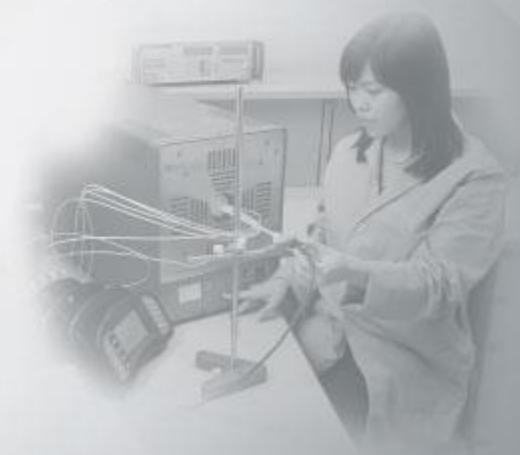


**FLUKE**®

Calibration

# End-to-End Calibration of PMM200 and PMM600 Pressure Measurement Modules

Kyle Clark  
5-October-2017



# End-to-End Calibration of pressure sensors

## Example

- Calibrate a PM200 module from a 6270A pressure calibrator in the PMM Calibration Kit with a PPC4 pressure controller (any reference can be used)
- Macros are used to:
  - Read cal coefficients
  - Calculate new coefficients
  - Run Verification (optional)



6270A



PMM Cal Kit



PPC4

# End-to-End Calibration of pressure sensors

## Example (apply to other applications)

Although this example is to calibrate a PM200 module from a 6270A pressure calibrator in the PMM Calibration Kit with a PPC4 pressure controller, the logic and macros can be used for many types of DUTs

### Changes for other DUTs

- Change the commands in the macros
- Comment out or delete unnecessary lines of code in the macros.

# COMPASS for Pressure

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## Configuring COMPASS to run a test

- Setup → DUT
- Setup → Piston Gauge (only if you use piston gauges or deadweight testers)
- Setup → Support Device (any device that is not a DUT, deadweight tester or piston gauge)
- Setup → Test

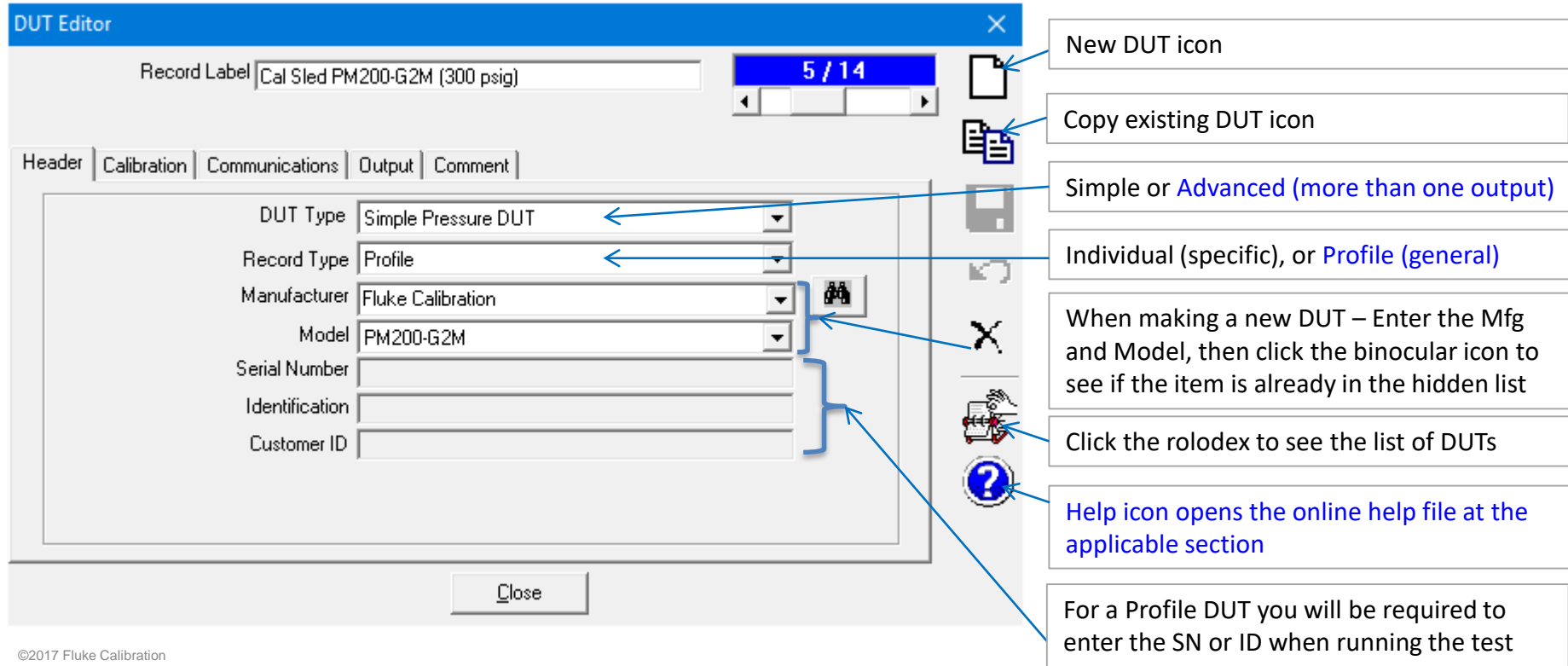
Note that there are many comments in the following pages explaining what additional choices can be made. Default settings are shown, and should remain unless necessary.

# Setup DUT (Screen-shots on following pages)

- Enter for all devices
  - Manufacturer, model, serial number and/or ID (SN or ID not needed for profile/generic DUTs)
  - Test to use with the DUT
  - Communication method (manual, RS232, IEEE, other device, etc.)
  - Min/max range, unit, tolerance
  - Remote command(s)
- The entered info can be used during the test, is saved to the data file, and can be shown on calibration reports

# Setup DUT (Device Under Test)

## Header Tab – PM module is setup as a Simple DUT



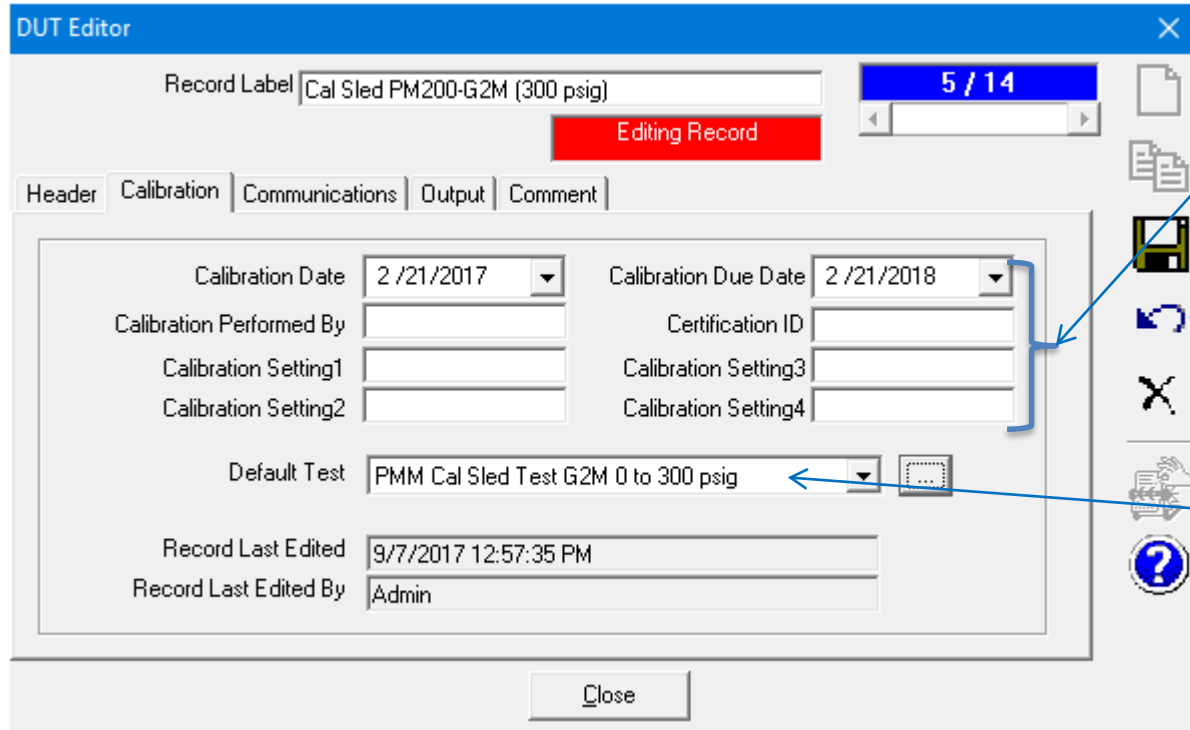
The screenshot shows the 'DUT Editor' window with a 'Record Label' of 'Cal Sled PM200-G2M (300 psig)' and a page indicator '5 / 14'. The interface has tabs for 'Header', 'Calibration', 'Communications', 'Output', and 'Comment'. The 'Header' tab is active, showing fields for 'DUT Type', 'Record Type', 'Manufacturer', 'Model', 'Serial Number', 'Identification', and 'Customer ID'. A 'Close' button is at the bottom.

Callouts on the right side of the interface:

- New DUT icon
- Copy existing DUT icon
- Simple or **Advanced (more than one output)**
- Individual (specific), or **Profile (general)**
- When making a new DUT – Enter the Mfg and Model, then click the binocular icon to see if the item is already in the hidden list
- Click the rolodex to see the list of DUTs
- Help icon opens the online help file at the applicable section
- For a Profile DUT you will be required to enter the SN or ID when running the test

# Setup DUT (Device Under Test)

## Calibration Tab - All cells are optional



DUT Editor

Record Label Cal Sled PM200-G2M (300 psig) 5 / 14

Editing Record

Header Calibration Communications Output Comment

Calibration Date 2 / 21 / 2017 Calibration Due Date 2 / 21 / 2018

Calibration Performed By Certification ID

Calibration Setting1 Calibration Setting3

Calibration Setting2 Calibration Setting4

Default Test PMM Cal Sled Test G2M 0 to 300 psig

Record Last Edited 9/7/2017 12:57:35 PM

Record Last Edited By Admin

Close

Calibration info or settings can be included on the cal report and/or used in a macro. Example: Cal Setting 1 (CalInfo1) could be offset & Cal Setting 2 (CalInfo2) could be slope. You could also prompt for these at the start of a test.

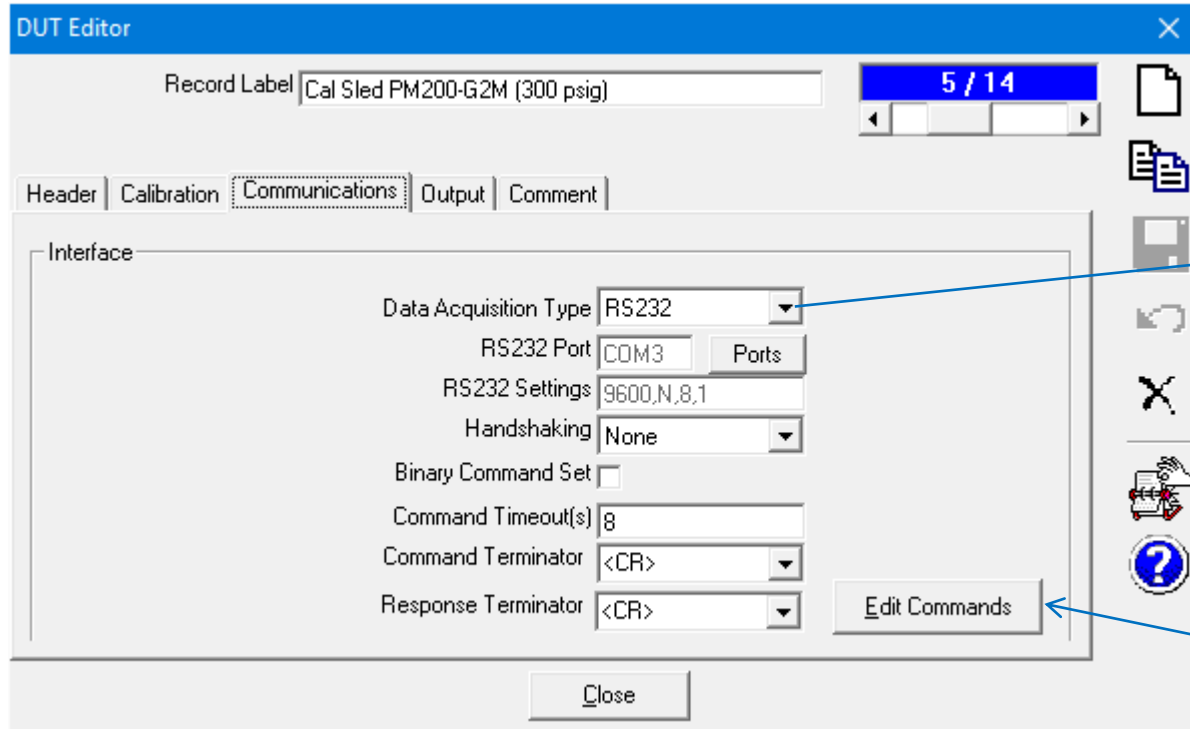
Click the Restore button at any time to undo any changes and restore to the last saved version

Specify the Default Test so the technician doesn't have to pick it when initializing the test



# Setup DUT (Device Under Test)

## Communications Tab – for the PMM Cal Kit



Many communications methods possible

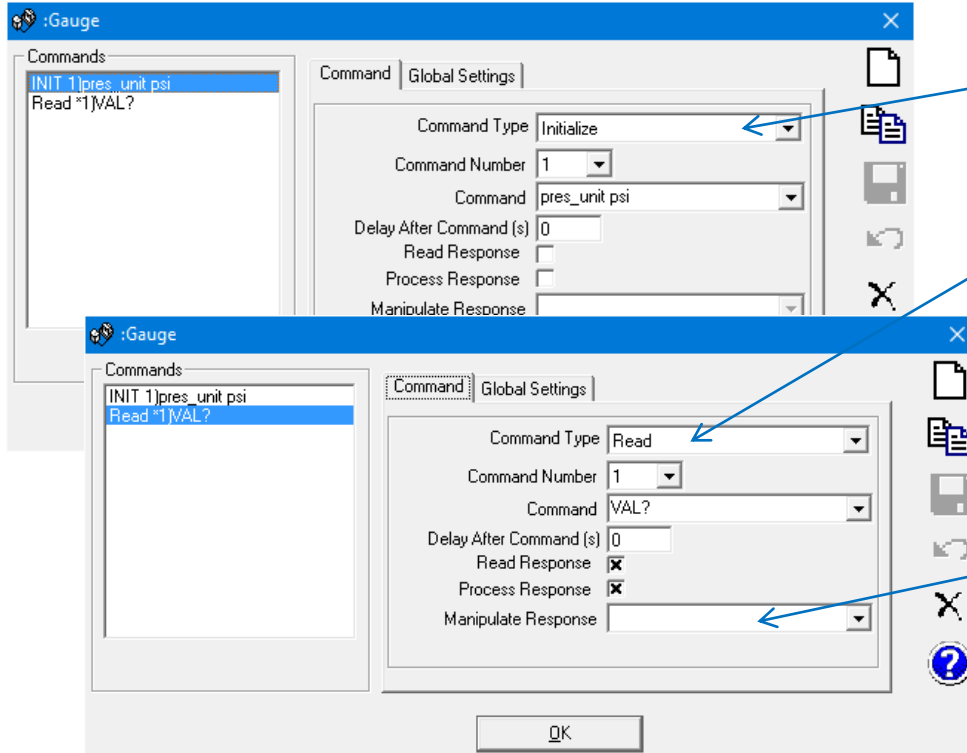


For a Simple DUT, commands are edited from the Communications tab view



# Setup DUT (Device Under Test)

## Communications Tab – [Edit Commands] button, for the PMM Cal Kit



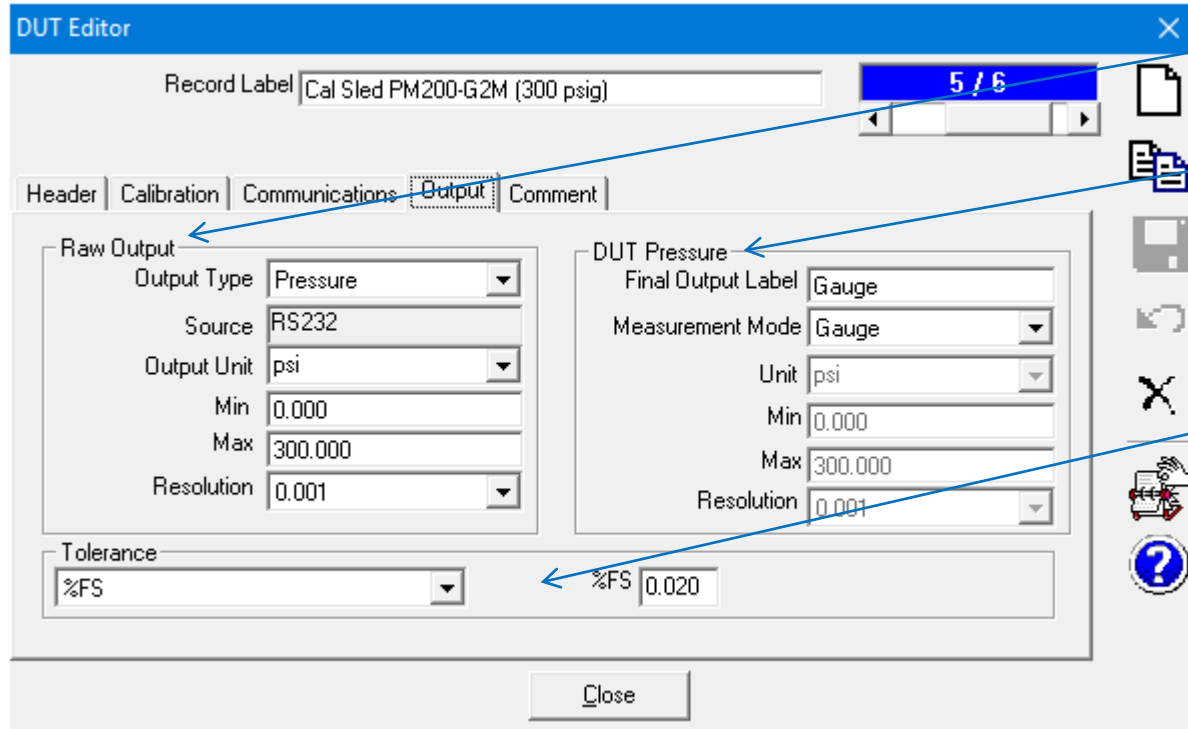
**Initialize** command sets units to psi.  
Test macros can be called here also  
(instruct technician to do something, etc.)

**Read** command is processed by COMPASS

**Manipulate Response** box can be used to  
**parse the reply**; enter two commas to skip  
everything before the second comma, enter  
the number 4 to skip the first 4 characters  
of a reply, or use a ReplyParser macro

# Setup DUT (Device Under Test)

## Output Tab – Simple DUT



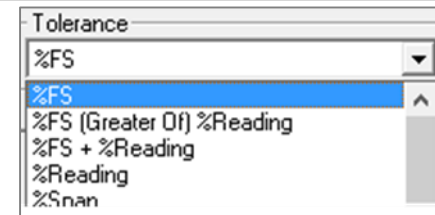
The screenshot shows the 'DUT Editor' window with the 'Output' tab selected. The 'Record Label' is 'Cal Sled PM200-G2M (300 psig)'. The 'Raw Output' section is configured with 'Output Type' set to 'Pressure', 'Source' as 'RS232', 'Output Unit' as 'psi', 'Min' at '0.000', 'Max' at '300.000', and 'Resolution' at '0.001'. The 'DUT Pressure' section is configured with 'Final Output Label' as 'Gauge', 'Measurement Mode' as 'Gauge', 'Unit' as 'psi', 'Min' at '0.000', 'Max' at '300.000', and 'Resolution' at '0.001'. The 'Tolerance' section is set to '%FS' with a value of '0.020'. A 'Close' button is at the bottom.

**Raw Output** is typically pressure, volts or milliamps

**Final output** is always pressure (for a DUT)

If different, the final output is linear proportional to the raw output.  
For example 0-5V to 0-100 psi

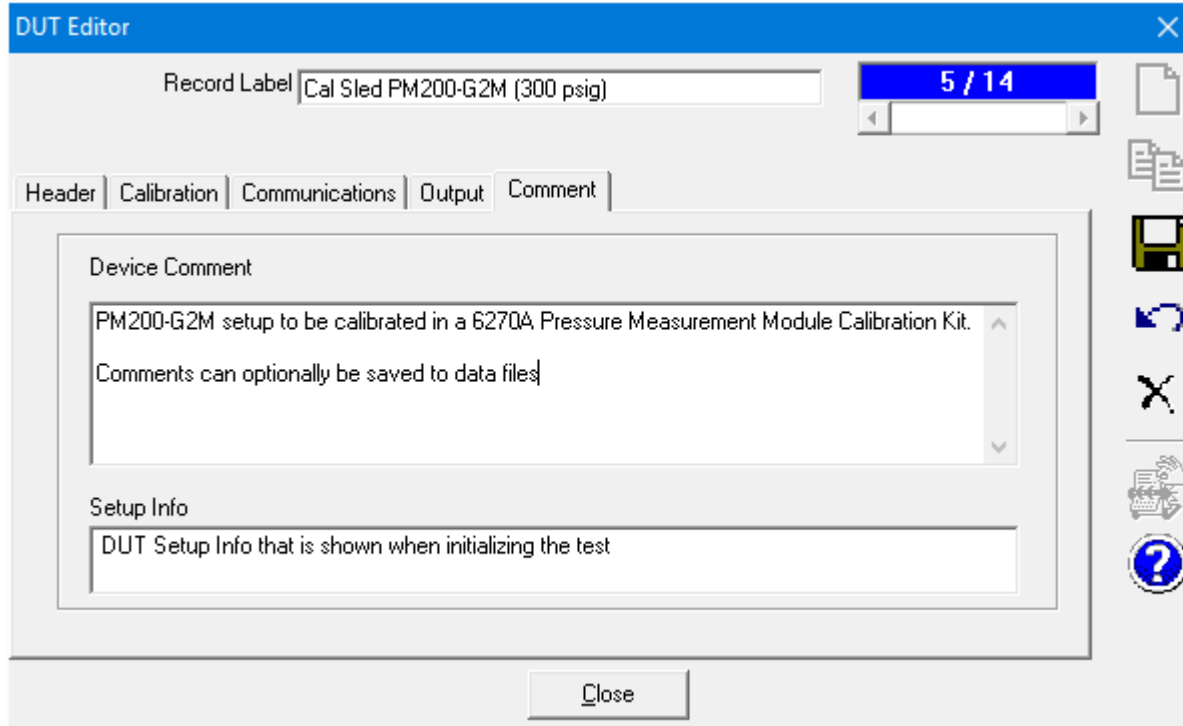
Many options for **Tolerance** (even more for Advanced DUTs)



The screenshot shows a dropdown menu for 'Tolerance' with the following options: %FS, %FS (Greater Of) %Reading, %FS + %Reading, %Reading, and %Snan. The '%FS' option is currently selected and highlighted in blue.

# Setup DUT (Device Under Test)

Comment Tab – All cells are optional



DUT setup takes some time but is done only once for each DUT, and doesn't have to be done each time you run a test.

Most often, existing DUTs are copied to make new DUTs (edit range, commands, etc.)

# Setup Support Devices

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Support Devices are all devices that are not DUTs, piston gauges or deadweight testers

- Setup is the same as DUT (advanced/simple device, read and set outputs, communications)
- Example today uses a PPC4 controller



# Setup Test (Screen-shots on following pages)

Test Definitions specify how the test will be performed

- Leak check and/or exercise the DUT (optional)
- Define set points
- Specify Reference(s), any other Support Devices
- Ready/not ready criteria
- Dwell time (wait time before taking data)
- Data collection method (manual or averaging)
- Specify calibration report template to use (with Advanced test with COMPASS for Pressure Enhanced)

# Setup Test

## Pre-Test Tab – all settings are optional

The screenshot shows the 'Test Editor' window with the 'Pre-Test' tab selected. The 'Test Record Label' is 'PMM Cal Sled Test G2M 0 to 300 psig' and the 'Test Definition Type' is 'Advanced Test'. The 'Pre Test Macro' is set to 'None'. The 'Leak Test' section includes: Run Leak Test (checkbox), Leak Test Unit (psi), Leak Test Target (psi) 300, Set Target Timeout (s) 360, Leak Rate Limit (psi/s) 0.006, Dwell(s) 30, Leak Test Time (s) 30, and Abort test on failure (checkbox checked). The 'Exercise' section includes: System exercise (checkbox), Exercise Unit (psi), Min Target (psi) 0, Max Target (psi) 300, Dwell (s) 30, Number Of Repetitions 2, Hold Limit (psi) 0.06, Set Target Timeout (s) 180, and Abort test on failure (checkbox). A blue arrow points from the 'Pre Test Macro' dropdown to a callout box on the right.

**Pre Test Macro** to provide instructions, query technician for needed info (message entry box), turn on a driver (to a vac pump), etc.

**Leak Test** – Typically set “Leak Rate Limit” to 10% of the DUT’s tolerance

# Setup Test

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## Pressure Tab – Set Points

Test Editor

Test Record Label: PMM Cal Sled Test G2M 0 to 300 psig

Test Definition Type: Advanced Test

9 / 12

Pre-Test | **Pressure** | Data | Auxiliary | Options | Comment

Test Pressure Points - psi

1)M	ATM	12)	
2)	75	13)	
3)	150	14)	
4)	225	15)	
5)	300	16)	
6)	225	17)	
7)	150	18)	
8)	75	19)	
9)	ATM	20)	
10)		21)	
11)		22)	

General | **Read** | Set

Unit: psi

Measurement Mode: Gauge

Read: PPC4 / RPT Measurement

Set: PPC4 / RPT Control

Jog Before Dwell: N/A

Regulate: None 45 s

Dwell: Automatic 20 s

Pressure Cycle: 2

Vent after each cycle:

Insert Auto Fill Close

**Unit** - Set to %DUT FS for a more universal test

**Read** - Specify the Reference Device (more options on the [Read] child tab)

**Set** - Specify the Controller (more options on the [Set] child tab)

**Jog Before Dwell** - Typically only for cardinal point calibrations on analog gauges (needle exactly on the mark)

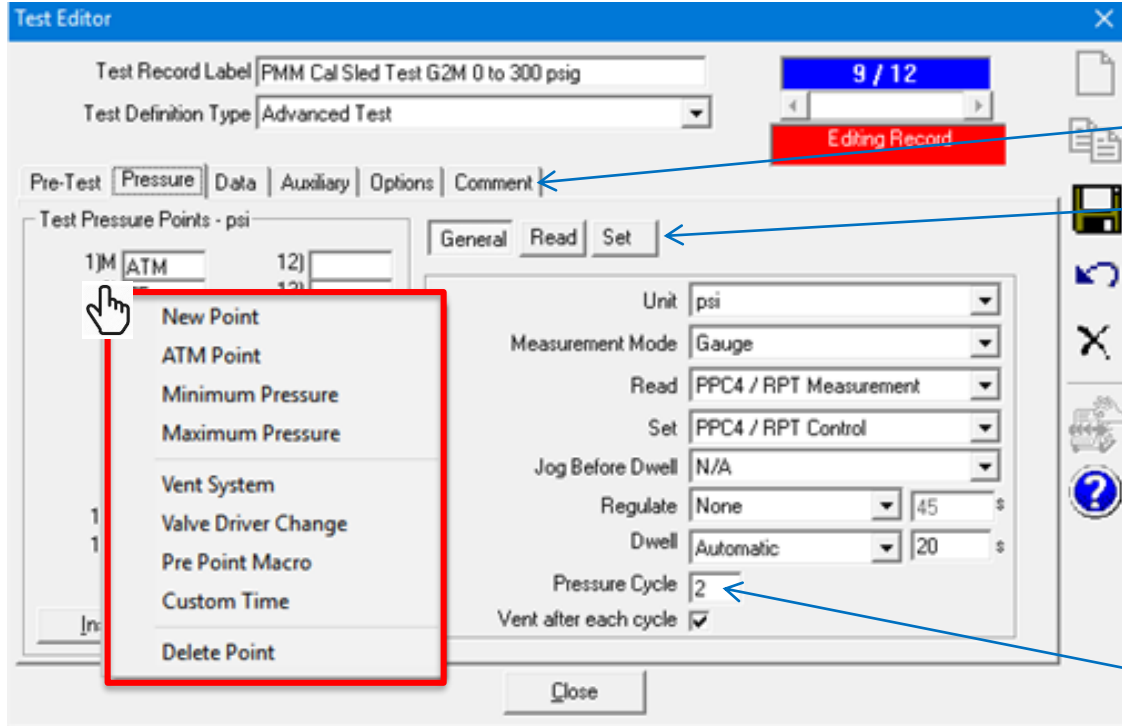
**Regulate** - With an automated controller, adjust the pressure every xx seconds so the Reference or DUT pressure matches the set point exactly

**Dwell** - Enter zero (0) for no dwell (soak) time



# Setup Test

## Pressure Tab



Called "Parent Tabs" in help file

Called "Child Tabs" in help file

Click the point number next to each point to get a list of point options

- "Valve Driver Change" will activate the specified driver (typically a relay). Must have a Valve Driver Controller setup as a Support Device. (open/close a valve, turn on/off a vacuum pump, etc.)
- "Pre Point Macro" is added the same way as a Pre Test Macro

How many times to run this pressure cycle. In our example we run two, As Found & As Left

# Setup Test

## Pressure Tab – “Read” Child Tab

The screenshot shows the 'Test Editor' window with the following details:

- Test Record Label: PMM Cal Sled Test G2M 0 to 300 psig
- Test Definition Type: Advanced Test
- Page indicator: 10 / 13
- Navigation tabs: Pre-Test, Temperature, Pressure (selected), Data, Auxiliary, Options, Comment
- Test Pressure Points - psi: A list of 22 points, with 1) ATM, 2) 75, 3) 150, 4) 225, 5) 300, 6) 225, 7) 150, 8) 75, 9) ATM, and 10) blank.
- Child tabs: General, Read (highlighted in red), Set
- Test Reference: 1) PPC4 / RPT Measurement
- Change Before Point: 1
- Macro: None
- Buttons: Add, Remove, Edit, Insert, Auto Fill, Close

Add or Edit References, specify what points they are used at. Can also specify exactly which Q-RPT or piston or module to use so the technician doesn't have to (if applicable) in the [Edit] window

# Setup Test

## Pressure Tab – “Set” Child Tab

The screenshot shows the 'Test Editor' window with the 'Pressure' tab selected. The 'Test Record Label' is 'PMM Cal Sled Test G2M 0 to 300 psig' and the 'Test Definition Type' is 'Advanced Test'. The 'Test Pressure Points - psi' list contains 22 entries, with 1) ATM, 2) 75, 3) 150, 4) 225, 5) 300, 6) 225, 7) 150, 8) 75, 9) ATM, 10) blank, 11) blank, 12) blank, 13) blank, 14) blank, 15) blank, 16) blank, 17) blank, 18) blank, 19) blank, 20) blank, 21) blank, and 22) blank. The 'Set' child tab is active, showing 'Test Pressure Control' for '1)PPC4 / RPT Control'. The 'Change Before Point' is set to 1. The 'Add', 'Remove', and 'Edit' buttons are visible. The 'Test Pressure Control' parameters are: Macro: None, Control mode: Dynamic, Ready Criteria: COMPASS, Hold / Stability Unit: %DUTSpan, Hold Limit (%DUTSpan): 0.006, Stability Limit (%DUTSpan/s): 0.006, Ready Hold Time (s): 5, and Control Timeout (s): 300. The 'Close' button is at the bottom.

Add or Edit Controllers (not common), specify what points they are used at

**Dynamic** or **Static** control mode (if applicable)

**COMPASS** or **Controller** determines ready condition (if Controller has a Ready/Not Ready reply)

How close to set point to get a Ready condition (in Dynamic mode). Typically 10% of the DUT tolerance (if possible)

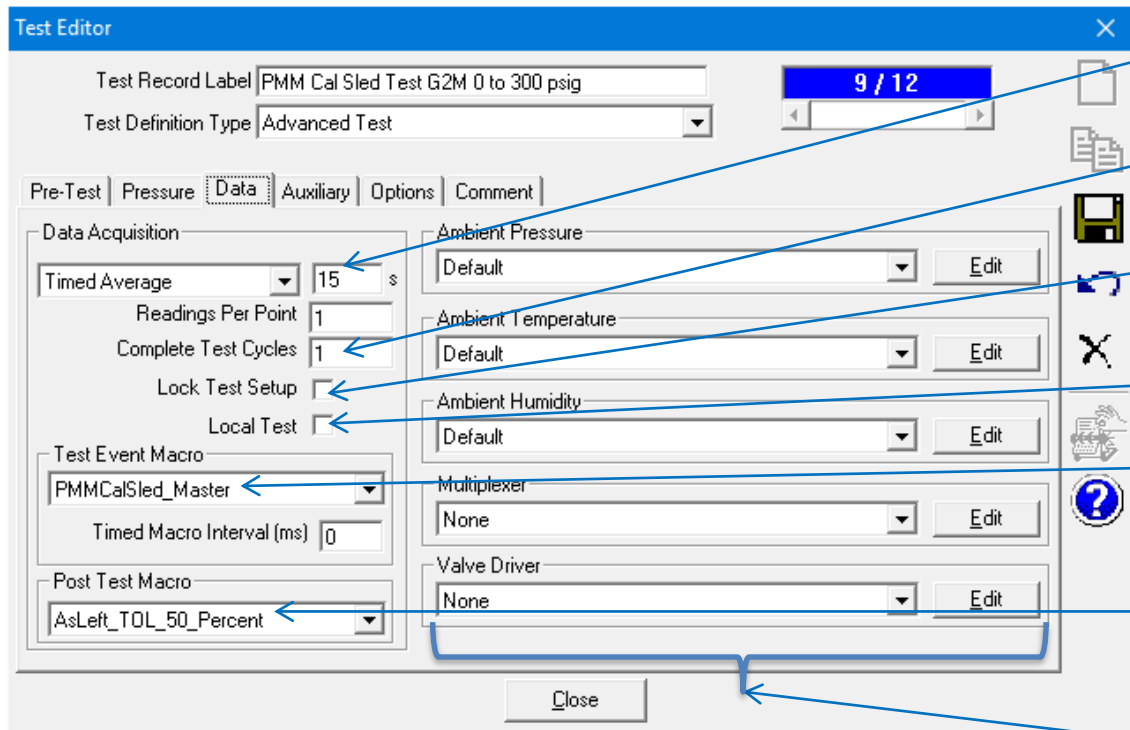
How stable to get a Ready condition (in Dynamic mode). Typically 10% of the DUT tolerance (if possible)

How long to be Ready to continue to Dwell

Timeout to get Ready (continue or abort test)

# Setup Test

## Data Tab



- Enter zero for no averaging
- How many Complete Test Cycles to run (with pre test macro, leak test, exercise (optional temperature and/or line pressure cycles))
- Prevent users from editing tests
- If checked test can only run on this PC (must have networked install)
- Add a Test Event TestMacro (many capabilities with this)
- Add a Post Test TestMacro (many capabilities with this). This one checks if any as-left errors are more than 50% of the tolerance. Change to "None" if you don't want this checked.
- Specify other Support Devices to use

# Setup Test

## Auxiliary Tab – Optional, specify any Aux devices to use

The screenshot shows the 'Test Editor' window with the 'Auxiliary' tab selected. The 'Test Record Label' is 'PMM Cal Sled Test G2M 0 to 300 psig' and the 'Test Definition Type' is 'Advanced Test'. The page number '10 / 13' is displayed. The 'Auxiliary Device' table lists several calibration sleds from Fluke Calibration.

Label	Manufacturer	Model	Serial
Cal Sled PM200-A100K	Fluke Calibration	PM200-A100K	
Cal Sled PM200-BG200K	Fluke Calibration	PM200-BG200K	
Cal Sled PM200-BG200K -100 to 206 kPa	Fluke Calibration	PM200-BG200K	
Cal Sled PM200-G20M	Fluke Calibration	PM200-G20M	
Cal Sled PM200-G2M (300 psig)	Fluke Calibration	PM200-G2M	
Cal Sled PM200-G3.5M	Fluke Calibration	PM200-G3.5M	
Cal Sled PM200-G700K	Fluke Calibration	PM200-G700K	

Buttons: Search, Remove, Close

# Setup Test

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## Options Tab (only with Advanced Test)

The screenshot shows the 'Test Editor' window with the 'Options' tab selected. The 'Test Record Label' is 'PMM Cal Sled Test G2M 0 to 300 psig' and the 'Test Definition Type' is 'Advanced Test'. The 'Options' tab contains a 'Default Report Template' field with the path 'C:\dhi\COMPASS for Pressure\Templates\PM200 as found - as left.tpl', a list of checkboxes for report generation options, and a 'Test Definition Group' dropdown.

Test Record Label: PMM Cal Sled Test G2M 0 to 300 psig

Test Definition Type: Advanced Test

9 / 12

Pre-Test | Pressure | Data | Auxiliary | Options | Comment

Default Report Template

C:\dhi\COMPASS for Pressure\Templates\PM200 as found - as left.tpl

Auto generate report when the test completes.

Execute post test macro on aborted tests.

Prompt for test notes at the end of complete tests

Include test comment in test notes.

Include DUT comment in test notes.

Test Definition Group 1

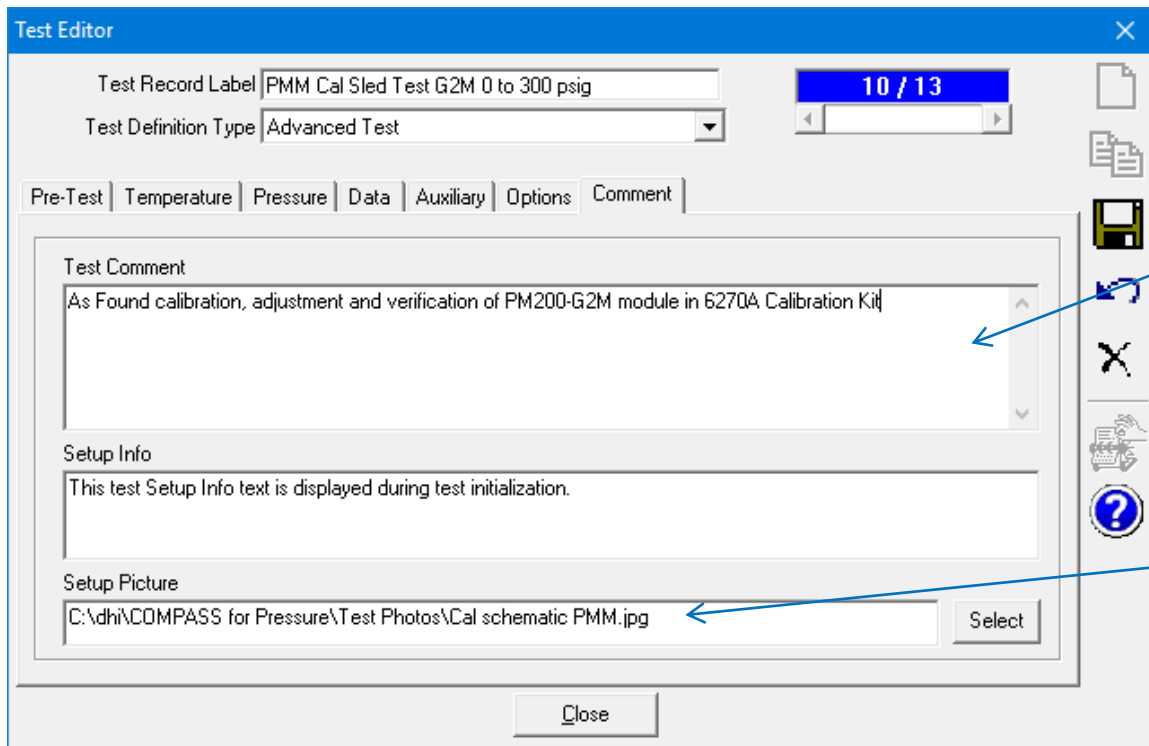
Close

Specify calibration report template. Useful if you have multiple templates. Our example uses a custom As Found – As Left template

Automatically open cal report when test is done

# Setup Test

## Comments Tab – All cells are optional



Can be saved to data file if desired

Technician can view this picture when initializing the test



# Run Test

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Run → [Run Test Definition](#) (screen-shots follow)

- Initialize Test - Follow the on-screen prompts for selection of DUT(s), the Test and any Support Devices
- Run Test - Proceed through the leak test/exercise, test points, collecting data (might be fully automated)
- End Test - Upon completion, click to create the calibration report in the COMPASS Report Editor (or it might open automatically if configured to do so)

# Initialize Test

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Calibration

## Select Units / User

Run Test (Hardware Setup)

Select Units of Measure

The unit lists below define the units of measure to use when logging outputs to the data file. The selections also represent the default display unit of devices that output the corresponding quantity. Select the desired units and press [Next]. The selected Test Definition may override the units selected.

Test Pressure Unit

Temperature Unit

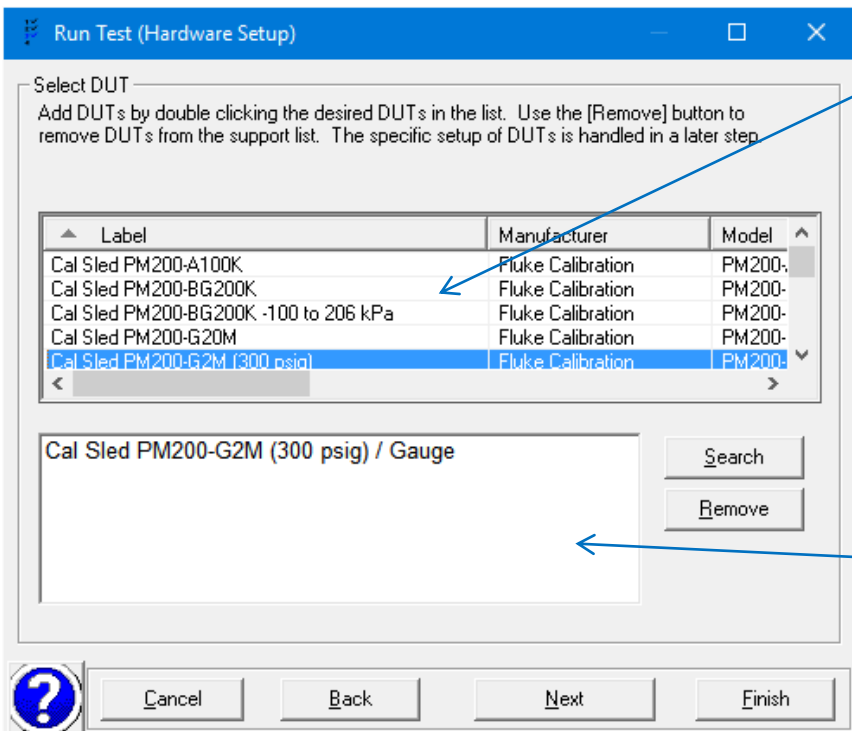
Select/enter user name

Can run test in different units than device and/or test setups

Clear history of the previous run. If you want to run the same exact DUT, test, etc. (you made a mistake the last time) just press the [Finish] button and the same previous test will run

# Initialize Test

## Select DUT(s)



Run Test (Hardware Setup)

Select DUT

Add DUTs by double clicking the desired DUTs in the list. Use the [Remove] button to remove DUTs from the support list. The specific setup of DUTs is handled in a later step.

Label	Manufacturer	Model
Cal Sled PM200-A100K	Fluke Calibration	PM200-
Cal Sled PM200-BG200K	Fluke Calibration	PM200-
Cal Sled PM200-BG200K -100 to 206 kPa	Fluke Calibration	PM200-
Cal Sled PM200-G20M	Fluke Calibration	PM200-
Cal Sled PM200-G2M (300 psig)	Fluke Calibration	PM200-

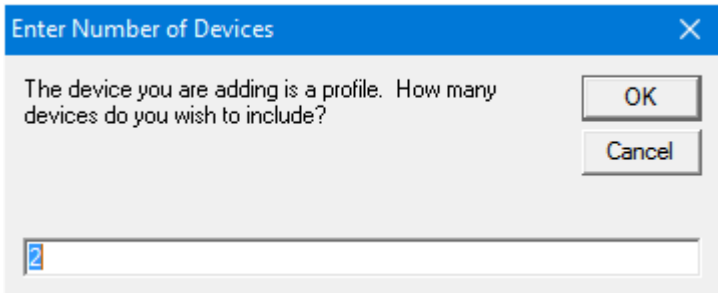
Cal Sled PM200-G2M (300 psig) / Gauge

Search

Remove

Cancel Back Next Finish

List of available DUTs. Double-click to select (then shows in bottom window). Double-click a profile DUT more than once and COMPASS will prompt you for how many



Enter Number of Devices

The device you are adding is a profile. How many devices do you wish to include?

OK

Cancel

2

Selected DUT, PM200-G2M

# Initialize Test

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## Configure DUT(s)

Run Test (Hardware Setup)

Configure DUT (1 / 1) Cal Sled PM200-G2M (300 psig)

Manufacturer: Fluke Calibration

Model: PM200-G2M

Serial Number: 123456879

Identification:

Customer ID:

RS232 Settings: COM3:9600,N,8,1

Parameter ID:

DUT Pressure Output Label: Gauge

[Customize Output](#)

Min (psi): 0

Max (psi): 300

Measurement Mode: Gauge

Raw Output Type: Pressure

Pressure (psi): RS232

DUT Temperature: None

Buttons: ? Cancel Back Next Finish

Have to enter Serial Number, Identification or Customer ID of any Profile DUTs now

No temperature output is needed for a PMM

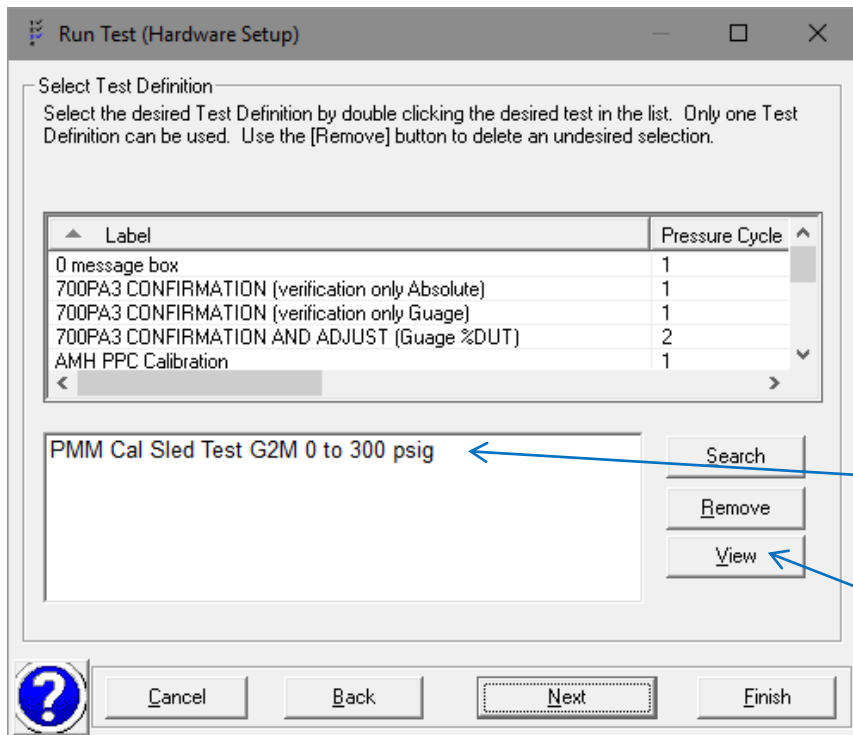
Click "Customize Output" link to change the range of a Profile DUT if desired

# Initialize Test

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## Select Test



The Test we specified on the "Calibration" tab in the DUT Setup is here. Can change if desired unless the Test is locked

Can view all tabs of the Test here

# Initialize Test

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Calibration

## Test Hardware Configuration

Run Test (Hardware Setup)

Test Hardware Configuration

Ambient Pressure	None
Ambient Temperature	None
Ambient Humidity	None
Reference Pressure	PPC4 / RPT Measurement
Test Pressure Control	PPC4 / RPT Control
Reference Temperature	None
Temperature Control	None
Multiplexer	None
Valve Driver	None

**This test Setup Info text is displayed during test initialization.**

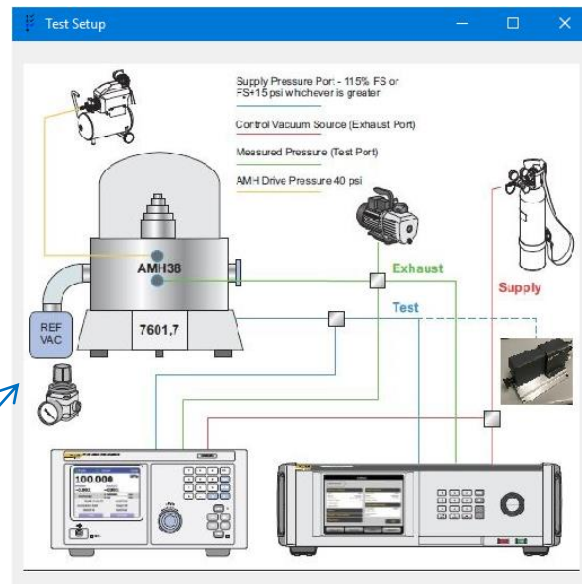
Default Hardware Setup

Setup Picture

Cancel Back Next Finish

Devices that we specified in the Test setup populate here. Can change if desired unless the Test is locked

The image specified in the Comments tab in the Test setup shows if you click the [Setup Picture] button



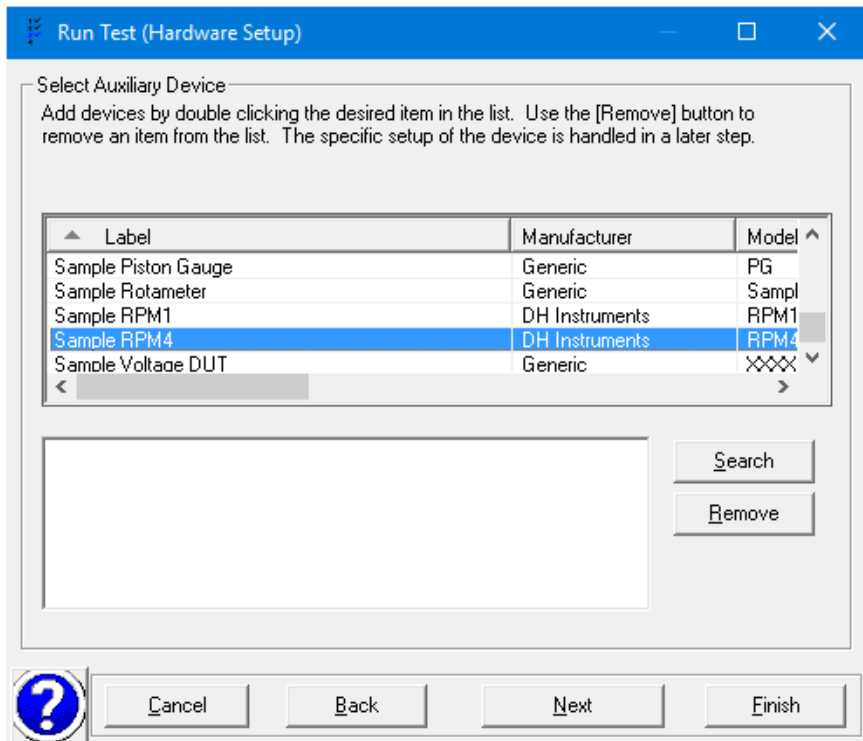
Text from the "Comments" tab in the Test setup (bold and blue to stand out)

# Initialize Test

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## Select Auxiliary Devices (optional)



Run Test (Hardware Setup)

Select Auxiliary Device

Add devices by double clicking the desired item in the list. Use the [Remove] button to remove an item from the list. The specific setup of the device is handled in a later step.

Label	Manufacturer	Model
Sample Piston Gauge	Generic	PG
Sample Rotameter	Generic	Sampl
Sample RPM1	DH Instruments	RPM1
Sample RPM4	DH Instruments	RPM4
Sample Voltage DUT	Generic	XXXX

Search

Remove

Cancel Back Next Finish

Same selection method as DUTs

You can prevent this screen from showing by this path:  
[Tools], <Options>, "Initialize" tab



# Initialize Test

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## Configure/Verify Reference, Controller, Auxiliary Device(s)

Run Test (Hardware Setup)


Configure Device [2 / 2]

Manufacturer	DH Instruments	Customer ID	
Model	PPC3	RS232 Settings	COM1:9600,N,8,1
Serial Number	157	Parameter ID	
Identification			<input type="button" value="Load Settings"/>

Reference Pressure Output Label:RPT Measurement

[Customize Output](#)

Min (psi)	0.000	Head Height	0	cm
Max (psi)	300.000	Medium	N2	
Measurement Mode	Gauge			
	Auto Range			
Enable Auto Zero	<input checked="" type="checkbox"/>			



# Initialize Test

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## Final Verification / Summary

Run Test (Hardware Setup)

Initialization Complete

The initialization process is complete. Verify that the remote interface connections and settings are correct for each device. Press [Finish] to begin the test.

Test	PMM Cal Sled Test G2M 0 to 300 psig
DUTs	1 0.000 / 300.000 psi
Reference Pressure	0.000 / 300.000 psi
Temperature	N/A

?

Cancel Back Next Finish

# COMPASS Macro Editor (view of)

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## Test Macro “PMMCalSledMaster” (Specified on the Data tab in the Test)

COMPASS Macro Editor

Edit Settings

All Code

- DataFile
- GlobalCode
- Interface
- Relationship
- ReplyParser
- ReportField
- Test
- \_Declaration
- AsLeft\_TOL\_30\_Percent
- AsLeft\_TOL\_50\_Percent
- CalActivate
- CalActivate\_PreTest
- Fluke700\_Zero
- Fluke700CalibrationAdjust
- Fluke700P\_Zero
- Fluke700PCalibrationAdjust
- Fluke700PShutDown
- FPG\_CloseBypass
- FPG\_OpenBypass
- FPG\_ZeroandVent
- LogReadyAndPrs
- MsgBoxPreTestDummy
- PM200\_BG200k\_pretest
- PMMCalSled\_Master

Title: PMMCalSled\_Master

```
5273 Function PMMCalSled_Master(iT, iL, iC, iP, cTest, cConfig)
5274
5275 ' Determine which macro to run. There are five Meas Mode codes:
5276 '0 = Absolute
5277 '1 = Gauge
5278 '2 = Abs by Atms
5279 '3 = Differential (Bi-Directional)
5280 '4 = ???
5281 '5 = Negative Gauge
5282
5283 Select Case cTest.TestPrsMeasMode
5284     Case 0:
5285         Call FlukeCalSledAbsolute(iT, iL, iC, iP, cTest, cConfig)
5286     Case 1:
5287         Call FlukeCalSledGauge(iT, iL, iC, iP, cTest, cConfig)
5288     Case 3:
5289         Call FlukeCalSledDifferential(iT, iL, iC, iP, cTest, c
5290
5291 End Select
5292
5293 End Function
```

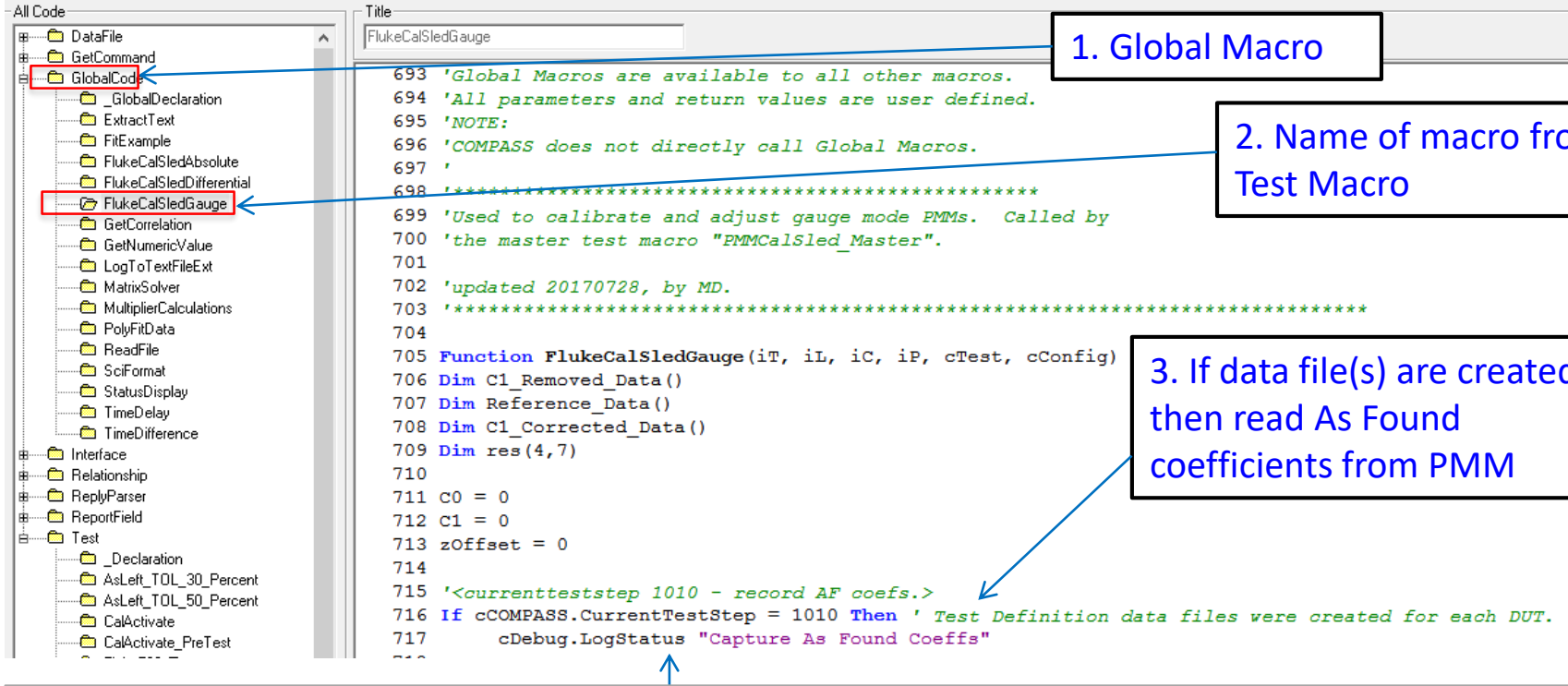
1. Test Macro

3. This Test Macro calls the appropriate GlobalCode macro based on the mode of the Test; Absolute, Gauge, Differential

4. Green text are comments

2. Macro

# Global Macro "FlukeCalSledGauge"



1. Global Macro

2. Name of macro from Test Macro

3. If data file(s) are created then read As Found coefficients from PMM

```
693 'Global Macros are available to all other macros.
694 'All parameters and return values are user defined.
695 'NOTE:
696 'COMPASS does not directly call Global Macros.
697 '
698 '*****
699 'Used to calibrate and adjust gauge mode PMMs. Called by
700 'the master test macro "PMMCalSled_Master".
701
702 'updated 20170728, by MD.
703 '*****
704
705 Function FlukeCalSledGauge(iT, iL, iC, iP, cTest, cConfig)
706 Dim C1_Removed_Data()
707 Dim Reference_Data()
708 Dim C1_Corrected_Data()
709 Dim res(4,7)
710
711 C0 = 0
712 C1 = 0
713 zOffset = 0
714
715 '<currentteststep 1010 - record AF coefs.>
716 If cCOMPASS.CurrentTestStep = 1010 Then ' Test Definition data files were created for each DUT.
717     cDebug.LogStatus "Capture As Found Coeffs"
718
```

4. Debug statements show in the macro spy window (during the test) and are logged to the macstat.log file. Very useful for troubleshooting macros and saving extra info that is not saved to the data file

# Global Macro "FlukeCalSledGauge"

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```
cDebug.LogStatus "Capture As Found Coeffs"
```

```
For i = 1 To cConfig.DUTPrs.Count  
  cDebug.LogStatus "DUT: " & i
```

```
  ' Read A/F C0 from PMM; write to calcoef1:
```

```
  C0 = cConfig.DUTPrs(CInt(i)).IoSendCommand("OFFSET_SET?", False)
```

```
  cCOMPASS.DataCollection(i).DUT.CalibrationCoefficient1 = c0
```

```
  cDebug.LogStatus "Command OFFSET_SET?: " & C0
```

```
  cDebug.LogStatus "CalibrationCoefficient1: " & cCOMPASS.DataCollection(i).DUT.CalibrationCoefficient1
```

```
  ' Read A/F C1 from DUT; write to calcoef2
```

```
  C1 = cConfig.DUTPrs(CInt(i)).IoSendCommand("GAIN_SET?", False)
```

```
  cCOMPASS.DataCollection(i).DUT.CalibrationCoefficient2 = c1
```

```
  cDebug.LogStatus "Command GAIN_SET?: " & C1
```

```
  cDebug.LogStatus "CalibrationCoefficient2: " & cCOMPASS.DataCollection(i).DUT.CalibrationCoefficient2
```

```
  ' Read A/F zOffset from PMM, write to calcoef3:
```

```
  zOffset = cConfig.DUTPrs(CInt(i)).IoSendCommand("UCOEF_SET[0]?", False)
```

```
  cCOMPASS.DataCollection(i).DUT.CalibrationCoefficient3 = zOffset
```

```
  cDebug.LogStatus "Command UCOEF_SET[0]?: " & zOffset
```

```
  cDebug.LogStatus "CalibrationCoefficient3: " & cCOMPASS.DataCollection(i).DUT.CalibrationCoefficient3
```

For each DUT, send command to PMM to read Offset (C0) and save to DUT Cal Coef 1

Same for Slope (C1) and zOffset/AutoZero/Tare

# Global Macro “FlukeCalSledGauge”

Macro continues...

1. Reads PMM calibration date
2. Zeroes the PMM reading at the start of the first pressure cycle
  - a. Calls macro FlukeCalSled\_WaitForReady that is in the PMMCalSled\_Master Test Macro
  - b. Calls macro FlukeCalSled\_Dwell in the same test macro with a dwell time of 10 seconds
  - c. Sets zOffset (AutoZero) value to zero (As Found value is already stored)
  - d. Reads current offset to newOffset and converts to psi as newOffsetPsi
  - e. Writes newOffsetPsi to the module to zero it, verifies it and saves to DUTRaw3
3. Test continues through the pressure points in pressure cycle 1

# Global Macro “FlukeCalSledGauge”

Macro continues...

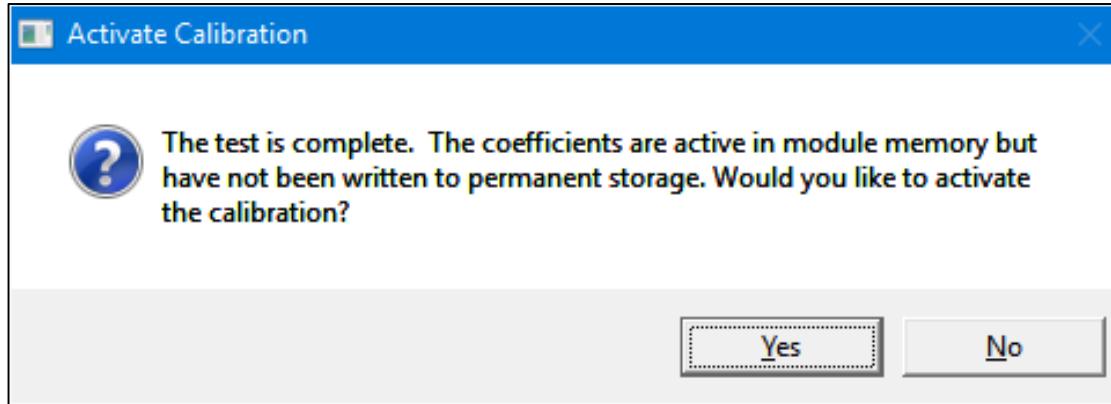
4. Calls Global Macro PolyFitData with test data
  - a. Sends Reference data
  - b. Sends Raw DUT data – As Found data adjusted for As Found  
C0 and C1 coefficients removed
  - c. PolyFitData calculates new C0 and C1 values
5. Send new C0, C1 and cal date to PMM and save to  
DUTCalCoef4 and DUTCalCoef5
6. Test continues through pressure cycle 2 (verification run)



# Global Macro “FlukeCalSledGauge”

Macro continues...


## 7. Message box is displayed

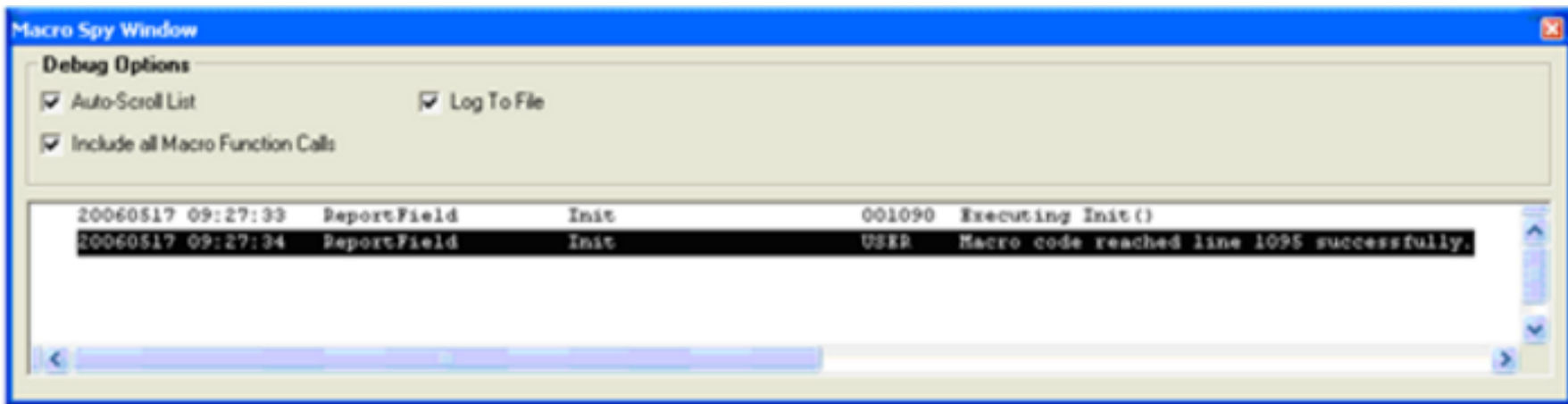


- [Yes], command sent to PMM to save new coefficients and cal date
- [No], another message box instructing to cycle power of the PMM Cal Kit to remove the coefficients from the PMM

# Run Test – Display macro spy

**Macro Spy** (show macro calls and macro debug statements)

- If the test does not have a macro in it, the option to view the macro spy window does not appear
- Click the Device Run Screen Display icon  and select <Show Macro Spy> to bring up the Macro Spy Window



# Run Test – Display macro spy

## Macro Spy and macstat.log

- Ensure that the “Log To File” and “Include all Macro Function Calls” checkboxes are checked to log any debug statements and macro calls to the file c:\dhi\common\MacStat.log
- **MacStat.log**

20170906 14:30:20	Test	FlukeCalSledCalibrat	USER	FlukeCalSledCalibrationAdjust new_CO: -6.68389887431305E-02
20170906 14:30:20	Test	FlukeCalSledCalibrat	USER	CalibrationCoefficient4: -6.68389887431305E-02
20170906 14:30:20	Test	FlukeCalSledCalibrat	USER	Sent command: OFFSET_SET -6.68389887431305E-02
20170906 14:30:20	Test	FlukeCalSledCalibrat	USER	CalibrationCoefficient5: 0.997338053453363
20170906 14:30:20	Test	FlukeCalSledCalibrat	USER	Sent command: GAIN_SET 0.997338053453363
20170906 14:30:20	Test	FlukeCalSledCalibrat	USER	CalDueDate: 9/6/2017
20170906 14:30:20	Test	FlukeCalSledCalibrat	USER	Sent command: CAL_DATE 09/06/17
20170906 14:30:20	Test	FlukeCalSledCalibrat	USER	Sent command: UCOEF_SET[0] 0
20170906 14:30:20	Test	FlukeCalSledCalibrat	USER	Finished with CurrentTestStep 1150
20170906 14:30:49	Test	FlukeCalSledCalibrat	003668	Executing FlukeCalSledCalibrationAdjust(1, 1, 2, 1, <object>, <object>)

# End of Test

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## Test data:

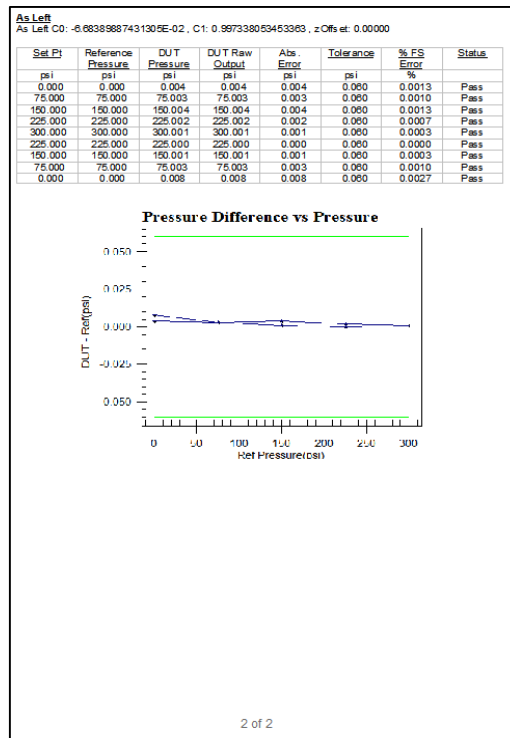
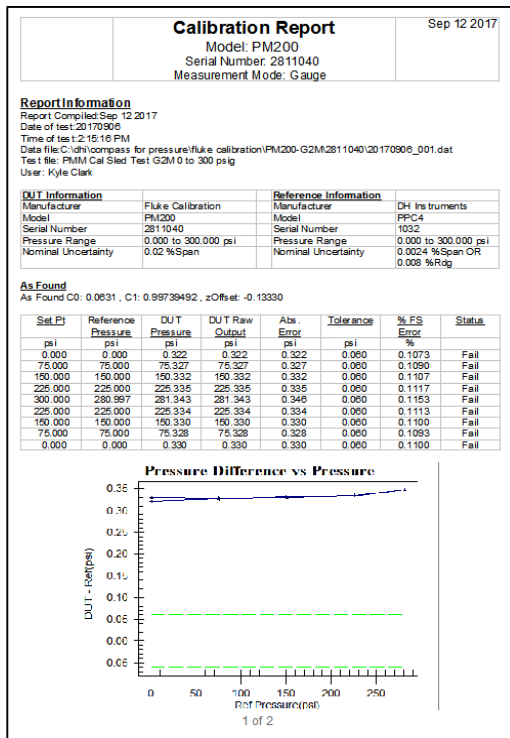
- As COMPASS runs, data is written to a storage location, saved as an ASCII delimited text file
- Storage location is local drive or network location
- Optional, can also save in \*.mdb database file
- Import COMPASS data file into MET/TEAM (Optional – do from MET/TEAM)

# Calibration Report

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## COMPASS Report Editor Produces professional quality calibration reports



# Calibration Report

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COMPASS Report Editor Produces professional quality calibration reports

Title / Header section

	<b>Calibration Report</b> Model: PM200 Serial Number: 2811040 Measurement Mode: Gauge	Sep 12 2017	
<b><u>Report Information</u></b> Report Compiled: Sep 12 2017 Date of test: 20170906 Time of test: 2:15:16 PM Data file: C:\dh\compass for pressure\fluke calibration\PM200-G2M\2811040\20170906_001.dat Test file: PMM Cal Sled Test G2M 0 to 300 psig User: Kyle Clark			
<b><u>DUT Information</u></b>		<b><u>Reference Information</u></b>	
Manufacturer	Fluke Calibration	Manufacturer	DH Instruments
Model	PM200	Model	PPC4
Serial Number	2811040	Serial Number	1032
Pressure Range	0.000 to 300.000 psi	Pressure Range	0.000 to 300.000 psi
Nominal Uncertainty	0.02 %Span	Nominal Uncertainty	0.0024 %Span OR 0.008 %Rdg

# Calibration Report

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## As Found Data

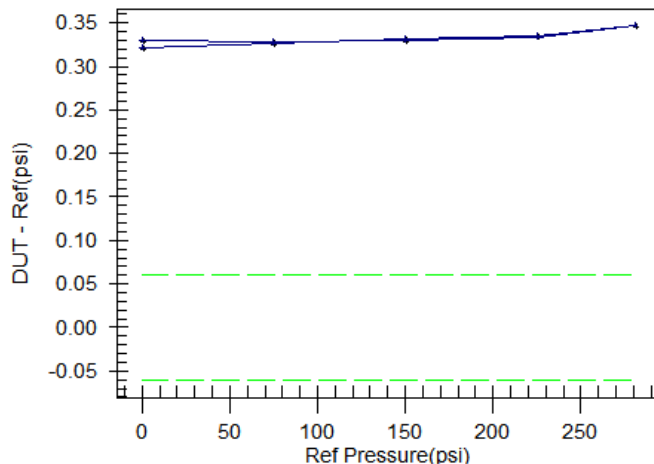
### As Found

As Found C0: 0.0631 , C1: 0.99739492 , zOffset: -0.13330

Set Pt	Reference Pressure	DUT Pressure	DUT Raw Output	Abs. Error	Tolerance	% FS Error	Status
psi	psi	psi	psi	psi	psi	%	
0.000	0.000	0.322	0.322	0.322	0.060	0.1073	Fail
75.000	75.000	75.327	75.327	0.327	0.060	0.1090	Fail
150.000	150.000	150.332	150.332	0.332	0.060	0.1107	Fail
225.000	225.000	225.335	225.335	0.335	0.060	0.1117	Fail
300.000	280.997	281.343	281.343	0.346	0.060	0.1153	Fail
225.000	225.000	225.334	225.334	0.334	0.060	0.1113	Fail
150.000	150.000	150.330	150.330	0.330	0.060	0.1100	Fail
75.000	75.000	75.328	75.328	0.328	0.060	0.1093	Fail
0.000	0.000	0.330	0.330	0.330	0.060	0.1100	Fail

Significant offset shift, unusual for a gauge mode module (but remember this is a demo)

Pressure Difference vs Pressure



# Calibration Report

## As Left Data

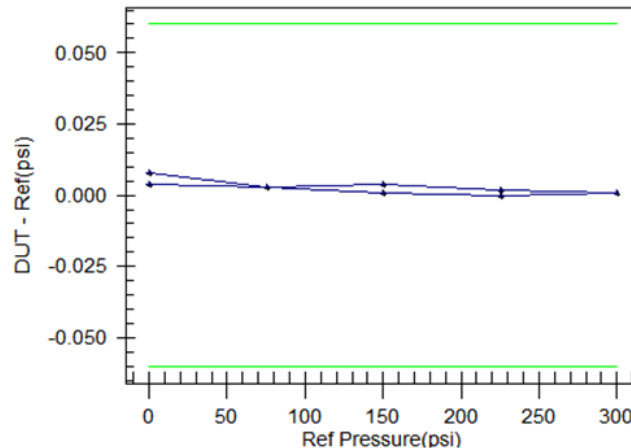
### As Left

As Left C0: -6.68389887431305E-02, C1: 0.997338053453363, zOffset: 0.00000

Set Pt	Reference Pressure	DUT Pressure	DUT Raw Output	Abs. Error	Tolerance	% FS Error	Status
psi	psi	psi	psi	psi	psi	%	
0.000	0.000	0.004	0.004	0.004	0.060	0.0013	Pass
75.000	75.000	75.003	75.003	0.003	0.060	0.0010	Pass
150.000	150.000	150.004	150.004	0.004	0.060	0.0013	Pass
225.000	225.000	225.002	225.002	0.002	0.060	0.0007	Pass
300.000	300.000	300.001	300.001	0.001	0.060	0.0003	Pass
225.000	225.000	225.000	225.000	0.000	0.060	0.0000	Pass
150.000	150.000	150.001	150.001	0.001	0.060	0.0003	Pass
75.000	75.000	75.003	75.003	0.003	0.060	0.0010	Pass
0.000	0.000	0.008	0.008	0.008	0.060	0.0027	Pass

Good As Left results

### Pressure Difference vs Pressure





# COMPASS Report Editor

## Customize template (.tpl) files

- Edit any black/white text (even change language)
- Yellow fields can be selected from the available fields to the left
- Data from data file
- Plots (edit or make new)
- Calculations
- Apply macros to the data in the data file

Available Data

- [-] General Information
  - [-] Devices
  - [-] General
  - [-] Misc Information
  - [-] Pre Test
  - [-] Test Information
- [-] Test Data
  - [-] Auxiliary Data
  - [-] Calculations
  - [-] DUT Calculations
  - [-] DUT Data
  - [-] General Data
  - [-] Macro Defined Fields
  - [-] Reference Data
  - [-] User Defined Fields
- Macros
  - [-] Excel Field
  - [-] Field Macros
  - [-] Template Macros
- Plots
  - [Add New Plot]
  - [-] %Reading Error vs. Reference Pressure
  - [-] %Span Error vs. Reference Pressure
  - [-] %Span Error vs. Reference Pressure
  - [-] 3D %Error vs Temperature and Pressure
  - [-] Ambient Pressure vs. Points
  - [-] DEFAULT STRIP CHART
  - [-] DUT Pressure vs Points
  - [-] Pressure Difference vs Pressure

**Calibration Report** Today

Model: **Model**  
 Serial Number: **Serial**  
 Measurement Mode: **Pres**

**Report Information**

Report Compiled: **Today**  
 Date of test: **Date**  
 Time of test: **Test**  
 Data file: **Data>Data**  
 Test file: **Test**  
 User: **Opera**

DUT Information		Reference Information	
Manufacturer	<b>Manuf</b>	Manufacturer	<b>Manuf</b>
Model	<b>Model</b>	Model	<b>Model</b>
Serial Number	<b>Serial</b>	Serial Number	<b>Serial</b>
Identification	<b>Ident</b>	Identification	<b>Ident</b>
Pressure Range	<b>Min O to Max O Unit</b>	Pressure Range	<b>Min O to Max O Unit</b>
Data Acquisition Method	<b>DAQ M</b>	Data Acquisition Method	<b>DAQ M</b>
Nominal Uncertainty	<b>Final</b>	Nominal Uncertainty	<b>Final</b>

**As Found**  
 As Found C0: **Calib**, C1: **Calib**, z-Offs et: **Calib**

Set Pt	Reference Pressure	DUT Pressure	DUT Raw Output	Abs. Error	Tolerance	% FS Error	Status
<b>Set P</b>	<b>Pres</b>	<b>Pres</b>	<b>Raw O</b>	<b>DUT -</b>	<b>Toler</b>	<b>%FS E</b>	<b>Statu</b>
<b>Set P</b>	<b>Pres</b>	<b>Pres</b>	<b>Raw O</b>	<b>DUT -</b>	<b>Toler</b>	<b>%FS E</b>	<b>Statu</b>

**Pressure Difference vs Pressure**

Plot

# COMPASS features

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## COMPASS Macro Editor

- VB Script editor for specialized interfaces, parsing (stripping out bad replies), calculations, etc.
- For terms unique to COMPASS see online Knowledge Base article “Macros in COMPASS for Pressure - Find names of variables, fields, parameters”  
<https://support.flukecal.com/hc/en-us/articles/204376304>
- For VB Script help, search internet for “vbscript” and the search term
- Run multiple Test macros in a test by making a “master” Test macro that calls the other macros, [Macros: Call multiple macros with a single macro](#)
- Measurement Uncertainty Macro included with COMPASS version 5

# Other COMPASS resources

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- Application Notes
  - Knowledge and Information tab of the COMPASS for Pressure web page at [flukecal.com](http://flukecal.com)
- Overview and video tutorial files
  - Online Knowledge Base at [support.flukecal.com](http://support.flukecal.com)
- Miscellaneous
  - Search Fluke Calibration website [flukecal.com](http://flukecal.com) for “COMPASS for Pressure”

# Other COMPASS resources

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- Example macros
  - Look through the COMPASS Macro Editor
    - [Ctrl] + [F] for the Find/Search window
    - Copy the text from a macro to a new macro and edit it
      - The macros in this example are a great template for many devices
  - Search the COMPASS Macro Editor help file
  - Search the COMPASS help file (yes, two different help files)
- Contact Pressure Technical Support  
[pressuresupport@flukecal.com](mailto:pressuresupport@flukecal.com)

# COMPASS Training Classes

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## 1. Formal courses in Phoenix, Arizona, USA

**[Register today at](http://us.flukecal.com/training/pressure-calibration-training/setting-and-using-compass%C2%AE-pressure-software)**

**<http://us.flukecal.com/training/pressure-calibration-training/setting-and-using-compass%C2%AE-pressure-software>**

## 2. Onsite at your facility

### Register now: Setting Up and Using COMPASS® for Pressure Software

October 3-6, 2017  
4 days  
Phoenix, AZ, USA

Learn to set up and use COMPASS for Pressure calibration software. Bring your laptop and a device under test and practice configuring a setup that is specific to your needs. We'll use piston gauges, automated pressure controller/calibrators, reference pressure monitors and a variety of gauges, calibrators, transducers and transmitters to give you plenty of hands-on experience.

#### Course topics

- Overview of COMPASS objectives
- General principles and structure
- Advanced devices under test
- Advanced tests and software macros



**Register today**



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# Questions?

Contact Pressure Technical Support  
[pressuresupport@flukecal.com](mailto:pressuresupport@flukecal.com)







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# Thank you

Be the first to know. Sign up for Fluke Calibration e-news bulletins, and the quarterly *Total Solutions in Calibration* newsletter:

[www.flukecal.com/signmeup](http://www.flukecal.com/signmeup)





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## Future web seminars

For the latest schedule visit

[www.flukecal.com/calwebsem](http://www.flukecal.com/calwebsem)

Our seminar topics cover principles and practical tips about electrical, flow, pressure, RF and temperature calibration



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