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SECTION 1 INTRODUCTION

1.1 GENERAL DESCRIPTION

The OMEGA® FPM-700 Series Digital Indicator is a microprocessor-based instrument designed to indicate flow rate of a liquid by measuring the signal generated by a flow sensor. Variations in flow are damped by internal averaging with a time constant of approximately 8 seconds which yields an easy-to-read non-flickering readout. The display is updated every 2 seconds.

The measurement is indicated on a 3½ digit LCD (Liquid Crystal Display). The units and multiplier (if any) are shown in a window below the display. The rugged, solid-state design of the meter insures proper operation in high-vibration environments.

The range and scaling of the FPM-700 Series is pre-set as ordered at the factory, according to specified ordering information. Standard units are gallons per minute. The FPM-700 requires no routine maintenance.

The Digital Indicator is powered by a 12-volt nominal DC 125-milliamp source. The supplied AC/DC power converter permits operating the FPM-700 using 117 ±12 volts AC at 60 Hz.

The FPM-700 Series with appropriate plug-in input module is compatible with the OMEGA Series FP-540, FP-550, FP-5300, FP-5100 and FMG-5300 sensors. Input and output connections are made on a terminal strip mounted on the rear of the flow meter's case.

A TTL compatible pulse output of the digital flow meter can be used for data logging and computer interfacing. In addition, this output can drive other flow instruments (except the FPM-800 Self-Powered Flow meter) resulting in systems that can measure, control, and/or integrate flow over a wide range of parameters.

The FPM-700 can be mounted in an instrument panel or on the optional mounting bracket. The front of the case is submergible.

SECTION 2 INSTALLATION

2.1 UNPACKING

Remove the packing list and verify that all equipment has been received. If there are any questions about the shipment, please call OMEGA Customer Service Department at (203) 359-1660.

Upon receipt of the shipment, inspect the container and equipment for any signs of damage. Take particular note of any evidence of rough handling in transit. Immediately report any damage to the shipping agent.

NOTE

The carrier will not honor any claims unless all shipping material is saved for their examination. After examining and removing contents, save packing material and carton in the event reshipment is necessary.

2.2 MECHANICAL INSTALLATION

2.2.1 Power Converter

The supplied power converter case may be secured in any convenient location near the FPM-700 by its four mounting holes using #6 hardware. Mounting hole centers are 2.50 inches and 3.187 inches rectangular.

2.2.2 Digital Indicator

The FPM-700 may be installed as far as 200 feet from the flow sensor (1000 feet from the Magnetic Processor of the FMG-5300). Refer to the flow sensor operator's manual for flow sensor installation. If the FPM-700 location is beyond the standard 25-foot sensor cable length, (except when used with the FMG-5300), an extension cable must be used. Additional distances, or systems incorporating several instruments, may require the use of the OMEGA FLSC-720 Signal Conditioner.

The FPM-700 Series indicator may be mounted in an instrument panel having a 5.1-inch square hole with sufficient clearance around it to accommodate the 5½ inch front bezel. There must be a minimum 4¾ inch rear clearance. To install:

1. Assemble the clamp ring (see Figure 2-1).
2. Loosen the two "A" screws of the clamp ring (see Figure 2-1).
3. Insert the rear of the indicator through the front of the prepared hole.
4. Slip the clamp ring over the rear of the indicator. With the front flange of the unit held tightly against the front panel, position the clamp ring snugly against the rear of the panel.
5. Tighten the two "A" screws.
6. Seal the front flange firmly against the panel by tightening the two "B" clamping screws hand tight. Do not overtighten these screws. Overtightening will cause the clamp ring to slip.

NOTE

For flow sensor installation, refer to the flow sensor operator's manual.

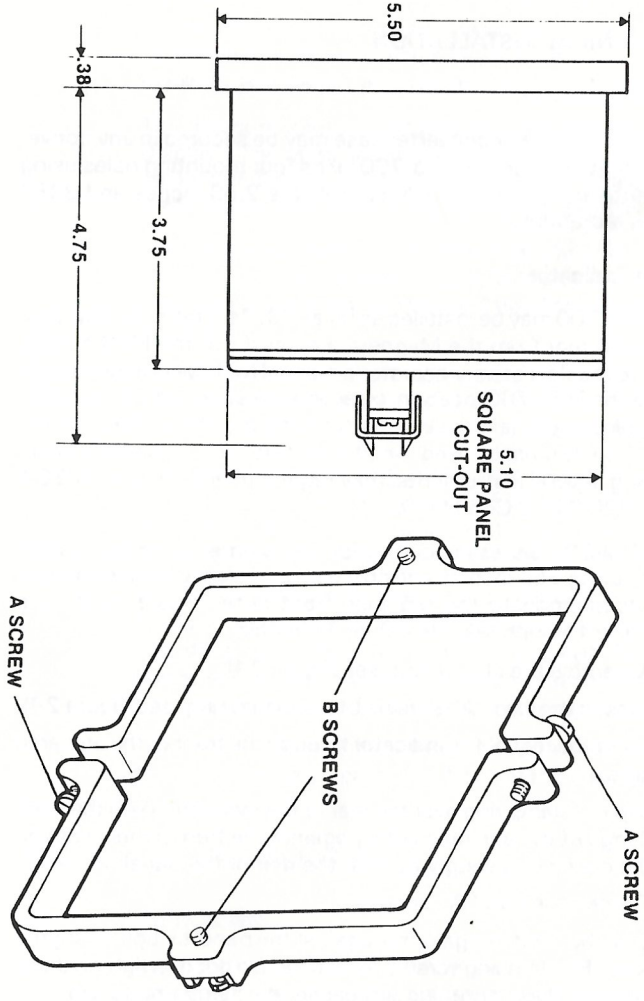


Figure 2-1. Detailed Profile of the FPM-700 Series and an Isometric View of the Clamp Ring (right).

2.3 INPUT/OUTPUT TERMINAL STRIP

All input and output connections are made on the terminal strip on the rear of the FPM-700 (see Figure 2-2). The terminal strip is accessed by removing its plastic safety shield. This is accomplished by pinching inward each pair of plastic locking latches. Once all terminal connections are made, replace the safety shield.

2.4 INPUT CONNECTIONS

2.4.1 From Flow Sensor

Connect the wires from the flow sensor to the XDCR terminal group: the black wire to the BLK terminal, the red wire to the RED terminal, and the shield (white) wire to the SHLD terminal (see Figures 2-2 and 2-3). For a magnetic flow sensor, connect a twisted-wire pair from PULSE OUT of the magnetic processor to the RED terminal of the FPM-700 and from the PULSE RETURN of the Magnetic Processor to the SHLD terminal.

2.4.2 From Power Source

When using the supplied Power Converter, connect 117 volts AC (60 Hz) to the power converter's input AC terminals. Then connect either adjacent + and − terminal pair of the converter to the + and − terminals respectively of the FPM-700. Since the FPM-700 draws minimal current, #20 gage wire is sufficient for this application for distances up to 25 feet. The FPM-700 does not have a power switch.

2.5 OUTPUT CONNECTIONS

2.5.1 Pulse Out

Other flow instruments (except the FPM-800 Self-Powered Flow meter) or other TTL-compatible devices (such as a data acquisition system, data logging instruments, etc.) may be driven by the pulse output of the FPM-700. Connect the high input of these instruments to the PULSE OUT terminal of the FPM-700 and the low input to the SIG GND terminal. The CNT OUT terminal of the FPM-700 is not used.

Figure 2-3. Various Inputs To, and Output From, the FPM-700.
NOTE: VERIFY ALL FLOW SENSOR OUTPUT CONNECTIONS BY REFERRING TO THE APPROPRIATE OPERATORS MANUAL.

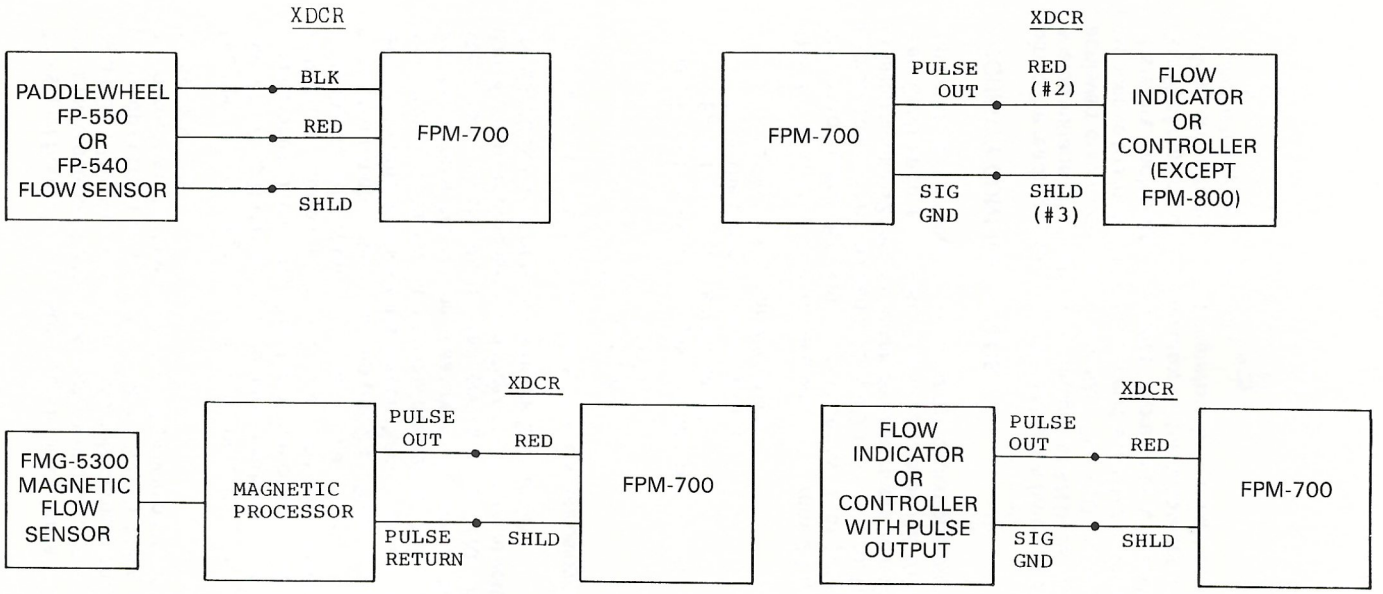
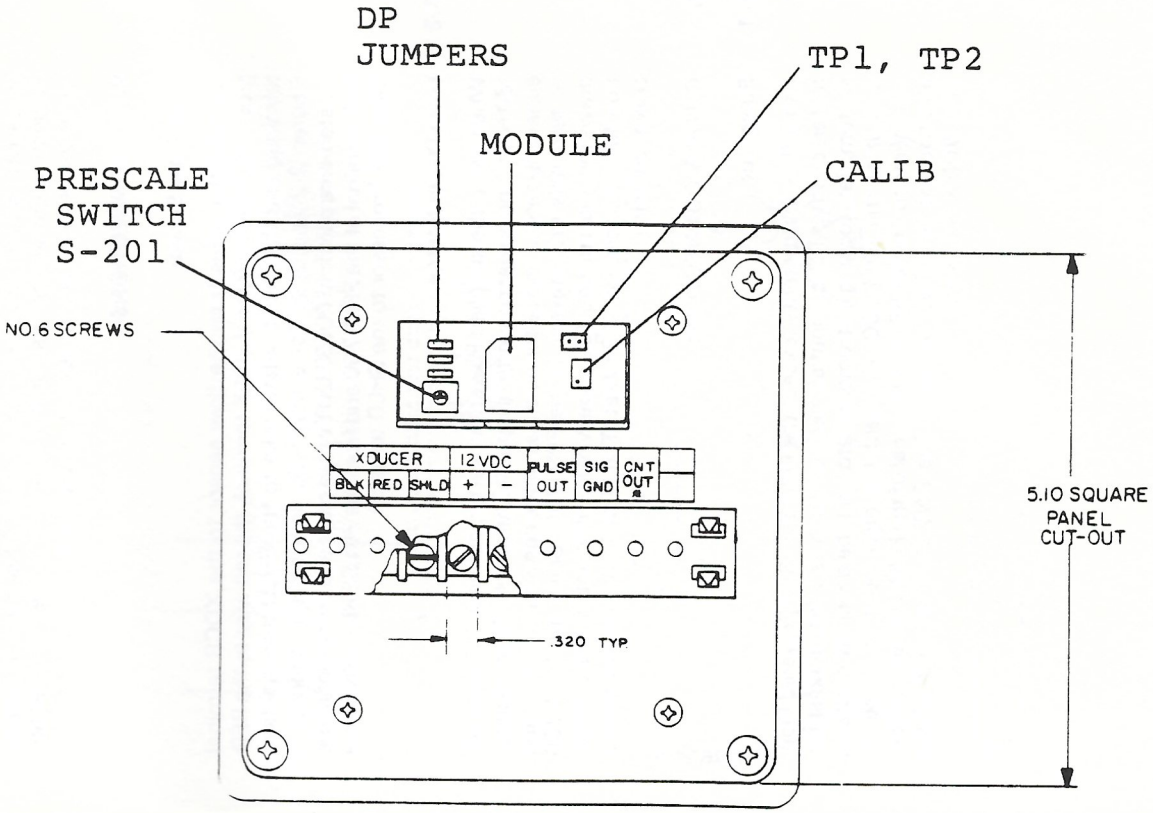


Figure 2-2. Rear View of the FPM-700.



SECTION 3 THEORY OF OPERATION

The signal from a flow sensor is conditioned, buffered, prescaled and then processed by the flow meter's microprocessor. (Refer to Figure 3-1). This microprocessor is a single-component microcomputer operating at a clock rate of 3.579 MHz. From the microprocessor, the flow rate is then displayed on the 3½ digit LCD of the FPM-700.

The flow sensor's signal is applied to the plug-in input module of the FPM-700. This module conditions the flow sensor signal. The initial processor circuitry then forms the conditioned signal into square-wave pulses. These pulses, which have the same frequency as the transducer output, are available at the PULSE OUT terminal on the meter's terminal strip (see 2.5.1 Pulse Out) to drive external TTL-compatible instrumentation. Next, these same pulses are applied to a prescaler which divides the frequency by N + 1 (N being the number set on the prescale rotary switch S-201). The Microprocessor counts this frequency input at AN0. The A/D section of the microprocessor quantizes the reference voltage, set by the CALIB potentiometer (see Figure 2-2), at AN1.

The microprocessor then calculates the flow rate using the formula:

$$R = \frac{f}{N+1} \times E_C \times 5 \qquad (1)$$

Where R is the reading (neglecting decimal points)
E_C is the reference voltage
N is the prescale switch setting
f is the transducer frequency

The 3½ digit LCD display receives data from 22 ports of the microprocessor. Backplane frequency is originated in the microprocessor and divided by 2 by a D-type flip-flop. This frequency is nominally 82 Hertz and can be used to self-test the indicator (see Calibration sections). The unregulated 12 VDC power is regulated to +5 volts DC which is the circuit operating voltage.

3.1 ACCURACY CONSIDERATIONS

Since the reading shown on the display is a function of a digitized analog voltage (the "reference voltage" at AN1), calibration can be achieved only in discrete "quanta." The A/D conversion is referenced to the internal 5V supply and is divided up into 256 parts. Therefore, each part or "quanta" represents .019 volts. Table 3-1 lists % of reading quantizing error vs. the calibration voltage. This calibration voltage should therefore be as high as possible, to minimize the quantizing error.

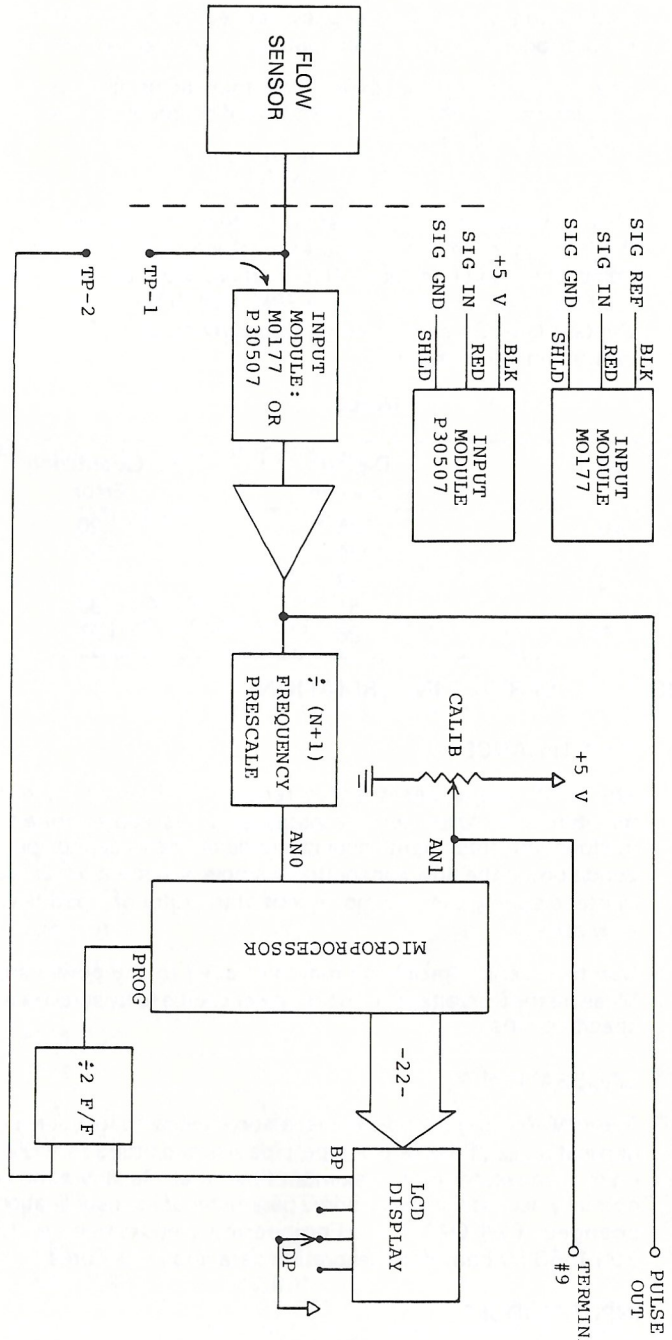


Figure 3-1. Simplified Block Diagram of the FPM-700 Circuitry.

Further, in order to provide the conversion from frequency into engineering units, the frequency applied to the microprocessor must be prescaled to an appropriate value (as shown in equation 1).

The low frequency limit (lowest flow that can be displayed) of the instrument is constrained by the value of the pre-scale switch. The equation for this is:

$$F_{Lo} = 2 \times (N + 1) \qquad (1)$$

This translates into the lowest flow rate by multiplying F_{Lo} times the "A" figure from the calibration chart. A copy of OMEGA's Calibration Chart is required. This chart provides calibration data for the FPM-700 as well as for the FPM-400, 500 and 600 meters. Contact OMEGA's Engineering Department (203) 359-1660 for calibration information.

TABLE 3-1

E_C	Digital Equivalent	± Quantizing Error
5.0	255	.20
4.5	230	.22
2.5	128	.39
1.0	51	.98
0.5	26	1.96

SECTION 4 SERVICE INFORMATION

4.1 MAINTENANCE

The FPM-700 is designed to require minimal or no routine maintenance. After correct installation has been verified, any malfunctions that might occur can generally be traced to operating conditions at the flow sensor (for example, sediment or particulate matter clogging the free movement of the rotor of a paddlewheel flow sensor).

Non-flow sensor problems may be traced to the power supply. Measure the DC voltage from the power source to be sure it is within specifications.

4.2 CALIBRATION

The FPM-700 Digital Indicator is factory-calibrated for your specific application (i.e., flow sensor type, pipe size and fitting as applicable, units of measurement, maximum flow rate). Recalibration is not normally necessary unless some parameter of your application has changed. Call OMEGA's Engineering Department at (203) 359-1660 for complete calibration data and procedures.

4.3 INPUT MODULE

Assure that the proper module is installed as shown in Table 4-1.

The input module provides the proper interface for each flow sensor. The module configuration for your instrument was factory installed per your order. If it is necessary to change the module, first remove the calibration cover on the rear panel of the FPM-700. The input module is located in the center of the opening (see Figure 2-2). Make sure that you place the new module with the flat corner (pin 1) in the upper left-hand corner.

TABLE 4-1

Sensors	Module
FP-5100 FP-5300	M0177
FP-540 FP-550	P30507-x

SECTION 5 SPECIFICATIONS

ACCURACY: ±1% full scale
REPEATABILITY: ±1 count
OPERATING TEMPERATURE: 32° to 150°F
INPUT SIGNAL: 0.4 V P-P min.
POWER REQUIREMENTS: 8 to 18 VDC nominal. Not damaged by voltage as high as 25 VDC. Contains reverse voltage protection.
WEIGHT: 1.5 lbs.
ELECTRICAL CONNECTIONS: Screw terminals

Model No.	Pipe Size	Range* GPM	Minimum Flow GPM
FPM-701	0.50"	0-12	1.0
FPM-702	0.75"	0-18	1.5
FPM-703	1.00"	0-30	2.7
FPM-704	1.25"	0-50	4.5
FPM-705	1.50"	0-80	6.2
FPM-706	2.00"	0-120	10.5
FPM-707	2.50"	0-180	15
FPM-708	3.00"	0-300	23
FPM-709	4.00"	0-500	39
FPM-710	6.00"	0-1200	88
FPM-711	8.00"	0-1800	154
FPM-712	10.00"	0-3000	240
FPM-713	12.00"	0-5000	346

* When using the FP-540 or FP-550 Series sensors, the meter display will correspond to the appropriate range of the sensor.

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