Process Control

FOUNDATION Fieldbus[™] Device Configuration

Courseware Sample 86002-F0

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By the staff of Festo Didactic

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Safety and Common Symbols

The following safety and common symbols may be used in this manual and on the equipment:

Symbol	Description
A DANGER	DANGER indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.
A WARNING	WARNING indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
	CAUTION indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.
CAUTION	CAUTION used without the <i>Caution, risk of danger</i> sign Λ , indicates a hazard with a potentially hazardous situation which, if not avoided, may result in property damage.
A	Caution, risk of electric shock
	Caution, hot surface
	Caution, risk of danger
	Caution, lifting hazard
	Caution, hand entanglement hazard
	Notice, non-ionizing radiation
	Direct current
\sim	Alternating current
\sim	Both direct and alternating current
3~	Three-phase alternating current
<u> </u>	Earth (ground) terminal

Safety and Common Symbols

Symbol	Description
	Protective conductor terminal
\rightarrow	Frame or chassis terminal
Å	Equipotentiality
	On (supply)
0	Off (supply)
	Equipment protected throughout by double insulation or reinforced insulation
Д	In position of a bi-stable push control
	Out position of a bi-stable push control

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Acronyms	Preliminary steps FFLD macro	

Preface

Automated process control offers so many advantages over manual control that the majority of today's industrial processes use it to some extent. Breweries, wastewater treatment plants, mining facilities, and the automotive industry are just a few industries that benefit from automated process control systems.

Maintaining process variables such as pressure, flow, level, temperature, and pH within a desired operating range is of the utmost importance when manufacturing products with a predictable composition and quality.

The Instrumentation and Process Control Training System, series 353X, is a state-of-the-art system that faithfully reproduces an industrial environment. Throughout this course, students develop skills in the installation and operation of equipment used in the process control field. The use of modern, industrial-grade equipment is instrumental in teaching theoretical and hands-on knowledge required to work in the process control industry.

The modularity of the system allows the instructor to select the equipment required to meet the objectives of a specific course. Two mobile workstations, on which all of the equipment is installed, form the basis of the system. Several optional components used in pressure, flow, level, temperature, and pH control loops are available, as well as various valves, calibration equipment, and software. These add-ons can replace basic components having the same functionality, depending on the context. During control exercises, a variety of controllers can be used interchangeably depending on the instructor's preference.

We hope that your learning experience with the Instrumentation and Process Control Training System will be the first step toward a successful career in the process control industry.



Standard Learning Path

Preface



Manuals of the 353X Series



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We invite readers of this manual to send us their tips, feedback, and suggestions for improving the book.

Please send these to did@de.festo.com.

The authors and Festo Didactic look forward to your comments.

Safety considerations

Safety symbols that may be used in this manual and on the equipment are listed in the Safety Symbols table at the beginning of the manual.

Safety procedures related to the tasks that you will be asked to perform are indicated in each exercise.

Make sure that you are wearing appropriate protective equipment when performing the tasks. You should never perform a task if you have any reason to think that a manipulation could be dangerous for you or your teammates.

Systems of units

Units are expressed using the International System of Units (SI) followed by the units expressed in the U.S. customary system of units (between parentheses).

To the Instructor

You will find in this Instructor Guide all the elements included in the Student Manual together with the answers to all questions, results of measurements, graphs, explanations, suggestions, and, in some cases, instructions to help you guide the students through their learning process. All the information that applies to you is placed between markers and appears in red.

Accuracy of measurements

The numerical results of the hands-on exercises may differ from one student to another. For this reason, the results and answers given in this manual should be considered as a guide. Students who correctly performed the exercises should expect to demonstrate the principles involved and make observations and measurements similar to those given as answers.

Sample Exercise Extracted from the Student Manual and the Instructor Guide

Exercise 2-1

Differential-Pressure Transmitter Configuration

EXERCISE OBJECTIVE	Become familiar with the configuration of a FOUNDATION Fieldbus differential- pressure transmitter.
DISCUSSION OUTLINE	The Discussion of this exercise covers the following points:Parameter blocks
DISCUSSION	The DP transmitter is described in the <i>Familiarization</i> manual (P/N 85980-E0, 85987-E0, or 86004-E0).

The DTM for the DP transmitter is part of Endress+Hauser's FOUNDATION Fieldbus DTM package provided on the *FieldCare* installation DVD.

Parameter blocks

Figure 2-3 shows the blocks of the differential-pressure DTM, as they appear in *FieldCare* when the device is connected. The DP transmitter has one resource block, five transducer blocks, and an analog input function block. The analog input function block takes its data from the pressure transducer block, processes it, and publishes it over the FF network.

PDIT01_PMD75 (Online Parame	eterize) 🔀					×
Language							
	🦻 🤋						
Devi	ceType:	Deltabar S / PMx 7x / FF	/ V3.00.xx Device Revision:	6 P	rimary Value, Value: 💦 -	0.064646	4 % _+
Devi	ce ID:	0×1009	PD Tag:	PDIT01_PMD75 5	econdary Value, Value: 2	23.0	°C
instr	rument Health	Status 🗹 OK					
Label	[Туре	Tag	Target		Actual	Normal State
Diagnosis	;	Resource & Transducer Bloc	ks				
E l 🔁 🙀 Quick Set	:up		PDIT01_BLK_1	Auto	-	Auto	005
🗄 🚛 Settin	gs 🛛	Pressure with Calibration Device	PDIT01_PCB_1	005	•	005	Auto
田 建 Clispla	У 	SERVICE	PDIT01_SERV_1	Auto	•	Auto	Auto
E E E Proce:	ss Info	DP_FLOW	PDIT01_TOT_1	Auto	•	Auto	Auto
🗄 🗄 Opera	ation	DIAGNOSTIC	PDIT01_DIAG_1	Auto	•	Auto	Auto
단 쎭 Diagnu - 문 쀁 Eunction	ostics Blocks	DISP	PDIT01_DSP_1	Auto	•	Auto	Auto
표 🤬 Function 표 🤮 Analog	g Input 1	I/O Function Blocks					
		Analog Input	PDIT01_PMD75_AI	005	•	005	005
<	>	r				Apply	Cancel
🔠 Online		🕼 🎼 🐢 🖶 🖏 Block Mode					
Sconnected	🖸 🖸	Device					

Figure 2-3. Parameter blocks in *FieldCare*.

The Procedure is divided into the following sections:

- Setup and connections
- Communication with *FieldCare*
- Unlocking the device
- Setting the language
- Resetting to factory settings
- Commissioning
- Testing the transmitter

PROCEDURE

Setup and connections

1. Secure the differential-pressure transmitter valve on a mounting pipe.

Table 2-1. Material needed.					
Name	Model				
DP Transmitter (FOUNDATION Fieldbus)	46920-A or 46921-A				
Electrical Unit	46970				
Pneumatic Unit	46971				
FOUNDATION Fieldbus Terminator	46978				
FOUNDATION Fieldbus Bridge	46979				
FOUNDATION Fieldbus Software Configurator	46982-A or -B				
Accessories	46993				

2. Connect the DP transmitter to the FF Bridge's H1-1 connectors and set up the FOUNDATION Fieldbus HSE and H1 networks as shown in Figure 2-4.



Figure 2-4. FOUNDATION Fieldbus connections.

3. Turn on the power supply to energize the Electrical Unit, the FF Bridge, and the DP transmitter.

Communication with *FieldCare*

4. Launch *FieldCare* on your computer and start the macro for scanning the FF network with the bridge (Figure 2-5).



Refer to Appendix B (Step 28) for instructions on how to set up the FF bridge macro.

E	FieldCare					X
	FieldCare	R			Endress + Propile for Pr	Hauser 🔝
	New					1
	Create Project	Scanning Wizard	Bridge Bridge Service (Level, Pressure) FX	HART (MultiDrop) (MultiDrop) Service (CDI) FXA291	HART (Point-to-Point)	Profibus PROFIdtm
	Help				Open	Cancel

Figure 2-5. Selecting the FF Bridge macro.

5. *FieldCare* should detect one device (the DP transmitter) as shown in Figure 2-6.



Figure 2-6. Found new device.

6. After the device has been detected, *FieldCare* should automatically connect to the device, as indicated by the ◆ sign beside the valve in the Network view (Figure 2-7). Alternately, you can connect to the device via *Device Operation* ► *Connect*.

	Network					루 🔀
	Network Tag 🗠	Connect	Channel	Address	Device type (DTM)	Physical Device
	📃 Host PC				_	
	🖻 🕵 1757-FFLD2	♦		•	🇞 1757-FFLD2	
	PDIT01_PMD75	●	FFH1 Link 1	0.24	🔠 Deltabar S / PMx7x	Deltabar S
Communication —						
DP transmitter —						

Figure 2-7. Network view.

The Offline Parameterize window allows you to write multiple parameters all at once.

7. If the Online Parameterize window does not open right away, right-click on the device name in the Network view and select the Online Parameterize command to open the DTM pertaining to the DP Transmitter (Figure 2-8). Note the presence of the parameters tree at the left of the screen. Clicking the plus (+) and minus (-) signs opens and closes the different menus.



The menus are not necessarily organized in terms of Resource, Transducer, or Function blocks within FieldCare.

PDIT01_PMD75 (Online Parameterize) 🔀	
Language	
🖬 📅 📾 🧇 💡	
DeviceType:	Deltabar S / PMx 7x / FF / V3.00.xx Device Revision: 6 Primary Value.Value: -0.0646464 % / 🔁
Device ID:	0x1009 PD Tag: PDIT01_PMD75 Secondary Value: Value: 23.2 °C
Instrument Health Status 🗹	ок
Label	
に Diagnosis 日本語 Quick Setup	
	Instrument Health Status
⊞ Gettings	
⊕ 🛱 Process Info	🖌 🗹 OK
⊞ 归 Operation 田 唱 Diagnostics	
⊡-Te Analog Input 1	
E Block Mode	
<	
C Online	🔏 🛛 🎼 🖓 🖏 Diagnosis
Connected 🙋 🧕 Device	

Figure 2-8. Online Parameterize.

8. From now on, you can use *FieldCare* commands to set up the transmitter for your experiments. The following sections show you how to perform some specific configuration procedures.

Unlocking the device

9. Open the Online Parameterize window.

10. Make sure that the device is not locked. If it is locked, the ⁴ (key) symbol is shown on the display. There are two reasons why the device can be locked: a dip switch is activated under the display (Figure 2-9) or the device was locked remotely, via software (Figure 2-10).

Label	Allowed Min. Temp: -40.0 °C 1	^
	Allowed Max.Temp: 85.0 °C 1	
	Status Locking: HW Locked	
	Hardware Rev.: 00000000 1	
	Firmware Version: 03.00.02	~
🖽 Online	🖄 🎼 🖅 🖶 📲 Transmitter Data	

Figure 2-9. LOCKSTATE: Hardware (HW) locked.

Label	Pcb Temperature:	25.8	∘⊂ 😌		^
⊡ 🔓 Display	Allowed Min. Towns	40.0	oc. :		
📗 🖃 🚰 Transmitter Info 📃 📃	Allowed Min, Lemp:	J-40.0	°C <u>1</u>		
🕀 🚰 Transmitter Data	allowed and the second	05.0	oc. :	1 Contraction	
🔢 🕀 🔛 Process Connection	Allowed Max. Lemp:	185.0	°C <u>1</u>		
🕀 🤮 Sensor Data 📃	Chabina Landrinan	CIVIL asked	— :		
🛨 🧱 Process Info	Status Locking:	Sw Locked			
Coperation	Hardware Rev.:	00000000	i	100	
🖽 Online	🙆 📻 🖷 🗣 🤅	Transmitter Data			

Figure 2-10. LOCKSTATE: Software (SW) locked.

11. If the dip switch is activated, position it in the unlocked position (down), as shown in Figure 2-11.



Figure 2-11. Position of the locking dip switch.

To lock the device remotely, set the OPERATING MENU ► OPERATION ► INSERT PIN No. parameter to "0". **12.** If the device was locked via software, put the *DIAGNOSTIC* block *Actual* mode to *OOS* and enter "100" for *Setup* ► *Operation* ► *Insert Pin No.* parameter. Put the block mode back to *Auto*.

Setting the language

To set the language used on the transmitter's display:

- **13.** Open the Online Parameterize window.
- **14.** Select *Block Mode* in the parameters tree. Change the *DISP* (display transducer block) *Target* mode to *OOS* as shown in Figure 2-12. Click *Apply* to confirm your choice. The *Actual* mode should change accordingly within a few seconds.

PDIT01_PMD75 (Online Parameteri	ize) 🔀							×
Language								
🖬 🗃 🖬 🧇 💡								
DeviceType:	Deltabar S / PMx 7x / FF / V	/3.00.xx Device Revision: 6	5	Primary Value, Value:	0.02204	1 65	inH2O	
Device ID:	0×1009	PD Tag: F	DIT01	_PMD75 Secondary Value.Value:	23.2		°C	
Instrument Health Sta	itus 🗹 OK							
Label	Туре	Tag		Target	Actual	Normal	State	
Diagnosis	Resource Block	R5_CA00311509D		Auto 🔻	Auto	005		
E Cuick Setup	Pressure with Calibration De	TRD1_CA00311509D		Auto 🔻	Auto	Auto		
Er ∰ Settings	SERVICE	SERVICE_CA00311509D		Auto	Auto	Auto		
±-ta Display	DP_FLOW	DP_FLOW_CA00311509D		Auto	Auto	Auto		
	DIAGNOSTIC	DIAGNOSTIC_CA00311509D		Auto	Auto	Auto		
⊕ ∰ Operation	DISP	DISPLAY_CA00311509D		005	Auto	Auto	۲	
⊡-∰ Diagnostics				✓ 005				
	I/O Function Blocks			T Auto				
ga biock hodo	🛨 Analog Input				-			
	Discrete Input	DI_CA00311509D	[005 🗸	005	005		-
						1		
< >				_	Apply		Cancel	
Conline	🙆 📭 🛹 🖦 🖏 Block Mod	le						
Connected	evice							//

Figure 2-12. Changing DISP block mode.

15. Go to Setup ► Display, select the desired language (Figure 2-13), and press Enter to confirm your choice.

PDIT01_PMD75 (Online Parameter	ize) 🔀	×
Language		
🗖 📅 🖬 🤣 💡		
DeviceType:	Deltabar S / PMx 7x / FF / V3.00.xx Device Revision: 6 Primary Value, Value: 0.0223786	inH2O
Device ID:	0x1009 PD Tag: PDIT01_PMD75 Secondary Value. Value: 23.2	°C
Instrument Health Sta	atus 🗹 OK	
Label	Main Line Cont.: Measured Value(PV) 💽 🧎	^
E 🛱 Quick Setup	Main Data Format: Auto	
日婚 Setup 田瑞 Settings		
E Consplay	Alternate Data: Off	
🕀 🔓 Transmitter Info	Language: English	
🕀 🥁 Process Info	Press Enter to confirm	
또 및 Operation	Display Contrast: 8	
Block Mode	Curry Courry	
		~
Conline Online	🙆 📭 🕫 🖏 🤤 Display	
😍 Connected 🛛 🚯 👥 D	Device 📃 🚉	

Figure 2-13. Display block Online Characterization.

16. Select *Block Mode* in the parameters tree. Return the *DISP* (display transducer block) *Target* mode to *Auto*, and click *Apply* to confirm your choice.

Resetting to factory settings

It can sometimes be preferable to start with a fresh configuration when using the transmitter, especially if you are not familiar with it. Note that resetting the unit to the factory settings has no effect on the language used on the display. To reset the transmitter to the factory settings:

- **17.** Open the Online Parameterize window.
- **18.** Select *Block Mode* in the parameters tree. Change the *DIAGNOSTIC* (transducer block) *Target* mode to *OOS* and click *Apply* to confirm your choice. The *Actual* mode should change accordingly within a few seconds.

19. Go to *Setup* ► *Operation* and type "7864" for *Enter Reset Code* parameter value (Figure 2-14). Confirm your choice by pressing *Enter*.

PDIT01_PMD75 (Online Parameter	ize) 🔀						×
Language							
E = 6 🤣 🔋							
DeviceType:	Deltabar S / PMx 7x / FF	/ V3.00.xx Device Revision:	6	Primary Value, Value:	0.0223647	inH2O	
Device ID:	0×1009	PD Tag:	PDIT01_PMD75	Secondary Value, Value:	23.3	°C	
Instrument Health Sta	itus 🗹 OK						
Label	Enter Reset Code: 7864						^
⊕	Operating Hours: 1859	h 🗸					
王 编 Settings 田 編 Display	Insert Pin No: 100	1					
⊞ Transmitter Info	Historom Avail.: No	•					_
E E Diagnostics			2				
世場 Function Blocks 聞Block Mode			2				
				000			
			5 B				
			9	000			~
Ell Online	🕼 🔰 🐖 🖶 🖏 Operat	ion					
😌 Connected 🛛 🔃 🖸	evice						

Figure 2-14. Resetting to factory settings.

20. The unit will reboot with the factory settings and you will lose communication with the device. If the device does not reconnect automatically after a few minutes, close the project and restart the macro for scanning the FF network with the bridge.

Commissioning

When the DP transmitter is powered, it takes a few seconds to boot. At the end of the boot process, the transmitter automatically displays the MEASURED VALUE screen. The information shown on this screen depends on the last configuration saved by the user. Refer to the *Resetting to factory settings* section above if you need a clean configuration. Follow one of the procedures below to configure the DP transmitter for pressure, flow, or level measurement.

Commissioning for differential pressure measurements

Follow the procedure below to configure the DP transmitter to behave as a differential pressure measurement device.

21. Open the Online Parameterize window.

Pressure measurement is the default device mode.

- **22.** Select *Block Mode* in the parameters tree. Change the *DP_FLOW* and *Pressure with Calibration Device* blocks *Target* mode to *OOS* and click *Apply* to confirm your choices.
- **23.** Go to Setup ► Settings ► Basic Setup as shown in Figure 2-15 and make the following choices:
 - Set *Primary Value Type* to *differential pressure*. Confirm your choice by pressing *Enter*.
 - Set *PRESS. ENG. UNIT* to the desired unit, usually kPa or psi. The factory setting is inH₂O. Confirm your choice by pressing *Enter*.
 - Set *Scale Out. Decimal* according to the number of decimals that you wish to see on the display.
 - Verify that the DAMPING_VALUE parameter is set to an appropriate value. This parameter affects the speed at which the transmitter reacts to a change in the differential pressure sensed. The default value is two seconds, which is appropriate for most uses.

PDIT01_PMD75 (Online Parameterize) 🛽	3					×
Language						
E E 🖬 🤣 💡						
DeviceType:	Deltabar S / PMx 7x / F	F / V3.00.xx Device Revision:	6	Primary Value, Value:	18.4008121	kРа
Device ID:	0×1009	PD Tag:	PDIT01_PMD75	Secondary Value, Value:	23.3	°C
Instrument Health Status	🛛 ок					
-Rise.						
Label	Primary Value Type:	differential pressure				<u>^</u>
🙀 Diagnosis		,	Duese Enter to a	anfirm 🖉		
世留 Quick Setup	Linearization:	No Linearization				
	Press, Eng. Unit:	kPa 💌				
世場 Position Adjust.						
🛨 🙀 Basic Setup	Scale Out.Decimal:	2				
Extended Setup				SE B	1000	
世場 Display	Scale Out,Units Index:	kPa		e 1		
				्य		
	Damping Value:	2.0 s				
				3 (0)	and the	
E Clagnostics				4 4 1	000	
E BIOCK Mode				6 3	-	
				3		<u> </u>
🔠 Online		Basic Setup				
😍 Connected 🛛 🚯 🧕 Device						

Figure 2-15. BASIC SETUP screen.

24. Go to Setup ► Settings ► Position Adjust. as shown in Figure 2-16. Select Confirm under Pos. Zero Adjust and press Enter to set the new zero.



Keep in mind that the zero must be adjusted every time you reposition the unit or impulse lines. The measurements are very sensitive to displacements, even though they are of very small magnitude.



Figure 2-16. Position Adjust screen.

- **25.** Select *Block Mode* in the parameters tree. Return the *DP_FLOW* and *Pressure* blocks *Target* mode to *Auto*. Also, change the *Analog Input 1 Target* mode to *OOS*. Click *Apply* to confirm your choices.
- **26.** Go to *Function Blocks* ► *Analog Input 1* and make the changes illustrated in Figure 2-17 and Figure 2-18:
 - Set *Transducer Scale.Units Index* to the same unit as *PRESS. ENG. UNIT* above (e.g., kPa).
 - Enter the value corresponding to maximum pressure in the selected unit next to Set Transducer Scale.EU at 100%.
 - Select Indirect for Linearization Type.



Figure 2-17. Transducer Scale.

PDIT01_PMD75 (Online Parameterize) 🔀							×
Language							
🖬 🖬 📾 🤣 🔋							
DeviceType:	Deltabar S / PMx 7x / FF / V3.00.xx	Device Revision:	6	Primary Value, Value:	17.0503864	∔ kPa	
Device ID:	0×1009	PD Tag:	PDIT01_PMD75	Secondary Value, Value:	23.5	°C	
Instrument Health Status 🚦	2 ок						
Label		🗖 Local					^
Diagnosis							.
⊞ 🛱 Quick Setup	I/O Options:	📃 Low Cuto	off				1
E- E Setup							.
🛨 🔚 Settings	Status Options:	Propogal	te Fault Fwd				1
🕂 🔚 Display		🔲 Uncertair	n if Limited				
Transmitter Info		📃 Bad if Lin	nited				
H transferrer Hereiter Hereit		Uncertair	n if Man.				
		,					
H- # Diagnostics	Channel:	Pressure				•	i al
	Linearization Type:	Indirect				•	8
⊞ 🛱 Analog Input 3					P	ress Enter to	o confirm
🕀 🤮 Discrete Input 1	Low Cutorr:	0.000000				%	1
🖽 🛱 Discrete Output 1 🛛 🗸	Drococc Value Filter Timer	0.000000					: 🗸
						,	>
Ell Online	🕼 📭 🐖 🖦 🖏 Analog Inpu	ut					
Connected							

Figure 2-18. LinearizationType: Indirect.

- 27. Select *Block Mode* in the parameters tree. Return the *Analog Input 1* block *Target* mode to *Auto*.
- **28.** The unit is now configured to send the sensed pressure differential into a 0-100% range over the FF network.



The device converts automatically to 0-100% values from the entire working range of the DP transmitter (i.e. 0-50 kPa (0-7.3 psi) for the low-range or 0-1600 kPa (0-240 psi) for the high-range transmitter).

Commissioning for flow rate measurements

The DP can be used to automatically convert the sensed pressure differential to a flow rate value. To configure the DP for flow rate measurement, perform the procedure below.

- **29.** Open the Online Parameterize window.
- **30.** Select *Block Mode* in the parameters tree. Change the *DP_FLOW* and *Pressure with Calibration Device* blocks *Target* mode to *OOS* and click *Apply* to confirm your choices.
- **31.** Go to *Setup* ► *Settings* ► *Basic Setup* as shown in Figure 2-19 and make the following choices:
 - Set Primary Value Type to Flow. Confirm your choice by pressing Enter.
 - Set *PRESS. ENG. UNIT* to the desired unit, usually kPa or psi. The factory setting is inH₂O. Confirm your choice by pressing *Enter*.
 - Make sure that *Flow-Meas. Type* is set to *Volume p. cond*.
 - Set Unit Flow to the desired unit (usually L/min or gal/min).
 - Set *Scale In.EU at 100%, Max Press. Flow*, and *Max. Flow* according to your primary element pressure curve. In the example below, the DP transmitter is configured for use with a Venturi tube, in SI units with 49 kPa corresponding to 57 L/min.
 - Verify that the DAMPING_VALUE parameter is set to an appropriate value. This parameter affects the speed at which the transmitter reacts to a change in the differential pressure sensed. The default value is two seconds, which is appropriate for most uses.

Keep in mind that using the low-range DP transmitter may limit the maximum flow you can measure when you use a device such as a Venturi tube.

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DeviceType:	Deltabar S / PMx 7x / Fi	F / V3.00.xx Device Revision:	6	Primary Value, Value:	51.8164215	l/min
Device ID:	0×1009	PD Tag:	PDIT01_PMD75	Secondary Value, Value:	23.6	°C
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Figure 2-19. BASIC SETUP screen.

32. Go to Setup ► Settings ► Position Adjust. as shown in Figure 2-20. Select Confirm under Pos. Zero Adjust and press Enter to set the new zero.



Keep in mind that the zero must be adjusted every time you reposition the unit or impulse lines. The measurements are very sensitive to displacements, even though they are of very small magnitude.



Figure 2-20. Position Adjust screen.

- **33.** Select *Block Mode* in the parameters tree. Return the *DP_FLOW* and *Pressure* blocks *Target* mode to *Auto*. Also, change the *Analog Input 1 Target* mode to *OOS*. Click *Apply* to confirm your choices.
- **34.** Go to *Function Blocks* ► *Analog Input 1* and make the changes illustrated in Figure 2-21 and Figure 2-22:
 - Set *Transducer Scale.Units Index* to the same unit as *Unit Flow* (e.g., *L/min* or *gal/min*).
 - Enter the value corresponding to maximum flow in the selected unit next to Set Transducer Scale.EU at 100% (e.g., 57 L/min).
 - Select Primary Value for Channel.
 - Select Indirect for Linearization Type.

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Device ID:	0×1009	PD Tag:	PDIT01_PMD75	Secondary Value, Value:	23.1	°C		
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Figure 2-21. Transducer Scale.

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Figure 2-22. Channel and Linearization Type.

- **35.** Select *Block Mode* in the parameters tree. Return the *Analog Input 1* block *Target* mode to *Auto*.
- **36.** Open the Setup ► Display screen (Figure 2-23). Make sure Main Line Cont. is set to Measured Value (PV). If not, set the DISP block to OOS mode, change Main Line Cont. to Measured Value (PV) and put the DISP block back to Auto mode.

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DeviceType:	Deltabar S / PMx 7	x / FF / V3.00.xx Device Re	vision: 6	Primary Value, Value:	28.2697201	l/min
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Figure 2-23. DISPLAY screen.

37. The unit is now configured to send a 0-100% proportional to the measured flow rate over the FF network. Notice that the **1** symbol shown at the left of the measured value on the display, indicating that the transmitter is currently working as a flowmeter.

Commissioning for level measurements

The DP transmitter can be used to automatically convert the sensed pressure differential to a level value. To configure the DP for level measurement, perform the procedure below while the DP transmitter is connected to the process column. The impulse line must be full of water (bleed your DP if necessary).

38. Open the Online Parameterize window.

- **39.** Select *Block Mode* in the parameters tree. Change the *DP_FLOW* and *Pressure with Calibration Device* blocks *Target* mode to *OOS* and click *Apply* to confirm your choices.
- **40.** Go to Setup ► Settings ► Position Adjust. as shown in Figure 2-24. Select Confirm under Pos. Zero Adjust and press Enter to set the new zero.



Keep in mind that the zero must be adjusted every time you reposition the unit or impulse lines. The measurements are very sensitive to displacements, even though they are of very small magnitude.



Figure 2-24. Position Adjust screen.

- **41.** Go to *Setup* ► *Settings* ► *Basic Setup* as shown in Figure 2-25 and make the following choices:
 - Set *Primary Value Type* to *Level*. Confirm your choice by pressing *Enter*.
 - Set Level Selection to Level Easy Pressure. Confirm your choice by pressing Enter.
 - Set *PRESS. ENG. UNIT* to the desired unit, usually kPa or psi. The factory setting is inH₂O. Confirm your choice by pressing *Enter*.
 - Set *Output Unit Level Easy* to the desired unit, usually mm or inch. Confirm your choice by pressing *Enter*.
 - Make sure that Calibration Mode Level Easy is set to Wet.
 - While the column is empty, set *Empty Calib. Level Easy* to "0" and press *Enter*. The new zero is now set.

- Fill the column to the maximum level (100%) required for your current experiment. Set *Full Calib. Level Easy* to that value in the unit of your choice. Figure 2-25 is an example where a height of 30 inches corresponds to 100%.
- Verify that the *DAMPING_VALUE* parameter is set to an appropriate value. This parameter affects the speed at which the transmitter reacts to a change in the differential pressure sensed. The default value is two seconds, which is appropriate for most uses.

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- **42.** Select *Block Mode* in the parameters tree. Return the *DP_FLOW* and *Pressure* blocks *Target* mode to *Auto*. Also, change the *Analog Input 1 Target* mode to *OOS*. Click *Apply* to confirm your choices.
- **43.** Go to *Function Blocks* ► *Analog Input 1* and make the changes illustrated in Figure 2-26 and Figure 2-27:
 - Set *Transducer Scale.Units Index* to the same unit as *Output Unit Level Easy* (e.g., mm or inch).
 - Enter the value corresponding to maximum level in the selected unit next to *Set Transducer Scale.EU at 100%* (e.g., 30 inches).

- Select Primary Value for Channel.
- Select Indirect for Linearization Type.

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Figure 2-26. Transducer Scale.

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😌 Connected 🛛 😥 🗓	Device						

Figure 2-27. Channel and Linearization Type.

- **44.** Select *Block Mode* in the parameters tree. Return the *Analog Input 1* block *Target* mode to *Auto*.
- **45.** Open the *Setup* ► *Display* screen (Figure 2-28). Make sure *Main Line Cont.* is set to *Measured Value (PV)*. If not, set the *DISP* block to *OOS* mode, change *Main Line Cont.* to *Measured Value (PV)* and put the *DISP* block back to *Auto* mode.



Figure 2-28. DISPLAY screen.

46. The unit is now configured to send a 0-100% output proportional to the measured level.

Testing the transmitter



Make sure to follow the safety instructions of the *Familiarization* manual regarding the Pneumatic Unit when making connections to the air outlets.

47. Connect the high-pressure inlet of the DP transmitter to a variable source of pressurized air, such as an outlet of the Pneumatic Unit.



In a level measurement configuration, you can vary the height of liquid in the process column instead of the air pressure to test the DP transmitter configuration.

48. Go to Setup ► Process Info ► Process Values. Vary the pressure applied to the DP transmitter and verify that *PRESSURE* and *Primary Value.Value* (pressure, flow, or level measurement in the unit of your choice) change according to the pressure variation.



Don't forget that flow measurements are proportional to the square root of the measured pressure!

49. Go to Function Blocks ➤ Analog Input 1. Make sure that Output. Value is a percentage that is proportional to the maximum process value expected. For instance, in the case of a level measurement where 30 inches correspond to 100% level, a 15-inch mark should result in an Output. Value parameter of 50%. This parameter is sent over the FOUNDATION Fieldbus network and hence, is very important to check. At the same time, the parameter status (Output. Status) should indicate GOOD.

If you wish to verify that the correct 0-100% value is passed over the FOUNDATION Fieldbus network, there are at least two ways to do so. The first one is to visualize the online value of the AI block OUT parameter in your RSFieldbus project. Another one is to check the Logix block input value received by the PLC from within RSLogix 5000.

50. Close the main switch to cut the power to the Instrumentation and Process Control Training System.

CONCLUSION In this exercise, you have configured selected parameters of a FOUNDATION Fieldbus differential-pressure transmitter.

- **REVIEW QUESTIONS**
- 1. What is the default measurement mode of the differential-pressure transmitter?

Pressure measurement.

2. What are the two ways of locking the differential-pressure transmitter?

Actuating a dip switch and remotely, via software.

3. Why must the differential-pressure transmitter zero be adjusted whenever the setup is modified?

Measurements are very sensitive to displacements.

D

4. Which types of measurement can the differential-pressure transmitter accomplish?

Pressure, flow, and level measurement.

5. Which graphical tool can help you configure the differential-pressure transmitter for flow measurement?

Primary element pressure curve.

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