User's Guide

FLR2000/FLV2000 Series
Liquid Flow Meters and Controllers

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Contents

1.0 Introduction.

1.1 This manual covers the following Omega instruments.

1.1.1 Omega FLR2000 series Flow Meters.
1.1.2 Omega FLV2000 series Flow Controllers.

NOTE: It is important that you read this manual before installing or operating any of the instruments. Some sections apply to all of the listed instruments and will be marked accordingly. There are sections which apply only to the series you have purchased and these are also marked accordingly.

1.2 Unpacking Your Instrument.

1.2.1 Inspect Carton for Visible Damage.

Your instrument was packed to withstand normal shipping. If there is any visible damage to the carton, you should contact the shipping company immediately.

1.2.2 Unpack Your Instrument.

Open the container carefully and inspect for concealed shipping damage. If there is damage, this should be reported to the shipping company and a copy sent to your Omega representative.

Please verify that all items on the Packing List are in the box. Any shortages should be reported immediately.

1.2.3 Returning Instrument for Repair.

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should be marked on the outside of the return package and on any correspondence. The purchaser is responsible for shipping charges, freight, insurance and

proper packaging to prevent breakage in transit. In the event that instruments returned for repair are found to be free from warranted defects, then Omega may, at its discretion, charge a fee to the customer for service. The customer shall be notified before repairs are made as to the warranty status of the needed repair. All shipping charges shall be paid by the customer.

All instruments returned for servicing must have a signed certification attached which states that returned instruments have been purged and neutralized of any hazardous materials including but not limited to corrosive, radioactive, toxic or infectious. This certification form is available from Omega customer service.

2.0 Installation.

2.1 Primary Fluid Connections.

Omega FLR2000 series Flow Meters and Omega FLV2000 series Flow Controllers are manufactured with a 1/2" NPT internal thread on both the inlet and outlet ports. Omega kit model FLR2000-MC is available for installation of these instruments utilizing standard O.D. tubing sizes of 1/4", 3/8" and 1/2". The kit material is black polypropylene.

Inspect all parts of the system including pipe, tubing and fittings for dust or other contaminants before assembly. Omega FLR2000 series Flow Meters and Omega FLV2000 series Flow Controllers are tested with water and then closed with a plastic plug before shipping. Upon removal of the plugs, water may drip from the flow body. You should remove the plugs only in a location which will not be damaged by a small amount of water, and the location should also be free of dust or other contaminants which could enter the chamber.

If Teflon tape is used as a thread sealant for the NPT connections, you must not allow pieces of the tape to fall into the flow body as this could clog the orifice. Liquid or paste thread sealants are not recommended. Thread sealants are not to be used on the tube fittings. When removing fittings which

have been sealed with Teflon tape, you must clean both the internal and external threads to prevent pieces of tape from falling into the flow body.

THE DIRECTION OF FLUID FLOW IS LEFT TO RIGHT WHEN FACING THE METER.

2.2 Omega Accessory FLR2000-MC Fitting Installation.

If the fittings supplied in Omega Accessory FLR2000-MC are used, the tubing should be inserted as follows.

2.2.1 Loosen the nut sufficiently so that the O-ring is not compressed.

2.2.2 Using tubing of the O.D. size for which the fitting is designed, cut the tubing with a square end and inspect to see that there are no sharp edges that could damage the O-ring in the fitting.

2.2.3 Insert the tubing carefully, moving the tubing in a slow circular motion until it passes through the stainless steel grab ring, the washer and the O-ring, and "bottoms" in the fitting. You should not have to use excessive force to insert the tubing. If the tubing does not go in easily then you should unscrew the nut completely and visually inspect to verify that the O-ring has not been pushed into the fitting well. You can push the tube through the O-ring and into the fitting with the nut out of the way, however you should be careful to not push the grab ring farther up the tube than it will be when the nut is tightened as the grab ring cannot be moved in a tightening direction on the tube without damaging the grab ring and/or the tube.

2.2.4 Once the tubing has "bottomed" in the fitting, you should hand tighten the nut, forcing the grab ring to grip the tubing surface and compressing the O-ring. The nut should come close to the body of the fitting but does not have to contact the body.

2.3 Checking For Leaks.

The entire system should be checked for leaks using a fluid which is not hazardous and using a system pressure that is within the stated limits of the instruments. *See Maximum Operating Pressure in section **5.12.**

2.4 Mounting.

2.4.1 Locating the Meter.

Omega FLR2000 series Flow Meters and Omega FLV2000 series Flow Controllers are not attitude sensitive; however, it is recommended that they be installed with the flow body in a horizontal position. The display and membrane switches are designed for use in the horizontal.

THE DIRECTION OF FLUID FLOW IS LEFT TO RIGHT WHEN FACING THE METER.

2.4.2 Opening the Box.

It is necessary to open the box in order to access the mounting holes in the back panel of the box. In order to remove the front cover, first remove the power/communication I/O 18 pin plug (this plug can be removed by rotating the locking ring counterclockwise to a stop and then gently pulling down on the plug). The front cover with all the electronic components and circuitry can then be removed by loosening the four plastic screws on the front corners of the enclosure (they have a retainer feature and can be left in the front cover after loosening about 1/2"), separating the cover from the back of the box about 4" (enough to turn the front cover 90° to the side) and then disconnecting the sensor cable connector (the middle connector on the bottom left side of the circuit board which is attached to a cable running through the bottom back of the box). The connector which is removed has a center latch release which must be depressed before pulling the connector from the mating end. You can then put the front of the box with the electronics to one side while mounting the back of the box to the mounting surface. Please use caution while the box is open to insure that no liquids or dirt are allowed to

contact the interior components of the box as this may cause premature meter failure.

2.4.3 Attaching the Box.

The box may be attached by inserting a fastener in either the four holes in the corners of the box (if this is used, then you must be careful to not damage the threads toward the upper end of the holes which are used to attach the front of the box to the back of the box), or you may use the four holes in the back of the box (if these are used, there are four plastic covers to place over the screw heads). The box must be attached securely with the proper size and style of fasteners for the surface on which it is to be mounted.

2.4.4 Reinstalling the Front of the Box.

Once the back of the box has been mounted and the plumbing has been attached, the front of the box can then be reattached in the reverse manner. To insert the 18 pin connector (or 7 pin connector), it will be necessary to pull the lock ring toward the body of the plug to the open position and rotate the locking ring so that the rib on the lock ring lines up with the rib on the inside of the plug body. Then align the locator rib on the plug with the mating slot on the socket and insert the plug. When the plug is fully inserted then push the locking ring toward the panel socket and rotate clockwise until it stops.

3.0 Electrical and I/O

3.1 Power Supply

The standard power supply furnished with all Omega FLR2000 series Flow Meters and Omega FLV2000 series Flow Controllers consists of an ungrounded wall adapter which plugs into a 120VAC, 60 Hz standard receptacle and delivers 15 VDC with maximum 500 mA current to the instrument through pins 1 & 2 of an 18 pin circular watertight industrial I/O connector which plugs into a mating 18 pin socket on the bottom right side of the front portion of the enclosure. If it is necessary to remove the front cover for service, first remove the power/communication I/O 18 pin plug (this plug can be removed by rotating the locking ring counterclockwise and then gently pulling down on the plug). The front cover with all the

electronic components and circuitry can then be removed by loosening the four plastic screws on the front corners of the enclosure (they have a retainer feature and can be left in the front cover after loosening about 1/2"), separating the cover from the back of the box about 4" (enough to turn the front cover 90° to the side) and then disconnecting the sensor cable connector (the middle connector on the bottom left side of the circuit board which is attached to a cable running through the bottom back of the box).

3.2 18 Pin Circular Connector.

In addition to providing the power input to the unit, the 18 pin watertight connector is used to access other I/O functions as follows (see pin indexing illustration # 1). Any pins not referenced here are not used or spare:

3.2.1 Power Supply.

Pin 1 is DC power input (+).
Pin 2 is DC power ground (-).

3.2.2 Chassis Grounding.

The unit can be grounded by attaching the green wire (#7) to a permanent earth ground connection.

3.2.3 Relay Output.

Pin 4 is used for a normally open relay contact.
Pin 6 is used for a normally closed relay contact.
Pin 5 is the common for the relay outputs.

3.2.4 Analog Input.

Pin 8 (**red lead marked #8**) is used for analog in and must be 0 to 5 VDC.
Pin 9 (**blue lead marked #9**) is the ground pin for analog in.

3.2.5 Analog Output #1.

Pin 11 (**orange lead marked # 11**) is used for analog out (+) signals and this can be 0 to 5 VDC or 4 to 20 mA. This option must be selected when placing an order. If 4 to 20 mA is not specified, then it will be set at 0 to 5 VDC.

Pin 12 (**violet lead marked # 12)** is analog out (-) or ground.

3.2.6 Analog Output # 2.

Pin 14 **(yellow lead marked # 14)** is used for analog out (+) signals and this can be 0 to 5 VDC or 4 to 20 mA. This option must be selected when placing an order. If 4 to 20 mA is not specified, then it will be set at 0 to 5 VDC.

Pin 15 **(brown lead marked # 15)** is analog out (-) or ground.

Analog Out #2 is used for the control output on Controller models.

3.2.7 Digital Input.

Pin 17 will accept 0 to 5 VDC digital inputs and is TTL-CMOS compatible.

Pin 18 is the digital ground.

3.3 7 Pin Circular Connector.

This connector is used for RS232 serial communication as follows (see pin indexing illustration #1). Any pins not referenced here are not used or spare:

3.3.1 Serial Communication.

Pin 2 is used to transmit data from the unit to a remote computer.

Pin 3 is used to receive data from a remote computer.

Pin 5 is a ground pin.

3.3.2 Factory Use only.

Pin 4 is for use by the factory only. Any use by the purchaser will void the warranty.

3.4 Accessory Cables.

3.4.1 Standard Cable.

The only accessory cable supplied with Omega FLR2000 series Flow Meters and Omega FLV2000 series Flow Controllers is an ungrounded wall adapter which plugs into a 120VAC, 60 Hz standard receptacle and delivers 15 VDC with maximum 500 mA current to the

instrument through pins 1 & 2 of the 18 pin circular watertight industrial I/O connector which plugs into a mating 18 pin socket on the bottom right side of the front portion of the enclosure.

3.4.1.1 Meter.

The cable supplied with the meter has additional flying leads for analog output and chassis ground. The yellow lead (#14) is for analog output (+) and the brown lead (#15) is for analog output (-). The green lead (#7) is a chassis ground.

3.4.1.2 Controller.

The cable supplied with the controller has additional flying leads for 1 analog input, 2 analog outputs, and chassis ground. Analog input has a red lead (#8) for analog in (+) and a blue lead (#9) is for analog in (-). Analog output #1 has an orange lead (#11) for analog out (+) and a violet lead (#12) for analog out (-). Analog output #2 has a yellow lead (#14) for analog out (+) and a brown lead (#15) for analog out (-). The green lead (#7) is a chassis ground.

3.4.2 Custom Cables.

Custom cables to access all of the available inputs and outputs can be purchased separately. You may order these at the time the original order is placed or at any time afterwards. Please call the factory for pricing.

4.0 Operating Principle.

Omega FLR2000 series Flow Meters and Omega FLV2000 series Flow Controllers are based on the measurement of a pressure drop across a restriction. From this measured pressure drop, the volumetric flow rate is determined. Because the flow does not behave in a purely inviscid manner, a simple loss coefficient can be experimentally determined and applied. The volumetric flow rate is related to the measured pressure drop as found in Equation 1.

$$Q = KA_1 \sqrt{\frac{2\Delta P}{\rho\left(\left(\frac{A_1}{A_2}\right)^2 - 1\right)}} \qquad \text{(Equation 1)}$$

Where: K = experimentally determined loss coefficient
ΔP = measured pressure drop across restriction
ρ = density of fluid or gas
A_1 = cross-sectional area upstream of restriction
A_2 = cross-sectional area downstream of restriction

5.0 Specifications – Omega FLR2000 series Flow Meters and Omega FLV2000 series Flow Controllers.

5.1 Flow Range: .03 to 475GPH

5.2 Flow Medium: The Omega FLR2000 series Flow Meters and Omega FLV2000 series Flow Controllers are designed for liquids.

5.3 Flow Units: Cubic centimeters per minute (CCM) is default. Select GPM, GPH or LPM options from menu. Contact factory for customized units.

5.4 Calibration: Performed at standard conditions (25°C and 14.7 psia).

5.5 Accuracy: ± 1% Full Scale.

5.6 Repeatability: ± 0.5% Full Scale.

5.7 Linearity: ± 0.25%

5.8 Temperature Coefficient: .05%/degree C

5.9 Temperature Range: 0 to 70 degrees C

5.10 Turndown Ratio: 50:1

5.11 Response Time (typical): 50 milliseconds

5.12 Maximum Pressure: 250 PSIG

5.13 Relative Humidity Range (ambient): 0 to 100%

5.14 Attitude Sensitivity: None. Unit is designed to be installed with the flow body in a horizontal position for operation of membrane switches.

5.15 Input Signals: 1 Digital input – TTL/CMOS compatible and 1 analog input – 0-5 VDC equals maximum flow setting.

5.16 Output Signals: 2 Analog 4-20 mA (standard) outputs or 0-5 VDC (optional) outputs (one output drives valve on Controllers), 1 RS232 serial port (19200 baud rate – full duplex operation on separate 7 pin connector), and 1 relay output (SPDT 1 amp).

5.17 Supply Current: 0.25 Amp with back lighting on meters and .45 amp with back lighting on controllers.

5.18 Supply Voltage: 15.0 VDC maximum @ 300 mA maximum current on meters and 500 mA maximum current on controllers.

5.19 Supply Voltage – 4-20 mA output models: Loop powered – no supply necessary.

5.20 Power Consumption: less than 3.5 watts on meters and 6 watts on controllers.

5.21 Indicating Display: 4 line x 20 character LCD – back lighted

5.22 Human Interface: Membrane Touch Switch with menu driven screens with audible beep standard.

5.23 Connector Electrical: Serial connector is 7 pin circular watertight Female, I/O connector is 18 pin circular watertight female.

5.24 Connector Mechanical: 1/2" NPT standard, 3/4" optional w/high flow model.

5.25 Wetted Materials (Standard): PVC

5.26 Wetted Materials (Optional): CPVC, 316 L Stainless, Teflon, Kel-F, Alloy.

5.27 Dimensions: 7.125" wide x 10.25" tall x 4.875" deep

5.28 Pressure Drop (Typical Full Scale): 20-60 psi

5.29 Totalizer: Totalizes flow over specified time with reset.

5.30 Relay Output Standard: .5 Amp, Single Pole, Double Throw.

5.31 Aggressive, Corrosive, Abrasive Medias: Call factory for availability.

6.0 Operation

6.1 Keypad Functions

These functions are the same on Omega FLR2000 series Flow Meters and Omega FLV2000 series Flow Controllers.

6.1.1 Up Arrow Key – Multi-function.

Use the Up Arrow Key to page through screens from forward to backward. Use the Up Arrow Key to change the ten's value of a setpoint on the setpoint screen (Controller models only) after selecting either up or down with the Scroll Key.

6.1.2 Down Arrow Key – Multi-function.

Use the Down Arrow Key to page through screens from backward to forward. Use the Down Arrow Key to change the one's value of a setpoint on the setpoint screen (Controller models only) after selecting either up or down with the Scroll Key.

6.1.3 Scroll Key – Multi-function.

Use the Scroll Key to select a function on a user selectable screen. Use the Scroll Key to select Up or Down while changing setpoints on controller units (the Scroll Key must be depressed and held with the asterisk indicating Up or Down, while using the Arrow Key to change the value).

6.1.4 Enter Key.

Use the Enter Key to store function changes made by the Scroll Key or setpoint changes (Controller models only) made by the Scroll Key and Arrow Keys.

Note: When the Enter Key is pressed on a user selectable screen, an exclamation point will appear on the upper right hand corner of the display to indicate that the selected value has been accepted and stored.

6.2 Screens and Screen Actions – Omega FLR2000 series Flow Meters and Omega FLV2000 series Flow Controllers.

(This section lists screens and screen actions for Omega FLR2000 series Flow Meters and Omega FLV2000 series Flow Controllers. Screens which are only active on controller models are so marked.)

6.2.0 Boot-up Screen.

The boot-up screen will only display on start-up. Information available on the boot-up needed for obtaining service is also available on the service screen.

6.2.1 Flow Rate Screen.

This screen displays the flow rate in real time and in the flow units which were selected (see Flow Units Screen 6.2.6). This is the default screen and the system will default to this screen from others (except the Flow Totalizer Screen – see 6.2.4, the Reset Totalizer Screen – see 6.2.5, the Alarm Message Screen – see 6.2.10, and

the Service Screen – see 6.2.12) if no action is taken on a screen for 10 seconds. When this screen is selected, the RS232 serial port will stream the actual flow rate at a baud rate of 19200. The flow rate transmission data is transmitted approximately every .5 seconds and the unit is the same as the unit selected on the Flow Units screen.

6.2.2 Setpoint Change Screen. (Only active in controller model.)

This screen allows the user to change the flow set point using the local keypad, analog input or serial input (see Select Input Screen 6.2.7). Use the scroll key to select up or down. While holding the scroll key depressed on the desired direction (asterisk must be showing in the proper box), use the arrow keys to change the setpoint. The left arrow key changes the 10's digit and the right arrow key changes the 1's digit. After reaching the desired setpoint, you must release the scroll key and then press the enter key to retain that setpoint in the memory. An exclamation point will show in the upper right hand corner of the screen to indicate that the entry was recorded.

6.2.3 Orifice Screen.

This screen displays the identification of the orifice that is installed in the flow body.

6.2.4 Flow Totalizer Screen.

This screen displays the accumulated flow in the selected units over time in real time (does not default).

6.2.5 Reset Totalizer Screen.

This screen allows the user to reset the totalized flow to zero on the Flow Totalizer Screen. Use the scroll key to select reset (by putting an asterisk inside the brackets) and then push the enter key to complete the reset operation (an exclamation point will appear in the upper right corner when the reset has been entered into the memory). Because this meter is a real-time flow indicator, the flow totalizer will not be zero when you

return to that screen if there is flow. This screen does not default.

6.2.6 Select Flow Units Screen.

This screen allows the user to select the flow units which will be displayed on the Flow Screen. There are 4 units available as standard. Cubic centimeters per minute (CCM) is default. Select GPM, GPH or LPM options from menu. Contact factory for customized units Use the scroll key to select the desired flow unit then use the enter key to retain the selection in memory. Other flow units are available.

6.2.7 Select Input Screen. (Only active in controller models.)

This screen allows the user to change the flow set point input mode by selecting analog input, serial input (com1) or local keypad. Use the scroll key to select the desired input and then use the enter key to retain the selection in memory. If the serial input (com1) is selected and there is an operating computer wired to the system, then the keypad setpoint function will automatically be locked out. If this function is selected without an operating computer wired to the system, then the unit will default to local (keypad) input after 10 seconds. This screen function only controls input to the set point. All other screens can be viewed when Com1 is selected. Analog input power is set at the factory for either 0-5VDC or 4-20 mA and cannot be changed in the field.

6.2.8 System Alarm Screen.

This screen allows the user to select failures which will send alarm notification. Over differential pressure, external alarm and no/low flow are standard. Use the scroll key to select the alarm feature desired (a double arrow will point to the feature selected). If an asterisk appears within the brackets and you want to select that feature, then press the enter key to retain the selection in memory (the asterisk will then remain in the display). Scroll to the second and third features and repeat. After all feature selections have been determined, use the arrow keys to move to an adjacent screen and then back to verify your selection. Without pressing the scroll key to

activate the pointer, the asterisks will show the features which are currently in memory. Deselect by using the scroll key to point to the feature desired. If the feature was previously selected, then the asterisk will disappear if you point to that feature. Press the enter key and the deselection will be retained in memory. You should always verify your selection by moving to an adjacent screen and returning. After selecting alarms to be used, the alarm relay must still be enabled (see also Alarm Relay Enable Screen 6.2.9). Anyone or all three alarm features can be selected or deselected at any time. Once an alarm has occurred, the user must deselect the feature in order to reset the alarm. If the cause of the alarm has not been repaired, and the alarm feature is selected again, then the alarm will reactivate after 10 seconds. If an alarm occurs, a message will appear on the Alarm Message screen and the flow rate screen until the alarm is cleared.

6.2.9 **Alarm Relay Enable Screen**.

This screen allows the user to enable or disable the internal relay to send an alarm message to the Alarm Message Screen or energize the Alarm Beeper or both. Use the scroll key to select the alarm notification method desired (a double arrow will point to the feature selected). If an asterisk appears within the brackets and you want to select that feature, then press the enter key to retain the selection in memory (the asterisk will then remain in the display). Scroll to the second feature and repeat. After all feature selections have been determined, use the arrow keys to move to an adjacent screen and then back to verify your selection. Without pressing the scroll key to activate the pointer, the asterisks will show the features which are currently in memory. Deselect by using the scroll key to point to the feature desired. If the feature was previously selected, then the asterisk will disappear if you point to that feature. Press the enter key and the deselection will be retained in memory. You

should always verify your selection by moving to an adjacent screen and returning. Enabling the Alarm Relay will activate the alarms that have been selected on the System Alarm Screen (6.2.8).

6.2.10 Alarm Message Screen

When alarms are activated, this screen will appear as the default screen until alarm condition is corrected (Alarm Message Screen can be deactivated by disabling alarm relay – 6.2.9). Keypad will allow viewing of other screens, but will default to Alarm Message Screen after 10 seconds of inactivity.

6.2.11 Analog Output Screen.

This screen identifies the analog output of the instrument as 4-20 mA or 0-5 VDC, which was preset at the factory by customer's order.

6.2.12 Service Screen.

This screen contains the Software Version Number, Model Number, Serial Number, and customer service phone number. This screen will not default to the Flow Screen. You must manually move to another screen to activate the screen default.

7.0 Installation Tips and Troubleshooting.

7.1 Alarm Functions.

7.1.1 Over Differential Pressure Alarm.

When the flow exceeds the high-high limits of the controller or meter, and the function has been selected, the alarm screen will indicate an over pressure alarm. The unit remains in an alarm condition until the flow is reduced to a safe level and the alarm is cleared. In an alarm condition you may move to the System Alarm Screen (6.2.8) and deselect the alarm or you may move to the Alarm Relay Enable Screen (6.2.9) and disable the alarm relay, however if the alarm condition is not removed, then the alarm will reactivate if the alarm and relay are selected again. The notification of an active

alarm will also appear on the Flow Rate Screen (6.2.1) until it is cleared.

7.1.2 Low Flow/No Flow Alarm.

When the flow rate drops below the minimum flow capacity of the meter or controller, or to zero, the unit will indicate a low flow/no flow alarm condition. In a start-up situation, the flow must first move above the minimum flow rate after boot-up after which time the low flow/no flow alarm will be active if it has been selected and the alarm relay has been enabled. The unit remains in an alarm condition until the flow has been restored and the alarm is cleared. In an alarm condition you may move to the System Alarm Screen (6.2.8) and deselect the alarm or you may move to the Alarm Relay Enable Screen (6.2.9) and disable the alarm relay, however if the alarm condition is not removed, then the alarm will reactivate if the alarm or relay are selected again. The notification of an active alarm will also appear on the Flow Rate Screen (6.2.1) until it is cleared.

7.1.3 External Alarm.

You may activate the alarm from an external source by using the digital input to send a dry closure or a TTL signal to the alarm relay. If the digital input is grounded, the Meter or Controller will, after a 10 second delay, indicate on the alarm screen that there is an External Alarm. The alarm indication will remain until the digital low input is removed or the grounded input is allowed to go to the high or open state and the alarm is cleared by deselecting the function. In an alarm condition you may move to the System Alarm Screen (6.2.8) and deselect the alarm or you may move to the Alarm Relay Enable Screen (6.2.9) and disable the alarm relay, however if the alarm condition is not removed, then the alarm will reactivate if the alarm or relay are selected again. The notification of an active alarm will also appear on the Flow Rate Screen (6.2.1) until it is cleared.

7.2 Filtering.

The liquid media should always be filtered as close to the inlet of the flow body as is practical. The size of the filter mesh should be at least 20% smaller than the diameter of any one of the flow element pathways.

7.3 System Shut-Down.

In the event that the system is shut-down for more than 24 hours, then the flow body should be drained and washed.

7.4 Periodic Cleaning – Sodium Hypochlorite Media.

Depending on the purity of Sodium Hypochlorite media used, it may be necessary to wash the flow body and orifice periodically. The flow restrictor should not be removed from the flow body except by Omega service technicians.

7.5 Flow Body/Flow Restrictor Cleaning.

In the event that the flow restrictor does become clogged, partial disassembly should be done to remove the flow body and fittings after purging and neutralization. The flow body can then be backwashed with clean filtered water from the downstream end to dislodge any particle from the flow restrictor. Once the backwashing is complete, the upstream side of the flow body should be rinsed with clean filtered water to insure that no particles remain that could be pulled into the flow restrictor after reassembly.

7.6 Removal of the Flow Body.

If it is necessary to remove the flow body from the saddle, you should be careful to remove the connector located on the back side of the flow body first. The connector which is removed has a center latch release which must be depressed before pulling the connector from the mating end. When the flow body is removed from the saddle, use caution to not damage the sensor housing and contacts while they are exposed. Be sure to replace the flow body in the same direction with the sensor housing and connector facing toward the back of the assembly. Flow is from left to right. The large opening on the flow body (approximately 3/8") is in and the small opening (approximately 1/8") is out. The meter will not operate properly with the assembly reversed.

7.7 User Serviceable Parts.

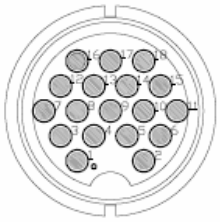
It is important to note that there are no user serviceable parts inside the electronics housing and this housing should only be opened for mounting or unmounting the unit. The sensor should not be removed from the flow body except by Omega service technicians.

8.0 Factory Servicing Information.

8.1 Calibration.

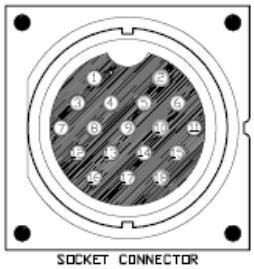
If you believe that your unit requires calibration, it should be returned to Omega. We recommend annual testing and recalibration under normal use conditions. Extreme or severe conditions might require greater frequency.

MATING FACE VIEWS
FOR 18-PIN CONNECTOR



PLUG CONNECTOR

MOUNTED TO BOX



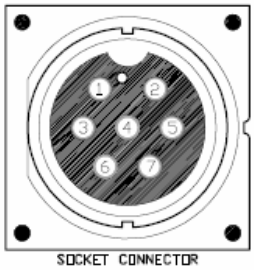
SOCKET CONNECTOR

PIN #	DESIGNATION		
1	- POWER	10	- SPARE
2	- POWER GROUND	11	- ANALOG OUT 1(+) - 0 TO 5 VDC OR 4-20 mA
3	- SPARE	12	- ANALOG OUT 1(-) OR GROUND
4	- NORMALLY OPEN CONTACT	13	- SPARE
5	- COMMON - RELAY OUTPUTS	14	- ANALOG OUT 2(+) - 0 TO 5 VDC OR 4-20 mA
6	- NORMALLY CLOSED CONTACT	15	- ANALOG OUT 2(-) OR GROUND
7	- SPARE	16	- SPARE
8	- ANALOG IN - 0 TO 5 VDC	17	- DIGITAL INPUT 0 TO 5 VDC TTL-CMOS
9	- ANALOG GROUND	18	- DIGITAL GROUND

MATING FACE VIEWS
FOR 7-PIN CONNECTOR

PLUG CONNECTOR

MOUNTED TO BOX



SOCKET CONNECTOR

PIN #	DESIGNATION		
1	- SPARE	5	- GROUND
2	- TRANSMIT DATA	6	- SPARE
3	- RECEIVE DATA	7	- SPARE
4	- BX-24 DOWNLOAD (FACTORY USE ONLY)		

Illustration #1 - Omega FLR2000 series Flow Meters and Omega FLV2000 series Controllers pin function reference chart for the 18 pin and 7 pin watertight connectors.

MADE IN USA

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

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RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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