# Model FP-100
General Specification

Features

▸ **Improved metering accuracy and functionality**

▸ **Single key access to most important parameters**

▸ **Display of data in user-selectable, engineering units**

▸ **Self diagnostics and operational fault monitoring**

▸ **Serial I/O ports for both a host computer and printer**

▸ **Full remote terminal unit (RTU) operation**

▸ **Highly versatile data logging capabilities**

▸ **NEMA 4 enclosure**

▸ **Battery back-up of all programmed data**
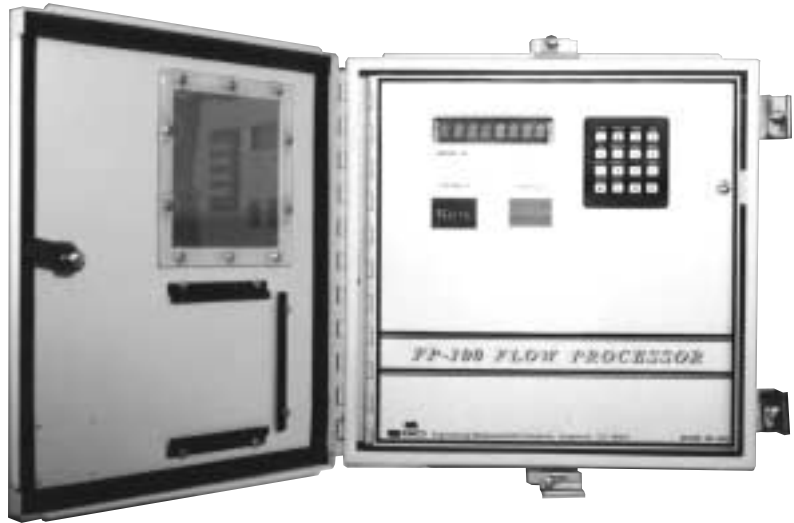
EMCO's FP-100 is a flow processor, data logger and remote terminal unit (RTU) that is fully programmable for a wide variety of flow applications. It accurately calculates volume, mass and heat flow rates for steam, most liquids and gases. Pressure and/or temperature compensation and a 6-point linearity correction for flow may be used to enhance the performance. All important flow related parameters are calculated by the FP-100 and may be displayed on the front panel, many with one key access. In addition, the corresponding engineering units (in either English or metric) may be displayed.

Three 4–20 mA current outputs and eight relay outputs are available options and may be assigned to one of the process variables. A host computer can be used to program and monitor any of the internal data from a remote location. An optional printer interface may be used to provide on-demand reports or data logging at intervals from 1 second to 99 hours.

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Operating Specifications

Fluid Types
Steam condensate, water, water energy, liquid, air, natural gas, ideal gas, steam

Storage Temperature
–40 to 140°F (–40 to 60°C)

Operating Temperature
32 to 120°F (0 to 49°C)

Relative Humidity
0 to 95% (non-condensing)

Power Requirement
The FP-100 power supply, 30 VDC ± 5% at 20 mA, is used for powering external transmitters.

Standard ....22 to 32 VAC, 0.8 amps maximum
Option 1 ....115 VAC ± 15% @ 50/60 Hz
Option 2 ....230 VAC ± 15% @ 50/60 Hz

Battery Backed Memory
3.0 VDC lithium cell; 6 month minimum retention of programmed data during power loss.

Input Signals
Analog (3 total)
$\quad$ 4–20 mA, 50 Ω nominal resistance.
RTD (2 total)
$\quad$ 2 or 3 wire platinum, 1000 Ω nominal at 0°C.
Frequency (2 total)
$\quad$ Square wave, sine wave, or pulse. 0 to 60 kHz, 2.5 to 40 V peak, 10 μsec minimum pulse width, 10 kΩ minimum impedance.
Digital (flow direction)
$\quad$ Forward = 5–30 VDC or ground.

Output Signals
Power
$\quad$ 30 VDC ± 5%, short circuit protected, 200 mA maximum.
Digital (2 total)
$\quad$ Isolated open collector transistor, 32 VDC, 50 mA maximum.
Analog (optional, 3 total): Isolated 4–20 mA ± 0.1%
Relay (optional, 8 total)
$\quad$ 100 VDC or peak AC maximum; 0.25 amp, 3 watt maximum.

Communications
Compatibility
EIA RS-232C

Multi-Drop Capability
Up to 10 units on a single RS-232C port (RS422 compatible)

Programmable Baud Rate
300, 600, 1200, 2400, 4800, 9600

Data Bits
7 or 8

Parity
Even, odd, or none

Stop Bits
1 or 2

Options
Mechanical Totalizers
Each FP-100 includes a 6-digit, non-resettable, mechanical totalizer mounted on the front panel in addition to two "software" totalizers. As an option, another mechanical totalizer may be added. Each totalizer may be independently assigned and scaled.

Battery Backup
The battery backup option provides at least 2 hours (1.2 amp-hr) of uninterruptable power in case of power failure. Housed in a separate NEMA 4 enclosure, it remains continuously charged during normal operation.

Accessories
Flo-Link Communication Software
Flo-Link is a communication program designed to work directly with EMCO's flow processors. It allows the user to maintain a computerized back-up of the programmed data and also operates as a remote host to the flow processor. Several flow processors may be linked to one central site using modems or direct RS-422 communication. Flo-Link requires an IBM® or compatible DOS based computer.
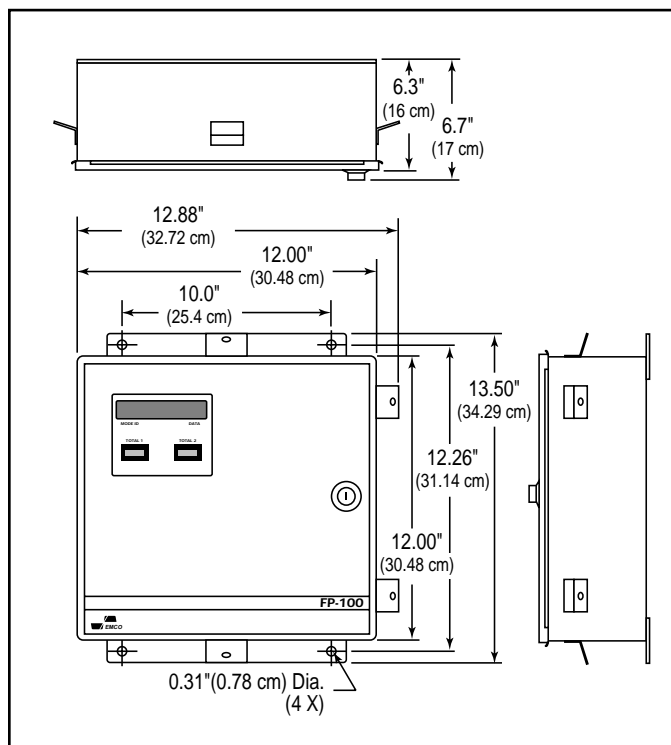
Dimensions

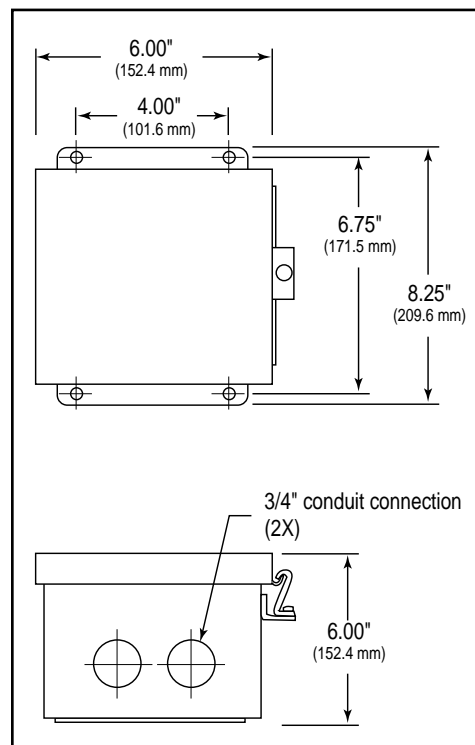Figure 1. FP-100 with NEMA 4 Enclosure Dimensions.

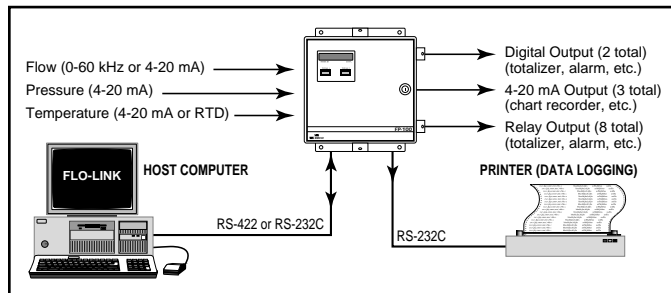Figure 2. FP-100 Battery Backup Dimensions.

Operation

Figure 3. FP-100 Installation with Host Computer and Printer.

As a microprocessor based device, the FP-100 can enhance both the accuracy and functionality of virtually any flow application. The unique characteristics of each application are programmed into the flow processor, and the unit's extensive algorithms compute the desired results. Programming of the unit may be done either directly from the front panel or indirectly via a serial communication link. Monitoring of the system may involve direct readout on the front panel, data returned via communication or hard copy in the form of printed reports.

Inputs
The FP-100 is capable of accepting a variety of electrical inputs, and if needed a 30 VDC supply is available to power the input devices. Table 1 outlines the input types available for each flow parameter.
Depending upon the application, one or more of the above inputs will be used in the flow calculations. If desired,

the operator may substitute constant values in place of the "live" inputs. Because of the flexibility of input types, a variety of flowmeters may be used including turbine, vortex, differential pressure, sonic and magnetic. Inputs may be scaled to any operating range; a fault indication occurs when an input drops out of range.

Flow Rate	Frequency (0–60 kHz), Analog (4–20 mA)
Flow Direction	Digital (contact closure)
Pressure	Analog (4–20 mA)
Temperature (2)	Analog (4–20 mA), RTD (1000 Ω)

Table 1. Available Input Types.

Outputs
The FP-100 comes standard with two digital outputs. Three analog (current) and/or eight relay outputs are available as an option. The digital outputs are optically isolated, solid-state devices and may be used to drive mechanical totalizers or external alarms. As totalizer drivers, they may be independently assigned to one of the flow rates listed in Table 3 and scaled to any value. As alarms, they may be independently assigned to one of several parameters, (also listed in Table 3), and set to trigger above or below a programmable setpoint. The three 4–20 mA current outputs may be used to drive chart recorders, control instruments, etc., or for signal retransmission. Each output may be individually assigned to one of the internal parameters listed in Table 3,

and scaled to any desired range. A fault indication will occur if the output drops out of the specified range. The eight relay outputs available are dry contact relays that function similarly to the digital outputs but provide additional driving capability. These outputs can be used for applications that require AC control or greater current output. Each relay is functionally tied to one of the two digital outputs –four relays associated with each output.

Calculations

Based upon electrical inputs received and data programmed into the unit, the FP-100 can calculate all the necessary flow related parameters. See Table 3 for a summary of most used parameters and the engineering units associated with each. Many of these parameters require a microprocessor based instrument to handle the sophisticated algorithms or table look-up routines; See Figure 4. Table 2, lists the accuracies inherent in these calculations.

In addition to instantaneous flow calculations, the FP-100 will compute total flow for any two flow rates in both the forward and reverse directions (see Table 1.) These "software" totalizers may be programmed to count at any desired increment. Average, minimum and maximum values for a number of important parameters are also maintained and may be reset during data logging or manually by the operator. See Table 3 for specific parameters which exhibit these features.
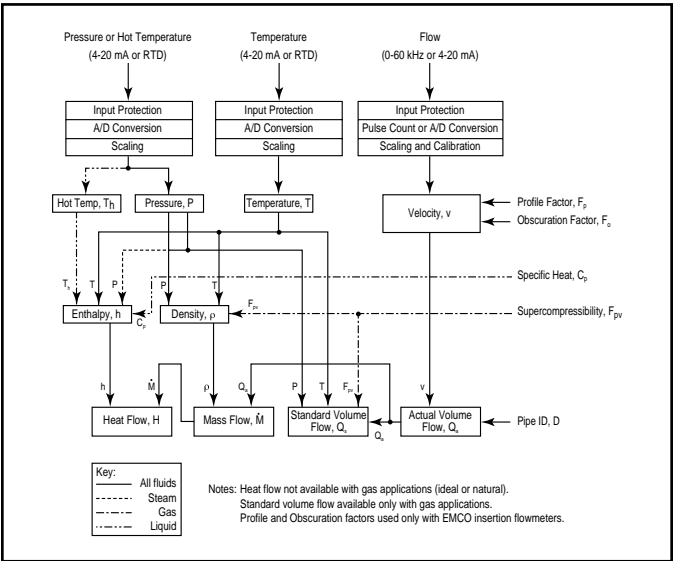
Front Panel

Any of the inputs, outputs or other important data may be monitored and/or programmed from the front panel. The 16-key, tactile-feedback keypad allows fast access to the most important data via individually labeled keys, or alternatively, to *any* of the internal data with a 3-keystroke sequence.

The front panel readouts include an 8-character alphanumeric display and a separate 6-digit mechanical totalizer. Optionally, a second totalizer may be added to the front panel. The main display can show any of the internal data or its associated English or metric units. All floating point numbers may be displayed with a floating decimal point or in scientific notation. Additionally, a fault indication is given if a problem occurs.

Host Communication (RTU operation)

A remote device may be used to fully monitor and/or program the FP-100. Any RS-422 or RS-232C compatible device may be used as the host. Flo-Link or other software, available from EMCO, can provide a convenient means of utilizing the RTU features. The RS-422 option allows long cable distances and "multi-dropping" of units where more than one FP-100 is connected to a single source.

The communication protocol observes a simple ASCII format. The baud rate and data format are both user-settable. In addition to examining data one piece at a time, the host may request a report of several parameters at once. Four standard reports of commonly requested data and one programmable report are available.

Printer (Data Logging)

An optional RS-232C compatible serial printer may be connected to the FP-100, providing hard copy reports of any or all of the internal data. The baud rate and data format are both user-settable. The FP-100 is capable of anywhere from 40 to 200 column formatted output. Both "on-demand" reports initiated by the operator and periodic reports for data logging are available. The four separate on-demand reports each print a different list of current data, given values, descriptions and engineering units where appropriate.

Data logging allows the periodic recording of flow data. The time interval between reports is programmable from 1 second to 99 hours (more than 4 days.) Any of the internal parameters may be included in each report (up to 20 total), and they may be printed in any order. See Table 3, for a partial list of parameters. In addition to the periodic reports, the FP-100 may be programmed to automatically generate a report upon the occurrence of a fault condition. See Figure 5.

Figure 4. FP-100 Flow Calculations.

Calculation	Range	Accuracy	
		Nominal	**Worst Case**
Pressure calculated from temperature (saturated steam)*	14.7–1500 psia, 212–600°F	0.2%	0.5%
Temperature calculated from pressure (saturated steam)*	14.7–1500 psia, 212–600°F	0.2%	0.6%
Density (saturated or superheated steam)*	14.7–1500 psia, 212–1500°F	0.1%	0.5%
Vapor enthalpy (saturated or superheated steam)*	14.7–1500 psia, 212–1500°F	0.2%	0.9%
Liquid density (water with temperature input)*	32–600°F	0.02%	0.2%
Liquid enthalpy (water with temperature input)*	32–600°F	0.2%	0.6%
Supercompressibilty (natural gas)	0–1300 psia, ⁻40–85°F	†	†

Table 2. Accuracy of Flow Calculations.

Notes:

* Accuracy referenced to ASME Steam Tables© 1983.

† Calculation performed in accordance with AGA NX-19 Report© 1963

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FP-100	English Units	Metric Units	Analog Output	Alarm	Totalizer	Average Min & max	Data Logging
Line Velocity	ft/sec	m/sec	•	•			•
Actual Volume Flow	ft³/time*	m³/time*	•	•	•	•	•
Liquid Volume flow	gal/time*	l/time*	•	•	•	•	•
Gas Flow Rate	scf/time*	ncm/time*	•	•	•	•	•
Mass Flow Rate	lbs/time*	kl/time*	•	•	•	•	•
Heat Flow Rate	Btu/time*	kJ/time*	•	•	•	•	•
Heat Flow Rate	refrigeration tons	kWatts	•		•		•
Line Pressure, Absolute	psia	bara	•	•		•	•
Line Temperature	°F	°C	•	•		•	•
Differential Temperature	°F	°C	•				•
Fluid Density	lbs/ft³	kg/m³	•	•			•
Specific Volume	ft³/lb	m³/kg					•
Fluid Enthalpy	Btu/lb	kJ/kg					•
Total Forward Flow	as assigned	as assigned					•
Total Reverse Flow	as assigned	as assigned					•
Analog Output Value	%	%		•			•
Fluid Viscosity	cP	cP					•
Flow Profile Factor	–	–					•
Obscuration Factor	–	–					•
Supercompressibility	–	–					•
Fault Occurrences	–	–		•			•
Fault Duration	min	min					•
System Time	hrs, min	hrs, min					•
System Date	year, month, day	year, month, day					•

Table 3. Application Guide.

Notes:

* The time base for all flow rates is selectable, and may be in seconds, minutes, hours, or days.

Figure 5. Sample FP-100 Periodic Report.

Model and Suffix Codes

| CATEGORY	DESCRIPTION	SUFFIX CODES					
Model	Single Channel Flow Processor	FP-100	. . .	. . .	. . .	. . .	. . .
CPU PCB Assembly	Printer output CPU	. . .	P	. . .	. . .	. . .	. . .
4–20 mA and Relay Output PCB Assy.	No output board	. . .	. . .	0	. . .	. . .	. . .
	3 analog outputs, 0 relays	. . .	. . .	1	. . .	. . .	. . .
	3 analog outputs, 8 relays	. . .	. . .	3	. . .	. . .	. . .
Electromechanical Totalizers	1 mechanical totalizer	. . .	. . .	. . .	1	. . .	. . .
	2 Mechanical Totalizers	. . .	. . .	. . .	2	. . .	. . .
Power Supply	24 VDC	. . .	. . .	. . .	. . .	0	. . .
	115 VAC, 60 Hz	. . .	. . .	. . .	. . .	1	. . .
	230 VAC, 60 Hz	. . .	. . .	. . .	. . .	2	. . .
	115 VAC, 50 Hz	. . .	. . .	. . .	. . .	3	. . .
	230 VAC, 50 Hz	. . .	. . .	. . .	. . .	4	. . .
	115 VAC, 60 Hz battery backup	. . .	. . .	. . .	. . .	5	. . .
	230 VAC, 60 Hz, battery backup	. . .	. . .	. . .	. . .	6	. . .
	115 VAC, 50 Hz, battery backup	. . .	. . .	. . .	. . .	7	. . .
	230 VAC, 50 Hz battery backup	. . .	. . .	. . .	. . .	8	. . .
Enclosure	NEMA 4 enclosure	. . .	. . .	. . .	. . .	. . .	N

Example

FP-100-P-1-1-1-N

Ordering Instructions

1   Select one character from each category of suffix codes
to fill in the complete model number.

2   The communications software (Flo-Link) is included. Flo-Link can
examine/alter current data or provide disk-file backup to the flow processor's
programmed data. Requires an IBM PC, AT or compatible computer.

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Providing innovative flowmeter products and services for over three decades . . .

Engineering Measurements Company (EMCO) is a long established manufacturer of precision flowmeters for liquid, gas, and steam applications for commerce and industry. Manufactured under an ISO 9001 certified quality system, which includes extensive flow calibration capability, engineering, applications, and service, underpining a world-wide sales and service organization totally focused on providing the best flowmeters and customer service in the industry.

▸ Manufacturing is housed in a modern plant located in Longmont, Colorado

▸ Modern clean-room, mechanized assembly equipment, and computer based testing ensure the highest quality product

▸ Trained professional flow specialists and technicians offer timely customer assistance

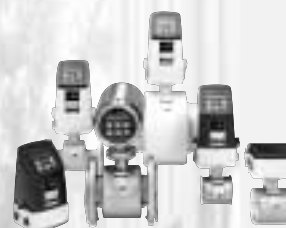▸ Factory trained and certified field technicians provide product support services
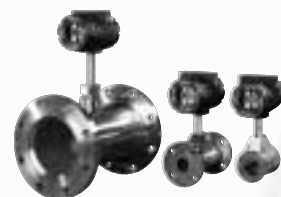
Vortex PhD™ Inline Vortex

V-Bar™ Insertion Vortex

Turbo-Bar™ Insertion Turbine

MAGFLO® Electromagnetic

PDH Helix

PDP Piston

Sono-Trak™

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