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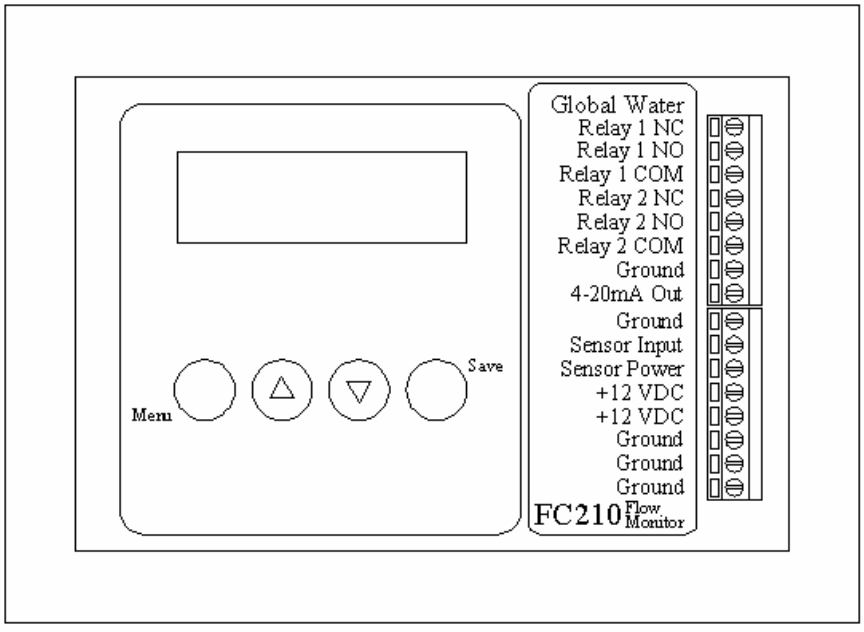
FC210: Open Channel Flow Monitor



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Congratulations on your purchase of the Global Water FC210 Open Channel Flow Monitor. This instrument has been quality tested and approved for providing accurate and reliable measurements. We are confident that you will find the monitor to be a valuable asset for your application. Should you require assistance, our technical staff will be happy to help.

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I. Checklist

a. Open Channel Flow Monitor

b. Open Channel Flow Monitor Manual

c. 0-3' Water Level Sensor

II. Inspection

a. Your Open Channel Flow Monitor was carefully inspected and certified by our Quality Assurance Team before shipping. If any damage has occurred during shipping, please notify Global Water Instrumentation, Inc. and file a claim with the carrier involved.

   Use the checklist to ensure that you have received everything needed to operate the Open Channel Flow Monitor.

III. Open Channel Flow Monitor Description

a. The Open Channel Flow Monitor is reliable and accurate for measuring and totalizing open channel flows for flumes and weirs, as well as any gravity-type open flow channel. The monitor measures water depth with a highly accurate water level sensor. The flow computer calculates and displays flow rate and total flow for any depth-to-flow relationship in various engineering units. The monitor is easily set up in the field using its unique four-button programming system.

b. For any open channel that is free flowing, there is a specific relationship between depth of water and the flow rate. Whenever a given depth occurs, there will always be the same flow. There are several common depth-to-flow relationship look up tables preprogrammed into the Flow Monitor. Once the correct table has been selected the computer will automatically display the flow, based on the depth reading of the level sensor. The flow value is integrated over time to display total flow.

c. The Global Open Channel Flow Monitor measures depth-of-flow with the highly accurate Global Water Level pressure transducer, which uses a fully submersible sensor, constructed of stainless steel. Its standard range is 3', full scale, of water that provides for accurate measurements of flow even with depth changes as small as a fraction of an inch.

d. Global Water Open Channel Flow Monitors produce a 4-20 mA output signal related to the flow rate. 4-20 mA is an industry standard signal for process control monitoring. Most PLCs (Programmable Logic Controller), RTUs (Remote Telemetry Unit), and data acquisition systems accept this signal directly. If the system only accepts voltage signals, the sensor output must be converted to a voltage signal by reading the voltage across a precision resistor in series with the signal wire. Since Ohms Law states that V = IR, if the 4-20 mA signal is dropped across a 250 ohm resistor, the output will be 1 to 5 volts DC. If the 4-20 mA signal is dropped across a 125-ohm resistor, the output will be halved to 0.5 to 2.5 VDC. The 4-20 signal wire is connected to

the datalogger voltage input terminal. The resistor is placed between this input and the ground terminal of the datalogger's battery. The power (or voltage to the sensor) must be connected to the positive battery terminal of the datalogger.

e. Global Water Open Channel Flow Monitors has two independently programmable relay outputs with normally open and normally closed contacts

IV. Open Channel Flow Monitor Installation

General

a. Open Channel Flow Monitors have many applications and therefore many installation solutions. The level sensor is fully submersible and may be suspended by its waterproof cable in the water to be monitored.

b. Install your Open Channel Flow Monitor so that it is easily accessible for calibration purposes.

c. The sensor may be submerged at the monitoring point and hung from its cable. It is recommended to protect the sensor inside a 2-4" PVC drainpipe that will act as a protective stilling well. Put a cap on the bottom end of the pipe, drilling holes or cutting slots to allow easy water flow past the sensor. Carefully drop the sensor until it touches the bottom of the stilling well and then pull it up slightly and secure the cable. The installation of the level sensor is critical to the accuracy of the flow measurement but generally, the end of the pressure transducer should be mounted at the "zero" flow depth of the channel, upstream from the throat of the flume or weir. For open channels with no primary device, the sensor should be mounted below the lowest expected water depth. Do not mount the level sensor facing directly into or away from rapidly moving water since the velocity may affect the accuracy, a stilling well should be used to provide accurate measurements.

V. FC210 Specifications

Open channel flow meter:

Power:	60mA DC normal, 100mA maximum 120uA during sleep mode
Enclosure:	18cm W x 13cm H x 4.3cm D, NEMA 4X
Flow Display:	5 digits + decimal point Resolution - .001 in CFS
Relay Contacts:	SPDT 30VDC, 5A Max Capacity: 150W
Analog Output:	Scalable 4-20 mA
Accuracy:	±0.1% + the depth-flow-table error
Total System Accuracy:	±0.1% + the depth-flow-table error + sensor error
Operating Temperature:	0° to +70°C
Engineering Units:	CFS, GPM, m3s, MGD
Look up tables:	*Parshall:* 1", 2", 3", 6", 9", 12" *Palmer-Bowlus:* 4", 6", 8", 10", 12", 15" *Weir:* 45° V notch, 90° V notch 1' rectangular, 2' rectangular *H:* 0.4HS, 0.6HS, 0.5H, 0.75H, 1.0H, 1.5H, 2.0H 60° Trapezoidal, Small/Large Three custom tables pre-programmed to customer specifications at the factory during production Look-up tables programmed into the FC210 are available at Globalw.com

Level Sensor:

Sensor Element:	Silicone Diaphragm, Wet/Wet Transducer
Range:	0-3'
Linearity and Hysteresis:	±0.1% FS
Accuracy:	±0.1% FS at constant temperature ±0.2% over 32° to 70°F range
Overpressure:	2 x full scale range

Burst Pressure:	10 x Full scale range
Resolution:	Infinite (Analog)
Output:	4-20mA ±1mA at full scale
Supply Voltage:	10-36VDC
Current Draw:	Equal to sensor output
Warm Up Time:	10mS Min, 3 sec. recommended
Operating Temperature:	0° (Not Frozen) to +185°F
Compensated Range:	32° to 70°F submerged, automatic barometric compensation

Housing:

Material:	WL400: 304L Stainless Steel WL400-S: 316 SS
Size:	WL400: 7.5” long x 0.82" diameter WL400-S: 9” long x 1.0” diameter
Weight:	WL400: 110g (4 oz) WL400-S: 250g (9oz)

Cable:

Conductors:	4 each 22 AWG
Jacket Material:	87A shore hardness Polyurethane
Cable O.D.:	7.8mm (0.307”)
Vent tube:	HD Polyethylene
Shield:	Aluminum Mylar
Temperature range:	-30 to 85°C (-22 to 185°F)
Weight:	~65g/m (0.7 oz/ft)

a. The submersible level sensor provided is a two-wire sensor with the red wire for power and the black wire for the output signal. Provision is also made for connecting 3-wire sensors.

b. The Open Channel Flow Monitor may be stored without any special provisions. Place the system inside a bag to keep it clean and store on a shelf or hang it on a wall.

VI. Maintenance

a. Global Water recommends verifying the sensor's calibration with a sounder or other measuring device once every 6 months.

b. The screen on the end of the sensor must be periodically checked for clogging from mud, sludge, and other debris. Wash the screen with clean water and/or scrub it gently with a toothbrush. Do not insert objects through the screen, as this may cause damage to the sensor.

VII. Trouble Shooting

Issue: Sensor reading incorrectly

a. Verify power source is supplying correct voltage.
b. Verify that the vent tube has not been kinked or sealed. The sensor uses this tube to compensate for barometric pressure changes.
c. Check the sensor's calibration.
d. Clean the sensor following the maintenance instructions.

Testing the sensor:

To check the level sensor calibration separate from the flow monitor, you will need:

1 column of water (the closer the depth is to the maximum range of the sensor the better the calibration will be)
1 power supply
1 current meter
Connecting wires as necessary

Unplug the Flow Meter and disconnect the sensor. Connect the sensor to the power supply and current meter in the following way. Attach the black wire to the positive input of the current meter. Connect the ground terminal of the power supply to the ground of the current meter. Attach the red wire to the positive terminal of the power supply. See Appendix B. Warning: Always connect the sensor with the power turned off.

At zero feet (out of water), the sensor should output approximately 4mA. This can be read directly on the current meter or,

if using the voltmeter method, the meter should read 0.5 volts across a 125 ohm resistor. At the maximum water depth of 3.0 feet, the sensor should output 19mA or 2.375 volts across the 125 ohm resistor.

See Appendix A for a description of how to calibrate the water level sensor with the flow monitor.

Issue: Water in the vent tube

a. If water gets into the vent tube of the cable place it next to a heater for 24 hours to dry the inside of the cable.

Other issues

a. Call Global Water for tech support: 800-876-1172 or 916-638-3429 (many problems can be solved over the phone). Fax: 916-638-3270 or Email: globalw@globalw.com.

   When calling for tech support, please have the following information ready;

   1. Model #.
   2. Unit serial number.
   3. P.O.# the equipment was purchased on.
   4. Our sales number or the invoice number.
   5. Repair instructions and/or specific problems relating to the product.

   Be prepared to describe the problem you are experiencing including specific details of the application, installation, and any additional pertinent information.

b. In the event that the equipment needs to be returned to the factory for any reason, please call to obtain an RMA# (Return Material Authorization). Do not return items without an RMA# displayed on the outside of the package.

   Clean and decontaminate the FC210 if necessary.

   Include a written statement describing the problems.

Send the package with shipping prepaid to our factory address. Insure your shipment, Global Water's warranty does not cover damage incurred during transit.

VIII. Warranty

c. Global Water Instrumentation, Inc. warrants that its products are free from defects in material and workmanship under normal use and service for a period of one year from date of shipment from factory. Global Water's obligations under this warranty are limited to, at Global Water's option: (I) replacing or (II) repairing; any products determined to be defective. In no case shall Global Water's liability exceed the products original purchase price. This warranty does not apply to any equipment that has been repaired or altered, except by Global Water Instrumentation, Inc., or which has been subject to misuse, negligence or accident. It is expressly agreed that this warranty will be in lieu of all warranties of fitness and in lieu of the warranty of merchantability.

d. The warranty begins on the date of your invoice.

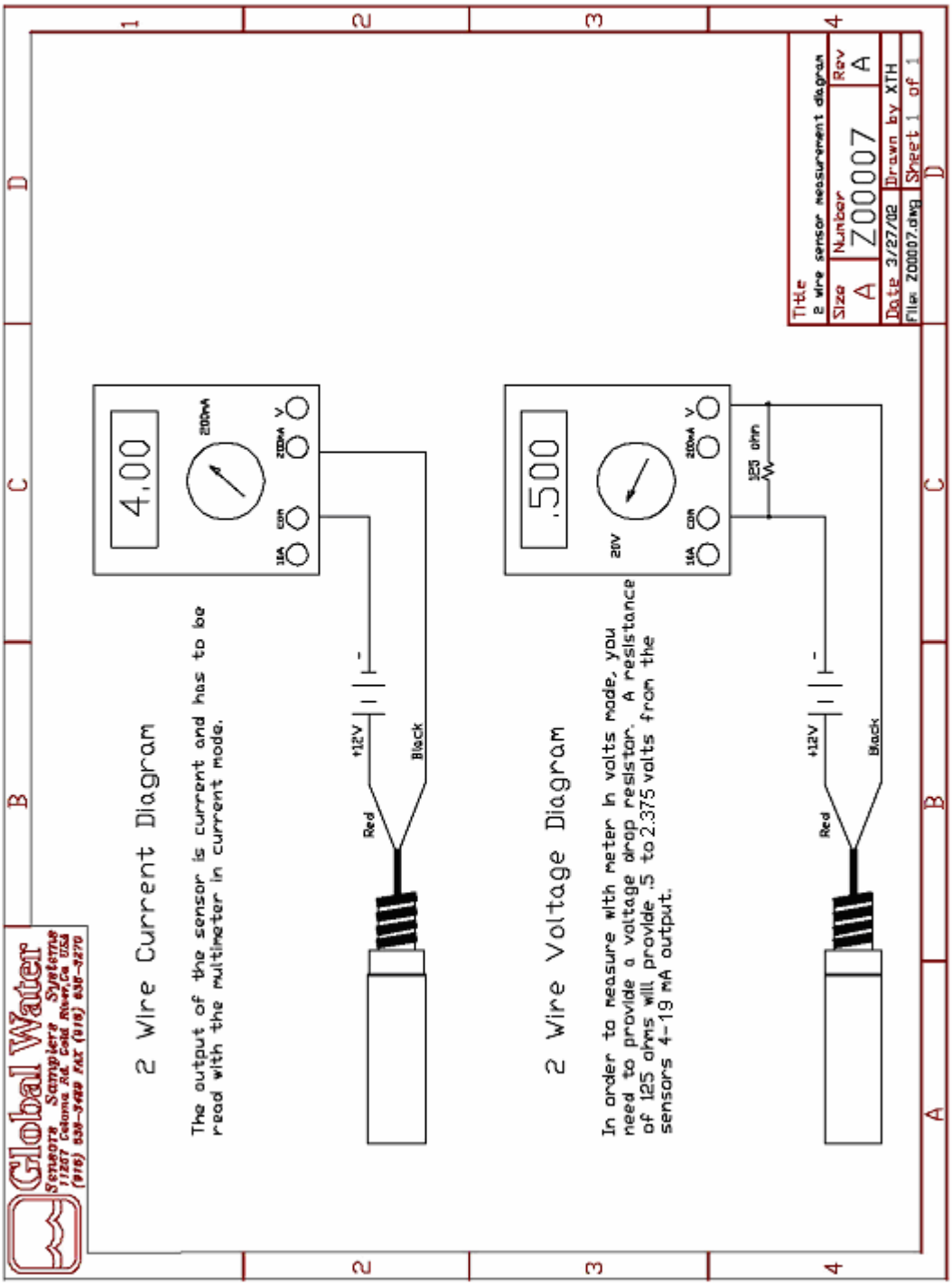
IX. Appendix A: Calibration Procedure

1. Turn on the power and wait 10 seconds for the system to warm up.
2. Press and hold the MENU button for 5-10 seconds to enter the first system calibration menu screen.
3. Press the up/down arrow keys to select the correct type of flume/weir to be used. Press SAVE to store the flume/weir. Press MENU to go to the next screen.
4. Select the desired measurement units by using the up/down arrow keys to scroll through the available options. Press the SAVE button to store the Unit type. Press the MENU button to enter the next menu screen. Note: You cannot change the units of a custom table if was programmed in units other than the 4 standard units offered in the FC210. The customer specifies these special units with custom table at the time the order is placed and the FC210 is programmed at the factory to read that table in the specified units only.
5. Place the level sensor in water at its minimum depth (out of water is zero feet) then record this depth. Press SAVE to store the low signal (LoSig) value. Press MENU to go to the next step.
6. Place the sensor in a column of water corresponding to its maximum depth (closest to 3.0 feet works best for most applications) then record the depth of the sensor. Press SAVE to store the high signal (HiSig) value. Press MENU to go to the next step.
7. Adjust the low level (LoLev) value by using the up/down arrow keys until the display reads the depth in feet that was used to set the LoSig value in step 5, then press SAVE to store the value. Press MENU to move to the next step.
8. Adjust the high level (HiLev) value by using the up/down arrow keys until the display reads the depth in feet that was used to set the HiSig value in step 6, then pressing SAVE to store the value. NOTE: This value is independent of the height of the weir or flume. Press MENU to go on to the next step.
9. The external output pulse screen is used to set the value at which a pulse is sent from the Open Channel Flow Monitor to an external device via the Relay #1 terminal's normally open and closed contacts. Use the up/down arrow keys to select the output scaling (ExtPR) value to be used. For example if an output is required every 100 gallons the screen value should be set to 100 gallons. Press SAVE to store the value. Press MENU to go to the next screen.
10. The next screen is used to set the value at which a pulse is sent from the Open Channel Flow Monitor to Relay #2. The relay has normally open and

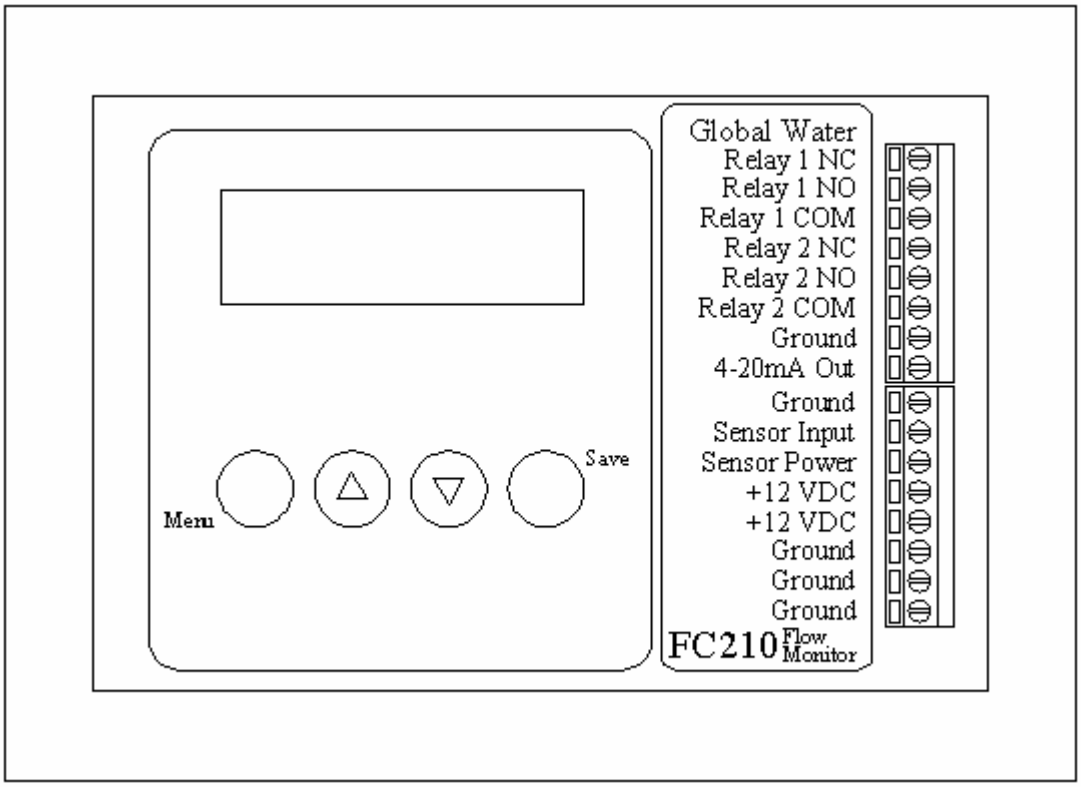
closed contacts available. Use the up/down arrow keys to select the output scaling (TotPR) value to be used. Press SAVE to store the value. Press MENU to go to the next screen. Note: *While the average time between pulses is accurate to within 1 minute over several days, the time between individual pulses may vary a small amount. Time delays between pulses can range from 1 minute to several weeks based on flow and settings. For very short or very long pulse durations, consult the customer service department. When the engineering units selected in step 4 above are set to CFS (cubic feet per second), GPM (gallons per minute) or m3s (cubic meters per second); the ExtPR and TotPR settings are in cf, gal and m3 respectively. When MGD (million gallons per day) is selected, the pulse settings are in Kgal (1000 gallons)*

11. Select the low range (LoRan) value that corresponds to 4mA for the 4-20mA output by pressing the up/down arrow keys then press SAVE to store the value. Press MENU to go to next step.
12. Select the highest range (HiRan) that corresponds to 20mA for the 4-20mA output by pressing the up/down arrow keys then press SAVE to store the value. For example: If a range of 2-18GPM is desired to correspond with the 4mA and 20mA end points, set LoRan to 2.000 and HiRan to 18.000. Press MENU to go to next step.
13. The SLEEP screen is used to set the length of time in minutes that the unit stays in sleep mode. Once the unit has slept for the specified length of time, it will wake up for one minute, then go to sleep again. Use the up/down arrow keys to select the length of time the unit will spend in this power saving mode. A value of 0.0 min. causes the Flow Monitor to be powered up all the time. NOTE: The unit will still average the flow and provide information to the total flow meter; however the sensor, the main LCD screen and most of the circuitry will be shut down to conserve power. The screen can be displayed prior to the end of the sleep period by pressing the MENU key for 15 seconds. Press SAVE to record the sleep length. Press MENU to start measuring flow rate. *NOTE: The external pulse channel ExtPR is not available in sleep mode. For external pulses in sleep mode, use the TotPR relay output.*

X. Appendix B: 2 Wire Sensor Measurement Diagram



XI. Appendix C: FC210 Terminal Diagram



Relay 1 NC – Relay 1 normally closed contact
Relay 1 NO – Relay 1 normally open contact
Relay 1 COM – Relay 1 common contact
Relay 2 NC – Relay 2 normally closed contact
Relay 2 NO – Relay 2 normally open contact
Relay 2 COM – Relay 2 common contact
Ground – 4-20mA output return, spare ground
4-20mA Out – Scalable 4-20mA output
Ground – Sensor ground, spare ground
Sensor Input – 4-20mA, 0-5V or 0-1V Input, jumper selectable
Sensor Power – +12V switched sensor power output
+12 VDC – Power supply input, spare 12V terminal
+12 VDC – Power supply input, spare 12V terminal
Ground – Power supply ground, spare ground terminal
Ground – Power supply ground, spare ground terminal
Ground – Power supply ground, spare ground terminal