Chapter 1 - General Information

This *Dattus™ fM Meter Technical Reference Guide* provides information important to the installation, operation, and maintenance of the Dattus fM Gas Meter. Actaris recommends that you read the entire guide before attempting installation, tests, operation, or maintenance of the meter.

This chapter contains a general description of the meter, information about the meter's features, metering applications, and meter specifications.

In addition to this chapter, this guide contains the following chapters:

Chapter 2	**Theory of Operation**	Describes technical details on the meter design and operation.
Chapter 3	**Installation & Programming**	Contains instructions for installing the meter, as well as information and procedures for programming and starting the meter.
Chapter 4	**Proving**	Contains basic instructions on proving the meter.
Chapter 5	**Differential Pressure Testing**	Contains basic instructions on differential pressure testing.
Chapter 6	**Calibration**	Contains basic instructions on testing and calibrating the temperature probe.
Chapter 7	**Maintenance**	Provides information and instructions for replacing the batteries, an index and a temperature probe.
Chapter 8	**Alarms**	Provides details on the possible alarms generated by the meter.
Chapter 9	**Troubleshooting**	Provides information on how to quickly and effectively identify and resolve typical problems that may be encountered while operating the meter.
Appendix A	**External Connections**	Contains pin-out descriptions of external connectors.
Glossary		Provides a listing of terms and definitions.

Using This Manual

The *Dattus™ fM Meter Technical Reference Guide* provides hardware-related information about the Dattus meter.

Note boxes provide essential information about using the ***Dattus™ fM Meter Technical Reference Guide***.

Cautions provide information that is important to consider when performing certain operations.

Warnings provide 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. Warnings are in bold text.

General Description

The Dattus fM Meter (see Figure 1.1) is intended for use in light industrial and commercial sites. Features available in the meter include:

- Volumetric flow measurement
- Temperature Correction
- Fixed Factor Pressure Correction
- Display of the instantaneous flow rate
- Logging of events
- Pulse outputs of corrected and uncorrected volume, and alarm events

Figure 1.1 Dattus fM Meter (*Model fM2 shown here*)

Meter Configuration

Dattus fM gas meters have two typical configurations:

- Basic—the standard meter features and fixed factor capabilities
- ETC—the basic version with a temperature probe mounted in the gas flow

These configurations may vary depending on added options.

In addition to these Dattus options, an fM meter may also be equipped with the *Gas Micro* Electronic Volume Correction plaform. This option gives an fM meter full pressure and temperature correction as well as logging and communications capabilities. For specific information on the capabilities and features of the *Gas Micro* platform please refer to the “Gas Micro Operator’s Manual.”

Standard Features

The basic meter performs volume metering based on the gas pressure and temperature in the meter. The following functions are available:

- Gas volume totaling
- Fixed factor correction
- Volume and alarm pulse outputs
- Non-volatile memory for storing values and data
- Optical communication port for reading/writing of values
- Eight-item programmable display
- Magnetic switch to change display values
- Circular event log
- Power management

Optional Features

In addition to the standard functionality of the basic configuration, the following options can be added:

- Temperature correction using a temperature probe mounted in the gas flow
- Push button to change display values

Meter Parts

The Dattus fM Meter is composed of three main parts: measurement unit, index housing, and external cover.

Measurement Unit

The measurement unit (see Figure 1.2) is the only part of the meter that is exposed to the gas. A series of threaded taps provide convenient access to the various internal gas chambers for monitoring pressure.

This unit is made of an aluminum structure that ensures gas tightness up to line pressures of 150 psi.

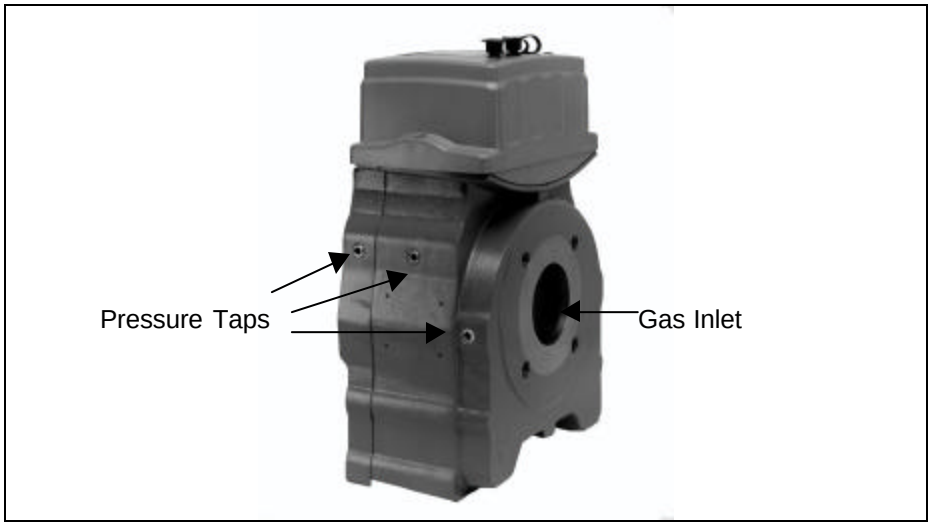


Figure 1.2 Measurement Unit

Index Housing

The index housing (see Figure 1.3) contains the index board and batteries that provide the main functionality of the meter. The housing is made of a UV- stabilized polycarbonate material designed to reduce the risk of damage from significant shock impact. This housing has a configurable index orientation.

Communication with the meter is accomplished through the optical port. To scroll the displayed values, a magnetic switch (or optional push button, if provided) is used.

Figure 1.3 Index Housing Layout

External Cover

The external cover (see Figure 1.4) provides both mechanical and tamper protection to the temperature probe.

Figure 1.4 External Cover

Meter Seals

Various meter seals are available:

- External Cover Seal(s) (optional)—seals the mounting screws on the external cover. Protects access to the temperature probe, pressure transducer, and batteries.
- Index Housing Seal—seals the index housing. Protects access to the index board and other electronic components (e.g., programming switch, temperature probe screwed connection).
- Measurement Unit Seal (optional)—seals the measurement unit. Protects against unauthorized opening of the measurement unit.
- Battery Access Door Seal (optional)—seals the battery access door with a seal wire. Protects against unauthorized access to the batteries.

The locations of the seals are shown in Figure 1.5.

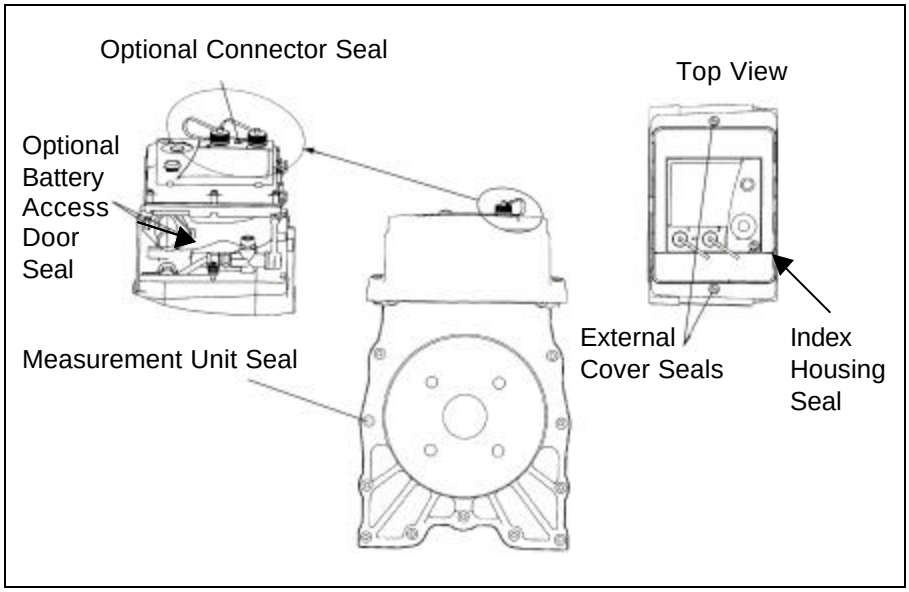


Figure 1.5 Meter Seal Locations

Specifications

Table 1.1 provides the specifications for the meter.

Table 1.1 Meter Specifications

General		
	Meter Type	Dattus
	Meter Model	fM2
	Flanges	2-inch and 3-inch ANSI 125
	Maximum Allowable Operating Pressure (MAOP)	150 psig (10 bar)
	Flange to Flange Length	6.75” (171 mm)
	Display	Programmable up to 8 digits for meter quantities and alarms
	Display Sequence Activator	Magnetic switch or push button option
	Operating Temperature Range	-40°F to 140°F
	Weight	37 lbs.
Construction		
	Measurement Unit	Cast aluminum A356T6
	Index Housing	UV-stabilized polycarbonate
	External Cover	ASA (Acrylonitrile Styrene Acrylate)
Flow Rates		
	Maximum Flow Rate	9,000 acfh (255 m^3/h)
	Comparable Meters	3,000 to 9,000 acfh
	Minimum Flow Rate	22 acfh (.625 m^3/h)
Flow Rate at 0.5 in wc, gas (0.6 specific gravity)		
	2” ANSI 125	2,457 acfth (69.6 m3/h)
	3” ANSI 125	2,750 acfth (77.9 m3/h)
Flange Version	**Flow Rate ft^3/h**	**Pressure Drop, gas (0.6 specific gravity) in w.c.**
2”	**9000**	**6.38**
	7968	5.00
	7000	**3.89**
	5000	**2.06**
	4918	2.00
	3481	1.00
	3000	**0.75**
	2457	0.50

3”	**9000**	**5.06**
	8905	5.00
	7000	**3.14**
	5535	2.00
	5000	**1.64**
	3871	1.00
	3000	**0.61**
	2750	0.50
Dynamic Range	± 2%	400:1
	± 1%	150:1
Temperature Measurement		
	Temperature Probe Type	Type PT1000, platinum resistance thermistor (RTD)
	Typical Probe Accuracy	0.1% of absolute measurement
	Probe Construction	Stainless steel tube, 0.25 in (6 mm) outer diameter
	Probe Cable	0.25 in (6 mm) diameter, 2 conductors with shield
Pulse Outputs		
	Pulse Type	Low frequency, standard Namur
	Form Type	A
	Pulse Duration	250 ms
	Pulse Value	User-scalable
Alarms		
	Temperature	Out-of-range
	Flow Rate	Over-range
	Battery	End-of-life
	Oscillation Sensor	Failure
	Oscillation Sensor	Warning
	Oscillation Sensor	Contamination
Communication		
	Optical Link	Optical port, 2400 baud
Event Logging		
		Stores 178 events Stores 22 “last occurrence” events
Power Supply		
		2 -3.6 V D-Cell lithium batteries; typical operating life of 7-10 years

Overall Dimensions

Figure 1.6 and Table 1.2 show the various outside dimensions and mounting hole thread depths.

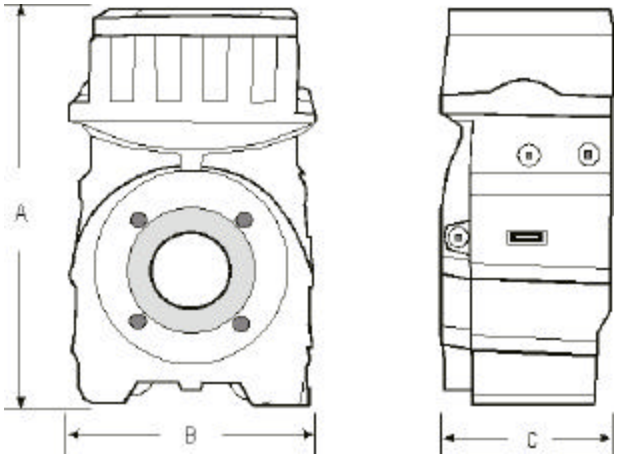


Figure 1.6 Dattus Meter Dimensions

Table 1.2 Dimensions

Dattus Model	A	B	C	Thread Depth	Flange Size
fM2	16.3 in. (41.5 cm)	10.4 in. (26.5 cm)	6.75 in (17.1 cm)	1.0 in.	2 in., 3 in. ANSI 125 Note: Adapter kit is available for 9.5” flange retrofit.

Liquid Crystal Display (LCD)

Figure 1.7 shows the LCD on the Dattus Gas Meter. The LCD provides eight (8) digits and symbols that offer indication of meter values.

The first item on the display will be the primary index. This will be either the uncorrected or corrected volume (as appropriate).

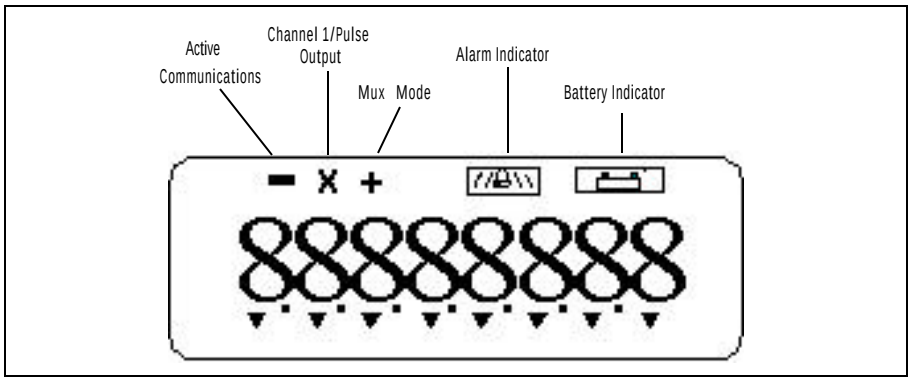
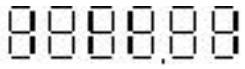
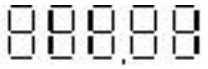
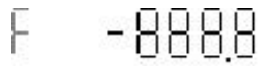


Figure 1.7 LCD Display

Table 1.3 explains each of the 8 possible digits.

Table 1.3 Typical Digit Display Items

Item	Display	Description
Uncorrected Volume		Number of digits is programmable from 4 to 8.
Corrected Volume		Number of digits is programmable from 4 to 8.
Corrected Flow Rate		Metric units - 4 digits left and 2 digits right of decimal point.
Uncorrected Flow Rate		Metric units - 3 digits left and 2 digits right of decimal point.
Corrected Flow Rate		Imperial units- 6 digits, no decimal point.
Uncorrected Flow Rate		Imperial units- 5digits, no decimal point.
Fixed Pressure *F* indicates fixed factor pressure.	 	Metric units- as shown. Imperial units- 3 digits to left and 2 to right of decimal point.
Temperature *F* indicates fixed factor temperature.	 	Metric units- as shown. Imperial units- as shown.
Correction factor		As shown
Alarm codes		As shown

The display updates every 2 seconds, unless the display switch is activated, in which case the display will be updated in the next 0.25 second processing.

The display is powered up continually, and if there is no display switch activation, then the displayed parameter will revert to either the uncorrected volume or corrected volume (configurable in the software). The time-out duration is programmable with 180 seconds default.

The volume display scale can also be programmed to display quantities using decade multipliers. The number of digits 4-8 can also be programmed using the software.

For each parameter the display shows the number of digits indicated. Values that are less than the full number of digits have leading zeros.

Table 1.4 provides a listing of the displayable items in alphabetical order.

All of the registered values in the meter are displayable.

Table 1.4 Displayable Items

Alarm Codes	Flow Rate Threshold
Alarm Passed Volume	Fixed Gas Pressure
Atmospheric Pressure	Gas Temperature
Back-up Corrected Volume	Lifetime Maximum Flow Rate
Back-up Temperature	Lifetime Maximum Temperature
Base Pressure	Meter Volume Per Cycle
Base Temperature	Minimum Temperature Threshold
Battery Life (days)	Monthly Back-up Index
Battery Voltage	Monthly Uncorrected Volume Index
Compressibility Ratio	Monthly Corrected Volume Index
Corrected Flow Rate	Serial Number
Corrected Volume	Station ID
Correction Factor	System Date
Corrected Volume at Alarm	System Time
Decimal of Corrected Volume	Uncorrected Volume at Alarm
Decimal of Uncorrected Volume	Uncorrected Flow Rate
Firmware Version	Uncorrected Volume

A magnetic switch (or optional push button) selects the displayed value. The currently-selected value is indicated by an arrow along the bottom edge of the display.

To change the displayed value, the operator passes a magnetic wand over the switch (see Figure 1.8). With each pass, the selection changes to the next value immediately to the right. The chosen value is indicated by an arrow on the bottom of the display, and points to a number which is indicated on the front panel.

Figure 1.8 Magnetic Switch Operation

Power Supply

Lithium batteries power the meter. These batteries provide a nominal operating life of 7-10 years, based on typical usage.

Remote Pulse Outputs

The meter provides a Form A type pulse output. Two pulse output channels are configurable by using PC Link software, with the choice of uncorrected volume, corrected volume, temperature corrected volume (channel 1 only) or none.

The connected inputs must have the following characteristics:

- be compatible with standard Namur
- be approved as intrinsically safe
- have the following electric limitations (including the connection cable)
- Umax < 16.5 V and Idc max < 50 mA

Pulse Outputs of the Uncorrected Volume

The uncorrected volume output has a programmable pulse weight of 1-1000 volume units per pulse. The pulse has a duration of 250ms. The minimum time between pulses is 250ms.

The maximum output pulse rate of the meter (2 pulses per second) may cause an overflow of output pulses. If this occurs, the pulses will be accumulated in a buffer and trickled out at 2Hz until all accumulated pulses are transmitted.

Pulse Outputs of the Corrected Volume

The corrected volume output has a programmable pulse weight of 1-1000 volume units per pulse. The pulse has a duration of 250ms. The minimum time between pulses is 250ms. The corrected volume pulse is updated every 20 seconds causing pulses to be streamed and so overflow of pulses is possible.

Activating unused output channels or using low pulse weights will reduce battery life.

Pulse outputs of the Temperature Corrected Volume are only available on Channel 1.

Alarm Outputs

The alarm is an open collector output allowing pulse output of the current alarms. If the contact is closed, there is an active alarm. This closure is reset after 20 minutes and remains open until another alarm is activated.

See Chapter *8, Alarms*, for detail information on the alarms.

Event Logger

The event logger is a database function. It checks for an event occurrence every minute. If an event has occurred, the event code, the date, and the time are recorded. The log can contain 178 events and 22 last occurrence events. This log is circular.

The events that are logged are shown in Table 1.5.

Table 1.5 Events Logged

Battery Alarm-- Low Voltage or Days Expired
Battery Change
Calculation Overflow
Change of Correction Parameter or P or T
Change of Parameter
Change of Pulse Output Parameters
Change of Volume Indexes or Meter Pulse Weight
Date/Time Changed
Meter Reset (either power outage or watchdog reset)
Oscillation Sensor Failure--Critical
Oscillation Sensor Contamination
Oscillation Sensor Warning
Over Flow Rate Alarm
Reset Alarm Volumes or Alarm Codes
Reset of Event Log or Last Occurrence Events
Temperature Alarm

Meter Badges and Labels

There are a variety of meter badges and labels offered to meet different market requirements. The standard meter has a metal badge mounted on the meter body and a label mounted on the index cover. There is also a provision for mounting an additional metal plate that can be used to identify the utility's serial number for the meter.

Meter Badges

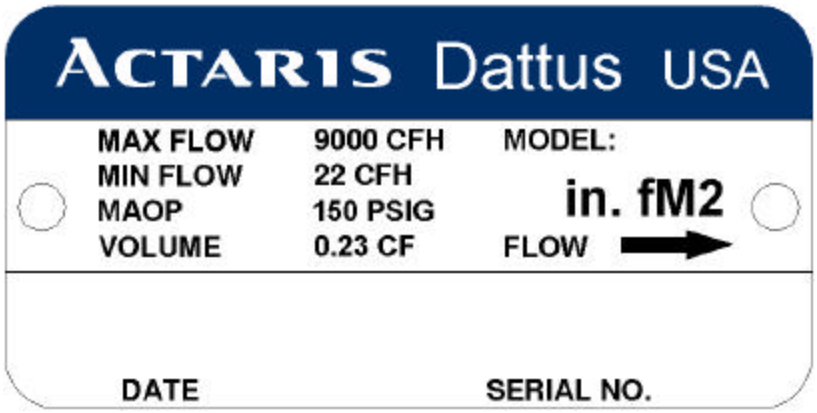


Figure 1.9 Meter Badge

The meter badge is an aluminum plate, mounted permanently to the cast body of the meter. This plate identifies the meter and its service limitations and contains the following information:

- Meter serial number
- Maximum Allowable Operating Pressure (MAOP)
- Maximum flow rate
- Minimum flow rate
- Manufacturer name
- Meter model name
- Date of manufacture
- Meter Volume (CV)

Labels

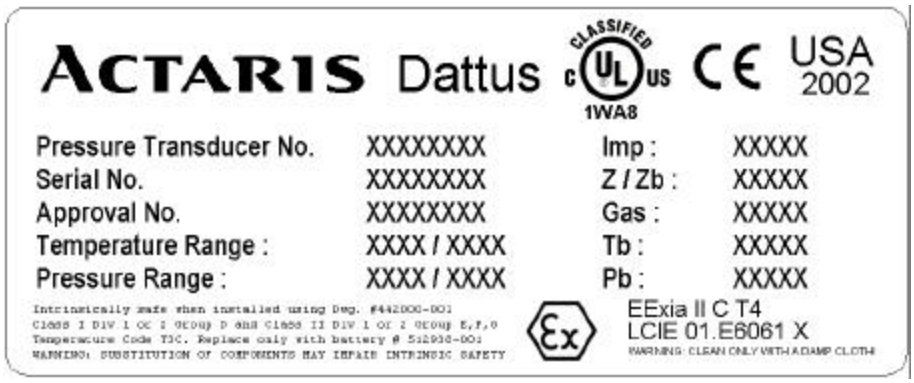


Figure 1.10 Meter Label

The information label is a plastic label on the side of the external cover. This plate identifies the functionality of the index. The meter serial number on the meter body and the index serial number on the label may not be from the same series of numbers. The label contains the following information:

- Manufacturer name
- Index serial number (if needed)
- Year of manufacture
- Temperature range (for correction)
- Pulse outputs (register and weight)
- Gas type
- Intrinsic safety reference and supplementary information
- CE and UL approval information
- Base Temperature
- Country of Origin