



Pressure Scanning Instruments (PSI) Utility Software User's Manual (PSI-Utility.exe)

January 2020

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Revision Sheet

Release No.	Date	Revision Description
Rev. 2.00	January 2016	Version 2.00 of PSI Utility User's Manual Released
Rev. 3.00	January 2020	Version 3.00 of PSI Utility User's Manual Released

Our Publication Disclaimer

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Our Company

Measurement Specialties develops, manufactures, and services physical devices called (as a group) Pressure Scanning Instruments (PSI) where the highest level of traceable accuracy is required for aerospace, industrial, municipal, and environmental applications. Our products have become the world standard for electronic level and pressure measurement and scanning. We are committed to the highest quality design, manufacture, and support of level and pressure instrumentation that is in the best interest of our customers. Measurement Specialties is an ISO 9001:2000 certified company.

Our Warranty

Measurement Specialties warrants each PSI Device (Optimus, Initium, or FDS) product to be free of defects in material and workmanship under normal use and service for one (1) year from date of shipment.

Merchandise Return Procedures

If your device seems to be in good working order, but the data seem abnormal, contact the **Applications Support Group** at Measurement Specialties. The staff is available for troubleshooting at **(757) 766-1500** or toll free at **1-800-745-8008** during normal working hours, Eastern time. If the entire system or any part must be returned to Measurement Specialties, please obtain a *Returned Merchandise Authorization* (RMA) from the Customer Service Department.

Be prepared to supply the following information when requesting the RMA:

- Part number
- Serial number
- Complete description of problems/symptoms
- **Bill To** and **Ship To** address
- Evaluation/repair purchase order number (not required for warranty repairs)
- Customer contact and telephone number

The above information, including the RMA number must be on the customer's shipping documents that accompany the equipment to be repaired. Measurement Specialties also requests that the outside of the shipping container be labeled with the RMA number to assist in tracking the repairs. All equipment should be sent to the following address:

ATTN: CUSTOMER SERVICE (with RMA number)
Measurement Specialties, Inc.
1000 Lucas Way
Hampton, Virginia 23666

Measurement Specialties will return North American warranty items prepaid via UPS GROUND. Overseas warranty items will be returned via AIR FREIGHT. If the customer desires another method of return shipment, Measurement Specialties will prepay and add the shipping charges to the repair bill.

Incoming freight charges are the customer's responsibility. The customer is also responsible for paying shipping charges to and from the Measurement Specialties factory for any equipment not under warranty.

All products covered under warranty policy will be repaired at no charge. An analysis fee will be charged to quote the cost of repairing any item not under warranty. If, for any reason, the customer decides not to have the item repaired, the analysis fee will still be charged. If the quote is approved by the customer, the analysis fee will be waived. The quote for repair will be based on the factory's flat rate for repair, calibration, and board replacement. When these prices do not apply, the quote will be based on an hourly labor rate plus parts. All replaced parts are warranted for 90 days from the date of shipment. The 90-day warranty is strictly limited to parts replaced during the repair.

Our Firmware

This manual was prepared for the module firmware as was released in 2006, 2010, and 2020. Addenda will be distributed as deemed necessary by Measurement Specialties. Any questions regarding firmware upgrades may be addressed to the Applications Support Group. Firmware revisions, application software revisions, and manual addenda may be obtained from the TE Test and Measurement Sensor Applications web page, <http://www.te.com/usa-en/industries/sensor-solutions/applications/test-measurement.html>.

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Chapter 1: Introduction

1.1 What is the PSI Utility Software?

The software allows the user to put a **Pressure Scanning Instrument** device (Optimus, DTC Initium, or FDS) into immediate use by:

- Automatically connecting to the PSI unit,
- Automatically discovering and initializing each attached DTC scanner,
- Quickly acquiring data,
- Real-time displaying of the most recent data on-screen,
- Logging data to disk in Excel™-ready CSV format,
- Commanding a re-zero as desired,
- Commanding a multi-point span cal.

The software also provides important utilities to:

- Verify system accuracy,
- Verify that each port is correctly plumbed,
- Update firmware in the **PSI** data acquisition unit,
- Read and display scanner calibration valve position,
- Store DTC coefficients to disk,
- Reload scanner coefficients from disk, Show attached scanners and,
- Show default initializations.

1.2 How Does the PSI Utility Software Work?

Setup files control the appearance and operation of the **PSI Utility Software**. These setup files are plain text files that the user may edit, and thus customize the behavior to the needs of a particular site or test. The default files should be sufficient for basic operation of most users.

The PSI Utility Software is a program with built-in functions, and the capability of defining new functions in terms of existing functions. As such, this software could be described as “user programmable.”

1.3 System Requirements

The “minimum computer” that will run the **PSI Utility Software** for demonstration or checkout is different from the “recommended computer” that would be used for operating a Optimus, Initium, or FDS operating with scanners that are taking data at high speed in a facility test.

The “minimum computer” required for the **PSI Utility Software** requires:

- Microsoft Windows® 98 or later (Win 98, Win 2000, Win XP, Win-7, Win-8 supported)
- Ethernet card: 10-base-T or faster
- 128 megabytes of RAM (Random Access Memory)
- Intel Pentium™-3 processor, 800 MHz processor
- SVGA display
- At least 5 megabytes of disk space available for the program and setup files.

The “minimum recommended computer” for using the **PSI Utility Software** as a data system requires:

- Microsoft Windows® XP Professional or later
- 1000-Base-T full duplex Ethernet card
- 4 Gigabytes of RAM
- Intel Core-3 processor, 1.6 GHz, or equivalent (better if possible)
- X VGA display, with hardware accelerator
- At least 10 megabytes of disk space available for the program and setup files.
- Disk space as required for test data (20+ gigabytes, recommended).
- Data backup method (Network, CD-ROM (CD-R), or tape).

PSI-Utility version 3.00 has been fully tested using Microsoft Windows® version 10.

The **PSI Utility Software** may also be used to control the PSI / Measurement Specialties System 8400, operating the System 8400 alone or concurrently with other Pressure Scanning Instruments (PSI) system(s).

If this capability is desired, and If the System 8400 Is ***NOT ETHERNET CAPABLE***, there is an additional requirement that the host computer have a National Instruments® IEEE-488 Interface Card installed. Supported models include:

- PC-2/PC-2A
- PCI-GPIB
- PCMCIA-GPIB
- PCUSB-GPIB

Chapter 2: Installation

2.1 Unpacking and Inspection

Please read and understand the appropriate Hardware User's Manual before operating the equipment. Examples include: DTC Initium User's Manual, Optimus User's Manual, or FDS User's manual. If there are any questions about its operation, do not hesitate to call the Applications Support staff or Customer Service at Measurement Specialties. (Telephone 757-766-1500 or 1-800-745-8008).

In addition to receiving your Pressure Scanning Instrument data acquisition unit, associated hardware for mounting, and necessary mounting tools, your shipment will also contain a CD-ROM with the appropriate User's Manual (in PDF format) and this utility application startup software for Windows®- based PCs.

2.2 Installing the PSI Utility Software

Insert the CD-ROM into the appropriate drive of your computer and wait for the autorun function to execute the setup file. If autorun does not begin the installation program, use Windows® Explorer or "My Computer" to go to the appropriate drive. Find the "setup.exe" file in the PSI-Utility Software folder and double-click it. This will begin the installation program. Follow the prompts and instructions presented in order to complete the installation. PSI Utility version 3.00 will create a directory named C:/PSI-Utility-300, and install the software in that directory. It is important that the program **NOT** be installed in the default locations set by Windows 7 or Windows 10. There is no need to reboot your computer after installation. Versions of Windows® prior to Windows 2000 will require a computer reboot prior to being able to operate the data acquisition system or the utilities.

An "Installation Successful" message will signify completion of the software installation.

Chapter 3: Operation

3.1 Starting the PSI Utility Software

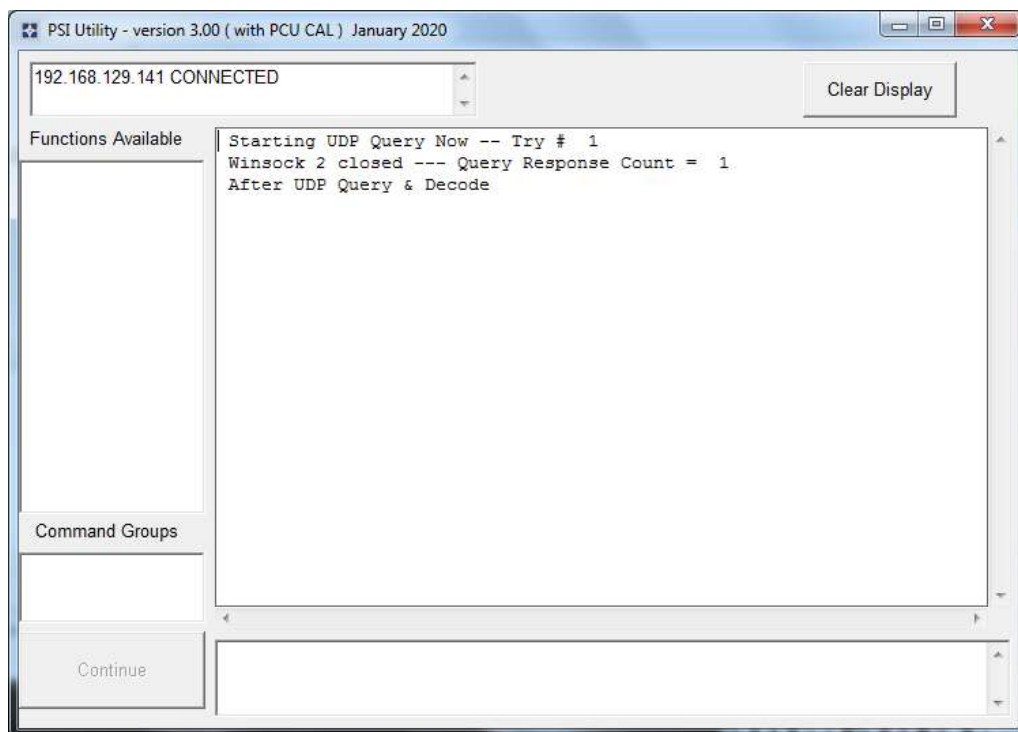
Locate the **PSI Utility Software** file on your computer by clicking on **Start/Programs/PSI Utility Software**, and then click the icon.

When the PSI Utility Software is started it will query the network, looking for Pressure Scanning Instruments: Optimus, Initium, or FDS units. If only one PSI device is found, the Utility Software will automatically connect to it.

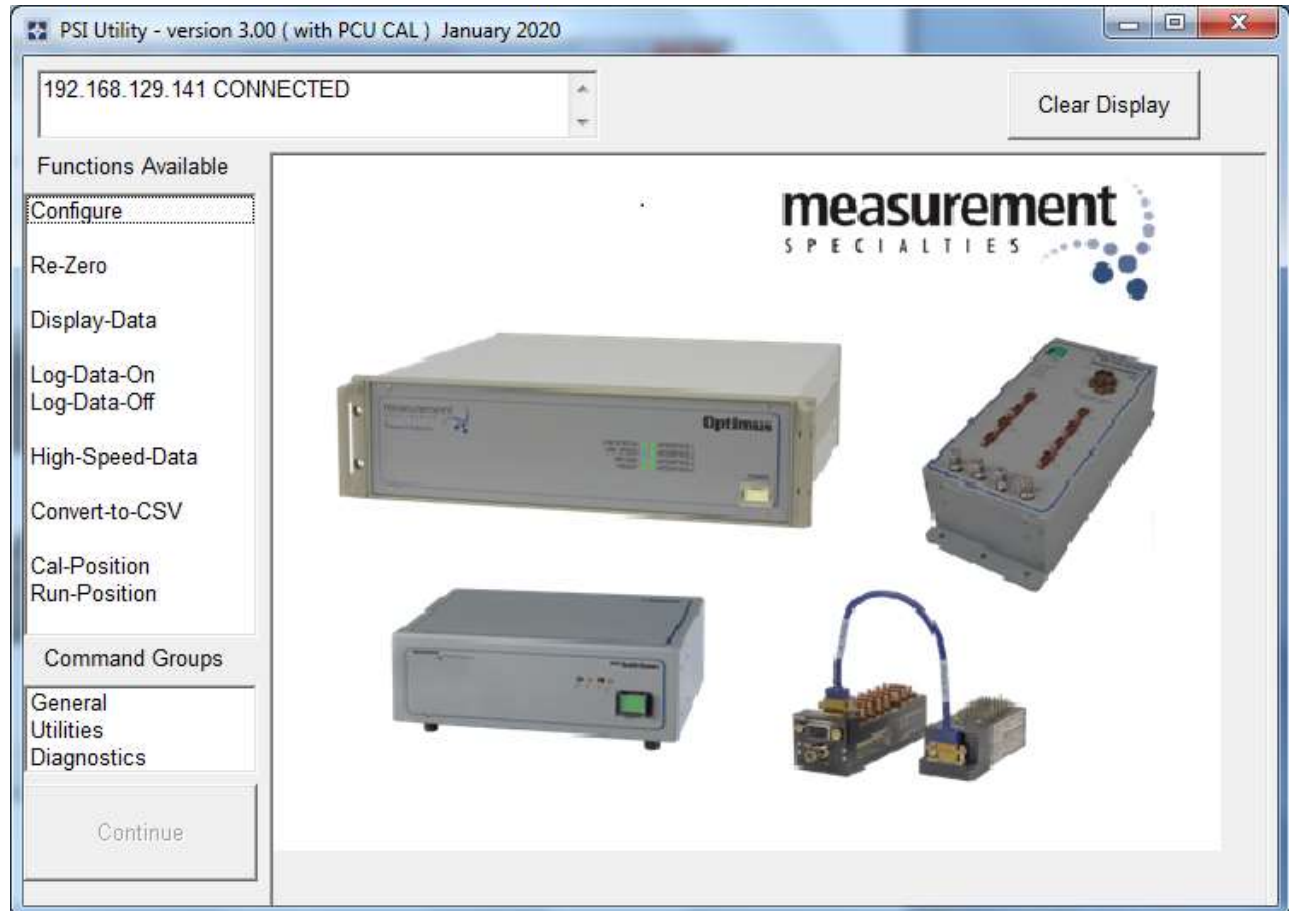
If more than one PSI device is found, the Utility Software will automatically connect to the unit with the IP address specified in the "InitiumSetup.txt" file. If none of the units match the specified IP address, then the user will be presented with a list of PSI devices (by IP address), and the user must select one device, and then click the "Connect" button.

Up to eight (8) PSI devices may be connected at the same time. To connect to more than one device (at the same time), the InitiumSetup.TXT file must be edited, and the units identified by IP address.

When a PSI Device is powered up, it will identify each DTC scanner that is attached and read all information that it needs from each scanner (e.g., pressure range(s), serial number(s), calibration coefficients, and the like). This takes approximately 30 seconds for each attached scanner. The PSI Utility Software will poll the PSI Device every five (5) seconds, waiting for it to become "ready." Until it is "ready," the following screen will appear.



When the **PSI Unit** has queried each scanner and extracted all pertinent information, the following “ready” screen will appear.



NOTE: Each PSI data acquisition unit is shipped with its Ethernet address set at 192.168.x.y, where x and y are determined by a function of the serial number. This may be changed at the discretion of the user.

3.2 Functions in the “General” Command Group

3.2.1 Configure

Configure brings up a screen (shown below) that allows you, the user, to:

- Select the drive, file path and folder name(s), and file name where data will be stored.
- Selects the UNIT OF MEASURE that data will be presented in. Note that “pounds per square inch” or PSI is the default. Other units such as Pascal, KiloPascal, millimeters of mercury, etc. are available.
- Set the DATA ACQUISITION parameters for up to 4 pre-defined user-defined configurations. You may specify a SETUP NAME, a software trigger DATA RATE (or set Hardware Trigger), and the quantity of data desired.
- Determine if the “automatic FFT display” will be run at the end of each data point.

The screenshot shows the 'Configure and Build Diags' window with the following settings:

- Select Data Drive:** c: [OS]
- Select Data Path:** C:\DATA-TEST\DATA-GOES-HERE
- Data File Name:** TEST-1
- Data File Per Scanner?:** ☒ Single Data File, ☐ Data File per ESP
- Append Data File or Data File per Point ???:** ☐ Append data to existing file, ☒ New Data file for each data point, with auto increment of file name
- Drive, Path, and Name:** C:\DATA-TEST\DATA-GOES-HERE\TEST-1
- Set Unit of Measure:** User (psi), inH2O
- Thermal Update Rate:** ☐ Best, ☒ One Only
- Start FFT at end of each data point:** ☐

	Setup Name (user defined)	Data Rate (Hz)	Data Time (seconds)	# of data points (enter if hardware)	Record Temp
Setup 1	DEMO1	333 Hz 250 Hz	10	2500	<input checked="" type="checkbox"/>
Setup 2	DEMO2	250 Hz 200 Hz	10	2000	<input checked="" type="checkbox"/>
Setup 3	DEMO3	53 Hz 50 Hz	5	250	<input type="checkbox"/>
Setup 4	HT-DEMO	Hardware No Delay	ENTER->	0	<input type="checkbox"/>

At the bottom, there are two buttons: 'Exit - No Save' and 'Exit - with Save'. A text box shows 'Text1 Click count = 1'.

3.2.2 Re-Zero

Re-Zero — Re-zero is a single point calibration at zero differential applied pressure and is all that is necessary to achieve the re-zero only published accuracy for the **PSI Device** and all attached scanners. Re-zero automatically does the following:

- Applies C1 control pressure for five (5) seconds to each attached scanner. This will shift each scanner's calibration valve from "RUN" to "CAL" position.
- Acquires data from all attached transducers, adjusts the "C_Z coefficient" for each transducer so that the transducer will indicate zero pressure.
- Applies C2 control pressure for five (5) seconds to each attached scanner. This will shift each scanner's calibration valve from "CAL" to "RUN" position.

Re-zero does not alter the coefficients stored in the scanner, only the coefficients currently in use by the PSI device. These coefficients may be examined, and/or permanently stored, using appropriate functions.

3.2.3 Display-Data

Display-Data — Display-Data will acquire data, using scan table #1 (default-inits will set a data rate of 2 Hz, but user may specify data rate), and display the data for any one scanner on the screen in real time.

- You may switch between DEVICES – if more than one PSI device is connected.
- If data acquisition is STOPPED, you may change units-of-measure.
- Option buttons are provided to allow the selection of any attached scanner. You may switch which scanner is being displayed even while data acquisition is running.
- Option buttons are also provided to allow for LOG TO DISK to be turned ON or OFF. The following screen is a typical display if only one scanner (with 32 ports) were attached to connector #1 of the DTC Initium.

NOTE: **The user must STOP data acquisition before exiting the Display-Data screen.**

When the "**Log Data to Disk**" (Data Logging) is **ON**, the Display-Data function will record data directly in Microsoft EXCEL® spreadsheet format (CSV), adding date and time information before each data record.

Display Data (Acquire data from all scanners, display data from one scanner)

DEVICE: Dev-111 Scan List #: 1 Ports in scan: 32 Units: User
psi

START LOG DATA TO DISK
☐ ON ☒ OFF

Select a Scanner ☒ #1 ☐ #2 ☐ #3 ☐ #4 ☐ #5 ☐ #6 ☐ #7 ☐ #8 Exit Data Display

101	-0.0015	117	-0.0018				
102	-0.0014	118	-0.0015				
103	-0.0018	119	-0.0008				
104	-0.0017	120	-0.0014				
105	-0.0012	121	-0.0013				
106	-0.0014	122	-0.0013				
107	-0.0013	123	-0.0015				
108	-0.0012	124	-0.0016				
109	-0.0012	125	-0.0014				
110	-0.0016	126	-0.0013				
111	-0.0012	127	-0.0015				
112	-0.0012	128	-0.0015				
113	-0.0014	129	-0.0025				
114	-0.0010	130	-0.0014				
115	-0.0018	131	-0.0009				
116	-0.0013	132	-0.0019				

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3.2.4 Log-Data-On & Log-Data-Off

Log-Data-On and **Log-Data-Off** — These functions switch the PSI Utility Software package so that when either “Display-Data” or “High-Speed-Data” are selected, the data logging function will obey the current switch settings. Data logging defaults to OFF each time the program starts.

3.2.5 High-Speed-Data

High-Speed-Data — High-Speed-Data acquires data using scan table #2, with the default data rate set at the maximum rate supported by the PSI Device and the scanners attached. This data rate is greater than 325 Hz per port for ESP-64-DTC scanners and 650 Hz for ESP-32-DTC scanners.

NOTE: Advanced users may configure ESP-64-DTC scanners to only scan 32 ports from each scanner. This allows the user to achieve 650 Hz using a mixture of ESP-32 and ESP-64 DTC scanners. Similarly, if only 16 ports are scanned from each ESP-32 or ESP 64 scanner, and if hardware trigger is used, then 1200 Hz

High-Speed-Data stores data in binary format. Function “Convert-to-CSV” may be manually activated by the user, or will be performed automatically when the program is terminated.

3.2.6 Convert-to-CSV

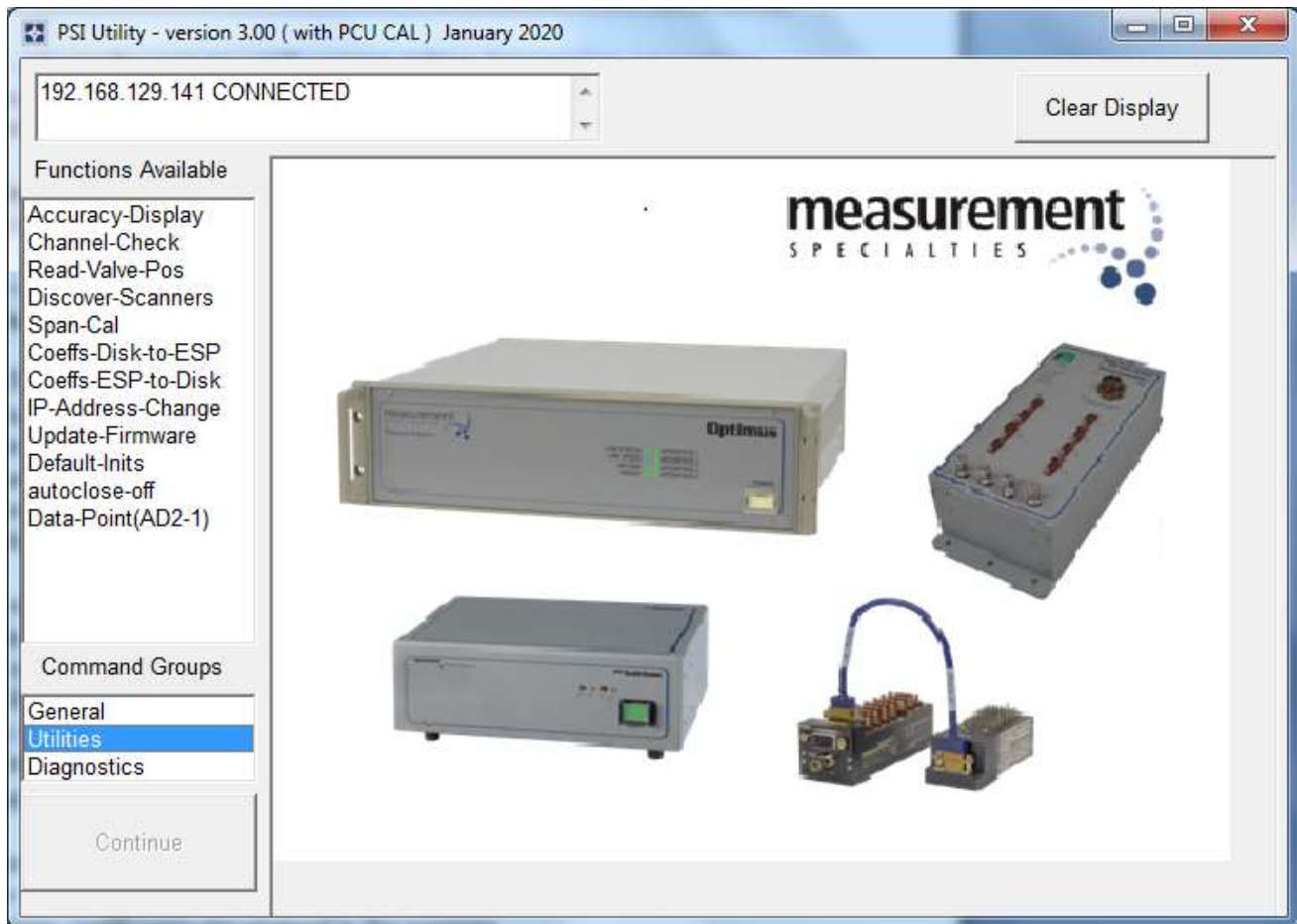
Convert-to-CSV -- This function converts any and all data in the high-speed binary-data storage file into Microsoft© CSV format. This allows the data to be easily imported into EXCEL© and other programs for data charting and data analysis (such as FFT).

3.2.7 Cal-Position & Run-Position

Cal-Position and **Run-Position** — These functions command the PSI Device to place all scanners into the “Calibrate Position” or to place all scanners into the “Run Position.” The PSI Device has the ability to “read” or “check” the valve position of each DTC scanner, but note that the Cal-Position and Run-Position commands do not verify position.

3.3 Functions in the “Utilities” Command Group

Clicking “Utilities” in the “Command Groups” section opens the following screen.



Accuracy-Display — Allows the user to verify the PSI Device accuracy by applying known pressures from an accurate pressure source. The user is prompted to provide a known pressure, the logical range number, the actual pressure applied, the full-scale pressure, the allowed error budget, a time delay in seconds, and the number of data points to average.

Accuracy Display with User Supplied Calibration Pressure

The Accuracy Display for a PSI Device: The PSI Device acquires data, and compares the reported pressures with the user-supplied calibration pressure. Results are displayed and optionally logged to disk.

The user is expected to provide a high-accuracy, stable, calibration pressure. Accuracy and stability to better than 0.02 percent of Full Scale is assumed.

Logical Range (default, all scanners @ 1)	Calibration Pressure (provided by user)	Full Scale Pressure	Error Budget (percent of full scale)	Time Delay (seconds)	Number of Data Points to Average
1	5	15	.05	5	1

LOG TO DISK
☒ On ☐ Off

Perform the Accuracy Demonstration

Exit Now

When the accuracy demonstration is finished, a report of the following format is shown. If log-to-disk is on then a similar report is available (ready to print) with the raw data available in the CSV file.

LRN	Px Desired	Full Scale Px	Pressure Applied	Mean Indicated Px
1	0	15	0.0000	0.0000

Port by port detail for current applied pressure

Accuracy Display : PCU vs Sensors 10:31:45 07-10-2006

Logical Range 1 Generated Px = 0.0000

Full scale = 15 Error Tolerance = 0.0500

Time Delay = 5

CRS	RSSPP	P_avg	Avg Error	PerCent-FS	bad-chnls
111	101	0.0000	0.0000	- 0.0001	
111	102	0.0000	0.0000	- 0.0001	
111	103	0.0000	0.0000	0.0002	
111	104	0.0002	0.0002	0.0012	
111	105	0.0000	0.0000	0.0001	
111	106	0.0000	0.0000	0.0001	
111	107	- 0.0001	- 0.0001	- 0.0004	
111	108	0.0001	0.0001	0.0004	
111	109	0.0002	0.0002	0.0012	
111	110	0.0000	0.0000	- 0.0001	
111	111	0.0003	0.0003	0.0017	
111	112	0.0000	0.0000	0.0003	

Mean Error - px and % FS	Accuracy Spec.	Pass Count	Fail Count
0.0000 (eu) or 0.0002 %FS	.05	32	0

Statistical Data

std dev of error = 0.0002

99 percent confidence level = 0.0005

Std Dev as a percent of full scale = 0.0011

If the user has PSI manufactured pressure calibrators (model 843x with System 8400, or model 903x NetScanner calibrators) then the accuracy demonstration may be fully automated.

Channel-Check — Allows the user to verify proper tubing (pneumatic) connections. Pressure is applied to one connection and the PSI Utility Software reports to which port the pressure is applied.

Read-Valve-Position — Each DTC scanner incorporates a calibration valve position sensor. This command instructs all scanners to report their current calibration valve positions.

Discover-Scanners — The PSI Device automatically discovers all attached scanners upon power-up. This command instructs the PSI Device to report this information to the user.

Span-Cal — The DTC Scanners require a span calibration at 6-month intervals to maintain published specifications. The span calibration may be applied at any temperature within the calibrated temperature range, once the PSI Device and all attached scanners have been powered up for at least one hour. All scanner calibration valves are automatically shifted if supply pressure is present at the PSI Device data acquisition unit and the C1/C2 lines are connected between the unit and the scanners.

The user selects one or more scanners to participate in the multi-point calibration. The AS-FOUND coefficients for each scanner are collected and written to disk – for security. The user will be prompted to select a unit of measure (PSI, mmHg, Pascal, etc.), and up to 10 “calibration points.” The user will then be prompted to apply accurate, known pressures, and to enter the pressure value. Data will be collected, new coefficients produced, a REPORT is generated (and written to disk). This data is then used to generate new zero (C_z) and span (C_s) coefficients unique to each port of each scanner.

The new coefficients are displayed, and the user will be prompted to store the new coefficients into the scanners. If the user exits the program without storing the new coefficients, the previous coefficients are retained in the scanners.

FOR STEP BY STEP INSTRUCTIONS, please see APPENDIX F of this document, or the ESP-calibration-how-to.doc, which may be found in the C:\PSI-Utility-300 folder.

Coefficient-Disk-to-ESP — This command instructs the PSI Device to load factory calibration coefficients from a file into the DTC scanners. This may be useful to recover from accidents, such as cut cables.

Coefficients-ESP-to-Disk — This command instructs the PSI Device to retrieve coefficients from a DTC scanner and write them to a file. Factory calibration coefficients are provided on disk for each scanner. This command serves to provide backup copies if the original file is not available.

IP-Address-Change — Each PSI Device is shipped with IP address set at 192.168.x.y, where x and y are determined by a function of the serial number, with subnet mask 192.0.0.0. This command allows the user to change either or both settings.

Update-Firmware — This command allows the user to download new firmware from a factory-supplied file. For reliability, the original firmware remains active until the firmware download has been successfully verified.

Default-Inits — This command tells the system to INITIALIZE all discovered devices using factory default values. All discovered scanners will be initialized, with all ports scanned. Scan Table #1 will default to 2 Hz data, 64 averages, software trigger, EU output. Scan Table #2 will default to “max data rate” (typically either 325 or 650 Hz), single point data, software trigger, with EU output.

Autoclose-off — This command instructs PSI-Utility to “not automatically close” the currently open window. Some functions turn AUTOCLOSE to ON, as this allows the scripting of functions. But when operating in an interactive mode, it is often needed to have AUTOCLOSE OFF. This function provides that.

Data-Point(AD2-1) — This command instructs PSI-Utility to acquire a single data point, using scan table #1, and display the data in linear tabular form on the screen. This is slow and inefficient, but valuable for trouble-shooting.

Chapter 4: Function File Construction

The PSI Utility Software program is controlled by “Function Files.” The default Function Files provide the most commonly needed functionality, and are easily customized by the user.

To encourage good documentation and readability, Function Files have the following characteristics:

- They are plain text (Notepad or WordPad may be used to edit them).
- They are not case sensitive.
- Embedded comments and white spaces are ignored by the program and encouraged for user documentation.
- Each Function File may contain up to 120 user-defined functions

Within a Function File, the following rules apply:

- Comments about what a function file does and how it works are strongly encouraged.
- Each function must begin with the key word “**FUNCTION**,” and have a Function Name. Function Names may be up to 18 characters long, but spaces between characters are **NOT** allowed.
- Functions may (and often do) contain **DTC Initium** commands.
- Functions may invoke “built-in-commands” (called Key-Words) of the **DTC Initium Utility Software**.
- Functions may invoke (or **CALL**) other functions.
- Each function must end with the Key-Word “**EndFunction**.”

In general, every line in the Function File should be one of the following:

- A comment or white space (to encourage good readability and documentation).
- A command recognized by the **DTC Initium** data acquisition unit (hardware).
- A Key-Word recognized by the **DTC Initium Utility Software** program.

The commands recognized by the **DTC Initium** data acquisition unit are fully documented in **Chapter 3** of the **DTC Initium User's Manual** and are fully compatible with the Pressure System's **System 8400** command set.

The Key-Words recognized by the **DTC Initium Utility Software** are listed below. More detail about each Key-Word is documented in **Chapter 5** of this manual. While the program is **NOT** case sensitive, upper case is often used to make the Key-Words more easily recognized.

KEY-WORD	ACTION SUMMARY
'	The apostrophe (not a comma) marks this line as a comment
"	Often the double apostrophe is used to start a comment
Function	Start Function definition, assign a function name
EndFunction	End the function definition
LOG	Turn DATA and REPORT Log-To-Disk ON or OFF
CLS	Clear the display (to reduce clutter)
DATE	Add the current date to all output(s)-report file, data file, display
TIME	Add the current time to all output(s)-report file, data file, display
CLEARPIT	Clear the "Port Index Table"
WAIT	Cause the Utility Software to delay for "n" seconds
SHOWBUFFER	Turn the hex dump facility ON or OFF
PRINT	Displays a string in the current text box
LET	Assign a value to one of the "user input strings"
INPUT	Enters a string from the Keyboard
OUTPUT	Sends a string to the DTC Initium unit
CALL	Cause another function to begin execution
AAT	Accuracy Demonstration Function
NOISE	Data Scatter (data noise) Demonstration Function
CHNLCHECK	Discover which pressure port has pressure applied
SHOWSCAN	Data display at 2 Hz
SPAN-CAL	Performs a zero and span calibration (2 points)
READ-VALVE-POS	Determine and display the current calibration valve position for each attached scanner

LOAD-COEFFS-DISK-TO-DTC-SCANNER	Copy DTC coefficients from disk, and load them into a DTC scanner
	or
DUMP-DTC-COEFFS-SCANNER-TO-DISK	Copy DTC coefficients from a DTC scanner and write them to disk

The default installation provides three Function Files which set the content of the “**General Command Group**,” the “**Utilities Command Group**,” and the “**Diagnostics Command Group**.” These function files are named: “General.Txt,” “Utility.Txt,” and “Diags.Txt,” respectively and are installed in the same directory as the program (C:\PSI-Utility-300\). Feel free to examine them as examples of how Function Files are constructed.

NOTE: The DTC Initium Software Utility reads these three files upon program startup. If any of these files is modified, the change(s) will become effective if you “select” another menu, and then return. For example, if changes are made to the diags.txt file, simply click off of “Diagnostics” onto “General”, and then back to “Diagnostics.” The program will re-load the diags.txt file, and the new DIAGS.TXT will be active, with your changes.

Chapter 5: Key-Word Syntax

Keyword: ' (the apostrophe)
Command Format: '[text-string]
Purpose: Mark a line of text as a comment, to be ignored
Parameters: text-string (optional)
Example: ' Please use comments to document your Functions

Keyword: Function Command
Format: Function Function-Name
Purpose: Start a function definition, assign a name to this function
Parameters: Function-name, up to 18 characters, no white space allowed
Example: Function This-Is-My-Test

Keyword: EndFunction
Command Format: EndFunction
Purpose: Mark the end of a Function
Definition Parameters: none
Example:

Keyword: LOG
Command Format: LOG [ON] [OFF] [Filename]
Purpose: Turn Data and Report Log-to-disk on or off
Parameters: OFF turn data log OFF (default)
Parameters: ON data log on using specified file name
Parameters: Filename data log on using specified file name
Example: LOG ON mytest01.dat
Explanation: Open file MYTEST01.DAT, for APPEND. If the file currently exists, add all output to the end of the file. If the file does not exist, create it, and add all output to end.

Keyword: CLS
Command Format: CLS
Purpose: Clear the current text box of the display
Parameters: none
Example: CLS

Keyword: DATE
Command Format: DATE
Purpose: Add current date (as reported by Windows™) to all outputs
Parameters: none
Example: DATE

Keyword: TIME
Command Format: TIME
Purpose: Add the current time (as reported by Windows™) to all outputs
Parameters: none
Example: TIME

Keyword: CLEARPIT
Command Format: CLEARPIT
Purpose: Clear the "Port Index Table." The DTC Initium Software Utility has a need to know the current initialization. Before changing the initialization, it is important to clear the default initialization, so that information is not duplicated.
Parameters: none
Example: CLEARPIT

Keyword: WAIT
Command Format: WAIT desired-delay-in-seconds
Purpose: Cause the program to delay for "n" seconds
Parameter: desired-delay-in-seconds
Example: WAIT 30
Explanation: Delay for 30 seconds, then continue

Keyword: SHOWBUFFER Command
Format: SHOWBUFFER [ON] | [OFF]
Purpose: Turn the PACKET HEX DUMP facility on or off. This allows the user to see exactly what the **Initium** has sent to the host computer - on a byte by byte basis.
Parameter: ON Turn the "Packet Hex Dump" option ON.
Parameter: OFF (DEFAULT) Packet Hex Dump is disabled
Example: SHOWBUFFER ON

Keyword: PRINT
Command Format: PRINT [text-string]
Purpose: Send the optional text-string to the current text box
Used to prompt the user for input
Parameter: text-string
Example: PRINT Please Input the actual pressure set

Keyword: LET
Command Format: LET string-designator= [text_string]
Purpose: Assign the optional text string to one of the five reserved "user definable" strings.
Parameter: string-designator, one of these: A\$ | B\$ | C\$ | D\$ | E\$
SPECIAL NOTE: String-designator must immediately be followed by the equal sign.
Example: LET A\$= LA4 111;

Keyword: INPUT
Command Format: INPUT string-designator
Purpose: Read input from the keyboard, and place the keyboard input into one of the five reserved "user definable" strings.
Parameter: string-designator, one of these: A\$ | B\$ | C\$ | D\$ | E\$
Example: Input E\$

Keyword: OUTPUT
Command Format: OUTPUT
Purpose: Concatenate (link) the five "user definable" strings, and send this command string to the Initium.
Example: OUTPUT

Keyword: CALL
Command Format: CALL Function-Name
Purpose: Pass Control to another Function. Upon completion, the "called" function will return control to the current function, at the next command in the current function.
Parameter: Function-Name Function-Name must match the name of another function in this function file. The called function may be before or after the current function in the macro file.
Example: Call Accuracy-Demo-R1

Keyword: AAT
Command Format: AAT lrn px pfs err-tol t-delay n-avgs [AUTOCLOSE]
[USER-MODE]
Purpose: Perform a "Automatic Accuracy Demonstration", for all
scanners calibrated by a specified Logical Range.
Parameter: lrn logical range number to be demonstrated
Parameter: px test pressure, to be externally set
Parameter: pfs full scale pressure of the scanners
Parameter: err-tol max allowable error, percent of full scale
Parameter: t-delay pressure settling delay, in seconds
Parameter: n-avgs number of data points to take, and average
Parameter: AUTOCLOSE (optional) automatically close the display window
Parameter: USER-MODE (optional and default) the user is prompted to
interactively enter each parameter, instead of specifying them in the
file.

Example: AAT 1 2.50 5.0 0.050 5 1 AUTOCLOSE
Explanation: Perform Auto Accuracy Demonstration, logical range 1.
Set a pressure of 2.50 PSI, on scanners that are 5.0 PSI full scale.
Flag any port that has more than 0.050 percent of full scale error.
Delay 5 seconds after the pressure is set, before the data is acquired,
and take only one data point. Automatically close the window at end
of demonstration.

Required pre-existent conditions:

- AAT does not shift scanner calibration valves. Pressure scanners must be shifted into the calibrate position (CALPOS) before the start of the test, and back to run position (RUNPOS) after the tests are completed.
- Scan Table #1 will be used to acquire data
- Data will be logged to disk if and only if LOG ON is in effect.

Keyword: NOISE

Command Format: NOISE lrn px pfs err-tol t-delay DUMMY [noise-spec]
[crs] [AUTOCLOSE] [USER-MODE]

Purpose: Perform a "Noise and Accuracy Demonstration", for all scanners calibrated by a specified Logical Range.

Parameter: lrn logical range number to be demonstrated

Parameter: px test pressure, to be externally set

Parameter: pfs full scale pressure of the scanners

Parameter: err-tol max allowable error, percent of full scale

Parameter: t-delay pressure settling delay, in seconds

Parameter: DUMMY parameter is ignored

Parameter: noise-spec Set "max allowable noise," percent of full scale.
default = 0.025 percent of full scale.

Parameter: crs optional address of the Initium to be tested. Default of 111 is assumed.

Parameter: AUTOCLOSE (optional) automatically close the display window

Parameter: USER-MODE (optional and default) the user is prompted to interactively enter each parameter, instead of specifying them in the file.

Example: NOISE 1 2.50 5.0 0.050 5 1 0.040 111

Explanation: Perform a Noise and Accuracy Demonstration, for logical range 1. Set a pressure of 2.50 PSI, on scanners that are 5.0 PSI full scale. Flag any port that has more than 0.050 percent of full scale error. Delay 5 seconds after the pressure is set, before the data is acquired. Acquire data from the Initium at address 111. Flag any port that has a standard deviation of noise that is greater than 0.040 percent of full scale.

Required pre-existent conditions:

- "Noise" does not shift scanner calibration valves. Pressure scanners must be shifted into the calibrate position (CALPOS) before the start of the test, and back to run position (RUNPOS) after the tests are completed.
- Scan Table #2 will be used to acquire data
- Data will be logged to disk if and only if LOG ON is in effect.

Keyword: CHNLCHECK or CHANNELCHECK (both accepted)
 Command Format: CHNLCHECK [<flag-error-delta> [<CRS> [<tbl>]]
]
 Purpose: Discover what ports(s) have pressure applied. Used to verify that all ports are functioning, that there is not port-to-port cross-talk, and/or that each port is plumbed correctly.
 Parameter: flag-error-delta Only ports where pressure indicated differs from base-line pressure by more than flag-error-delta are shown. Default value is 0.5 of current pressure unit.
 Parameter: CRS Data is taken only from one CRS. Default is CRS = 111.
 Parameter: tbl default: Data is taken using Scan Table #1

Keyword: SHOSCN
 Command Format: SHOSCN
 Purpose: Acquire data and display up to 64 ports of data on the screen, in near real time (default for Scan Table 1 is 2 Hz).
 Parameters: none

Keyword: LOAD-COEFFS-DISK-TO-DTC-SCANNER
 Command Format: LOAD-COEFFS-DISK-TO-DTC-SCANNER
 Purpose: Copy DTC coefficients from a disk file, and load them into a DTC Scanner
 Parameters: none
 Special NOTE: While this command has NO PARAMETERS, it does require the operator to locate the coefficient file (browsing the disk), and click on a command button to begin the process. Normally, the operator is expected to have only one DTC scanner attached to the **Initium**.

Keyword: DUMP-DTC-COEFFS-SCANNER-TO-DISK
 Command Format: DUMP-DTC-COEFFS-SCANNER-TO-DISK crs scanner-#
 Purpose: Copy DTC coefficients from DTC scanner, and create a disk file
 Parameter: crs The CRS of the Initium, default is 111
 Parameter: scanner#: Electrical connector of the scanner to be DUMPed

Appendix A – InitiumSetup.txt

```

"
" File Name: InitiumSetup.txt
"
" File Location: app.path & "\\InitiumSetup.txt"
"      ( default: c:\\PSI-Utility-300\\InitiumSetup.txt )
"
" Revised for PSI-Utility version 3.00, on January 3, 2020
"
" =====
"
" COPYRIGHT:
"
" January 2020
"
" Measurement Specialties,
" TE Connectivity
"
" =====
"
"
" INTRODUCTION
" -----
"
" "InitiumSetup.txt" is the main configuration file for PSI-Utility.
"
" PSI-Utility is the main application used to test and operate
" the Optimus, Initium, Flight Data System, and legacy System 8400 products
" produced by Measurement Specialties, a division of TE Connectivity.
"
" This Utility is provided at no cost, as a EXECUTABLE program (for Windows OS),
" and in SOURCE CODE (Visual Basic).
"
"
" RULES OF OPERATION
" -----
"
" 1) PSI Utility communicates with a LIMITED NUMBER of DEVICES.
"
" 2) PSI Utility should be told which devices you wish it to communicate with.
"
" 3) The list of <device-type> that PSI Utility recognizes is:
"
"      Initium
"      8400-SP
"      Optimus-SP
"      8400-LS
"      8400-RP
"      8426-FIU
"      Optimus-FIU
"      843x-PCU

```

```

"      9x16
"      9x46
"      903x-PCU
"      UDP          ( single-cast / multi-cast )
"      FDS          ( Flight Data System version of Initium )
"
"
" 4) Each and every DEVICE must also be assigned a CRS address
"
" 5) Each and Every DEVICE that you wish PSI-Utility to communicate with should have a DEVICE
"    command line of the format:
"
"    DEVICE  device-type crs-address device-ipaddress
"
"          where device-type is one of the entries found in the list of devices of rule #3 above
"          and device-ipaddress is the IPv4 address of the device, or of the "parent device".
"
"          NOTE: 8400-LS, 8400-RP, 8426-FIU, 843x-PCU will each have the Device-IPaddress
"                  of the 8400-SP or Optimus-SP that they are installed into.
"
"                  THEY MUST STILL EACH HAVE A "DEVICE" command line.
"
"
" 5) Some Legacy 8400 devices do not support Ethernet, and instead use the IEEE-488 instrument buss.
"    To support these, PSI-Utility recognizes USE488ONLY as key-word, and will communicate via
"    IEEE-488 instead of Ethernet.
"
"
"=====
"
" Example #1: OPTIMUS EXAMPLE
"
" The Optimus is a multi component system and PSI-Utility must be
" made aware of the components included in the local installation.
"
" This is accomplished by referencing each sub component through the
" TCP/IP address of the Optimus System Processor.
"
" The structure of the configuration stanza is:
"
" DEVICE <device-type> <CRS> <TCP/IP Address>
"
" Below is an example of an OPTIMUS system,
"   with the Optimus-SP assigned crs = 100
"   with 3 FIUs installed ( crs = 111, 112, 113 )
"   with 2 RPs ( remote processors )
"       RP #1 assigned crs = 200
"       RP #2 assigned crs = 300
"   With 4 843x-PCUs ( pressure calibrate units )
"       PCU #1 located in slot 1 of RP #1, assigned crs 211
"       PCU #2 located in slot 3 of RP #1, assigned crs 213
"       PCU #3 located in slot 1 of RP #2, assigned crs 311
"       PCU #4 located in slot 3 of RP #2, assigned crs 313
"
" Note that every device communicates with PSI Utility via the
" IP address of the Optimus-SP

```

```

"
" -----
"
"     DEVICE OPTIMUS-SP  100  192.168.1.149
"
"     DEVICE OPTIMUS-FIU 111  192.168.1.149
"     DEVICE OPTIMUS-FIU 112  192.168.1.149
"     DEVICE OPTIMUS-FIU 113  192.168.1.149
"
"     DEVICE 8400-RP    200  192.168.1.149
"     DEVICE 8400-RP    300  192.168.1.149
"
"     DEVICE 843x-PCU   211  192.168.1.149
"     DEVICE 843x-PCU   213  192.168.1.149
"     DEVICE 843x-PCU   311  192.168.1.149
"     DEVICE 843x-PCU   313  192.168.1.149
"
"
" =====
"
" Example #2: 8400 IEEE-488 example
"
" The IEEE488 interface for 8400 is configured in a similar
" manner to the Optimus with the exception being the substitution
" of the keyword "USE488ONLY" for the TCP/IP Address of the System Processor.
"
" The structure of the configuration stanza is:
"
" DEVICE <device-type> <CRS>  USE488ONLY
"
" =====
"
" Below is an example of an 8400 system,
"   with the 8400-SP assigned crs = 100
"   with 1 FIUs installed ( crs = 111 )
"   with 1 843x-PCU installed in the 8400-SP ( slot 3, CRS = 113 )
"   with 1 RP ( remote processor )
"       RP #1 assigned crs = 200
"   With additional 843x-PCUs ( pressure calibrate units )
"       PCU #2 located in slot 1 of RP #1, assigned crs 211
"       PCU #3 located in slot 3 of RP #1, assigned crs 213
"
"
" DEVICE 8400-SP  100  USE488ONLY
" DEVICE 8426-FIU  111  USE488ONLY
" DEVICE 843x-PCU  113  USE488ONLY
" DEVICE 8400-RP  200  USE488ONLY
" DEVICE 843x-PCU  211  USE488ONLY
" DEVICE 843x-PCU  213  USE488ONLY
"
" =====
"
" Example #3: 8400 Ethernet example
"

```

```

" The Ethernet interface for 8400 is configured in a similar manner
" to the Optimus with the exception being the keyword "NOQUERY" being
" added after the TCP/IP Address of the System Processor.
"
" This keyword tells PSI-Utility that there is no method for UDP discovery of the
" system because the 8400 did not support it.
"
" Forgetting to add "NOQUERY" results in the unit not being discovered
" at application start time.
"
"
" DEVICE <device-type> <CRS> <TCP/IP Address> NOQUERY
"
" =====
"
" Below is an example of an 8400 system, using ETHERNET
"   with the 8400-SP assigned crs = 100
"   with 1 FIUs installed ( crs = 111 )
"   with 1 843x-PCU installed in the 8400-SP ( slot 3, CRS = 113 )
"   with 1 RP ( remote processor )
"       RP #1 assigned crs = 200
"   With additional 843x-PCUs ( pressure calibrate units )
"       PCU #2 located in slot 1 of RP #1, assigned crs 211
"       PCU #3 located in slot 3 of RP #1, assigned crs 213
"
"
" DEVICE 8400-SP 100 192.168.0.1 NOQUERY
" DEVICE 8426-FIU 111 192.168.0.1 NOQUERY
" DEVICE 843x-PCU 113 192.168.0.1 NOQUERY
" DEVICE 8400-RP 200 192.168.0.1 NOQUERY
" DEVICE 843x-PCU 211 192.168.0.1 NOQUERY
" DEVICE 843x-PCU 213 192.168.0.1 NOQUERY
"
" =====
"
"
" Example #4: Single INITIUM example
"
" The Initium does not have any additional components to
" configure and so a single line configuration is all that
" is required.
"
" Multiple Initium can be used simultaneously by adding
" lines for each additional Initium. Each must have a unique
" CRS assigned.
"
" The structure of the configuration stanza is:
"
" DEVICE Initium <CRS> <TCP/IP Address>
"
" =====
"
"
" DEVICE Initium 111 192.168.128.152
"

```

```

"
" =====
"
" Example #5: Multiple INITIUM example
"
" =====
"
" DEVICE Initium 111 192.168.128.147
" DEVICE Initium 112 192.168.128.148
" DEVICE Initium 113 192.168.128.149
" DEVICE Initium 114 192.168.128.150
"
" =====
"
" Example #6: Flight Data System example
"
" The FDS is similar to an Initium but adds a UDP streaming
" mechanism which must be accounted for in the PSI-Utility configuration
"
" The structure of the configuration stanza is:
"
" DEVICE Initium <CRS> <TCP/IP Address>
"
" The structure of the configuration stanza is:
"
" DEVICE UDP-DEVICE <CRS> <TCP/IP Address>
"
" =====
"
" DEVICE FDS 111 200.206.3.233
" DEVICE UDP-DEVICE 111 200.206.3.233
"
"
" =====
" =====
" =====
"
" PSI-Utility is used by the factory to test and certify
" proper operation of several products, including (but not
" limited to) the INITIUM and mSDI products.
"
" The test data results are stored in locations set by
" the production department and the IT department.
"
" The Initium Test data is stored in the IFTPATH (Initium Final Test Path).
" The mSDI Test data is stored in the MSDITPATH (mSDI Test Path ).
"
" Default Data Paths are specified below.
" These are easily modified, and may be any valid path however, the folder must exist
" and the path must be terminated with a back-slash, as illustrated below.
"

MSDITPATH C:\PSI-Utility-300\DataTest\

IFTPATH C:\PSI-Utility-300\DataTest\

```

"
" The mastercrs parameter is used when an Initium is configured
" It should remain 111.
"

mastercrs 111

Appendix B – CmdDest.txt

CmdDest.txt

```
" -----
"
" Command Destination File
"
" This file sets the command destination for each and every
" command in the 8400 command set.
"
" Commands are sent to:
"
"  a) the connected device on the Ethernet at port 8400
"  b) the connected device on the IEEE-488 named DEV5
"  c) both
"
"
" Destination = 1  implies  send command over ETHERNET
" Destination = 2  implies  send command over IEEE-488
" Destination = 3  implies  send command over BOTH -- get 2 returns
"
"
" Commands that are not found in this list are considered "not supported"
" and have the following attributes:
"
"  a) they are not sent anywhere
"  b) no data is expected from them, so
"     no read operation is performed
"
"
"
" Dan Ridenour    jANUARY 2020
" -----
"
SP0 1
SP1 1
SP2 1
SP3 1
SP5 1
SP6 1
SP7 1
SP8 1

SP9 1
"
" SDU / FIU initialization commands
"
SD1 1
SD2 1
SD3 1
SD4 1
SD5 1
```

```
"
" Abort / Acquire Data commands
"
AD0 1
AD1 1
AD2 1
AD3 1
AD4 1

"
" Abort / set pressure / calibrate commands
"

"
" We want "rezero" to go to Ethernet: DTC System or 8400
"
CA0 1
CA1 1
CA2 1
CA3 1
CA4 1
CA5 1

"
" PCU setup - operation
"
"PC1 2
"PC2 2
"PC3 2
"PC4 2
"PC5 2
"
PC1 1
PC2 1
PC3 1
PC4 1
PC5 1

"
PS1 1
PS2 1
PS3 1
PS4 1
PS5 1
"
" Output Control commands
"
OP0 1
OP1 1
OP2 1
OP3 1
OP4 1
OP5 1
OP6 1
```

OP7 1

OP8 1

OP9 1

"

" Look-At commands

"

LA1 1

LA2 1

LA3 1

LA4 1

"

" Output Data commands

"

OD0 1

OD1 1

OD2 1

OD3 1

OD4 1

OD5 1

OD9 1

"

" Control Pressure commands

"

CP1 1

CP2 1

CP3 1

"

" System Control Commands

"

SC1 1

SC2 1

SC3 1

SC4 1

SC5 1

"

" Control Valve commands

"

CV0 1

CV1 1

CV2 1

"

" commands not found in this list

" are not sent anywhere

" and are flagged as no-response-expected

"

TS0 1

TS1 1

XS1 1

XC3 1

Appendix C – UserInfo.txt

USERINFO.TXT

BASEPATH C:\DATA-TEST\

BASEFILE TEST2

FILE-PER-POINT TRUE

FILE-PER-ESP FALSE

UNIT-INDEX 1

THERM-RATE ONE

INTERNAL-SPEED GEN-1

SETUP-NAME 0 DEMO1

RATE-INDEX 0 1

DATA-TIME 0 100

DO-TEMP 0 1

SETUP-NAME 1 DEMO2

RATE-INDEX 1 6

DATA-TIME 1 10

DO-TEMP 1 1

SETUP-NAME 2 DEMO3

RATE-INDEX 2 21

DATA-TIME 2 5

DO-TEMP 2 0

SETUP-NAME 3 HT-DEMO

RATE-INDEX 3 0

DATA-POINTS 3 0

DO-TEMP 3 0

Appendix D – General.txt

GENERAL.TXT

```
" =====
"
" DTC Initium General Function File
"
" File Name: general.txt
" Default Location: app.path & "\\general.txt"
"
" =====
" COPYRIGHT:
"
" March 2006
" March 2011
" Pressure Systems, Inc.
" April 2012
" Measurement Specialties, Inc.
" March 2015
" jANUARY 2020
"
" TE Connectivity // Measurement Specialties, Inc.
"
"
" =====
" =====

function Configure
configure
endfunction

"
" =====
"

function
endfunction

"
" =====
"

Function Re-Zero
"
" command the Initium to Re-zero calibrate DTC scanners
"
resync

CA2

resync

EndFunction
```

```
"
" =====
"
```

```
Function
EndFunction
```

```
"
" =====
"
```

```
Function Display-Data
```

```
"
" Command the Initium to acquire data and display
" the data on screen, at default data rate = 2 hz.
"
```

```
" Optionally log data to disk in CSV format
"
```

```
showscan
```

```
EndFunction
```

```
Function
EndFunction
```

```
"
" =====
"
```

```
Function Log-Data-On
```

```
"
" set LOG-DATA-Switch to TRUE
"
```

```
" data will be logged in printer friendly and CSV formats,
" or if high-speed data, in binary format
"
```

```
log on
```

```
EndFunction
```

```
Function Log-Data-Off
```

```
"
" set LOG-DATA-Switch to FALSE
"
```

```
" Data Logging will stop
"
```

```
log off
```

```
EndFunction
```

```
Function
EndFunction
```

```

" =====

Function High-Speed-Data
"
" Command the Initium to acquire data at maximum
" data rate. Data may be optionally logged to disk.
"
" Data rate is shown, as are data values for the selected
" scanner, updated every 5 seconds
"

"speed
speed showstats

EndFunction

"
" =====
"

Function
EndFunction

"
" =====
"
" If data is logged using High-Speed-Data, it is written
" into a BINARY DATA FILE.
"
" A function is provided to convert the bindary data file
" into a CSV file
"

Function Convert-to-CSV

playback

EndFunction

" =====

Function
EndFunction

" =====
" =====

Function Cal-Position
"
" Command the Initium to move the bi-stable
" valve of each DTC scanner into the
" CALIBRATE position
"

cv1 calpos 5

```

```
printbuffer
```

```
EndFunction
```

```
Function Run-Position
```

```
"
```

```
" Command the Initium to move the bi-stable
```

```
" valve of each DTC scanner into the
```

```
" RUN position
```

```
"
```

```
cv1 runpos 5
```

```
printbuffer
```

```
EndFunction
```

```
" =====
```

```
" =====
```

Appendix E – Utility.txt

Utility.Txt

```
"
"=====
"
" DTC Initium Utilities Function File
"
" File Name: utility.txt
" Default Location: C:\PSI-Utility-300\utility.txt
"
"=====
"
" March 2006
" February 2012
" January 2020
"
" Pressure Systems, Inc.
" Measurement Specialties
" TE Connectivity
"
"=====
"
"
"function normal-speed
"resync
"wbb00 56
"resync
"endm
"
"function high-speed
"resync
"wbb00 32
"resync
"endm
"
"
"=====
"

Function Accuracy-Display
aat USER-MODE
EndFunction

"
"=====
"

Function Channel-Check
"
" Command the Initium to acquire data, discover which port
" has pressure applied, and display the port number and pressure
" applied.
```

```
"
channelcheck
EndFunction

"
"=====
"
"
Function Read-Valve-Pos
rd-valve-pos
EndFunction
"
"
"=====
"

Function Discover-Scanners
"
" Command the Initium to discover how many DTC scanners
" are attached, and report this information to the user
"

discover
EndFunction

"
"=====
"

Function Span-Cal
"
" perform a multi-point calibration of attached scanners
"
" the user must supply the known calibration pressures
"
" minimum, 2 pressures ( zero and full scale recommended )
"
" up to 10 calibration pressures may be used
"

Multi-Point-Cal USER-MODE
"
EndFunction

"
"=====
"

Function Coeffs-Disk-to-ESP
"
" command the Initium to reload
" DTC coefficients from a disk file
```

```

" into a DTC scanner
"
LOAD-COEFFS-DISK-TO-DTC-SCANNER

EndFunction

"
" =====
"

Function Coeffs-ESP-to-Disk
"
" command the Initium to retrieve the
" DTC coefficients from a scanner,
" and write them into a disk file
" on the computer
"
"
"
dump-dtc-coeffs-scanner-to-disk 111 1 1
"dump-dtc-coeffs-scanner-to-disk 111 2 1
"dump-dtc-coeffs-scanner-to-disk 111 3 1
"dump-dtc-coeffs-scanner-to-disk 111 4 1
"dump-dtc-coeffs-scanner-to-disk 111 5 1
"dump-dtc-coeffs-scanner-to-disk 111 6 1
"dump-dtc-coeffs-scanner-to-disk 111 7 1
"dump-dtc-coeffs-scanner-to-disk 111 8 1
"
"EndFunction

"
" =====
"
"

Function IP-Address-Change
"
IP-Address-Change
"
EndFunction
"
"
" =====
"
"

Function Update-Firmware
"
" Update the firmware in the INITIUM
"
update-firmware
"
EndFunction
"
"
"

```

```
" =====
"
```

Function Default-Init

```
"
" default-init does:
"
"   b: clear all internal tables
"   c: discover the attached scanners
"   d: re-initialize using default values
"
```

```
default-init
```

EndFunction

```
"
" =====
"
"
" =====
"
```

```
function autoclose-off
autoclose off
endm
```

```
" =====
```

Function Data-Point(AD2-1)

```
"
" command the Initium to acquire a SINGLE
" Data point, and display the data in
" column format
"
ad2 1 1
```

EndFunction

```
"
"function rtwave
"rtwave
"endm
"
"function rtfft
"rtfft
"endm
"
"
"function set-date
"
```

```
" manually set the date to : mm dd yy hh mm ss
"
"sp5 05 08 17 21 30 00
"printbuffer
"endm
"
"function showbuffer-on
"showbuffer on
"endm
"
"function showbuffer-off
"showbuffer off
"
```

Appendix F – Span Calibration of DTC Scanners

Multi-Point Span Calibration of DTC Scanners using INITIUM data system

The Multi-Point Span Calibration is done in 10 steps

- 1) The DEVICE used for the calibration must be selected. This is usually DEV 1, but some customers have more than one Initium, and so we allow for more than one device.
- 2) The selected device must be RESET by the program
- 3) The SCANNERS TO BE CALIBRATED must be selected
- 4) The Unit of Measure must be selected
- 5) Each of the selected scanners must be “backed up” – This process
 - a. Records a FILE – on disk – for each scanner
 - b. Containing the COMPLETE CURRENT CALIBRATION of the scanner
 - c. This allows us to RESTORE THE SCANNER to the before calibration state, should that be necessary.
- 6) The FULL SCLE must be specified – in the CURRENT UNIT-OF-MEASURE
 - a. If PSI was specified – Full Scale must be in PSI
 - b. If KPa was specified – Full Scale must be in KPa
 - c. And so on
- 7) The LOGICAL RANGE (normally 1) must be specified
- 8) UP TO TEN (10) Calibration pressures must be entered
 - a. TWO calibration pressure is the absolute minimum allowed
 - b. BEST RESULTS occur with between 5 and 7 pressures
 - c. TEN is the absolute maximum number of pressures allowed
 - d. I recommend that you use 5, 6, or 7 calibration pressures, your choice.
- 9) The CALIBRATION PRESSURES must be applied, and the Data Taken
 - a. This is the real calibration process
 - b. You MAY – OPTIONALLY – put in the ACTUAL pressure generated, if it does not match the pressure you PLANNED (step 8) to use. NOT REQUIRED, but available
- 10) A REPORT is generated – on screen and on disk
- 11) IF the results are good – you may STORE THE NEW COEFFICIENTS into the scanner(s)

STEP 1: Select the DEVICE to be used for the Calibration. Normally, this is Dev 1

The screenshot shows the 'Multi-Point Calibration' window. At the top left, there's a section 'Device with scanners to be calibrated' with a dropdown menu showing 'None Selected' and 'Dev 1'. To its right is a 'RESET Selected Device' button. Further right is a 'Scanners to be Calibrated' section with checkboxes for 1 through 8. To the right of that is a 'Unit of Measure' dropdown menu showing 'User', 'psi', and 'inH2O'. At the top right is a 'Back Up the Selected Scanners' button. Below these is a section 'Up to 10 Desired Calibration Pressures (Left to Right, top then bottom)' with a grid of input fields. The first field in the first row is labeled 'Full Scale Pressure' and contains '1.0'. Below this is a 'Manually Set Next Cal Pressure' button and a text input field. At the bottom left is a button 'Store NEW Cz and Cs Coefficients into DTC Scanner(s)'. At the bottom right is an 'EXIT' button. A large text area in the center contains instructions: 'Multi-Point Cal of DTC scanners. You must first select a DEVICE to Calibrate and then press the RESET button. This program will then: (a) reset the device, (b) reconnect to the device (c) wait for the device to be ready, and (d) present you with a list of scanners available'.

Multi-Point Calibration

Device with scanners to be calibrated

RESET Selected Device

Scanners to be Calibrated

Unit of Measure

Back Up the Selected Scanners

None Selected
Dev 1

1 2 3 4
5 6 7 8

User
psi
inH2O

Up to 10 Desired Calibration Pressures (Left to Right, top then bottom)

Full Scale Pressure Logical Range V

1.0

Manually Set Next Cal Pressure

Multi-Point Cal of DTC scanners.

You must first select a DEVICE to Calibrate and then press the RESET button. This program will then: (a) reset the device, (b) reconnect to the device (c) wait for the device to be ready, and (d) present you with a list of scanners available

Store NEW Cz and Cs Coefficients into DTC Scanner(s)

EXIT

STEP 2: RESET the selected device

The screenshot shows the 'Multi-Point Calibration' window. It features a 'Device with scanners to be calibrated' dropdown menu with 'None Selected' and 'Dev 1' (highlighted). A 'RESET Selected Device' button is next to it. To the right, 'Scanners to be Calibrated' includes checkboxes for 1 through 8. Further right, the 'Unit of Measure' is set to 'psi' with 'inH2O' as an option. A 'Back Up the Selected Scanners' button is in the top right. Below these, a grid for 'Up to 10 Desired Calibration Pressures' is shown, with the first cell containing '1.0'. A 'Manually Set Next Cal Pressure' button and a text input field are also present. A large text area contains instructions: 'Multi-Point Cal of DTC scanners. You must first select a DEVICE to Calibrate and then press the RESET button. This program will then: (a) reset the device, (b) reconnect to the device (c) wait for the device to be ready, and (d) present you with a list of scanners available'. At the bottom, there are buttons for 'Store NEW Cz and Cs Coefficients into DTC Scanner(s)' and 'EXIT'.

Multi-Point Calibration

Device with scanners to be calibrated

RESET Selected Device

Scanners to be Calibrated

Unit of Measure

Back Up the Selected Scanners

None Selected
Dev 1

1 2 3 4
5 6 7 8

User
psi
inH2O

Up to 10 Desired Calibration Pressures (Left to Right, top then bottom)

Full Scale Pressure Logical Range V

1.0

Manually Set Next Cal Pressure

Multi-Point Cal of DTC scanners.

You must first select a DEVICE to Calibrate and then press the RESET button.
This program will then: (a) reset the device, (b) reconnect to the device
(c) wait for the device to be ready, and
(d) present you with a list of scanners available

Store NEW Cz and Cs Coefficients into DTC Scanner(s)

EXIT

STEP 3: Select the SCANNERS TO BE CALIBRATED – in this example, 2 scanners are available, and both have been selected

Multi-Point Calibration

Device with scanners to be calibrated: None Selected, Dev 1

RESET Selected Device

Scanners to be Calibrated: ☒ 1, ☒ 2, ☐ 3, ☐ 4, ☐ 5, ☐ 6, ☐ 7, ☐ 8

Unit of Measure: User, psi, inH2O

Back Up the Selected Scanners

Up to 10 Desired Calibration Pressures (Left to Right, top then bottom)

Full Scale Pressure	Logical Range V					
1.0						

Manually Set Next Cal Pressure

Back from Reset -- PSI Unit Connected and Ready!
Firmware version = 2.02
Scanner # 1 32 Detected
Scanner # 2 32 Detected
You must select the scanners to be calibrated, and the unit of measure.

Store NEW Cz and Cs Coefficients into DTC Scanner(s)

EXIT

STEP 4: Select a UNIT OF MEASURE - in this example, PSI was selected. You may choose any other unit of measure that is proper for your equipment.

The screenshot shows the 'Multi-Point Calibration' window. At the top left, there's a section for 'Device with scanners to be calibrated' with a dropdown menu showing 'None Selected' and 'Dev 1'. Next to it is a 'RESET Selected Device' button. To the right is a 'Scanners to be Calibrated' section with checkboxes for 1 through 8; checkboxes 1 and 2 are checked. Further right is the 'Unit of Measure' dropdown menu, which is set to 'psi' (with 'User' and 'inH2O' also visible). A 'Back Up the Selected Scanners' button is at the top right. Below these is a section for 'Up to 10 Desired Calibration Pressures (Left to Right, top then bottom)' with two rows of input boxes. The first row has five boxes, and the second row has five boxes. Below this is a 'Manually Set Next Cal Pressure' button and a large text area. The text area contains the following text:
*** Almost ready to begin ***
Multi - Point Calibration, with user supplied pressures
Please enter the correct full scale pressure (in selected units) in the
'Full Scale Pressure' box above.
At the bottom left is a button labeled 'Store NEW Cz and Cs Coefficients into DTC Scanner(s)'. At the bottom right is an 'EXIT' button.

Multi-Point Calibration

Device with scanners to be calibrated

RESET Selected Device

Scanners to be Calibrated

Unit of Measure

Back Up the Selected Scanners

None Selected
Dev 1

Up to 10 Desired Calibration Pressures (Left to Right, top then bottom)

Full Scale Pressure

Logical Range V

Manually Set Next Cal Pressure

*** Almost ready to begin ***

Multi - Point Calibration, with user supplied pressures

Please enter the correct full scale pressure (in selected units) in the 'Full Scale Pressure' box above.

Store NEW Cz and Cs Coefficients into DTC Scanner(s)

EXIT

STEP 5: BACK UP THE SELECTED SCANNERS

THIS IS VERY IMPORTANT. The program will not allow you to go on without completing this step. This guarantees that you can return the scanner to the “before calibration” condition, should something go wrong in the process.

IT IS ALWAYS GOOD TO HAVE A BACKUP FILE OF THE CALIBRATION FOR EACH SCANNER.
This will produce ONE FILE PER SCANNER. The File name will be Exxxxx-yyyy-mm-dd.COF

E – followed by the SERIAL NUMBER OF THE SCANNER
Followed by Year–month–day.COF

Example: E641234-2019-08-15.cof

The screenshot shows the 'Multi-Point Calibration' window. It features a 'Device with scanners to be calibrated' list with 'Dev 1' selected. A 'RESET Selected Device' button is next to it. To the right, 'Scanners to be Calibrated' has checkboxes for 1 through 8, with 1 and 2 checked. The 'Unit of Measure' is set to 'psi' in a dropdown menu. A 'Back Up the Selected Scanners' button is in the top right. Below these, a grid of 10 input boxes is labeled 'Up to 10 Desired Calibration Pressures (Left to Right, top then bottom)'. The first two boxes are pre-filled with '100' and '1'. A 'Manually Set Next Cal Pressure' button is below the grid. A text area at the bottom contains the message: 'Multi - Point Calibration, with user supplied pressures. Please enter at least two (but no more than 10) calibration pressures (in selected unit of measure)'. At the very bottom, there are two buttons: 'Store NEW Cz and Cs Coefficients into DTC Scanner(s)' and 'EXIT'.

STEP 6: ENTER the FULL SCALE of the scanner(s) – in the correct Unit of measure.
This example is for 2 scanners, both 100 PSI pressure range.

STEP 7: Enter the LOGICAL RANGE NUMBER – in this case, LOGICAL RANGE 1 was used
(recommended)

STEP 8: Enter the CALIBRATION PRESSURES PLANNED

- a) This example is using PSI for unit of measure
- b) And has 100 PSI FULL SCALE scanners
- c) Five (5) calibration points will be used: 0.0 psid, 25.0 psid, 50 psid,
75.0 psid, and 100.0 psid
- d) You DO NOT have to enter decimal points – these are the NOMINAL PRESSURES

WHEN THIS IS COMPLETE – CLICK on “Manually Set Next Cal Pressure”

The screenshot shows the 'Multi-Point Calibration' window. It has a title bar with standard window controls. The main area contains several sections: a 'Device with scanners to be calibrated' section with a dropdown menu showing 'None Selected' and 'Dev 1'; a 'RESET Selected Device' button; a 'Scanners to be Calibrated' section with checkboxes for 1 through 8, where 1 and 2 are checked; a 'Unit of Measure' dropdown menu showing 'User', 'psi', and 'inH2O'; and a 'Back Up the Selected Scanners' button. Below these is a section titled 'Up to 10 Desired Calibration Pressures (Left to Right, top then bottom)' with a grid of input fields. The first row contains values 0.0, 25.0, 50.0, 75.0, and 100.0. The second row contains 'Full Scale Pressure' (100) and 'Logical Range V' (1). Below the grid is a 'Manually Set Next Cal Pressure' button and a text area for notes. The notes area contains the text: 'Multi - Point Calibration, with user supplied pressures' and 'When you are finished entering the calibration pressures, click the 'Manually Set Next Cal Pressure' button, and the process will begin.' At the bottom, there are two buttons: 'Store NEW Cz and Cs Coefficients into DTC Scanner(s)' and 'EXIT'.

Full Scale Pressure	Logical Range V	0.0	25.0	50.0	75.0	100.0
100	1					

Manually Set Next Cal Pressure

Multi - Point Calibration, with user supplied pressures

When you are finished entering the calibration pressures, click the 'Manually Set Next Cal Pressure' button, and the process will begin.

Store NEW Cz and Cs Coefficients into DTC Scanner(s)

EXIT

STEP 9: The CALIBRATION PRESSURES must be applied, and the Data Taken
The program now knows that you are ready. It tells you to "GENERATE X NOW"

X in this case is ZERO – my first cal point

WHEN YOU HAVE THE PRESSURE GENERATED – YOU MAY ENTER THE EXACT VALUE IN THE BOX
Entering the EXACT VALUE (in place of the PLANED VALUE) that is OPTIONAL - BUT YOU MUST
CLICK ON "Manually Set Next Cal Pressure" again to continue. (This screen is step 9-A)

The screenshot shows the 'Multi-Point Calibration' window. At the top left, there's a section for 'Device with scanners to be calibrated' with a dropdown menu showing 'None Selected' and 'Dev 1'. Next to it is a 'RESET Selected Device' button. To the right is a 'Scanners to be Calibrated' section with checkboxes for 1 through 8, where 1 and 2 are checked. Further right is a 'Unit of Measure' dropdown menu with 'User', 'psi', and 'inH2O' options. At the top right is a 'Back Up the Selected Scanners' button. Below these is a section titled 'Up to 10 Desired Calibration Pressures (Left to Right, top then bottom)'. It contains two rows of input boxes. The first row has boxes for 0, 25, 50, 75, and 100. The second row has a box for 100 and a box for 1. Below this is a 'Manually Set Next Cal Pressure' button and a large text area. The text area contains the following text: 'Perform the multi-point cal, by setting cal point # 1', 'It is the users responsibility to generate 0', 'GENERATE 0 NOW', and 'When this is complete, enter the ACTUAL PRESSURE into the box, and then click the 'Manually Set Next Cal Pressure' button'. At the bottom left is a button labeled 'Store NEW Cz and Cs Coefficients into DTC Scanner(s)'. At the bottom right is an 'EXIT' button.

Multi-Point Calibration

Device with scanners to be calibrated: None Selected, Dev 1

RESET Selected Device

Scanners to be Calibrated: ☒ 1, ☒ 2, ☐ 3, ☐ 4, ☐ 5, ☐ 6, ☐ 7, ☐ 8

Unit of Measure: User, psi, inH2O

Back Up the Selected Scanners

Up to 10 Desired Calibration Pressures (Left to Right, top then bottom)

Full Scale Pressure	Logical Range V	0	25	50	75	100
100	1					

Manually Set Next Cal Pressure

Perform the multi-point cal, by setting cal point # 1
It is the users responsibility to generate 0

GENERATE 0 NOW

When this is complete, enter the ACTUAL PRESSURE into the box, and then click the 'Manually Set Next Cal Pressure' button

Store NEW Cz and Cs Coefficients into DTC Scanner(s)

EXIT

The PROGRAM will tell you that it is taking data – and give you information about the progress.
DO NOTHING until it tells you to GENERATE THE NEXT PRESSURE

The screenshot shows the 'Multi-Point Calibration' window. At the top left, there's a section for 'Device with scanners to be calibrated' with a 'None Selected' dropdown and a 'Dev 1' button. Next to it is a 'RESET Selected Device' button. To the right is a 'Scanners to be Calibrated' section with checkboxes for 1 through 8; checkboxes 1 and 2 are checked. Further right is a 'Unit of Measure' dropdown menu showing 'User', 'psi', and 'inH2O'. At the top right is a 'Back Up the Selected Scanners' button. Below these is a section titled 'Up to 10 Desired Calibration Pressures (Left to Right, top then bottom)'. It contains two rows of input fields. The first row has values 0, 25, 50, 75, and 100. The second row has a value of 100 under 'Full Scale Pressure' and 1 under 'Logical Range V'. Below this is a 'Manually Set Next Cal Pressure' button and a large text area containing the message: 'CLICK ACCEPTED -- Beginning to take data -- please be patient.' At the bottom left is a button labeled 'Store NEW Cz and Cs Coefficients into DTC Scanner(s)' and at the bottom right is an 'EXIT' button.

When the FIRST CALIBRATION POINT IS COMPLETE – the program will PROMPT you to GENERATE THE NEXT PRESSURE.

This example is prompting me to Generate 25 PSID NOW – and when complete, to enter the ACTUAL VALUE (in place of the 25) and click on “Manually Set Next Cal Pressure”

You can see that 25 PSID was my #2 calibration pressure

When 25.00 psid is READY, I can enter the actual value (or not) – and click “Manually Set Next Cal Pressure” again.

The screenshot shows the 'Multi-Point Calibration' window. At the top left, there's a section for 'Device with scanners to be calibrated' with a dropdown menu showing 'None Selected' and 'Dev 1'. Next to it is a 'RESET Selected Device' button. To the right is a 'Scanners to be Calibrated' section with checkboxes for 1 through 8; checkboxes 1 and 2 are checked. Further right is a 'Unit of Measure' dropdown menu with 'User', 'psi', and 'inH2O' options. At the top right is a 'Back Up the Selected Scanners' button. Below these is a section for 'Up to 10 Desired Calibration Pressures (Left to Right, top then bottom)'. It contains two rows of input fields. The first row has values 0, 25, 50, 75, and 100. The second row has a value of 100 under 'Full Scale Pressure' and 1 under 'Logical Range V'. Below this is a 'Manually Set Next Cal Pressure' button and a text input field. A large text area in the center contains instructions: 'Perform the multi-point cal, by setting cal point # 2', 'It is the users responsibility to generate 25', 'GENERATE 25 NOW', and 'When this is complete, enter the ACTUAL PRESSURE into the box, and then click the \'Manually Set Next Cal Pressure\' button'. At the bottom left is a button 'Store NEW Cz and Cs Coefficients into DTC Scanner(s)' and at the bottom right is an 'EXIT' button.

Multi-Point Calibration

Device with scanners to be calibrated: None Selected, Dev 1

RESET Selected Device

Scanners to be Calibrated: ☒ 1, ☒ 2, ☐ 3, ☐ 4, ☐ 5, ☐ 6, ☐ 7, ☐ 8

Unit of Measure: User, psi, inH2O

Back Up the Selected Scanners

Up to 10 Desired Calibration Pressures (Left to Right, top then bottom)

Full Scale Pressure	Logical Range V	0	25	50	75	100
100	1					

Manually Set Next Cal Pressure

Perform the multi-point cal, by setting cal point # 2
It is the users responsibility to generate 25

GENERATE 25 NOW

When this is complete, enter the ACTUAL PRESSURE into the box, and then click the 'Manually Set Next Cal Pressure' button

Store NEW Cz and Cs Coefficients into DTC Scanner(s)

EXIT

Again, we take data, and wait for DATA POINT # 2 to finish

Multi-Point Calibration

Device with scanners to be calibrated: None Selected Dev 1

RESET
Selected Device

Scanners to be Calibrated

<input checked="" type="checkbox"/> 1	<input checked="" type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4
<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7	<input type="checkbox"/> 8

Unit of Measure

User
psi
inH2O

Back Up the Selected Scanners

Up to 10 Desired Calibration Pressures (Left to Right, top then bottom)

Full Scale Pressure	Logical Range V	0	25	50	75	100
100	1					

Manually Set Next Cal Pressure

CLICK ACCEPTED -- Beginning to take data -- please be patient.

Store NEW Cz and Cs Coefficients into DTC Scanner(s)

EXIT

REPEAT for CAL POINT # 3

The screenshot shows the 'Multi-Point Calibration' window. At the top left, 'Device with scanners to be calibrated' has a dropdown menu with 'None Selected' and 'Dev 1' (selected). Next to it is a 'RESET Selected Device' button. To the right, 'Scanners to be Calibrated' has checkboxes for 1 through 8, with 1 and 2 checked. Further right, 'Unit of Measure' has a dropdown menu with 'User', 'psi' (selected), and 'inH2O'. At the top right is a 'Back Up the Selected Scanners' button. Below these is a section titled 'Up to 10 Desired Calibration Pressures (Left to Right, top then bottom)'. It contains two rows of input boxes. The first row has values 0, 25, 50, 75, and 100. The second row has values 100 and 1, followed by empty boxes. Below this is a 'Manually Set Next Cal Pressure' button and a large text area. The text area contains the following text: 'Perform the multi-point cal, by setting cal point # 3', 'It is the users responsibility to generate 50', 'GENERATE 50 NOW', and 'When this is complete, enter the ACTUAL PRESSURE into the box, and then click the \'Manually Set Next Cal Pressure\' button'. At the bottom left is a button labeled 'Store NEW Cz and Cs Coefficients into DTC Scanner(s)'. At the bottom right is an 'EXIT' button.

Multi-Point Calibration

Device with scanners to be calibrated: None Selected, Dev 1

RESET Selected Device

Scanners to be Calibrated: ☒ 1, ☒ 2, ☐ 3, ☐ 4, ☐ 5, ☐ 6, ☐ 7, ☐ 8

Unit of Measure: User, psi, inH2O

Back Up the Selected Scanners

Up to 10 Desired Calibration Pressures (Left to Right, top then bottom)

Full Scale Pressure	Logical Range V	0	25	50	75	100
100	1					

Manually Set Next Cal Pressure

Perform the multi-point cal, by setting cal point # 3
It is the users responsibility to generate 50

GENERATE 50 NOW

When this is complete, enter the ACTUAL PRESSURE into the box, and then click the 'Manually Set Next Cal Pressure' button

Store NEW Cz and Cs Coefficients into DTC Scanner(s)

EXIT

Taking Data for CAL POINT # 3

The screenshot shows the 'Multi-Point Calibration' window. At the top left, there's a section for 'Device with scanners to be calibrated' with a dropdown menu showing 'None Selected' and 'Dev 1'. Next to it is a 'RESET Selected Device' button. To the right is a 'Scanners to be Calibrated' section with checkboxes for 1 through 8; checkboxes 1 and 2 are checked. Further right is a 'Unit of Measure' dropdown menu with 'User', 'psi', and 'inH2O' options. At the top right is a 'Back Up the Selected Scanners' button. Below these is a section for 'Up to 10 Desired Calibration Pressures (Left to Right, top then bottom)'. It contains two rows of input fields. The first row has values 0, 25, 50, 75, and 100. The second row is empty. To the left of these fields are labels for 'Full Scale Pressure' (with a value of 100) and 'Logical Range V' (with a value of 1). Below these is a 'Manually Set Next Cal Pressure' button and a text input field. A large text area in the center contains the message: 'CLICK ACCEPTED -- Beginning to take data -- please be patient.' At the bottom left is a button labeled 'Store NEW Cz and Cs Coefficients into DTC Scanner(s)'. At the bottom right is an 'EXIT' button.

Multi-Point Calibration

Device with scanners to be calibrated

None Selected
Dev 1

RESET Selected Device

Scanners to be Calibrated

☒ 1 ☒ 2 ☐ 3 ☐ 4
☐ 5 ☐ 6 ☐ 7 ☐ 8

Unit of Measure

User
psi
inH2O

Back Up the Selected Scanners

Up to 10 Desired Calibration Pressures (Left to Right, top then bottom)

Full Scale Pressure	Logical Range V	0	25	50	75	100
100	1					

Manually Set Next Cal Pressure

CLICK ACCEPTED -- Beginning to take data -- please be patient.

Store NEW Cz and Cs Coefficients into DTC Scanner(s)

EXIT

REPEAT FOR CAL POINT # 4

Multi-Point Calibration

Device with scanners to be calibrated: None Selected, Dev 1

RESET Selected Device

Scanners to be Calibrated: ☒ 1, ☒ 2, ☐ 3, ☐ 4, ☐ 5, ☐ 6, ☐ 7, ☐ 8

Unit of Measure: User, psi, inH2O

Back Up the Selected Scanners

Up to 10 Desired Calibration Pressures (Left to Right, top then bottom)

Full Scale Pressure	Logical Range V	0	25	50	75	100
100	1					

Manually Set Next Cal Pressure

Perform the multi-point cal, by setting cal point # 4
It is the users responsibility to generate 75

GENERATE 75 NOW

When this is complete, enter the ACTUAL PRESSURE into the box, and then click the 'Manually Set Next Cal Pressure' button

Store NEW Cz and Cs Coefficients into DTC Scanner(s)

EXIT

Taking Data for CAL POINT # 4

The screenshot shows the 'Multi-Point Calibration' window. At the top left, there's a section for 'Device with scanners to be calibrated' with a dropdown menu showing 'None Selected' and 'Dev 1'. Next to it is a 'RESET Selected Device' button. To the right is a 'Scanners to be Calibrated' section with checkboxes for 1 through 8; checkboxes 1 and 2 are checked. Further right is a 'Unit of Measure' dropdown menu with 'User', 'psi', and 'inH2O' options. At the top right is a 'Back Up the Selected Scanners' button. Below these is a section for 'Up to 10 Desired Calibration Pressures (Left to Right, top then bottom)'. It contains two rows of input fields. The first row has values 0, 25, 50, 75, and 100. The second row is empty. To the left of these fields are labels for 'Full Scale Pressure' (with a value of 100) and 'Logical Range V' (with a value of 1). Below these is a 'Manually Set Next Cal Pressure' button and a text input field. A large text area in the center contains the message: 'CLICK ACCEPTED -- Beginning to take data -- please be patient.' At the bottom left is a button labeled 'Store NEW Cz and Cs Coefficients into DTC Scanner(s)'. At the bottom right is an 'EXIT' button.

Multi-Point Calibration

Device with scanners to be calibrated: None Selected, Dev 1

RESET Selected Device

Scanners to be Calibrated: ☒ 1, ☒ 2, ☐ 3, ☐ 4, ☐ 5, ☐ 6, ☐ 7, ☐ 8

Unit of Measure: User, psi, inH2O

Back Up the Selected Scanners

Up to 10 Desired Calibration Pressures (Left to Right, top then bottom)

Full Scale Pressure	Logical Range V	0	25	50	75	100
100	1					

Manually Set Next Cal Pressure

CLICK ACCEPTED -- Beginning to take data -- please be patient.

Store NEW Cz and Cs Coefficients into DTC Scanner(s)

EXIT

REPEAT FOR CAL POINT # 5

Multi-Point Calibration

Device with scanners to be calibrated
None Selected
Dev 1

RESET Selected Device

Scanners to be Calibrated
☒ 1 ☒ 2 ☐ 3 ☐ 4
☐ 5 ☐ 6 ☐ 7 ☐ 8

Unit of Measure
User
psi
inH2O

Back Up the Selected Scanners

Up to 10 Desired Calibration Pressures (Left to Right, top then bottom)

Full Scale Pressure	Logical Range V	0	25	50	75	100
100	1					

Manually Set Next Cal Pressure

Perform the multi-point cal, by setting cal point # 5
It is the users responsibility to generate 100

GENERATE 100 NOW

When this is complete, enter the ACTUAL PRESSURE into the box, and then click the 'Manually Set Next Cal Pressure' button

Store NEW Cz and Cs Coefficients into DTC Scanner(s)

EXIT

Taking Data for CAL POINT # 5 -- LAST CAL POINT IN THIS EXAMPLE

Multi-Point Calibration

Device with scanners to be calibrated: None Selected, Dev 1

RESET Selected Device

Scanners to be Calibrated: ☒ 1, ☒ 2, ☐ 3, ☐ 4, ☐ 5, ☐ 6, ☐ 7, ☐ 8

Unit of Measure: User, psi, inH2O

Back Up the Selected Scanners

Up to 10 Desired Calibration Pressures (Left to Right, top then bottom)

Full Scale Pressure	Logical Range V	0	25	50	75	100
100	1					

Manually Set Next Cal Pressure

CLICK ACCEPTED -- Beginning to take data -- please be patient.

Store NEW Cz and Cs Coefficients into DTC Scanner(s)

EXIT

STEP 10: THE PROGRAM will GENERATE A REPORT

- 1) The NEW SPAN should be NEAR 1.0 – always – within $\pm 0.15\%$
- 2) The NEW ZERO should be less than 5 % of scanner range
- 3) SHIFT % should be small

The REPORT is on SCREEN (you may click on it, select all, and copy into a document) – and it is **also** a TEXT FILE on the disk. CALRPT.TXT.

Multi-Point Calibration

Device with scanners to be calibrated: None Selected Dev 1

RESET Selected Device

Scanners to be Calibrated: ☒ 1 ☒ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8

Unit of Measure: User psi inH2O

Back Up the Selected Scanners

Up to 10 Desired Calibration Pressures (Left to Right, top then bottom)

Full Scale Pressure	Logical Range V	0	25	50	75	100
100	1					

Manually Set Next Cal Pressure:

Average Error using Old Coeffs = .00952 with worst = .03541
 Average Error using New Coeffs = .00000 with worst = .00883

port	Old-zero	old-span	new-zero	new-span	z-shift-%	span-shift-%
101	0.01265	1.00063	0.018111	1.000455	0.005459	-0.017428
102	-0.01021	1.00064	-0.010175	1.000412	0.000033	-0.022507
103	0.02107	1.00057	0.026392	1.000472	0.005320	-0.009537
104	0.00017	1.00060	0.001089	1.000516	0.000922	-0.008750
105	0.03353	1.00064	0.034420	1.000483	0.000886	-0.015402
106	0.00702	1.00063	0.005516	1.000447	-0.001508	-0.018406
107	0.04606	1.00058	0.050660	1.000497	0.004604	-0.008357
108	0.01167	1.00049	0.005870	1.000402	-0.005801	-0.009227
109	0.00904	1.00059	0.010247	1.000382	0.001202	-0.020516

Store NEW Cz and Cs Coefficients into DTC Scanner(s)

EXIT

IF THE PREDICTED AVERAGE ERROR WITH NEW COEFFICIENTS is GOOD – then SAVE THE COEFFICIENTS INTO THE SCANNERS!

SAMPLE OUTPUT

Average Error using Old Coeffs = .00952 with worst = .03541
 Average Error using New Coeffs = .00000 with worst = .00883

port	Old-zero	old-span	new-zero	new-span	z-shift-%	span-shift-%
101	0.01265	1.00063	0.018111	1.000455	0.005459	-0.017428
102	-0.01021	1.00064	-0.010175	1.000412	0.000033	-0.022507
103	0.02107	1.00057	0.026392	1.000472	0.005320	-0.009537
104	0.00017	1.00060	0.001089	1.000516	0.000922	-0.008750
105	0.03353	1.00064	0.034420	1.000483	0.000886	-0.015402
106	0.00702	1.00063	0.005516	1.000447	-0.001508	-0.018406
107	0.04606	1.00058	0.050660	1.000497	0.004604	-0.008357
108	0.01167	1.00049	0.005870	1.000402	-0.005801	-0.009227

109	0.00904	1.00059	0.010247	1.000382	0.001202	-0.020516
110	-0.04671	1.00064	-0.049891	1.000525	-0.003182	-0.011539
111	0.03120	1.00078	0.032889	1.000654	0.001691	-0.012434
112	-0.01728	1.00071	-0.021572	1.000521	-0.004290	-0.018620
113	0.01529	1.00055	0.013807	1.000441	-0.001485	-0.011110
114	0.17292	1.00073	0.171606	1.000658	-0.001316	-0.007248
115	0.01670	1.00017	0.014616	1.000020	-0.002079	-0.015342
116	-0.03583	1.00019	-0.034884	1.000036	0.000944	-0.015104
117	0.03571	1.00071	0.038996	1.000531	0.003286	-0.017476

You have COMPLETED THE CALIBRATION.

Appendix G – PCU Calibration

- 1) Start with PSI-UTILITY version 3.00 in folder C:\PSI-Utility-300\
It is **CRITICAL** that PSI-Utility **NOT BE INSTALLED** in either of the locations listed below:
 - a) C:\Program Files\
 - b) C:\Program Files(x86)\

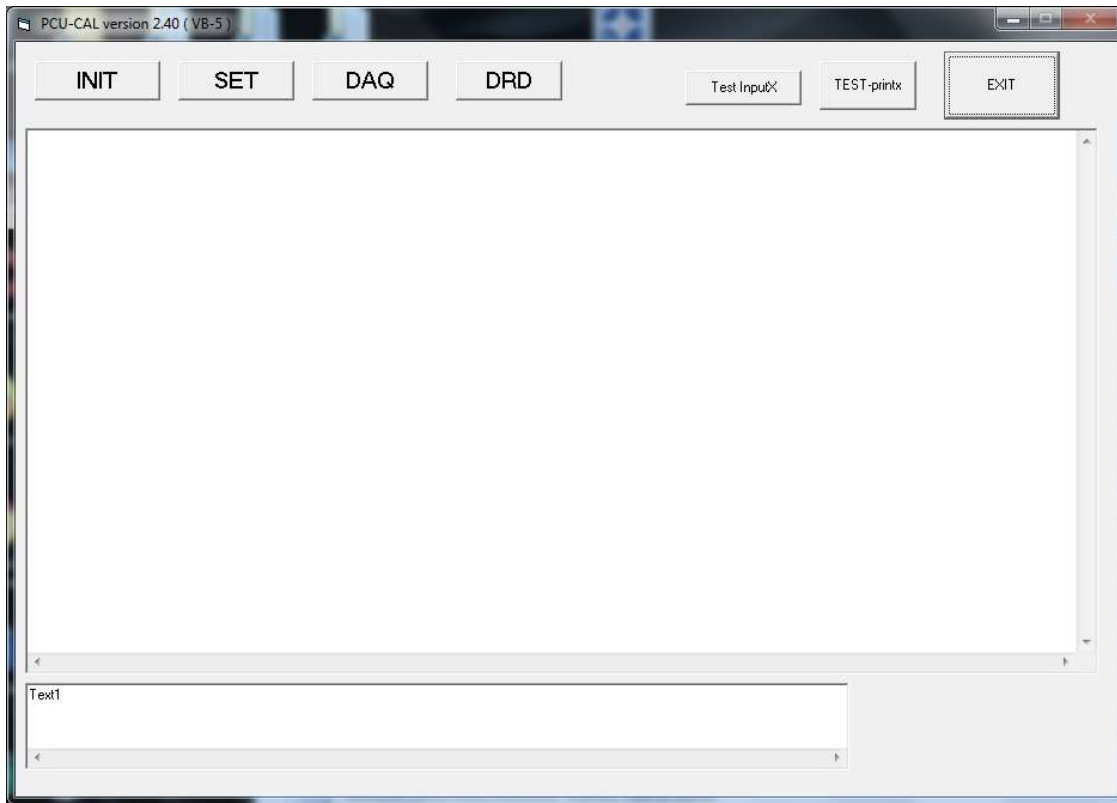
- 2) In folder C:\PSI-Utility-300\ you will find this file:
 - a. BPLATE.DAT

BPLATE.DAT contains “boiler-plate” identification information, such as the ID of the person doing the CALIBRATION. It is strongly recommended that you (a) read this file and (b) modify it to reflect reality at your installation.

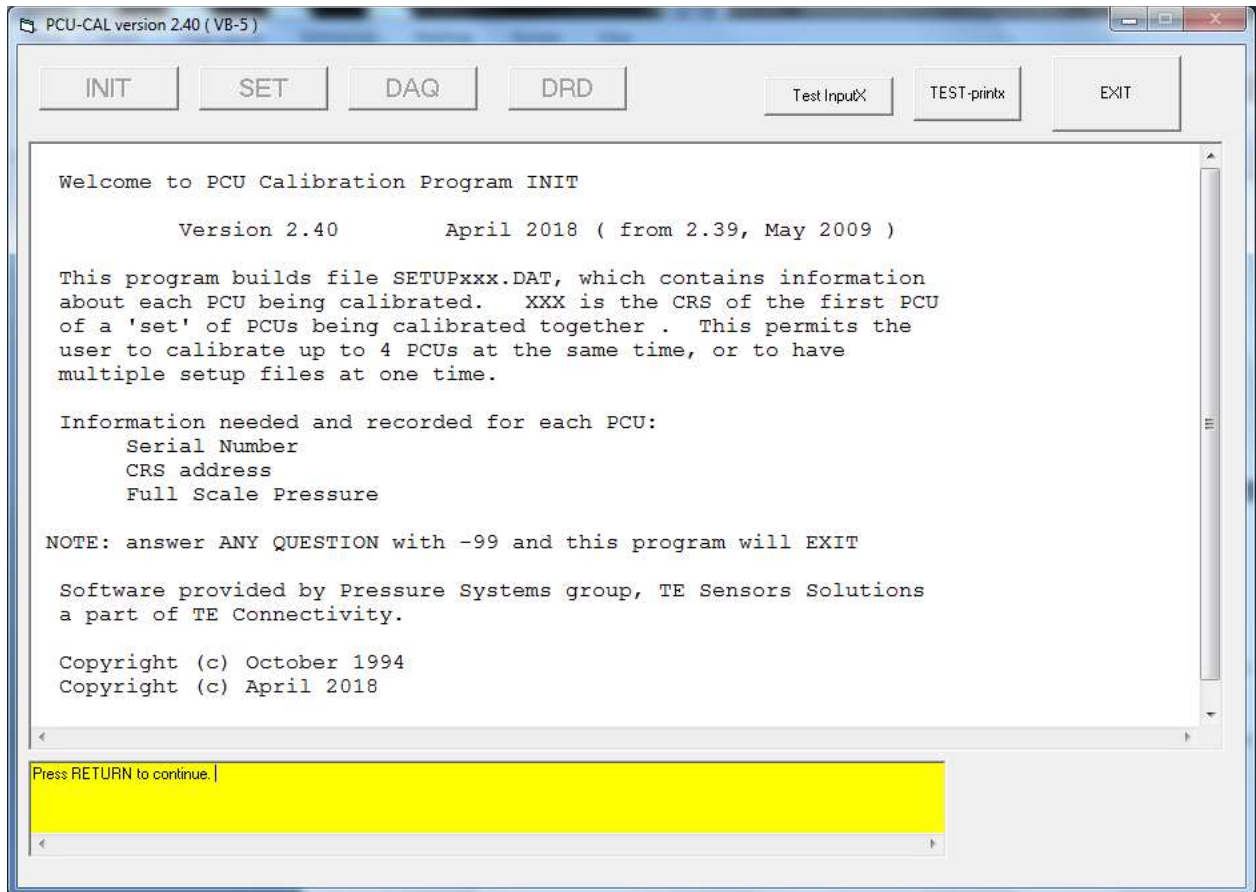
- 3) In the DIAGS.TXT file, create a “PCU-CAL” function

```
Function PCU-CAL  
PCU-CAL  
ENDM
```

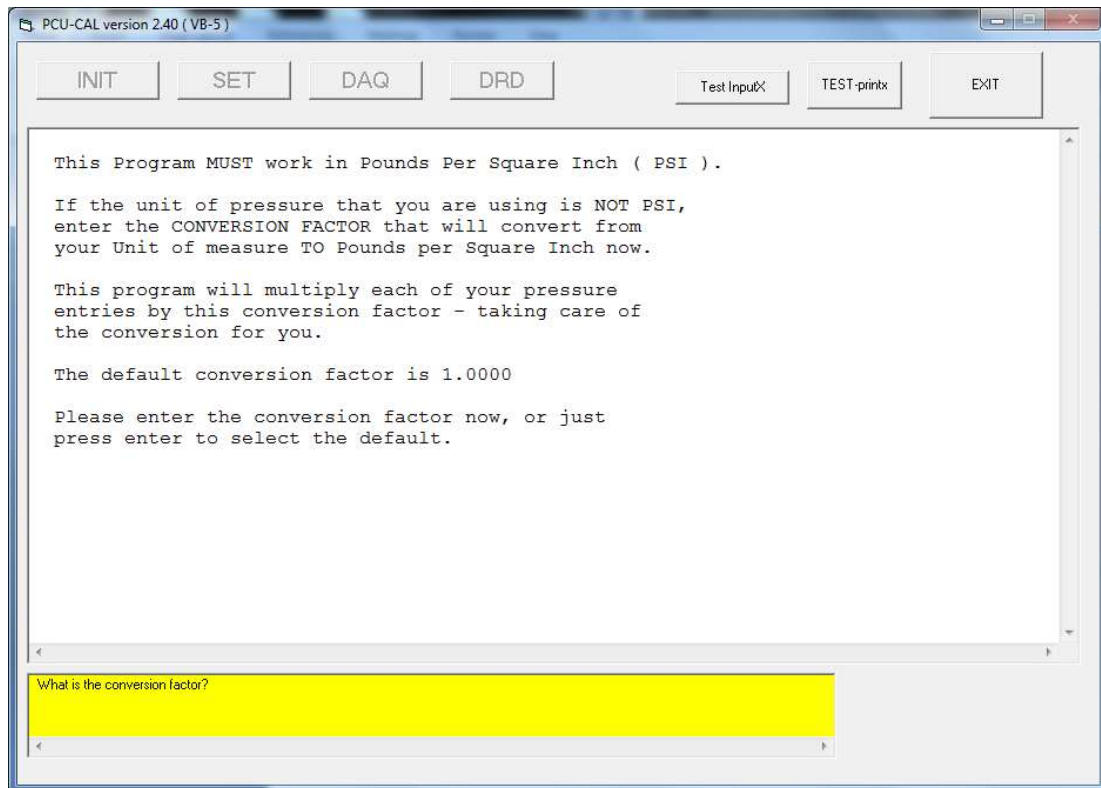
- 4) Run PSI-Utility-300.exe
 - a. Switch to the DIAGS menu
 - b. Click on PCU-CAL
 - c. when you “click on” PCU-CAL, you should see this:



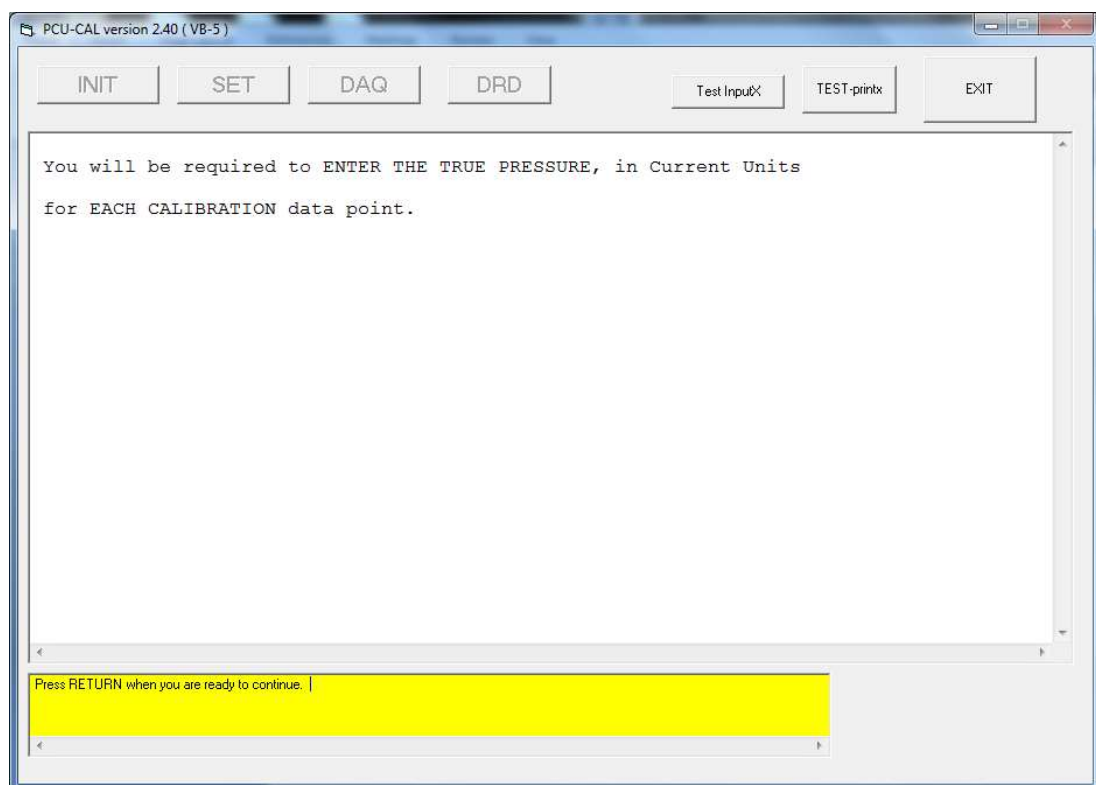
- 5) This Windows compatible PCU-CAL was designed to “look and feel” like the much older 16-bit DOS versions of PCU-CAL that PSI has distributed over the past 20 years. It is built on PCU-CAL Version 2.39, but any user of version 2.36 and later will find this very familiar.
- 6) The 4 “Control Buttons” (labeled INIT, SET, DAQ, and DRD) correspond directly to the 4 parts of PCU-CAL version 2.39: INIT239.exe, SET239.exe, DAQ239.exe, and DRD239.exe.
- 7) Clicking on INIT brings up this screen:



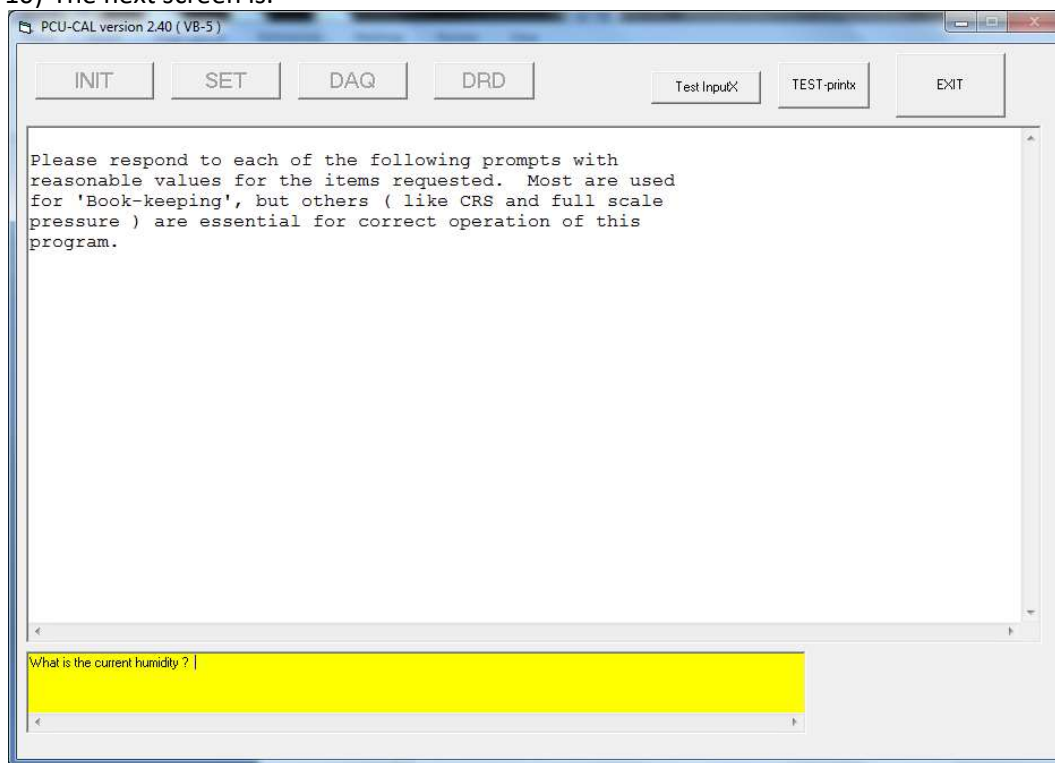
8) Pressing RETURN takes you to this screen:



- 9) If you enter a conversion factor, or take the default, press return and you get to this screen:

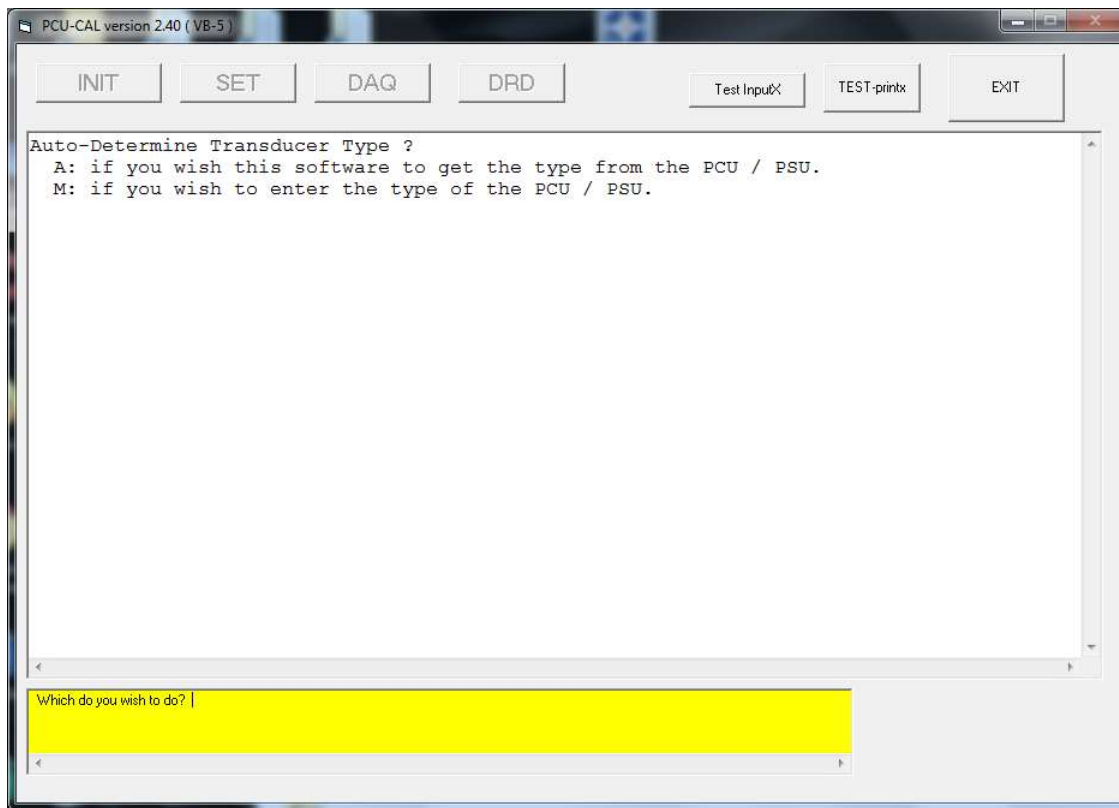


10) The next screen is:



- 11) You are expected to enter current
- Current Relative Humidity
 - Current Environmental Temperature, in degrees Celsius
 - Current Barometric pressure, in PSIA
 - The above 3 parameters ARE NOT USED IN CACLULATIONS, but are used as documentation
- 12) The next series of questions ARE CRITICAL:
- How Many PCUs are being calibrated?
 - What is the Serial Number of PCU #1?
 - What is the FULL SCALE PRSSURE (in PSI) for this PCU?
 - What is the FILE NAME for the CALIBRATION DATA?
 - What is the ORDER NUMBER? (used for book-keeping)
 - What is the CRS address for this PCU? (CRITICAL)

13) That will bring you to THIS SCREEN:



- a. It is generally easiest to AUTO-DETERMINE --- and VERIFY manually
- b. But you may manually enter the PCU Type
- c. If you select MANUAL ENTRY, you will be given a selection list

Enter the type of Transducer being calibrated, please.

- 1) Quartz, without temperature compensation
- 2) Quartz, with temperature compensation
- 3) Mensor
- 4) Hass
- 5) Smart Quartz
- 6) Digital Mensor

And you will be asked to enter a number: 1 to 6

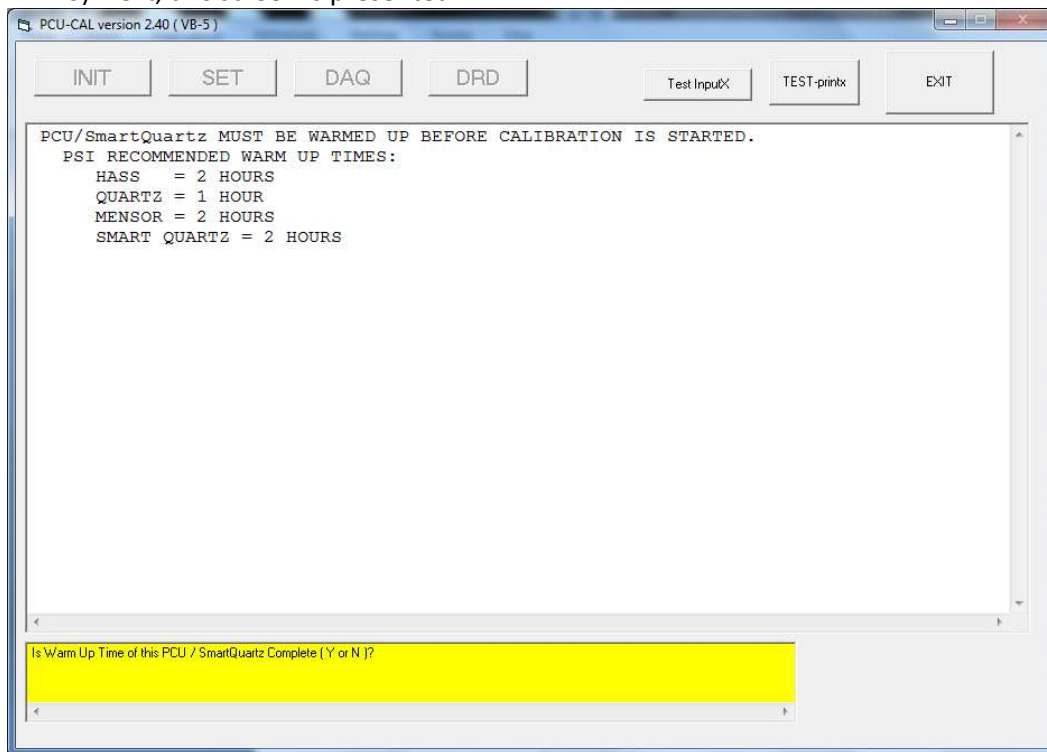
You will be asked if the unit is ABSOLUTE or DIFFERENTIAL
You may be asked other questions as well.

These MENUS and QUESTIONS are IDENTICAL to the menus and questions in
INIT239.exe.

- 14) If you are calibrating more than one PCU, these questions will be repeated for EACH PCU.
The program allows for up to four (4) PCUs to be calibrated at the same time.
- 15) After the question-and-answer session is finished:

- a. Each PCU will be initialized
- b. The CURRENT coefficients will be "READ FROM" the PCU and written to disk file (this is slow, be patient please. It is a critical backup that you probably will never need. If you do need it, it is invaluable!)

16) Next, this screen is presented:



- a) Warm-up is ENFORCED, not just recommended
- b) The START OF WARMUP time is recorded in the data file(s)
- c) The Start of DATA ACQUISITION time is also recorded
- d) We do not care what temperature the PCU CALIBRATION occurs at, in the range of 15 C to 35 C
- e) What is critical is that PCU Temperature (more precisely, the temperature of the device being calibrated) not change more than 0.5 degrees C. THIS IS MONITORED AND RECORDED.

17) At this point, the program will tell you:

- a. INIT240: That's all, folks.
- b. You have FINISHED the INIT Portion

18) THE "SET" Control button allows you to RESET all PCUs, without having to re-enter the data of the INIT section. You may need to power off the system, for example, to insert ANOTHER PCU and start it warming up. If so, JUST DO IT (power off the system, insert another PCU, power on the system), and Click on "SET". It will ask for the CRS of the first PCU used, and it will do all necessary setup, and the warm-up will RESUME. This is a significant time-saver.

19) The DAQ Command button is where CALIBRATION DATA ACQUISITION occurs. You are prompted to enter the CRS of the first PCU to be calibrated, and you will be given opportunity to:

- a. Quit
- b. Take another data point
- c. Enter the "TRUE PRESSURE APPLIED" for this data point

And you will be given a readout showing:

- a. Current Transducer Indicated Temperature
- b. Temperature CHANGE since start (stay within 0.5 C please !)
- c. Current Transducer Indicated Pressure

ALL data will be recorded to DISK.

- a. True Pressure
- b. Raw pressure data from transducer being calibrated
- c. Standard deviation of the pressure data
- d. Indicated temperature of the transducer at this data point

20) The program REQUIRES you to take at least 5 data points. It will not let you quit until you take 5 data points (This is true for the BETA TEST SOFTWARE, and should be fixed before final version is released).

- a. Dummy data points may be taken until you have the minimum 5
- b. This is a work-around
- c. But it does allow you to quit data acquisition if necessary

21) The DRD command button does the DATA ANALYSIS, Report Generation, and computes the new coefficients for the device(s) being calibrated.

- a. The reports are shown on screen
- b. The reports are written to TEXT FILES on disk
- c. You are given the option of updating coefficients in the PCU(s), or not, on an individual PCU basis.

We have tested on Windows 7 and Windows 10, and have not had issues.

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