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FC220/PC320 Data Logger Option

Congratulations on your purchase of a Global Water FC220 Flow Monitor or PC320 Process Controller with Internal Data Logger Option. This instrument has been quality tested and approved for providing accurate and reliable measurements. We are confident that you will find the product to be a valuable asset for your application. Should you require assistance, our technical staff will be happy to help.

Table of Contents

I. FC220/PC320 Data Logger Option

The FC220 Flow Monitor and PC320 Process Controller have a scalable 4-20mA output that can be used to monitor and record the sensor output values. They also have 4 relays for controlling external devices like water samplers, pumps, alarms, etc. These two products also have provision for a factory installed internal data logger option that can record the 4-20mA output on the logger's channel one input. The logger's channel 2 input is used to record an analog voltage that represents the current state of all 4 relays. Free software supplied with the logger option will convert this analog voltage to the relay states for real-time viewing and download to spreadsheets.

The logger option functions the same as all other Global Water loggers. A sample interval is programmed into the logger that will record the sensor data at regular programmable intervals. In addition; the data logger option also records the current state of all 4 relays whenever any of them change state, giving a time stamp to these relay events with a one second resolution. There are three possible relay states; On, Off and Pulse. ON and Off are steady states, the pulse state represents a relay turning on for one second before turning off again.

When the Global Logger II software with version 2.1.8 or greater is connected to the FC220/PC320 Data Logger Option, the following screen appears. The version number is shown at the top right corner, or by selecting Help from the toolbar, then About.
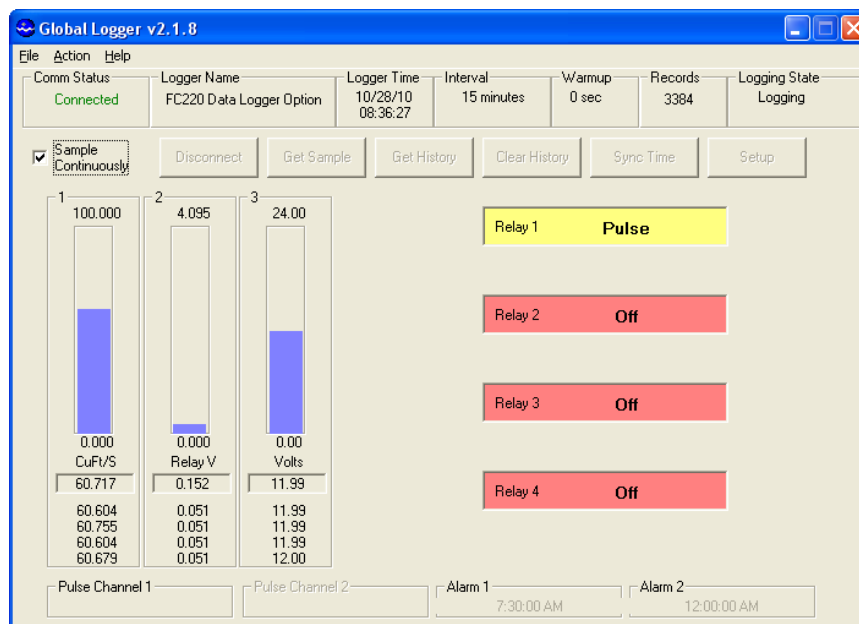
This screen differs from the screen shown when connecting to other Global Water logger products by the 4 fields at the right side of the main screen. By placing the software in Sample Continuously mode, these 4 fields show the current state of all 4 relays in real time. The relay states are also recorded into the historical record for download and analysis in a spreadsheet program such as Excel.

II. Scaling the 4-20mA Output

Before the data logger option can be fully calibrated, the 4-20mA output of the FC220 Flow Monitor or PC320 process Controller must be scaled to a particular range. By pressing the MENU button for 2 seconds, the menu display is show. Press the MENU key until the 4-20mA Output Calibration menu shown below is displayed.
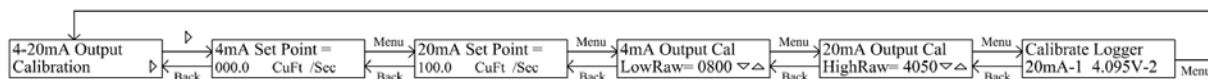

To scale and calibrate the 4-20mA output press the RIGHT arrow key. The 4mA Set Point is the flow or sensor value that results in an output current of 4mA. Use the LEFT and RIGHT arrow buttons to select a digit, then use the UP and DOWN arrow buttons to scroll through the number 1-9 and decimal point. In this way, set the 4mA Set Point to the desired value. If appropriate, use the same process to set the units as described in the FC220 or PC320 manual. Press SAVE to store these settings and MENU to move forward. The 20mA Set Point is the flow rate or sensor value that corresponds to a 20mA output current. Use the arrow buttons to change the 20mA Set Point value. Press SAVE to store this setting. Any flow rate or sensor reading between these two set points will be scaled to the corresponding output current. The next three menus are generally set at the factory and should not need to be changed. The 4mA Output Cal menu allows the 4-20mA output to be set to exactly 4mA. Connect a DC current meter between the 4-20mA output and ground. Use the UP and DOWN arrows to raise and lower the raw data number (and output current) until the current meter reads as close as possible to 4.000mA. Press SAVE and MENU. The 20mA Output Cal menu sets the 20mA output in the same way. Use UP and DOWN to adjust the output until the current meter reads 20.000mA. The Calibrate Logger menu is used to calibrate channel two of the data logger option.

III. Calibrating the Data Logger Option

Connect the computer to the USB port on the FC220 or PC320 data logger. Launch the Global Logger II software and connect to the logger, you must use Global Logger II version 2.1.8 or higher. Click the Setup button to enter the calibration screens. A few settings are required for the logger option to operate properly, these are shown below. In the General tab; set the Sensor Warm-Up Time to zero seconds and enable Sample-On-Demand by checking the checkbox. The logger will not record relay events unless the Sample On Demand function is enabled.
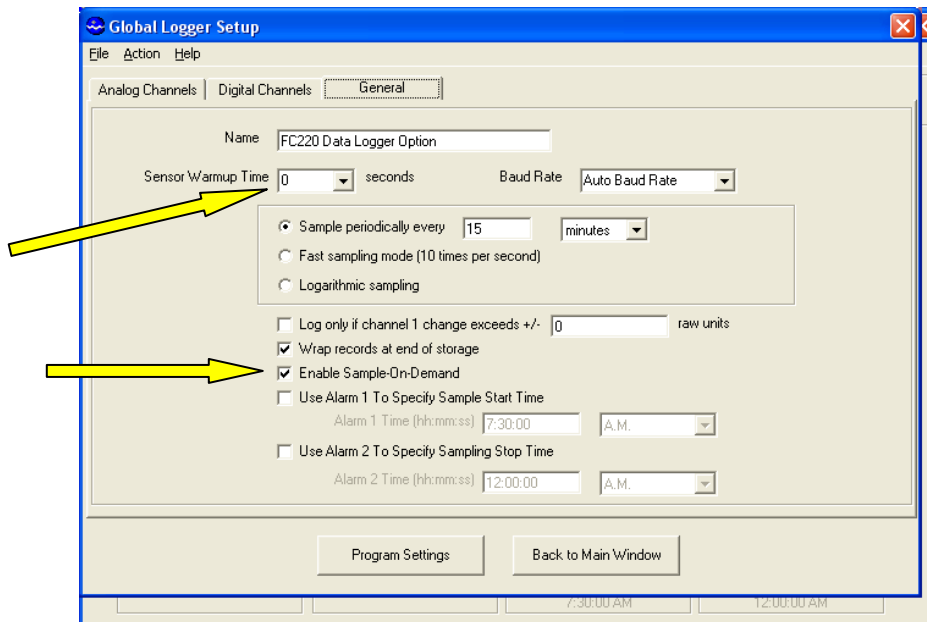
Select the Analog Channels tab.
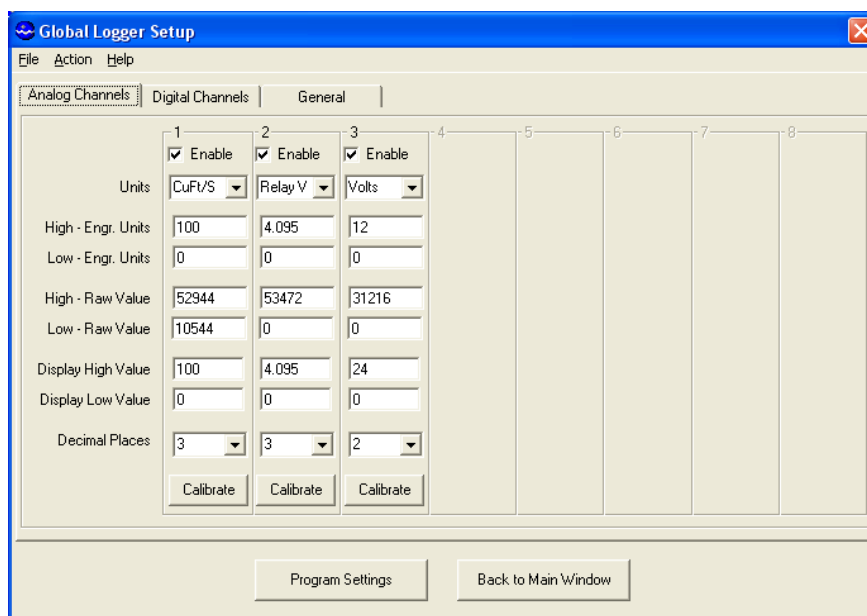
Before proceeding, make sure that the FC220 or PC320 4-20mA Output Calibration process has already been completed as described in the previous section. On the FC220 or PC320, enter the setup menus and scroll down to the output calibration menu. *Note that within 1 minute of the last button press, the FC220 and PC320 will automatically exit the setup menus. If this happens during the calibration process, return to the setup menu.*

| 4-20mA Output Calibration | ▷
▷ Back | 4mA Set Point =
000.0   CuFt /Sec | Menu
Back | 20mA Set Point =
100.0   CuFt /Sec | Menu
Back | 4mA Output Cal
LowRaw= 0800 ▽△ | Menu
Back | 20mA Output Cal
HighRaw= 4050 ▽△ | Menu
Back | Calibrate Logger
20mA-1 4.095V-2 | Menu |
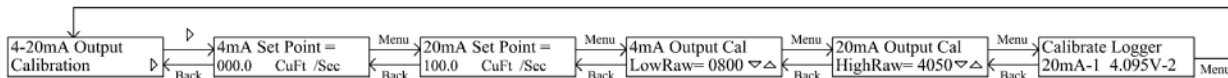
Calibrating Channel One

Enter the sub-menus and note the 4mA and 20mA Setpoints. Using the MENU button, advance to the 20mA Output Cal menu. From the Global Logger II software, click the Calibrate button at the bottom of the Channel 1 field in the Analog Channels tab. In the first of four calibration screens, enter the value of the 20mA Set Point programmed into the FC220 or PC320, then click Next. When the value has settled, click Next again. On the FC220 or PC320, press the BACK button to return to the 4mA Output Cal menu. In the Channel 1 Calibrate screen of Global Logger II, Enter the value of the 4mA Set Point programmed into the FC220 or PC320, then click Next. When the value has settled, click Next. Enter the engineering units into the Units field that correspond to the units used in the 4mA and 20mA Set Points in the FC220 or PC320. The Display High Value and Low Value fields are used to set the range of the bar graph of the main display only, they are not part of the calibration process. Enter values to scale the bar graph to the desired range.

Calibrating Channel 2

On the FC220 or PC320, advance to the "Calibrate Logger 20mA-1 4.095V-2" menu. In the Analog Channels setup menu of Global Logger II, click the Calibrate button for channel 2. For the High Engineering Value, enter 4.095 and click next. When the value has settled, click Next again. Enter zero into the Low Engineering Value, then click Next. Click Next one more time to exit the calibration menus. Click on the Low Raw Value box and enter zero. In the Display High Value box, enter 4.095. In the Display Low Value, enter zero. For the Channel 2 Units, enter Volts. Select the desired number of decimal places for channel 1, select 3 decimal places for channel 2. Click the Program Settings button to program the logger. Click the Back to Main Window button to return to the main screen. The calibration process is complete.

IV. Historical Record

To view the historical record in the data logger, click the Get History button.

Date / Time	CuFt/S	Relay V	Volts	Relay 1	Relay 2	Relay 3	Relay 4
10/28/10 09:25:00	60.943	0.000	11.99	---	---	---	---
10/28/10 09:26:00	60.679	0.000	12.00	---	---	---	---
10/28/10 09:27:00	60.604	0.000	11.99	---	---	---	---
10/28/10 09:28:00	60.642	0.000	11.99	---	---	---	---
10/28/10 09:29:00	60.679	0.000	11.99	---	---	---	---
10/28/10 09:30:00	60.642	0.000	11.99	---	---	---	---
10/28/10 09:30:05	60.604	0.151	11.99	Pulse	Off	Off	Off
10/28/10 09:31:00	60.792	0.000	11.99	---	---	---	---
10/28/10 09:32:00	60.642	0.000	11.99	---	---	---	---
10/28/10 09:33:00	60.604	0.000	12.00	---	---	---	---
10/28/10 09:34:00	60.604	0.000	11.99	---	---	---	---
10/28/10 09:35:00	60.604	0.000	11.99	---	---	---	---
10/28/10 09:35:35	60.679	0.152	11.99	Pulse	Off	Off	Off
10/28/10 09:36:00	60.717	0.000	11.99	---	---	---	---
10/28/10 09:37:00	60.566	0.000	11.99	---	---	---	---
10/28/10 09:38:00	60.679	0.000	11.99	---	---	---	---
10/28/10 09:39:00	60.717	0.000	11.99	---	---	---	---
10/28/10 09:40:00	60.717	0.000	12.00	---	---	---	---
10/28/10 09:41:00	60.604	0.000	11.99	---	---	---	---
10/28/10 09:41:03	60.679	0.151	11.99	Pulse	Off	Off	Off
10/28/10 09:42:00	60.642	0.000	11.99	---	---	---	---
10/28/10 09:43:00	60.792	0.000	11.99	---	---	---	---

Records Retrieved: 126. Logger Name: FC220 Data Logger Option.

The historical record shows the data recorded at the normal sample intervals programmed into the logger; in the above case, at 1 minute intervals. The data at the normal logging intervals will show the voltage as zero and the relay states as undefined, or ---. In addition to these records, the changing states of all 4 relays are also recorded. These records will not interrupt the normal logging interval of the logger. In the record shown above, the FC220 Flow Monitor is programmed to output a pulse on relay 1 for every 20,000 cubic feet of water. At an average flow rate of 60.6 cubic feet per second, relay 1 will pulse about every 5-1/2 minutes as shown in the historical data. In this example, relays 2-4 are disabled. For the PC320 Process Controller, the record will indicate pulse events, as well as the time when any or the relays turned on or off in a steady state mode.

V. Determining Relay States

The changing states of the relays are recorded as an analog voltage, generally on channel 2. The voltage represents the state the relay was changed to at that time; according to the equation:

Voltage in Volts = (50 + 50*S1 + 150*S2 + 450*S3 + 1350*S4) / 1000

Where S1 is the state of Relay1, S2 for Relay 2 ...
Off State, S = 0
On State, S = 1
Pulse State, S = 2

Thus a voltage between 0.050 and 4.050 Volts represents the states of all 4 relays.

The 4 relays have 81 possible combinations of states. The voltage is first converted to an integer from 0-80 using this equation:

StateValue = INTEGER ((Voltage + 0.025) / 0.05) – 1

In base 3 this number 0-80 is in the range of 0000 to 2222. The most significant digit is the state of relay 4, the least is the state of relay 1;

0 = Off
1 = On
2 = Pulse

These states are separated using these equations:

Relay 1 State = MODULUS (StateValue / 3)
Relay 2 State = MODULUS (INTEGER (StateValue / 3), 3)
Relay 3 State = MODULUS (INTEGER (StateValue / 9), 3)
Relay 4 State = INTEGER (StateValue / 27)

VI. Excel Macro

This Visual Basic macro can be used in an Excel spreadsheet to extract the relay state information from the recorded analog voltage:

```
Function RelayStatus(RelayVoltage As Double, RelayNumber As Integer) As String
    Dim Alpha As String

    Application.Volatile
    On Error GoTo FixError

    ' Convert relay voltage to integer from 0-80, in base 3 this value represents the state of all 4 relays
    ' Most significant digit is relay 4, least is relay 1
    ' 0 = Off, 1 = On, 2 = Pulse
    RelayVoltage = Int((RelayVoltage + 0.025) / 0.05) - 1


    ' Test for invald data
    If RelayVoltage < 0 Then GoTo Interval
    If RelayVoltage > 80 Then GoTo FixError
    If RelayNumber < 1 Then GoTo FixError
    If RelayNumber > 4 Then GoTo FixError


    ' Perform relay number base 3 conversion
    If RelayNumber = 1 Then RelayStatus = RelayVoltage Mod 3
    If RelayNumber = 2 Then RelayStatus = Int(RelayVoltage / 3) Mod 3
    If RelayNumber = 3 Then RelayStatus = Int(RelayVoltage / 9) Mod 3
    If RelayNumber = 4 Then RelayStatus = Int(RelayVoltage / 27)

     GoTo RelayStates

' RelayVoltage of <0 indicates a normal sample interval
Interval:
    Alpha = "---"
    RelayStatus = Alpha
    Exit Function

' Test for relay state
RelayStates:

    If RelayStatus = 0 Then Alpha = "Off"
    If RelayStatus = 1 Then Alpha = "On"
    If RelayStatus = 2 Then Alpha = "Pulse"
    RelayStatus = Alpha
    Exit Function

FixError:
    RelayStatus = "#Value"
  End Function
```

VII. Technical Support

a. Call Global Water for tech support: 800-876-1172 or (979) 690-5560 (many problems can be solved over the phone). Fax: (979) 690-0440 or E-mail: **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 equipment 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.