FCS - User Guide

Revision 7
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Introduction

The Flow Controller System is a Human-Machine Interface (HMI) designed to be used with Sonotec Clamp-On Flow Sensors. Features of this product include:

- Over-The-Air Software Updates
- Flow Data Logging to a USB Drive in CSV Format
- Flow Averaging Calculations
- Sensor Zeroing
- Flow Data Graphing
- Flow Calibration
- PID Pump Control (4-20mA)
- Automatic fluid dispensing
- SciLog and Pendotech Pressure Sensor Control

This User's Guide gives a brief overview of how to use the Flow Controller System and a summary of how it's features are integrated.

Note: Images in this guide are for reference only, and were captured using an emulator running on a PC to get screenshots. No sensor or pump was connected during the time of capture.

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I. Quick Start Setup

The steps to quickly get started with the Flow Controller System are as follows:

1. Plug in the unit with the provided DC power brick.
2. Plug in the Sonotec Sensor to the unit through the 8-pin M12 Connector 3. Connect the pump to be controlled (if one is to be controlled) to the 5-pin M12 Connector.
4. Press the power button to turn on the unit. The button should light up if power is connected.
5. The unit will now go through it's initial boot sequence, and a FCS Logo will shortly appear on the screen.
6. If Wi-Fi is available in the area, connect the device to the internet (detailed instructions follow in the "Connecting to Wi-Fi" Section on page 11)
7. Press start on the User Interface to begin controlling the pump.

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II. Using the GUI

Graphing Sensor Data

By default when the device starts up, it will attempt to find and connect to a Sonotec sensor. If none is attached, it will continue to look for a sensor until one is plugged into the M12 connector. Once the sensor is connected, the HMI will begin to graph the sensor's read flow rate (blue), along with the flow set point (red).

Figure 1: Sensor Data Graph

Data can be viewed in the graphing section from either the last 1, 5, or 10 minutes. Data is still being stored from before that timeframe (so long as the device has been powered on and running).

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Calibrating/Setting Flow Offset

The Sensor can be calibrated with the "Calibrate" button. This allows the user to set an offset between the wanted and currently read flow rate. This calibration persists between power cycles of the device.
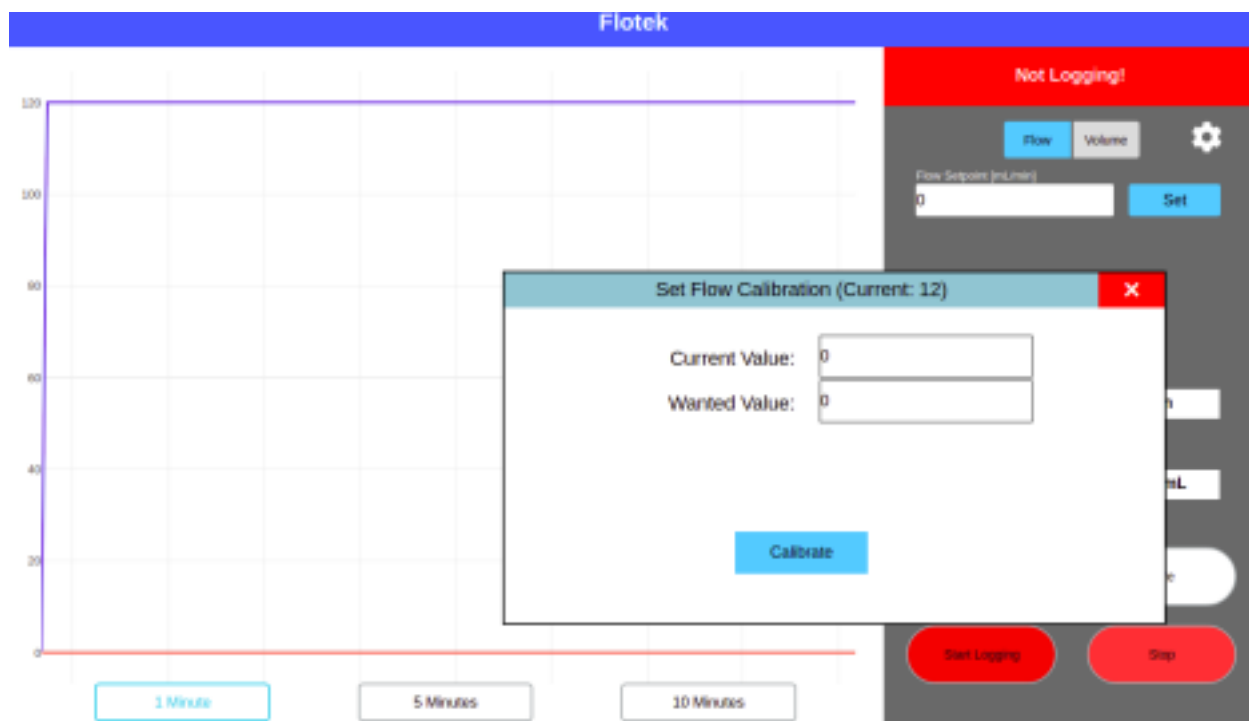

Figure 2: Flow Calibration Pop-up

Logging Data

The FDC allows for logging of flow data in a CSV format to a USB drive. To accomplish this, the "Start Logging" button must first be pressed. This sets the start point for data logging to a CSV

file. Once pressed, the button will change to a "Stop Logging" button, and the warning banner will disappear.

Figure 3: Controller In Logging Mode.
Note the "Stop Logging" State of the logging button and the green color

Then, at a later point in time, the "Stop Logging" button can be pressed. This will indicate to the device the point in time that logging is stopped. The CSV file can now be downloaded to a USB drive, and is indicated by the button changing color and state to a "Save Log" button.

Figure 4: FDC Ready to save logged data to a CSV File

When the "Save Log" button is pressed, a window will appear with a USB status bar, a file name, and a save button.
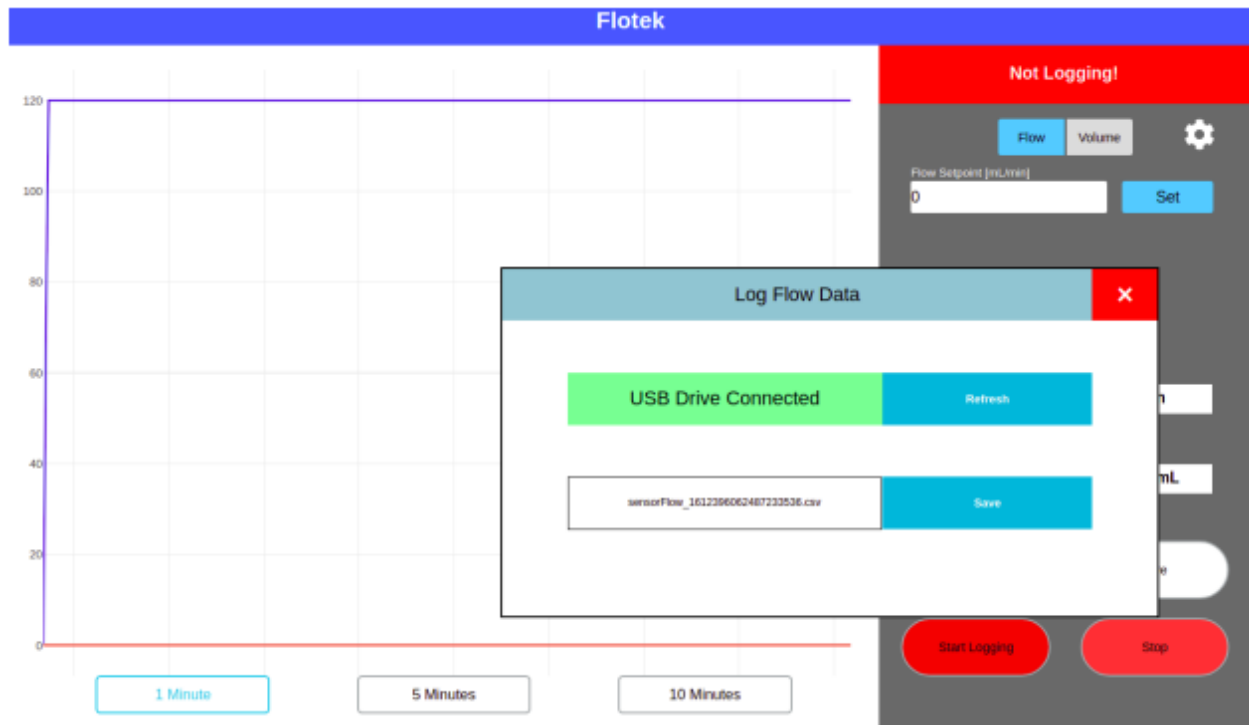
Figure 5: Save Log Pop-up with no USB drive connected

If a USB drive is inserted, and the "Refresh" button is pressed, the USB status bar will turn green and say "USB Drive Connected", indicating that data can be saved to the USB drive.

When the "Save" Button is pressed, the HMI will begin downloading data to the USB drive in CSV format. The time this takes is dependent on the length of time being saved. Once data is done being downloaded, the save button will change to "Saved" indicating that the window can be closed and the USB drive can be removed.

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Figure 6: Logging Pop-up with USB Drive Connection and File Available to be saved

Upon pressing the "Save" button on this popup, the button will display "Saving" as it copies data onto the USB drive. It will change to "Saved" once data transfer is complete.

Stopping/Starting Data Reading

The button on the bottom right of the GUI simply Starts and Stops reading of data from the sensor. The default state of the device is Stopped after boot.

Figure 7: Shortly after pressing the Stop button. Note the Color and State of the Start/Stop Button This is the state present at boot

Figure 8: Controller In Running mode with user prompt to stop graphing.

Sensor Tare/Zero

The Controller's Tare button is used to set the zero point of the sensor, which it accomplishes by sending a zero command over the RS485 bus. The Tare button also sets the average flow rate to zero. During the Tare procedure, the button will indicate that the sensor is currently being Tared, and the graph will stop, as the RS485 bus is being used to zero the sensor.

Figure 8: Controller GUI Shortly after pressing the Tare Button

Configuring PID Loop Settings

The FCS Controller features user configurable PID gains, which persist upon power cycling the device. To do so, the small gear at the top right of the screen in the PID control section of the User Interface should be pressed.
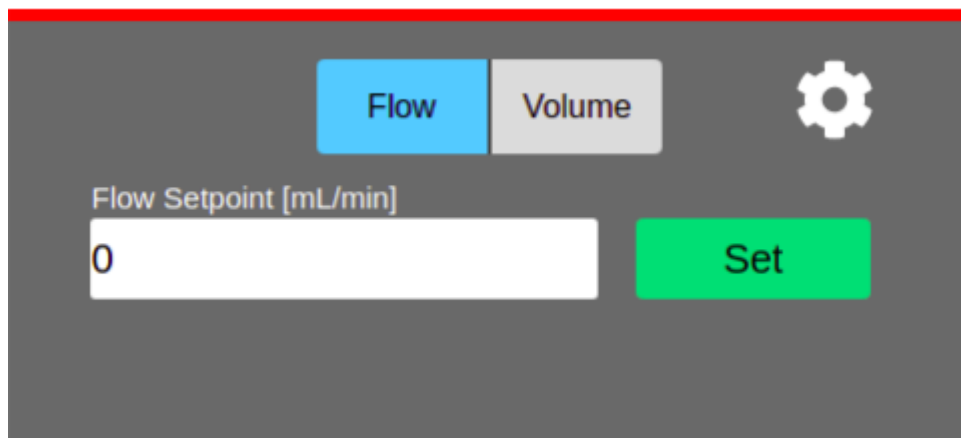

Figure 9: PID Control Section of User Interface, note the gear icon in the top right.

Once this button is pressed, a window will appear with fields to fill in PID tuning parameters. The Controller has default gains in place, so this procedure is optional if the response to a change in setpoint is desirable.
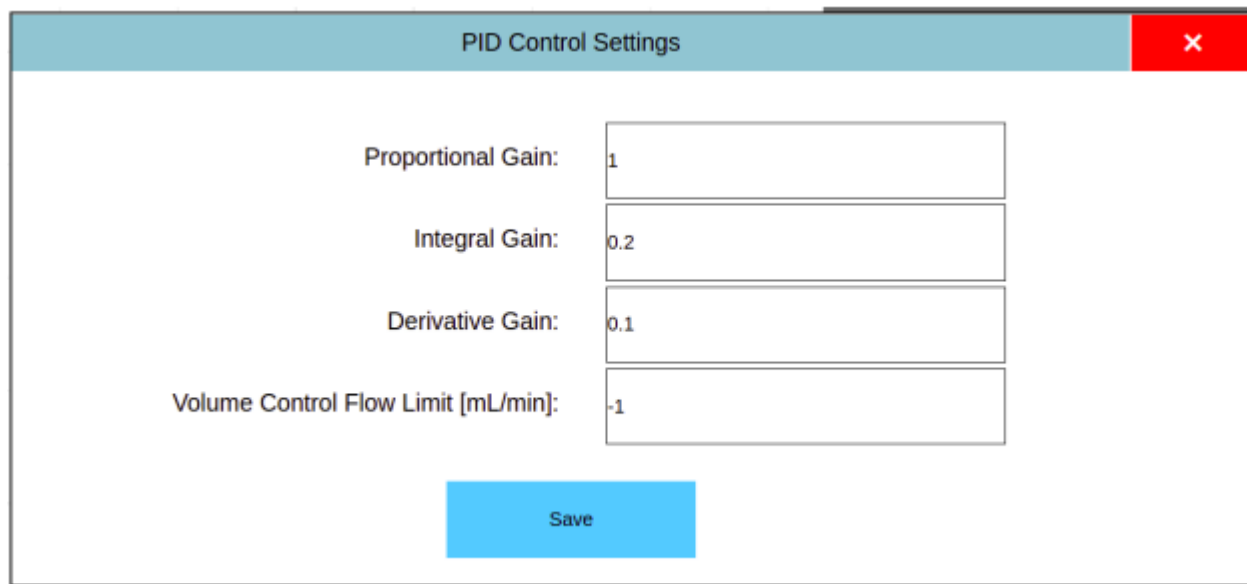

Figure 10: PID Configuration Options

Upon pressing any of the boxes, a keypad will appear on screen allowing the user to set the

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desired parameter. Volume Control Limit simply limits the flow rate during a fluid dispense run. The save button can then be pressed to confirm user configured PID parameters, and the window will close.

Please see our YouTube video on PID
https://www.youtube.com/watch?v=m9D81uW98jI

Setting Desired Flow Rate (Setpoint)

With the device in Flow Control mode ("Flow" button colored blue in PID section), the desired flow rate can be set using the box labeled "Flow Setpoint [mL/min].

Once a desired flow rate is entered, the Blue "Set" button can be pressed. Once pressed, it will turn green, the red line on the graph will go to the setpoint, and the controller will drive the pump to maintain that flow rate.
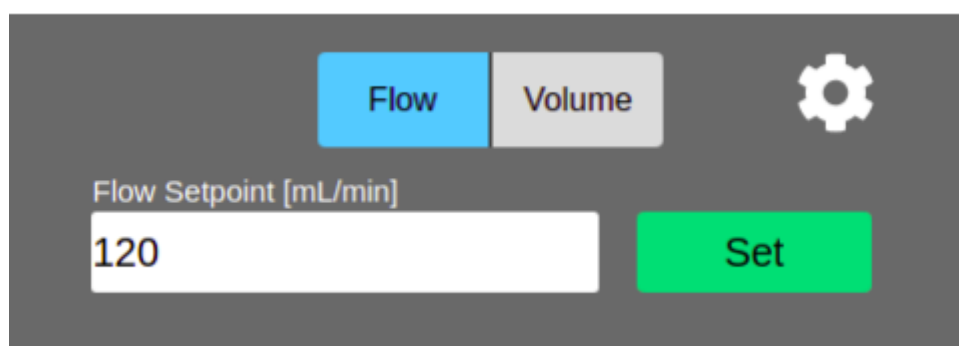

Figure 11: PID Section in Flow Mode after setting a desired 120mL/min flow rate

Dispensing A Set Volume of Liquid

The FCS Data controller features a mode to dispense a user defined volume of liquid. To Set the controller to this mode, simply press the "Volume" button in the PID section of the interface.
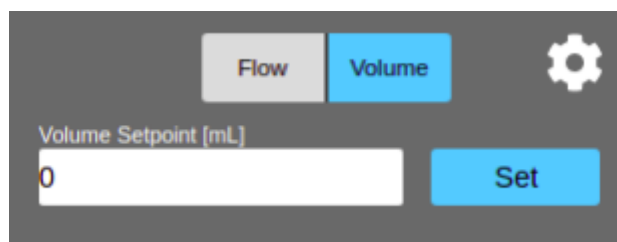

Figure 11: PID Section in Volume Dispense Mode

The procedure for dispensing liquid is similar to setting a static flow rate: simply enter the desired volume and press "Set".

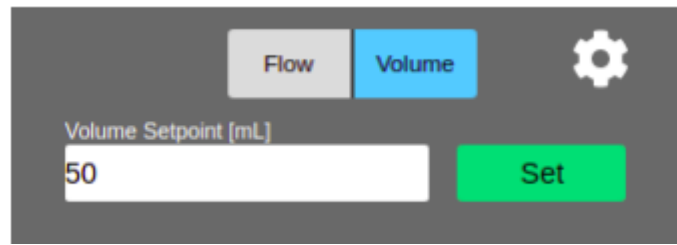*FCS - User Guide*

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Figure 12: PID Section after starting a dispense run of 50 mL

After setting a desired volume to dispense, the start button should be pressed to start dispensing liquid. The start button will then turn to "stop" Once the desired volume has been dispensed, the button will be changed back to "start". This can be pressed any number of times to dispense the set amount of liquid. Stop can also be pressed as the FC is dispensing liquid, which will pause the dispensing process, not restart it (e.g if set to 50 mL, stopping it at 30 mL will set the remaining volume to dispense to 20 mL). To reset it at this point (restart dispensing 50mL), the Tare button should be pressed.

Calibrating Dispensed Volume

If the actual dispensed volume does not match the desired volume, the Calibrate button can be pressed in Volume mode. This allows the user to set the actual volume dispensed compared to the desired (previously set) volume. The controller will then calculate a ratio between the desired and actual volumes, maintaining the calibration for any volume setpoint.
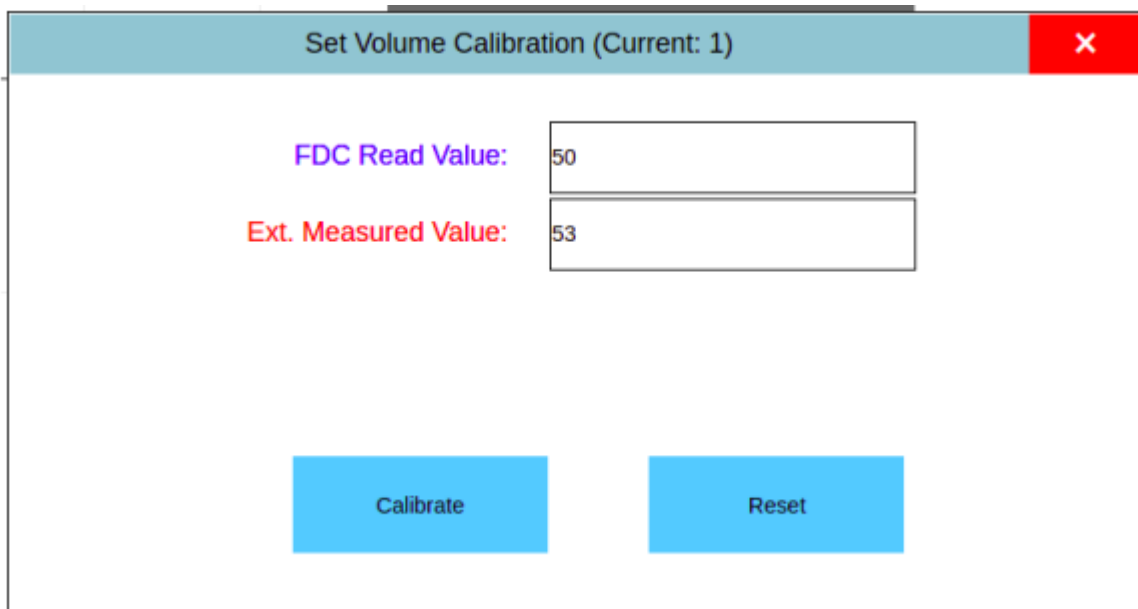

Figure 13: Volume Calibration (set to 50mL, actually dispensed 53 mL). Notice default calibration ratio of 1

Figure 14: After Pressing calibrate in Fig. 13. Notice the ratio is now less than 1 (controller will dispense less on next run)

Note: Changing Modes (Flow/Volume) will stop the pump and zero accumulated volume readings.
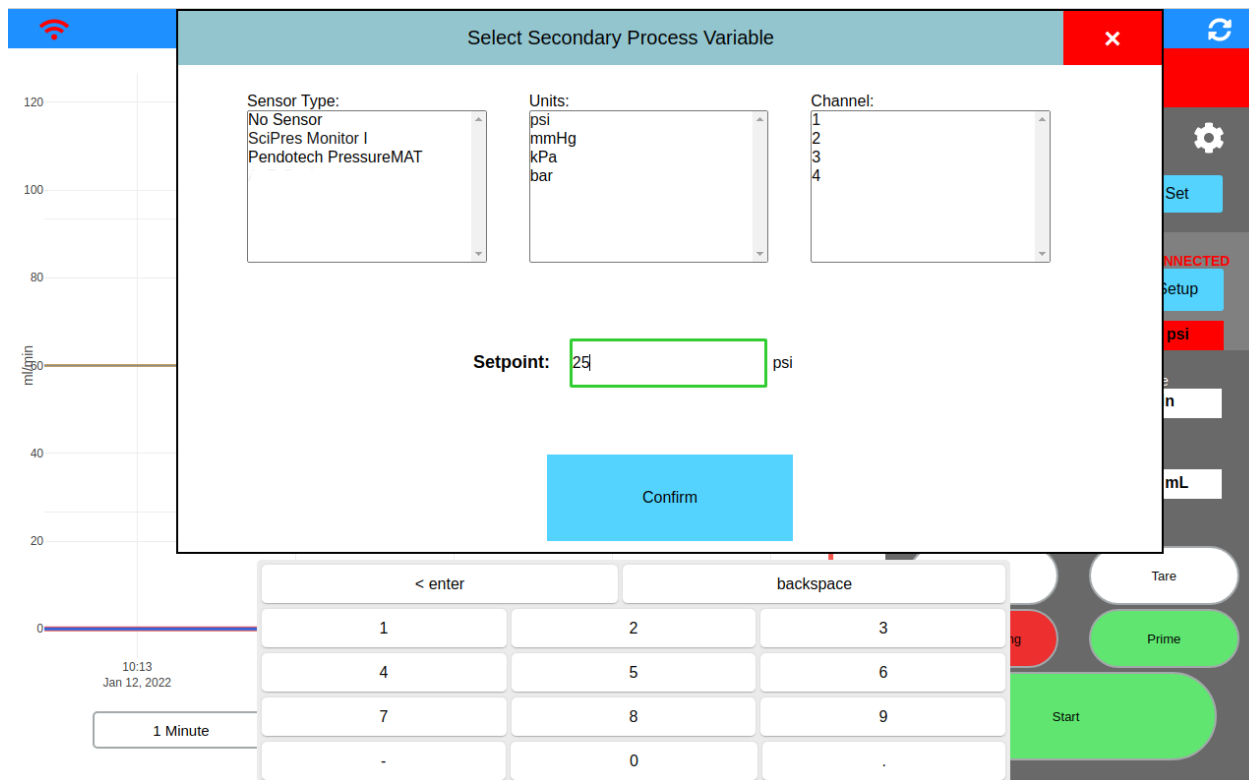
Pressure Control

The FCS can use pressure sensor inputs through its USB port to control line pressure during pump control. Supported pressure sensors are:

- Scilog SciPres Monitor
- PendoTech PressureMAT

To set up a pressure sensor, tap the setup button in the Secondary Control Panel.

This will open a menu where you can select the desired sensor, unit, and channel to read data from. You may also set a pressure limit, where the FCS will limit pump speed to keep line pressure below the Setpoint set.

The Secondary Control panel will then display "Connected" to indicate successful connection and receiving of data.
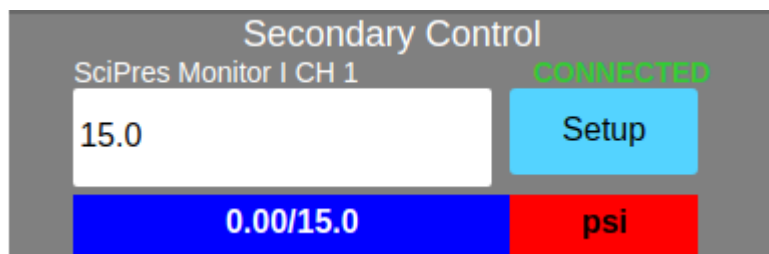
For proper operation and data collection, the respective pressure sensor must be configured correctly to send serial data to the FCS. The serial parameters are:

- Baud Rate: 9600
- Parity: None
- Flow Control: None

There are a few specifics for each sensor (Scilog/Pendotech) that must be configured:

- SciLog
  - 1 second serial Data rate
- Pendotech
  - Refer to PressureMAT manual to select the correct system times and data rate times. Set it to a 1 second data rate.

III. Connecting To WiFi

The FCS contains a menu that allows for connecting the controller to the internet for software updates and data acquisition over the internet.

First, to check the status of the Controller's internet connection, check the WiFi icon in the top left corner of the interface.

- **Red** means the controller is not connected to the internet.
- **Green** indicates the controller is connected.

Figure 15: The icon in the top left indicating internet connectivity state, in this case, disconnected.

To configure an internet connection, simply tap that icon and a menu will appear.

Figure 16: WiFi Connection Menu

To connect to a WiFi Network, simply select your desired Access Point, enter the password, and tap "Connect". The grey status text on the top of the menu will indicate if the connection was successfully made or not, and on success the WiFi icon in the top left of the main screen of the Controller will turn green.

Notes:
- The password input box can be toggled to either show or hide the WiFi password for privacy.
- The "Connect" button must be pressed instead of "Enter" on the keyboard. ●
An external USB keyboard can also be used to type in the password
- The FCS currently cannot utilize any WiFi Connections that require a "Sign-in" on a web browser. Attempting to connect to those will have no effect.
- The FCS can also be connected to the internet via a wired ethernet connection if preferred.

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Physically connecting your pump via the 4-20mA to the Controller

- **Complete assembled M12x5 pin wires of various lengths with both a DB25 and DB9 connections available upon request for Watson Marlow, Verder 5000 and Masterflex L/S**

- Reference the owner manual for your pump.
  - o Turn the pump to Auto /Remote mode
  - o Read your manual.

- Connect the M12 X 5 pin communication wire out of the Controller to the pump. •
Bare wire connection as follows:
  - o Blue- common –ground
  - o White- live 4-20mA

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The FCS Watchdog

This is a link that is sent to you, the customer upon receipt of the FCS Controller, this allows as many individuals to access remotely the FCS , to monitor and to be alerted showing the flowrate and volume which may move outside of the predetermined deadband.

The link is web based so its accessible via all internet instruments, it's an observe only resource and will alarm both audible (backing dog or chime) and visually flashing a red screen if outside of the deadbands.

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