPROM. This nessage is terminated with command,, it will remain in ance checks, over/under on. (Default: B= <empty>)</empty>
NOTE:						
EXAMPLES:						
Inquiry: *dd B	;=					
Actio	n: *dd WE			EEPRO	OM Store: *dd	WE
	*ddB=Yo	our_msg			*dd	SP=ALL
Yo	ter cha sta	minated with th aracters betwe	ne <cr> charac en the 'space' Other characte</cr>	eter. The legal ((SP) and lowe rs outside this	characters for er case 'z' inclu range are repl	naracter. The message is Your_msg include all sive, except the '*', in aced with the "space"
The B= com		with a *ddWE		ous write enab	le is active. Th	e SP=ALL command is now
	ore the value is					
	o implemented	parity with the			e required for the ed. The PPT2 i	ne PP12.

DD	ND CODE				DESCRIPTION	
BP			nd Parity Set			
Action Directing	Sequential Response with (90-99) address	Input or Output Type	Requires Write Enable	Terminates Continuous Commands	Can Write to EEPROM	Can Write to DAC
Yes DETAILS:	After (4)	In	Yes	Yes	Yes (9)	No
and BP comistatus (RS) of For this comivates beyon baud rate to the command the command the command activated, bu	mand <u>must</u> b command error mand, only th nd the first tw be set to 480 d error flag se ed RS-232 de d to be retran d at the same t are not perror	e sent as a glob or bit is set. e first two baud o valid baud rat 0. If the first two et in the RS com vices, this comr smitted to the n time. When the nanently stored	val address (e. rate character e characters w b baud rate cha mand respons nand causes the ext PPT2. For e command tra in the EEPRO	g. *99); otherw rs, that uniquel /ill be ignored. aracters are inv se. he new baud ra multi-drop netw insmission is co M until an SP=	vise, the comm y identify the b Example: *99E valid, the comm ate and parity s worked RS-485 omplete, the ne -AII command	Both the write enable (WE) and is rejected and a read aud rate, need to be used. BP=N48 X1will cause the nand will be rejected and setting to be changed and 5 devices all units receive ew baud rate and parity are is executed. A the SP=ALL command.
(Default BP= NOTE: As shipped, t rate has been reestablish c	he PPT2 is s che changed to ommunication	an unknown va າ.	lue, it will be n	ecessary to se	arch all the ba	and 1 stop bit. If the baud ud rate values to will be terminated.
(Default BP= NOTE: As shipped, t rate has been reestablish c When setting	N9600) the PPT2 is s n changed to ommunication the baud rat	an unknown va າ.	lue, it will be n	ecessary to se	arch all the ba	ud rate values to
(Default BP= NOTE: As shipped, t rate has been reestablish c	N9600) the PPT2 is s n changed to ommunication the baud rat	an unknown va າ.	lue, it will be n	ecessary to se commands (P	earch all the ba 2, P4 and T4) DM Store: *99	ud rate values to will be terminated.
(Default BP= NOTE: As shipped, t rate has been reestablish c When setting EXAMPLES:	N9600) the PPT2 is s n changed to ommunication the baud rat	an unknown va າ.	lue, it will be n s transmission	ecessary to se commands (P EEPRC	earch all the ba 2, P4 and T4) DM Store: *99	ud rate values to will be terminated.
(Default BP= NOTE: As shipped, t rate has been reestablish c When setting EXAMPLES: Inquiry:*dd B	the PPT2 is s in changed to ommunication the baud rat P e: #dd BP =	an unknown va ı. e, all continuous ■ <u>or</u> #dd BF	lue, it will be n s transmission P=E <u>o</u> r #dd	ecessary to se commands (P EEPRC BP=O	earch all the ba 2, P4 and T4) DM Store: *99 *99	ud rate values to will be terminated.
(Default BP= NOTE: As shipped, to rate has been reestablish co When setting EXAMPLES: Inquiry: *dd B Response	 N9600) the PPT2 is s in changed to ommunication of the baud rate the baud rate P #ddBP= Both a ³ 	an unknown va ı. e, all continuous ■ <u>or</u> #dd BF	lue, it will be n s transmission P=E <u>o</u> r #dd	ecessary to se commands (P EEPRC B P=O	earch all the ba 2, P4 and T4) DM Store: *99 *99	ud rate values to will be terminated. WE SP=ALL
(Default BP= NOTE: As shipped, f rate has been reestablish c When setting EXAMPLES: Inquiry: *dd B Response Note	 N9600) the PPT2 is s in changed to ommunication ommunication of the baud rate P #ddBP= #ddBP= a: #000000000000000000000000000000000000	an unknown va n. e, all continuous •N <u>or</u> #dd BF 99WE and *99F	lue, it will be n s transmission P=E <u>o</u> r #dd 3P= global a	ecessary to se commands (P EEPRC BP=O ddress <i>must</i> b	earch all the ba 2, P4 and T4) DM Store: *99 *99 e used to chan	ud rate values to will be terminated. WE SP=ALL
(Default BP= NOTE: As shipped, f rate has been reestablish c When setting EXAMPLES: Inquiry: *dd B Response Note	<pre>N9600) the PPT2 is s n changed to ommunication the baud rat P e: #ddBP= e: Both a * n: *99WE *99BP= N N E E</pre>	an unknown va n. e, all continuous •N <u>or</u> #dd BF 99WE and *99F	lue, it will be n s transmission P=E <u>o</u> r #dd 3P= global a	ecessary to se commands (P EEPRC BP=O ddress <i>must</i> b	earch all the ba 2, P4 and T4) DM Store: *99 *99 e used to chan	ud rate values to will be terminated. WE SP=ALL ige the baud rate.

The PPT2 adds three new baud rates: 38400, 57600, and 115200.

- ,	1112 0001 110				-	
	ND CODE			COMMAND D	DESCRIPTION	
C=		Data String	C			
Action Directing	Sequential Response with (90-99) address	Input or Output Type	Requires Write Enable	Terminates Continuous Commands	Can Write to EEPROM	Can Write to DAC
No (1)	After (4)	Both	Yes	No	Yes (9)	No
command mu the <cr> (EN the PPT2 eve range pressu NOTE:</cr>	ust have 1 to 8 TER key) char en after the po ire or temperat	characters im racter. If this st wer is turned c ture values, or	mediately follo ring is stored ir ff. Example us key pressure r	wing the '=' ch n EEPROM us ses include dat readings speci	haracter. The m ing the SP=AL ces for mainten fic to applicatio	s in the EEPROM. This nessage is terminated with L command, it will remain ir ance checks, over/under on. (Default: C= <empty>) cters of the user startup</empty>
Actior				EEPRC	OM Store: *dd	
	*ddC=Yo	our_msg			*dd	ISP=ALL
Yo	ter cha sta	minated with th aracters betwe	ne <cr> charac en the 'space' Other characte</cr>	ter. The legal (SP) and lowe rs outside this	characters for er case 'z' inclu range are repl	naracter. The message is Your_msg include all sive, except the '*', in laced with the "space"
The C= comr required befor The PPT also	ore the value is o implemented ponse is alway	with a *ddWE written to EEF parity with the	PROM. C= contents.	This will not be	e required for t	ne SP=ALL command is now he PPT2. responds only with the

COMMAI	ND CODE	COMMAND DESCRIPTION						
СК		Check Mem	ory					
Action Directing	Sequential Response with (90-99) address	Input or Output Type	Requires Write Enable	Terminates Continuous Commands	Can Write to EEPROM	Can Write to DAC		
No	After (4)	Out	No	No	No	No		
		nand performs a ory. This check				erization area and the		
automatic Cł When memo	K= response f	rom the PPT2.)	The MO comm ation cycles ar	nand can be u e immediately	sed to turn off	ts. (On power up, there is no this function at power-up. sociated bits in the RS		
EXAMPLES:								
Inquiry: *ddC	Ж							
Ther	e are eight po	ssible response	es for this com	mand.				
#(or ?)ddCK #(or ?)ddCK #(or ?)ddCK #(or ?)ddCK #(or ?)ddCK #(or ?)ddCK #(or ?)ddCK #(or ?)ddCK	=ERR1 C =ERR2 Pi =ERR3 D =ERR4 C =ERR5 C =ERR5 B	o checksum err onfiguration me ressure correcti AC correction d onfiguration me onfiguration me oth pressure an hecksum errors	mory checksur on data checks ata checksum mory and DAC mory and pres d DAC correct	sum error error correction da sure correctio ion data check	n data checksu sum errors			
The PPT cor The error res	sponses, ERR	iled "Check EEF 1 – ERR5 are s	lightly differen	t than the PPT	implementatio	off-chip EEPROM memory on. ses (2) 16-bit checksums		

for EEPROM memory, and (2) 24-bit checksums for pressure and DAC correction coefficients.

COMMAN	D CODE		COMMAND DESCRIPTION					
CM Compatibility Mode								
Action Directing	Sequenti Respons with (90-9 address	e Output Type 9)	Requires Write Enable	Terminates Continuous Commands	Can Write to EEPROM	Can Write to DAC		
Yes	Before	Both	Yes (6)	No	Yes (9)	Νο		
additional digination	it to the rig	ht of the decimal pres	place as comp	ared to the PP	T readings. (D	P2, P3 and P4) with an efault: CM=OFF) Analog output, temperature		
Inquiry:*dd CN	1							
Action	: *dd W	/E		EEPRO	DM Store: *do	WE		
	*dd C	M={ON OFF}			*dc	SP=ALL		
	ON	Pressure reading to the right of the				e the same number of digits		
	OFF	Pressure reading place as compare			•	it to the right of the decimal		
DIFFERENCE								

	ND CODE				DESCRIPTION	I
D=		Data String	n			
Action Directing	Sequential Response with (90-99) address	Input or Output Type	Requires Write Enable	Terminates Continuous Commands	Can Write to EEPROM	Can Write to DAC
No (1)	After (4)	Both	Yes	No	Yes (9)	No
command mu the <cr> (EN the PPT2 eve range pressu</cr>	ust have 1 to 8 TER key) char en after the po ire or temperat	characters im acter. If this st wer is turned c ture values, or	mediately follo ring is stored ir ff. Example us key pressure r	wing the '=' ch n EEPROM us ses include dat readings speci	aracter. The m ing the SP=AL es for mainten fic to applicatio	s in the EEPROM. This nessage is terminated with L command, it will remain ir ance checks, over/under on. (Default: D = <empty>) cters of the user startup</empty>
Actior	n: *dd WE			FFPRO	OM Store: *dd	WE
	*ddD=Yo	our_msg				ISP=ALL
Yo	ter cha sta	minated with th aracters betwe	ne <cr> charac en the 'space' Other characte</cr>	eter. The legal (SP) and lowe rs outside this	characters for er case 'z' inclu range are repl	naracter. The message is Your_msg include all sive, except the '*', in laced with the "space"
The D= comr required befor The PPT also	ore the value is o implemented ponse is alway	with a *ddWE written to EEF parity with the	PROM. D= contents.	This will not be	e required for t	he SP=ALL command is now he PPT2. responds only with the

COMMA	ND CODE		COMMAND DESCRIPTION				
DA		Digital and	Digital and Analog Control				
Action Directing	Sequential Response with (90-99) address	Input or Output Type	Requires Write Enable	Terminates Continuous Commands	Can Write to EEPROM	Can Write to DAC	
Yes	Before	Both	Yes (6)	No (12)	Yes (9)	Yes (10)	
	·	·				· · · ·	

DETAILS:

The Digital and Analog control command determines which signals connect to the digital output and which to the analog DAC output. The analog output can be disabled (C, D, M), set to track the input pressure (A, B, E, F), or can be set to the N= value (G, N, R). When the analog output is not changing, the voltage output remains at its last setting. When tracking pressure, the digital output can be set to binary format or ASCII format. When using the P1 or P2 commands, the digital output can be disabled (A, C, F, G, N), or set to track the pressure input using the ASCII format (B, D, E, M, R). When using the P3 or P4 commands, the digital output can be disabled (A, E, M, N), or set to track the pressure input using the binary format (B, C, D, F, G, R). (Default: DA=B)

NOTE:

See **AN**, **H=**, **L=**, **O=**, and **W=** commands for customizing the analog output range (Applicable to DA=A, B, C, D, E, F, and M only).

See the **NE** and **N=** commands for host processor control of the analog output (Applicable to DA=G, N, and R only).

EXAMPLES:

Inquiry:*ddDA

Action:	*dd WE *dd DA=	={A B C D E F G M N R		Store: *dd WE *dd SP=ALL
		Digital Output Commands P1, P2	Digital Output <u>Commands P3, P4</u>	DAC Analog Output Voltage
	A B C D E F G M N R V	Disabled (1) ASCII Format Disabled (1) ASCII Format ASCII Format Disabled (1) ASCII Format Disabled (1) ASCII Format ASCII Format	Disabled (2) Binary Format Binary Format Disabled (2) Binary Format Disabled (2) Disabled (2) Disabled (2) Binary Format Binary Format	Tracks Pressure Tracks Pressure Last Value (3) Last Value (3) Tracks Pressure Tracks Pressure Tracks 'N=' Input (4) Last Value (3) Tracks 'N=' Input (4) Tracks 'N=' Input (4) Disabled (5)
	C	ommand request will be ig ply has been disabled.	nored or the P2 mode cano	ddCP= to indicate disabled. A P2 celled when the ASCII Format

(2) Output response to P3 command will be xx??? (for both CM=ON and CM=OFF). The 'xx' is the header character and the 6 most significant bits of the address. A P4 command request will be ignored or the P4 mode cancelled when the Binary Format reply has been disabled.

(3) Output will remain at last value until a different DA mode is selected. After setting DA=C, D, or M, subsequent changes to H=, L=, O=, and W= have no effect upon the analog output or N= inquiry. Also, after setting DA=C, D, or M, subsequent IN=RESET or power-cycle will result in a fixed 0V analog output.

(4) Analog output will track the N= values transmitted by a host processor. After a powercycle or IN=RESET, and prior to a new N= setting, the analog output will be set to 0V.

(5) When DAC is disabled, the analog output circuitry is turned off and the analog output will float. If this is not desired, select DA=G|N|R and set the analog output using the N= configuration.

DIFFERENCES FROM LEGACY PPT:

Parameters **O**, **S**, **T** and **U** were available for the PPT but have been removed for the PPT2. A new parameter, **V**, has been added to provide a disabled DAC state. When selecting **DA=V**, all the analog output circuitry will be put into a shut-down mode.

It was possible for the PPT to issue a bandwidth warning with some DA parameter selections. This will not be necessary for the PPT2.

COMMAND CODE		COMMAND DESCRIPTION						
DO			rating Parame	eters				
Action Directing	Sequential Response with (90-99) address	Input or Output Type	Requires Write Enable	Terminates Continuous Commands	Can Write to EEPROM	Can Write to DAC		
Yes	Before	Both	Yes (6)	No	Yes (9)	No		
DO=E0N) NOTE: When configu unused. Parity errors	ured for BP=N are only indica	a value that rep l (no parity), the	PPT2 does n	umber of PPT2 ot check for pa or that device.	2s in an RS-232 arity bits and th	andles a command when a 2 network (Default: us the E R settings are hecked on responses from		
EXAMPLES:								
Inquiry:*dd D (C							
Actior	*dd DO=	/E EEPROM Store: *ddWE O={E R} or *ddSP=ALL O=numPPT2s *ddSP=ALL						
		Execute the command in the event of a parity error. Reject the command in the event of a parity error.						
num	the co nu ne In an thi da in	e same decima nnected (the d mber is calcula ext whole numb an RS-232 net d where all uni s parameter de ta are lost afte	I number from efault setting). ated by dividing er. work, where al ts have the sau etermines start r a global reset itial data and/o	0 to 9. The nu When 2 or mo the number of Il units are seq me MO setting up delay for ea t (*99IN=RESE or startup mess	Imber 0 should ore PPT2s are of of PPT2s by 10 Juentially addre of with regards t ach unit to ensu ET) or a power- sages may be l	ork is set, by the user, with be used if a single PPT2 is on the network, the correct and rounding up to the essed starting from the host o checksum calculations, ure no startup messages or on reset. If not configured lost. Individual or group		
	N Re	Reserved placeholder for PPT2backwards compatibility. Cannot be modified. Only visible in the DO inquiry response.						

PPT also allowed for separate Normal and noise Protection modes, $DO = \{N|P\}$. See the PPT User's Manual for detailed information.

COMMA	COMMAND CODE			COMMAND D	ESCRIPTION		
DS	DS		Dead Band and Sensitivity Control				
Action	Sequential	Input or	Requires	Terminates	Can Write	Can Write to DAC	
Directing	Response	Output	Write	Continuous	to		
	with (90-	Type	Enable	Commands	EEPROM		
	99)						
	address						
Yes	Before	Both	Yes (6)	No	Yes (9)	No	

DETAILS:

The **Deadband** and **S**ensitivity control command allows the user to adjust the threshold value that causes a change in pressure reading. There are two options for this, **C** and **S**.

The **C** option sets the deadband to around the center of the pressure reading that moved it last. When the deadband is first set, the deadband will be split half above and half below the current reading. When the pressure exceeds either limit, the new pressure value becomes centered in the deadband limits.

The **S** option sets the deadband based on the peaks and valleys of the pressure level. For instance, when a small peak pressure is sensed, the top edge of the deadband will move to that pressure and have the entire deadband range below this value. The output reading will be one-half the deadband below this pressure (see Figure xx). As long as the pressure stays within the new deadband range the output will not change. If a pressure is sensed below this range, the deadband will move so that the bottom edge will be at that pressure and the entire deadband will be above this value. (Default: **DS = 00S0**)

NOTE:

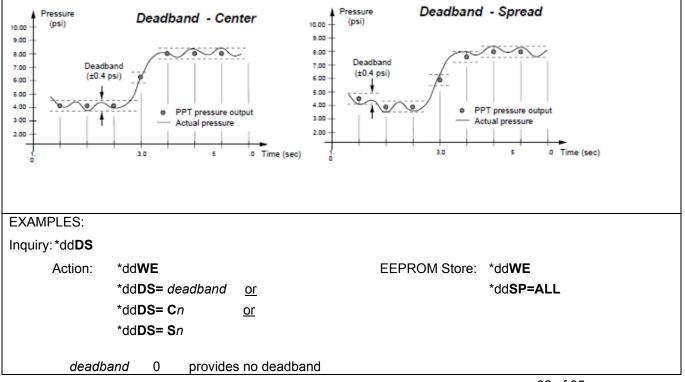
The **OP=U** command setting is typically used with the **DS** command to eliminate repetitive readings of the same pressure within the deadband range.

When the **W=S** command is used to establish an analog set point the deadband (**DS**) controls the set point null span (set point hysteresis).

See figures below for command illustrations using a 20 psi PPT2

*ddDS=40C1 (DS=40 sets deadband to ± 40 x 0.0005% FS. DS=C1 selects center option, 10x multiplier)

*ddDS=40S1 (DS=40 sets deadband to ± 40 x 0,005% FS. DS=S1 selects spread option, 10x multiplier)



	1-60 provides <i>deadband</i> x 0.005% of full scale deadband limits					
	 Note: The full scale for a 20 psig and a 20 psia is <u>20 psi</u>, but for a 20 psid it is <u>40 psi</u> (-20 to +20 psi) Note: <i>deadband</i> values of 1-9 must be requested without a leading zero. However, subsequent inquiries will display a leading zero. 					
С	Center deadband around each new pressure output change.					
S	Deadband S pread varies with the peaks and valleys of pressure changes.					
n	0 or 1 – provides a deadband multiplier to allow the user to specify a wider set point null span where:					
	0 provides a 1x multiplier (deadband x 0.005% FS) 1 provides a 10x multiplier (deadband x 0.05% FS)					
DIFFERENCES FROM No difference from PPT						

COMMAN DU Action	ND CODE					
					COMMAND DESCRIPTION	
Action			Units Cor			
Directing	Sequential Response with (90- 99) address	Input or Output Type	Requires Write Enable	Terminates Continuous Commands	Can Write to EEPROM	Car Write to DAC
Yes	Before	Both	Yes (6)	No	Yes (9)	No
command	splay U nits	s the pres	sure outpu	it to equal the	s. A USER defined display unit can be set with this value input by the U= command multiplied by the	
See page After chan Until then,	13 for a tab ging display P1 request the header	le showir / units, th s will resi	ng the num e new units ult in either	s will not be a * #ddCP= c	solution. o the right and left of the decimal place. available until the next integration (I=) cycle. or ?00CP= and P3 requests will result in xx??? ant bits of the address.	where
					* -1 -1\8/5	
Inquiry:*do		PROM St	ore:		*dd WE	
					*dd SP=ALL	
Act		WE				
		DU= { A1	MBARCI	MWC FTWC S }	HPA INHG INWC KGCM KPA	
MBAR MM Di	*dd MHG MPA N isplay Unit	DU= { A1 /IWC <mark> </mark> PSI PS	USER PF SI Multiplie	S	Units Description	
MBAR MM Di	*dd MHG MPA N isplay Unit	DU= { A1 /IWC <mark> </mark> PSI PS	USER PF SI Multiplie	S		
MBAR MM Di At	*dd MHG MPA N isplay Unit	DU= { A1 /IWC PSI PS	USER PFS SI Multiplie 068046	S	Units Description	
MBAR MM Di A1 B4	*dd /IHG MPA N isplay Unit IM	DU= { A1 /IWC PSI PS 0.	USER PF: 61 Multiplie 068046 068948	S	Units Description ambient atmosphere at sea level	
MBAR MM Di A1 BA CM	*dd IHG MPA M Isplay Unit IM AR MWC	DU= { A1 /IWC PSI PS 0. 0.	USER PF: 51 Multiplie 068046 068948 0.304	S	Units Description ambient atmosphere at sea level bar (10 ⁵ newtons/meter ²)	
MBAR MM Di A1 B4 CM FT	*dd isplay Unit TM AR MWC TWC	DU= { A1 //WC PSI PS 0. 0. 	USER PF: 51 Multiplie 068046 068948 0.304 3065	S	Units Description ambient atmosphere at sea level bar (10 ⁵ newtons/meter ²) centimeters of water column (4 °C)	
Mbar MM Di A1 B4 CM FT HF	*dd IHG MPA M Isplay Unit TM AR AR WWC TWC PA	DU= { A1 /IWC PSI 0. 0. 	USER PF: 51 Multiplie 068046 068948 0.304 3065 3.948	S	Units Description ambient atmosphere at sea level bar (10 ⁵ newtons/meter ²) centimeters of water column (4 °C) feet of water column (4 °C)	
MBAR MM Di A1 B4 CM F1 HF NN	*dd isplay Unit isplay Unit AR MWC IWC IWC IHG IHG	DU= { A1 //WC PSI PS 0. 0. 0. 0. 0. 0. 0. 2. 68 2.	USER PF: 61 Multiplie 068046 068948 0.304 3.065 3.948 0360	S } er ^(a)	Units Description ambient atmosphere at sea level bar (10 ⁵ newtons/meter ²) centimeters of water column (4 °C) feet of water column (4 °C) hectopascal (1 millibar)	
MBAR MM Di AT BA CM FT HF IN IN	*dd isplay Unit TM AR AR TWC PA HG WC	DU= { A1 //WC PSI PS 0. 0. 0. 	USER PF3 51 Multiplie 068046 068948 0.304 3.065 3.948 0360 7.679	S } er ^(a)	Units Description ambient atmosphere at sea level bar (10 ⁵ newtons/meter ²) centimeters of water column (4 °C) feet of water column (4 °C) hectopascal (1 millibar) inches of mercury (0 °C) inches of water column (4 °C)	
MBAR MM Di A1 B4 CM F1 HF IN IN KC	*dd //HG MPA N //splay Unit TM AR AR MWC PA IHG WC GCM	DU= { A1 //WC PSI PS 0. 0. 0. 70 2. 68 2. 27 0.	USER PFS 51 Multiplie 068046 068948 0.304 3065 3.948 0360 7.679 070307	S } er ^(a)	Units Description ambient atmosphere at sea level bar (10 ⁵ newtons/meter ²) centimeters of water column (4 °C) feet of water column (4 °C) hectopascal (1 millibar) inches of mercury (0 °C) inches of water column (4 °C) kilograms/centimeter ²	
MBAR MM Di A1 B4 CM F1 HF IN IN KC KF	*dd IHG MPA N Isplay Unit TM AR AR WWC PA IHG GCM PA	DU= { A1 //WC PSI PS 0. 0. 	USER PF3 SI Multiplie 068046 068948 0.304 3.065 3.948 0360 7.679 070307 8948	S } er ^(a)	Units Description ambient atmosphere at sea level bar (10 ⁵ newtons/meter ²) centimeters of water column (4 °C) feet of water column (4 °C) hectopascal (1 millibar) inches of mercury (0 °C) inches of water column (4 °C) kilograms/centimeter ²	
MBAR MM Di A1 B4 CM FT HF IN IN KC KF MI	*dd //HG MPA N isplay Unit TM AR AR MWC PA IHG GCM BAR	DU= { A1 //WC PSI PS 0. 0. 0. 70 2. 68 2. 27 0. 68 68 68	USER PFS 51 Multiplie 068046 068948 0.304 3065 3.948 070307 8948 3.948	S } er ^(a)	Units Description ambient atmosphere at sea level bar (10 ⁵ newtons/meter ²) centimeters of water column (4 °C) feet of water column (4 °C) hectopascal (1 millibar) inches of mercury (0 °C) inches of water column (4 °C) kilograms/centimeter ² kilopascal millibar (1 hectopascal)	
MBAR MM Di A1 B4 CM F1 HF IN IN IN KC KF MI MI	*dd /IHG MPA N isplay Unit TM AR AR AR AR AR AR AR DA BAR MHG	DU= { A1 //WC PSI PS 0. 0. 	USER PFS SI Multiplie 068046 068948 0.304 3.948 0360 7.679 070307 8948 3.948 1.714	S } er ^(a)	Units Description ambient atmosphere at sea level bar (10 ⁵ newtons/meter ²) centimeters of water column (4 °C) feet of water column (4 °C) hectopascal (1 millibar) inches of mercury (0 °C) inches of water column (4 °C) kilograms/centimeter ² kilopascal millibar (1 hectopascal) millimeters of mercury (0 °C) or torr	
MBAR MM Di A1 B4 CM FT HF IN IN KC KF MI MI MI	*dd //HG MPA N isplay Unit TM AR AR MWC PA BAR MHG PA	DU= { A1 //WC PSI PS 0. 0. 0. 70 2. 68 2. 21 0. 68 57 0. 0.	USER PFS 51 Multiplie 068046 068948 0.304 3065 3.948 070307 8948 3.948 1.714 0068948	S } er ^(a)	Units Description ambient atmosphere at sea level bar (10 ⁵ newtons/meter ²) centimeters of water column (4 °C) feet of water column (4 °C) hectopascal (1 millibar) inches of mercury (0 °C) inches of water column (4 °C) kilograms/centimeter ² kilopascal millibar (1 hectopascal) millimeters of mercury (0 °C) or torr megapascal	
MBAR MM Di AT BA CM FT HF IN IN IN KC KF MI MI MI MI	*dd /IHG MPA N isplay Unit TM AR AR AR AR AR AR AR AR PA BAR BAR PA	DU= { A1 //WC PSI PS 0. 0. 	USER PFS SI Multiplie 068046 068948 0.304 3.948 0360 7.679 070307 8948 1.714 0068948 70304	S } er ^(a)	Units Description ambient atmosphere at sea level bar (10 ⁵ newtons/meter ²) centimeters of water column (4 °C) feet of water column (4 °C) hectopascal (1 millibar) inches of mercury (0 °C) inches of water column (4 °C) kilograms/centimeter ² kilopascal millibar (1 hectopascal) millimeters of mercury (0 °C) or torr megapascal meters of water column (4 °C)	
MBAR MM Di A1 B4 CM FT HF IN IN KC KF MI MI MI MI PS	*dd IHG MPA N isplay Unit TM AR AR MWC PA BAR BAR MHG PA SI SI	DU= { A1 //WC PSI PS 0. 0. 70 2. 68 2. 21 0. 68 57 0. 0. 0. 0. 1.	USER PFS 51 Multiplie 068046 068948 0.304 3.065 3.948 070307 8948 3.948 1.714 0068948 70304 0000	S }	Units Description ambient atmosphere at sea level bar (10 ⁵ newtons/meter ²) centimeters of water column (4 °C) feet of water column (4 °C) hectopascal (1 millibar) inches of mercury (0 °C) inches of water column (4 °C) kilograms/centimeter ² kilopascal millibar (1 hectopascal) millimeters of mercury (0 °C) or torr megapascal	

⁽¹⁾ From the CRC Handbook Of Tables For Applied Engineering Science

DIFFERENCES FROM LEGACY PPT: LCOM is removed. HPA (equivalent to MBAR) is added.

	COMMAND CODE		COMMAND DESCRIPTION DAC Slope Compensation Control						
A									
Action Directing	Sequential Response with (90-99) address	Input or Output Type	Requires Write Enable	Terminates Continuous Commands	Can Write to EEPROM	Can Write to DAC			
Yes	After (4)	Both	Yes (6)	No	Yes (9)	Νο			
analog output Attempting to If there is an i See Figure be NOTE: Offset correct	i. The algorith set DX > 300 nput error, the elow for comm ions (DZ) to t	the analog outp	djustment is sh X=300. Attemp nd error flag in n with the defau Analog Out (V)	erformed prior	 < -300 will rest and will be set a Scale. (Defau (Defau re (psi) 	and no change will occur. It: DX=0) Jjustments (DX).			
		quation below.	NE and N- Con	imanus anu tr		ne amount of required DAC			
EXAMPLES:									
_	ζ								
Inquiry: *dd DX				EEDDO	M Storo: *dd				
_	: *dd WE			EEPRO	DM Store: *dd				
Inquiry: *dd DX		ррр		EEPRO		WE SP=ALL			
Inquiry: *dd DX	: *dd WE *dd DX= <i>ppp</i> 0 cc At	to ±300 This prrection as sho t 5 volts, each c	wn below: count of correct	increases or o	*dd: decreases the a s 100 µV of slop	SP=ALL			

DZ				$(() \wedge / (\wedge / (\Delta \cap))))$	DESCRIPTION			
	COMMAND CODE		COMMAND DESCRIPTION DAC Offset Compensation Control					
Action Directing	Sequential Response with (90-99) address	Input or Output Type	Requires Write Enable	Terminates Continuous Commands	Can Write to EEPROM	Can Write to DAC		
Yes	After (4)	Both	Yes (6)	No	Yes (9)	No		
analog outp If there is ar	ut. The algorith	m for the DZ a	djustment is sh nd error flag in	nown below. the RS comma	and will be set	ndjusts the offset of the and no change will occur. ult: DZ=0)		
		5	Analog Out (V)	+0.6%FS Offset=0 -0.6%FS 20 Pressure	e (psi)			
and determi output.) Offset correc To adjust, se	ne how much c ctions to the an	orrection is rec alog output she 0V using the N	quired. (See the ould be perforr NE and N= com	e N= command med prior to an nmands and th	d description fo ly slope adjust en determine f	he amount of required DA		
EXAMPLES	:							
EXAMPLES								
	DZ	<i>I</i> q }		EEPRC		WE SP=ALL		

AD3-14221, F		allual			C	Clober, 2010
COMMAN	D CODE			COMMAND D	DESCRIPTION	
F=		Customized	Full Scale Ra	nge		
Action Directing	Sequential Response with (90-99) address	Input or Output Type	Requires Write Enable	Terminates Continuous Commands	Can Write to EEPROM	Can Write to DAC
Yes DETAILS:	After (4)	Both	Yes (6)	No	Yes (9)	Yes
user compens at least one-hi command value function and re- number used NOTE: The transduce command is c The response was set. Exan Changes to th (±6000).	ation of the F alf the FS value can have u eturn to the fa for other com er's accuracy hanged, ensu to an F = inqu nple response e F= value w	PT2. The F = c ue (M =). Some up to 5 significa actory default (I <u>mands and rar</u> specification is ure all paramet ury will yield bo e: #01F=1000.0	command allow a units <u>may</u> allow ant digits with a M=) full scale w age calculation a always refere ers are stored oth the value a 0 MBAR xisting Z= value	vs the user to r ow up to 10x re a decimal point value. The new <u>s. (Default:</u> nced to the fac in EEPROM u nd the pressur e to be recalcu	reduce the full seduction of the eduction of the t. Enter an F=0 v F= value become F=0.0000) ctory (M =) full se sing the SP=A re units that we ulated; up to the	nize the full scale range and scale range of the PPT2 by full scale value. The F = 0 command to disable this omes the standard FS scale value. After the F = .LL command. ere active when the F = value e limit of valid Z= values
Inquiry: *dd F =						
Action				EEPRC	OM Store: *dd	
	*dd F= FS	Snum			*dd	ISP=ALL
FSnum	desired (scale val [For som	except for USE ue in those dis	ER , or PFS) us play units. it may not be	ing the DU corpossible to set	mmand. Now, <i>i</i> the pressure r	First, select the display units <i>FSnum</i> is the desired full ranges using only 5 digits.
DIFFERENCE Unlike the PP *01F= #01F=10.000	T, the PPT2 v		n the value and	l display units	in response to	an F= inquiry. For example

COMMA	ND CODE			COMMAND D	DESCRIPTION	
FD		Factory Defa	aults			
Action Directing	Sequential Response with (90-99) address	Input or Output Type	Requires Write Enable	Terminates Continuous Commands	Can Write to EEPROM	Can Write to DAC
Yes	No	In	Yes	No	No	No
command ca static memor (SP=ALL) is cycled. NOTE: This comman enable (*ddW FD=ALL, FD	nuses these defing into the working required to stor and will not work VE) command p P=AL, and FD=4 mand cancels a	ault settings, v ing RAM of the re the defaults when a *ddW preceding it. A are all valid	with the excep e PPT2 microp into static con /E=RAM contir commands.	tion of baud i rocessor. A su figuration men	rate, parity, an ubsequent store nory so they ar able is active.	bry. The Factory Defaults d ID, to be copied from e parameters command e available after power is It must have a singular write
	E					
Action: *ddW						
Action: *dd W	*dd FD= A	II Copies fa	ctory default se	ettings into PP	T2 RAM.	

This command was not available on the PPT.

ADO-14221, 1	PP12 User Ma	inuar			C	clober, 2016
COMMAN	ND CODE			COMMAND D	DESCRIPTION	
H=		Highest Ana	log Voltage			
Action Directing	Sequential Response with (90-99) address	Input or Output Type	Requires Write Enable	Terminates Continuous Commands	Can Write to EEPROM	Can Write to DAC
Yes	After (4)	Both	Yes (6)	No	Yes (9)	Yes (11)
volts, or 1 mil conjunction w Figure below change will o	livolt per coun vith the L=, and . If there is an ccur. (Default	t. An H= inquir d AN comman input error, the : H=5000)	y reads the va ds to customiz en the commar	lue in 1 millivo le the range of nd error flag in	It counts. This the PPT2 anal the RS comma	from 0.02 to 100% of 5 command is used in og voltage output see and will be set and no e default 0 to 5 volts.
		L85 -	Analog Out (V)			
		1-	Press	AN=ON sure (psi) 20	-	
the H= and L equal the L= EXAMPLES:	= settings and value, no char	for the effect of	on analog reso		empting to set	d for enabling and disabling the H= value to less than or
Inquiry: *dd H :	=					
Action	n: *dd WE			EEPRO	OM Store: *dd	WE
	*dd H= pp	рр			*dd	SP=ALL
ppp	millivolts.	An H=0 settin	g will set the h	igh level to 50	00 mV. As an e	e as an integer value of example, H=4250 5000 will set H= 5000.
	ES FROM LEC entation only us	GACY PPT: ses H= values	of 0 to 100.			

		anual				october, 2016	
COMMAND CODE COMMAND DESCRIPTION I= Integration Time							
=		Integration 7	Гime				
Action Directing	Sequential Response with (90-99) address	Input or Output Type	Requires Write Enable	Terminates Continuous Commands	Can Write to EEPROM	Can Write to DAC	
Yes	After (4)	Both	Yes (6)	No	Yes (9)	No	
filter noisy presselected period The integration msec to 10 sec The only valid 3, 4, 5, 6, 7, 8, The associated 62, 58, 55, 52, 17, 16, 15, 14, For example, if highest valid sec of 7 corrected The I= values of last stored sett command will I (Default: I = M NOTE: The bandwidth maximum 1,00 the P4 continue	ssure inputs I d of time. See time can be c/reading usin I=Rxxxx setti 91000 wh d valid I=Rxx 50, 47, 45, 4 13, 12, 11, 1 f a setting of election; I=R pressure value range from 0 ing in EEPRe be set and no 20 [200mse available at 0 readings p ous binary fo	by averaging, or e Figures X.X as set within a rang the I=Mn for ngs represent ere each values xx values are: $\cdot 3$, 41, 40, 38, 0, 9, 8, 7, 6, 5 I=R140 is required table for each print to 1000 for bo OM will be rest or change will or c = 5 readings the maximum er second to P rmat.	br smoothing, t and Y.Y. ange of 1 to 10 rm. the averaging takes approxi 1000, 500, 333 37, 35, 34, 33, 4, 3, 2, 1. uested, the PP fror flag set in t ressure reading th the rate (R n tored. If there is ccur. /sec = 200 aver baud rate of 1 2 continuous A	the internally g 00 readings/se of an integer r mately 1 ms to 3, 250, 200, 16 32, 31, 30, 29 T2 firmware wi the RS response the RS response to form and mill s an input erro eraged corrected 15,200 will limit ASCII format w	enerated corre consing the I=I number of corre o generate. 66, 142, 125, 1 1, 28, 27, 26, 29 Il set the integr se. The I=R142 lisecond (Mn) r, then the con ed pressure van t continuous tr with header char	Rn form or a range of 10 ected pressure values over a Rn form or a range of 10 ected pressure values; 1, 2, 11, 100, 90, 83, 76, 71, 66, 5, 24, 23, 22, 21, 20, 19, 18, ration time to the next 2 represents the averaging form. For I=R0, or I=M0, the nmand error flag in the RS lues per reading]) ansmit of digital data at the racters removed (OP=R) or ly valid with I=Mxxx	
EXAMPLES:							
Inquiry: *dd l=							
Action:	*dd WE			FFPRC	M Store: *dd	WE	
	*dd l= R n	or M n					
		<u>or</u> Mn			*44	SP=ALL	
	10 cor rea set	00 readings pe rected pressu iding rate does ting. I=R0 will	er second which re values; 1, 2, s not utilize the restore the las	h represent the 3, 4, 5, 6, 7, 8 IC command. st setting saved	Rate to intege e averaging of 9, 91000. Wh Setting I=R <i>n</i> v d in EEPROM.	SP=ALL r values between 1 and an integer number of ten using the Rn form, the vill clear any current IC	

	ID CODE	COMMAND DESCRIPTION						
IC		Idle Count P						
Action Directing	Sequential Response with (90-99) address	Input or Output Type	Requires Write Enable	Terminates Continuous Commands	Can Write EEPROI		Can Write to DAC	
Yes	Before	Both	Yes (6)	No	Yes (9)	Νο	
between outp Time (I=) con the average t (see OP com bus from PP ⁻ NOTE: Note: If the (out values (se nmand. (See ransducer po mand descrij [2s whose re DP=W (watcl	e Fig. x.xx). Th the I= comman wer requiremen otion). This para sponse time is in ndog timer) com	is command is d for setting inf ht by as much a meter is also u not critical. (De mand is set, th	only operation tegration times as 50-60% who used to reduce fault: IC=0)	nal for the I s.) This pa en increase the reply i mand will	I=Mn for ramete ed res messa not ex	icroprocessor skips orm of the Integration er can be used to reduce ponse time is acceptabling ge traffic on the network ecute (other than IC=0)	
when I≥M20 information o	<u>and</u> IC>0 , yie n power savi	Iding "quiet time	es" of 200 ms o	or greater. See	OP comm	hand d	ment will begin to reduc escription for additional ing.	
when I≥M20 information o	<u>and</u> IC>0 , yie n power savi	Iding "quiet time ng modes.	es" of 200 ms o	or greater. See	OP comm	hand d	escription for additional	
when I≥M20 information o P1 or P3 req EXAMPLES:	and IC>0 , yie n power savi uests during o	Iding "quiet time ng modes.	es" of 200 ms o	or greater. See	OP comm	hand d	escription for additional	
when I≥M20 information o P1 or P3 req	and IC>0, yie n power savi uests during o	Iding "quiet time ng modes.	es" of 200 ms o	or greater. See	OP comm	nand d e read	escription for additional	
when I≥M20 information o P1 or P3 req EXAMPLES: Inquiry: *ddI	and IC>0, yie n power savi uests during o	lding "quiet time ng modes. quiet times will r	es" of 200 ms o	or greater. See	OP comm	re read	escription for additional	
when I≥M20 information o P1 or P3 requ EXAMPLES: Inquiry: *ddI Actior	and IC>0, yie n power savi uests during o C n: *ddWE *ddIC=/	lding "quiet time ng modes. quiet times will r	es" of 200 ms o	or greater. See	OP comm	re read	escription for additional ing.	
when I≥M20 information o P1 or P3 requ EXAMPLES: Inquiry: *ddI Action	and IC>0, yie n power savi uests during o C : *dd WE *dd IC =/ Ccount 0 ere: 0 ca 1 ca 2 ca	Iding "quiet time ng modes. quiet times will r	es" of 200 ms of return the previous ation cycles to egration cycles egration cycles	be used. to be used. to be used.	OP comm ed pressur	re read	escription for additional ing.	
when I≥M20 information o P1 or P3 requ EXAMPLES: Inquiry: *ddI Action	and IC>0, yie n power savi uests during of C : *ddWE *ddIC=/ Ccount 0 ere: 0 ca 1 ca 2 55 ca ES FROM LE	Iding "quiet time ng modes. quiet times will r Ccount to 255 auses all integra auses 1 of 2 inte auses 1 of 3 inte auses 1 of 256 i	es" of 200 ms of return the previous egration cycles egration cycles ntegration cycles	be used. to be used. to be used. to be used. les to be used.	OP comm ed pressur	re read	escription for additional ing.	

COMMA	ND CODE	COMMAND DESCRIPTION				
ID		Identification Number				
Action Directing	Sequential Response with (90-99) address	Input or Output Type	Requires Write Enable	Terminates Continuous Commands	Can Write to EEPROM	Can Write to DAC
Yes	Before	Both	Yes (6)	No	Yes (9)	No

Set the device **ID**entification number. This command is used to set a unique PPT2 address and/or a group address. Two sections below describe this command based on the RS-232 or RS-485 type of unit. (Default: device **ID=00**, **group address=90**)

RS-232 type only

To unassign all device IDs, send a ***99WE** and a ***99ID=00** command. In this case, all the PPT2 units in the network will set their device IDs to address '00', the null address.

To sequentially assign device IDs on an RS-232 ring network, send ***99ID=01**. The first unit will number itself **ID**=01, increment the command and automatically send a ***99ID=02** to the next transducer in line. This will continue down the ring until all of the transducers have sequentially numbered themselves. The host processor will receive: ***99ID=nn**, where nn= the number of transducers in the network plus 1. For example, if 6 transducers are connected in a network, then a ***99ID=01** command will sequentially assign device IDs to all six units and return a ***99ID=07** to the host processor. Note that ID=01 must be entered and not just ID=1. The transducers will now be sequentially assigned device IDs from 01 to 06.

Inquiry:*dd**ID** (reply is group number)

Action:	*dd Wl	E		EEPR	OM Store:	*dd WE	
	*dd ID :	=newNuml	ber			*dd SP=ALI	L
newNum	ber	00 – 99	(must enter a TWO	digit decimal r	number)		
where:			ers itself '00' (null ad will change all PPT2				
01-	-88	Unit numb transmits f	ers itself with device the message. This w ld, with ID= <i>newNum</i> l	ID newNumb ill sequentially	<i>er</i> , incremer number all	nts the numb	per by 1, and
		Unit numb message.	ers itself with device	ID '89', chang	ges the num	ber to '99', a	and transmits the
90-	-98	Unit assig	ns itself group addre:	ss newNumbe	r, and trans	mits the me	ssage unchanged.
		Unit does message.	not change its addre	ess, changes <i>n</i>	ewNumber	to 'ER' and t	transmits the
I	ER	Unit does	not change its addre	ess and transm	its the mes	sage unchar	ıged.
.							

RS-485 type only

RS-485 units have a factory-default identification address of 00. The PPT2 will not respond to group or global commands until it is assigned a non-zero address. Similarly, RS-485 units have a factory-default sub-address of 00. The PPT2 will not respond to group commands until it is assigned a non-zero sub-address. This can be accomplished by the following methods:

1) An identification address can be assigned off-line by connecting the PPT2 to an RS-485 compatible serial port. The command sequence to assign address 01 is:

*00WE *00ID=01 *01WE *01SP=ALL

If global addressing is to be used for PPT2 responses, then all PPT2's that are to respond to global requests

must be addressed sequentially starting with address 01. See the **TO** command description for further information on RS-485 global addressing.

If group addressing is to be used for PPT2 responses, then all PPT2's within a single group must have a group sub-addresses assigned sequentially starting with address 01. (The valid range of assigned sub-addresses is 01 - 99.) The command sequence to assign group address 91 and sub-address 01 to a PPT2 with identification address 03 is:

*03WE *03ID=9101 *03WE *03SP=ALL

See the **TO** command description for further information on RS-485 global addressing.

2) If the PPT2s to receive ID addresses have null addresses, they can be installed on the RS-485 bus *one at a time*. After each PPT2 is connected, its ID address can be assigned by using the above procedure.

3) Any number of null addressed, or unknown addressed, PPT2s can be connected to a RS-485 bus and have ID individually assigned by using their serial numbers as unique identifiers. The command sequence to assign the address 02 to a PPT2 with serial number 3175 is:

*99WE *99S=00003175 (must use all 8 numbers) *99WE *99ID=02 *02WE *02SP=ALL

When the identification address has been assigned, group address and sub-address can be assigned in the same manner as in **1**) above.

NOTE:

Regardless of communications type (RS-232 or RS-485), it is recommended that any network of more than 1 unit be configured with unique sequential ID's. For example, a network of 3 units should be addressed with 01, 02, and 03.

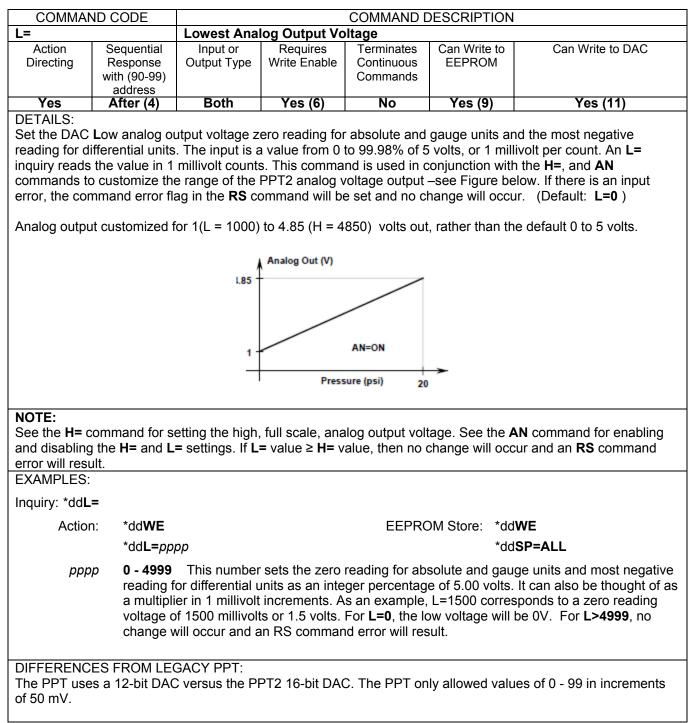
For RS-485 units, all ***9xID=** commands are ignored unless the command has been preceded by a serial number command (***99S=**ssssss) with the serial number that matches that unit. The next ***9xID** command will set that unit's device ID number.

EXAMPLES:

See DETAILS above.

DIFFERENCES FROM LEGACY PPT: No difference from PPT implementation.

COMMAN	ND CODE	COMMAND DESCRIPTION					
IN		Initialize PP	T2 Microproce	essor			
Action Directing	Sequential Response with (90-99) address	Input or Output Type	Requires Write Enable	Terminates Continuous Commands	Can Write to EEPROM	Can Write to DAC	
No (2)	No	In	No	Yes	No	No	
performs the		function as re				the RESET option, it (exceptions to this are	
	the receipt of	• •	P4, T2) with th	e IN command	d, as many as t	wo additional readings may	
Action: *ddl	N						
	This stops	a continuous r s are retained.	ead operation	but does not p	erform a powe	r-on reset. All RAM stored	
Action:*ddIN:	-R ESET						
	a group or activated.	global address Subsequently,	s (90-99), the n	nessage is re-l neters are repla	transmitted bef	r reset. If the command has ore the power-on reset is iously stored parameters	
-	ES FROM LEC e from PPT imp						



		Maximum C	COMMAND DESCRIPTION aximum Customized Full Scale						
M=	Convential			1		. 10			
Action Directing	Sequential Response	Input or Output Type	Requires Write Enable	Terminate Continuou			Can Write		
Directing	with (90-99)	Output Type		Command					
	address								
Yes	After (4)	Out	No	No	No		N	0	
command). This value is f determination NOTE: Typical respo	ixed at the fac nse is #ddM=	e M aximum full ctory and corre 0100psid , whe e (psia, psid, ps	sponds to the	full scale re	eference value	e for a	ccuracy and e	error	
<u>RS-4</u> This o This o	<u>85 type only</u> command is us can be used w	sed to select th hen there is a	conflict betwe	en the stan	dard PPT2 m	essag			
This of This of mess To ch	85 type only command is us can be used w age character ange from sta		conflict betwe e other compo	en the stan onents that	dard PPT2 m share the bus	essag S.	e headers and		
RS-4 This of This of mess	85 type only command is us can be used w age character ange from sta : *dd WE	when there is a s used by som andard to altern	conflict betwe e other compo	en the stan onents that	dard PPT2 m	essag s. (ctrl '	e headers and		
RS-4 This of This of mess To ch	85 type only command is us can be used w age character ange from sta	when there is a s used by som andard to altern	conflict betwe e other compo	en the stan onents that	dard PPT2 m share the bus	essag s. (ctrl '	e headers and		
RS-4 This of This of mess To ch Action	B5 type only command is us can be used w age character ange from sta : *ddWE *ddM=AL	when there is a s used by som andard to altern	conflict betwe e other compo ate headers:	en the stan onents that	dard PPT2 m share the bus	essag s. (ctrl '	e headers and		
RS-4 This of This of mess To ch Action	85 type only command is us can be used w age character ange from sta *dd WE *dd M=AL ange from alte	when there is a s used by som andard to altern _T ernate to stand	conflict betwe e other compo ate headers:	en the stan onents that EEF	dard PPT2 m share the bus	essag s. (ctrl ' (ctrl '	e headers and) dd WE) dd SP=ALL		
RS-4 This of This of mess To ch Action	85 type only command is us can be used w age character ange from sta *dd WE *dd M=AL ange from alte	when there is a s used by som andard to altern -T ernate to stand WE	conflict betwe e other compo ate headers:	en the stan onents that EEF	dard PPT2 m share the bus PROM Store:	essag s. (ctrl [*] (ctrl [*]	e headers and) dd WE) dd SP=ALL		

COMMAND CODE MO Action Sequer Directing December	- 1		(()MMAND)	DESCRIPTION	
Action Sequer	Power-Up N	Node			
Directing Respon with (90 addre	ntial Input or nse Output Type -99)	Requires Write Enable	Terminates Continuous Commands	Can Write to EEPROM	Can Write to DAC
Yes Befor		Yes (6)	No	Yes (9)	No
when stored in the EE an IN=RESET comma NOTE:	PROM with the SP and, or a watchdog tings, start-up mes	 command, cau timer timeout (if sages with User 	ses the specif factivated).	ied option(s) to (Default: MO=) DEPROM er	ror information will always
ser provided messag he message is store elected, a message i haracter of the D= st r D= message if a sp	ges may be up to 1 d in the EEPROM v s transmitted starti ring, or until a spac acing is desired. e startup message	6 characters lon with the C= and ng with the left n e character is e before sending	ng and may co D= command nost character ncountered. I commands to	ntain any infor s. When an M 2 r of the C= strir Jse the unders	litional information.) mation desired by the user or M3 power-up option is ng to the right most core (_) character in the C ne startup message is
o use the P2 , P4 , or ne bus. XAMPLES: nquiry:*dd MO	T2 commands on I	RS-485 units, th	e TO=C comn	nand must be s	set, and only for one unit o
, ,					
Action: *dd' *dd	WE MO={X2 P2 P4 T MO={M0 M1 M2			OM Store: *dd *dd	WE SP=ALL
Action: *dd' *dd	MO={X2 P2 P4 T	M3 N0 N1 N2 eadings. ssure readings ir	N3} ASCII formation binary formation	*dd t.	
Action: *dd' *dd *dd X2 P2 P4	MO={X2 P2 P4 T MO={M0 M1 M2 No continuous res Continuous pres Continuous cels	M3 N0 N1 N2 eadings. ssure readings ir ssure readings ir sius temperature	N3} ASCII formation binary formation	*dd t.	SP=ALL
Action: *dd *dd *dd X2 P2 P4	MO={X2 P2 P4 T MO={M0 M1 M2 No continuous res Continuous pres Continuous cels	M3 N0 N1 N2 eadings. ssure readings ir	N3} n ASCII forma n binary forma e readings.	*dd t.	
Action: *dd *dd *dd X2 P2 P4 T2	MO={X2 P2 P4 T MO={M0 M1 M2 No continuous res Continuous pres Continuous pres Continuous Cels	M3 N0 N1 N2 eadings. ssure readings ir sius temperature er-up Memory	N3} n ASCII formation binary formation readings.	*dd t. t.	IN=RESET Memory
Action: *dd *dd *dd X2 P2 P4 T2	MO={X2 P2 P4 T MO={M0 M1 M2 No continuous res Continuous pres Continuous Cels Powe Message (1)	M3 N0 N1 N2 eadings. ssure readings ir ssure readings ir sius temperature er-up Memory checksum (2)	N3} ASCII formation binary formation e readings.	*dd t. ssage (1)	SP=ALL IN=RESET Memory checksum (2)
Action: *dd' *dd *dd X2 P2 P4 T2 M0 M1 (3) M2 (3)	MO={X2 P2 P4 T MO={M0 M1 M2 No continuous pres Continuous pres Continuous Cels Powe Message (1) none factory user	M3 N0 N1 N2 eadings. ssure readings ir sius temperature er-up Memory checksum (2) no	N3}	*dd t. ssage (1)	IN=RESET Memory checksum (2) no
Action: *dd' *dd *dd X2 P2 P4 T2 M0 M1 (3) M2 (3) M3 (3)	MO={X2 P2 P4 T MO={M0 M1 M2 No continuous pres Continuous pres Continuous cels Powe Message (1) none factory	M3 N0 N1 N2 eadings. ssure readings ir sius temperature er-up Memory checksum (2) no yes	N3}	*dd t. t. ssage (1) none actory	SP=ALL IN=RESET Memory checksum (2) no no
Action: *dd' *dd *dd X2 P2 P4 T2 M0 M1 (3) M2 (3) M3 (3) N0 (4)	MO={X2 P2 P4 T MO={M0 M1 M2 No continuous pres Continuous pres Continuous Cels Powe Message (1) none factory user	M3 N0 N1 N2 eadings. ssure readings ir sius temperature er-up Memory checksum (2) no yes no	N3}	*dd t. t. ssage (1) none actory user	SP=ALL IN=RESET Memory checksum (2) no no yes
Action: *dd' *dd *dd X2 P2 P4 T2 M0 M1 (3) M2 (3) M3 (3) N0 (4) N1	MO={X2 P2 P4 T MO={M0 M1 M2 No continuous res Continuous pres Continuous Cels Powe Message (1) none factory user factory	M3 N0 N1 N2 eadings. ssure readings ir sius temperature er-up Memory checksum (2) no yes no yes	N3}	*dd t. t. ssage (1) none actory user user	SP=ALL IN=RESET Memory checksum (2) no no yes yes yes
Action: *dd' *dd *dd X2 P2 P4 T2 M0 M1 (3) M2 (3) M3 (3) N0 (4)	MO={X2 P2 P4 T MO={M0 M1 M2 No continuous res Continuous pres Continuous Cels Powe Message (1) none factory user factory none	M3 N0 N1 N2 eadings. ssure readings ir sius temperature er-up Memory checksum (2) no yes no yes no	N3}	*dd t. t. ssage (1) none actory user user none	IN=RESET Memory checksum (2) no no yes yes no

DIFFERENCES FROM LEGACY PPT:

T4 (°F) was available in the PPT but has been removed from the PPT2.

efore executing e enable must RS command tinuously updat	g this command be activated - * will be set and	d the digital and * ddNE , or * ddN no change will	Can Write to DAC Yes (11) DAC for direct host analog control must be IE=DAC. If there is an inpu
Write Enable No (7) apply an ASCI efore executing e enable must RS command tinuously updat	Continuous Commands No Il decimal form g this command be activated - * will be set and	EEPROM No at value to the d the digital and *ddNE, or *ddN no change will	Yes (11) DAC for direct host analog control must be
apply an ASCI efore executing e enable must RS command tinuously updat	II decimal form g this command be activated - ' will be set and	at value to the d the digital and * ddNE , or * ddN no change will	DAC for direct host I analog control must be
efore executing e enable must RS command tinuously updat	g this command be activated - * will be set and	d the digital and * ddNE , or * ddN no change will	analog control must be
L). the DAC is confor temperature 2T2 temperature f the next N = convite with the N = convite ubsequent N = convite digital input value	ntinuously upda e effects. When e changes, the ommand. mmand, chang command. ue at the DAC	ated at a rate d n DA=G, N , or I DAC output m les to DX and D at any time, wit	
digit past the de	ecimal point, ar r 4.000 volts) o d value <u>is</u> adjus	re input to the a or in millivolts to sted by DX and	
_	volts). The ddd	volts). The <i>dddd</i> value <u>is</u> adju by the O= , W= , H= , or L= settin	volts). The <i>dddd</i> value <u>is</u> adjusted by DX and by the O= , W= , H= , or L= settings if activated.

COMMAN	D CODE			COMMAND D	DESCRIPTION	
NE		Analog Outp	out Enable			
Action Directing	Sequential Response with (90-99) address	Input or Output Type	Requires Write Enable	Terminates Continuous Commands	Can Write to EEPROM	Can Write to DAC
No	No	In	No	No	Yes (9)	Yes
		and allows the mand for direc		r to control the	e DAC analog o	utput. This command is
EXAMPLES:						
Action: *ddNE	1					
	This enable	es the next cor	nmand to write	to the DAC a	nalog output.	
Action	: *dd NE=D	DAC		EEPRO	OM Store: *dd	WE
					*dd	SP=ALL
	remains ac		NE or*ddNE=			N= command. This enable condition can be stored in
Action	: *dd NE=C	DFF				
	This turns	off any active a	analog output e	enable, * ddNE	or *ddNE=DA	C
	E=DAC com	mand used wit				tly control the DAC. The '~ ot supported by the PPT2.

COMMAN				COMMAND E				
O=		Offset Pressure Window						
Action Directing	Sequential Response with (90-99) address	Input or Output Type	Requires Write Enable	Terminates Continuous Commands	Can Write to EEPROM	Can Write to DAC		
Yes	After (4)	Both	Yes (6)	No	Yes (9)	Yes (11)		
is used with t output voltag command. If will occur. For example analog 0V ou (W=1600) to	the W =, L=, and e. This command there is an inp (Default: O=0 when L=0 and utput would beg adjust the spa	d H= comman and has no effe ut error, then t) I H=0, if a 20 p gin at 4 psi (20 n if only a port	ds to customiz ect on the digit he command e sia (or 20 psig % of 20 psi) a ion of the rema	e the size of th al readings. Th error flag in the) unit had the o and be rescaled aining range is	ne PPT2 analog is command is RS command offset window s d to 5V at 20 ps of interest. If th	0.05%FS. This command g output window and analo enabled by the AN will be set and no change set to O=400 , then the si. Use the W= command he range of 4psi to 16psi is % of 20=12 psi) + 4 psi =		
psi). The ana was > 1600, NOTE: The sum of V	nit had the offs log 0V output then it is autor V= value and (set pressure wi would begin at natically set to D= values canr	indow set to O -12 psi, cross 1600. not exceed 200	=400 , then the 2.5V at 4 psi, 00. If the existin	and output 5V	e would be 8 psi (20% of 4 at 20 psi. If the W= value newly selected O= value >		
If a 20 psid u psi). The ana was > 1600, NOTE: The sum of V 2000, the exi	nit had the offs log 0V output then it is autor V= value and (sting W= value	set pressure wi would begin at natically set to D= values canr	indow set to O -12 psi, cross 1600. not exceed 200	=400 , then the 2.5V at 4 psi, 00. If the existin	and output 5V	e would be 8 psi (20% of 4 at 20 psi. If the W= value		
If a 20 psid u psi). The ana was > 1600, NOTE: The sum of V 2000, the exi	nit had the offs log 0V output then it is autor V= value and (sting W= value	set pressure wi would begin at natically set to D= values canr	indow set to O -12 psi, cross 1600. not exceed 200	=400 , then the 2.5V at 4 psi, 00. If the existin	and output 5V	e would be 8 psi (20% of 4 at 20 psi. If the W= value newly selected O= value >		
If a 20 psid u psi). The ana was > 1600, NOTE: The sum of V 2000, the exi EXAMPLES:	nit had the offs log 0V output then it is autor V= value and (sting W= value	set pressure wi would begin at natically set to D= values canr	indow set to O -12 psi, cross 1600. not exceed 200	=400 , then the 2.5V at 4 psi, 00. If the existin	and output 5V	e would be 8 psi (20% of 4 at 20 psi. If the W= value newly selected O= value >		
If a 20 psid u psi). The ana was > 1600, NOTE: The sum of V 2000, the exi EXAMPLES:	nit had the offs log 0V output then it is autor V= value and C sting W= value	set pressure wi would begin at natically set to D= values canr	indow set to O -12 psi, cross 1600. not exceed 200	=400 , then the 2.5V at 4 psi, 00. If the existined such that O	and output 5V	e would be 8 psi (20% of 4 at 20 psi. If the W= value newly selected O = value > = value equals 2000.		
If a 20 psid u psi). The ana was > 1600, NOTE: The sum of V 2000, the exi EXAMPLES: Inquiry: *dd O	nit had the offs log 0V output then it is autor V= value and C sting W= value	set pressure wi would begin at natically set to D= values canr e will automatic	indow set to O -12 psi, cross 1600. not exceed 200	=400 , then the 2.5V at 4 psi, 00. If the existined such that O	and output 5V ng W= value + = value plus W OM Store: *dd	e would be 8 psi (20% of 4 at 20 psi. If the W= value newly selected O = value > = value equals 2000.		

	ND CODE	Operating M	ada naramata		DESCRIPTION		
OP Action	Sequential	Input or	ode paramete Requires	Terminates	Can Write to	Can Write to DAC	
Directing	Response with (90-99) address	Output Type	Write Enable	Continuous Commands	EEPROM		
Yes	Before	Both	Yes (6)	No	Yes (9)	No	
control for pro perform an a external influ	essure reading utomatic syste ences. This o	is, watchdog ti m reset, simila otion is useful i	mer feature, a r to an IN=RE in applications	nd sleep mode SET command that are subje	s. If enabled, I, if the PPT2 b	sage, sequential read the watchdog timer will becomes interrupted due to noise, power glitches, (I)	
command err Descriptions	ror condition. below for OP= on compatible	N C and OP=	E F R S assum	ne CM=OFF. W	/ith CM=ON, P	not set and cause a RS 1-P4 pressure readings V command for more	
Actior				EEPRC	OM Store: *dd		
	*dd OP= {	A U } <u>or</u> *dd	OP={N C } <u>or</u>	•	*dd	SP=ALL	
	*dd OP= {	EFRS} or	*dd OP={X W	/}			
	 A Transmit <u>all</u> readings for sequential requests and continuous mode. U Transmit <u>only changed</u> pressure readings for sequential requests and continuous r Note: See DS command for controlling the amount of pressure deviation that is detected as a change. Upon receipt of a P2 or P4 command, the PPT2 will send of reading and then wait for a pressure change before sending another. Also, when C and MO=P2/P4, a power-up or IN=RESET will generate a single reading and then for a pressure change before sending another. N No checksum. C Apply an integrity Checksum to the binary format readings. When all of the charact the message, including the header and this character, are added together (with can the least significant six bits of the resultant sum will be zero. Do not include the <cr that is, if you add the 6 least significant bits of the – header, 5 data, and checksum</cr 						
		pendix A for th				ult will be zeroes (see	
	bin		dress and a 23	bit magnitude		ormat. This yields a 7 bit re reading. The pressure	
	F Fix	ed sign position for the P	n provides the 1 and P2 read	e same functior ings. With this	option the pre	bove but forces a sign ssure readings do not shift ifferential PPT2s.	
	R Re Th val rar	move header of e first transmitt ue and a <cr>. nge pressure of</cr>	characters from ted byte will be . In this mode, ondition in the	n P1 and P2 p the pressure there is no de P1 and P2 mo	ressure reading sign character vice ID number odes.	followed by the pressure or indication of out-of- mat. This yields a 7 bit	
	bin		fress and a sig		initude for data		
	W Wa	atchdog timer e	enabled resulti			top for > 5 ms. After reset, p message, regardless of	

	MO settings, and a flag will be set in the RS command response.
I	"Idle" mode (default) when I ≥ M20 and IC>0. PPT2 electronics enter a lower power mode during the idle time between integrations. Power savings of 10-20 percent can be expected.
D	"Deep Sleep" mode when I ≥ M20 and IC>0. PPT2 electronics will enter a sleep deep mode during the idle time between integrations. Power savings of 50-60 percent can be expected. However, any incoming characters will wake the device and place it into "Idle" mode.
	As such, this mode cannot be stored and all subsequent inquiries will indicate OP=I. To effectively utilize this mode, first place the transducer into a continuous transmit mode followed by setting OP=D.
	NOTE: Timing between continuous readings may not be accurate while in Deep Sleep mode. During Deep Sleep mode the PPT2 utilizes an internal RC oscillator which has a tolerance of ±60%.
DIFFERENCES FROM	I LEGACY PPT:
PPT command descrip	tion mentioned A/D pressure conversion counts in OP=E and OP=S, in an attempt to
demonstrate the effect	of 17 bit or 16 bit data. That information has been removed from PPT2 description. CM ne operation of OP. CM was not available with the PPT.
OP=I D is a new optior	n on the PPT2. The PPT had only one power saving mode.

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October, 2016

COMMAN	ND CODE	COMMAND DESCRIPTION					
P=		Production Date					
Action	Sequential	Input or	Requires	Terminates	Can Write to	Can Write to DAC	
Directing	Response	Output Type	Write Enable	Continuous	EEPROM		
	with (90-99)			Commands			
N	address			N			
No	After (4)	Out	No	No	No	No	
DETAILS:							
The Producti	on date comm	and reads the	factory set PP	T2 manufactur	red date with fo	rmat mm/dd/yy.	
NOTE:							
_							
EXAMPLES:							
L/V IVII LLO.							
Inquiry:	*dd P=						
inquiry.	uur –						
	ES FROM LEO						
No difference	e from PPT imp	plementation.					

COMMA	ND CODE	COMMAND DESCRIPTION				
P1		Pressure, S	Pressure, Single, ASCII Format			
Action Directing	Sequential Response with (90-99) address	Input or Output Type	Requires Write Enable	Terminates Continuous Commands	Can Write to EEPROM	Can Write to DAC
No	Before (5)	Out	No	No	No	No

The **P1** command requests a temperature compensated pressure (CP) reading in ASCII format. Refer to page 7 for decimal placement and significant digits. The **OP=A** or **U** 'all or changes only' parameter controls the output. If this command is executed while a **P2**, **P4**, **T2**, or **T4** command is executing, then one ASCII pressure reading is transmitted and the continuous command resumes operation.

NOTE:

The PPT2 continuously integrates (see **I=** command) and calculates pressure and temperature readings. When this command is received, the latest available reading is transmitted.

EXAMPLES:

Inquiry: *dd**P1**

A response of **#ddCP!0.000** either indicates the pressure is at zero and a temperature over/under range occurred or an error occurred in the PPT2 memory . Check **RS** for specific error.

A response of **#01CP=..** indicates a pressure reading is not yet available. Try again. This response may be a result of a **P1** request after a **CK or SP=ALL** request. **#01CP=..** may also be seen immediately after a power-up cycle and before valid data is available (long integration time). **#01CP=..** will also be the result when the ASCII output has been disabled using the **DA** command

DIFFERENCES FROM LEGACY PPT:

The PPT will reject any commands after an IN=RESET command and before the first integration cycle is complete. For example, if a PPT has an integration setting of I=M100, it will be 10 seconds after an IN=RESET before it will accept ANY commands. The PPT2 will respond to all commands immediately after initialization is complete, even if the response is only **#01CP=..**

	ND CODE				DESCRIPTION	
P2		Pressure, Co	ontinuous, AS	CII Format		
Action Sequential Directing Response with (90-99) address		Input or Output Type	Requires Write Enable	Terminates Continuous Commands	Can Write to EEPROM	Can Write to DAC
No (3) DETAILS:	After	Out	No	Yes (8)	No	No
reading rate suspend read	is controlled by dings options.	y the I= , IC , and For RS-485 m	d OP comman	d settings. See command m	e the DO=P or	in ASCII format. The N commands for the ansmit continuous reading:
sends only o For multiple I network and For a single I For single RS than one unit It is recomme especially wh If a P2 commented integration cy transmission	ne reading. RS-232 units in suspends the RS-232 unit, *c S-485 units (wi t continuously ended that con hen the PPT2 i hand is sent in ycle is complet is already acti at a rate determ	n a network, ty pressure readi ddIN will both s th TO=C) type broadcasting p tinuous broadc s broadcasting the midst of a e. This is most ve, subsequen	pe a \$*99IN to ngs while the * suspend and di a *ddIN to stop ressure in an F cast be interrup multiple readi PPT2 integration noticeable wit	o stop this com 99IN comman sable the outp p this comman RS-485 networ oted before ser ngs per secon on cycle, the fi h long duration Is will be ignor	imand. The '\$' id disables the out function. id. (It is not rec rk.) nding other act d. irst reading will n integration se	o TO=C), the P2 command is sent through the entire continuous output function ommended to have more ion or inquiry commands, not occur until the ettings. If P2 continuous gs will continue to be
Inquiry: *ddP						
		sable continu	ous pressure	readings for a	a single PPT2	
Туре	e: "dain Di				-	(RS-232 or RS-485)
			nuous pressu	ıre readings f	or all RS-232	(RS-232 or RS-485) PPT2s in a network.

COMMA	ND CODE	COMMAND DESCRIPTION				
P3		Pressure, Si	Pressure, Single, Binary Format			
Action Directing	Sequential Response with (90-99) address	Input or Output Type	Requires Write Enable	Terminates Continuous Commands	Can Write to EEPROM	Can Write to DAC
No	Before (5)	Out	No	No	No	No

The P3 command produces a single binary encoded temperature compensated pressure reading:

[With CM=OFF] 7 byte binary format; 1 byte header, 5 bytes encoded address and pressure data, and 1 byte <cr> char.

[With CM=ON] 6 byte binary format; 1 byte header, 4 characters of encoded address and pressure data, 1 byte <cr> char.

The OP=A or U 'all or changes only' parameter controls the output. If this command is executed while a P2, P4, or T2 command is executing, then one single binary format pressure reading is transmitted and the continuous command resumes operation.

The OP command also controls whether an integrity checksum is to be inserted between the last data byte and the <cr> character. See OP command for checksum calculation.

NOTE:

See notes in P1 command.

(see Appendix A – PPT2 Binary Command Format for P3 and P4 Commands). Refer to page 7 for default decimal placement and significant digits.

When CM=ON (PPT2compatibility mode) the P3 command produces a shorter PPT-compatible binary encoded temperature compensated pressure reading – 6 byte binary format; a 1 byte header, 4 bytes encoded address and pressure data, and 1 byte <cr>

EXAMPLES:

Inquiry: *ddP3

Typical reply: {@!160 Binary format compensated pressure reading from device ID=01 is 46.6352 mWC; refer to Table x.x and x.x

If reply is: xx??? Binary format compensated pressure reading not available, a memory error has occurred, or it has been disabled. The 'xx' is the header character and

the 6 most significant bits of the address. Response is xx??? for both CM=ON and CM=OFF.

DIFFERENCES FROM LEGACY PPT:

Default PPT2 implementation is 7 bytes versus 6 bytes for the PPT. Also, if a reading is not available, the only PPT2 response is xx??? where xx is the header character and 6 bits of address. The PPT also allows a response of xx_?? to indicate no reading is available.

No (3)	After	Out	No	Yes (8)	No	No
Directing	Response with (90-99) address	Output Type	Write Enable	Continuous Commands	EEPROM	
P4 Action	Sequential	Pressure, Co	ontinuous Bin Requires	ary Format	Can Write to	Can Write to DAC
COMMA	ND CODE	COMMAND DESCRIPTION				

The **P4** command produces a continuous stream of binary encoded temperature compensated pressure readings:

[With CM=OFF] 7 byte binary format; 1 byte header, 5 bytes encoded address and pressure data, and 1 byte <cr> char.

[With CM=ON] 6 byte binary format; 1 byte header, 4 characters of encoded address and pressure data, 1 byte <cr> char.

See P3 for typical reply. See the DO=P or DO=N commands for suspending readings from a P4 command.

The reading rate is controlled by the **I=**, **IC**, and **OP** command settings.

For RS-485 mode, the TO=C command must be set to transmit continuous readings.

NOTE:

(see Appendix A – PPT2 Binary Command Format for P3 and P4 Commands). Refer to page 7 for default decimal placement and significant digits.

For RS-485 units, when the continuous transmit parameter is NOT active (is not set to TO=C), the P4 command sends only *one* reading.

For RS-232 units, type a \$*ddlN to stop this command. The '\$' character suspends the pressure readings while the *ddlN command disables the continuous output function. For RS-485 units when TO=C, type a *ddlN to stop this command.

It is recommended that continuous broadcast be interrupted before sending other action or inquiry commands, especially when the PPT2 is broadcasting multiple readings per second.

If a P4 command is sent in the midst of a PPT2 integration cycle, the first reading will not occur until the integration cycle is complete. This is most noticeable with long duration integration settings. If P4 continuous transmission is already active, subsequent P4 commands will be ignored and readings will continue to be transmitted at a rate determined by the I=, IC, and OP settings.

EXAMPLES:

Inquiry: *ddP4

Type: *ddlN To stop a single PPT2 from continuous pressure reading.

Type: \$*99IN To stop the continuous readings for all PPT2s on the bus.

DIFFERENCES FROM LEGACY PPT:

Default PPT2 implementation is 7 bytes versus 6 bytes for the PPT. Also, if a reading is not available, the only PPT2 response is xx??? where xx is the header character and 6 bits of address. The PPT also allows a response of xx_?? to indicate no reading is available

No	Before (5)	Out	Out No No No No				
Action Directing	Sequential Response with (90-99) address	Input or Output Type	Requires Write Enable	Terminates Continuous Commands	Can Write to EEPROM	Can Write to DAC	
RS		Read Status	Read Status				
COMMAND CODE		COMMAND DESCRIPTION					

The **R**ead **S**tatus command is used to determine if an error, or warning, condition has been detected by the PPT2. The act of reading the **RS** command clears the error, or warning, indicators, except for memory checksum errors, which require <u>two consecutive</u> **RS** commands to clear.

If a sequential **RS** command is issued with the form: ***9dRS**, only addressed PPT2s with one or more error indications in the status register will respond; e.g., if the ***9dRS** command is returned with no response, then no errors exist.

If a sequential **RS** command is issued with the form: ***9dRS= =**, then all sequentially addressed PPT2's respond in connected sequential order, whether an error exists or not. This form can be used to get a sequential "I am here and OK" response from all PPT2s.

NOTE:

In the unlikely event of pressure correction memory, DAC correction memory, or configuration memory error, the temperature and pressure integration cycles will continue but readings will not be available. This can be overridden by executing two RS commands consecutively, which clears these error indications. Pressure, temperature and DAC readings will now be available, however, the readings may not be correct. The fourth error indicator (s) is prioritized in the order shown. When the **RS** command is issued with a group or global address (sequential mode), only PPT2s which have at least one error condition will respond. Replies are in sequential RS-232 bus loop connection order, followed by the return of the **RS** command.

At power-up, the internal PPT2 software checks to ensure that correction memory is properly loaded. If the transducer determines that correction memory has not been properly loaded, the RS response will be **RS=!!!!**. EXAMPLES:

Inquiry:*ddRS or *ddRS=

Re	olies:	?ddRS=	pqrs (n	ull address)	or	#ddRS=pqrs	(assigned address)	
		Where:	p = 0 p = 1 p = 2 p = 3 p = 4 p = 5 p = 6 p = 7 p = 8	Configuration Both pressure	memory chec ection data ch on data checks memory and memory and and DAC cor	ksum error ecksum error sum error DAC correction c		
			q = 0 q = 1	No command Command err				
			r = 0 r = 1 r = 2 r = 3	Framing error	See DO comm	and for additiona	l information)	
			s = 0 s = > s = < s = + s = - s = W s = R		ture condition ature conditio e condition (> re condition () er interrupt oc	n 1% over FS) >1% under lower	· limit) command description)	

A pressure-over-range error condition will occur when the applied pressure is greater than or equal to 1% of full scale (FS) above the FS limit. For example, if the pressure applied to a 20 psi unit is \geq 20.200 psi, then an over range error condition is set. Similarly, an under range condition occurs when the applied pressure is greater than or equal to 1% FS below the minimum limit. If the temperature exceeds the operating temperature limits, the over/under temperature error flag is set. The temperature output reading will remain at the limits.

Out-of-range temperature has display precedence over out-of-range pressure, which has precedence over s=W or s=R (only one of which can be active at a time). The indication is cleared only if the condition no longer exists. If temperature out-of-range, pressure out-of-range, and s=W had all existed, then with successive RS commands, the first command would show the temperature condition, the second command would show the pressure condition, the third command would show s=W, and the fourth command would show no error. If there had been an over and an under-range condition, then the first RS inquiry reply will be "000+", the second will be "000-" and the third will be "0000"

The maximum pressure reading will flatten out somewhere between 1% and 5% beyond the FS limit with increasing pressure. This limit varies from device to device but will continue to display the out-of-range indicator ("!" in place of "=") until the pressure drops below the 1% over FS limit.

DIFFERENCES FROM LEGACY PPT:

PPT "control" memory is now PPT2 "configuration" memory.

PPT "characterization table memory" is now PPT2 "pressure correction data memory".

No parity is used in PPT2 configuration or PPT2 pressure correction table memory.

Microprocessor bandwidth and internal noise indicators have been removed.

RS=!!!! is a new response sequence and indicates improperly loaded correction memory. The PPT did not have a similar RS response.

The PPT User's Manual indicated: "An ***9dRS!** or ***9dRS!=** echo response indicates one or more addressed PPTs had status data to transmit but did not have sufficient buffer space due to bus traffic. The **RS** command should be re-executed."

This will not be an issue with the PPT2

COMMAN	ID CODE	CODE COMMAND DESCRIPTION							
S=		Serial Numb	er						
Action Directing	Sequential Response with (90-99) address	Input or Output Type	Requires Write Enable	Terminates Continuous Commands	Can Write to EEPROM	Can Write to DAC			
No	After (4)	Out	No	No	No	Νο			
NOTE: If two PPT2 u numb		185 bus have t	he same ID the	en you can use	e the sequence	e below to re-assign ID			
EXAMPLES:									
In mu uniqu chara beca numt	85 type only ulti-drop bus co le ID for a new acter serial nur use the identif per), identifies	/ ID (address) nber of the PP ication match i the PPT2 for ic	assignment. C T2 (in this cas s made on all a	Command *99 \$ e the leading z 8 ASCII charac ddress assignn	S= ssssssss, wh zeros of the sen cters- not the d	ate a PPT2 with a non- nere ssssssss is the 8 rial number must be used lecimal value of the serial ress assignment is then			
Actior	Action: *99WE *99S= <i>sssssss</i> (this allows the PPT2 to accept the next *99ID command) *99WE *99ID= nn (this assigns the PPT2 #ssssssss the ID number 'nn')								
Where	e: ssssssss	,	U U			provide 8 characters.			
-	ES FROM LEC I parity bits sto		= value. No S=	a parity will be	stored or chec	ked in the PPT2.			

COMMA	ND CODE		COMMAND DESCRIPTION				
SP		Store Param	Store Parameters in EEPROM				
Action Directing	Sequential Response with (90-99) address	Input or Output Type	Requires Write Enable	Terminates Continuous Commands	Can Write to EEPROM	Can Write to DAC	
Yes	No	In	Yes	No	All	No	

The **S**tore **P**arameters command causes all control parameter(s) to be stored in the static memory (EEPROM) so they are available after power is cycled. Only changes are updated, and if an update is made, the configuration parameter memory checksum is also automatically recalculated and stored.

NOTE:

This command will not work when a ***ddWE=RAM** continuous write enable is active. It must have a singular write enable (***ddWE**) command preceding it.

To ensure the integrity of stored values, **SP=ALL** is only valid at transducer temperatures of -40°C or greater, per **T1/T2** temperature readings. At temperatures < -40°C, an **SP=ALL** request will be rejected and a command error indicated in the **RS** response.

EXAMPLES:

Action: *ddWE

*dd**SP= ALL** Writes all parameters to EEPROM.

DIFFERENCES FROM LEGACY PPT:

Only differences are the size, location, and contents of the EEPROM storage.

In PPT, SP=A, SP=AL, and SP=ALL are all valid variations of the Store Parameters command. In the PPT2, only SP=ALL is valid.

COMMA	ND CODE		COMMAND DESCRIPTION					
T=		Set Tare Value (gauge units only)						
Action Directing	Sequential Response with (90-99) address	Input or Output Type	Requires Write Enable	Terminates Continuous Commands	Can Write to EEPROM	Can Write to DAC		
Yes	After (4)	Both	Yes (6)	No	Yes (9)	Yes		

The Tare command allows the user to input a tare (zero offset) value, and is applicable only to gauge (psig) PPT2 types. This command has two forms. 1) Use the currently applied pressure to zero the PPT2 (SET), or 2) The user may supply a zero set point value (*TareValue*) in terms of a %FS pressure range. If there is an input value limit error, the command error flag in the **RS** command will be set and no change will occur. A pressure over or under range error will be set (see **RS**) and the "!" will appear in the reading if the applied pressure exceeds the FS range, or falls below zero, by 1%FS. (Default:**T=0.0000**)

What is a tare? Setting the tare is similar to setting an offset pressure. An example would be weighing an empty container before filling it. A tare is set to offset the weight of the container so that it is not included in the final weight.

EXAMPLES:	ligital and analog outputs.	
Inquiry: *dd T=		
Action: *dd	WE	EEPROM Store: *dd WE
*dd	T={SET <i>TareValue</i> }	*dd SP=ALL
SET	Set tare value to current pre	ssure present at the PPT2 pressure port.
TareValue	tare value that is between 2 four digits may be supplied PPT2 to 1/1000 psi (=0.01% *ddT=01 would be used. If command after the setting is percentage of full range (10 value outside of the allowed (see RS) will occur. When the	al number between 1.02 and -0.02. This corresponds to % above FS and 2% below zero, for gauge units only. Up following the decimal point. For example, to tare a 100 ps b) below its untared zero point, the command *ddT=-0.01 is advisable to confirm the setting by executing a *ddT= e established. The confirmation reply is always in terms o %FS = 0.1000). If an attempt is made to establish a tare range, the tare update will not occur and a command err the T= command is legally executed, it turns the tare control d for subsequent disabling and enabling of the user supp
DIFFERENCES FROM	I LEGACY PPT	

COMMAN	ND CODE		COMMAND DESCRIPTION							
T1		Sensor Tem	perature, Sing	gle, °C						
Action Directing	Sequential Response with (90-99) address	Input or Output Type	Requires Write Enable	Terminates Continuous Commands	Can Write to EEPROM	Can Write to DAC				
No	Before (5)	Out	No	No	No	No				
NOTE: When IC=0, reading every to indicate a When IC≠0,	corrected sens y 64 millisecon new T1 reading the delay for th not be availab	or temperature ds. Immediate g is not yet ava le first valid rea	ly after power- ailable.	enerally create up or IN=RES arger. For exa	d every 1 millis ET , the PPT2 n	econd resulting in a new T1 nay respond with #ddCT= and I=R1000 , a new T1				
PPT also had PPT descript	ion indicated th	r °F. PPT2 will he possibility o		obal command		! indicating that RS-232 e an issue with the PPT2.				

COMMAN	ID CODE			COMMAND D	DESCRIPTION				
T2		Sensor Tem	perature, Con	tinuous, °C					
Action Directing	Sequential Response with (90-99) address	Input or Output Type	Requires Write Enable	Terminates Continuous Commands	Can Write to EEPROM	Can Write to DAC			
No (3)	After	Out	No	Yes (8)	No	No			
DETAILS: The T2 command requests continuous temperature readings in degrees Celsius. The reading resolution is 0.1 degrees C. Each T2 reading is the average of 64 corrected temperature values. The reading rate for T2 is approximately 15 readings per second.									
NOTE: For RS-485 units, when the continuous transmit parameter is NOT active (is not set to TO=C), the T2 command sends only <i>one</i> reading.									
For RS-232 ι	inits, type a \$*	Ŭ	is command.	The ' \$ ' charact	er suspends th	e readings while the *99IN			
It is recomme	ended that con	tinuous broado	ast be interrup	oted before ser	nding other act	ion or inquiry commands.			
See also the	notes for the 1	1 command.							
EXAMPLES:									
Inquiry: *dd T	2								
Туре	: \$*99IN	T	o stop the con	tinuous tempe	erature reading	command.			
-	ES FROM LEC T3 and T4 for	GACY PPT: r °F. PPT2 will	not support T3	3 and T4.					

COMMAN	ND CODE			COMMAND D	DESCRIPTIO	N
тс		Tare Contro	I Switch			
Action Directing	Sequential Response with (90-99) address	Input or Output Type	Requires Write Enable	Terminates Continuous Commands	Can Write to EEPROM	
Yes DETAILS:	Before	Both	Yes (6)	No	Yes (9	Yes
established b		mand is used to				ction. When ON , the setting OFF , the factory supplied
	rror" will be set		mmand will be nmand status b		osolute and d	lifferential units and
Actior)M Store: *	
Action		ON OFF}		EEPRC		dd SP=ALL
			o T= command o factory zero s			
	ES FROM LEC e from PPT imp					

COMM	IAND CC	DDE					COMMAN	ID DESC	RIPTION			
то							rameters					
Action Directing	Res with	uential sponse (90-99) dress		ut or ut Type	Requ Write E		Terminat Continuo Comman	us EE	Write to PROM	Can	Write to DAC)
Yes		efore	В	oth	Yes	(6)	No	Y	es (9)		No	
DETAILS: Sets the T PPT2back Default: Te NOTE:	ransceiv ward cor	npatibili	ty						time. Oth	er settings	are reserve	ed for
EXAMPLE	ES:											
Inquiry: *de	d TO											
Action: *dd WE EEPROM Store: *dd WE												
	*dd TO={0-3 } *dd SP=ALL											
						.,						
	R Ring protocol for RS-232 units. For inquiry only. Cannot be modified.											
	M Multi-drop protocol for RS-485 units. For inquiry only. Cannot be modified.											
	0-	ba ba	ud rate	e of 960 es above	0 and be	elow, ea each co	ich count ount repres	(0-3) repr	esents ab	out 1 millis	nd time. Fo econd. Fo ion time. T	r
Ва	aud	120	240 0	480	960 0	1440 0	1920 0	28800	38400	57600	115200	
tin	ne/coun	0	1	0	-	0.7	0.5	0.35	0.26	0.17	0.09	
t		ms	ms	ms	ms	ms	ms	ms	ms	ms	ms]
	C Reserved placeholder for PPT2backward compatibility. Cannot be modified.											
		N Re	eservec	l placeh	older for	PPT2	backward	compatib	ility. Cann	ot be modi	fied.	
DIFFEREI PPT allow Also, the F See the Pl	ed for se PPT had	tting RS addition	-232 u al setti	nits to N ngs of T	- O={C A	S H} aı	nd TO={N					

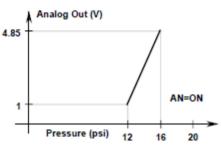
COMMAN	ND CODE				DESCRIPTION				
U=		User Suppli	ed Display Un	its					
Action Directing	Sequential Response with (90-99) address	Output Type	Requires Write Enable	Terminates Continuous Commands	Can Write to EEPROM	Can Write to DAC			
Yes	After (4)	Both	Yes (6)	No	Yes (9)	No			
The User supplied display units command allows the user to enter units of measure for the PPT2. The value entered for this command is multiplied by the actual pressure in psi to get the user defined units. For example, if *ddU=15.0 <cr>>, then the compensated pressure output values will be 15 times the actual psi value. This function (multiplier) is activated by executing the *ddDU=USER<cr>> command. If there is an input error, then the command error flag in the RS command will be set and no change will occur. Default: 1.0000</cr></cr>									
EXAMPLES: Inquiry: *dd U									
Actior	n: *dd WE			EEPROM Store: *dd WE					
	*dd U=	UserValue			*dd	SP=ALL			
<i>UserValue</i> Must be a value between 0.001 and 999.99. It is advisable to confirm the setting by executing a * ddU= <cr> command after the U= setting is established. The user supplied display function is activated by executing the *ddDU=USER<cr> command.</cr></cr>									
		EGACY PPT: mplementation.							

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COMMAN	ND CODE			COMMAND D	DESCRIPTION				
V=		Version Nun	nber						
Action Directing	Sequential Response with (90-99) address	Input or Output Type	Requires Write Enable	Terminates Continuous Commands	Can Write to EEPROM	Can Write to DAC			
No	After (4)	Out	No	No	No	No			
DETAILS: The V ersion number command transmits the factory-set software version number.									
NOTE:									
EXAMPLES:									
Inquiry: *dd V	=								
Reply	y: #01 V= 04	.44S2V							
	04.4	4 Software	version numb	er					
	;	S PPT2 Ty	ре	S: Stand	lard PPT2				
	2 or -	4 Digital O	utput	2 : RS-23	4 :	RS-485			
	,	Analog C	output	V: 0-5 vo	olt				
	ES FROM LEC								

COMMA	ND CODE	COMMAND DESCRIPTION					
W=		Width of Pressure Window					
Action Directing	Sequential Response with (90-99) address	Input or Output Type	Requires Write Enable	Terminates Continuous Commands	Can Write to EEPROM	Can Write to DAC	
Yes	After (4)	Both	Yes (6)	No	Yes (9)	Yes (11)	

Set the width, or span, of the pressure window to a smaller range to fill the analog output voltage limits. This command sets a pressure window value, or span, from 0.05 to 100% of full scale in increments of 0.05%FS. This command is used with the **O**=, **L**=, and **H**= commands to customize the size of the PPT2 analog pressure window and analog output voltage. If there is an input error, then the command error flag in the **RS** command will be set and no change will occur. This command is enabled by the **AN** command. See Figure below for command illustration with O=1200 and W=400, and a 20 psi PPT2 (Default: **W=2000**)



For example the figure above shows when L=0 and H=5000, if a 20 psia (or 20 psig) unit had the pressure window width set to **W=400**, then the 0 to 5 volt analog output span would correspond to 0 to 4 psi (20% of 20 psi). Use the **O=** command (**O=1200**) to offset the pressure window by 12 psi. Now the analog output values range from 0 volt=12 psi up to 5 volt=16 psi.

If a 20 psid unit had the pressure window width set to **W=1200**, then the pressure window would be 24 psi (60% of 40 psi). The analog 0V output would begin at -20 psi, cross 2.5V at -8 psi, and output 5V at 4 psi. If a window offset of **O=400** was set, then the analog 0V output would begin at -12 psi, cross 2.5V at 0 psi, and output 5V at 12 psi. When setting W=1200 and the pre-existing O= value is > 800, the O= value is automatically adjusted to 800.

NOTE:

The sum of **W**= and **O**= values cannot exceed 2000. If the existing **O**= value + newly selected **W**= value > 2000, the **O**= value will automatically be adjusted such that **O**= plus **W**= equals 2000.

EXAMPLES:

Inquiry:*dd**W=**

Action: *dd**WE**

EEPROM Store: *dd**WE**

*dd**W=**pppp |S

*dd**SP=ALL**

- *pppp* 0 2000 This number is a 0.05% percent (%) multiplier of the full scale pressure that sets the pressure span across the analog output range. It can also be thought of as scaling, or shrinking, the pressure window to fill the output voltage range. Requesting W=0 will set W=2000, full span. A W= entry greater than 2000 will set W=2000.
 - **S** This enables the analog output setpoint. The setpoint trip voltage is controlled by the **O**= command. The setpoint null, or hysteresis, is controlled by the **DS** command. The setpoint off voltage is controlled by the **L**= command and the on voltage is controlled by the **H**= command. See Appendix C for additional information.

DIFFERENCES FROM LEGACY PPT:

PPT only allowed settings of 0-100, each count representing 1%FS.

COMMA	ND CODE	COMMAND DESCRIPTION						
WE		Write Enable to EEPROM or RAM						
Action Directing	Sequential Response with (90-99) address	Input or Output Type	Requires Write Enable	Terminates Continuous Commands	Can Write to EEPROM	Can Write to DAC		
Yes	No	In	No	No	No	No		

The **W**rite Enable command enables a static memory write or a RAM write operation. It is used as a safeguard to prevent erroneous command sequences from changing the PPT2 configuration. A ***ddWE** command must immediately precede the **SP** command when storing information in static memory. The ***ddWE** command must also immediately precede any command that changes the configuration parameters in the RAM. When manually making multiple configuration changes, ***ddWE=RAM** command form may be used to permanently enable RAM updates until the next ***ddWE** or ***ddWE=OFF** command is executed

NOTE:

The ***ddWE** command remains active until the next '*' followed by a <cr> is received, or passes through. The only valid user parameters past the **WE** are "**=RAM**" and "**=OFF**". All other parameters will generate a command error.

EXAMPLES:

Action: *ddWE

This enables the next command to write to the RAM or EEPROM, and also disables the ***ddWE=RAM** condition after the next command is received.

Action: *dd**WE=RAM**

This provides a permanent RAM write enable. All commands following a *dd**WE=RAM** will be stored in RAM. A *dd**WE** command will disable, or deactivate, this permanent RAM write enable. The *dd**WE=RAM** command will not allow the **SP** command to write to EEPROM.

Action: *ddWE=OFF

This immediately disables the ***ddWE=RAM** condition.

DIFFERENCES FROM LEGACY PPT:

Unlike the PPT, incorrect characters following the WE will result in a command error. For example, the PPT would reject *01WEjlkm and yet not report a command error. The PPT2 will both reject the improper command and report a command error.

X=		COMMAND DESCRIPTION						
		Slope 1 – Us	er Compensa	tion Control				
Action Directing	Sequential Response with (90-99) address	Input or Output Type	Requires Write Enable	Terminates Continuous Commands	Can Write to EEPROM	Can Write to DAC		
Yes	After (4)	Both	Yes (6)	No	Yes (9)	Yes		
adjusts the s devices and adjustment is	lope of the pre modifies the po s shown below	ssure output co ositive full scale If there is an i See Figure bel	urve for positive slope of diffe nput error, the	e pressures. rential PPT2s. n the comman	This applies to The algorithm	ds. The X= command all absolute and gauge n for the X= slope the RS command will be se		
				-0.6%FS 20 Pressur	e (psi)			
Offset errors When chang request.	ing the X= valu				g any X= corre the first full int	ection. egration cycle following the		
Offset errors When chang request. EXAMPLES:	ing the X= valu							
Offset errors When chang request. EXAMPLES:	ing the X= valu	e, the correction		apparent until	the first full int	egration cycle following the		
When chang request. EXAMPLES: Inquiry: *dd X	ing the X= valu = n: *dd WE *dd X= <i>pp</i> 0 to ±30	e, the correction	on may not be	apparent until	the first full int DM Store: *dd *dd ng by multiplyi	egration cycle following the		

COMMAN	ND CODE			COMMAND D	DESCRIPTION				
Y=		Slope 2 – Us	er Compensa	ation Control					
Action Directing	Sequential Response with (90-99) address	Input or Output Type	Requires Write Enable	Terminates Continuous Commands	Can Write to EEPROM	Can Write to DAC			
Yes	After (4)	Both	Yes (6)	No	Yes (9)	Yes			
DETAILS: The user can adjust the pressure vs. output curve using the X=, Y=, and Z= commands. The Y= command adjusts the slope of the pressure output curve for negative pressures on differential type PPT2s. The algorithm for the Y= slope adjustment is shown below. If there is an input error, then the command error flag in the RS command will be set and no change will occur. See Figure below for command illustration. (Default: Y=0)									
		A Ani	alog Out (V)						
		5		+0.6%FS -0.6%F -0.6%F 20 Press	S				
					g any Y= corre the first full int	ection. egration cycle following the			
EXAMPLES:									
Inquiry: *ddY	=								
Actior	n: *dd WE *dd Y= pp	p		EEPRO	OM Store: *dd *dd	WE SP=ALL			
рр		0 This numb ne slope of the				ng it by 0.00002 and			
		Press	ure Output = [1 + (pp x 0.000	002)] x Pressu	e Reading			
-	ES FROM LEG entation was 0		0005 incremer	its: Pressure C	0utput = [1 + (p	p x 0.00005)] x Pressure.			

COMMA	ND CODE	COMMAND DESCRIPTION					
Z=		Offset – User Compensation Control					
Action Directing	Sequential Response with (90-99) address	Input or Output Type	Requires Write Enable	Terminates Continuous Commands	Can Write to EEPROM	Can Write to DAC	
Yes	After (4)	Both	Yes (6)	No	Yes (9)	No	

DETAILS:

The user can adjust the pressure vs. output curve using the X=, Y=, and Z= commands. The Z= command adjusts the offset of the pressure output curve. This applies to all absolute, gauge, and differential PPT2s. The algorithm for the Z= adjustment is shown below.

If non-zero, use the Customized Full Scale Range setting (F=) for the "Full Scale" in the equation. If F=0, use the factory-set M= full scale value. For differential units use one-half the range (FS=10 for a 10psid).

For a gauge unit, a zero offset null can be set by removing pressure and executing a Z=CAL command. For a differential unit, a zero offset null can be set by applying equal pressure to both ports and executing the Z=CAL command. Z=CAL is not applicable for absolute units.

If there is an input error, then the command error flag in the RS command will be set and no change will occur. See Figure X.X for command illustration. (Default: Z=0)

NOTE:

When changing Z= settings, deadband should be turned off (DS=0) to ensure Z= adjustments are properly applied.

Changes to the user F= value will cause any existing Z= value to be recalculated; up to the limit of valid Z= values ($\pm 60,000$) where (Z= new) = (Z= old) x (Full Scale Old / Full Scale New).

Example, if 20 psia PPT2 has Z=10 and F= is set to 15 PSIA, Z= is recalculated as: (Z= new) = 10 x (20/15) = 13.

When changing the Z= value, the correction may not be apparent until the first full integration cycle following the request.

EXAMPLES:

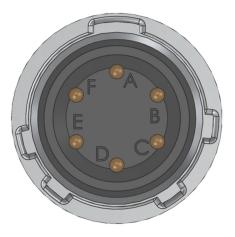
Inquiry:	*dd Z=
----------	---------------

Action:	*dd WE	EEPROM Store:	*dd WE					
	*ddZ={ppp CAL} *ddSP=ALL							
ррр	0 to \pm 60000 This number adjusts the pressure reading by adding (ppp x 0.0001% FS).							
	Pressure Output = [(ppp x 0.000001) x (Full Scale)] + Pressure Reading							
CAL	Sets the zero pressure condition to zero output. Offset is calculated and stored, then applied to all readings thereafter. Set Z=0 to cancel. The range of correction for the CAL command is the same as <i>ppp</i> described above. If the correction is out of range, then the Z= parameter will not be set and a command error will be indicated in the RS command response. Applicable for gauge and differential units only.							
DIFFERENCES FROM LEGACY PPT:								
PPT implementation was 0 to ±120 in 0.005%FS increments.								

itself will tem ired rate but v n continuous	porarily stop, o will not be trans	Can Write to DAC Can Write to DAC ontinuous pressure reading r suspend, transmission. smitted on the RS-232 d be filling the display. ey) is pressed.						
Continuous Commands eader charac itself will tem ired rate but v n continuous	EEPROM eter. During a co porarily stop, o will not be trans readings would	ontinuous pressure reading r suspend, transmission. smitted on the RS-232 d be filling the display.						
itself will tem ired rate but v n continuous	porarily stop, o will not be trans readings would	r suspend, transmission. smitted on the RS-232 d be filling the display.						
		us readings to resume afte eadings to resume.						
<pre>\$*ddV= (Suspend continuous pressure readings to read version number) (Resume continuous pressure reading after the V= reply)</pre>								
re	e readings t							

6.0 Electrical Connections

- Pin Name
- A RS-232 (TD) or RS-485 (B)
- B RS-232 (RD) or RS-485 (A)
- C Case Ground
- D Common Ground
- E DC Power Input
- F Analog Output

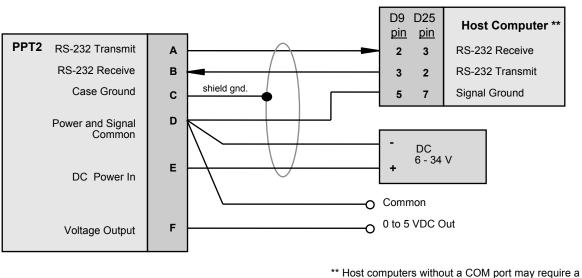


The generic P/N for PPT2 mating connector is "MS3116F10-6S"

Examples:

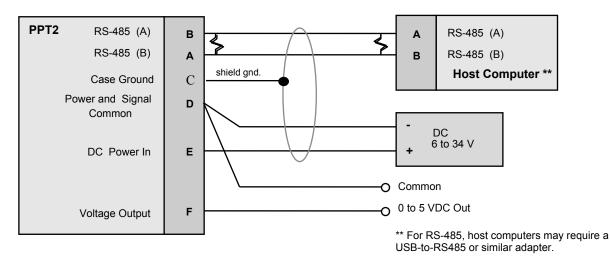
Amphenol P/N PT06A10-6S, Newark Stock no. 93F9344 Amphenol P/N PT06A10-6S (005), Newark Stock no. 09J8978 ITT Cannon P/N MS3116F10-6S Newark Stock no. 93F3377

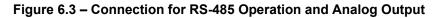




** Host computers without a COM port may require a USB-to-RS232 or similar adapter.

Figure 6.2 – Connection for RS-232 Operation and Analog Output





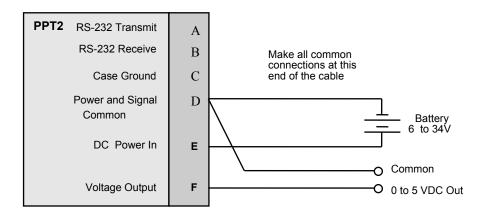


Figure 6.4 – Connection for Analog Output and Battery Operation

7.0 Installation Recommendations, Cautions and Materials of Construction

7.1 RECOMMENDATIONS

- 1. PPT2 media compatibility is non-condensing, non-corrosive, non-combustible gases. To ensure the best transducer performance it is strongly suggested that PPT2 transducers and associated plumbing be oriented to prevent accumulation of debris or condensation in the pressure ports.
- PPT2 port P1 should be shielded from direct light due to a strong photoelectric effect on the sense element.
- 3. For digital communications, cable length should be appropriate for the chosen standard: RS-232 or RS-485.

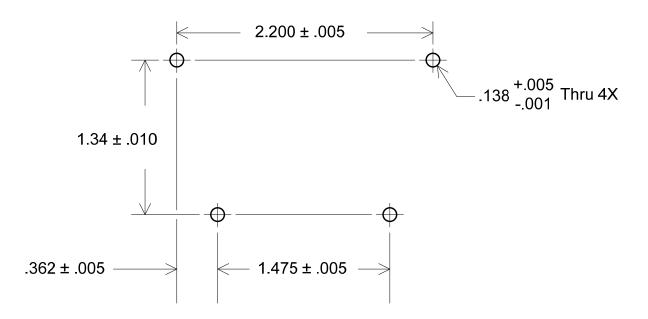
For RS-232, the commonly published maximum cable length is 50 feet. However, with high quality cable and lower bit rates, the maximum reliable cable length may be much longer.

For RS-485, the commonly published maximum cable length is 4000 feet. However, with high quality cable and lower bit rates, the maximum reliable cable length may be much longer.

4. The PPT2 was tested to show compliance with European Electromagnetic Compatibility directive 2004/108/EC.

To ensure the best performance in an EMI environment, cabling should be shielded twisted-pair with 360° shield termination at the mating connector back-shell. In addition, the PPT2 housing should be electrically grounded to a suitable chassis or airframe.

5. Mounting holes in the PPT2 are threaded for 4-40 UNC-2B screws, to a depth of .425 inches. When mounting the PPT2 to a plate, the recommended mounting hole pattern is shown below (upright orientation):



To install the PPT2 into legacy PPT applications, please consult Honeywell Application Note AN106, "Mechanically Mounting the PPT2 in Legacy PPT Applications", found at: <u>www.pressuresensing.com</u>.

7.2 CAUTIONS

- 1. The PPT2 is an ESD (electrostatic discharge) sensitive device. Damage may occur when subjected to high energy ESD. Proper ESD precautions should be taken to avoid performance degradation or loss of functionality.
- 2. The PPT2 is an EOS (electrical overstress) sensitive device. Damage may occur when subjected to EOS. Do not exceed specified ratings to avoid performance degradation or loss of functionality.

7.3 MATERIALS OF CONSTRUCTION

The PPT2 housing and cover are machined from 6061-T6/651 aluminum and plated with high phosphorus (10 – 13%) nickel, 0.0003 – 0.0005 inches thick. The cover is attached using Creative Materials silver-filled epoxy adhesive 118-15C. User-selected pressure fittings are either UNS C36000 H02 free cutting brass or UNS S30300/31600 stainless steel. As indicated in the PPT2 datasheet, internal sensor materials are compatible with non-condensing, non-corrosive and non-combustible gases.

8.0 Firmware Errata

8.1 Known issues with current PPT2 firmware revision 4.45SxV

As compared with the legacy PPT, absolute pressure PPT2's configured with OP=R (remove header characters), will insert an extra leading space character (0x20) in the P1/P2 response. This issue is not present on gauge or differential pressure PPT2's.

Appendix A: PPT2 Binary Command Format for P3 and P4 Commands:

For CM=ON (compatible with existing PPT)

- Binary format reply consists of 1 byte header character, 4 characters of encoded data, 1 byte optional cyclic checksum, 1 byte <cr> character.
- Error condition in the Header Character is **yes**, if over/under temperature or pressure error bit is set in the RS Command. Sign of Pressure data is also encoded in the header character. See Table 1 below.
- The 4 byte data value contains the device address and pressure reading. The most significant bit of each data character is a parity bit. The next most significant bit of each data character is either a 1 or 0 required to make the resultant byte a printable character. The six least significant bits of each data character are used for the device address and pressure reading.
- Sign bit is also encoded in binary value if OP=S.

{hhhh<cr>

'{' represents the header character 'hhhh' represents the 4 bytes of data.

Header Characters	Assigned Address	Error Condition	Data Sign	Alternate Hdr. RS-485 only (1)
{	Yes	No	+	DC1 (ctrl Q)
}	Yes	No	-	DC2 (ctrl R)
!	Yes	Yes	+	DC3 (ctrl S)
@	Yes	Yes	-	DC4 (ctrl T)
۸	Null	No	+	none
&	Null	No	-	none
	Null	Yes	+	none
%	Null	Yes	_	none

Table 1 – Header Description for Binary Format Pressure Readings

The device ID and the pressure reading can be read by combining the 6 least significant bits of each of the four 'h' characters, which result in 24 bits of information. The first 7 bits represent the device address in binary form (00 through 89 decimal). The next 17 bits represent the pressure reading and can be configured in the signed form or the extended form by using the OP=S command. The 24 bit binary forms are:

Extended:	7 bit binary device address	17 bit binary pressure data
Signed:	7 bit binary device address	sign bit + 16 bit binary pressure data
Example binary reply:	{@#16 <cr></cr>	

Refer to Table 1 for the header character '{' definition. The sign of this pressure value is determined by the header character. The next 4 characters, '@#16', contain the encoded device address and the temperature compensated pressure reading. For this example, the extended form is used so that the pressure data is represented as a 17 bit binary value.

Using standard ASCII codes, convert each of the 4 byte characters into the binary value equivalent. The bold portion of each character below represents the 6 least significant bits. (Both parity is off and OP=N)

'@' = 01 000000 '#' = 00 100011 '1' = 00 110001 '6' = 00 110110 Using the least significant (LS) 6 bits of each of the 4 data bytes, regroup the binary numbers into the 7 bit binary device address and 17 bit binary pressure data, which produces the 24 bit string:

000000 100011 110001 110110 = @#16 least significant 6 bits of each byte

<u>0000001</u> <u>00011110001110110</u> = (device ID=01) and (pressure = 15478)

The binary format reply indicates the device address is ID=01 and the pressure reading is 15478. Now, the decimal point position for the pressure reading must be determined. The decimal place is in the same position as when it reads a P1 pressure command, (see page 14 for decimal position information.) So, if this is a 20 psig device reading in inches water column (DU=INWC) then there are 2 decimal places. The final reading from the binary format will be 154.78 inH2O. The header character for this binary reply was '{' which indicates a positive pressure value.

For CM=OFF (PPT2 default, extra resolution)

- Binary format reply consists of 1 byte header character, 5 characters of encoded data, 1 byte optional cyclic checksum, 1 byte <cr> character.
- Error condition in the Header Character is **yes**, if over/under temperature or pressure error bit is set in the RS Command. Sign of Pressure data is also encoded in the header character. See table 1 below.
- The 5 byte data value contains the device address and pressure reading. The most significant bit of each data character is a parity bit. The next most significant bit of each data character is either a 1 or 0 required to make the resultant byte a printable character. The six least significant bits of each data character are used for the device address and pressure reading.
- Sign bit is also encoded in binary value if OP=S.

{hhhhh<cr>

'{' represents the header character

'hhhhh' represents the 5 bytes of data.

The device ID and the pressure reading can be read by combining the 6 least significant bits of each of the five 'h' characters, which result in 30 bits of information. The first 7 bits represent the device address in binary form (00 through 89 decimal). The next 23 bits represent the pressure reading and can be configured in the signed form (OP=S) or the extended form (OP=E). The 30 bit binary forms are:

Extended:	7 bit binary device address	23 bit binary pressure data
Signed:	7 bit binary device address	sign bit + 22 bit binary pressure data

Example binary reply: {@!160<cr>

Refer to Table 1 for the header character '{' definition. The sign of this pressure value is determined by the header character. The next 4 characters, '@!160', contain the encoded device address and the temperature compensated pressure reading. For this example, the extended form is used so that the pressure data is represented as a 23 bit binary value.

Using standard ASCII codes, convert each of the 5 byte characters into the binary value equivalent. The bold portion of each character below represents the 6 least significant bits. (Both parity is off and OP=N)

'@' = 01 000000 '!' = 00 100001 '1' = 00 110001 '6' = 00 110110 '0' = 00 110000

Using the least significant (LS) 6 bits of each of the 5 data bytes, regroup the binary numbers into the 7 bit binary device address and 23 bit binary pressure data, which produces the 30 bit string:

000000 100001 110001 110110 110000 = @!160 least significant 6 bits of each byte

<u>0000001</u> <u>0000111000111011010000</u> = (device ID=01) and (pressure = 466352)

The binary format reply indicates the device address is ID=01 and the pressure reading is 466352. Now, the decimal point position for the pressure reading must be determined. The decimal place is in the same position as when it reads a P1 pressure command, (see page 14 for decimal position information.) So, if this is a 100 psig device reading in meters of water column (DU=MWC) then there are 4 digits to the right of the decimal place (with CM=OFF). The final reading from the binary format will be 46.6352 mWC. The header character for this binary reply was '{', indicating a positive pressure value.

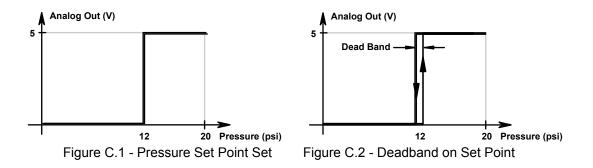
Appendix B: ASCII Table

DEC	HEX	ASCII	KEY	DEC	HEX	ASCII	DEC	HEX	ASCII	DEC	HEX	ASCII
0	00	NUL	ctrl @	32	20	SP	64	40	0	96	60	•
1	01	SOH	ctrl A	33	21	!	65	41	Α	97	61	а
2	02	STX	ctrl B	34	22	"	66	42	В	98	62	b
3	03	ETX	ctrl C	35	23	#	67	43	C	99	63	С
4	04	EOT	ctrl D	36	24	\$	68	44	D	100	64	d
5	05	ENQ	ctrl E	37	25	%	69	45	Е	101	65	е
6	06	ACK	ctrl F	38	26	&	70	46	F	102	66	f
7	07	BEL	ctrl G	39	27	•	71	47	G	103	67	g
8	08	BS	ctrl H	40	28	(72	48	Н	104	68	h
9	09	ΗT	ctrl I	41	29)	73	49	Ι	105	69	i
10	0A	LF	ctrl J	42	2A	*	74	4A	J	106	6A	j
11	0B	VT	ctrl K	43	2B	+	75	4B	κ	107	6B	k
12	0C	FF	ctrl L	44	2C	,	76	4C	L	108	6C	Ι
13	0D	<cr></cr>	ctrl M	45	2D	-	77	4D	М	109	6D	m
14	0E	SO	ctrl N	46	2E		78	4E	Ν	110	6E	n
15	0F	SI	ctrl O	47	2F	1	79	4F	0	111	6F	0
16	10	DLE	ctrl P	48	30	0	80	50	Ρ	112	70	р
17	11	DC1	ctrl Q	49	31	1	81	51	Q	113	71	q
18	12	DC2	ctrl R	50	32	2	82	52	R	114	72	r
19	13	DC3	ctrl S	51	33	3	83	53	S	115	73	S
20	14	DC4	ctrl T	52	34	4	84	54	Т	116	74	t
21	15	NAK	ctrl U	53	35	5	85	55	U	117	75	u
22	16	SYN	ctrl V	54	36	6	86	56	V	118	76	v
23	17	ETB	ctrl W	55	37	7	87	57	W	119	77	w
24	18	CAN	ctrl X	56	38	8	88	58	Х	120	78	х
25	19	EM	ctrl Y	57	39	9	89	59	Y	121	79	у
26	1A	SUB	ctrl Z	58	3A	:	90	5A	Z	122	7A	z
27	1B	ESC	ctrl [59	3B	;	91	5B	[123	7B	{
28	1C	FS	ctrl \	60	3C	<	92	5C	Ň	124	7C	i
29	1D	GS	ctrl]	61	3D	=	93	5D]	125	7D	}
30	1E	RS	ctrl ^	62	3E	>	94	5E	^	126	7E	~
31	1F	US	ctrl _	63	3F	?	95	5F	_	127	7F	DEL

* ASCII – American Standard for Coded Information Interchange

Appendix C: Setting an Analog Pressure Set Point

Another feature of the PPT2 is the ability to program an analog pressure set point that triggers the analog output from the low voltage setting (L=) to the high voltage setting (H=) using the W= and O= commands. These outputs can be used to activate alarms or lights based on pressure conditions. The set point can be changed via the digital serial interface.



If a set point from a 20 psig unit was desired whenever the pressure equals, or exceeds 12 psi, then set O=1200 (1200 x 0.05% =60%, 12 psi = 60% of 20 psi FS) and W=S (for setpoint). Figure C.1 illustrates the pressure vs. voltage response curve. The output will change to 5 volts at 12 psi. The output levels can be changed by using the L= and H= commands. If the unit were a 20 psid (differential), then the commands O=1600 (1600 x 0.05% = 80%, 32 psi = 80% of 40 psi FS) and W=S are used. The difference is that the offset (O=) is referenced to the minimum pressure value, which is -20 psi for this differential unit. If the pressure signal has some noise in it, then a deadband should be added to the set point. For a 20psig unit, setting DS=60 will put a ± 0.06 psi deadband around the 12 psi set point. That is, the output will switch from 0 to 5V at 12.06 psi for increasing pressures and switch from 5 to 0V at 11.94 psi for decreasing pressures. The I= command can be used to filter, (by increasing the integration time), any noise on the pressure signal.

Appendix D: RAM Initialization



