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Dattus Meter Technical Reference Guide

Identification
Dattus Meter Technical Reference Guide
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Regulatory Notices
Intrinsic Safety for Hazardous Locations
Dattus Gas Meter design conforms to the UL, CSA ratings of Class 1 Div 1 group C&D and Class 1 Div 2 hazardous locations.
The meter is approved to the CENELEC standards for rating of an IIB T4.
The intrinsic safety includes design constraints on the batteries, electronic board, outputs, and external plastic surfaces.

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Suggestions
If you have comments or suggestions on how we may improve this documentation, send them to TechnicalCommunicationsManager@itron.com
If you have questions or comments about the software or hardware product, contact Itron Technical Support:

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CHAPTER 1

Dattus Meter Technical Reference Guide Usage

This Technical Reference Guide provides Dattus Meter hardware and software related information. The following document conventions apply to this reference guide.

Document Conventions

Note A **Note** provides essential information about using the Technical Reference Guide.

Caution A Caution provides information that is important to consider when performing certain operations.

Warning A Warning provides special, must-read information. If you ignore a warning, you may omit essential data or make a critical error that could cause bodily harm or severely damage the meter.

General Information

This technical reference guide provides hardware and software installation and operation information for the following Itron Dattus® fM2 and fM3 base model gas meters:

- Basic-L
- Basic-EXT
- ETC-L
- P-only
- PTZL

Dattus Basic fM2

Dattus Basic fM3

Dattus Nomenclature

This reference guide refers to the Dattus meter circuit boards responsible for a variety of functions. Dattus meter versions addressed in this guide have three circuit boards (the Dattus Basic-L is the exception and does not contain a DS1 board):

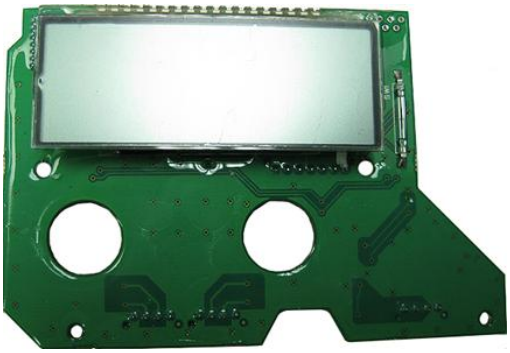
- DM2. Metrology board
- LC2. Primary display board
- DS1. Corrector board

DM2 Board (Metrology)

DM2 refers to the Dattus second generation metrology. The DM2 board may be referred to as the meter since it is the component that receives the raw signal from the meter's sensors and processes the raw signal to accumulate uncorrected volume. The uncorrected volume pulse is fed to the LC2 or DS1 board depending on the meter configuration. A DM2 board on the Basic-L meter may also apply a correction factor to the volume if the meter is configured for fixed factor pressure correction (the pulse to the LC2 is a corrected pulse). The DM2 board also holds the data logging information and manages security and communications when interrogating the meter using the PCLink software.

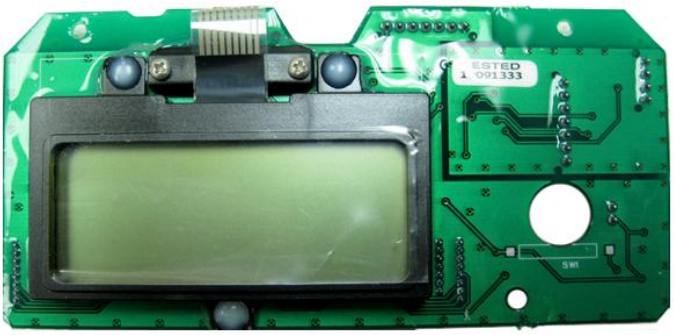
LC2 Board (LCD display)

The LC2 board is the main display on the Dattus. The LC2 displays the meter's volume information and indicates alarm and flow (if enabled). The LCD board continuously displays meter volume, manages the pulse outputs, and contains the RS-232 chip that allows pass-through communication to the DM2. All meters are equipped with an LC2 board.



DS1 Board (Corrector)

The DS1 board is the meter's corrector. Once the DM2 accumulates the uncorrected volumes, it re-transmits the uncorrected volume pulses to the DS1. Dependent of the meter configuration, the DS1 measures the temperature or pressure and calculates the correction factor. The DS1 board applies the correction factor to the uncorrected volume pulses from the DM2. Then, the DS1 increments the LC2 with the corrected volume and manages pulse outputs and display updates for the DS1 display. The display is a secondary LCD that is not normally energized and requires activation by the customer who either pushes the display button (standard) or waves a magnetic wand to activate the display. The DS1 is configurable and can display up to 16 different information types.



Features

Dattus meters feature:

- Static measurement technology
- Gas volume totalizing
- Live correction factors
- Fixed pressure factor correction
- Configurable pulse outputs
- Meter capacities from 1000 to 56000 CFH
- Field upgradeable capacity
- Datalogging (optional)
- Event logging
- RS-232 communications
- MODBUS protocol

Model Overview

Dattus models offer variable features:

- Basic-L. Basic-L meters function primarily as counters by simply recording the accumulated actual volume that passes through the meter without performing any type of correction. A fixed factor pressure correction option within PCLink can be applied to the gas measurement and displayed as corrected volume.
- Basic-EXT. Basic extended (-EXT meters) function like the Basic-L but have an additional DS1 circuit board. There is no temperature or live pressure correction in the Basic-EXT meter. The primary purpose for the Basic-EXT meter is to provide DS1 display information.
- P-Only. P-Only Dattus meters are equipped with pressure transducers that allow the meter to compensate for pressure fluctuations.
- ETC-L. ETC-L meters are equipped with temperature probes that allow the meter to compensate for temperature fluctuations.
- PTZ-L. PTZ-L meters are equipped with both a temperature probe and a pressure transducer to correct for live temperature and pressure fluctuations. This meter is configurable for super-compressibility compensation (Z).

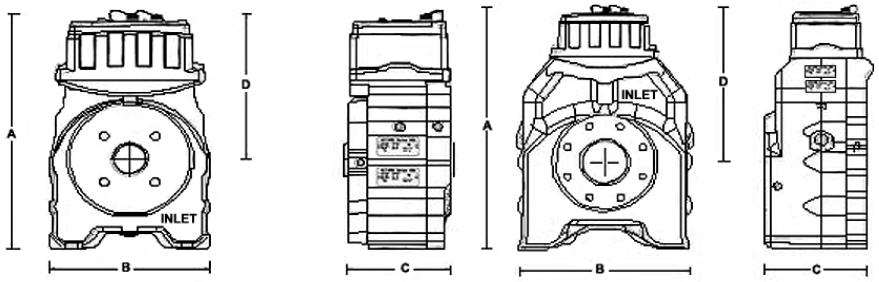
	Basic-L	Basic-EXT	P-Only	ETC-L	PTZ-L
Static measurement technology	Yes	Yes	Yes	Yes	Yes
Gas volume totalizing	Yes	Yes	Yes	Yes	Yes
Fixed factor correction	Yes	Yes	No	Yes	No
Configurable pulse outputs	Yes	Yes	Yes	Yes	Yes
Meter capacities from 1000 to 56000 CFH	Yes	Yes	Yes	Yes	Yes
Field upgrade capacity	Yes	Yes	Yes	Yes	Yes
Data logging	Yes	Yes	Yes	Yes	Yes
Event logging	Yes	Yes	Yes	Yes	Yes
RS-232 communications	Yes	Yes	Yes	Yes	Yes
MODBUS protocol	Yes	Yes	Yes	Yes	Yes
Live temperature correction	No	No	No	Yes	Yes
Live pressure correction	No	No	Yes	No	Yes
Configurable DS1 display	No	Yes	Yes	Yes	Yes

General Specifications and Dimensions

	fM2	fM3
Minimum flow (±2%)	22CFH	60CFH
Accuracy (±1%)	60 CFH to meter max	100 CFH to meter max
Flange to flange	22 CFH to 60 CFH	60 CFH to meter max
Flange size	2 inch or 3 inch ANSI 125	4 inch ANSI 125
Shipping weight	42 pounds	128 pounds
Operating temperature	-40 to +140º F (-40 to +60º C)	
Maximum allowable operating pressure (MAOP)	150 PSIG	175 PSIG
Communication	RS-232 and MODBUS	
Pulse outputs	Four channels, three-user configurable. Configurable pulse weight and pulse width. For details, see pulse outputs.	
Power Supply	Two D-cell lithium batteries at 3.6V	
Meter body and electronic housing enclosure		
Cast aluminum (AT356T6)		
External cover display ASA (acrylonitrile styrene acrylate)		

See Appendix A for details on sizing, capacity, turn-down, and pressure drop information.

Dattus Meter Dimensions



Dattus Model	A	B	C	D	Thread Depth	Flange Size
fM2	16.5 in. (41.9 cm)	10.6 in. (26.9 cm)	6.75 in. (17.1 cm)	10.0 in. (25.4 cm)	1.0 in.	2 in. or 3 in. ANSI 125 Note: Spacer kit is available for 3" flange retrofit to 9.5 in. C dimension.
fM3	23.7 in. (60.2 cm)	16.5 in. (41.9 cm)	9.5 in. (24.1 cm)	15.2 in. (38.6 cm)	1.0 in.	4 in. ANSI 125

Meter Components

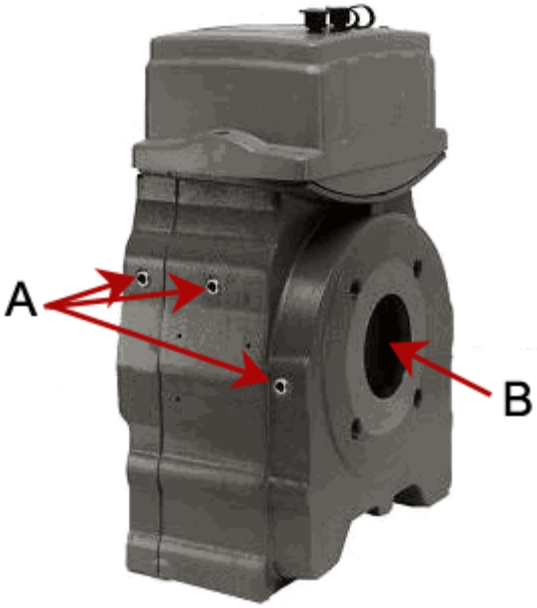
The Dattus meter is comprised of three main components:

- Measurement unit
- Electronics housing
- External cover

Measurement Unit

The measurement unit is the only meter component exposed to gas. Threaded pressure taps provide access to the various internal gas chambers to monitor pressure.

The measurement unit is an aluminum structure designed to ensure gas tightness up to line pressures of 150 psig (10 bar) for the FM2 models and 175 psig (12 bar) for the FM3 models.



A Pressure taps

B Gas inlet

Electronics Housing

The electronics housing is a clear UV-stabilized polycarbonate that contains the DM2 Metrology board, LC2 board LCD, and DS1 Corrector board (dependent on model). The electronic housing is compliant to IP-67 and NEMA-4 standards for water submersion and dust exposure.

Dattus Basic-L

Dattus Basic-L meter face components are shown in the cover design below.

Basic-L meter face components

A Meter type

B Meter descriptor

C LCD display screen (LC2 board)

D Pulse outputs connector

E Serial number

F Meter multiplier

G Communication connector

Dattus Corrector Models

Dattus Corrector models include:

- PTZ-L
- ETC-L
- P-only
- Basic EXT

All Corrector models share the same meter face cover design shown below.

Dattus Corrector meter face components

A DS1 display screen

B LC2 display screen

C Meter descriptor

D Pulse connector

E Push button

F Meter type

G Serial number

H Meter multiplier

I Communication connector

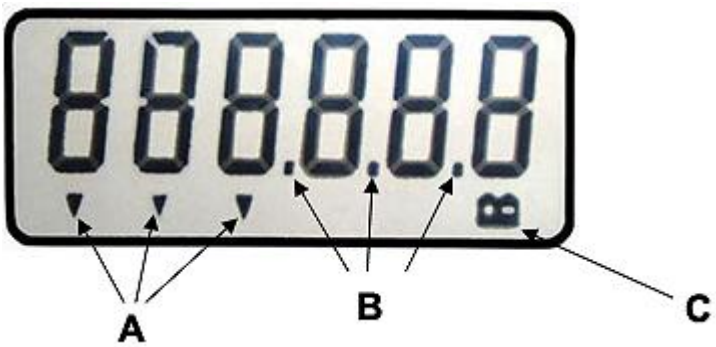
LC2 Liquid Crystal Display (LCD)

Note Dattus meter LCDs display uncorrected or fixed factor corrected volume. The LCD displays four to six digits. The number of digits displayed is listed on the Dattus meter label.

The LC2 Display is configured using PCLink™ software to display (Imperial units) from 1 cubic foot to 1000 cubic feet (CFx1 to CFx1000) or (Metric units) cubic meters (CMx1). The Dattus unit multiplier is noted on the meter face. Use the LCD readout multiplied by the unit multiplier to determine the register's total volume. Dattus meters provide an additional unit descriptor that is either uncorrected or corrected volume. The additional descriptor is dependent on the meter model.

Uncorrected volume	Indicates the volume on the register is not corrected on Basic-L models. The register represents the actual cubic feet (or cubic meters) volume.
Corrected volume	Indicates the volume is corrected for a known fixed pressure on Fixed Factor enabled Basic-L and DS1 models. Typically, there is a label on the meter indicating the fixed pressure programmed into the meter.

Caution Both the unit multiplier and the uncorrected or corrected volume are configurable using the PCLink software. If the unit multiplier and volume parameters do not match the printed unit multiplier, there may be a register misinterpretation.



Dattus LCD display descriptions

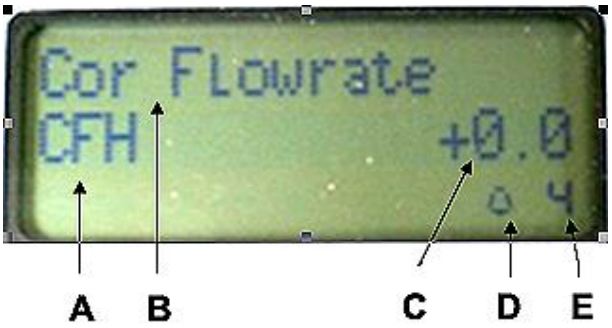
A Flow indicator. The flow indicator helps calculate the flow rate (clock the meter). Symbols move in proportion to flow and change at a rate of 1/10th of the unit multiplier. Flow indicator is enabled or disabled using PCLink software. (See flow rate.) Flow indicator is typically disabled on Dattus Corrector models since the DS1 can display live flow rates.

B Alarm indicator. The alarm indicator decimal points flash if the alarm is live. The decimal points flash if the alarm is saved. The alarm decimal point will flash on the LCD every 12 seconds (see Alarms for more information.)

C Battery indicator. A flashing battery indicator signals a low battery alert (see Alarms or PCLink Software Basics for more information.)

DS1 Display

Note The Dattus DS1 display can show up to 16 types of information. The DS1 display is configured using the PCLink software DS1 Display tab.



DS1 Display information

A Display item units. Display item unit type.

B Display item. Description of the current item.

C Display item value. Numeric value of current item displayed.

D Alarm indicator. Live DS1 alarms (see).

E Display item number. Selected "*display item*" number on DS1 Display tab.

Dattus Operating Principle

Dattus fM meters operate on the fluidic oscillation principle based on Bernoulli's theory that states for an inviscid flow, an increase in the speed of the fluid occurs simultaneously with a decrease in pressure or a decrease in the fluid's potential energy.

The Dattus meter creates slow moving high pressure gas which becomes a fast moving low pressure gas at the nozzle exit forming a jet of gas.

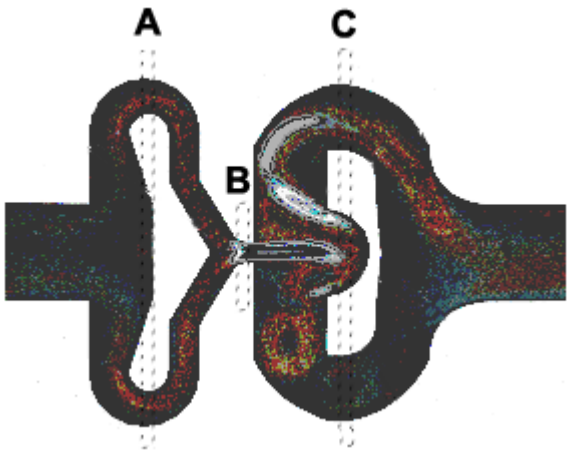
Once formed, the gas jet can be controlled (by the Coanda effect) using an obstacle in the flow designed to optimize the meter's performance. The gas jet path is controlled to enable the formation of feedback pressure nodes on either side of the gas jet resulting in a predictable gas jet oscillation.

The Dattus meter metrology relates to the fluidic oscillation chamber's mechanical design and conditioning flow entry. Gas jet oscillations are detected using a thermal sensor device that provides metering data to the meter's electronic index. The measurement unit consists of three functional elements shown below:

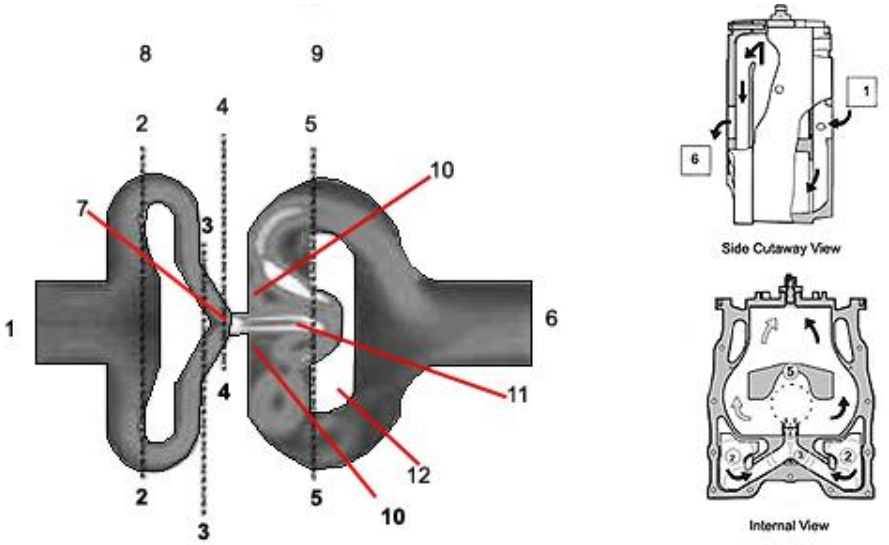
A Flow conditioner

B Jet nozzle formation

C Fluidic oscillation chamber



As shown in the following diagram, gas enters the meter (1) and divides into two separate flow paths (2). These two flows recombine (3) as they exit the flow entries and enter the fluidic oscillation chamber (5) through the nozzle. The process of dividing the flows eliminates upstream disturbances and creates a well-conditioned flow. In the fluidic oscillation chamber, a jet forms as the gas enters through the nozzle (4). Then, the gas starts oscillating back and forth (5). Thermal sensors located just after the nozzle (6) detect a temperature variance as the gas jet passes from one side to the other. The volume of gas passed through the meter is counted by the number of oscillations detected by the thermal sensors. The gas passes around the obstacle and exits the meter (7).



Flow diagram

1 Gas entry

2 Flow paths

3 Recombined flow

4 Flow exit into fluidic oscillation chamber

5 Fluidic oscillation chamber

6 Gas exit

7 Nozzle

8 Conditioning flow chamber

9 Fluidic oscillation chamber

10 Thermal sensors

11 Gas flow jet

12 Obstacle

CHAPTER 2

Receiving and Installing the Dattus Meter

Warning These instructions are suggested when Itron-approved utility or installer company-established meter installation procedures and practices are not available.

Itron does not endorse or warrant the completeness or accuracy of any third party meter installation procedures or practices, unless otherwise provided in writing by Itron. Follow your company's standard operating procedures regarding the use of personal protection equipment (PPE). Adhere to guidelines issued by your company in addition to those given in this document when installing or repairing meters.

This product, as of the date of manufacture, is designed and tested to conform to all governmental and industry safety standards as they may apply to the manufacturer. The purchaser/user of this product must comply with all fire control, building codes, and other safety regulations governing the application, installation, operation, and general use of this meter to avoid leaking gas hazards resulting from improper installation, startup or use of this product.

To ensure safe and efficient operation of this product, Itron strongly recommends installation by a qualified professional.

Receiving Your Meter

Handling and Storage

Store the meter in a clean, dry environment until you are ready to install the meter. The meter ships with protection caps on the inlet and outlet sides to prevent foreign matter from entering the measurement unit (see the following diagram). The protection caps must remain in place until mounting the meter in the system.

Unpacking and Inspection

The meter is packaged in a well-supported cardboard box. If the box is damaged, notify the carrier immediately of a potential mishandling problem.

The meters are packed individually. Each package should contain the following components:

- Meter with protection caps on the inlet and outlet
- Meter seals
- Calibration certificate
- Installation instructions
- Control drawing

Installation (Proper Meter Orientation)

Horizontal Pipe Run

Itron recommends installing the Dattus meter with the index (LCD) out to the side in horizontal pipe runs (meter's long axis is parallel to the ground) as in the figure below.

Vertical Pipe Run

Itron recommends installing the Dattus meter with the gas flow down in vertical pipe runs as shown in the figure below.

Incorrect Installation Example

Warning Incorrectly installed Dattus meters (installations with the index [LCD] facing up) increase the likelihood contaminants in the gas line can strike and damage the sensors used to measure gas flow. In rare cases where the gas line is free of contamination, the Dattus meter could be installed in any orientation. In most installations, there is some contamination (rust, sand, weld slag, pipe shavings or other foreign materials) in the gas line. Orienting the Dattus as recommended above, minimizes the chance of debris damaging the meter's sensors. Dattus meter sensors damaged by pipeline contaminants are not covered by the meter's warranty.

Incorrect installation

Note Itron recommends using a strainer or filter device upstream of the meter. This protects the meter as well as all downstream equipment.

Warning If liquids are present in the metering line, Itron recommends mounting the meter in a horizontal position and/or the use of a filter designed to remove liquids from the metering line.

Rotating the LCD

If the Dattus LCD readout is configured from the factory (or your Itron distributor) incorrectly for your installation (for example, the LCD is oriented for a left to right gas flow, horizontal application and you would like it for a vertical application (see Vertical Pipe Run on page 25), it may be modified using the following process and images.

- Remove the meter cover.
- Rotate the electronics housing.
- Re-install the meter cover.

Start-up/Shut-down Procedures

Meter start-up and shut-down procedures depend on the installation type. This section includes installation procedures with and without a by-pass.

Installing the Meter

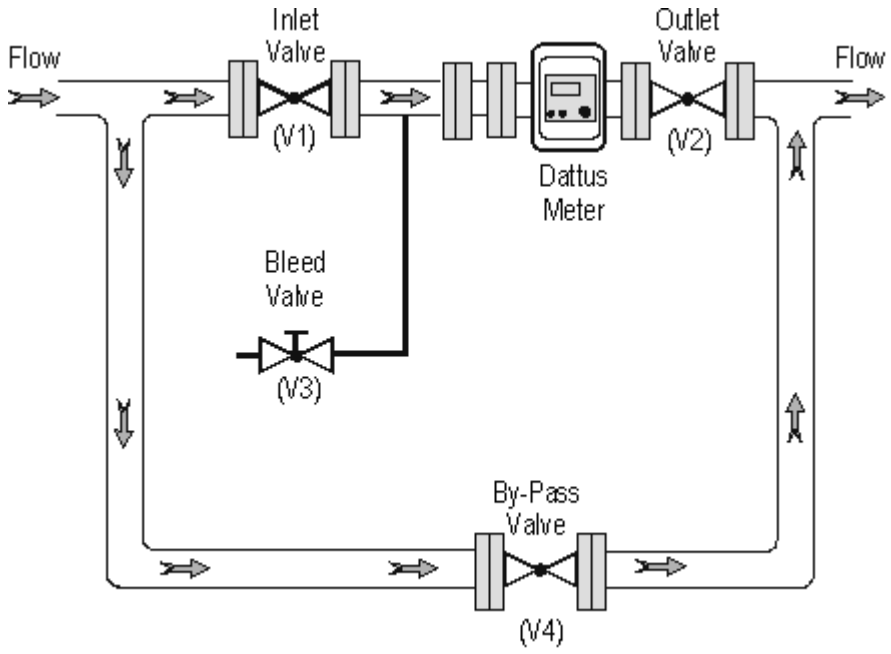
When installing the meter:

- Verify the meter is oriented correctly for installation.
- Remove the protective caps from the meter inlet and outlet.
- Install the meter using the appropriate 5/8-inch bolts.
- Tighten the bolts in a cross pattern with 55-60 ft/lbs of torque.

Warning Always open and close valves slowly to prevent pressure surges that may damage equipment.

Installation with a By-Pass

The following diagram shows an example of an installation with a by-pass:



To shut down the meter (with bypass)

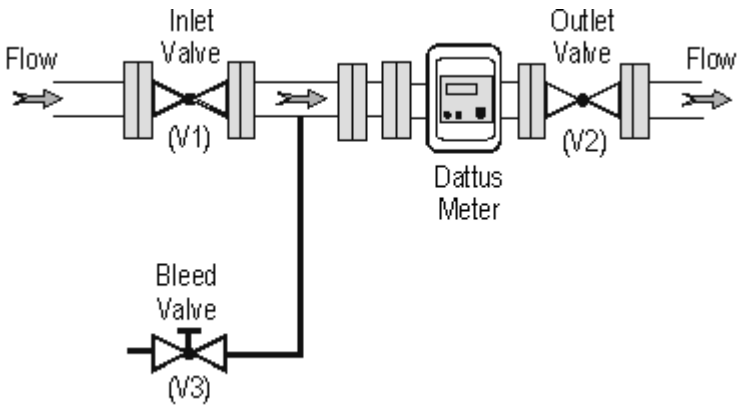
1. Slowly open the by-pass valve (V4).
2. Close the inlet valve (V1) of the metering line.
3. Close the outlet valve (V2).
4. De-pressurize the metering line (not exceeding 4 psi per second) with the small bleed valve (V3).

To start up the meter (with bypass)

1. Slowly open the outlet valve (V2) to pressurize the metering line (not exceeding 4 psi per second).
2. When the metering line is completely pressurized, fully open the outlet valve (V2).
3. Check for leaks by applying soapy water to the joints and looking for air bubbles.
4. Open the inlet valve (V1).
5. Close by-pass valve (V4).
6. Verify the flow does not exceed the capacity of the meter.

Installation without a By-Pass

The following diagram shows an example of an installation without a by-pass:



To shut down the meter (without bypass)

1. Slowly close the outlet valve (V2).
2. Close the inlet valve (V1).
3. Open the bleed valve (V3) and slowly de-pressurize the metering line (not exceeding 4 psi per second).

To start up the meter (without bypass)

1. Slowly open the inlet valve (V1) to pressurize the metering line (not exceeding 4 psi per second).
2. Open the outlet valve (V2) until the outlet pressure is stable.
3. Check for leaks by applying soapy water to the joints and looking for air bubbles.
4. Fully open the outlet valve (V2).
5. Check that the flow does not exceed the capacity of the meter.

CHAPTER 3

PC Link Software

Chapters 3, 4, and 5 provide the information for interrogating and programming the Dattus meter. These chapters provide Dattus information most often requested by meter users and support sections in this guide that reference PCLink.

PCLink Topics

Chapter three provides the following PCLink information.

- System Requirements
- Installing PCLink
- Setting up communication ports
- Verifying communication ports
- Logging on to the Dattus meter

Chapters four and five provide additional PCLink information for:

- Calibration
- Alarms Status
- Alarm options
- Pulse outputs
- Upgrading

System Requirements

Compatible Operating Systems

- Windows® NT4 with service pack 4
- Windows 2000 Professional with service pack 4
- Windows XP Professional edition with service pack 2
- Windows Vista

Recommended Minimum Hardware Requirements

- Processor. Intel or AMD with at least 300 MHz
- RAM. 128 Mbytes
- Graphics. SVGA 1024x728 - 256 color
- Hard Drive. PCLink occupies about 36MB, additional hard drive space may be required dependent on file management needs and PCLink upgrades
- CD ROM. CD for installation (or alternative)
- Output Connection Port. Either a direct serial port connection or USB (for use with USB to serial port converter/adapter).
- Communication cable. Part Number 600204-001

Installing PCLink

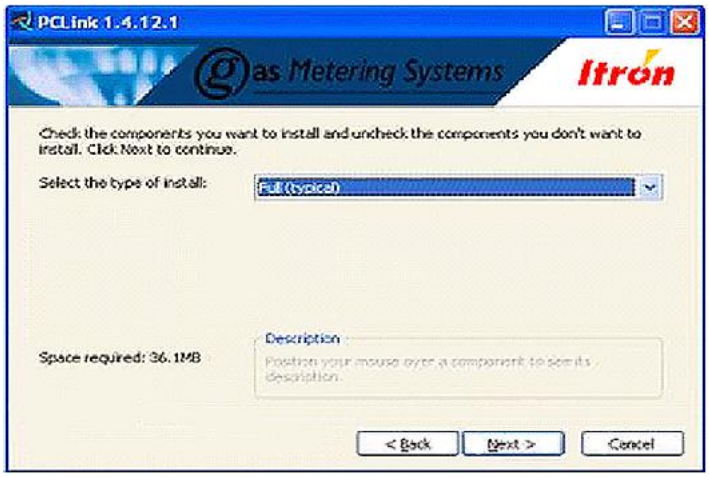
PCLink software basic installation is similar to other software installations. If you received a software CD from the factory, it is configured as *AutoPlay* and begins the installation process when the CD is inserted in the drive.

If PCLink installer does not automatically begin installation, navigate through Windows Explorer to the CD-ROM drive and double-click the *PCLink_Setup.exe* file.

After the splash screen displays, a series of screens (beginning with Start, then Installation Agreement, Registration, and Installation Type) display where you configure your desired installation.

Installation Type

PCLink gives you the option to either install the full version or install a custom installation (see the Installation Type Selection figure below). Itron recommends a full installation. Installing a PCLink customized version would save about 3MB of hard drive space and would remove the useful Online Help File and Templates.



Note There are options for selecting alternative file locations and folder names. Itron recommends keeping the selected defaults to make support easier to provide if necessary.

Setting Up or Verifying Communication Ports

Once PCLink successfully installs, setup the proper communication ports to successfully communicate with a Dattus meter. You will need both the physical connections between the computer and the Dattus and the communication ports between Windows and PCLink properly configured.

Hardware

Communication with the Dattus meter requires a communications cable (600204-001) available from your Itron representative. The communications cable has a Binder connection (type of connector on the Dattus meter) on one end and a DB9 serial Port connection on the other end.

Connection to your laptop/desktop requires either a direct serial port connection (DB9) or connection using a USB to serial port converter (adapter). Properly install the drivers for the USB converter.

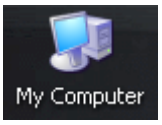
Note A PCMCIA card may be used instead of a direct serial port connection or USB converter. PCMCIA cards are generally more expensive and less support experience is available for those using PCMCIA cards with Dattus meters.

Software Configuration

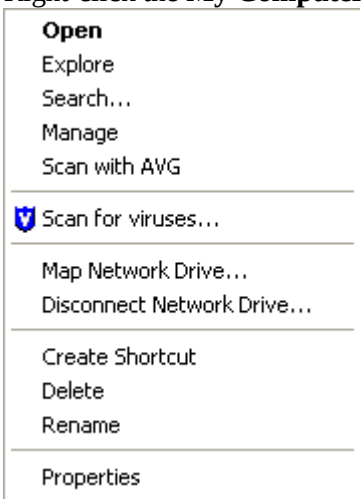
If you are using a direct serial port connection on the back of your computer, it is typically a COM1 port by default and you may skip this section (unless you experience difficulties connecting to the Dattus meter).

To determine which COM Port Windows assigned for the USB adapter

1. Navigate to **My Computer** (typically available as an icon on the desktop as shown below).

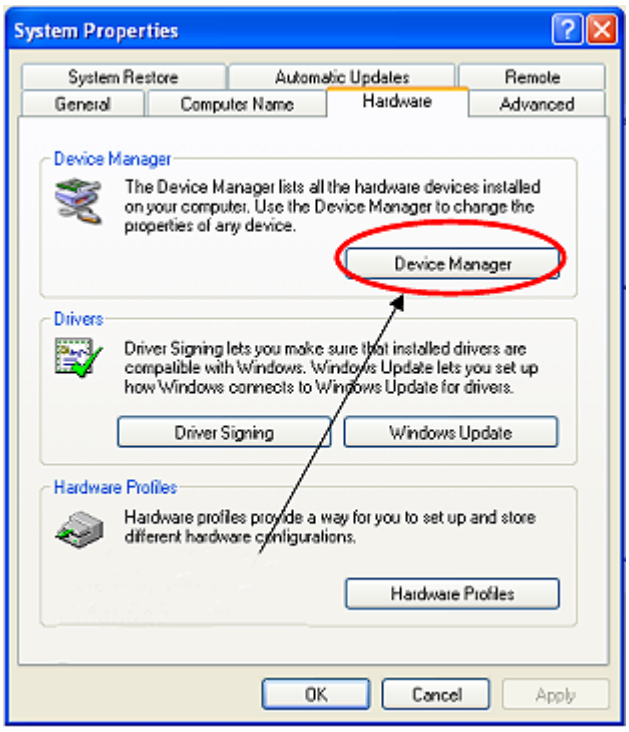


2. Right-click the **My Computer** icon to display the menu shown below.

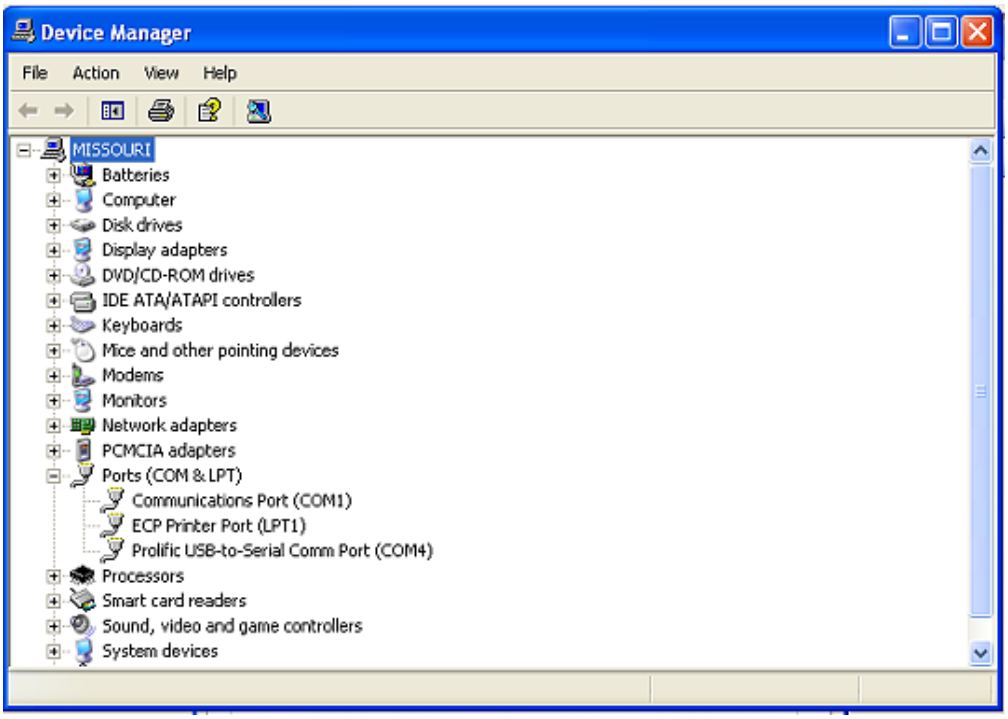


3. Select **Properties**. This will populate your **System Properties** dialog (shown below). **Properties** are also available by going to the control panel and selecting **System**. Select the **Hardware** tab.

4. On the **Hardware** tab, click the **Device Manager** button.



5. The **Device Manager** provides access to view how Windows assigned the COM port selections (see the figure below). This is available under the **Ports (COM & LPT)** selection in **Device Manager**.



In the above example, the user has both a direct port (assigned to COM1) and a USB-to-Serial Comm Port (COM4). Note the COM Port number so you can match the COM selection in PCLink.

Logging On to the Dattus Meter

After successfully installing PCLink and identifying the COM Port, verify the same COM Port is also configured to match in PCLink. COM1 is the default.

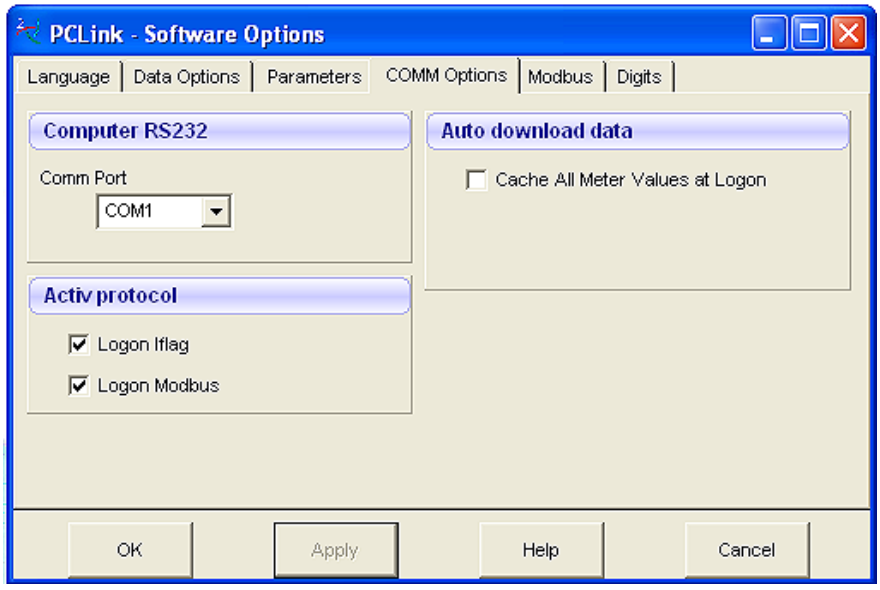
To select the COM port in PCLink

1. Start the PCLink software application. The opening screen shown below displays.

2. Open PCLink's software preferences by doing *one* of the following:

- Click the **Preferences** (Prefs) icon.
- Select **File > Preferences**
- Press **CTRL+P**.

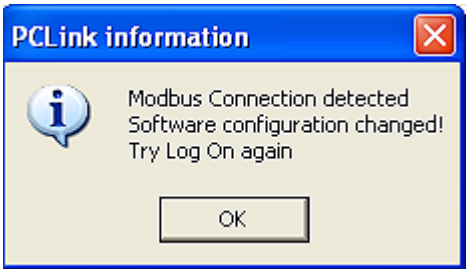
2. The Software Options dialog displays.



3. Click the **Comm Port** drop-down and select the COM Port that matches the COM Port configured in **Device Manager**. After you make your selection, click **Apply**.

To test PCLink communications

1. Select **Communications** > **Test Connection**, or press **F2**. A successful connection test displays a message box indicating that the connection is successful.



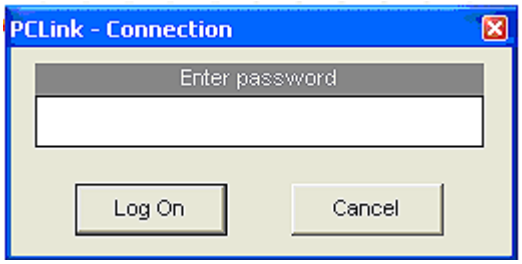
2. Click **OK** to close the message box.

To Logon

1. To Logon, do *one* of the following:

- Click the **Log On** icon.
- Select **Communications** > **Log On**.
- Press **F3**.

2. A password box displays.



3. Enter your password, and then click **Log On**.

-

Default Passwords

PCLink default passwords provide for initial logon to PCLink software.

PCLink Default Passwords

Password	Description
11111	Read-Only Access. This password allows the user to log onto the meter and download any available data. Programming capability is disabled. Also called *Operator Access*.
22222	General Access. This password allows all PCLink read and write privileges available to a customer. Also called *Supervisor Access*.

Notes Supervisor Access limitations are dependent on governmental regulatory requirements. *For example*, in Canada, a user may only overwrite *metrological* parameters if the measurement seal is broken and a programming switch is enabled.

Users with Supervisor Access may change passwords when they use PCLink software. This function is not covered in this technical reference guide.

PCLink software is backwards compatible. The newest version of PCLink will work with any previously sold Dattus meter. Itron, Inc. will periodically release new operating system (firmware) versions for the Dattus meter. New firmware releases may create new features, improve an existing feature, accommodate a design change, or fix a problem. Sometimes these newer firmware versions will require a newer PCLink version. Dattus meters are programmed to *not* allow non-compatible PCLink software to communicate with the meter and will display a message box stating a newer PCLink version is required.

PCLink File Types

Save PCLink software and functions in one of four file formats. The format is dependent on the information being saved.

- PCL. The PCL file saves the configuration tabs downloaded during the logon session. This file is essentially a snapshot of the meter's configuration setup.
- PCA. A PCL file is a saved snapshot of a downloaded data log. Only the informational tabs downloaded in the logger (hourly, daily, monthly) will appear in the saved file. You can export the information contained in the PCA to Microsoft Excel.
- PCE. The PCE file is a snapshot of the event logger. You can export the information in this file to Microsoft Excel.
- PCK. PCK files are used only to perform meter upgrade changes.

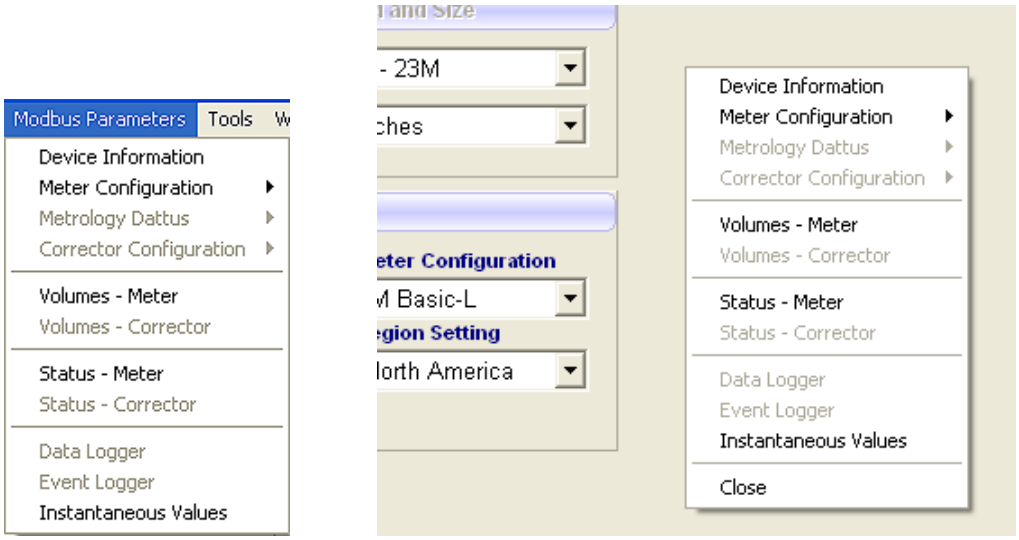
CHAPTER 4

Basic Navigation

Communications to the Dattus meter using PCLink is done primarily through navigational tabs or configuration pages. This chapter covers the available configurations generally accessed by typical users.

Note PCLink has associated language files (not covered in this manual) that are used for all descriptions used in PCLink. This language file is modified from time to time to improve the descriptions for various PCLink functions and to make the software most usable to the broadest base of PCLink users. Occasionally, menu items or descriptions may be different than they are described in this manual. The location and availability of these menus and functions are not affected by this file, only the description. Periodic updates to this manual will be made to reflect any changes.

PCLink software design provides navigation similar to other Windows applications. All user-accessible functions and configuration tabs are accessed by either using the **Modbus Parameters** menu options, or by right-clicking in the gray area to access the same menu as shown below. As tabs download, they populate the bottom of the screen.



The **Associate** button acts as a toggle switch between the meter side and corrector side of the meter.

(1/2) denotes the meter side;

(2/2) denotes the corrector side.

Note The Associate button applies only to Corrector model meters (PTZ-L, ETC-L, P-Only, and Basic-Ext).

Some configurations may be shaded (grayed) out. These options are either not available for the meter type you logged onto, or the feature is not enabled for your meter.

Program/Refresh Function

When you first log on and download configuration data from the meter, the software user interface (GUI) populates with the programmed meter configuration (and current information). Any changes made to the GUI are not made to the meter until you click **Program** as described below.

Refresh	Refresh. Clicking this button downloads the current configuration and information from the meter into the GUI.
Program	Program. Clicking this button programs any changes made in the GUI to the meter. Make sure that your changes are accurate before clicking this button.

CHAPTER 5

Configuration Tabs

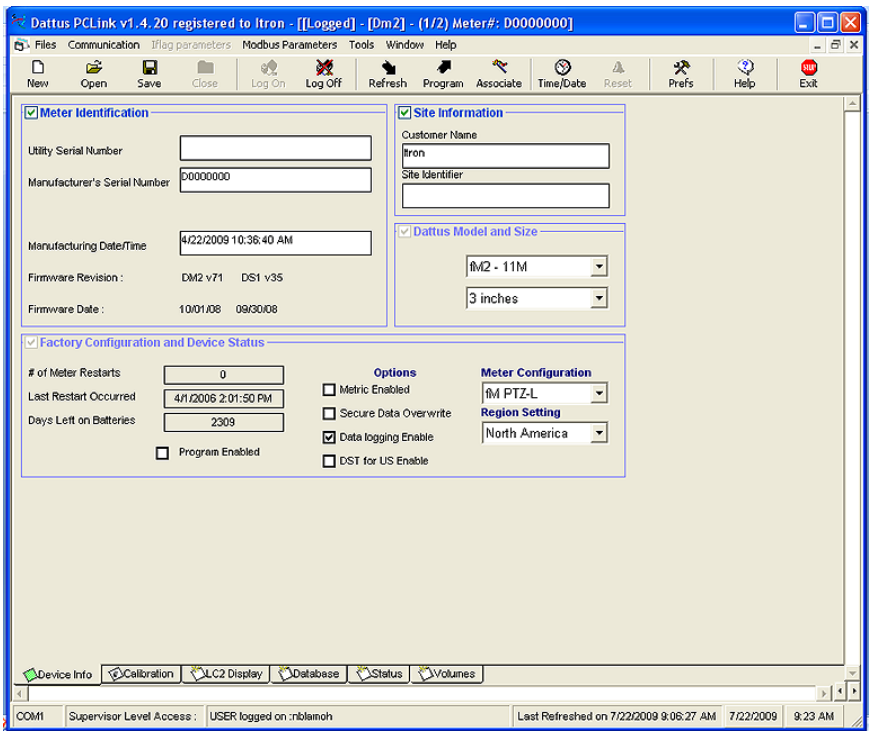
This chapter briefly outlines and describes PCLink tabs.

Note At initial log on to the Dattus meter, the first screen that displays is the **Device Info** tab. You may download all accessible meter configurations by pressing **F5**, or selecting **Communication** > **Download all Tabs**, or enabling an automatic download on log on by selecting **Auto Download Data** in **Preferences**.

Device Information Tab

Note When you initially log on to the Dattus meter, the first screen displayed is the **Device Info** tab. You may download all of the accessible meter configurations either by pressing **F5**, by selecting **Communication > Download all Tabs**, or by enabling an automatic download upon log on by selecting **Auto Download Data** in **Preferences**.

The Device Info tab displays when you log on to a Dattus meter with PCLink. This configuration tab defines the meter's major attributes. The **Utility Serial Number**, **Customer Name**, and **Site Identifier** fields are user-configurable fields. All remaining fields are factory-defined.



The following table describes each of the **Device Info** tab fields. Some of these items may be modified with an **Upgrade** (see Upgrading a Dattus Meter).

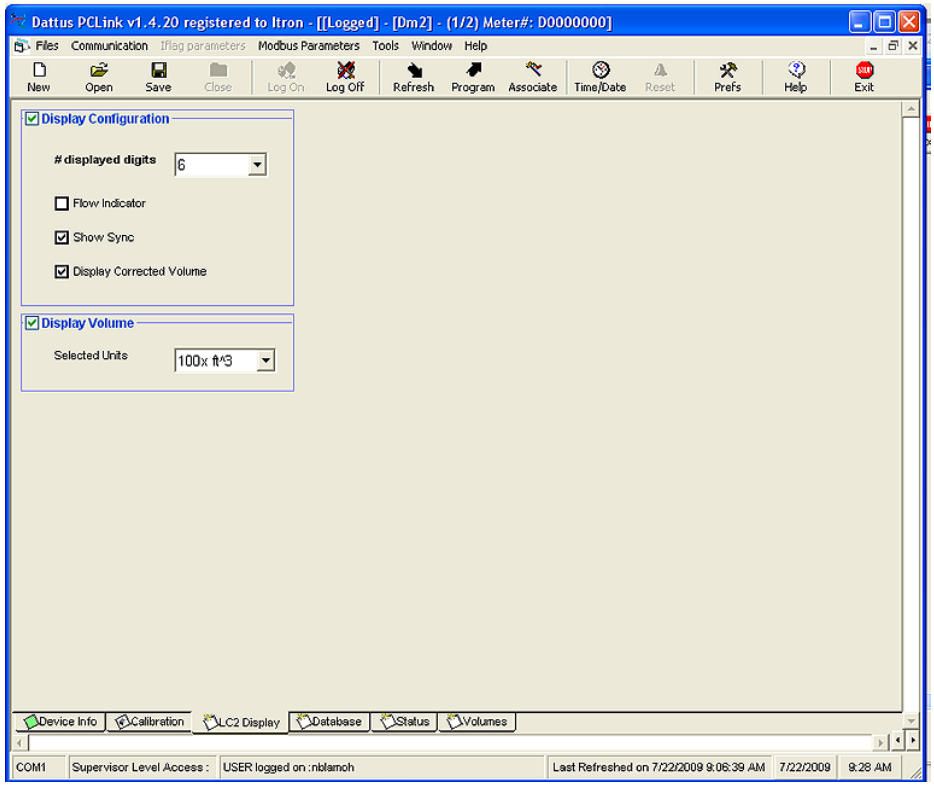
Field	Description
Meter Identification	
Utility Serial Number	The unique utility ID.
Manufacturer's Serial Number	The unique factory ID for the meter. This number is required to create keys for upgrades or for technical support.
Manufacturing Date/Time	The date and time of the meter's manufacture.
Firmware Revision	The firmware (both DM2 and DS1) supplies the operating instructions for the meter. (The software supplies the application that runs the meter. This distinction may be important if technical assistance is required.)
Firmware Date	The firmware revision's release date.
Site Information	
Customer Name	Customer's name.
Site Identifier	An identifier for this site (i.e., address).
Dattus Model and Size	
	Meter model (FM2 or FM3) and capacity listed in industry nomenclature (1M, 1.5M…56M).
	Physical flange connection size (2", 3", or 4").
Factory Configuration and Device Status	
# of Meter Restarts	Indicates when the meter reboots itself. This can be caused by disconnection/re-connection of the batteries.
Last Restart Occurred	Indicates the last meter restart date and time.
Days Left on Batteries	An estimated countdown of the number of days left in the batteries. This field is dependent on the meter's initial configuration and number of days in use.
Program Enabled	If checked,
Options	
Metric Enabled	If checked, Metric is used for all volume (m3), pressure (bar), and temperature (Celsius) measurements/configurations. If unchecked volume is in CF, pressure in PSI, and temperature is in Fahrenheit.

Field	Description
Secure Data Overwrite	A security provision not currently used.
Data logging Enable	If checked, the meter is configured to log data (create an audit trail). If unchecked, this feature is not accessible.
DST for US Enable	If checked, the meter accommodates Daylight Saving Time (U.S. standard) in its clock.
Meter Configuration	Meter definition (Basic-L, PTZ-L, P-only, ETC-L).
Region Setting	Security configuration setting. Choose between *North America* and *Canada*. North America allows full users read and write access (user must provide proper password). Canada has certain restrictions due to meter sealing requirements.

Fixed Factor Tab (LC2 Display Tab)

The **LC2 Display** tab controls the LCD Readout configuration and pressure configuration when **Display Corrected Volume** is selected. (The **LC2 Display** tab may also be called Always on LCD.)

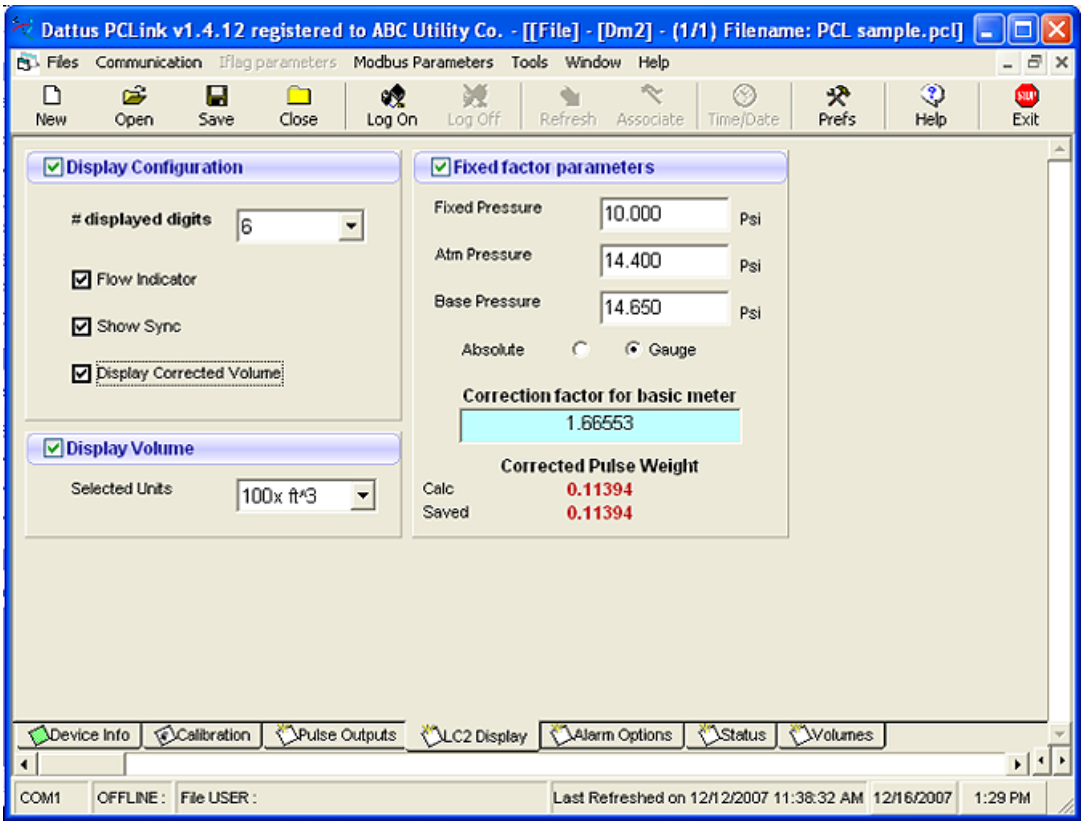
The **LC2 Display** tab is shown in following screen with **Display Corrected Volume** selected.



The following table describes the **LC2 Display** tab fields. See LCD Display on page 107 for an LCD visual.

Field	Description
Display Configuration	
# displayed digits	The number of digits shown on the LCD. User configurable from 4 to 6 digits.
Flow Indicator	If checked, allows meter clocking.
Show Sync	If enabled, Show Sync will momentarily display **SYNC** on the LCD and allow it to be an alarm condition if communication is broken. See Alarms for more details. Itron recommends keeping this enabled.
Display Corrected Volume	If enabled, will display the Fixed Factor parameters. (Fixed factor parameters are described in the next table).
Display Volume	
Selected Units	Configures the LCD units, typically CFx100 or CFx1000.

Check the **Display Corrected Volume** box to enable fixed factor pressure correction. After you enable fixed factor pressure correction (check **Display Corrected Volume**), the **Fixed factor parameters** box displays on the **LC2 Display** tab (see the following **LC2 Display** screen).



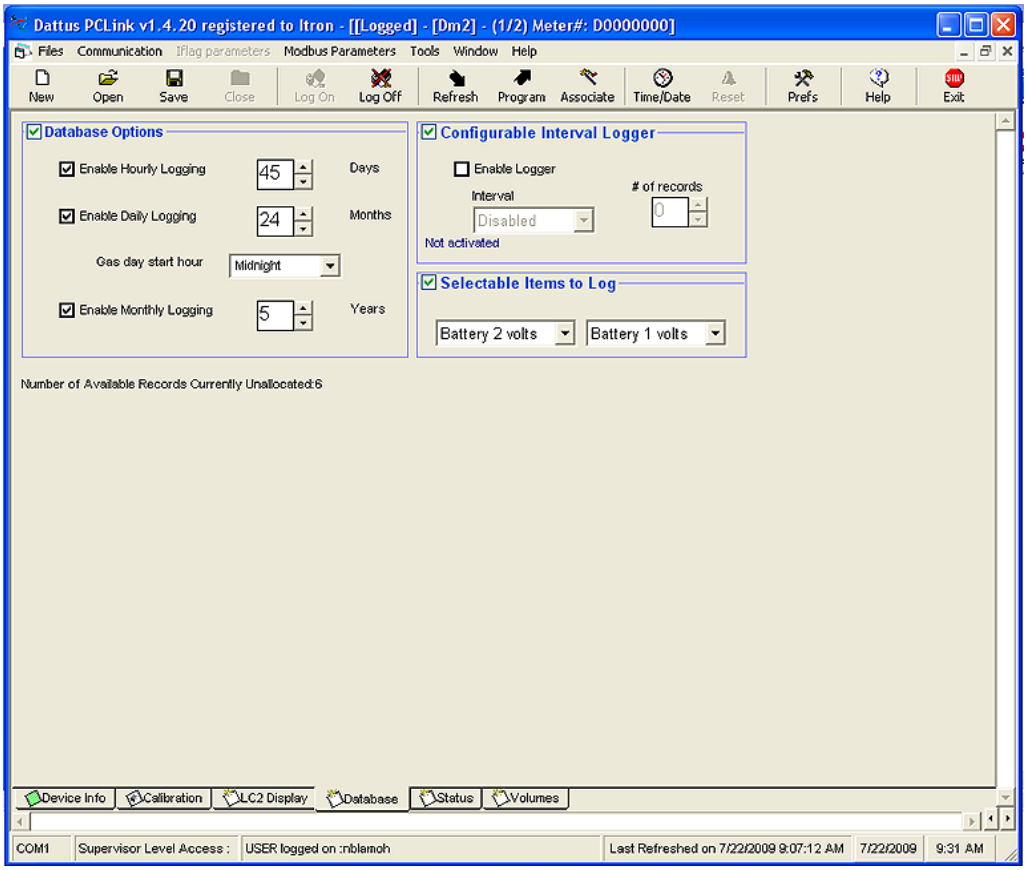
Selecting **Display Corrected Volume** changes the LCD's register display and allows you to configure **Fixed factor parameters** (see Meter Volumes (Volumes Tab) on page 47) for the descriptions of volume registers). The following table describes the **Fixed factor parameters** fields.

Field	Description
Fixed Pressure	The pressure that will go through the meter. Pressure must be very stable to ensure correction factor accuracy.
Atm Pressure	Atmospheric Pressure. The local atmospheric pressure or the standard atmospheric pressure used to calculate the correction factor.
Base Pressure	The contract pressure, also called billing base.
Correction Factor	The factor (multiplier) applied to the uncorrected volume to obtain the corrected volume. The factor is calculated by adding the Atmospheric Pressure and the Fixed Pressure and dividing that value by the Base Pressure. This box shows the result of the calculation.
Corrected Pulse Weight	The Dattus meter calculates fixed factor by applying the correction factor to the oscillation pulse weight to get the **Corrected Pulse Weight**. Each oscillation at this oscillation pulse weight is counted in the Corrected Volume Register. See the caution below on *Calc* vs. *Saved* values. **Caution** When modifying **Fixed factor parameters**, ensure all parameters are correct before they are programmed into the meter. The following validation check may be performed: The **Calc Corrected Pulse Weight** is the correction factor multiplied by the oscillation pulse weight in the software. The **Saved Corrected Pulse Weight** is the value programmed into the meter. After programming new values, click refresh and verify the Calc and Saved values match. Because part of the LCD Configuration is printed on the label (see LCD Display (Readout), changing the configuration programmed into the meter may lead to a mismatch between the programmed configuration and that listed on the display.

Note When buying a pre-configured Dattus meter from the factory, the Atm Pressure will be programmed for 14.4 PSI and the Base Pressure will be 14.65 PSI unless otherwise specified.

Meter Database Tab

The Meter Database tab allows configuration for meter data logging.

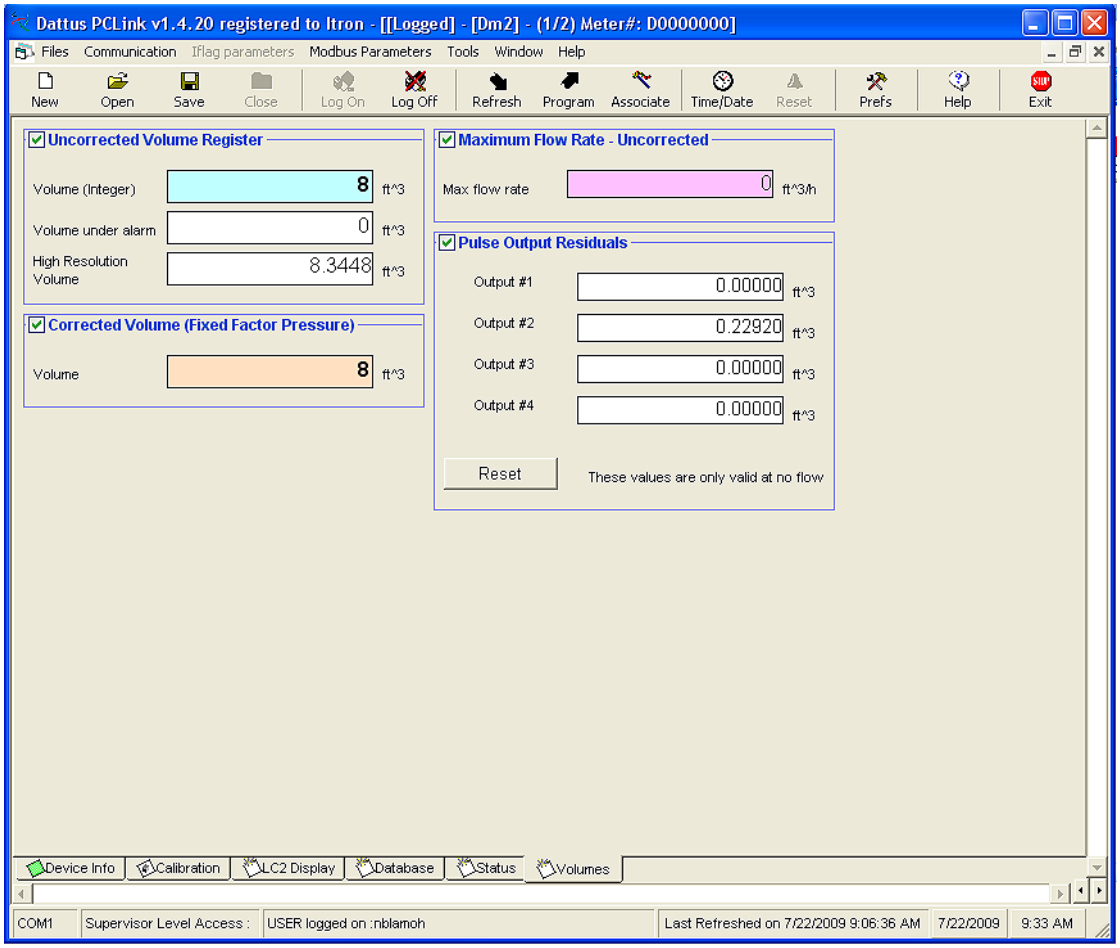


The following Meter Database tab table describes the Database tab fields.

Field	Description
Database Options	
Enable Hourly Logging	If enabled, select the number of days to log hourly data.
Enable Daily Logging	If enabled, select the number of months to log daily data.
Gas day start hour	Select the time of day to begin logs.
Enable Monthly Logging	If enabled, select the number of years to log monthly data.
Configurable Interval Logger	
Enable Logger	If selected, Enable Logger allows you to configure the data logging intervals.
Interval	If Enable logger is selected, configure the time interval to perform data logging. Range is 30 seconds to 30 minutes.
# of records	If Enable Logger is selected, configure the number of records. The number of available records for all Basic meters is 3100. For all other meter types, the number is 1800.
Selectable Items to Log	
Choose the battery voltages	

Meter Volumes (Volumes Tab)

The Meter **Volumes** tab includes register volumes (Uncorrected and Corrected), user configured overflow, and meter maximum flow rate as shown in the following figure.

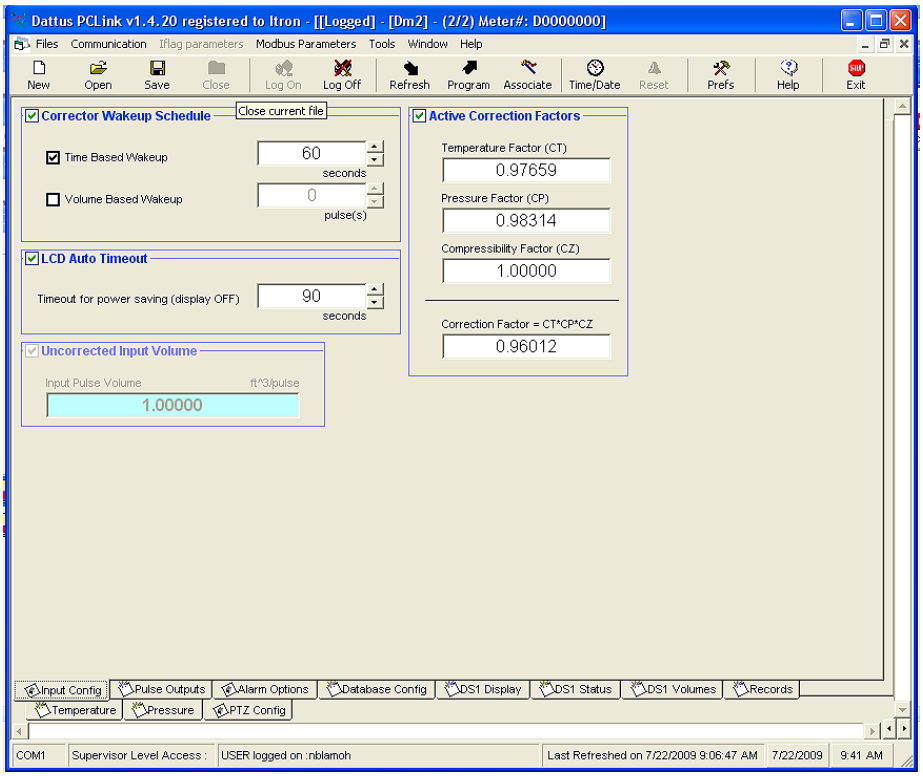


The table below describes of each of the Volume Tab fields.

Field	Description
Uncorrected Volume Register	
Uncorrected Volume (Integer)	The integer volume for the Dattus meter uncorrected volume. Units are CF or m3 dependent on configuration.
Volume under alarm	Only increments if selected as an option in Alarm Options and the meter is in an alarm condition. Generally not used.
High Resolution Volume	Includes the integer volume plus the fractional increment volume.
Corrected Volume (Fixed Factor Pressure)	
Volume	The volume register that increments the register at the Corrected Pulse Weight described in the **LC2 Display tab** if **Display Corrected Volume** is enabled. If the Display Correct Volume is not enabled on the **LC2 Display** tab, the Uncorrected Volume is displayed.
User Max Flow Rate Before Alarm	This is a user-configurable field for the maximum flow rate before alarm. It also configures the scale for the High Frequency pulse output, discussed in Output Modes.
Maximum Flow Rate - Uncorrected	
Max flow rate	This is the maximum flow rate the meter has seen since its last reset. See Resetting Alarms via PCLink.
Pulse Output Residuals	
Output #1 Output #2 Output #3 Output #4	Records the volume for each pulse output residual register. When the volume reaches the pulse weight configured for that output, it closes an electronic switch and resets the residual volume to zero. When zeroing a meter, pulse output residual should also be reset.
Reset	Values are valid at no flow only.

Input Config Tab

The **Input Config** tab allows you to monitor and implement power saving Dattus meter features.

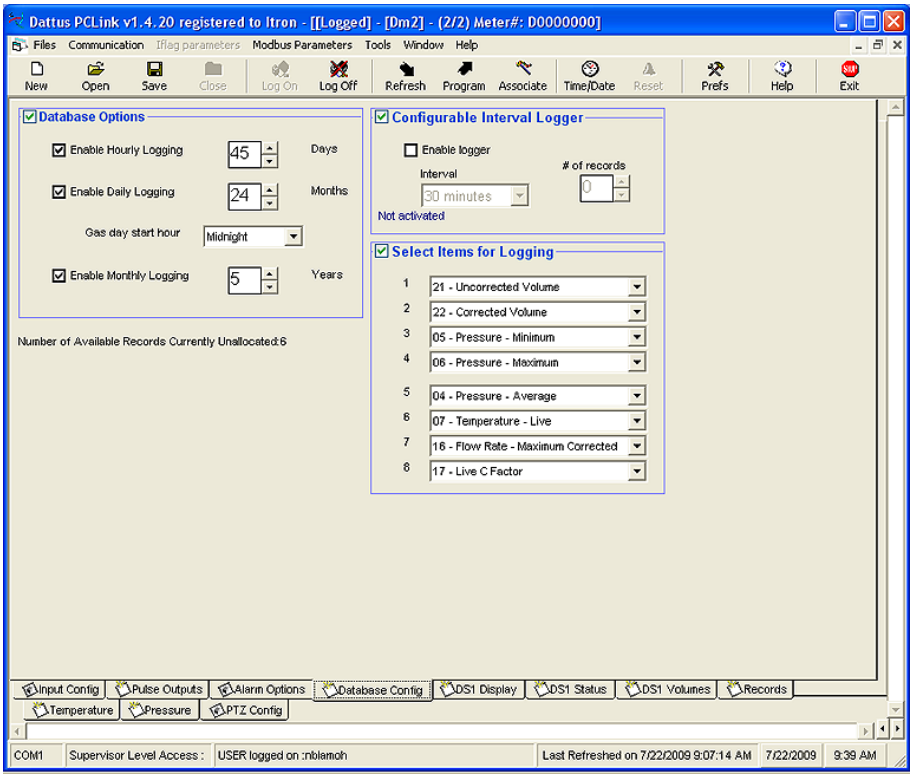


The following table describes the **Input Config** tab fields.

Field	Description
Corrector Wakeup Schedule	
Time Based Wakeup	Wakes the DS1 at the configured time and applies new correction factors to the uncorrected volume.
Volume Based Wakeup	Wakes the DS1 at the configured volume and applies new correction factors to the uncorrected volume.
LCD Auto Timeout	
Timeout for power saving (display OFF)	Powers down the DS1 LCD at the configured time.
Uncorrected Input Volume	
Input Pulse Volume	The corrector's index drive rate.
Active Correction Factors	
Temperature Factor (CT) Pressure Factor (CP) Compressibility Factor (CZ) Correction Factor = CT*CP*CZ	The current live and/or fixed correction values.

Database Config Tab (DS1)

The **Database Config** tab allows you to configure the Dattus meter's logged data database.

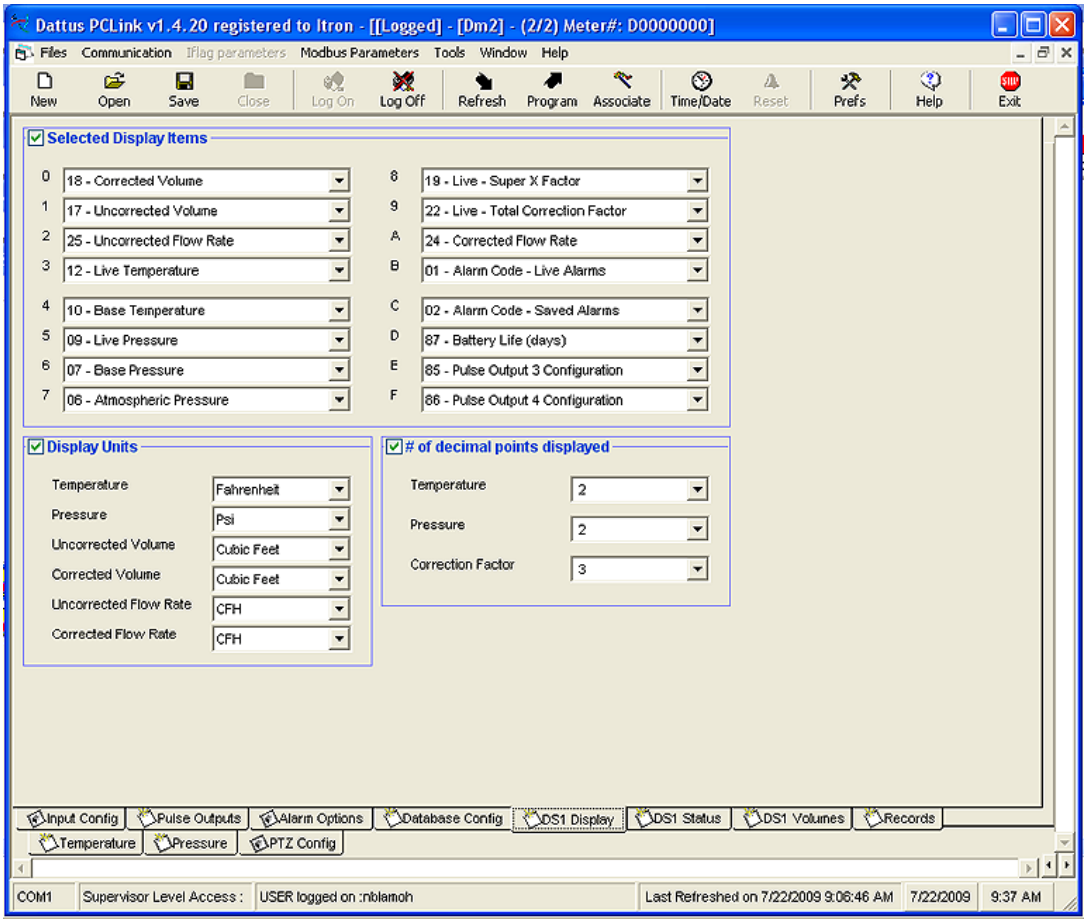


The following table describes the **Database Config** tab fields.

Field	Description
Database Options	
Enable Hourly Logging	If enabled, select the number of days to log hourly data.
Enable Daily Logging	If enabled, select the number of months to log daily data.
Gas day start hour	Select the time of day to begin logs.
Enable Monthly Logging	If enabled, select the number of years to log monthly data.
Configurable Interval Logger	
Enable Logger	If selected, Enable Logger allows you to configure the data logging intervals.
Interval	If Enable logger is selected, configure the time interval to perform data logging. Range is 30 seconds to 30 minutes.
# of records	If Enable Logger is selected, configure the number of records. The number of available records for all Basic meters is 3100. For all other meter types, the number is 1800.
Select Items for Logging	
Select the data items to display. The DS1 can display up to 16 items.	

DS1 Display Tab

The **DS1 Display** tab allows you to configure the items displayed on the DS1 LCD.

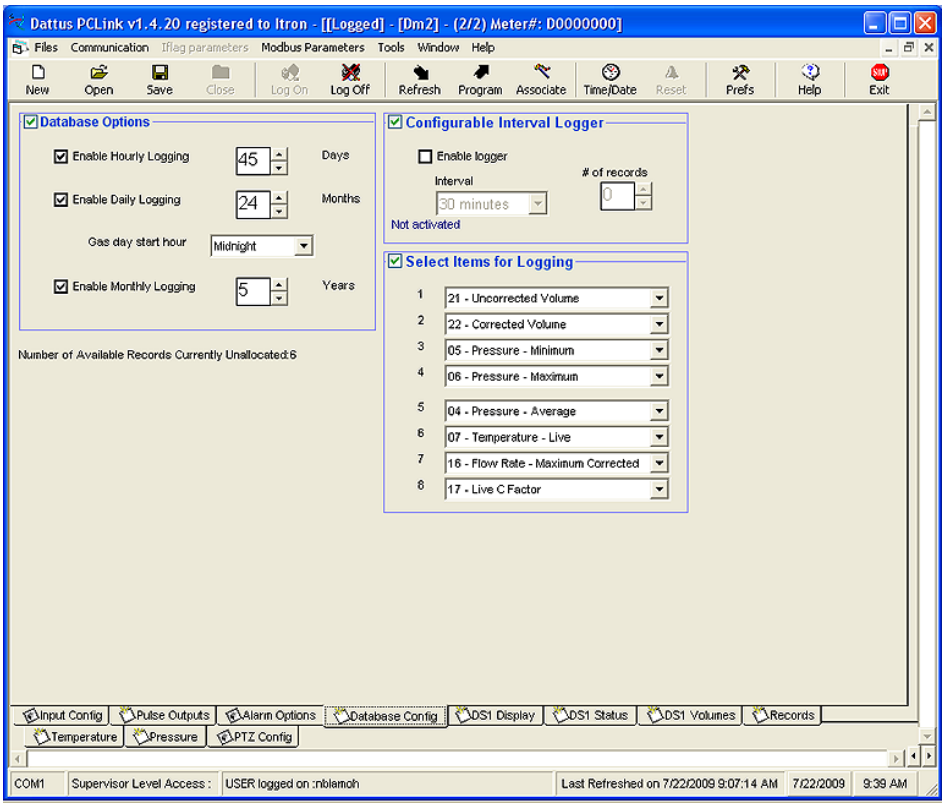


The following table describes **DS1 Display** tab fields.

Field	Description
Selected Display Items	
Select up to 16 items to view on the DS1 display.	
Display Units	
Temperature	If **Display Units** is selected, configure the temperature designator.
Pressure	If **Display Units** is selected, configure the pressure designator.
Uncorrected Volume	If Display Units is selected, configure the uncorrected volume designator.
Uncorrected Flow Rate	If **Display Units** is selected, configure the uncorrected flow rate designator.
Corrected Flow Rate	If **Display Units** is selected, configure the corrected flow rate designator.
# of decimal point displayed	
Temperature Pressure Correction Factor	If # of decimal points displayed is selected, configure the number of digits displayed after the decimal point.

Database Config Tab (DS1)

The **Database Config** tab allows you to configure the Dattus meter's database of logged data.

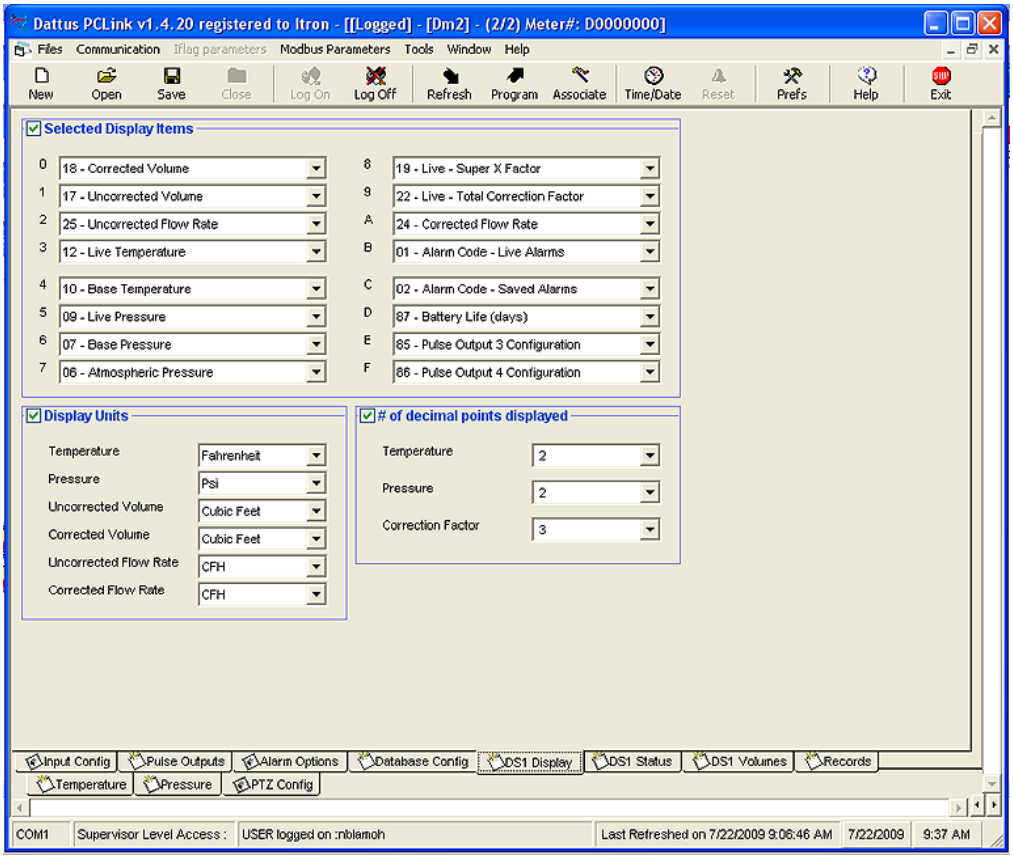


The following table describes the **Database Config** tab fields.

Field	Description
Database Options	
Enable Hourly Logging	If enabled, select the number of days to log hourly data.
Enable Daily Logging	If enabled, select the number of months to log daily data.
Gas day start hour	Select the time of day to begin logs.
Enable Monthly Logging	If enabled, select the number of years to log monthly data.
Configurable Interval Logger	
Enable Logger	If selected, Enable Logger allows you to configure the data logging intervals.
Interval	If Enable logger is selected, configure the time interval to perform data logging. Range is 30 seconds to 30 minutes.
# of records	If Enable Logger is selected, configure the number of records. The number of available records for all Basic meters is 3100. For all other meter types, the number is 1800.
Select Items for Logging	
Select the data items to display. The DS1 can display up to 16 items.	

DS1 Display Tab

The **DS1 Display** tab allows you to configure the items displayed on the DS1 LCD.

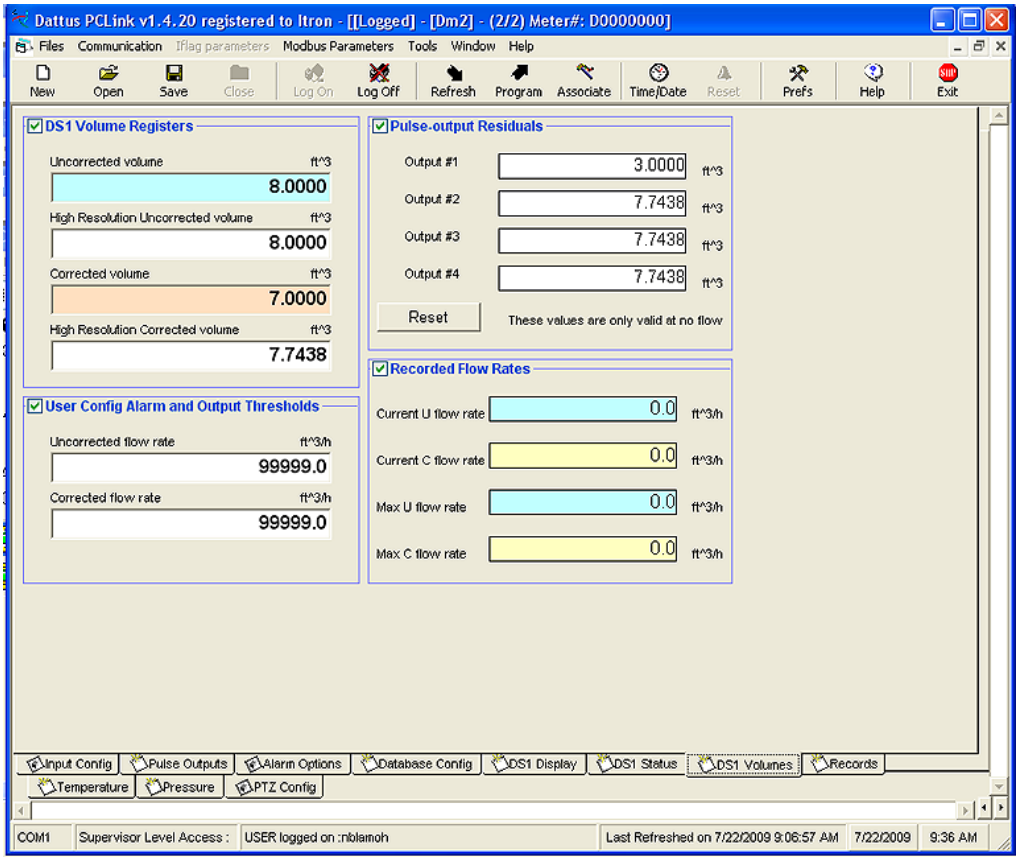


The following table describes **DS1 Display** tab fields.

Field	Description
Selected Display Items	
Select up to 16 items to view on the DS1 display.	
Display Units	
Temperature	If **Display Units** is selected, configure the temperature designator.
Pressure	If **Display Units** is selected, configure the pressure designator.
Uncorrected Volume	If Display Units is selected, configure the uncorrected volume designator.
Uncorrected Flow Rate	If **Display Units** is selected, configure the uncorrected flow rate designator.
Corrected Flow Rate	If **Display Units** is selected, configure the corrected flow rate designator.
# of decimal points displayed	
Temperature	If # of decimal points displayed is selected, configure the number of digits displayed after the decimal point.
Pressure	
Correction Factor	

DS1 Volumes Tab

The **DS1 Volumes** tab displays current meter register volumes.



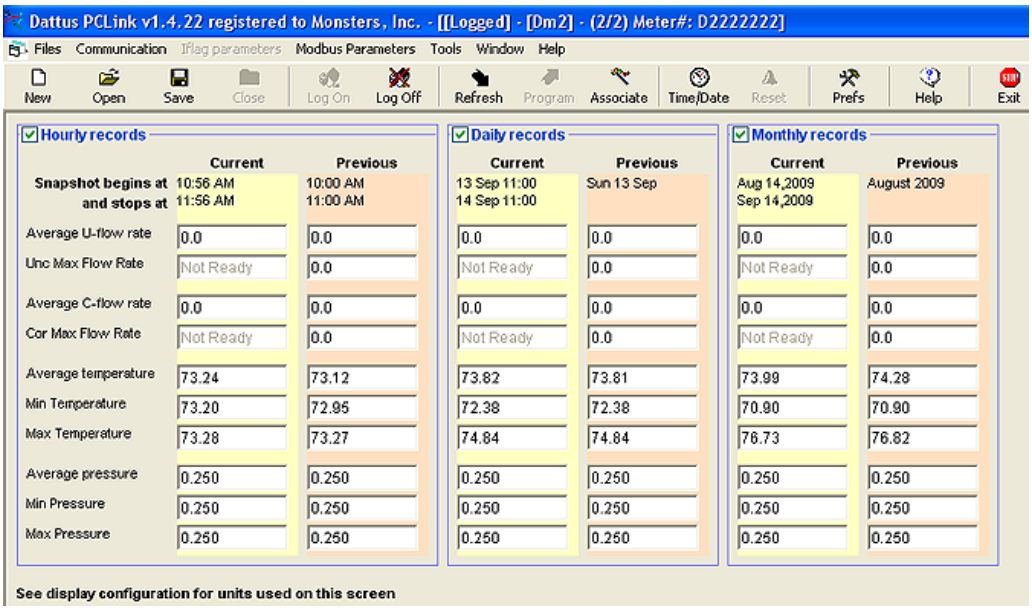
The following table describes **DS1 Volumes** tab fields.

Field	Description
DS1 Volume Registers	
Uncorrected volume	The integer volume for the Dattus meter uncorrected volume. Units are CF or m3, dependent on configuration.
High Resolution Uncorrected volume	The integer volume plus the fractional increment volume.
Corrected volume	The raw uncorrected volume coming from the meter. The Corrected volume is multiplied by the correction factor found on the Input Config tab on page 49.
High Resolution Corrected volume	The sum of the integer corrected volume and the fractional increment volume.

Field	Description
User Config Alarm and Output Thresholds	
Uncorrected flow rate	Rate calculation of the meter's (DM2) raw gas volume to corrector (DS1) with no correction. The calculation is completed based on eight input volume pulses from the meter to the corrector.
Corrected flow rate	The uncorrected flow rate multiplied by the DS1 correction factor found on the Input Config Tab on page 49.
Pulse-output Residuals	
Residuals for outputs 1 through 4.	
Reset	
Recorded Flow Rates	
Current U flow rate	Current uncorrected flow rate.
Current C flow rate	Current corrected flow rate.
Max U flow rate	Maximum uncorrected flow rate recorded by the meter.
Max C flow rate	Maximum corrected flow rate recorded by the meter.

Records Tab

The **Records** tab displays the average, minimum, and maximum flow rates, temperatures, and pressures from meter and displays them in hourly, daily, or monthly increments. Essentially the Records Tab acts as a smaller scale data log.

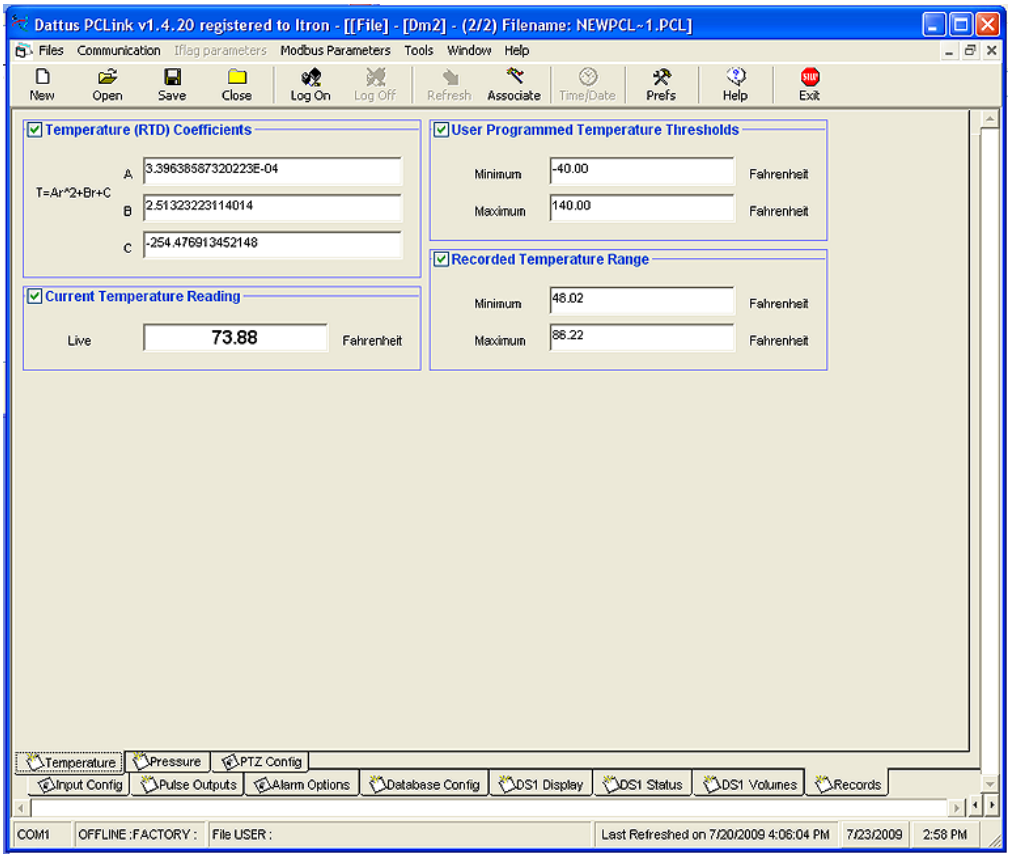


The following table describes the **Records** tab fields.

Field	Description
Hourly, Daily, and Monthly records	
Snapshot begins at and stops at	Displays the current and previous hourly, daily, or monthly time span for displayed records.
Average U-flow rate	Displays the average uncorrected flow rate for the current and previously selected time span.
Unc Max Flow Rate	Displays the uncorrected maximum flow rate for the current and previously selected time span.
Average C-flow rate	Displays the average corrected flow rate for the current and previously selected time span.
Cor Max Flow Rate	Displays the corrected maximum flow rate for the current and previously selected time span.
Average temperature Min Temperature Max Temperature	Displays the average temperature, average minimum temperature, and average maximum temperature for the current and previously selected time span.
Average pressure Min Pressure Max Pressure	Displays the average pressure, average minimum pressure, and average maximum pressure for the current and previously selected time span.

Temperature Tab

The **Temperature** tab allows you to view Dattus meter temperature parameters.

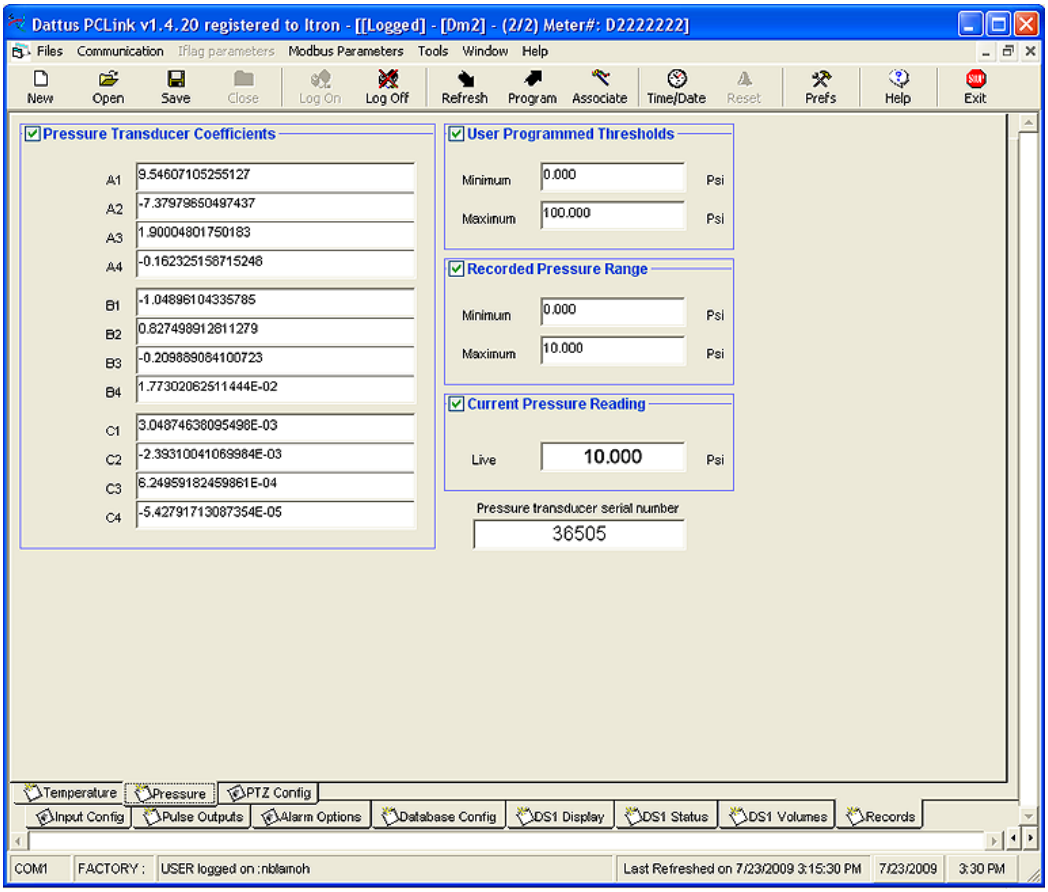


The following table describes **Temperature** tab fields.

Field	Description
Temperature (RTD) Coefficients	
T=Ar^2+Br+C	If selected, displays factory configured temperature coefficients.
Current Temperature Reading	
Live	If selected, displays the current temperature reading in the units chosen on the DS1 Display Tab on page 51.
User Programmed Temperature Thresholds	
If selected, displays the minimum and maximum user-defined minimum and maximum temperature limits.	
Recorded Temperature Range	
If selected, displays the minimum and maximum user-defined minimum and maximum temperature range.	

Pressure Tab

The **Pressure** tab displays the Dattus meter's pressure parameters.

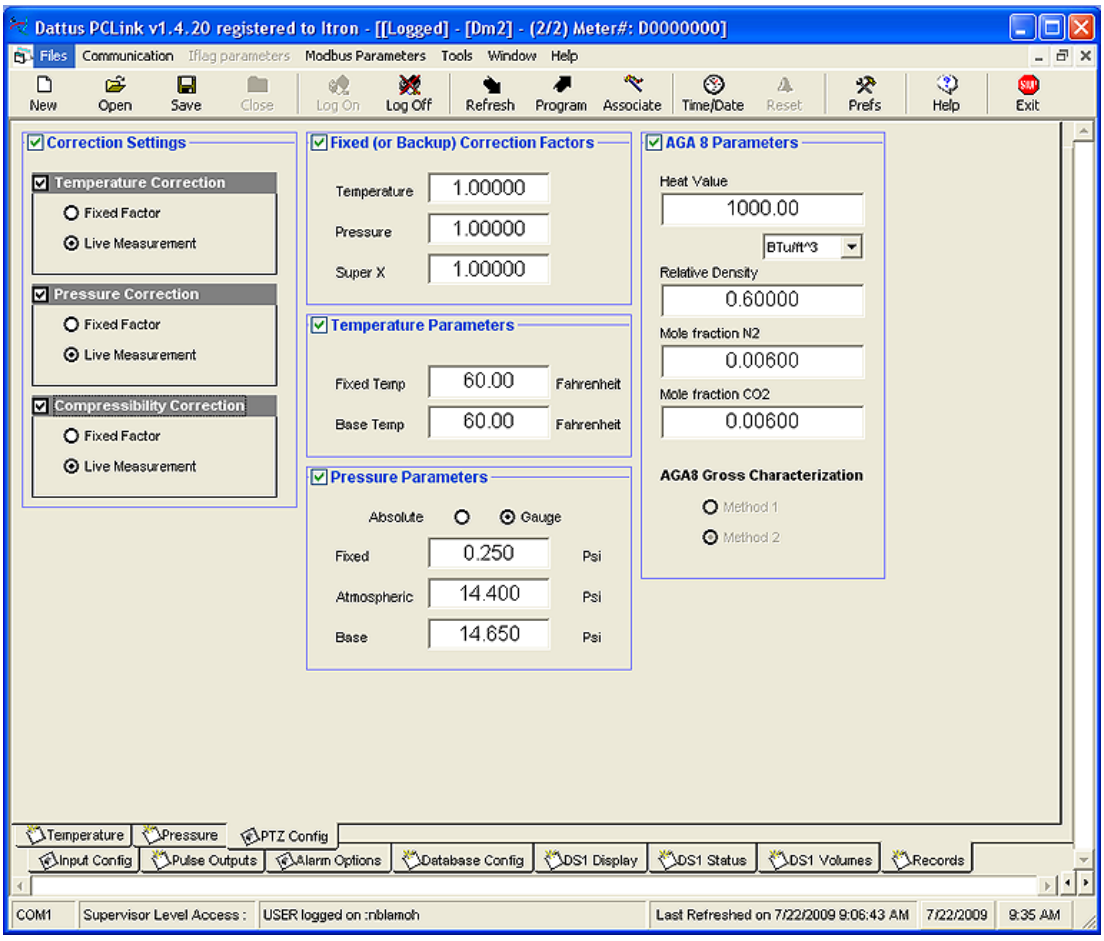


The following table describes the **Pressure** tab fields.

Field	Description
Pressure Transducer Coefficients	
Displays factory-configured pressure transducer coefficients.	
User Programmed Thresholds	
Displays the user-configurable minimum and maximum pressure range the meter must operate within to prevent a prevent a pressure alarm (in Psi).	
Recorded Pressure Range	
Displays the minimum and maximum recorded pressure values (in Psi).	
Current Pressure Reading	
Displays the current pressure reading (in Psi).	
Pressure transducer serial number	Displays the Dattus meter's transducer serial number.

PTZ Config Tab

The **PTZ Config** tab allows you to select fixed factor or live measurement settings. Unlike Basic-L models, the fixed factor correction adjustments for meters equipped with a DS1 are made on the **PTZ Config** Tab.



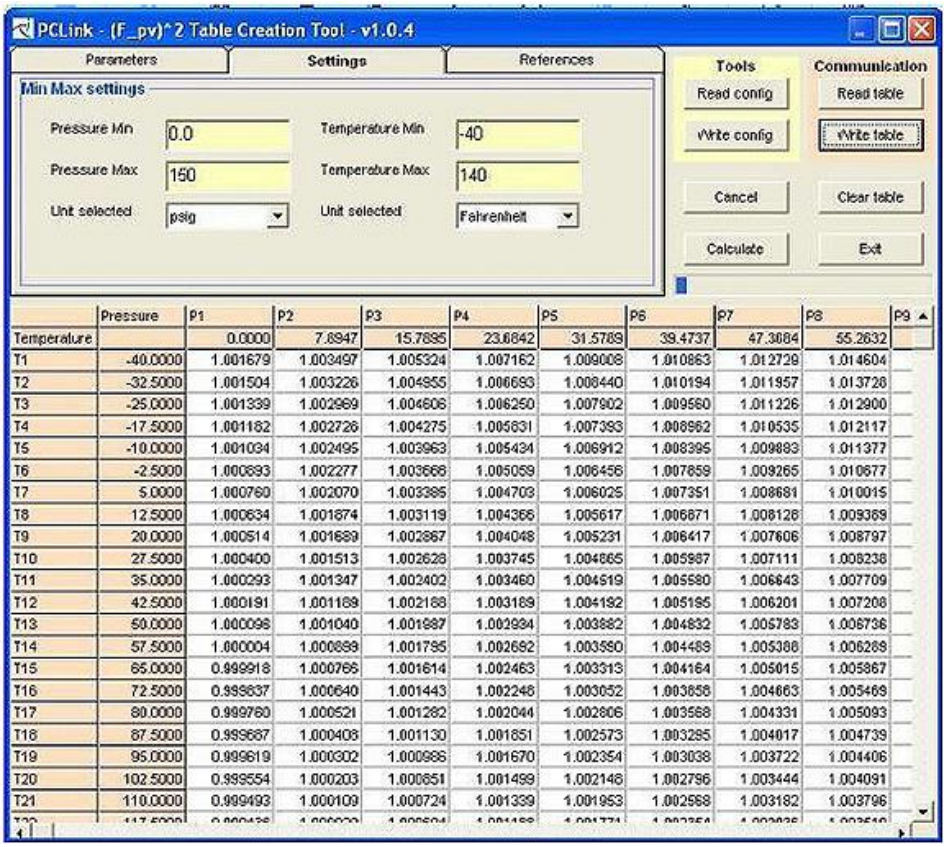
The following table describes the **PTZ Config** tab fields.

Field	Description
Correction Settings	
Temperature, Pressure, and Compressibility Correction	If selected, allows you to select between liver or fixed correction settings. Fixed settings are based on the parameters displayed on this tab.
Fixed (or Backup) Correction Factors	
Temperature	Settings implemented during fix factor measurement or alarm.
Pressure	
Super X	
Temperature Parameters	
Fixed Temp	Controls configurable fixed temperature parameters.
Base Temp	

Pressure Parameters	
Absolute Gauge	Select parameter type.
Fixed Absolute Base	Controls configurable fixed pressure parameters (in Psi).
AGA 8 Parameters	
Heat Value Relative Density Mole fraction N2 Mole fraction CO2	Displays current AGA 8 parameters. Values are acquired by manual input or by the generated AGA 8 table.
AGA Gross Characterization	

AGA8 Table

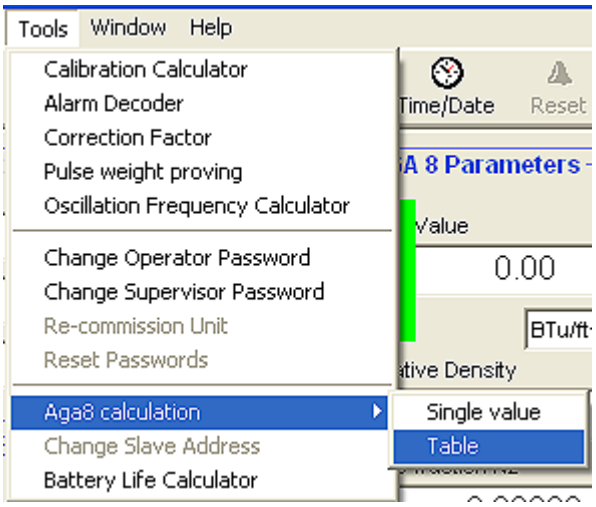
The AGA8 table is used to determine the compressibility factor. The compressibility factor is not a live calculation; it is polled from the AGA 8 table.



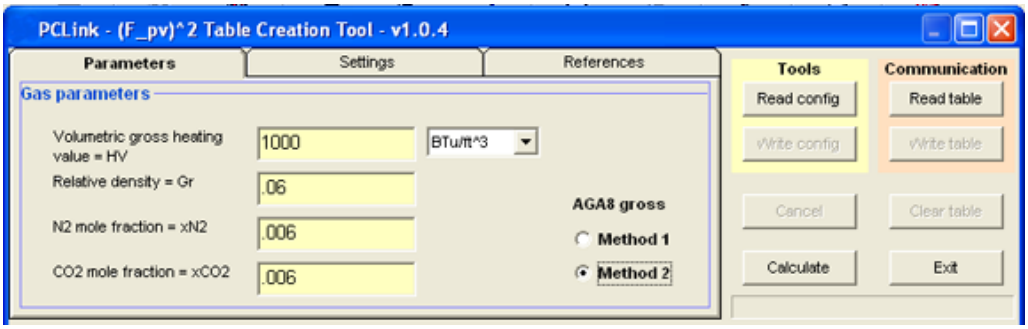
	Pressure	P1	P2	P3	P4	P5	P6	P7	P8	P9
Temperature		0.0000	7.8947	15.7895	23.6842	31.5789	39.4737	47.3684	55.2632	
T1	-40.0000	1.001679	1.003497	1.005324	1.007162	1.009008	1.010863	1.012729	1.014604	
T2	-32.5000	1.001504	1.003226	1.004955	1.006693	1.008440	1.010194	1.011957	1.013728	
T3	-25.0000	1.001339	1.002969	1.004606	1.006250	1.007902	1.009560	1.011226	1.012900	
T4	-17.5000	1.001182	1.002726	1.004275	1.005831	1.007393	1.008962	1.010535	1.012117	
T5	-10.0000	1.001034	1.002495	1.003963	1.005434	1.006912	1.008395	1.009883	1.011377	
T6	-2.5000	1.000893	1.002277	1.003666	1.005059	1.006456	1.007859	1.009265	1.010677	
T7	5.0000	1.000760	1.002070	1.003385	1.004703	1.006025	1.007351	1.008681	1.010015	
T8	12.5000	1.000634	1.001874	1.003119	1.004366	1.005617	1.006871	1.008128	1.009389	
T9	20.0000	1.000514	1.001689	1.002867	1.004048	1.005231	1.006417	1.007606	1.008797	
T10	27.5000	1.000400	1.001513	1.002628	1.003745	1.004865	1.005987	1.007111	1.008238	
T11	35.0000	1.000293	1.001347	1.002402	1.003460	1.004519	1.005580	1.006643	1.007709	
T12	42.5000	1.000191	1.001189	1.002188	1.003189	1.004192	1.005195	1.006201	1.007208	
T13	50.0000	1.000098	1.001040	1.001987	1.002934	1.003882	1.004832	1.005783	1.006736	
T14	57.5000	1.000004	1.000899	1.001795	1.002692	1.003590	1.004489	1.005388	1.006289	
T15	65.0000	0.999918	1.000766	1.001614	1.002463	1.003313	1.004164	1.005015	1.005867	
T16	72.5000	0.999837	1.000640	1.001443	1.002246	1.003052	1.003858	1.004663	1.005469	
T17	80.0000	0.999760	1.000521	1.001282	1.002044	1.002806	1.003568	1.004331	1.005093	
T18	87.5000	0.999687	1.000408	1.001130	1.001851	1.002573	1.003295	1.004017	1.004739	
T19	95.0000	0.999619	1.000302	1.000986	1.001670	1.002354	1.003038	1.003722	1.004406	
T20	102.5000	0.999554	1.000203	1.000851	1.001499	1.002148	1.002796	1.003444	1.004091	
T21	110.0000	0.999493	1.000109	1.000724	1.001339	1.001953	1.002568	1.003182	1.003796	

To generate the AGA8 table

1. Select **Tools** > **AGA8 calculation** > **Table**.



2. Enter the AGA8 parameters and select the calculation method.



Note There are two options for calculating the AGA8 table; Method 1 and Method 2. Method 1 requires the carbon dioxide mole fraction, the heating value, and gas's specific gravity. Method 2 requires the gas's specific gravity, carbon dioxide mole fraction, and nitrogen mole fraction.

3. Click the **Calculate** button to write the values to the AGA8 table.

Caution Values are accepted only if the calculate function completes without failing. A failure is noted by a value of *Error* appearing in the AGA8 table.

4. Click the **Write config** button to program the eight parameters.
5. Click the **Write table** button to generate the AGA8 table based on the eight programmed values.

Note After a table is generated, it can be viewed again by opening the AGA8 table and clicking **Read Config** followed by **Read table**.

CHAPTER 6

Collecting Meter Information

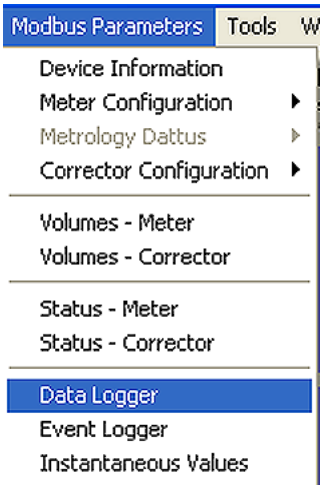
This chapter describes meter data extraction methods.

Data Logger

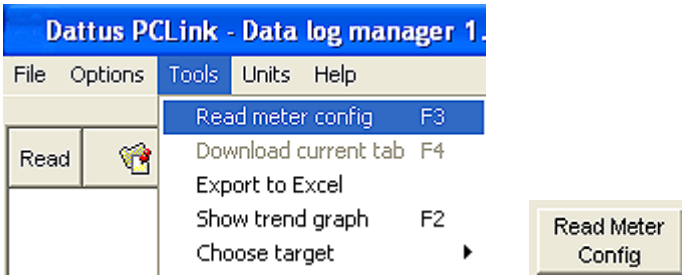
The Data Logger collects meter information on an hourly, daily, and monthly basis. It is primarily used as an audit trail for gas usage. The Data Logger is not a standard feature of the meter.

To download the Data Logger

1. Install and open the PCLink program.
2. Click the desktop PCLink icon or press F3 to log on. Log on requires a user password.
3. Select > **Modbus Parameters** > **Data Logger**.

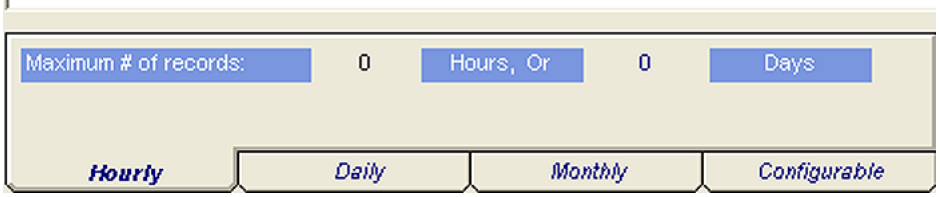


4. The Data Logger appears as a blank white screen. The meter configuration must be read from the meter to populate the Data Logger. Select **Tools** > **Read meter config** or click the **Read Meter Config** button.

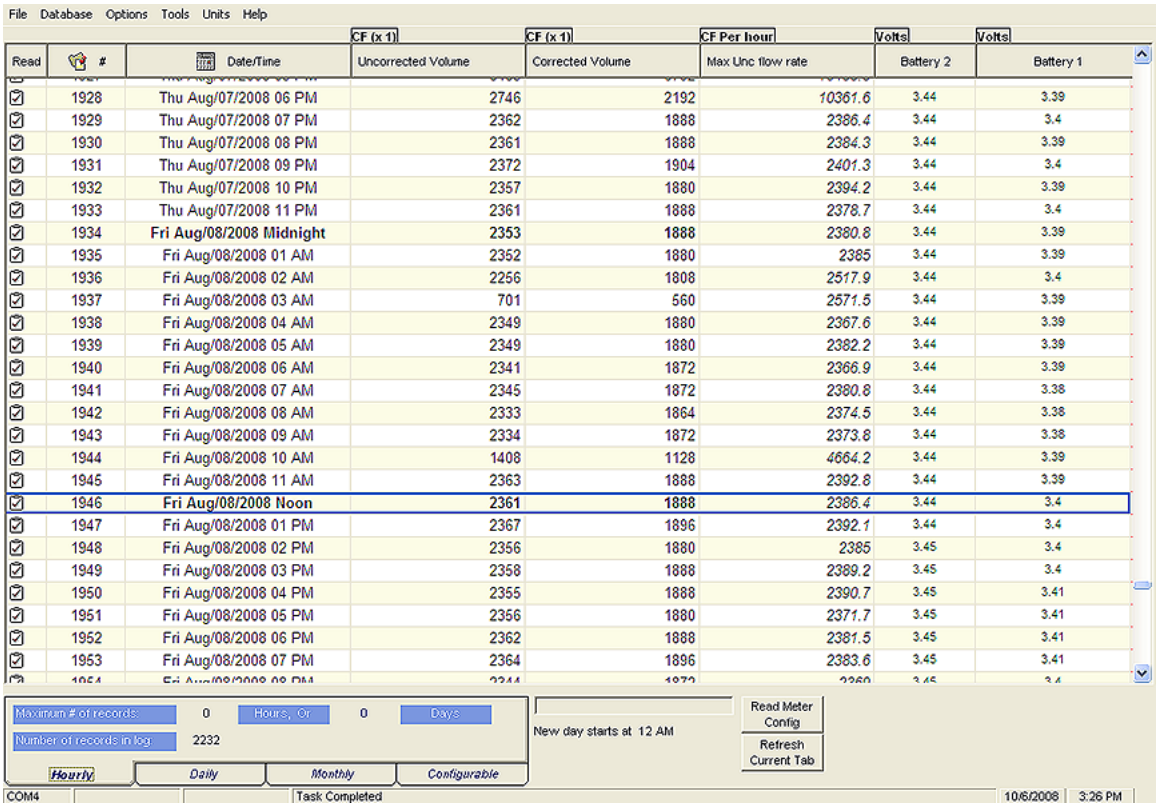


5. After the meter is read, the **Refresh Current Tab** activates.

The event logger has four selectable tabs (**Hourly**, **Monthly**, **Daily,** and **Configurable**).

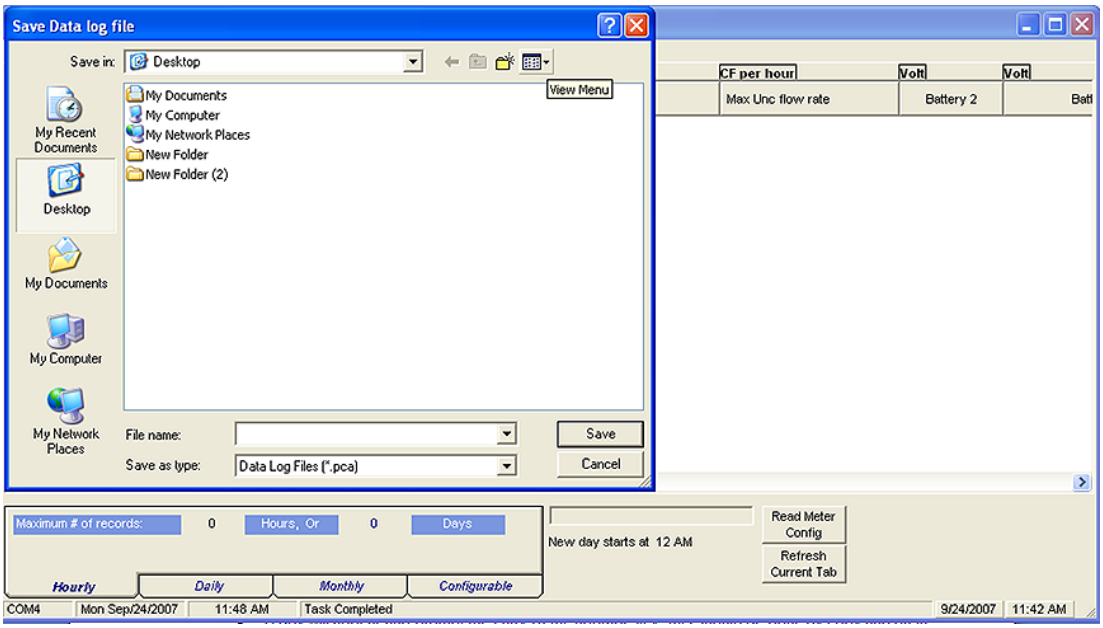


6. Select the desired event logger tab and click **Refresh Current Tab** to view the tab's content.

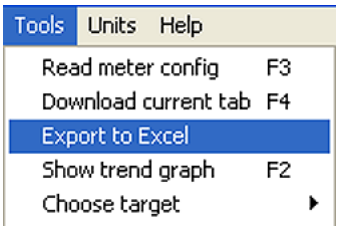


To save and export Data Logger information

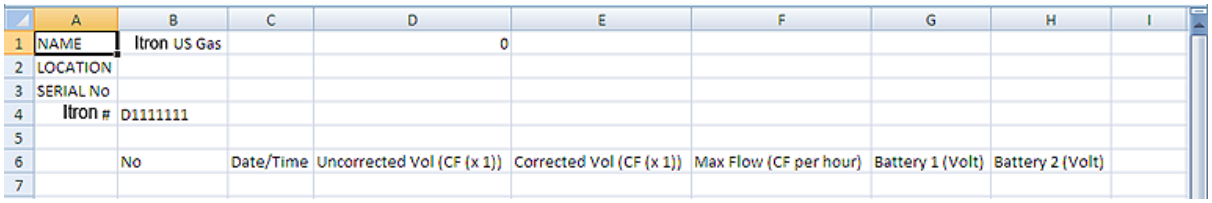
1. To save the Data Logger to a .pca file, select **File** > **Save**.



2. The Data Logger can be exported to a Microsoft Excel® spreadsheet. Select **Tools** > **Export to Excel**.



3. The Data Logger opens in Excel.



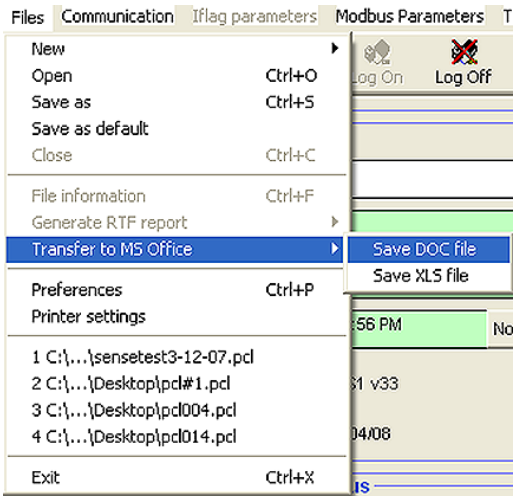
	A	B	C	D	E	F	G	H	I
1	NAME	Itron US Gas		0					
2	LOCATION								
3	SERIAL No								
4	Itron #	D1111111							
5									
6		No	Date/Time	Uncorrected Vol (CF (x 1))	Corrected Vol (CF (x 1))	Max Flow (CF per hour)	Battery 1 (Volt)	Battery 2 (Volt)	
7									

Exporting Meter Configuration PCL Files to Microsoft Word

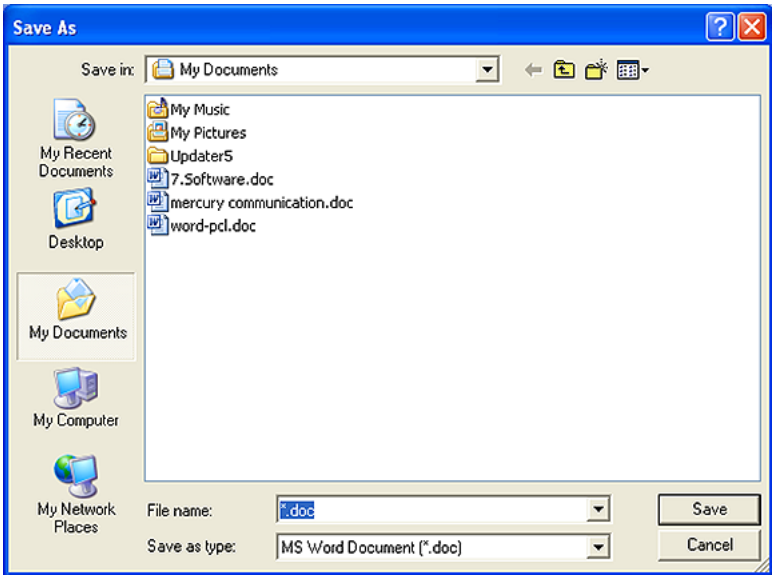
Dattus meter configuration information can be downloaded and viewed in a two-page Microsoft Word® document.

To save and view Dattus meter configuration information in MS Office

1. Log on to the Dattus meter.
2. Select **Files** > **Transfer to MS Office** > **Save DOC file** or **Save XLS file**.



3. Name the file. MS Word files save as .doc files. MS Excel files save as .xls files.



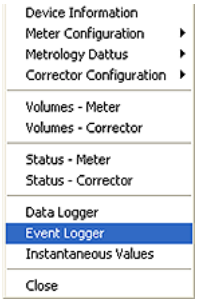
4. Open the saved meter configuration information file as an MS Word document or MS Excel spreadsheet.

Event Logger

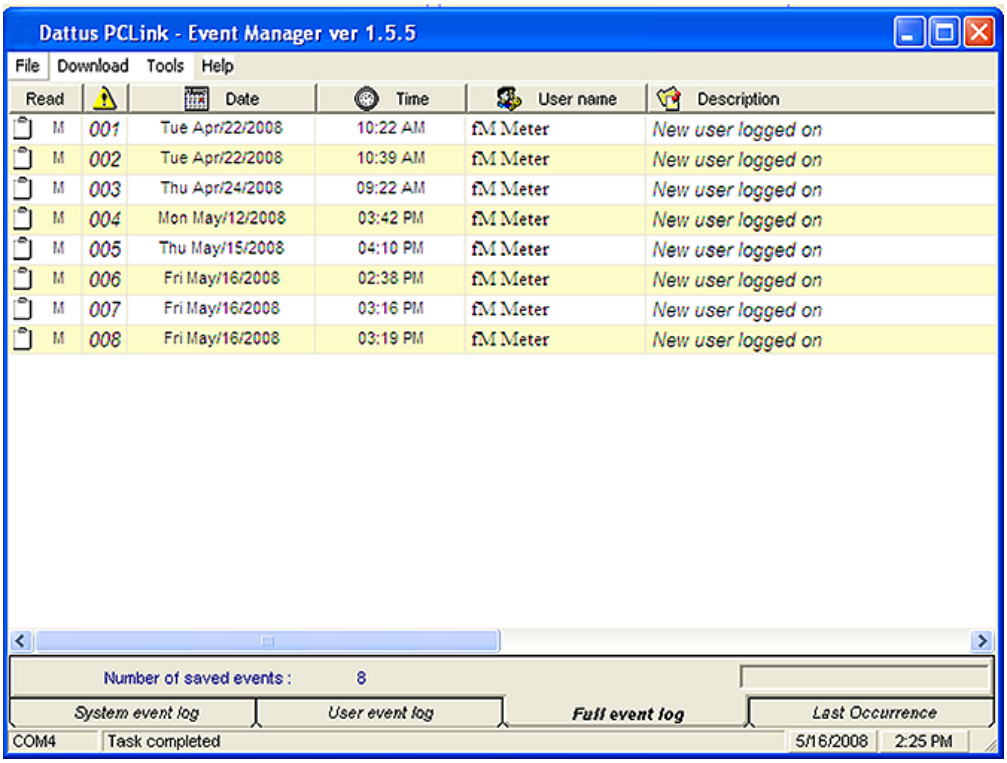
The Event Logger records configuration changes and alarm occurrences for the currently logged meter.

To open the Event Logger and export the meter event log

1. Select **Modbus Parameters** > **Event Logger**.



2. The Event Logger opens as a blank screen. Press F3 to download the event log.



3. Select **Tools** > **Export to Excel** (or press **F8**) to export the event log to an MS Excel spreadsheet.

CHAPTER 7

Proving and Calibrating the Dattus Meter

This chapter provides the information to prove and calibrate the Dattus meter and verify meter accuracy.

Proving a meter is comparing a reference volume (prover) with the volume measured by a meter under test. One system (prover) gets pressure inputs, temperature, and uncorrected meter volume from the meter under test. The prover system compares those values to the corrected volume measured by the prover (after accounting for pressure, temperature, and uncorrected volume differences between the meter under test and the reference).

The proving procedure shown in the following information works with rotary transfer meters, specifically the Roots Model 5® transfer prover. Most prover technologies and types may be adapted for the Dattus meter.

Materials List

Proving the Dattus meter using the Model 5 Rotary Transfer Prover requires the following materials:

- Dattus Meter
- Rotary Transfer Prover and software
- Rotary Transfer Prover hoses for pressure and temperature
- 25-feet proving hose or longest available proving hose
- 3-feet proving hose (available from Itron)
- Dampener (Either Itron version or Roots version)
- Choke Valve (available from Itron)
- Inlet Conditioning Flange (for 2-inch FM2 model)
- ¼-inchAllen Wrench
- Dattus RS-232 communications cable (P/N 600204-001)
- Dattus proving cable (P/N 442405-003)

Physical Setup

The following information describes setting up the Dattus meter for proving.

Using the Dampener Kit to Minimize Pulsation

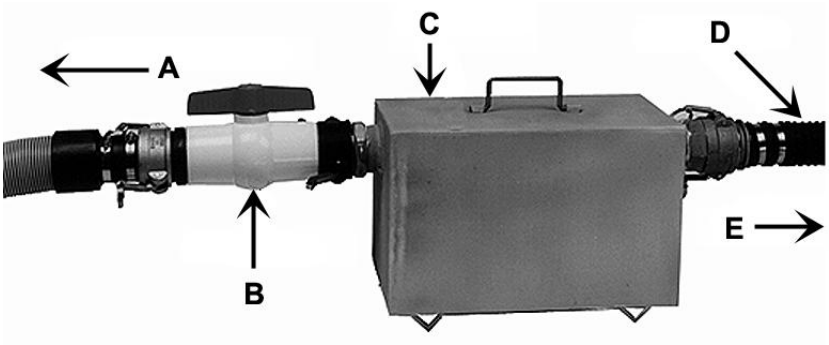
Rotating rotary pistons create pulsations in the gas stream. The effective gas flow opening and closing causes the pulsation. This effect is known to skew the measured accuracy of turbine meters using a rotary transfer prover. Utilities testing turbine meters with rotary transfer provers typically use dampeners to remove some pulsation effect and obtain a more accurate test result. Dattus meters require the use of a dampener for testing.

The pulsation effect on Dattus accuracy is most pronounced between 500 CFH and 3000 CFH. Above 5000 CFH, the effect is minimized enough that dampening is not required. This has been determined empirically and is specific to the use of the 10M rotary and the FM2 Dattus models.

In addition to the dampener, the dampener kit also includes a plastic 2-inch flange and pipe assembly. This inlet conditioning is necessary to help remove additional bias when testing a 2 inch flanged Dattus FM2 meter.

Dampener Kit Setup

Set up the Itron dampener kit following the figure below.



A To Dattus meter
B Choke valve
C Dampener
D 3-foot hose
E To Prover

Warning Do not use the dampener as a pressure vessel.

Inlet Conditioning

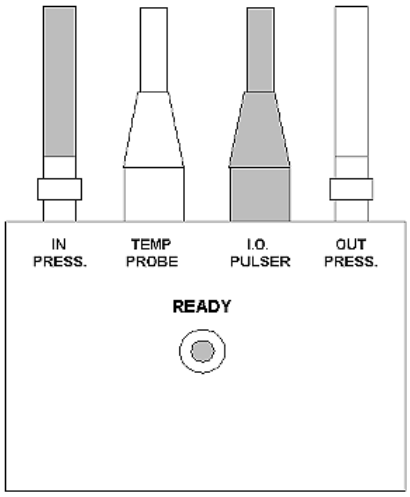
Testing a 2-inch Dattus FM2 requires a flange/pipe assembly as shown in the following figure.

Model 5 Junction Box

Model 5 junction box connections required for a Dattus meter are:

- The Inlet Pressure Connection
- The Temperature Probe

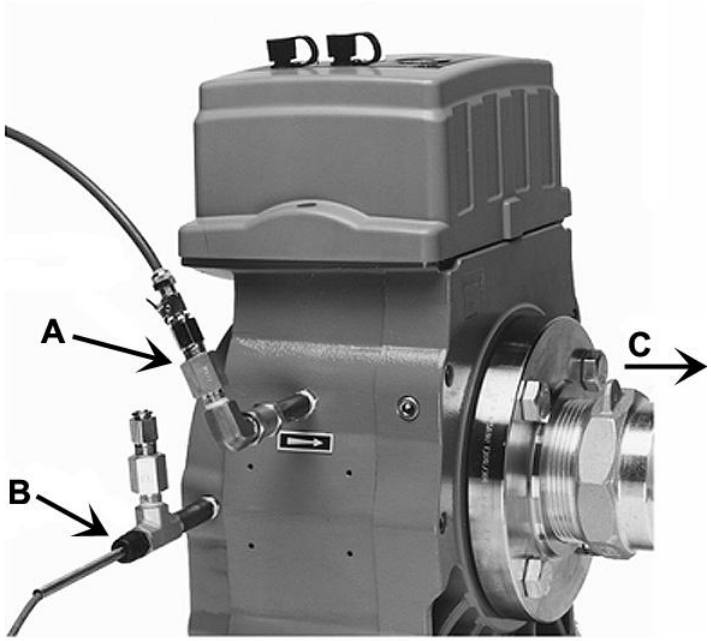
- The IO Pulser



The outlet pressure connection is used to determine the differential across the meter. This is only relevant to rotary meters and is not used in the accuracy calculation.

Pressure and Temperature Connections

The following figure shows pressure and temperature connections to the Dattus meter. Verify the flow direction is correct. The meter inlet is marked both on the meter casting and on the manufacturers' badge.



A Inlet pressure connection
B Temperature connection
C To choke valve

Warning The inlet pressure connection must be at the center pipe plug on the Dattus meter. The inlet pressure is the pressure used for correction in the prover. The pressure at the center pipe plug is the actual pressure at the measurement point for the Dattus meter.

Proving Cable Connection

The Proving Cable connection goes directly from the Pulse Outputs Connection (see Dattus Basic-L on page 16) into the Model 5 junction box. After the physical setup is completed between the Dattus meter and the Model 5 Junction Box, the software configuration for both the meter and the junction box need to match as described in Software Configuration Setup.

Software Configuration Setup

This section describes PCLink software configuration for proving and calibration. The Dattus meter communicates its uncorrected volume to the prover through a pulse. The output being sent from the Dattus meter must match prover configuration to get the best results.

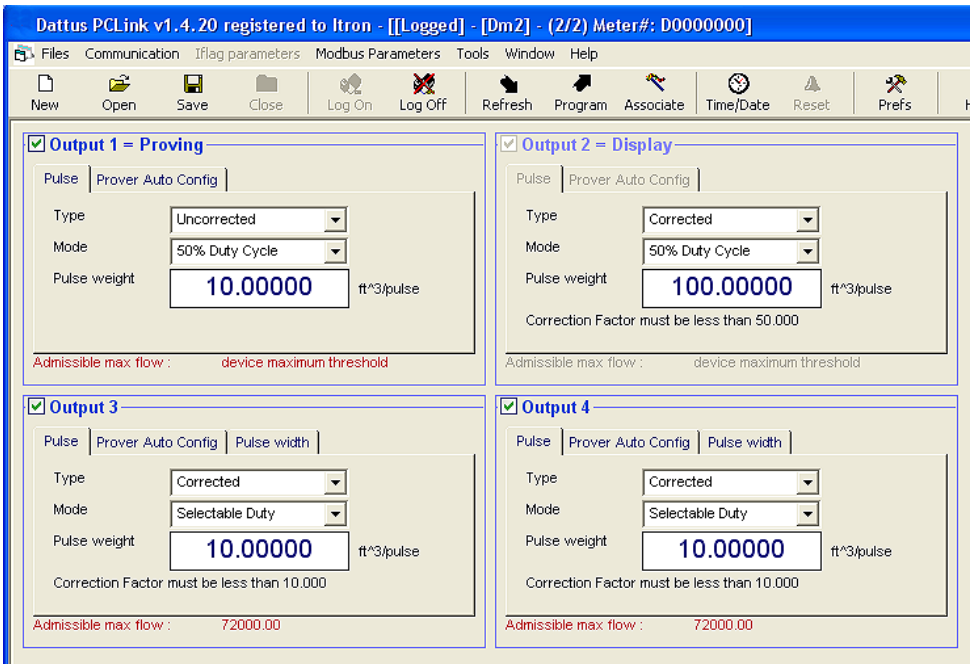
Caution PCLink configuration must ensure the Dattus output pulse is set to a known quantity and matches the Prover setup configuration.

Pulse Output Configuration

The Dattus transfer proving cable (P/N 442405-003) connects the Dattus Output Channel 1 (seeDattus Basic-L on page 16) to the appropriate pins connection on the input/output (IO) connector for the junction box. The factory set pulse output 1 configuration is shown on the Dattus original Certificate of Calibration. Pulse output 1 is a user-configurable value and may have changed.

Note For help in logging on and navigating PCLink software, please see PCLink Software Basics.

Configure the **Output 1 Pulse Weight** on the **PCLink Pulse Output** tab to the required volume as shown in the following figure. The Output 1 Pulse weight is typically 10 CF or 1 CF.



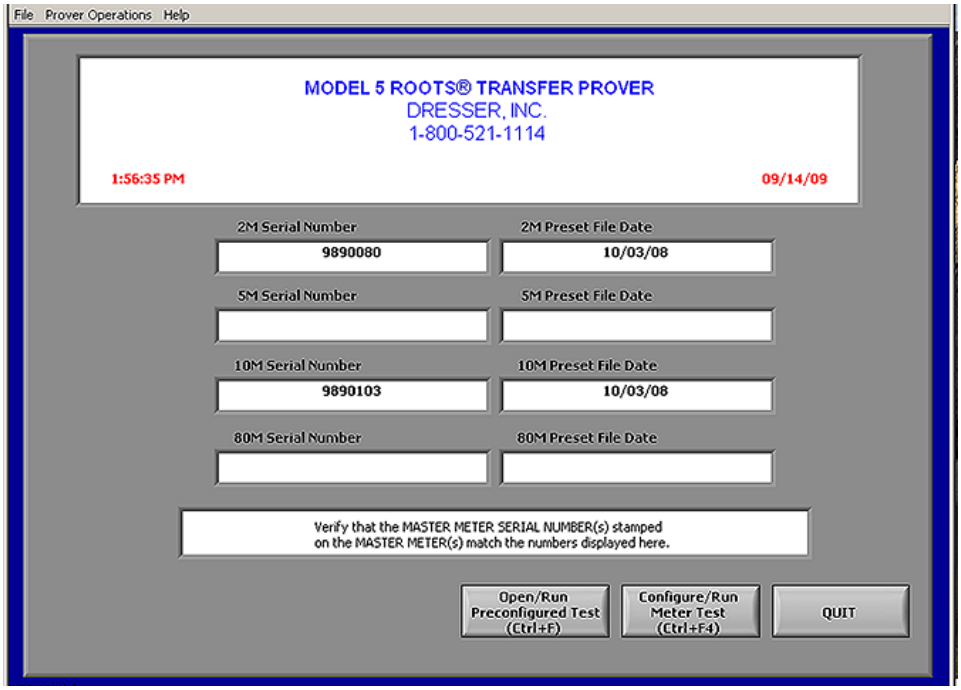
Roots Model 5 Software Setup

These Roots Model 5 software setup instructions are basic configuration requirements for working with a Dattus meter. These instructions assume a user's working knowledge of the Model 5 Software.

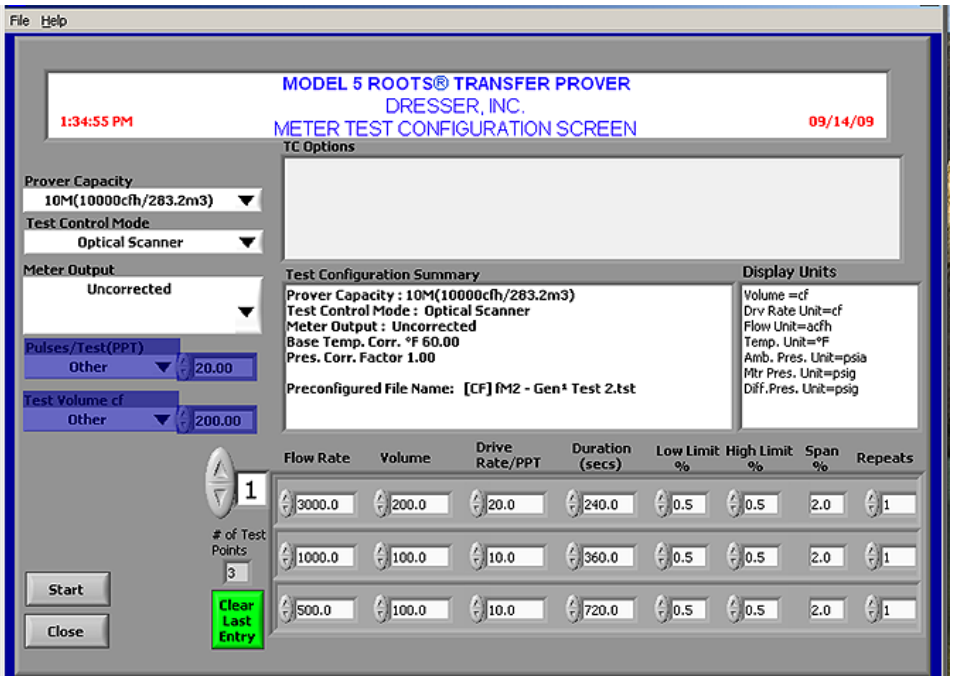
To launch and configure the Roots Model 5 Software

1. Launch the Roots software.

2. Select **Configure/Run Meter Test**.



3. Select > **Test Control Mode** > **Optical Scanner**.



Caution Verify the **Volume** and **Drive Rate/PPT** are configured correctly. The **Drive Rate/PPT** should be the **Volume** divided by the **Pulse Output 1 Pulse Weight** setting from PCLink. For example, if you have a test volume of 200 and a pulse output of 10, the PPT should be 20 (200/10).

Test Configurations

Testing the Dattus meter with the Model 5 prover is accurate on the 10M from 500 CFH to 8500 CFH. Below 500 CFH, the pulsation frequency becomes low enough that the dampener does not adequately dampen and skewed results are possible. For testing flow rates below 500 CFH, Itron recommends using another technology such as sonic or bell testing. Above 7000 CFH, the Dattus meter's (fM2 model) pressure drop and the dampener put a significant strain on the blowers and may reach the maximum flow obtainable without removing the dampener and choke valve.

Suggested Test Configurations

Users must decide the flow rates to test. Generally, two points are tested, high flow and low flow (also called Open and Check flows). The only limit is the meter's maximum capacity.

The following table lists possible testing configurations for various flow rates:

Flow Rate (CFH)	Test Volume (CF)	Drive Rate/PPT	Output Pulse Weight (CF)	Choke Valve Position
8500	200	20	10	Open
8000	200	20	10	Open
7000	200	20	10	Open
5000	200	20	10	Open
3000	100	10	10	Closed
2200	100	10	10	Closed
1400	50	50	1	Closed
1100	50	50	1	Closed
1000	50	50	1	Closed
700	30	30	1	Closed
600	30	30	1	Closed
500	30	30	1	Closed

Note At a minimum, try to configure the test setup for at least 10 pulses and at least one minute in test duration. This minimum configuration should ensure good resolution.

Modifying the Calibration Factor

The Dattus meter measures gas by counting the number of oscillations it detects and multiplying the number of oscillations by the oscillation pulse weight (or calibration factor).

The calibration factor is a single volume quantity determined through testing and defined in the meter's electronics. The calibration factor may be modified by the user through PCLink. Any adjustments will modify the accuracy at all points (flow rates).

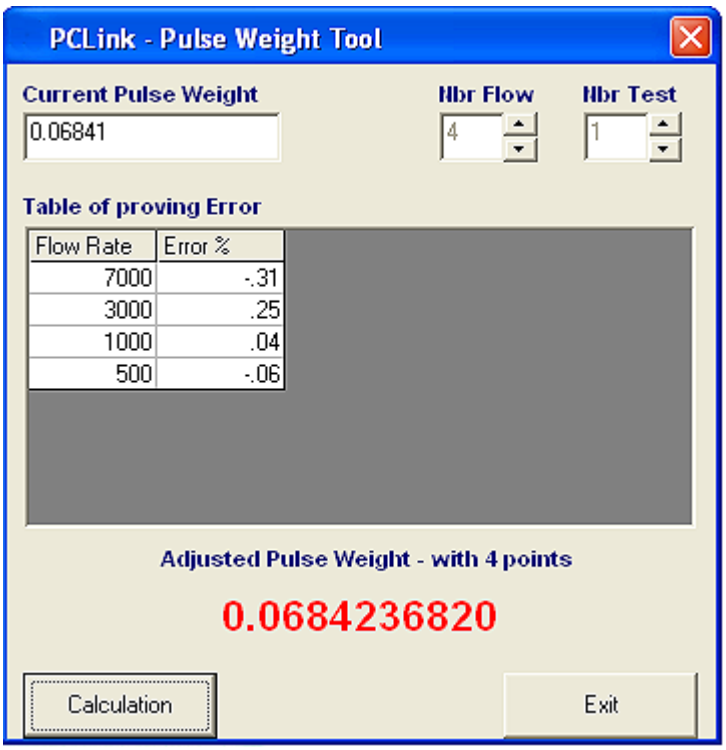
Note Calibration factor modifications require the appropriate security access.

Adjustment Calculation

Your company's standard practices will determine any calibration factor adjustment applied to the Dattus meter. PCLink provides a tool to help calculate new oscillation pulse weights.

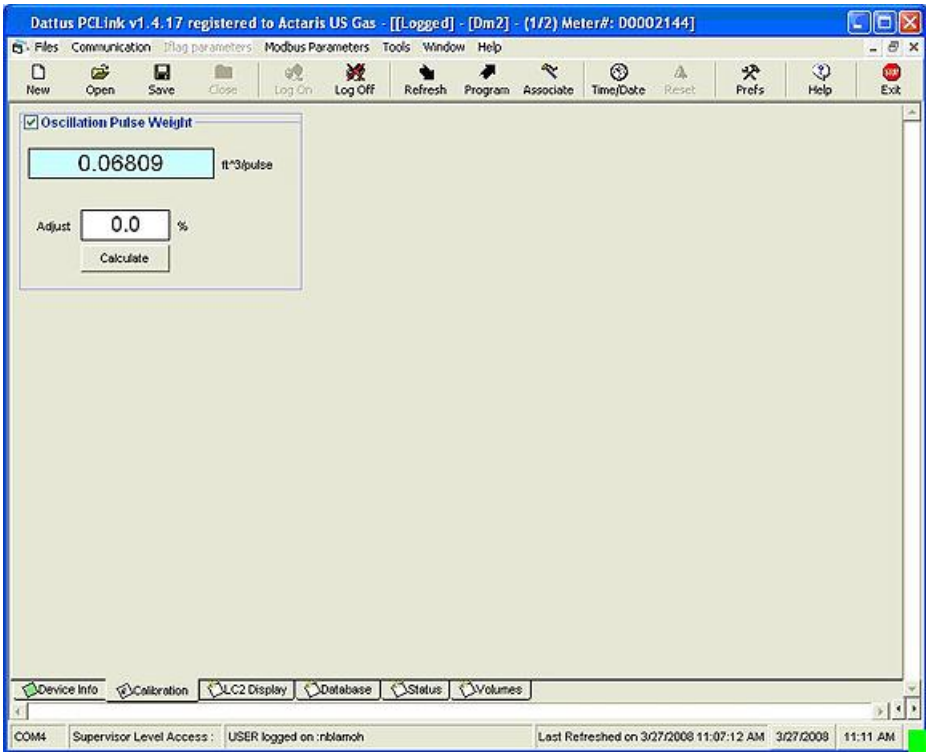
To access PCLink's Pulse Weight Proving tool

1. Start PCLink.
2. Select **Tools > Pulse Weight Proving**.
3. Enter the tested flow rates and the resulting error. The calculator can provide the user with a recommended new oscillation pulse weight. The following example shows an adjustment calculation.



PCLink Calibration Procedure

Configure the **Oscillation Pulse Weight** on PCLink's **Calibration** tab. The **Oscillation Pulse Weight** can be configured for ft3/pulse or m3/pulse representing the actual volume per oscillation.



To configure the Oscillation Pulse Weight

1. If you determine that the meter should be sped up or slowed down, insert the calibration change (in percentage) in the **Adjust** field. The percentage change is positive (to speed up) or negative (to slow down).
2. After entering the calibration change value, click **Calculate** to modify the oscillation pulse weight. (If you calculated the adjustment with the Pulse Weight Tool, you can enter the oscillation pulse weight and then click the **Program** icon to write this value into the electronics of the meter.)

Caution Observe Dattus adjustment limits. Adjustment limits are determined through factory testing and define the reasonable minimum and maximum calibration factors expectations. If you attempt to program a meter calibration outside the adjustment limits, a warning box will display.

CHAPTER 8

Differential Pressure Testing

Differential pressure testing is a simple procedure where pressure drop, expressed in inches of water column, is measured between the meter inlet and outlet.

Industry Uses and Applications

This differential pressure testing method is used to assess rotary meter accuracy changes while in use in the field. Excessive dirt build-up on the rotary meter's impellers or wear on the meter's bearings can increase friction resulting in altered accuracy and a high differential pressure. Pressure readings taken across the meter are used to indicate whether or not the meter has an acceptable accuracy level. Rotary meter manufacturers and individual utilities established differential limits that infer acceptable/unacceptable meter accuracy.

Dattus Meter Application

The Dattus meter has no moving parts so the meter does not experience an increase in differential pressure associated with worn parts. Dattus meter differential tests are directly linked to gas flow rates through the meter and inferentially to the accuracy.

Caution Using differential testing to confirm Dattus accuracy is most successful when flow rate and pressure conditions are stable and the flow rate is high enough to generate a minimum 0.2 inches water column pressure drop.

Dattus Differential Tables

The following tables list differential pressures (for atmospheric pressure and 0.6 specific gravity gas) at common flow rates. Refer to the graphs shown in Differential Pressure Curves for additional differential data.

Dattus fM2 Model		
Flow Rate (ft3/h)	**2" ANSI 125, in w.c.**	**3" ANSI 125, in w.c.**
9,100	5.60	5.00
9,000	5.48	4.89
8,600	5.00	4.48
7,000	3.28	3.01
5,700	2.17	2.00
5,500	2.00	1.89
5,000	1.67	1.57
3,950	1.05	1.00
3,850	1.00	0.95
3,000	0.61	0.59

Dattus fM3 Model	
Flow Rate (ft3/h)	**4" ANSI 125, in w.c.**
56,000	34.37
38,000	15.35
31,000	10.00
23,000	5.47
16,000	2.61
14,050	2.00
12,200	1.50
11,000	1.22
10,000	1.00
7,100	0.50
7,000	0.48
5,000	0.24

Required Differential Pressure Testing Materials

Differential pressure testing requires the following materials:

- Pressure gauge.
- Differential pressure gauge or manometer with a pressure capability level meeting the operating meter's demands.
- Dattus differential pressure curves from this manual or spreadsheet.
- Determining measured flow rate by clocking the meter or by direct communications using PCLink.

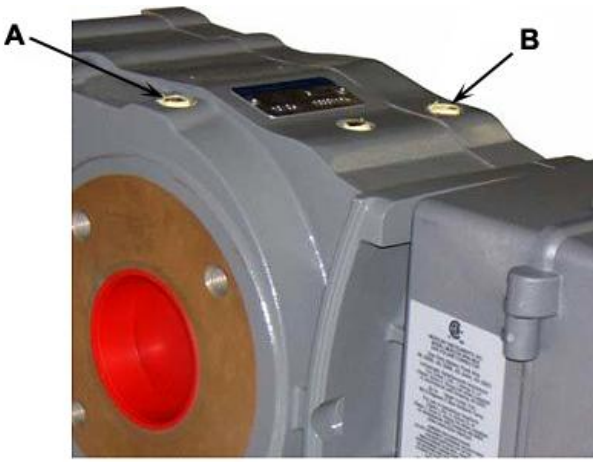
Differential Test Overview

The Differential Test procedure includes determining:

- Pressures.
- Flow rates.
- Comparison differential.

To determine pressures

1. Measure and record gauge line pressure.
2. Using the differential pressure gauge, determine the pressure drop. Use the pressure drop between the inlet and outlet.



A Inlet
B Outlet

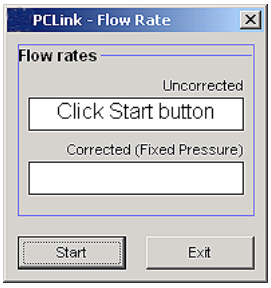
Determining Flow Rate

Determining the measured actual flow rate or uncorrected flow rate is best done under stable flow rates with a minimum of 0.2 inches w.c (water column) pressure drop. Determining measured flow rate can be done one of two ways:

1. Using PCLink communications to the meter.
2. Clocking the meter.

To determine flow rate using PCLink communications

1. Log on to meter.
2. Select **Modbus Parameters > Instantaneous Values**.
3. Click **Start** on the associated Flow Rate box.



4. Use the *Uncorrected* value.

To determine flow rate using meter clocking

1. Use the Flow Indicator on the LCD. Use meter clocking only if the meter is configured to display uncorrected volume.
2. Ascertain the multiplier for the LCD (typically CFx100). The flow indicator arrows will have a value of 1/10 of the display multiplier (or typically 10 CF).
3. When gas flows through the meter, the rolling icon symbol (if enabled) displays on the left-hand side of the LCD below the volume read with a sequence in the following pattern:

∇	Indicates 1st increment)
∇ ∇	Indicates 2nd increment)
∇ ∇	Indicates 3rd increment)
∇	Indicates 4th increment)
--------	(Blank corresponding to the 5th increment)

4. The sequence then starts over. You will see two of these sequences per increment of the volume display on the LCD.
5. Start the stopwatch as soon as the next icon shows on the LCD after you are ready to clock the meter.

6. Wait for at least 2 increments and 30 seconds. Using these as minimums should give good resolution to determine the flow rate. Stop the clock when the next icon increments.
7. Flow rate in actual cubic feet per hour (or uncorrected CFH) is calculated by:

   Flow rate = (3600/time in seconds) * (# increments * volume per increment)

For example, using CFx100 as the displayed multiplier and 10 CF as the icon increment, the flow rate would be calculated:

∇	(Indicates 1 increment, or 10 CF)
∇ ∇	(Indicates 2 increments) → Start stopwatch
∇ ∇	(Indicates 3 increments)
∇	(Indicates 4 increments) → Stop stopwatch
--------	(blank corresponding to the 5th increment)

The system took 36 seconds for two increments or 20 cubic feet. Flow rate is calculated:

Flow rate = ((3600 seconds/hr) /(36 seconds)) * (2 increments* 10 CF/increment)

= (3600/36) * 20 CF

= 100/hr * 20 CF = 2000 CFH

To determine comparison differential from graphs

1. Note the flange size of the meter and the line pressure.
2. Based on these values, select the appropriate graph from Graph 8.1 to Graph 8.15 (see Differential Pressure Curves on page 87).
3. Follow the appropriate curve to the point that matches the differential (in inches w.c.).
4. Determine from the curve the flow rate based on your flange size and pressure conditions.

Calculating Accuracy

To determine accuracy, we compare the desired flow rate (based on the line pressure, flange size, and differential) to the actual flow rate the meter measured (based on clocking or interrogating the meter).

Variables difficult to control or measure introduce error (see Test Result Factors on page 86). Consider variables when you compare the measured flow rate against the desired flow rate range. To mitigate difficult or uncontrollable variables, use a range of +/- 10% of the differential and use the range of flow it represents.

Example:

Suppose a 0.50" differential measurement was taken on a 2" FM2 meter with a line pressure of 10 psig. From the appropriate chart, applying a differential range of .45" to .55" w.c. gives an approximate expected flow rate range of 1900 to 2100 CFH. Assuming we clocked the meter at 2000 CFH (as in the example), we see the measured flow rate is in line with the expected flow rate. From this, we assume the meter is measuring properly.

Note Ask your Itron sales representative for a Microsoft® Excel-based graphing tool to facilitate your differential testing.

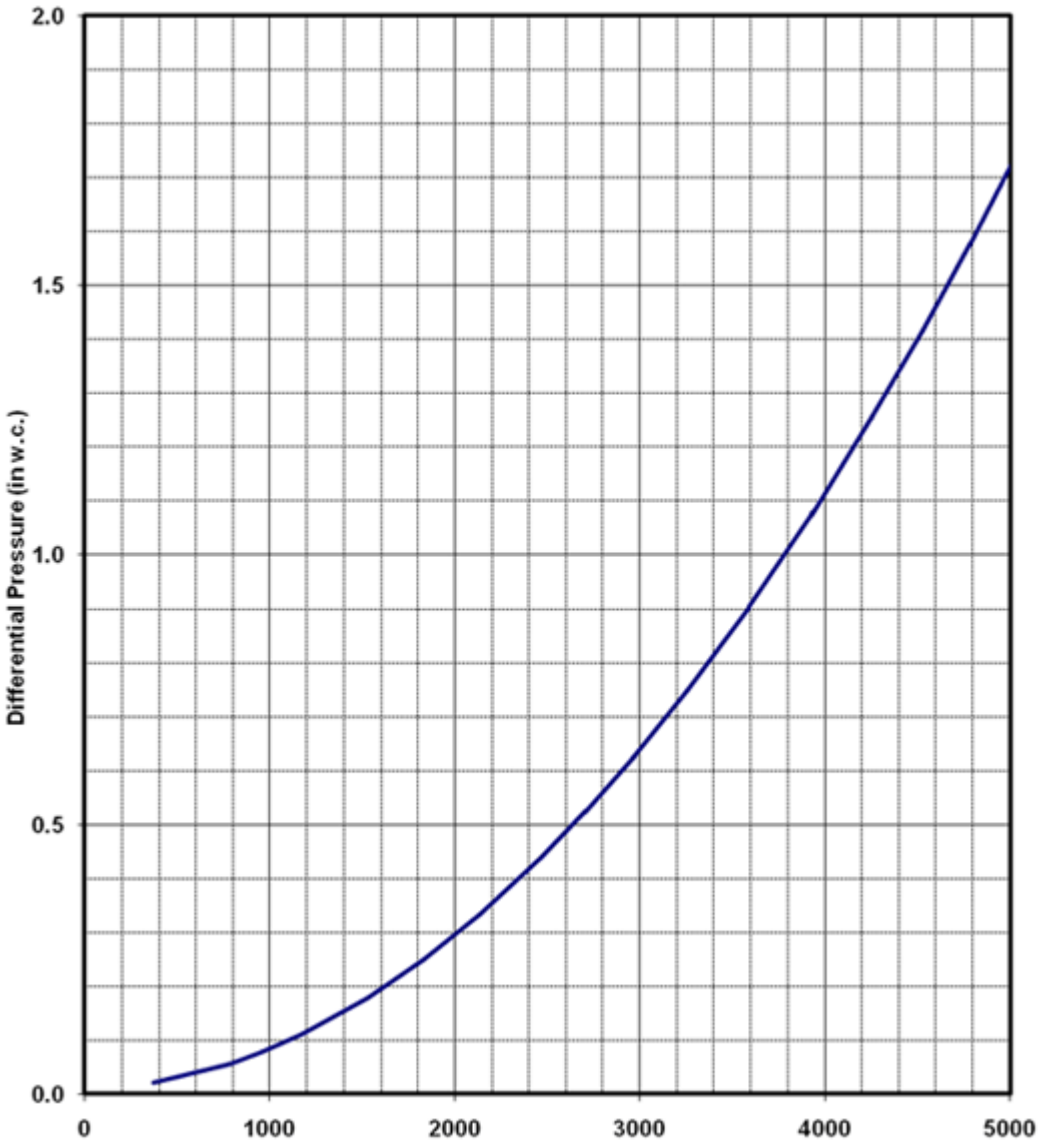
Test Result Factors

Meter model, flow rate, line pressure, and measured differential pressure are used to make Dattus accuracy calculations. These values provide a guideline to ensure the Dattus is operating and measuring properly. There are a number of factors that can skew differential versus flow rate calculation results:

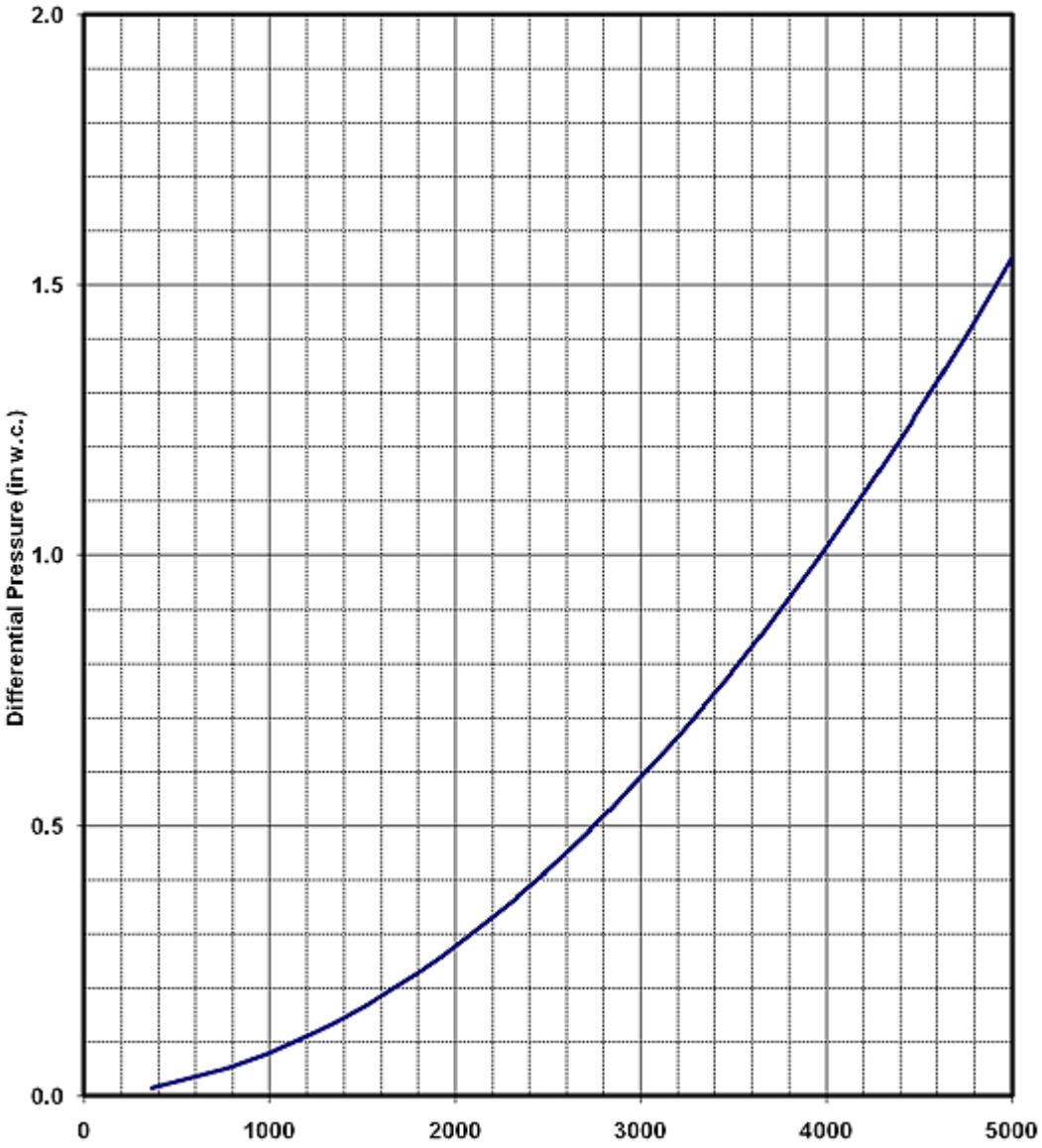
- Specific gravity. All graphs assume 0.6 specific gravity gas. A variation 0.58 to 0.62 represents a 7% range in differential pressure at a given flow rate.
- Dattus body. The graphs represent average differential. There are slight variations meter to meter that can account for as much as 1% variation in differential pressure.
- Pressure Gauges. There is an error range (associated with the gauges) used to determine line pressure and differential pressure.
- Line Pressure. There is an error associated with an uncharted line pressure. For example, we measure the 5.2 psig but use the 5 psig graph. This can be factored out.
- Atmospheric Pressure. The differential was determined at the factory by a pulling a vacuum on the meter at the prevailing atmospheric pressure (approximately 14.5 psi) when the tests were conducted. If the atmospheric pressure at the site is significantly different, there will be a noticeable effect on the differential relative to flow rate.

Dattus Differential Pressure Curves

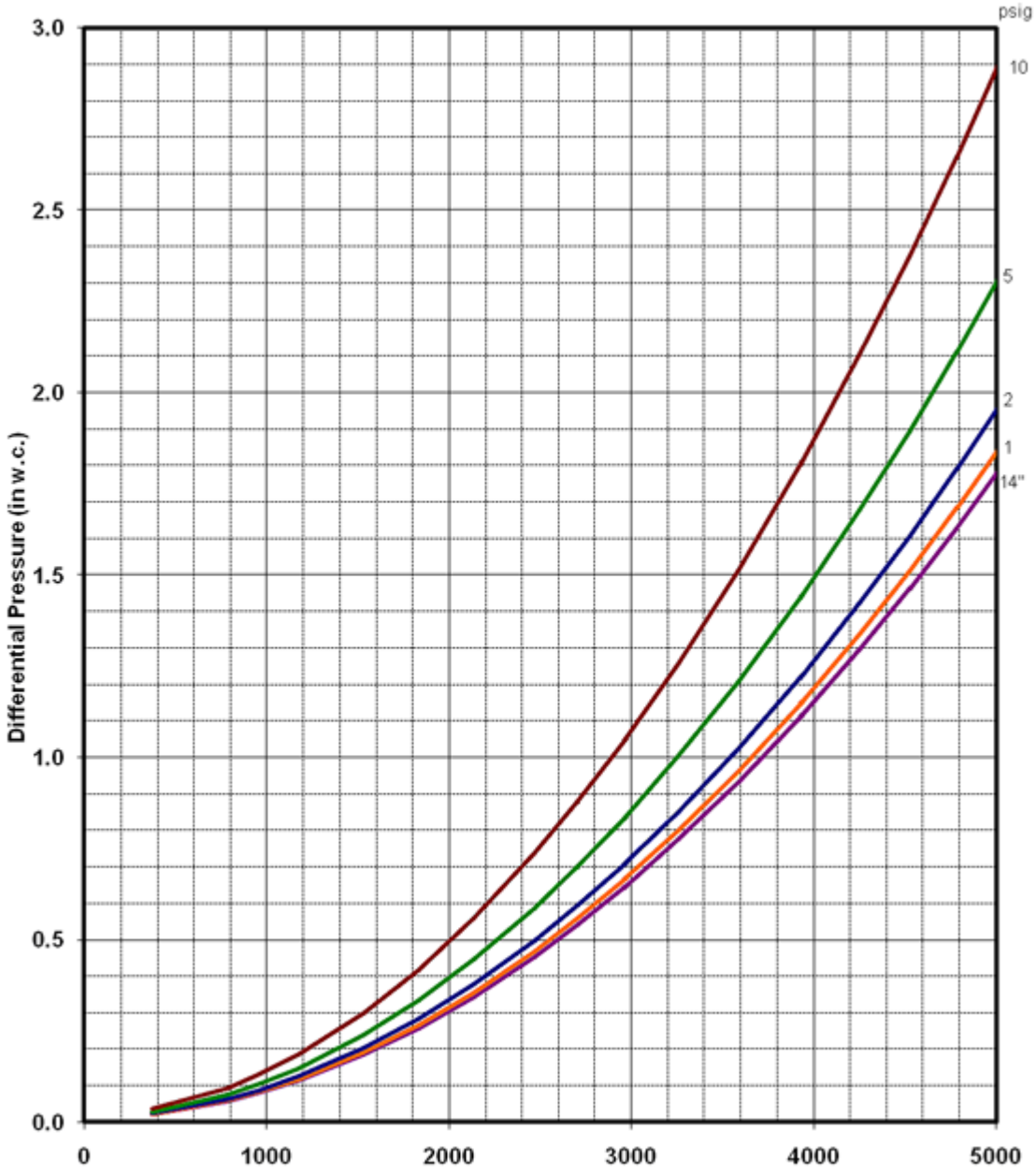
Graph 8.1: Dattus FM2 2" at Atmospheric Pressure



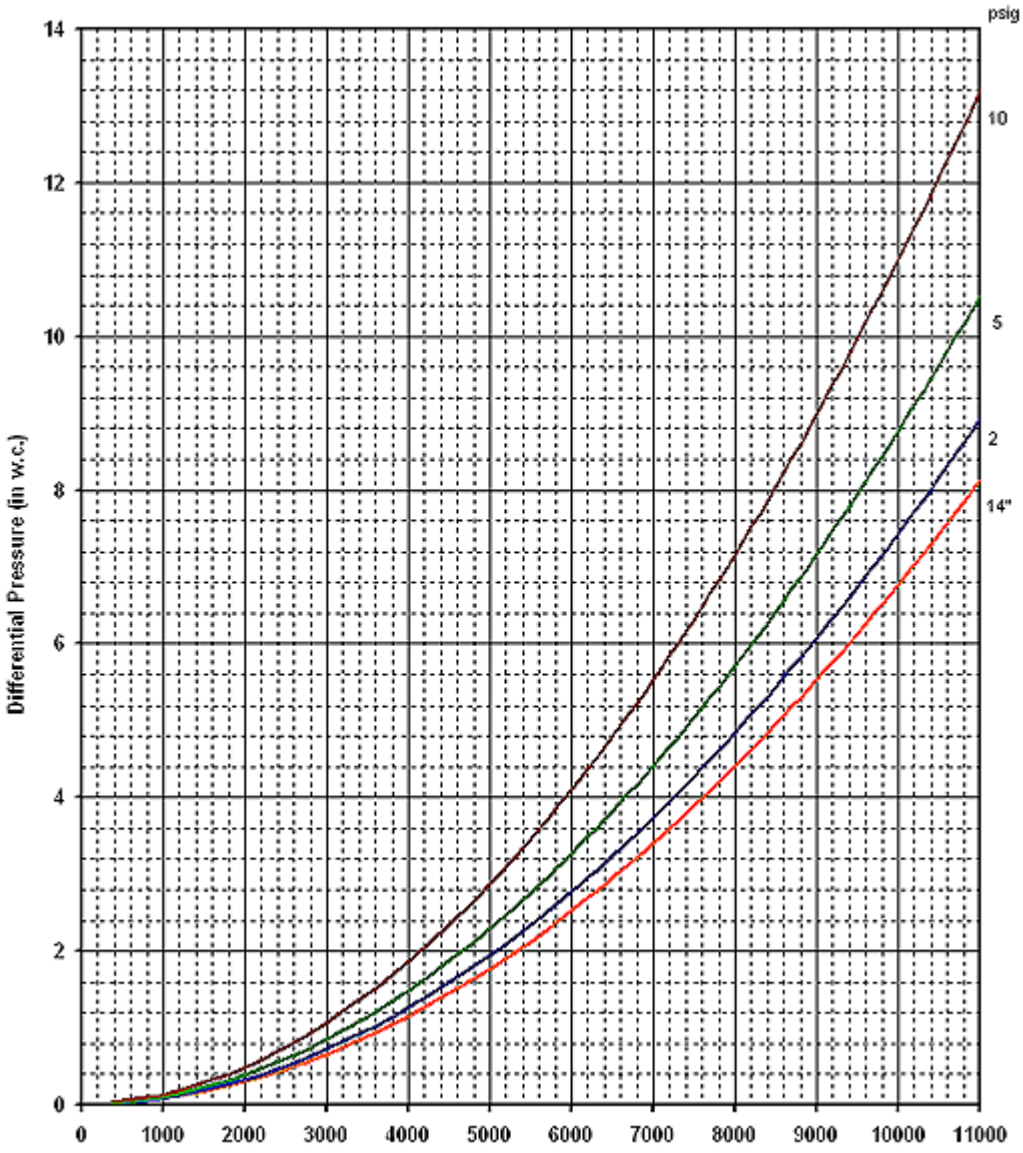
Dattus FM2 3" at Atmospheric Pressure



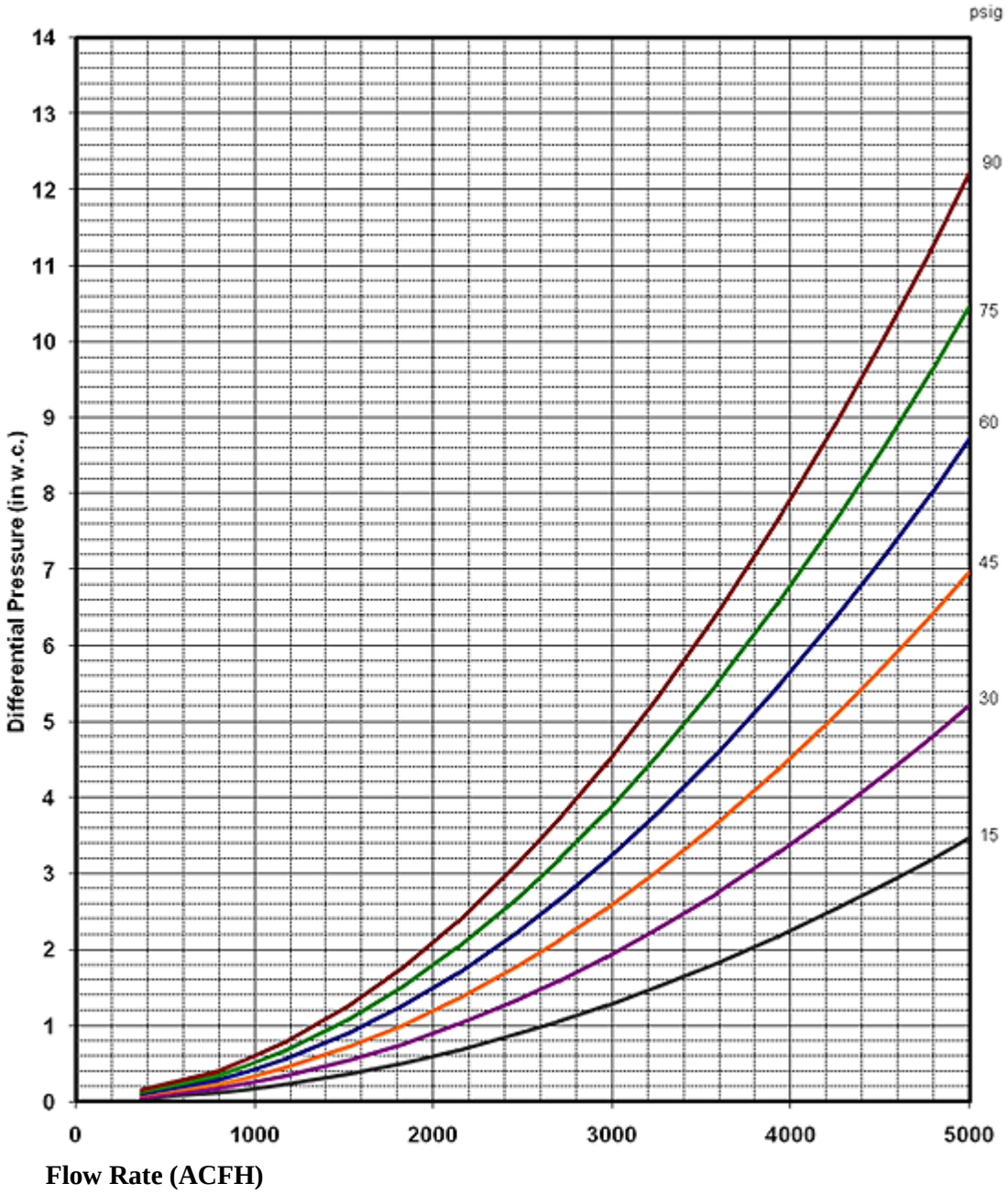
Dattus FM2 2" at Medium Pressures (up to 5000 ACFH)



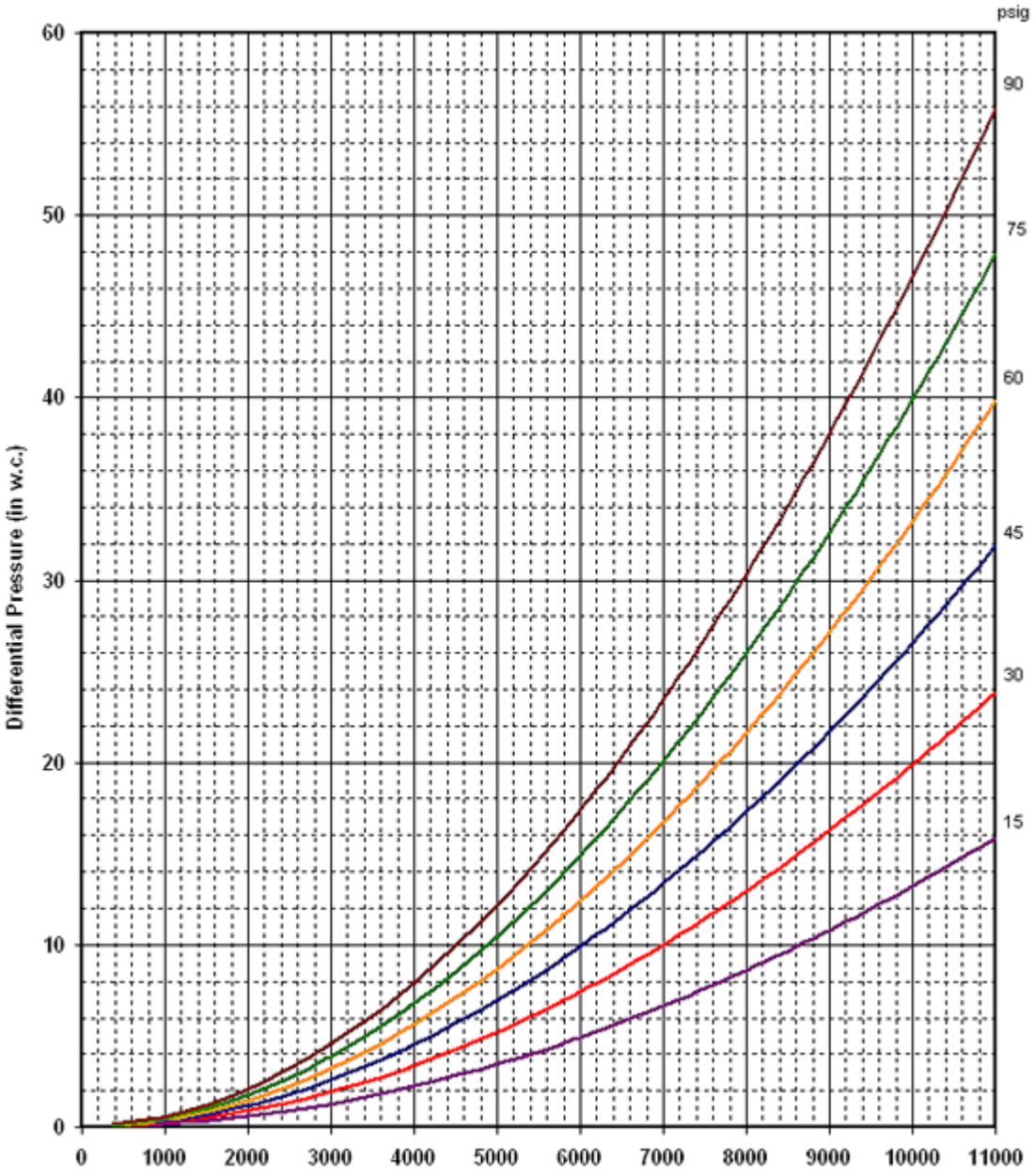
Dattus FM2 2" at Medium Pressures (up to 11,000 ACFH)



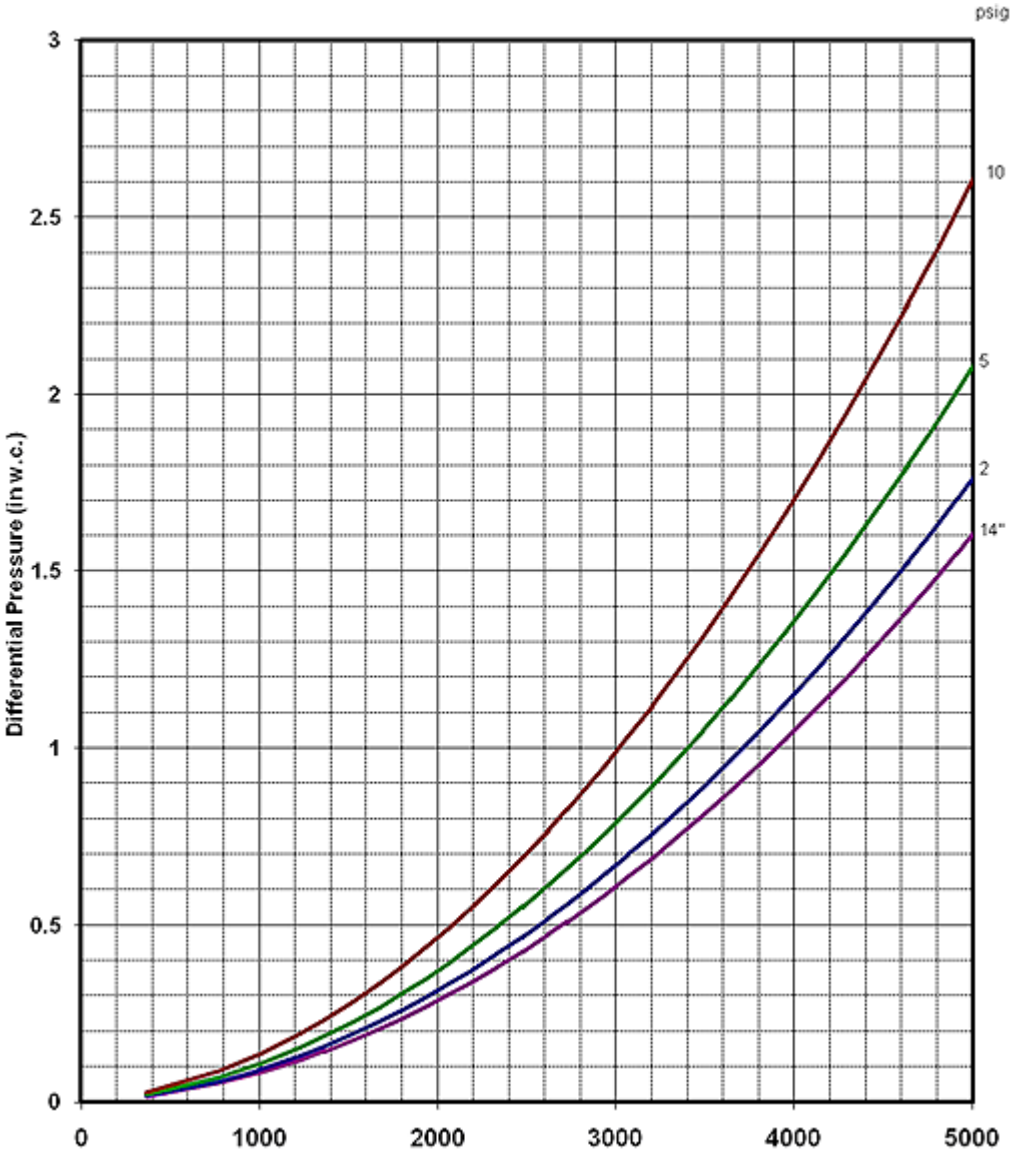
Dattus FM2 2" at Higher Pressures (up to 5000 ACFH)



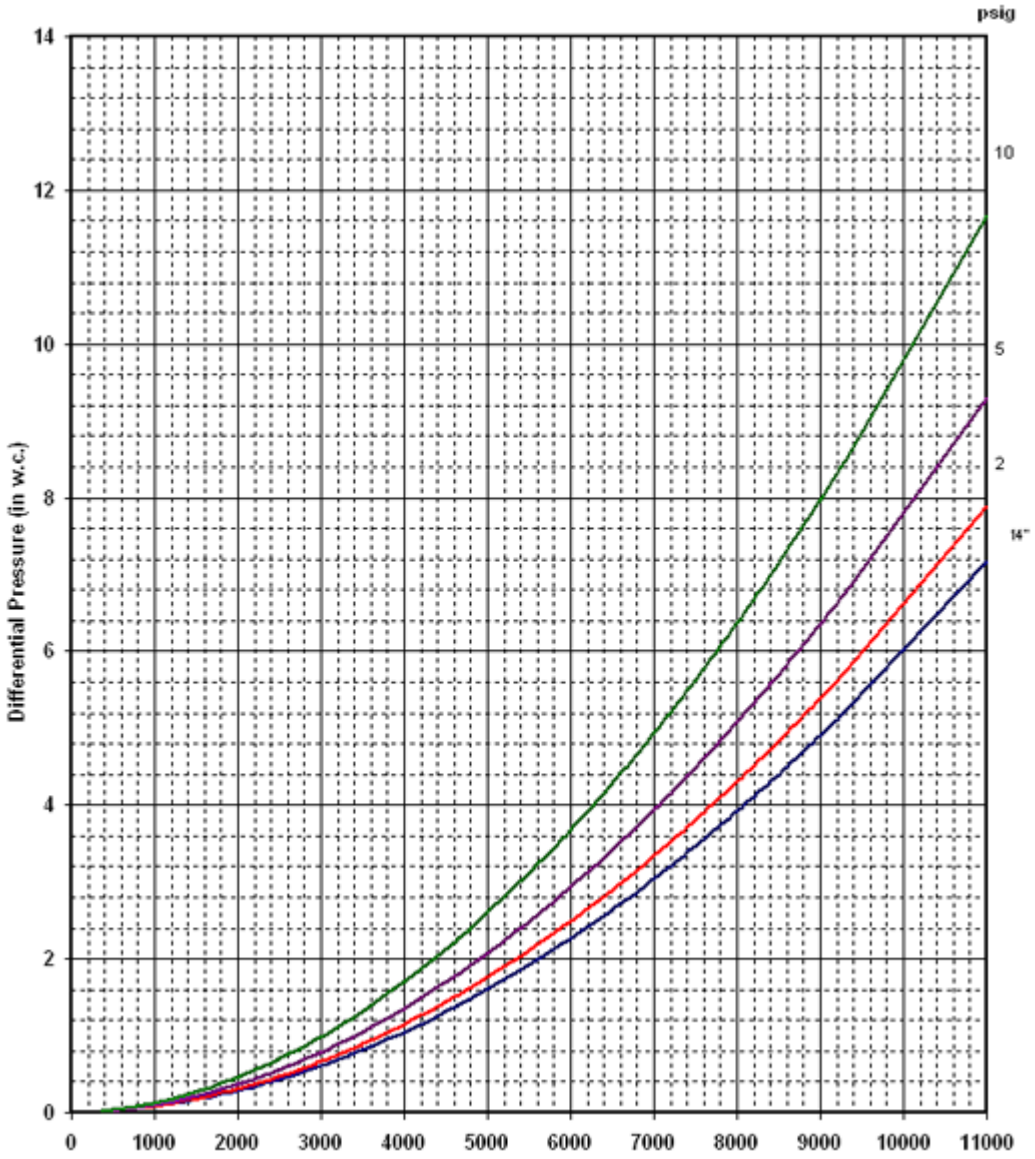
Dattus FM2 2" at Higher Pressures (up to 11,000 ACFH)



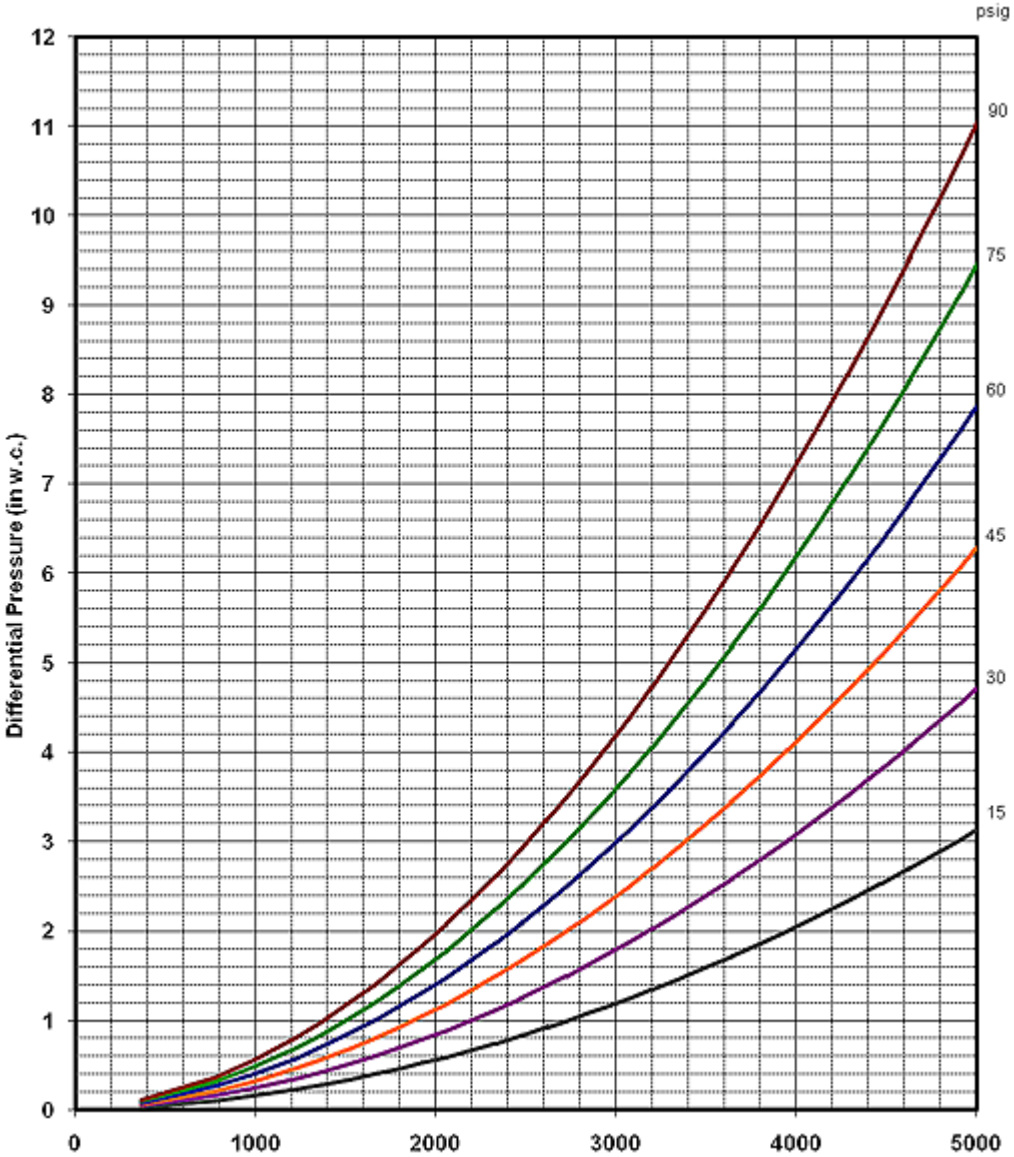
Dattus FM2 3" at Medium Pressures (up to 5000 ACFH)



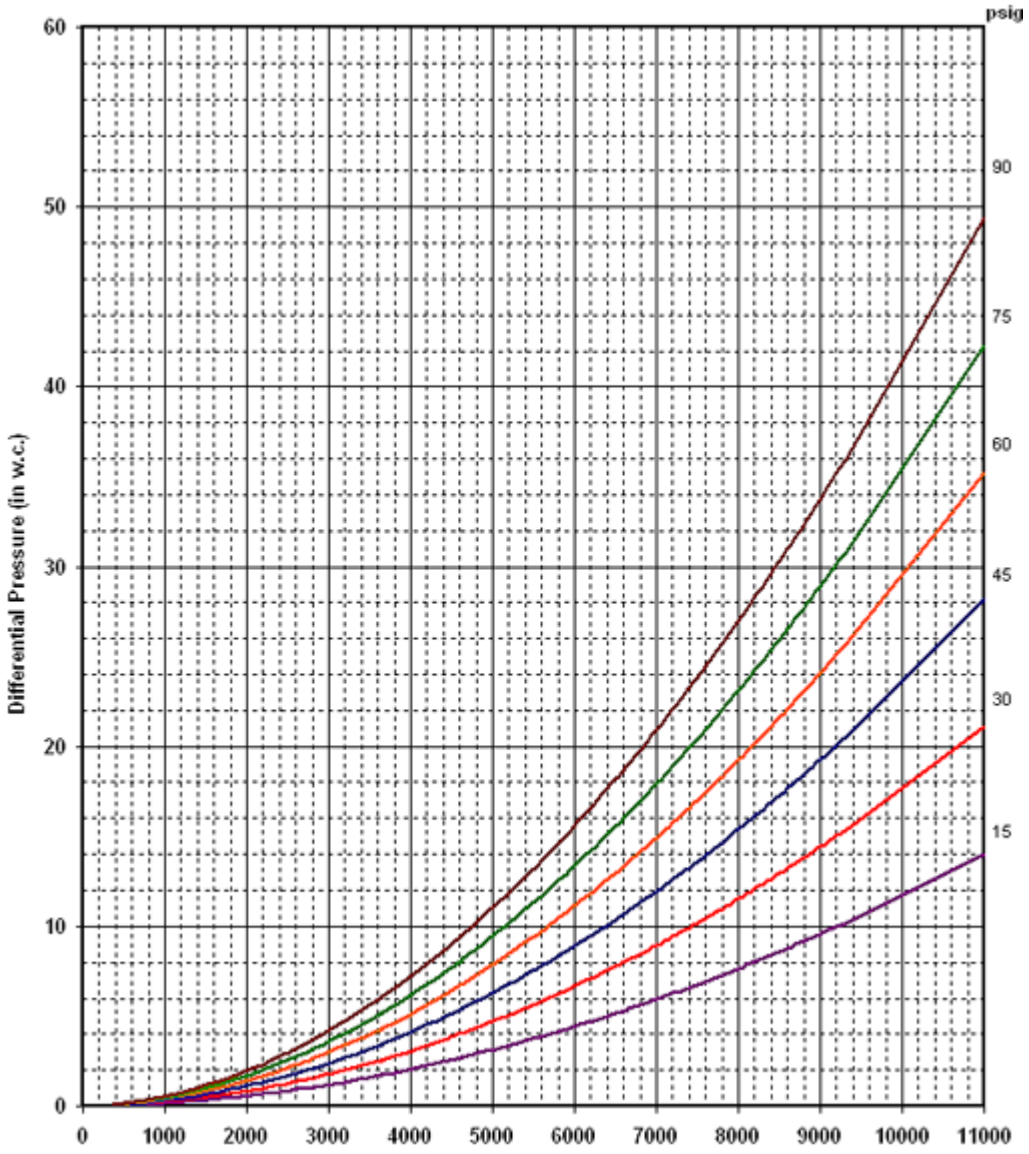
Dattus FM2 3" at Medium Pressures (up to 11,000 ACFH)



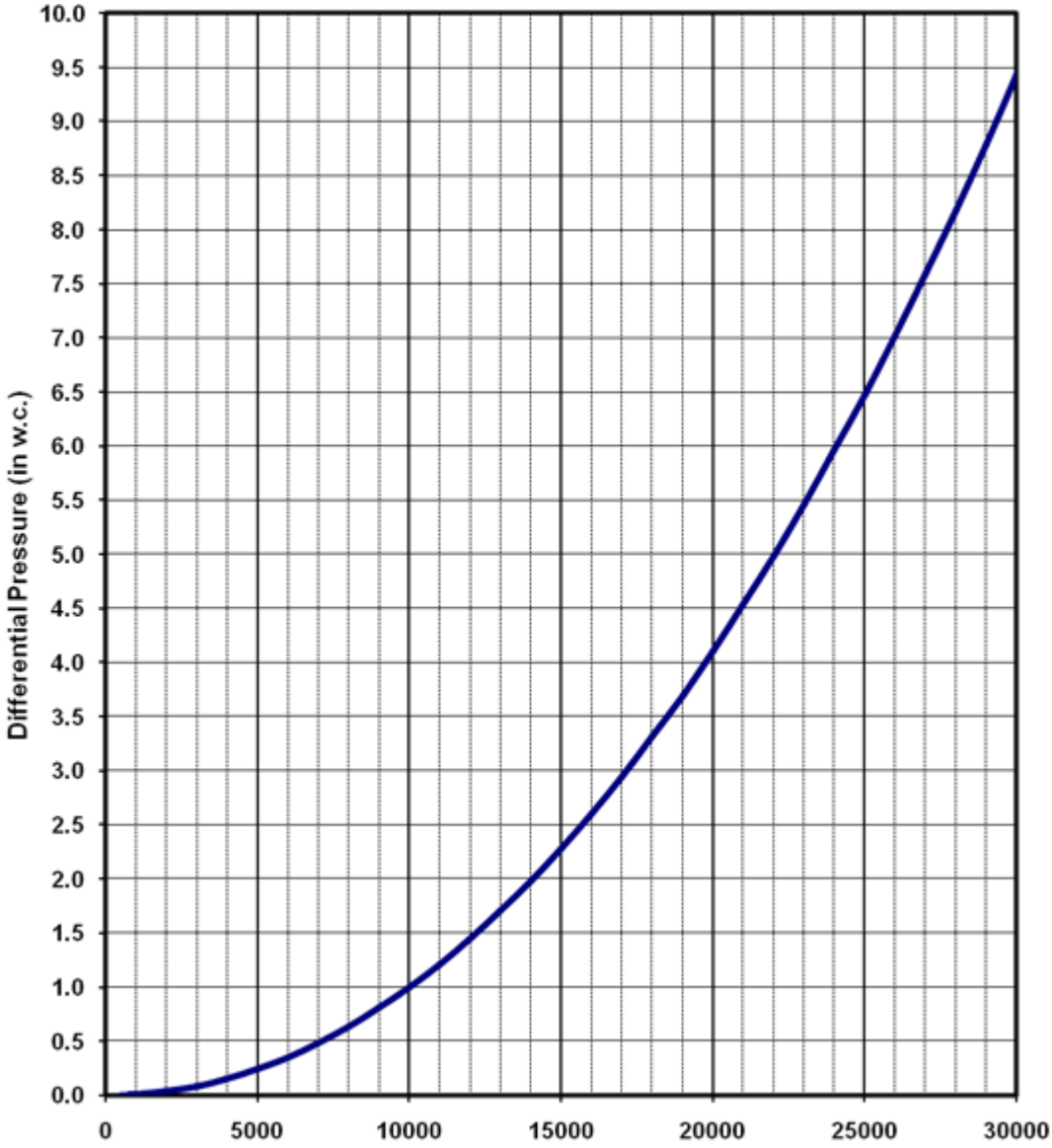
Dattus FM2 3" at Higher Pressures (up to 5000 ACFH)



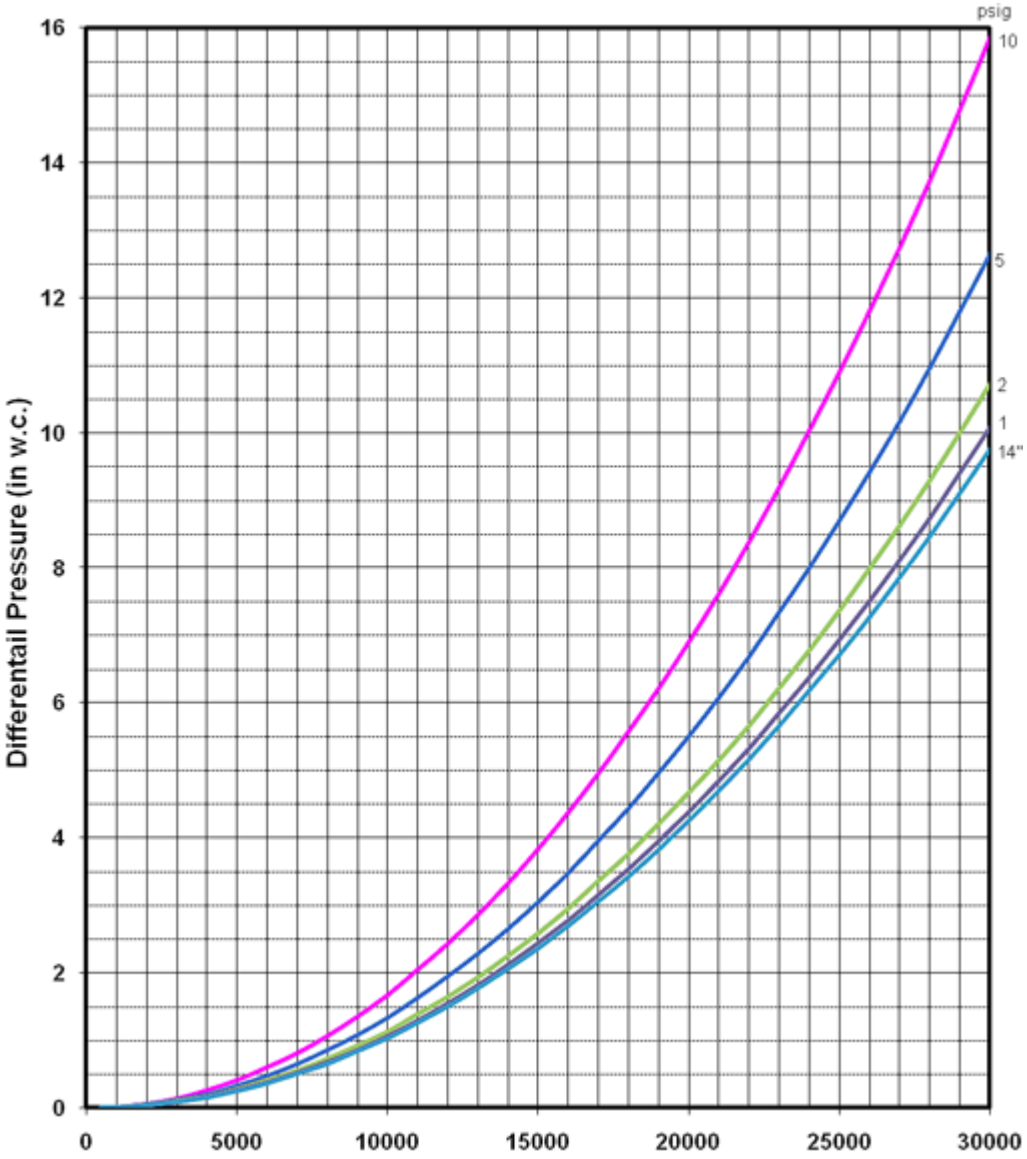
Dattus FM2 3" at Higher Pressures (up to 11,000 ACFH)



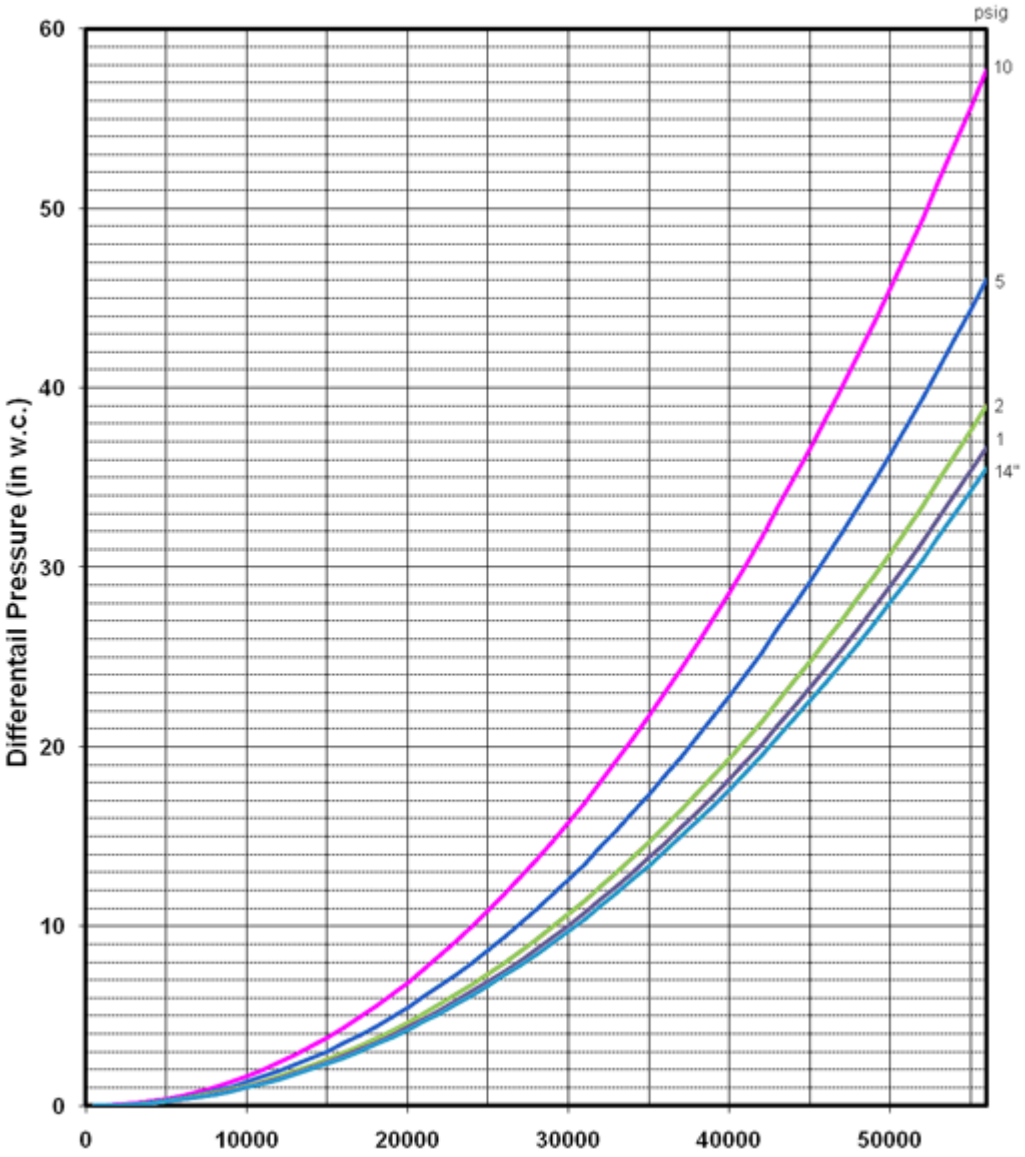
Dattus FM3 4" at Atmospheric Pressure



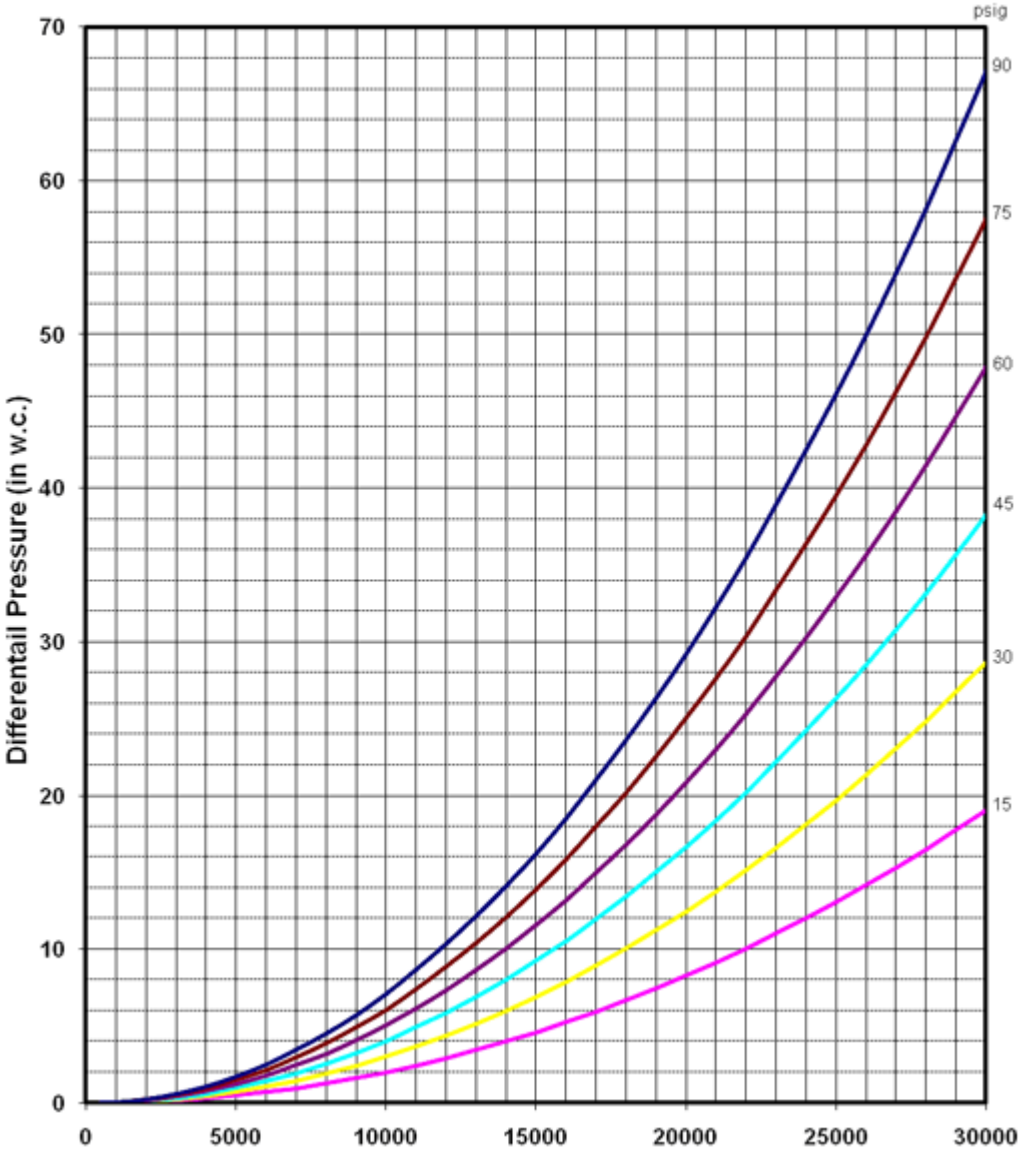
Dattus FM3 4" at Medium Pressures (up to 30,000 ACFH)



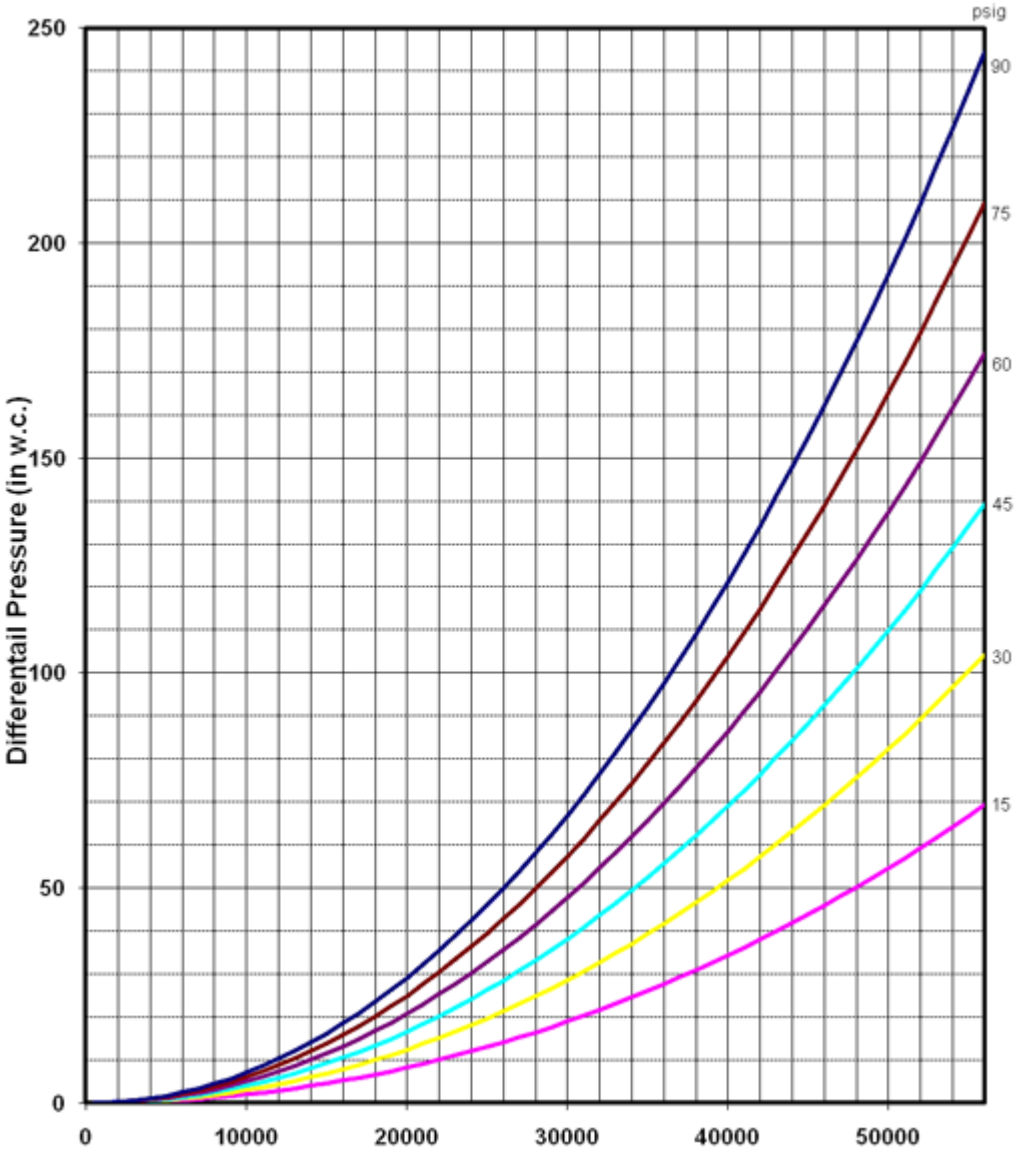
Dattus FM3 4" at Medium Pressures (up to 56,000 ACFH)



Dattus FM3 4" at Higher Pressures (up to 30,000 ACFH)



Dattus FM3 4" at Higher Pressures (up to 56,000 ACFH)



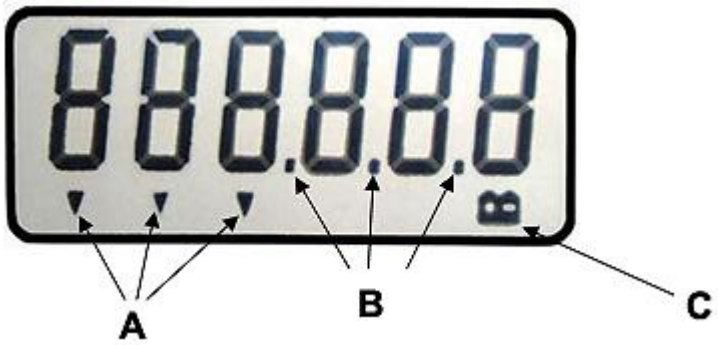
CHAPTER 9

Alarms

Determine the alarm status or alarm history of the Dattus meter visually through alarm indications on the LCD, through PCLink communications to the meter, or through configured pulse outputs (see Pulse Outputs).

Liquid Crystal (LCD) Display

This chapter focuses on the LCD Display's Alarm and Battery indicators. For general LCD information, see LC2 Liquid Crystal Display (LCD) on page 18. For LCD Flow Indicator information, see and Determining Flow Rate on page 84.



A Flow Indicators
B Alarm Indicators
C Battery Indicators

Live / Saved Alarms (LC2)

Alarm Indicator

Live Alarm. Three decimal points flash in the event of a live alarm.

Saved Alarm. Three decimal points are a constant ON.

The alarm description flashes on the LCD display every 12 seconds.

Battery Indicator

A flashing battery indicator signals a low battery alarm.

All alarms are recorded in the Dattus meter's Event Log. A visual alarm indication is shown on the PCLink Status Tab.

Caution Inactive saved alarms may be automatically cleared from the LCD, dependent on the Dattus programming configuration. Automatically clearing inactive alarms is enabled or disabled using PCLink.

LC2 Alarms

LCD Alarm Display	Description	Action
000.0.0.0 	Low Battery Alarm. Indicated by a flashing battery symbol. Change the primary, secondary, or both batteries.	Replace meter batteries (at a minimum, replace the primary battery).
0 - F.L.0. 	Overflow Alarm. Indicates one of two alarms. Overflow. User configurable for desired flow (as long as it is less than the meter's maximum capacity). Over Device Limit. Indicates meter exceeded the maximum capacity.	Over Device Limit typically caused by temporary high gas flow (usually occurs at installation startup) or the Dattus is undersized for this application and should be upgraded or replaced with larger capacity meter.
SEN.S. - . 1 	Sensor 1 Failure. Indicates sensor pair 1 is broken (failed) or it is disconnected from the electronics.	Dattus will operate on secondary sensor pair. To ensure redundant sensors, repair sensor pair 1.
SEN.S. - 2 	Sensor 2 Failure. Indicates sensor pair 2 is broken (failed) or it is disconnected from the electronics.	Dattus will operate on primary sensor pair. To ensure redundant sensors, repair sensor pair 2.
- HE.L.P. - 	HELP. Indicates both sensor pairs are broken or are disconnected from the electronics, measurement is stopped. HELP will remain on the LCD until the unit is repaired.	Dattus is not operational. Repair is required.
- SYNC - 	SYNC. Indicates a synchronization problem between the measurement electronics and the LCD.	Usually temporary. Displays after installing new batteries or during a top of the hour synchronization. If SYNC remains displayed, there may be a problem with the circuit board or connection. Repair is required.
Error 	Error. Indicates either a bad pressure or bad temperature reading.	Log on to the meter and view the Corrector side status tab. If the problem persists, check the temperature and/or pressure. Thresholds may need adjustment.

Live/Saved Alarms (DS1)

Alarms are classified as Live or Saved and are displayed numerically.

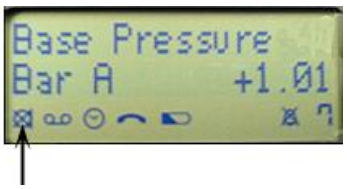
Live Alarm DS1

Saved Alarm DS1

Coded alarms are deciphered through the Alarm Decoder.

Caution Inactive saved alarms may be automatically cleared from the LCD, dependent on the Dattus programming configuration. Automatically clearing inactive alarms is enabled or disabled using PCLink.

DS1 Display Alarms

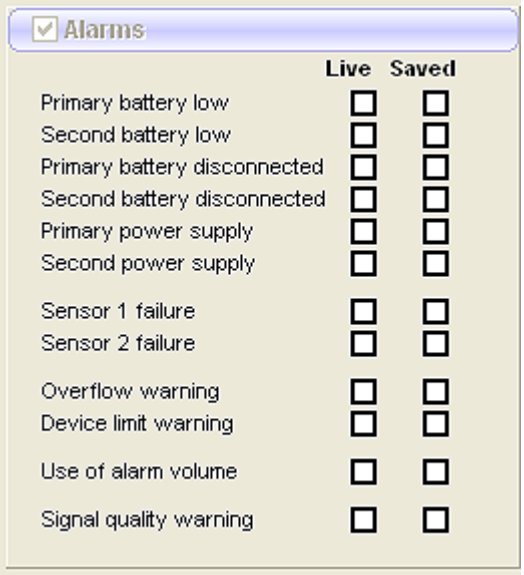
LCD Alarm	Description	Action
	**X-filled circle**. Indicates synchronization between the DS1 board and the DM2 board is requested.	This alarm is briefly displayed onscreen. If the icon remains indefinitely, contact Itron Technical Support.
	**Clock**. The corrector is checking for scheduled tasks.	This alarm should frequently display around the top of the new hour.
	**Phone**. Indicates an RS-232 communication attempt.	This alarm displays during a logon attempt. It does not indicate a problem.
	**Battery**. Indicates low power for primary, secondary, or both batteries.	This alarm signals a need to replace (at least) the primary battery. If this alarm displays before the fifth-year of use, investigate for a potential problem.
	**Bell**. Indicates a live corrector alarm.	Log on to the Dattus meter (using PCLink) to view the Corrector status tab to investigate the alarm's nature.
	**x-filled bell**. Indicates a saved DS1 alarm(s). **Note** If live alarms are also present, the bell-X symbol will remain displayed.	Log on to the Dattus meter (using PCLink) and clear all saved alarms.

Using PCLink to View Alarms

Note See PCLink Software Basics for information regarding installation and log on to the Dattus meter using PCLink.

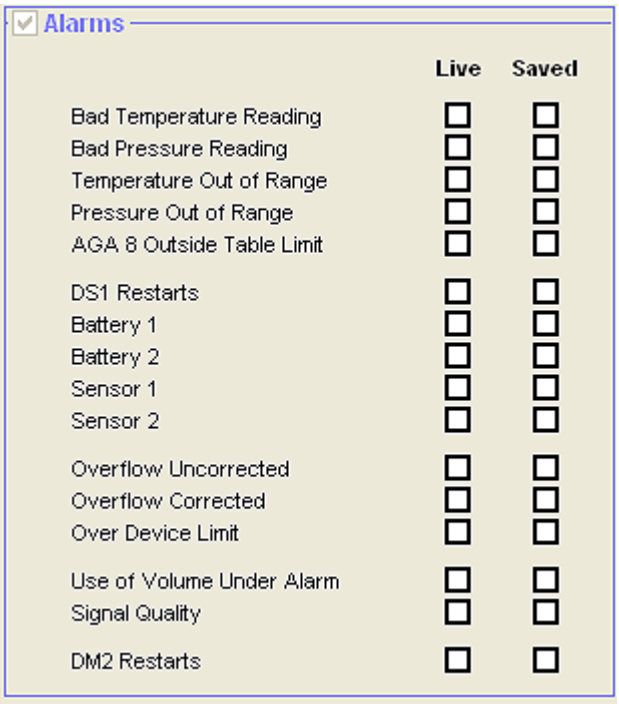
Meter (DM2) Alarms

Primarily read-only, the Status tab in PCLink provides alarm status information.



Alarm	Description
Primary battery low	Triggered when the battery voltage goes below 3.1V.
Second battery low	Triggered when the battery voltage goes below 3.1V.
Primary battery disconnected	Indicates either a disconnected battery or very low voltage.
Second battery disconnected	Indicates either a disconnected battery or very low voltage.
Primary power supply	Indicates a disconnection, very low voltage, or primary power circuit problem.
Second power supply	Indicates a disconnection, very low voltage, or secondary power circuit problem.
Sensor 1 failure	Indicates a disconnected or broken Sensor 1 pair.
Sensor 2 failure	Indicates a disconnected or broken Sensor 2 pair.
Overflow warning	Indicates the flow rate exceeded the user programmable quantity. Refer to Meter Volumes (Volumes Tab).
Device limit warning	Indicates the flow rate exceeded the maximum capacity of the meter.
Use of alarm volume	Indicates volume registration into the *volume under alarm* register (refer to Meter Volumes (Volumes Tab). This is rarely used.
Signal quality warning	Indicates erratic sensor oscillation detection to the degree that the erratic sensor oscillation is compromising accuracy.

Corrector (DS1) Alarms



Alarm	Description
Bad Temperature Reading	Indicates a temperature probe misread.
Bad Pressure Reading	Indicates a pressure reading misread.
Temperature Out of Range	Indicates temperature is out of configured threshold range limits.
Pressure Out of Range	Indicates pressure is out of configured threshold range.
AGA 8 Outside Table Limit	Indicates AGA 8 value is not listed in the generated table.
DS1 Restarts	Indicates the DS1 board rebooted.
Battery 1	Indicates a low battery 1 reading.
Battery 2	Indicates a low battery 2 reading.
Sensor 1	Indicates sensor 1 is damaged.
Sensor 2	Indicates sensor 2 is damaged.
Overflow Uncorrected	Indicates the corrected flow rate exceeds the meter's capacity.
Overflow Corrected	Indicates the corrected flow rate exceeds the user programmed value.
Over Device Limit	Indicates the flow rate exceeds the meter capacity.
Use of Volume Under Alarm	Indicates the volume accumulated during an alarm.
Signal Quality	Indicates the sensor detected erratic oscillation that is compromising accuracy.
DM2 Restarts	Indicates the DM2 board rebooted.

Using PCLink to Reset Alarms

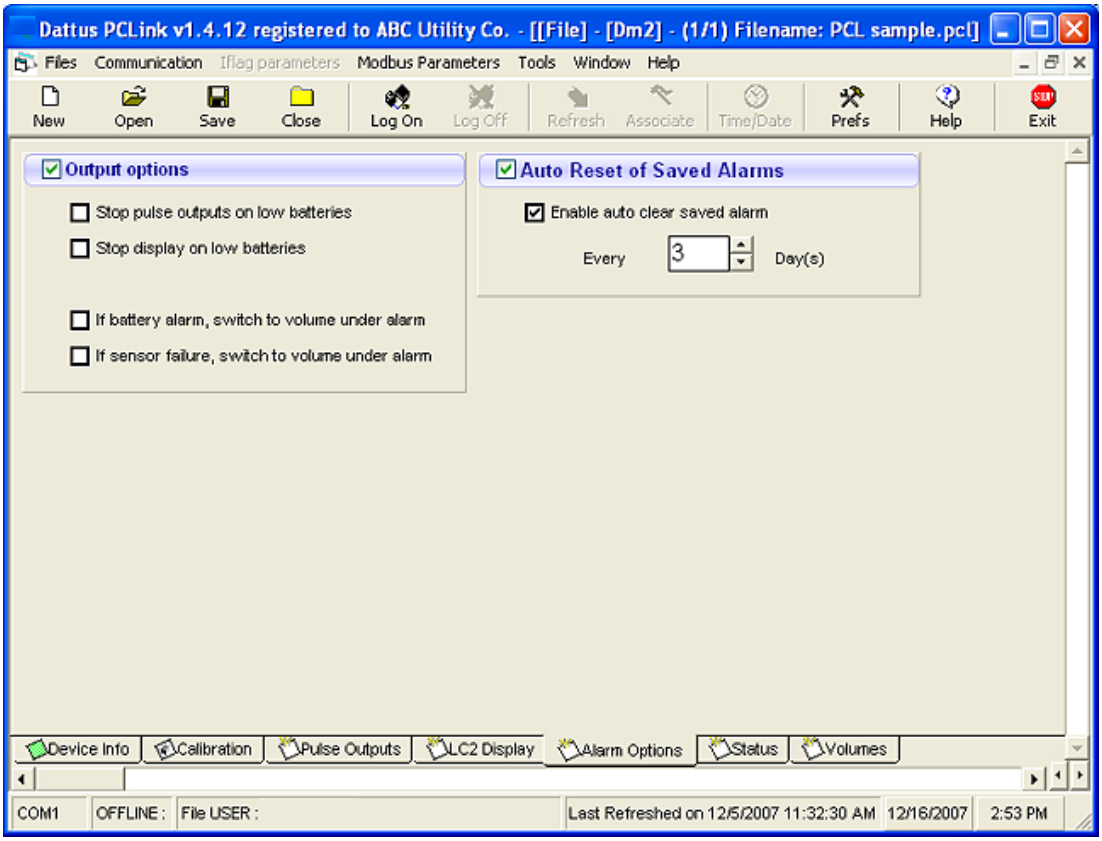
Note This section applies primarily to saved alarms. Unless the cause of the live alarm is eliminated, the saved alarm will typically display again at the top of the next hour (dependent on alarm type).

There are two methods for clearing or resetting Dattus alarms.

1. Automatically clear saved alarms after a set number of days through a configuration setting.
2. Manually log on to the Dattus using PCLink and reset the alarms.

Alarm Options

PCLink's **Alarm Options** configuration tab allows users to configure the Dattus to automatically reset any saved alarms after a programmed number of days (between 1 and 15). Refer to the following figure.

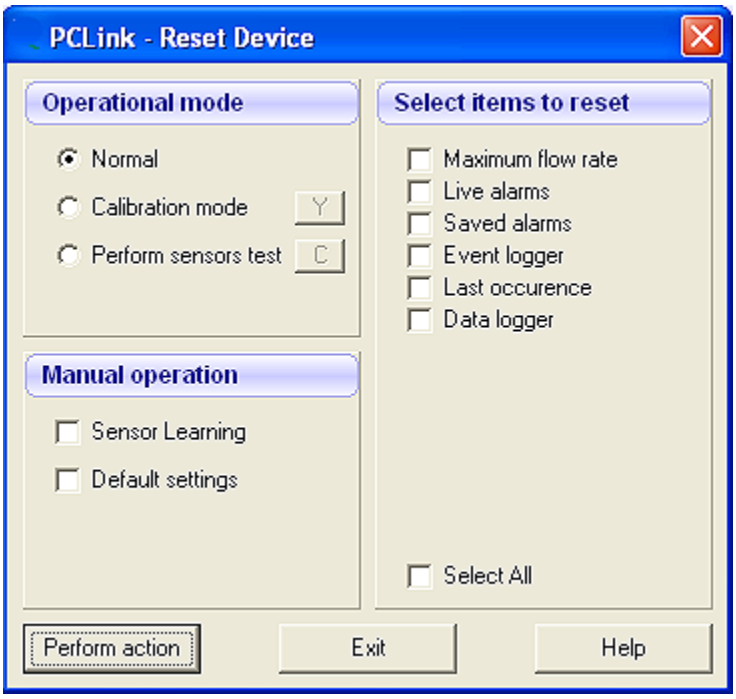


To manually reset Alarms using PCLink

1. Log on to the meter using PCLink. Go the **Status Tab** (either the Meter or Corrector Status tab). The **Reset** icon is available only when the **Status Tab** is active.

2. Click the **Reset** icon.

Note Clicking the **Reset** icon will display the Reset Device dialog.



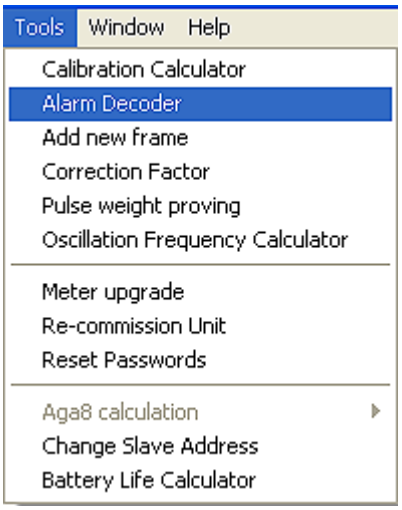
3. Select the items to clear in the **Select items to reset** area.
4. After selecting the items, click the **Perform Action** button to reset the alarms or clear recorded information.

PCLink Alarm Decoder

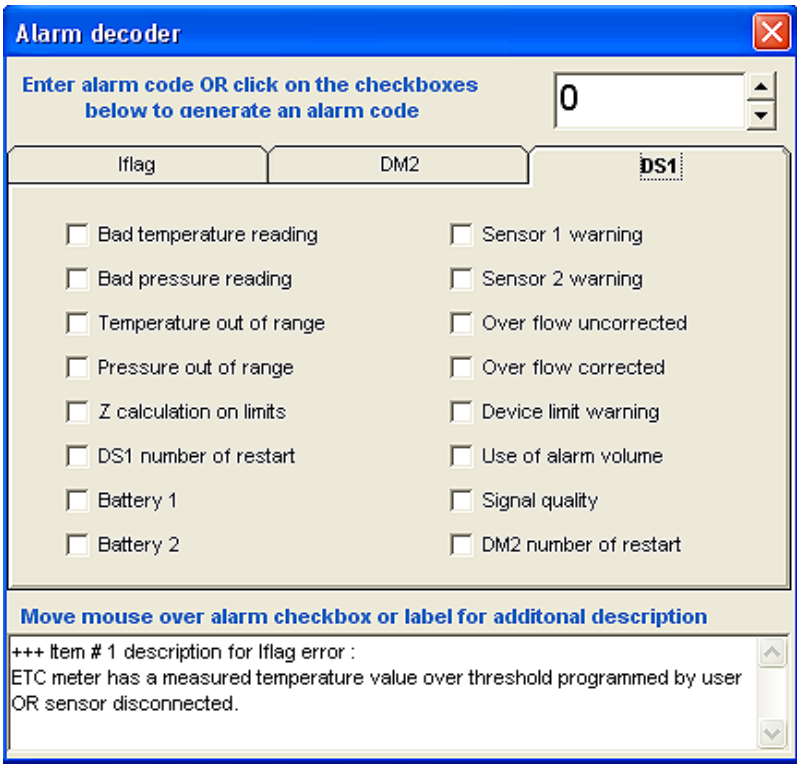
While the alarm indicators displayed on the meter indicate an active or saved alarm, they do not tell the exact nature of the alarm. By default, most Dattus Corrector meters are configured to display live and saved alarm codes for the meter. To decipher the meaning of the codes, use the PCLink Alarm decoder. The Alarm Decoder does not require a connection to the meter and no log on action is required during the process.

To access the Alarm Decoder

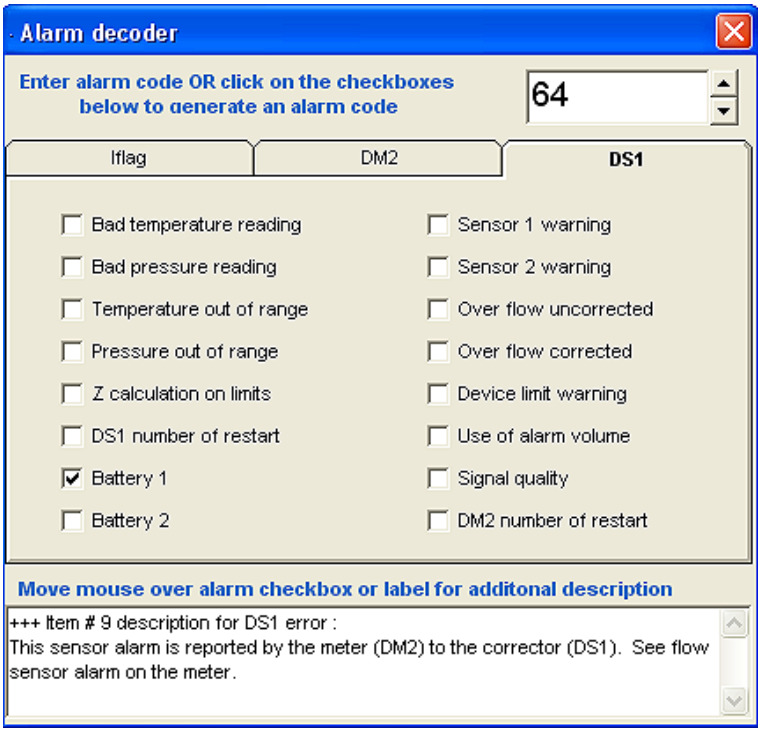
1. Open PCLink. Select **Tools** > **Alarm Decoder**.



2. After the Alarm Decoder opens, select the **DS1** Tab.



3. Enter the alarm code number in the upper right text box.



4. A corresponding check mark(s) displays next to the associated alarm.

CHAPTER 10

Dattus Pulse Outputs Overview

This chapter describes the software configuration for Dattus pulse outputs and provides schematic basics to connect the Dattus using a pulse output cable to auxiliary devices.

Required Materials

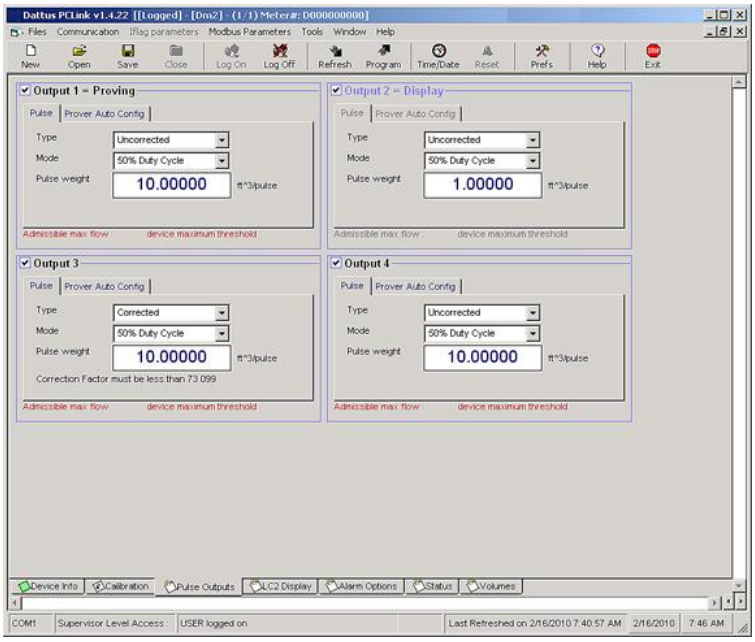
Connecting pulse outputs from the Dattus meter requires:

- Pulse output cable.
- Computer running PCLink software.
- Communication cable.
- Any additional items to run cable or connect auxiliary devices.

If the pulse outputs were configured at the factory, communications to the Dattus are not required; simply make the physical connections (see the Certificate of Calibration on page 143 to verify factory configured pulse outputs).

Output Channel Overview

The Dattus meter is equipped with four pulse output channels. Pulse output configuration (factory programming) is listed on the Certificate of Calibration included with each Dattus meter.



The following table describes the four pulse outputs.

Output Channel	Purpose
Output 1	Output 1 is physically wired to prove/calibrate the Dattus meter with the transfer proving cable (Itron part number). It may be used for any user applications/purpose.
Output 2	Output 2 communicates information from the metrology board (DM2) or Corrector (DS1) to the display (LCD readout). Output 2 is not configurable through the pulse output tab. Output 2 may be used (piggybacked) providing output configuration meets the user's needs.
Output 3	Output 3 is a customer output channel and offers the most flexibility. Output 3 is designed specifically for user configuration.
Output 4	Output 4 is a customer output channel and offers the most flexibility. Output 4 is designed specifically for user configuration.

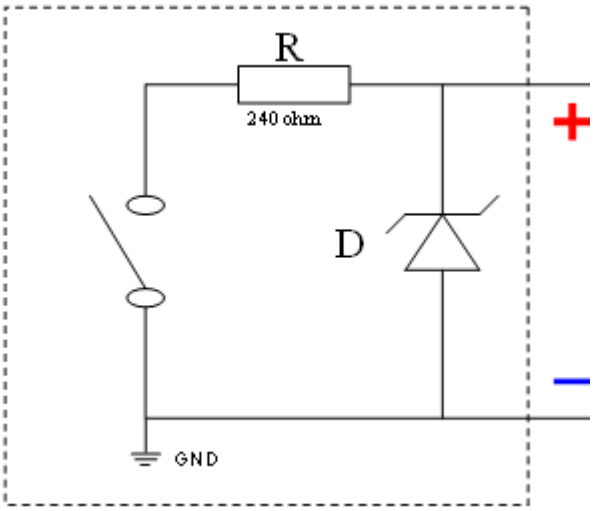
Electrical Schematic and Connection Specifications

Dattus meter output circuitry provides the following features:

- Non-isolated.
- Dry contact.
- Open drain N channel MOSFET.
- 240 ohm contact resistance (R).
- Common/negative connection to the meter body.
- Zener diode provides reverse current protection.

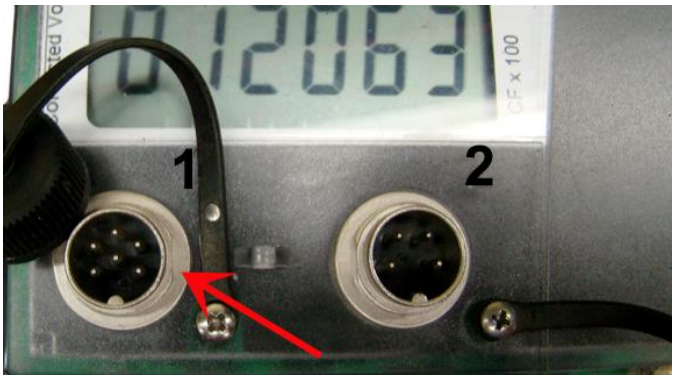
Specifications: output connections

- Up to 35 VDC DC voltage only.
- To maintain intrinsic safety (UL 913 CSA 22.2), up to 16 VDC.
- Maximum current of 25 mA.



Hardware Setup

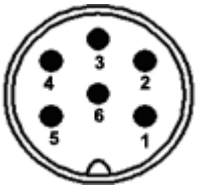
A meter connector provides the connection for the pulse outputs on the Dattus meter; a six-pin binder connector on the meter's face labeled *1*.



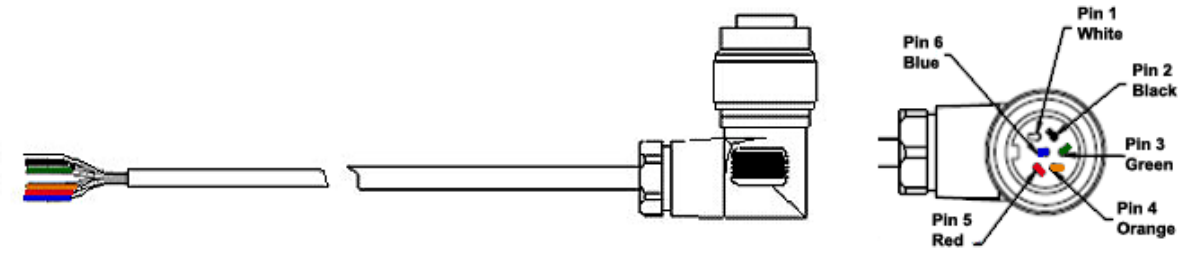
To use the pulse output, an output cable is required. Pulse output cables have a binder connector on one end (that screw onto the binder connector on the meter) and bare lead connections on the other end (to attach to the auxiliary device).

Standard pulse output cables

Pulse output cable length	Itron part number
10 feet	442461-005
20 feet	442461-006



Male binder connector pin-out



Pulse output cable

Pin	Wire color	Function
1	White	Output 2 (+)
2	Black	Output 4 (+)
3	Green	Ground (-)
4	Orange	Output 3 (+)
5	Red	Output 1 (+)
6	Blue	Ground (-)

Note The blue and green ground connections are tied together in the Dattus meter to the meter body. All channels have a common ground; they are non-isolated.

Addressing Special Applications

The standard output cable and setup are compatible for most applications however, in some applications, the Dattus meter's pulse outputs are not directly compatible with auxiliary devices. Special applications are more typical in industrial applications where a wide range of devices are used. For example:

- The 240 ohm contact resistance is higher than device allowable maximum.
- The device requires an isolated output.
- The device provides AC voltage.
- The device requires a wetted output.

For special applications, Itron offers a pulse cable option (with a built-in MOSFET transistor for contact resistance bypass). Pulse option cables have a binder connector on one end (that screw onto the binder connector on the meter) and bare lead connections on the other end (to attach to the auxiliary device). The pulse cable is a 3-wire connection, but will also work with 2-wire connections (to offer contact resistance bypass). This cable may be used in conjunction with a power supply (to address a wetted output application) or a power supply and relay (to address requirements for either an isolated output or an AC voltage application).

Itron optional pulse cables (open source P, Channel MOSFET and wetted output applications)

Pulse Cable Length	Itron Part Number
10 feet	442461-007
20 feet	442461-008

Itron pulse cables only connect to outputs 3 and 4 with output 3 providing the only connection with open source P – Channel MOSFET. Channel 4 is a standard output connection. The table below shows the 4 bare lead wires and their function for these cables.

Itron optional pulse cable bare wire leads and functions

Output	Wire color	Function
Output 3	Red	Power supply (+)
	White	Signal
Output 4	Black	Output 4 (+)
Common to both	Green	Power supply (-) and ground for outputs 3 and 4

Note Itron's optional pulse output cable's maximum power supply voltage is 18 VDC due to the transistor's operation and interaction with the output circuitry's zener diode.

Two wire connections

For applications with two wire connections (+ and -) for contact resistance:

- Connect the red wire to + on the device
- Connect both the signal (white) and ground (green) to the negative/common.

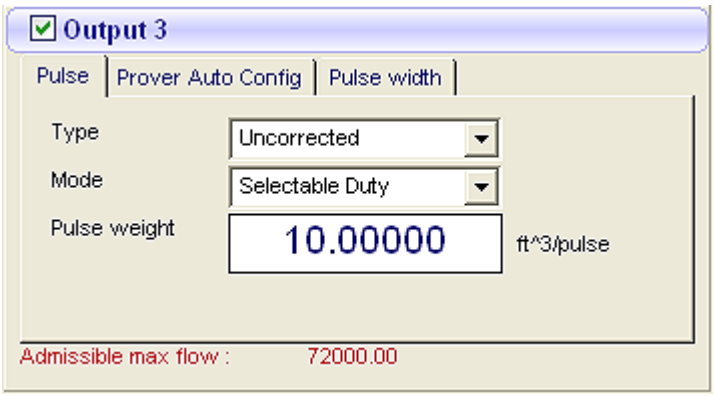
Using a relay with the optional pulse output cable

For some applications, Itron recommends the use of a relay in conjunction the pulse output cable to separate the auxiliary device circuit from the Dattus output circuit. These applications include:

- Auxiliary devices with voltage above 18V.
- AC powered devices.
- Devices that require an isolated output.

Pulse Output Channel Software Configurations

This section provides software configurations for output channels 3 and 4 because they are the most commonly used and configured channels for auxiliary equipment. The figure below shows an output pulse channel configuration example.



Type

Output Type	Description
None	Deactivates the channel output.
Uncorrected	Uncorrected volume output.
Mux uncorrected	Do not use.
Corrected	Corrected volume output. See Key Output Configuration Limitations on page 119.
Alarm	Activates a switch closure. Discrete output type.

Mode

Mode allows configuration of the pulse outputs operating modes. **Mode** is available for only Uncorrected or Corrected Pulse Types.

Output Mode	Description
Selectable Duty	Allows the user to specify the pulse width. Specifying a pulse width specifies the length of time the contact will close. See Selectable Duty
50% Duty Cycle	Selecting 50% Duty Cycle specifies the contact will close 50% of the time. 50% Duty Cycle does not impose a flow rate limitation. 50% Duty Cycle my cause more power drain on auxiliary equipment (dependent on configuration).
High Frequency (HF) Output	HF output frequency is proportional to flow rate. The maximum output frequency is 512 Hz at a user-defined flow rate. (For Basic-L meters, see Meter Volumes (Volumes Tab). For meters equipped with a DS1, see DS1 Volumes Tab. The minimum frequency is 0.5 HZ at zero.

Pulse Weight

You may select a pulse weight for your output if your Output Type is Corrected or Uncorrected and your mode is 50% or Selectable duty cycle.

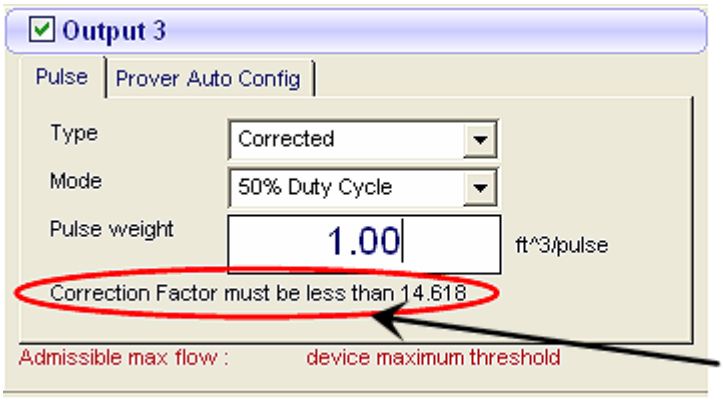
Key Output Configuration Limitations

PCLink's Pulse Output configuration tab provides helpful information about pulse output configuration limitations. Configuration limitation information displays under the Pulse weight data entry box.

When programming:	Configuration limitation consideration:
Corrected volume	Correction factor does not exceed maximum.
Selectable duty	• Flow rate does not exceed admissible maximum flow. • Pulse width.
Pulse weight	Pulse weight must be the least minimum required.
High Frequency (HF)	Frequency output is based on a calculated flow rate. The HF output will not always match the actual flow rate. Varying loads and flow rate speed (particularly slowing flow rates) affect HF outputs. (See HF Output.)

Corrected Volume

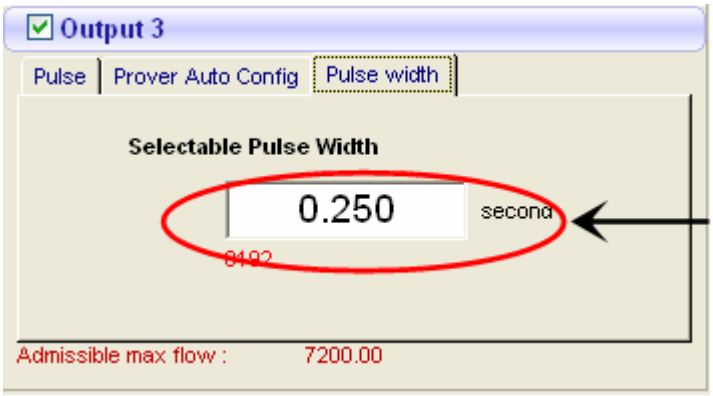
When selecting **Corrected** as the Pulse Output **Type**, pay careful attention to the **Correction Factor must be less than**.



The Correction Factor is calculated by (Pulse Weight) / (Oscillation Pulse Weight). If the Correction Factor multiplied by the oscillation pulse is larger than the pulse output, the meter would attempt to send more than one pulse out for every pulse in, which is impossible. (For Corrector models, the method to calculate Correction Factor is (Pulse Weight) / (Input Pulse Weight.)

Selectable Duty

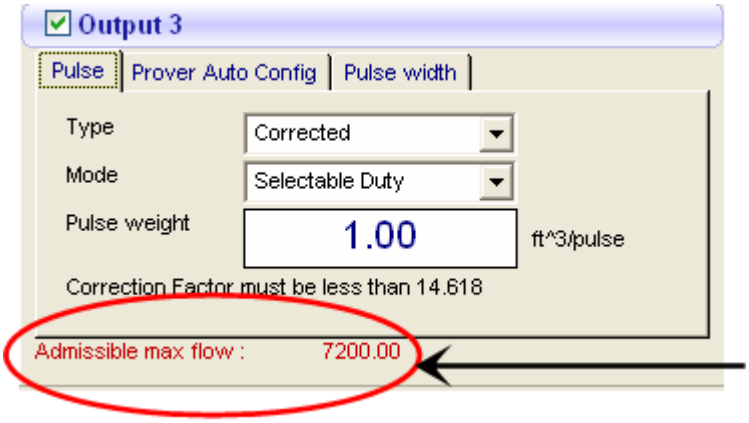
When Mode is configured for Selectable Duty, the meter uses a specific pulse width creating a maximum flow limitation. The Selectable Pulse Width configuration entry box is only available when **Mode** is configured for **Selectable Duty**.



The pulse width duration is the time the contact is closed and the minimum time the pulse is open. A 0.250 second pulse width means it will take 0.50 seconds for a complete pulse cycle. In this example, 2 cycles per second (2 Hz) is the maximum output rate.

Caution Pulse width has a 10 millisecond (0.010 seconds) minimum and a 1.75 second maximum.

The admissible maximum flow rate is a calculation based on the pulse width and the pulse weight. For example (see the figures above and below), with a 1.00 CF/pulse weight and a 0.250 second pulse width, the maximum flow rate is 7200 CFH before the pulses become saturated and lose pulses (maximum pulse rate 2 per second [7200 per hour] and 1 CF pulse weight).

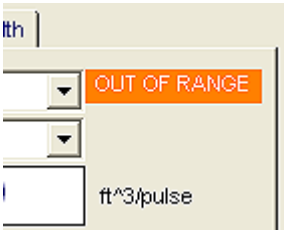


Pulse Weight

Pulse weight is limited based on the Dattus model.

- Basic-L Dattus models. 2 times the oscillation weight limit.
- DS1 Dattus models. 1 times the input pulse weight limit.

There are no maximums specified but Itron recommends you do not exceed 1000 CF (or m3) per pulse. An out of range error will display if either pulse width is outside acceptable parameters or the pulse weight is not above the minimum requirements.



High Frequency Output

Dattus Basic Meters

Basic Dattus meters calculate the instantaneous flow rate (based on the last 40 oscillations) as a percentage of the scale (see Meter Volumes (Volumes Tab) on page 47. The resulting fraction is applied to 512 Hz to obtain the output frequency. Since the HF output is dependent on the instantaneous flow rate calculation, the output can lag the real flow rate and appear to (slightly) jump around as each new calculation is factored.

Typically, the HF output responds faster to increased flow rate than in decreased flow rates (because 40 oscillation occur at faster rates in increasing flows than decreasing flows). The timeout period (or zero flow) is approximately 20 seconds. The meter's minimum flow rate is about one oscillation every 20 seconds.

The primary HF output application is to feed pulses to current and voltage converters where the normal pulse (selectable duty or 50% duty cycle) may be below minimum.

Corrector Models

All DS1 Dattus corrector models calculate instantaneous flow rates via the DS1 corrector board. The meter (DM2 board) collects uncorrected volume and sends pulses to the corrector (DS1) board. Dattus corrector versions calculate instantaneous flow rate based on 8 input volume pulses from the meter to the corrector. These input pulse values are visible in the Uncorrected Input Volume window located on the Input Config tab on page 49.

Caution HF Output is not a volume output. HF Output will not provide accuracy for counting the pulse number from the HF output to calculate volume. The inaccuracy degree (compared to a volumetric pulse) will depend on flow rate, flow rate change frequencies, time at zero flow, and other variables.

When the Dattus has a zero (0) flow rate, the HF output will send pulses at 0.5 Hz to indicate a functioning output. The zero flow rate pulses may be *zeroed out* for auxiliary equipment using the HF output.

CHAPTER 11

Modbus Communication Overview

This chapter provides a demonstration of a Dattus meter remote read option using Modbus communication. Communication to the Dattus meter is typically accomplished using your PC/laptop Dattus RS-232 communication cable to connect to the meter. PCLink software allows users to log on to the meter to read specific meter information (essentially a Modbus RTU communication). Modbus communication allows you to read Dattus information (for example, Uncorrected or Corrected Volume) without a direct RS-232 communication cable or PCLink.

Required Materials

Dattus meter Modbus communications require the following materials.

- Dattus Meter.
- Modbus RTU device. This device must have an RS-232C input DTR connection.
- Power supply to power the Modbus device as well as supply a 5V current to the meter from the Modbus device.
- Software capable of register range reads of 50,000 to 59,999.

General Dattus Modbus Setup

To setup the Dattus for Modbus communications

1. Apply power to the Modbus RTU device.
2. Log on to the Modbus RTU device.
3. Configure the Modbus device for the following settings:
   - Baud rate: 9600
   - 8 bits
   - Even parity
   - 1 stop bit
4. Enter the Slave ID/address (default for the meter is 90, default for the corrector is 91).
5. A Modbus Register List (Default Meter Address 90 and Default Corrector Address 91) follows these instructions. The list shows meter addresses, corrector addresses, register type (Long, Integer, Float), and function codes to read values. Use the Meter Register Addresses with the Modbus reading program.
6. If the option is available, read values in *Big Endian* order (values are read from High Byte to Low Byte or High Word to Low Word).

Modbus Register List

Note Use the following Modbus Register List table definitions for **Type**:

- Long. Unsigned 32-bit integer.
- Integer. Unsigned 16-bit integer.
- Float. IEEE 754 32-bit floating point.

Use Modbus read input registers (function code 4) and request 1 or 2 registers dependent on entity size.

Default Corrector Address 90

Register	Description	Type	Equation (if applicable)
50095	Uncorrected Volume	Long	
50141	Uncorrected Volume - decimal	Float	
50145	Corrected Volume	Long	
50135	Unc Flow Rate - Current	Long	If *Value* = 0, then flow rate is 0 else $= \frac{117964800}{Value} \times OSC.PulseWeight$
50110	Unc Flow Rate - Maximum	Long	If Value = 0, then flow rate is 0 else $= \frac{117964800}{Value} \times OSC.PulseWeight$
50091	Battery 1 voltage	Integer	$= Value \times \frac{5.0314}{4095}$
50102	Battery 2 voltage	Integer	$= Value \times \frac{3.9051625}{4095}$
50117	Unc. Volume under alarm	Long	
50064	Oscillation Pulse Weight	Float	

Default Corrector Address 91

Register	Description	Type	Equation
51253	Uncorrected Volume	Long	
52155	Corrected Volume	Long	
52169	Uncorrected Flow Rate	Float	
52171	Corrected Flow Rate	Float	
52279	Live Pressure	Float	
52325	Max Pressure	Float	
52323	Min Pressure	Float	
52066	Saved Alarms	Integer	Use Alarm Decoder in PCLink
52065	Live Alarms	Integer	Use Alarm Decoder in PCLink
52277	Live Temperature	Float	
52321	Max Temperature	Float	
52319	Min Temperature	Float	
52177	Max Flow Rate	Float	
52179	Corrected Flow Rate	Float	
52145	Temp Correction Factor	Float	
52147	Pressure Correction Factor	Float	
52149	Super X Factor	Float	
52151	Total Correction Factor	Float	

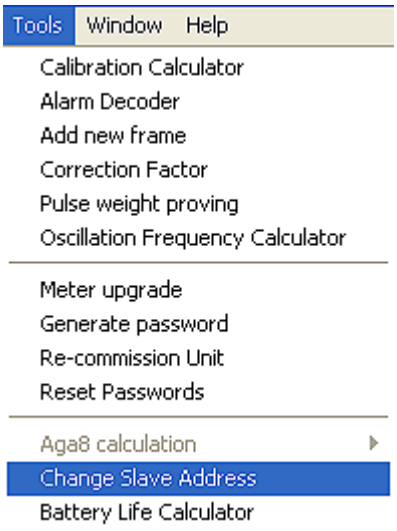
Verifying and Changing the Slave Address

Dattus default Slave Addresses for the meter and corrector are 90 (meter) and 91 (corrector). If a event a Modbus device occupies the slave address, it may be necessary to change the address.

To verify (or change) the meter and connector Slave Address

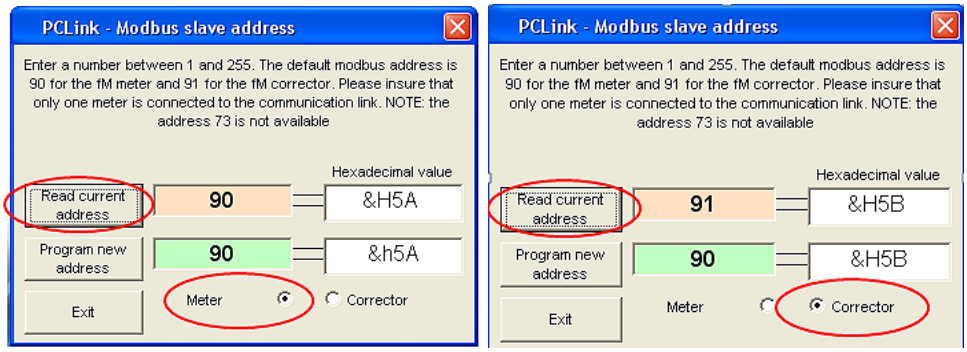
1. Connect an RS-232 communication cable (Itron part number 600204-001) to the Dattus.
2. Open PCLink.
3. Do not log on to the meter.

4. Select **Tools** > **Change Slave Address**.



Warning The meter and corrector must not share the same Slave Address. If the same address is selected, the meter will enter permanent lockup and render it permanently inaccessible.

5. The PCLink - **Modbus slave address** window opens. Locations 1-255 are available (with the exception of address 73). Select the Dattus meter or corrector button (to view the current slave address).



6. Click **Read current address**.

Caution Read the corrector and meter addresses prior to making changes. The new addresses must not match either of the current addresses!

7. Read and make note of the addresses of both the meter and corrector.
8. Select the meter or corrector address to change.
9. Enter the new address for the selected device (meter or corrector) in the bottom (green) box.
10. Click > **Program new address**.

CHAPTER 12

Dattus Upgrade Overview

Dattus meters feature configuration upgrades using a software or *upgrade key*. The upgrade key is an encrypted 75-digit number specific for the meter and upgrade type. Each upgrade key is valid only for the meter it was designed to upgrade. The upgrade key is a *.pck (PCK) file that once opened (using PCLink) inserts the upgrade key number into the appropriate upgrade field (see Performing an Upgrade on page 128.)

Dattus Upgradable Components

The following Dattus components are upgradable:

- Flow rate capacity.
- Data logging enable.
- Password reset.
- Convert to metric.

Flow Rate Capacity

Flow rate capacity is the most commonly performed Dattus upgrade. A flow rate capacity upgrade allows the user to increase the meter's flow rate capacity (with the meter still installed and working) for a new increased load or to inventory less expensive, smaller capacity meters. Dattus flow rate capacity upgrades have the following constraints:

- fM2. Upgrade from current capacity to a maximum of 11M.
- fM3. Upgrade from current capacity to a maximum of 56M.

Data Logging Enable

A Dattus meter data logging enable upgrade gives the user access to data logging (creating an audit trail).

Password Reset

A Dattus password reset allows the user to reprogram the default Dattus password (see Default Passwords on page 37). A password reset is useful when a customer changed and forgotten a password.

Metric Enable

A Dattus metric enable upgrade converts the meter from imperial to metric (or metric to imperial) units.

Note A metric enable upgrade will change the LCD readout units and may introduce a discrepancy between the units printed (on the label) and those programmed into the meter.

Upgrade Method

The following information is required to generate a Dattus meter upgrade key. Contact your Itron sales representative with the following information. Your representative will supply the information to the factory where the upgrade key will be generated.

- The Dattus serial number (typically a D followed by a 7-digit number).
- The upgrade type (see Dattus Upgradeable Components on page 127).
- If the upgrade type is flow rate capacity, your meter's current capacity rating.

Upgrade Contents

Your Dattus upgrade includes the following:

- A .pck file sent by email (or alternate method). The PCK file is typically formatted as serial number - upgrade type - customer name - date created (for example, D1234567 - 2M to 5M - ABC Utility Co. - 02-28-10).
- If the upgrade is a flow rate capacity upgrade, two manufacturer badges showing the new capacity and a capacity sticker.

Note New manufacturer badges for flow rate capacity upgrades typically do not list a serial number. If you require embossed badges, specify embossed badges at the time of the upgrade order.

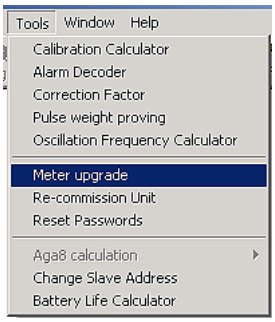
Performing an Upgrade

After you receive the upgrade key, save it to the computer you will use to communicate with the meter. (Itron recommends saving the file in a temporary folder or on the desktop.)

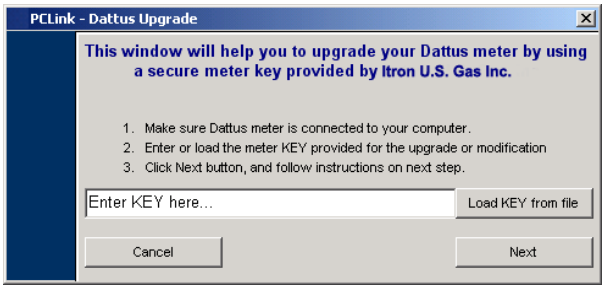
To upgrade the Dattus meter

Note To perform the meter upgrade, do not log on to the meter. If you are logged on, log off. **Meter upgrade** is only available when you are not logged on to the meter.

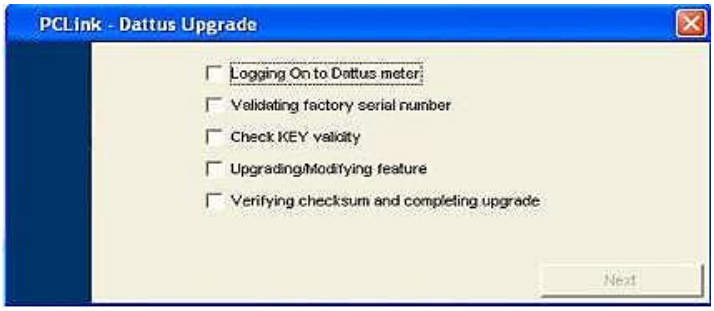
1. Start PCLink. Go to **Tools** > **Meter upgrade**.



2. The Dattus upgrade window opens.



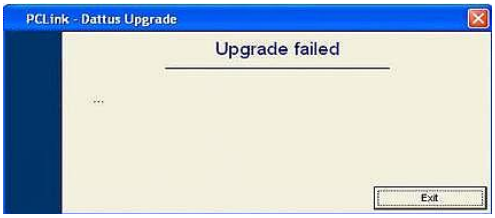
3. You may manually enter the upgrade key or click **Load KEY from file**. (Itron recommends using the **Load KEY from file** option to eliminate entry errors.) Browse to the PCK file. The number automatically populates the field.
4. Click **Next**.
5. The upgrade process window opens.



The upgrade process involves the following five-step process:

- Logging On to Dattus meter. PCLink verifies it can communicate with the meter.
- Validating factory serial number. PCLink verifies the key entered applies to the meter being upgraded.
- Check KEY validity. PCLink verifies the upgrade key is valid for the specific upgrade. For example, a 3M to 11M upgrade key will not complete an upgrade if the meter is a 2M.
- Upgrading/Modifying feature. PCLink is performing the upgrade.
- Verifying checksum and completing upgrade. PCLink is completing the final checks.

6. After the upgrade is complete, the Next button becomes active. Click **Next**. If the upgrade was successful, the Congratulations window displays. If the upgrade fails, an Upgrade failed window displays.



Note Upgrade failures are typically caused by an upgrade key being applied to the incorrect meter or a mismatched factory serial number. If a Dattus upgrade fails, contact your Itron Sales Representative.

CHAPTER 13

Dattus Meter Maintenance Overview

The Dattus meter requires very little routine maintenance. Generally, only periodic battery replacements are necessary. The meter has 2 D-cell lithium batteries. The Dattus first uses the primary battery. If the primary battery is battery is depleted, the meter switches to the backup or secondary battery. The meter's primary battery typically lasts four to six years before the battery requires replacement.

Caution The Dattus meter requires a constant power source to maintain measurements and power the LCD (LC2). In the event that both batteries are disconnected from the unit simultaneously, the meter will not register until power is restored. Itron recommends following the Dattus battery replacement guidelines to ensure at least one battery is connected to the meter at all times.

Dattus Battery Replacement Guidelines

When a battery alarm occurs (see Meter (DM2) Alarms on page 107) replace Dattus meter batteries using one of the following three Itron-recommended options:

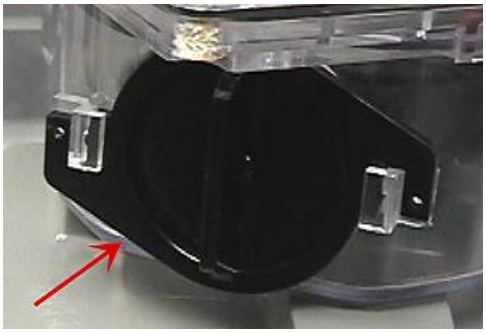
1. Order one new replacement battery. Replace the secondary battery with the new battery. Replace the primary battery with the secondary battery. Discard the primary battery following environmentally safe practices. Contact the EPA for more information.
2. Order one new battery and replace the primary battery with the new battery. Discard the primary battery following environmentally safe practices. Contact the EPA for more information.
3. Order two new batteries and replace the primary battery with a new battery. After the primary battery is replaced, replace the secondary battery with the remaining new battery. Discard the both batteries following environmentally safe practices. Contact the EPA for more information.

To change batteries in the Dattus meter

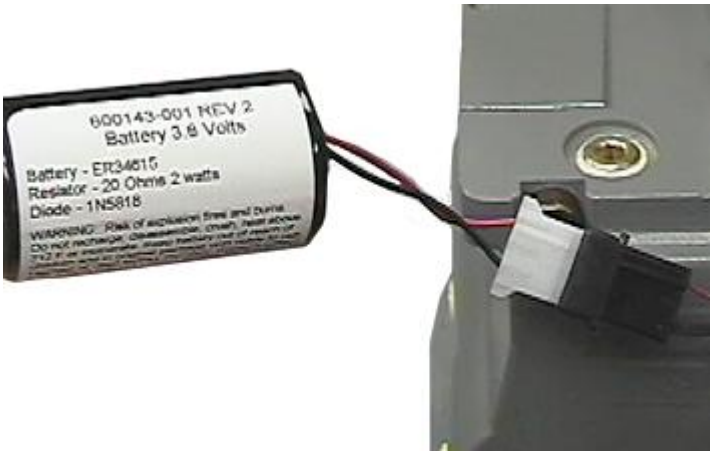
Caution The Dattus meter requires a constant power source to maintain measurements and power the LCD (LC2). In the event that both batteries are disconnected from the unit simultaneously, the meter will not register until power is restored. Itron recommends following the Dattus battery replacement guidelines to ensure at least one battery is connected to the meter at all times.

1. Remove the protective cover.

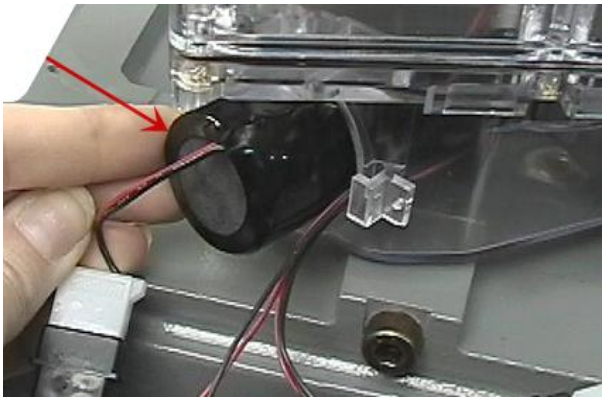
2. Twist the battery door to unlock the battery door tabs. Remove the battery door.



3. Remove the batteries following the Dattus Battery Replacement Guidelines on page 131.



4. Install the new battery (batteries). Replace the battery in the meter with the connector-end out.



5. Replace the battery door, the Dattus meter cover, and meter seals (if necessary).

3-way Valve

All Dattus PTZ-L and P-only meters are equipped with a 3-way valve combined with a Pete's plug, valve assembly tubing and pressure transducer. The 3-way valve regulates the location of the pressure that the transducer is measuring. The valve itself can be accessed by removing the plastic grey cover. The valve positions and their possible uses are described in the following sections.

Position 1 Standard Position (Pete's Plug sealed)

The standard position is the default valve position for all meters. When the valve is left in position, the transducer is measuring the pressure currently going through the meter. The Pete's Plug is sealed off in this position.

Position 2 All Open

This position is similar to the default standard position with one exception, the Pete's Plug is no longer sealed off from the rest of the pressure. Position 2 All Open is an ideal mode for the pressure transducer's field calibration. A gage with a needle nose attachment could be placed in conjunction with the Pete's plug to compare the pressure transducer to the gage.

Position 3 Meter Sealed

In Position 3, the meter is sealed from the pressure transducer and the Pete's Plug. In Position 3, an external pressure may be applied to the pressure assembly using the Pete's Plug. The applied pressure value can be checked using the live pressure calculation on the DS1 screen or PCLink.

APPENDIX A

fM2 Specifications

Dattus fM Meter	Flange Size	Units	fM2 1M	fM2 1.5M	fM2 2M	fM2 3M	fM2 5M	fM2 7M	fM2 11M
Read Capacity	-	ACFH	1000	1500	2000	3000	5000	7000	11000
Maximum Capacity*	-	ACFH	1250	1875	2500	3750	6250	8750	13750
MAOP	-	PSIG	150	150	150	150	150	150	150
Dynamic Range +/- 1%	-	ratio	17:1	25:1	33:1	50:1	83:1	116:1	183:1
Dynamic Range +/- 2%	-	ratio	45:1	68:1	91:1	136:1	227:1	318:1	500:1
Flow Rate. 0.5" w.c., Gas	2" FL	ACFH	**	**	**	2457	2457	2457	2457
	3" FL	ACFH	**	**	**	2750	2750	2750	2750
	4" FL	ACFH	NA	NA	NA	NA	NA	NA	NA
Flow Rate. 1.0" w.c., Gas	2" FL	ACFH	**	**	**	**	3481	3481	3481
	3" FL	ACFH	**	**	**	**	3871	3871	3871
	4" FL	ACFH	NA	NA	NA	NA	NA	NA	NA
Flow Rate. 2.0" w.c., Gas	2" FL	ACFH	**	**	**	**	4918	4918	4918
	3" FL	ACFH	**	**	**	**	5535	5535	5535
	4" FL	ACFH	NA	NA	NA	NA	NA	NA	NA
Pressure Drop at Rated Capacity	2" FL	Inches w.c.	0.09	0.19	0.33	0.75	2.06	3.89	9.25
	3" FL	Inches w.c.	0.05	0.14	0.26	0.61	1.64	3.14	7.55
	4" FL	Inches w.c.	NA	NA	NA	NA	NA	NA	NA
Flange Connection Size	-	Inches	2" or 3"	2" or 3"	2" or 3"	2" or 3"	2" or 3"	2" or 3"	2" or 3"
Flange to Flange Dimensions	-	Inches	6 3/4	6 3/4	6 3/4	6 3/4	6 3/4	6 3/4	6 3/4
Weight	-	lbs.	37	37	37	37	37	37	37
Shipping Weight	-	lbs.	42	42	42	42	42	42	42

fM2 Meter Sizing

Meter Size	fM2 1M	fM2 1.5M	fM2 2M	fM2 3M	fM2 5M	fM2 7M	fM2 11M
Rated Capacity ACFH	**1000**	**1500**	**2000**	**3000**	**5000**	**7000**	**11000**
Meter Pressure psig	**Metering capacity in MSCFH**						
1	1.1	1.6	2.1	3.2	5.3	7.4	11.6
5	1.3	2.0	2.6	4.0	6.6	9.3	14.6
10	1.7	2.5	3.3	5.0	8.3	11.7	18.3
15	2.0	3.0	4.0	6.0	10.0	14.0	22.1
20	2.3	3.5	4.7	7.0	11.7	16.4	25.8
25	2.7	4.0	5.4	8.1	13.4	18.8	29.6
60	5.1	7.6	10.2	15.2	25.4	35.5	55.9
90	7.1	10.7	14.3	21.4	35.6	49.9	78.4
100	7.8	11.7	15.6	23.4	39.0	54.7	85.9
150	11.2	16.8	22.4	33.7	56.1	78.6	123.4

fM3 Specifications

Dattus fM Meter	Flange Size	Units	fM3 7M	fM3 11M	fM3 16M	fM3 23M	fM3 38M	fM3 56M
Read Capacity	-	ACFH	7000	11000	16000	23000	38000	56000
Maximum Capacity*	-	ACFH	8750	13750	20000	28750	47500	57000
MAOP	-	PSIG	175	175	175	175	175	175
Dynamic Range +/- 1%	-	ratio	70:1	110:1	160:1	230:1	380:1	560:1
Dynamic Range +/- 2%	-	ratio	117:1	183:1	267:1	383:1	633:1	933:1
Flow Rate. 0.5" w.c., Gas	4" FL	ACFH	6650	6650	6650	6650	6650	6650
Flow Rate. 1.0" w.c., Gas	4" FL	ACFH	**	9350	9350	9350	9350	9350
Flow Rate. 2.0" w.c., Gas	4" FL	ACFH	**	**	13150	13151	13152	13153
Pressure Drop at Rated Capacity	4" FL	Inches w.c.	0.55	1.39	2.98	6.18	17.37	37.73
Flange Connection Size	-	Inches	4"	4"	4"	4"	4"	4"
Flange to Flange Dimensions	-	Inches	9 1/2	9 1/2	9 1/2	9 1/2	9 1/2	9 1/2
Weight	-	lbs.	114	114	114	114	114	114
Shipping Weight	-	lbs.	128	128	128	128	128	128

fM3 Meter Sizing

Meter Size	fM3 1M	fM3 1.5M	fM3 2M	fM3 3M	fM3 5M	fM3 7M
Rated Capacity ACFH	7000	11000	16000	23000	38000	56000
Meter Pressure psig	Metering capacity In MSCFH					
1	7.4	11.6	16.8	24.2	39.9	58.9
5	9.3	14.6	21.2	30.5	50.3	74.2
10	11.7	18.3	26.6	38.3	63.3	93.3
15	14.0	22.1	32.1	46.2	76.3	112.4
20	16.4	25.8	37.6	54.0	89.2	131.5
25	18.8	29.6	43.0	61.9	102.2	150.6
60	35.5	55.9	81.3	116.8	193.0	284.4
90	49.9	78.4	114.0	163.9	270.8	399.1
100	54.7	85.9	124.9	179.6	296.7	437.3
150	78.6	123.4	179.5	258.1	426.4	628.4
175	90.5	142.2	206.9	297.4	491.3	724.0

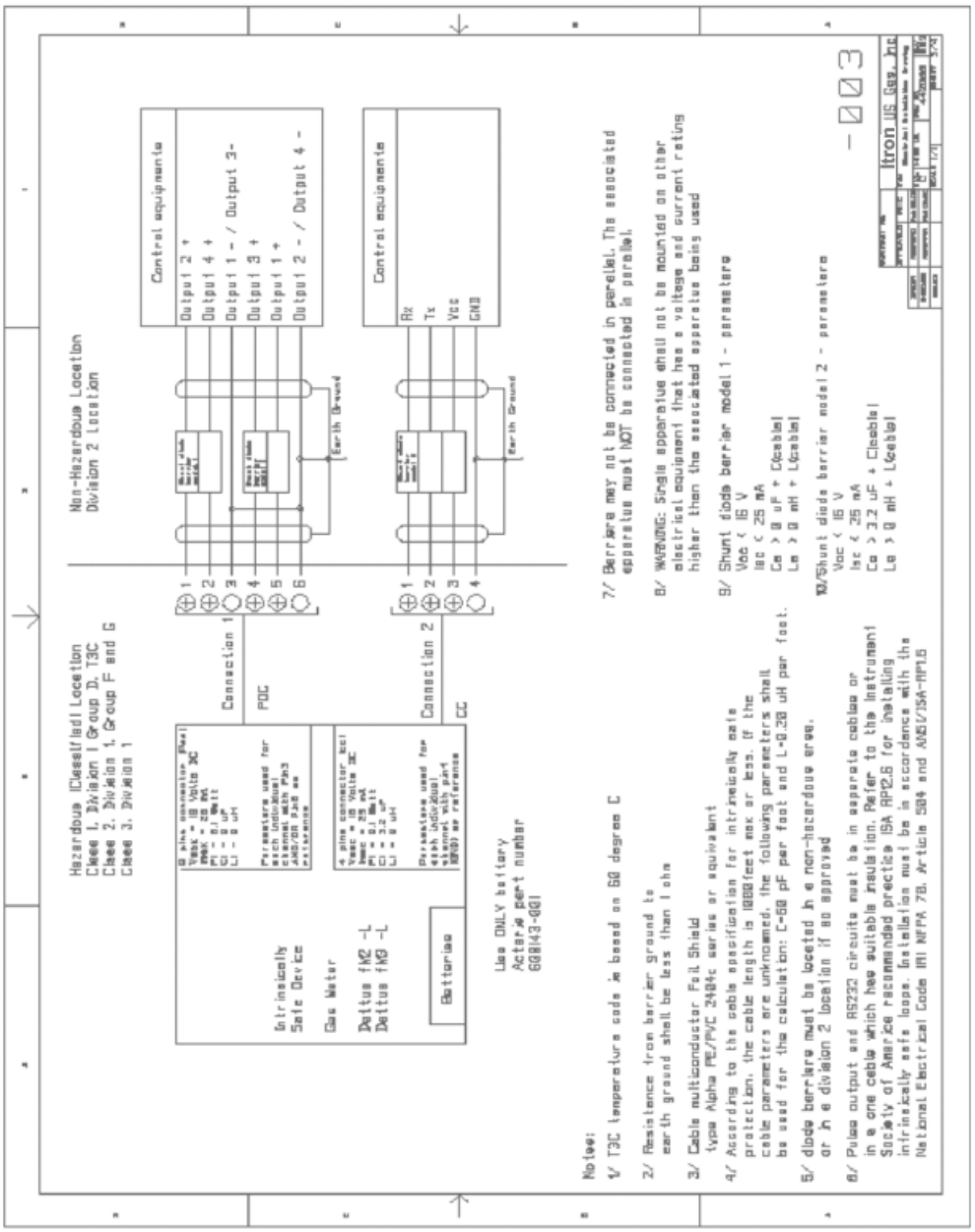
APPENDIX B

Accessories

Part Number	Description
600204-001	RS-232 communication cable used to connect a computer via serial port connection to the Dattus.
442001-002	PCLink Software CD.
442461-005	Pulse Cable 10'.
442461-006	Pulse Cable 20'.
442465-001	9 ½" Flange Adapter Kit. Spacer that adapts the FM2 3" to a 9 ½" Flange spread. Helps accommodate for a change-out of a rotary 7M.
442502-001	Pulsation Dampener Kit; Includes: pulsation dampening box, 3 ft. prover hose, choke valve.
442405-003	Model 5 Transfer Prover Cable.
442503-001	Choke Valve assembly (for use with Dresser dampening box).
442461-007	P-channel MOSFET pulse cable 10'.
442461-008	P-Channel MOSFET pulse cable 20'.

APPENDIX C

Control Drawing



APPENDIX D

Certificate of Calibration

Itron

Knowledge to Shape Your Future

CERTIFICATE OF CALIBRATION

MODEL: Dattus ETC-L IM2 ANSI 2"

DATE CALIBRATED: January 25, 2010

FACTORY SERIAL NUMBER: D0004000

CUSTOMER:

CUSTOMER SERIAL NUMBER: Not Applicable

CALIBRATION INSTRUMENT: Model 5 ROOTS 1M Prover (SN 9890103)

CALIBRATION MODE: Uncorrected (UC)

METER CONFIGURATION: As Factory Programmed

CAPACITY: IM

DATA LOGGING ENABLED: Yes

DISPLAYED VOLUME: Corrected

FIXED PRESSURE: Not Applicable

PULSE OUTPUT CONFIGURATION

Output - Channel 1:	10	ft³/pulse	Uncorrected
Output - Channel 2:	100	ft³/pulse	Corrected
Output - Channel 3:	100	ft³/pulse	Corrected
Output - Channel 4:	100	ft³/pulse	Corrected

METER CALIBRATION

OSCILLATION PULSE WEIGHT: 0.0685400000

Flow Rate: (cfh)	7000	7000	3000	3000	1000	1000	500	500
Test Volume: (cf)	200	200	100	100	50	50	50	50
% Error:	-0.48	-0.48	0.25	0.26	0.02	0.39	0.41	0.19

Itron, Inc. Gas Division - US
970 Highway 127 North
Owenton, KY 40359-9302, USA

Tel: (800) 490-0657
(502) 484-5747
Fax: (502) 484-6223

APPENDIX E

Glossary

% Accuracy. The volume ratio registered by the meter divided by the volume registered by the reference, and multiplied by 100.
% Accuracy = (meter volume / reference volume) x 100.

% Error. The volume ratio registered by the meter minus the volume registered by the reference, divided by the reference volume, and multiplied by 100. % Error = {(meter volume- reference volume) / reference volume} x 100.

% Proof. The ratio of the volume registered by the reference, divided by the volume registered by the meter, and multiplied by 100. % Proof = (reference volume /meter volume) x 100.

Accuracy Curve. Graphical expression of accuracy of a meter as a function of flow.

ACFH. Actual cubic feet per hour. The meter reading without pressure, temperature, or compressibility correction.

Ambient Temperature. The temperature of the atmosphere surrounding the equipment or area.

Atmospheric Pressure. Measure of the weight of the earth's atmosphere at a given place and time. At sea level, atmospheric pressure is approximately 14.696 psia.

Base (Standard Pressure). The standard pressure base condition used for the volumetric measurement of natural gas. ANSI/API 2562-1969 established 14.73 psia as the base pressure to which all volumes are commonly referred. Base pressure is normally defined in gas measurement contracts.

Base (Standard Temperature). The standard temperature base condition used for the volumetric measurement of natural gas. ANSI/API 2562-1969 established 60°F as the base temperature to which all volumes are commonly referred.

Base Conditions. The standard pressure and temperature base conditions for the volumetric measurement of natural gas. ANSI/API 2562-1969 established 14.73 psi as the base pressure, and 60°F as the base temperature, to which all volumes are commonly referred.

Compressibility. In gas measurement, volume decreases when there is an increase in pressure. Compressibility (Z) is the variance from the ideal gas law behavior.

Corrected Volume. Meter volumes multiplied by the correction factor (volume after compensating for pressure and/or temperature).

Correction Factor. Numerical factor (single constant or coming from a mathematical function) by which the uncorrected result of a measurement is multiplied to compensate for systematic error.

Differential Pressure. The difference in pressure (DP) between the inlet and outlet of a metering or regulating device.

DM2. Dattus Metrology 2nd generation, specifically the circuit board performing the core measurement in the Dattus.

Drift. Slow metrological characteristic change of a measuring instrument.

Energy. The capacity to do work/heat (measured in the same units as work). Energy may be transferred from one form into another.

Fixed Factor. (Also pressure factor measurement.) Used as a compensation factor when delivery pressure is higher than standard but variable pressure compensation is not used. See Correction Factor.

Gauge Pressure. Measured pressure relative to atmospheric pressure taken as zero; abbreviated as psig. Measured pressure above atmospheric pressure.

Index. The device displaying the volume of gas passing through the meter.

LC2. The term for the LCD circuit board used on the Dattus Basic.

MAOP (Maximum Allowable Operating Pressure). The maximum safe operating pressure.

Maximum Capacity. The maximum flow rate at which a meter may run without losing measurement.

Maximum Flow. The meter's maximum flow (Qmax) capacity.

Meter Accuracy. The degree to which a meter correctly measures the volume of gas passing through it, determined by comparing the volume registered by the meter with that registered by the prover.

Minimum Flow. The minimum flow rate (Qmin) at which the accuracy falls in a defined tolerance range.

MODBUS. A serial communication protocol used by the Dattus meter.

Non-volatile Memory. Data memory not dependent on battery voltage for persistence.

Optical Port. Programming and communications port located on the meter's front face.

Pressure. Force per unit area applied to a surface. Pressure = Force / Area

Prover. Device for measuring the accuracy of gas meter registration.

Rangeability. A ratio (Qmax/Qmin) expressing the flow range in which a meter accurately measures within a defined set of accuracy parameters (i.e., a range of 50:1 for 100 ± 1% accuracy range).

Rated Capacity. The rated flow rate at which a meter may operate.

Readout. LCD, index, register - The device displaying the gas volume passing through the meter.

SCF. Standard Cubic Foot. That quantity of gas which under an absolute pressure of 14.73 psia and at a temperature of 60°F (base conditions) occupies a volume of one cubic foot.

Seal(s). A device designed to give evidence of meter tampering.

Specific Gravity. Ratio of the density of gas to the density of air (under equivalent pressure and temperature conditions).

Start Flow. The minimum flow rate required for gas flow registration.

Transfer Prover. A device used to determine a meter's accuracy under test by comparing its reading against the reading obtained from a calibrated reference meter connected in series with the meter under test.

Transition Flow Rate. The flow rate (Qt) at which the error channel will open up to a wider band.

Uncorrected Volume. Actual metered volume before any pressure or temperature compensation.

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