



OPERATING INSTRUCTIONS

CONNEX 3D™ CD3D FLEXIBLE PROCESS MONITOR



Introduction

Please read carefully! No liability can be accepted for damage caused by improper use or installation of the CONNEX 3D™ Flexible Process Monitor

CONNEX 3D™ flexible process monitor provides sensors/field device connectivity from standard analog inputs to RS-485 Modbus communications inputs that are wired to the CONNEX 3D CPU module and communicated to a host of devices; ie: CONNEX 3D display module, eXmod relay expansion module, CONNEX 3D data logger, CONNEX 3D Radio Module, CONNEX 3D TCP/IP Ethernet Module, CONNEX 3D CELLULAR module. With the selection of modules, the CONNEX 3D provides the user flexibility to configure any analog or digital input into a stand-alone or distributed monitoring and control system. The system communicates over a standard RS-485 Modbus™ data highway for remote monitoring through PC communications port (USB) or TCP/IP Ethernet or Cellular or Radio and local monitoring through the CONNEX 3D Display.

Safety Precautions

If you are unsure of the suitability of a CONNEX 3D™ for installation, please consult your FLO-CORP representative for further information.

Electrical Shock Hazard

It is possible to contact components that carry high voltage, causing serious injury or death. All power to the CONNEX 3D™ and (where applicable) the relay circuit it controls should be turned OFF prior to working on the CONNEX 3D™. If it is necessary to make adjustments during powered operation, use extreme caution and use only insulated tools. Making terminal block adjustments or installation adjustments to a powered CONNEX 3D™ is not recommended by FLO-CORP.

Flammable or Explosive Applications

FLO-CORP manufactures several different display models with different mounting and internal configurations. It is the user's responsibility to select a controller model that is appropriate for the application, install it properly, perform tests on the installed system, and maintain all components.

Disclaimer

The information contained in this document is subject to change without notice. FLO-CORP makes no representations or warranties with respect to the contents hereof and specifically disclaims any implied warranties of merchantability or fitness for a particular purpose.

Incorrect Wiring

FLO-CORP assumes no responsibility for users incorrectly wiring their CONNEX 3D™ Flexible Process Monitor.

DESCRIPTION


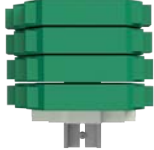









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FEATURES & BENEFITS

- RS-485 Field or Panel display interface, providing field and plant operations vital process information data.
- Provides local and/or remote monitoring
- Simplify I/O management with innovative software
- Wide operating temperature range (-40 to 167°F)
- Monitor any number of analog inputs
- Supports Ethernet TCP/IP Network Connectivity
- Flow totalize and grand totalize with remote reset
- Ships from factory pre-configured for customer's application to ensure easy installation and setup
- 5 Year Warranty

CUSTOMIZE YOUR CONNEX 3D™

The CONNEX 3D™ is extremely versatile and flexible. Think of the modules like Legos, pick and choose from a wide variety of options that plug into your CONNEX 3D to create a unique system to fit your exact needs.

CONNEX 3D™ DISPLAY	ANALOG INPUTS MODULE	AC INPUT MODULE	TCP/IP ETHERNET MODULE	
 <p><i>Integral or Remote Mount</i></p>	 <p><i>Up to 4 analog inputs available</i></p>	 <p><i>100-240 VAC, 47-63Hz 0.3A</i></p>	 <p><i>Enhance Communications</i></p>	
USB DATA LOGGER MODULE	RELAY AND PUMP CONTROL MODULE	CELLULAR MODULE	ENCLOSURE OPTIONS	
 <p><i>Retrieve information directly from unit</i></p>	 <p><i>4-Relay Output Module</i></p>	 <p><i>Monitor application wirelessly</i></p>	 <p>DIN RAIL</p>	 <p>OPTIMUM</p>
			 <p>COMPACT</p>	 <p>XP</p>

SPECIFICATIONS

CONNEX 3D DIGITAL DISPLAY	
Display Type	6-digit, bright red LED
Display Units	Any - User Programmable
Decimal Point	Programmable up to 5 decimal places
Display Output	99999 to +999999
Display Height	0.6" (15mm)
Status Indicators	(1) Totalizer, Yellow LED (4) Input or Relay
Over Range Display	Display flashes O-Range -exceeds input value 4
User Interface	Sealed pushbuttons or DigaLink™ PC Interface
Password Protected	Yes
Accuracy	± 0.1% of calibrated span
Supply Voltage	10 to 28 VDC @ 0.5A Fuse Protected
Dimensions	1.772" x 4.272" x 2.717" (45 x 108.5 x 69mm)
Enclosure Type	Panel or Surface Mounting
Enclosure Rating	NEMA 4X
Enclosure Material	Anodize Aluminum and Acrylic
CONNEX 3D CPU SPECIFICATIONS	
Analog Input	1 channel
Isolation	Complete Analog Out
Resolution	12 Bits
I/O Mode	Voltage & Analog - Current
Input Range	4 to 20 mA
Accuracy	0.1%FSR @25°C, 0.5%FSR@-40 and 75°C
Sampling Rate	1.5 samples / sec
Built-in Resistor for Current Input	240 ohms
Power Requirements	10-28 VDC

Analog Output	4-20mA isolated output
Transmitter Power Supply	10 to 30 VDC or 90 to 240 VAC 50/60 Hz
Serial	2
Interface	2 RS-485 with 3-wire terminal blocks
Parity	Non-Fixed
Data Bits	8
Stop Bits	1, 2
Baudrate	9600 to 921600
Protocols	Modbus RTU (Master, Slave)
PHYSICAL SPECIFICATIONS	
Wiring	I/O cable max. 16 AWG
Dimensions	1.09" x 4.88" x 3.31" (27.8 x 124 x 84mm)
Weight	Under .40lb (190g)
Mounting	DIN-rail or surface - NEMA 4X (XP optional)
Operating Temperature	40 to 185°F (-40 to 85°C)
Ambient Relative Humidity	5 to 95% (non-condensing)
Shock	IEC 60068-2-27
Vibration	IEC 60068-2-6
Safety	UL 508
EMC	EN 55022/24
EMI	CISPR 22, FCC Part 15B Class A
Green Product	RoHS, CRoHS, WEEE
Mean Time Between Failures	1,325,447 hrs
PROTECTION	
Warranty	5 Years

Specifications are subject to change without notice.

HOW TO USE THIS MANUAL

The CONNEX 3D™ manual is used as an easy guide for operating and interfacing with the flexible monitoring system. The system can be provisioned with a single input module which will monitor any analog input and convert the measured value into a serial data RS-485 Modbus communications output as well as output an isolated analog output. The system is flexible and can be provisioned with multiple CPU modules connected to a single CONNEX 3D display module (max. number of CPU to Display; 4). A typical system configuration may include a single Input module and a Display module, powered by a AC to DC inverter/power supply. This manual will provide the details for wiring, programming and communicating with the CONNEX 3D™ monitoring system. There are several options that can be ordered with the CONNEX 3D™ system that your specific system may not incorporate. This manual will include most of these options so you may need to skip over the options that are not included in your specific system. As an example, there is a section in the manual that includes the CONNEX 3D Cellular™ option. If your system is not equipped with the cellular communications option, you may want to skip this section.

THE CONNEX 3D SYSTEM is pre-engineered, pre-wired and pre-configured (programmed) to the user's specifications at time of order. When unpacking the system, make sure all wiring connections are connected and tight as the connections or wires may have come loose or loosened during shipping.

HARDWARE INSTRUCTIONS

Configurations Display Options

When the display is connected as a host device (RS-485 Host port – see figure 1.0)

Upon power up, the display will query the CPU for some setup option data such as display mode (Rate, Total or Both) and the Total display format (E-2 to E100). Based upon these settings, the display will know what data to display and how to display it.

Setup options for the display board are accessed by pushing the program button on the back of the display module. The display will show "Config" for a couple seconds, then go to the first option of Type. Press enter and select between Std (Standard – used when connected to single CPU/Input module for setup/configuration) or Host (used when connected to multiple CPU/Input modules for displaying more than one input). Next Addr1 will be displayed. Enter the Modbus address for the 1st Connex CPU. Do the same for Addr2, Addr3 and Addr4. If a value of 0 is entered, that unit will be skipped as this will command the CPU to ignore that CPU. The last option is PASSword. If password protection is required to perform a total reset, enter the password. If no totalizer or password is required, leave it at 0.

The display will show ===== if communications fails with the currently addressed CPU. As the display scans between CPU's (Dwell time is 6 seconds), the status LED's indicates which CPU is being displayed. The Total LED will light if it is the Total Value.

If you press the UP ARROW button, the auto scan is disabled, and you can manually index to the CPU of your choice. Pressing the MENU key returns the display back to auto scan mode.

By pressing the MENU key and the ENTER key at the same time, the Total register of the currently selected CPU will be reset and T-RST will be displayed. If a password is entered, it will prompt for password first.

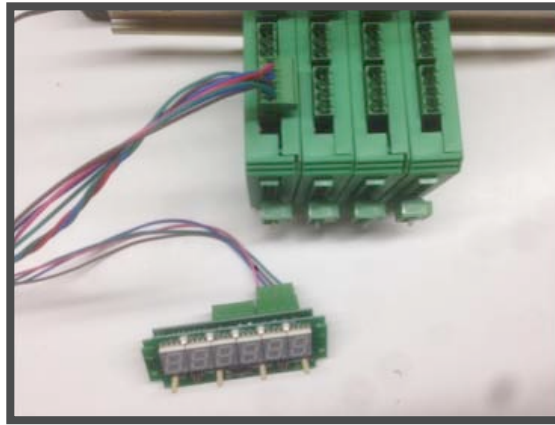


Figure 1.0: Display board connected to the CPU display port. Display board is configured as Std operating mode. Note the interface is plugged into the RS-485 IN Port.

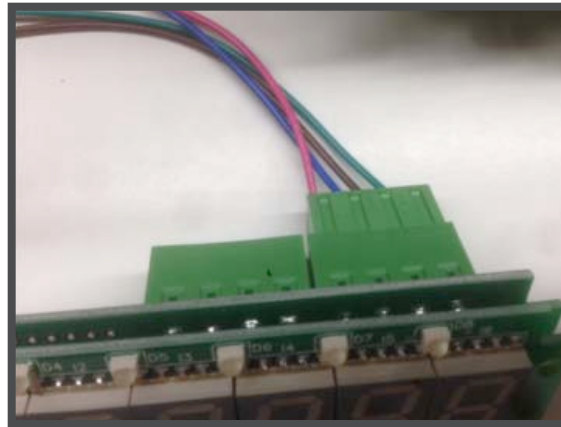


Figure 1.1: The display module in the photo above and below is shown without the NEMA 4X enclosure so you can see the connectors inside the enclosure. The display board has two RS-485 ports located on the rear of the board. The ports are labeled IN TB and OUT TB. The photo above and below shows the CONNEX CPU module connected to the RS-485 IN TB of the display board. This will be the correct connection if your system includes 1 CONNEX CPU input module connected to a CONNEX Display module.

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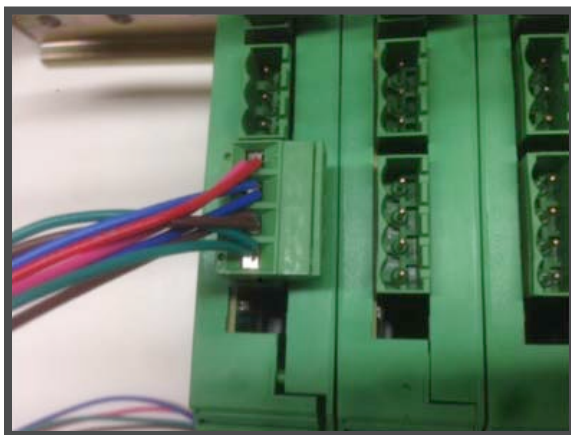


Figure 1.2: display board connected to the CPU DISPLAY PORT (see figure above) TB on the CPU/Input module

The RS-485 HOST port on the CPU/input module has 4 terminal positions. 1 terminal each for DC power +, TR + (transmit), TR -, and Ground.

The CPU's will be polled for data through their host port when 1 display module is connected to multiple CPU modules as opposed to connecting the display module to the display port on the CONNEX CPU/ Input module when using only 1 input, 1 display and 1 CPU module (Single input system).

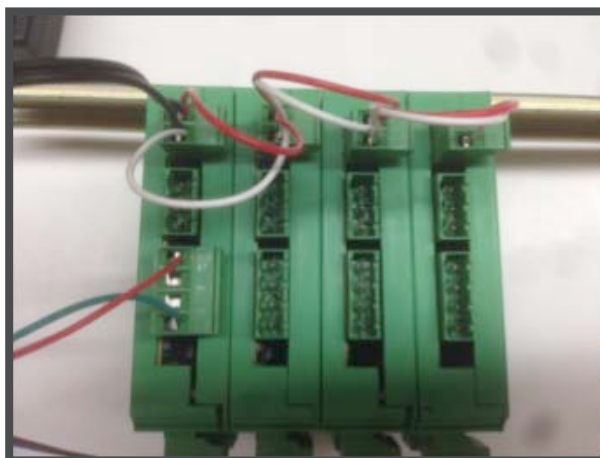


Figure 1.4: Note that the display is powered from the CPU board. Power and ground are connected to the display port at the CPU module. This provides DC power to the CONNEX 3D display module. The display module does not have an input fuse, so this provides fuse protection to the display via the fuse in the CPU module. This is an auto resettable fuse.

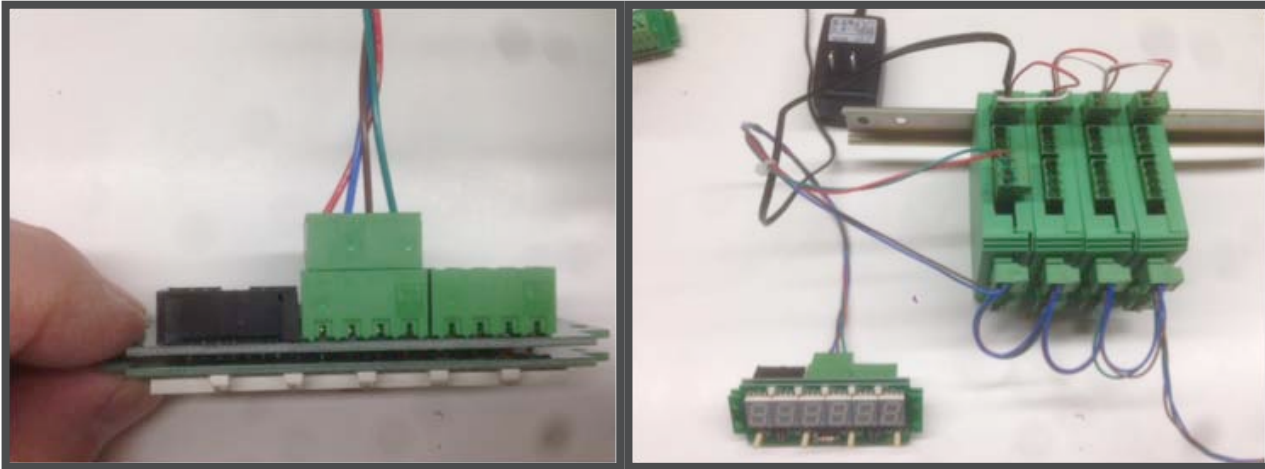


Figure 1.5: Note in this view that only the TR+ and TR- wires from the display module are connected to the host port. The ground and DC power is connected to the display port as shown in figure 1.4. The ground connection on the host port has a 100 ohm resistor to ground, so that is good for the RS-485 ground reference, but not for DC power ground. To keep things simple, you can connect the ground from the display to this ground as well so that it will work whether the display is powered from the CPU power supply or a remote power supply.

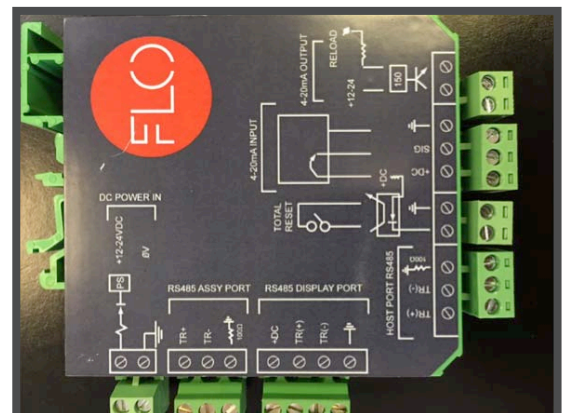
The CONNEX 3D Display module can monitor and display up to 4 CPU Modules (4 field instruments) by connecting the RS-485 OUT PORT on the display board to one of the CPU boards RS-485 HOST port. Figure 1.3 & 1.31 shows 4 CPU's connected to a display that is configured as a host device (refer to **Configurations Display Options** (page 5))

WIRING NOTE: RS-485 serial devices can communicate using a multi-drop type of wiring connections. Digital communications networks implementing the standard can be used effectively over long distances and in electrically noisy environments. Multiple receivers may be connected to such a network in a linear, multi-drop configuration. These characteristics make such networks useful in industrial environments and similar applications.

CONNEX 3D™ CPU/INPUT MODULE

The CONNEX CPU module wiring diagram is located on the DIN mount case for quick reference. Wiring terminations can be made using the plug-in style screwed anchor connections using 18 AWG to 22 AWG wire. Termination ports include:

- o DC Power In
- o RS485 Accessory
- o RS485 Display
- o RS485 Host
- o Total Reset
- o Analog Input - 2 or 3 wire connections, sourcing or sinking inputs
- o Analog output, Isolated



The CPU is programmed for analog scaling (4-20mA values corresponding to a scaled mA input and output), display value, display decimal point, display type, communications type and Modbus address, password protection, relay set points and other parameters covered in the programming section of this manual. The CPU is programmed using the CONNEX 3D DISPLAY module connected to the RS485 Display port on the CPU and the RS485 IN port on the DISPLAY module. SEE Programming instructions for the CPU module on page_____.

CONNEX 3D™ DATA LOGGER & CELLULAR MODULE

The CONNEX Data Logger & Cellular module wiring diagram is located on the DIN mount case for quick reference. Wiring terminations can be made using the plug-in style screwed anchor connections using 18 AWG to 22 AWG wire. Termination ports include:

- o DC Power In
- o RS485 Accessory

The 1/8" female USB plug receptacle and manual operation pushbutton (SW1) are located on the same side as the wiring plug-in ports. The USB plug receptacle is only used as a method to extract the logged data to a mobile or desktop PC using the CONNEX 3D Data Log Interface Application. Or to configure, test, diagnostics and view data using the CONNEX 3D Interface Application. The manual operation pushbutton is used to force a cellular callout for testing cellular connectivity by pressing pushbutton once for 2 seconds, or for retrieving logged data via cellular connectivity by pressing pushbutton once for 2 seconds wait 10 seconds and push for 2 seconds again.



Figure 1.6: Status LED is located between the 1/8" USB connector and the pushbutton. The status LED blinks once per second to indicate normal operation or sleep mode, change rate at cellular transmission operation.

The **CONNEX 3D Configuration Utility** can be downloaded at: <https://www.flo-corp.com/wp-content/uploads/2018/01/3D-Configuration-Utility-Install.zip>

The Utility should be used on a laptop or desktop PC running Windows™ operating system, WIN XP, 7 – 10 versions. The PC should be connected via USB connector on the supplied USB/cable/1/8" connector to the CONNEX 3D Data Log board. Once connected, the Utility can be opened to the startup screen (fig. 10.0)

The **CONNEX 3D Configuration Utility and Datalog – Retriever Utility** can be downloaded at: <https://www.flo-corp.com/product/connex-3d-cd3d-flexible-process-meter/>

CONNEX 3D™ TCP/IP ETHERNET MODULE

The Module can be setup with simple auto-discover on an existing network or through virtual private network setup. Please read the communications and protocol notes for the basic understanding of communications and terms used in setup. Proceed to page 9 for the software setup and information.

COMMUNICATIONS NOTE: Master-slave arrangement

Often in a master-slave arrangement when one device dubbed “the master” initiates all communication activity, the master device itself provides the bias and not the slave devices. In this configuration, the master device is typically centrally located along the set of RS-485 wires, with two slave devices located at the physical end of the wires providing termination. The master device itself could provide termination if it were located at a physical end of the wires, but that is generally regarded as a bad topology design[7] as the master operates optimally when located at a halfway point between the slave devices, thereby maximizing signal strength and therefore line distance and speed. Applying the bias at multiple node locations could possibly cause a violation of the RS-485 specification and cause communications to malfunction.

Protocol NOTE:

RS-485 is not a protocol; it's simply an electrical interface. Although many applications use RS-485 signal levels, the speed, format, and protocol of the data transmission is not specified by RS-485. The protocol or also known as the communications protocol is called MODBUS RTU. Modbus is the communication protocol standard for industrial environments and is now a commonly available means of connecting the CONNEX 3D flexible monitoring system. The main reasons for the use of Modbus in the CONNEX 3D monitoring system are:

- developed with industrial applications in mind,
- robust and reliable communications that is time proven,
- openly published and royalty-free,
- easy to deploy and maintain,
- moves raw bits or words without placing many restrictions

Modbus enables communication among many devices connected to the same network, for example, a system that measures temperature and humidity and communicates the results to a PC or computer. Modbus is often used to connect a supervisory computers with a remote terminal unit (RTU) in supervisory control and data acquisition (SCADA) systems. Many of the data types are named from its use in driving relays: a single-bit physical output is called a coil, and a single-bit physical input is called a discrete input or a contact.

- Modbus RTU — This is used in serial communication and makes use of a compact, binary representation of the data for protocol communication. The RTU format follows the commands/data with a cyclic redundancy check checksum as an error check mechanism to ensure the reliability of data. Modbus RTU is the most common implementation available for Modbus. A Modbus RTU message must be transmitted continuously without inter-character hesitations. Modbus messages are framed (separated) by idle (silent) periods.

REMOTE MONITORING WITH TCP/IP ETHERNET & DIGALINK 3.0 SOFTWARE INTERFACE:

NETWORK SETUP & PREPERATION: The CONNEX 3D monitor has the ability to connect directly to your network through TCP/IP Ethernet connection port at the monitor. In order to remote monitor the device on the network, setup and preparation should be considered as detailed below.

At the CONNEX 3D Monitor:

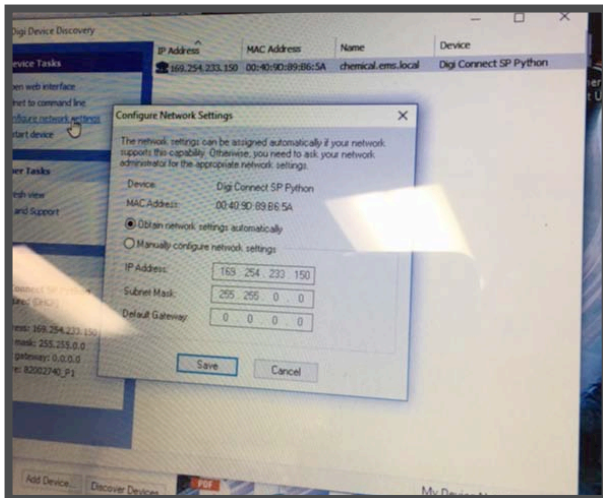
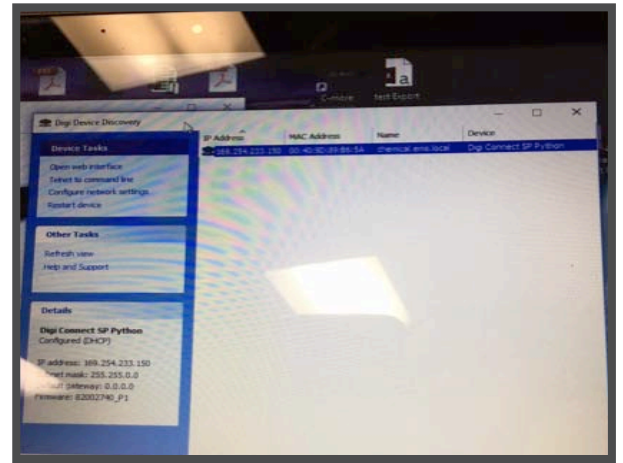
Step 1) Locate the DIGI CONNEXT SP hardware in the monitor enclosure. Make sure the power and Ethernet cable to the Ethernet port are connected.

Step 2) At your PC connected to your network. Download the required software and documentation. From your browser go to: <https://www.digi.com/support/productdetail?pid=2474&type=documentation>

Select your operating system in the filter.

Use the Digi Discovery Utility – Remote to discover devices on your network and open the web interface.

1. In the list of discovered devices, select the Digi Connect SP device.
2. Using the Digi Discovery Utility to configure the IP address if you do not select to Auto Discover.
3. Open the Digi Connect SP web interface. In the Device Discovery Utility, click OPEN WEB INTERFACE.
4. A login prompt for the web interface appears. Enter the default username and password: **root** and **dbps**.
5. Select Configure network setting
6. Select Obtain network settings automatically for auto discovery or Manually configure network settings. If manually is selected, select the IP Address and Subnet Mask and select SAVE.



Step 3) Open DigiLink 3.0 remote monitoring and configuration software.

1. If Auto Discovery is selected in Digi Connect web interface:
DigiLink software will offer two options for connectivity. By selecting the Discover Device button on the lower right hand screen.

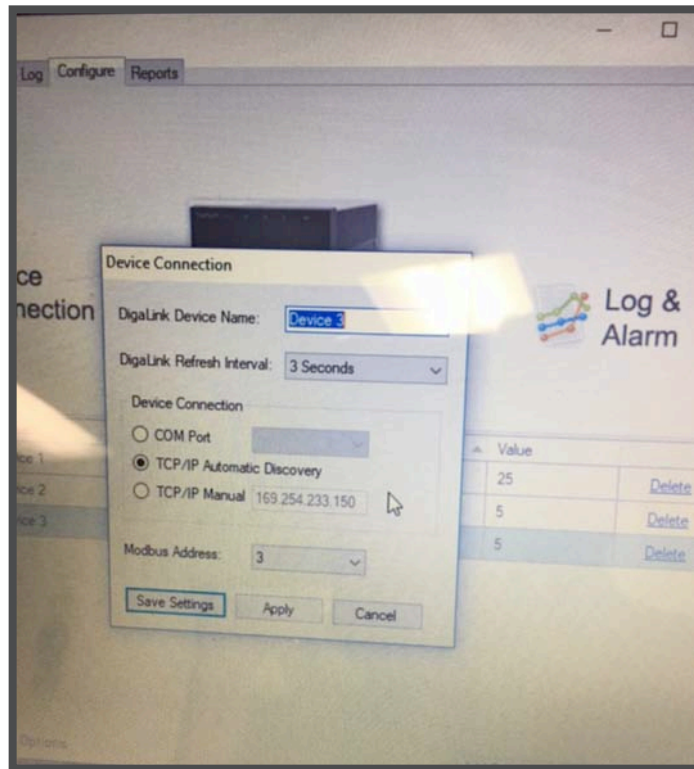
If Static IP is selected in the Digi Connect web interface:
In DigiLink software select the ADD DEVICE button on the lower right hand screen.

In Device Connection select TCP/IP Manual and enter the corresponding IP address entered into Digi Connect web interface.

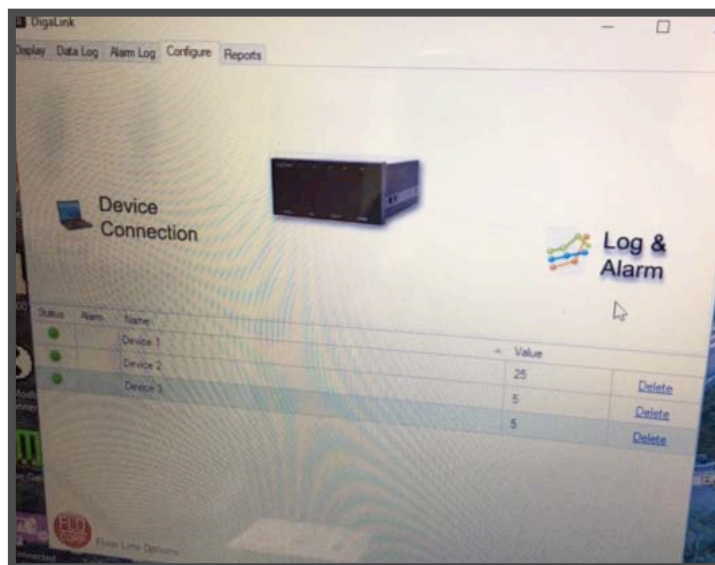
Add/select the Modbus address in the Modbus Address field.

The Modbus address should be selected as follows as this is already programmed into the CONNEX CPU module. EXAMPLE:

- FLOW: Modbus address 1
- WASH: Modbus address 2
- PH FLUME: Modbus address 3

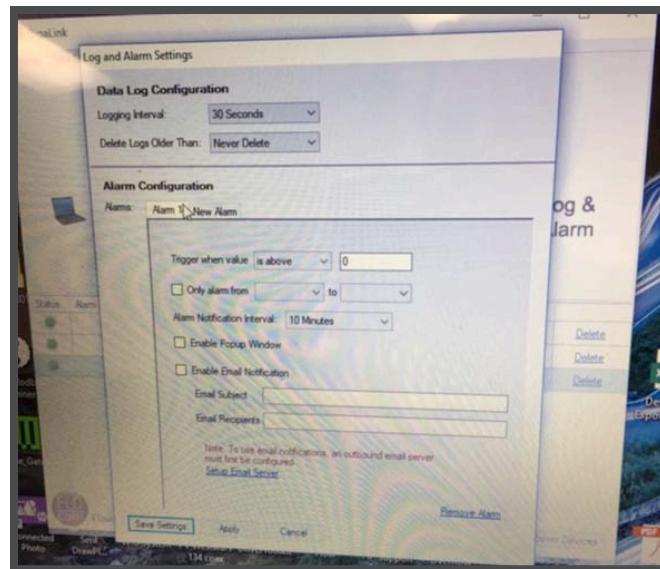


Select the Configure Tab at the top of the screen. The three devices should populate the lower screen as shown in the photo below. The Green status will indicate connectivity with the CONNEX monitor.



Select Log & Alarm to setup the alarm levels for each field measurement.

Select the field for a NEW ALARM.



The settings in the above photo can be entered and selected to customize the alarm settings for each sensor monitored in DigaLink. The software will allow popup alarms as well as send email alerts to selected users. Once settings are selected for alarm settings click Apply, Save Settings.

Select the Data Log Tab to access the logged numerical data from each device.

Filter From/To - select the Filter From checkbox and To checkbox to change the date and time intervals displayed at the bottom of the history chart. The logged numerical data in the history chart is filtered according to the specified date and time range.

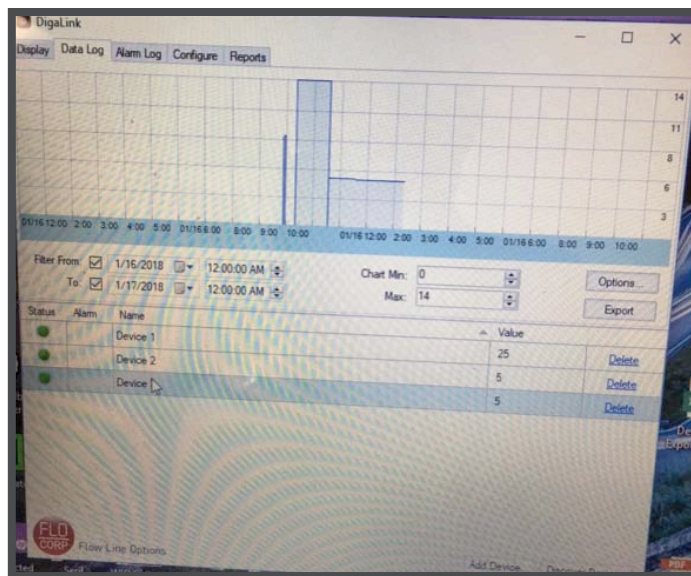


Chart Min/Max - Adjust the numbers in the Min and Max boxes to change the minimum and maximum amounts appearing on the right side of the history chart. The minimum and maximum amounts can be set at different intervals for each device and will be saved.

Export - Select the Export button to export and save the logged numerical data appearing on the history chart as a Comma Separated Value (CSV) file. If Microsoft Office is installed on the computer, the file can be opened with Microsoft Excel.

