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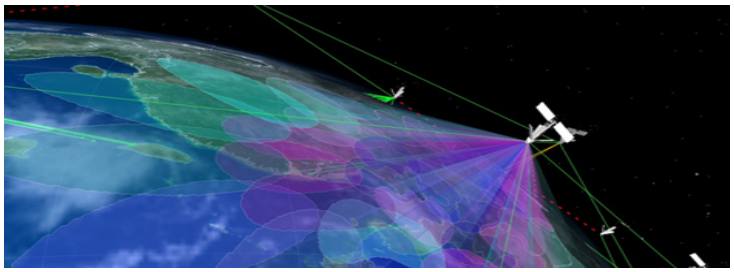
HYDROMETRIC AND DAM SAFETY MONITORING STATION WITH RADIO MODEM & GOES SATELLITE TELEMETRY

MUSKRAT FALLS, LABRADOR

APPLICATION NOTE



Station: ***Remote Dam Safety and Hydrometric Station***

Model: ***9210 Datalogger with ELPRO Radio Telemetry and Sutron Accubar Constant Flow Bubbler***

For Sales & Service Contact:
Hoskin Scientific Ltd.
Edmonton Ph. (780) 434-2645
Vancouver Ph. 1-800-663-3023

System Overview:

The Muskrat Falls Remote Hydrometric station has the following configuration:

Remote slave station with radio modem and GOES satellite telemetry

The remote hydrometric slave station integrates a Sutron Accubar constant flow bubbler, Hydrolab water quality sonde with a Sutron Xlite 9210 data logger, ELPRO serial radio modem, and Sutron Satlink 2 GOES transmitter.

The 12 volt, 240 amp-hour battery, 120 watt solar panel and solar regulator together make up an autonomous power supply that operates the system. The solar panel will be mounted on a 3 meter tripod located outside of the gauging hut. The battery keeps the system running for extended periods of darkness and cloudy weather until sufficient sunlight allows recharging of the battery. The solar regulator monitors the charging status and shunts away surplus energy when the battery reaches full capacity.

Stage measurements are performed by the Accubar bubbler under control of the Xlite data acquisition system. The Sutron Satlink transmitter transmits data on a scheduled interval to Environment Canada's GOES data management center.

Master Station Radio Telemetry system situated in the spillway electrical room

The Master Station integrates Sutron 9210 datalogger, ELPRO serial radio modem and AC Power supply. The Xlite 9210 datalogger at the Master station polls the data from the slave station using the Elpro radio modem. The Master 9210 datalogger is connected to Muskrat Falls LAN where it is automatically transmitted VIA FTP to SutronWIN a web hosting and data management site.

On a scheduled interval the logged data stored on the Master 9210 will be polled through the LAN using Autopoll software which appends a CSV file on a network directory.

This document outlines the hardware configuration and programming options used in this project. Complete operation manuals are also available from the manufacturers.

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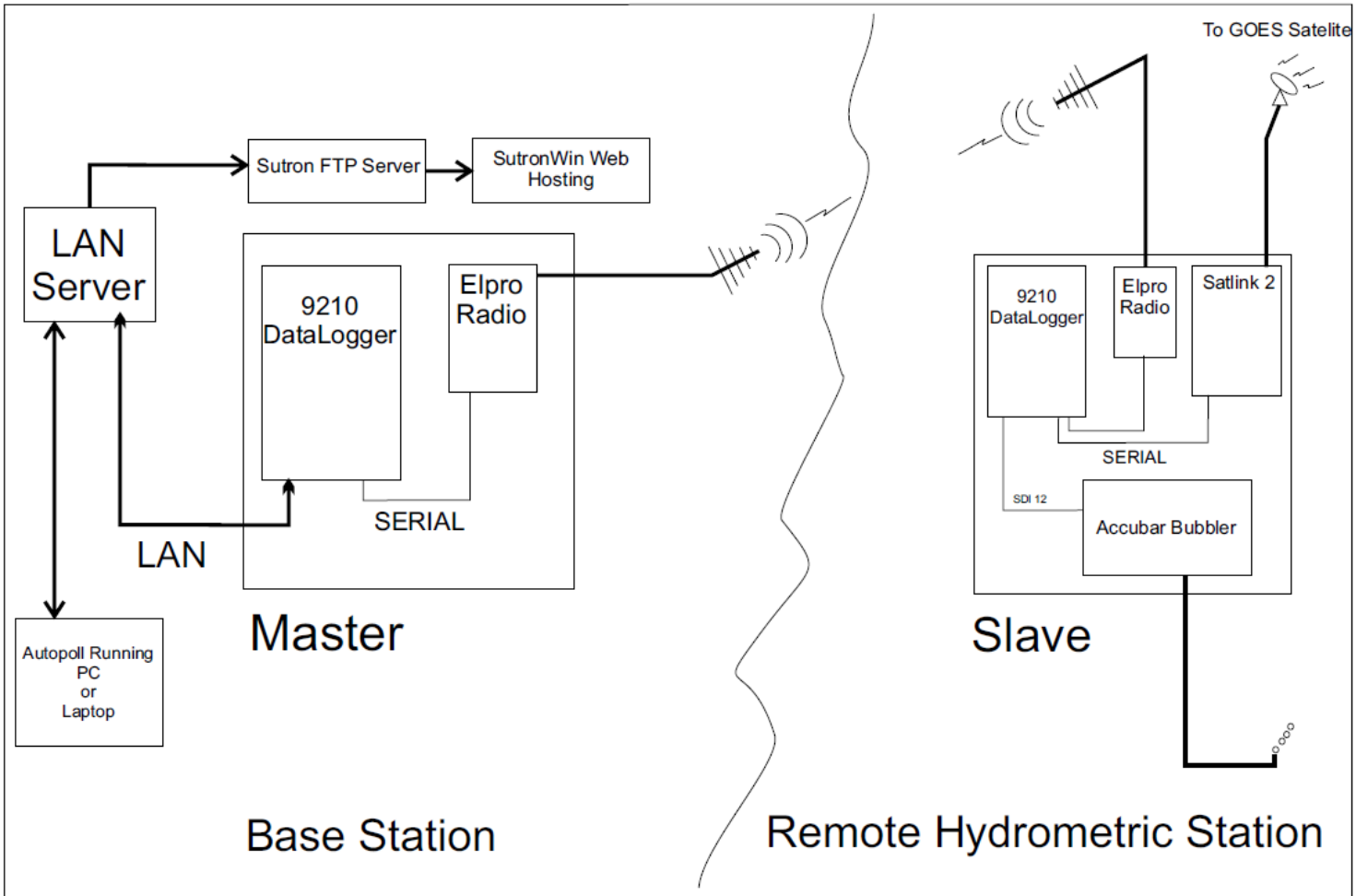
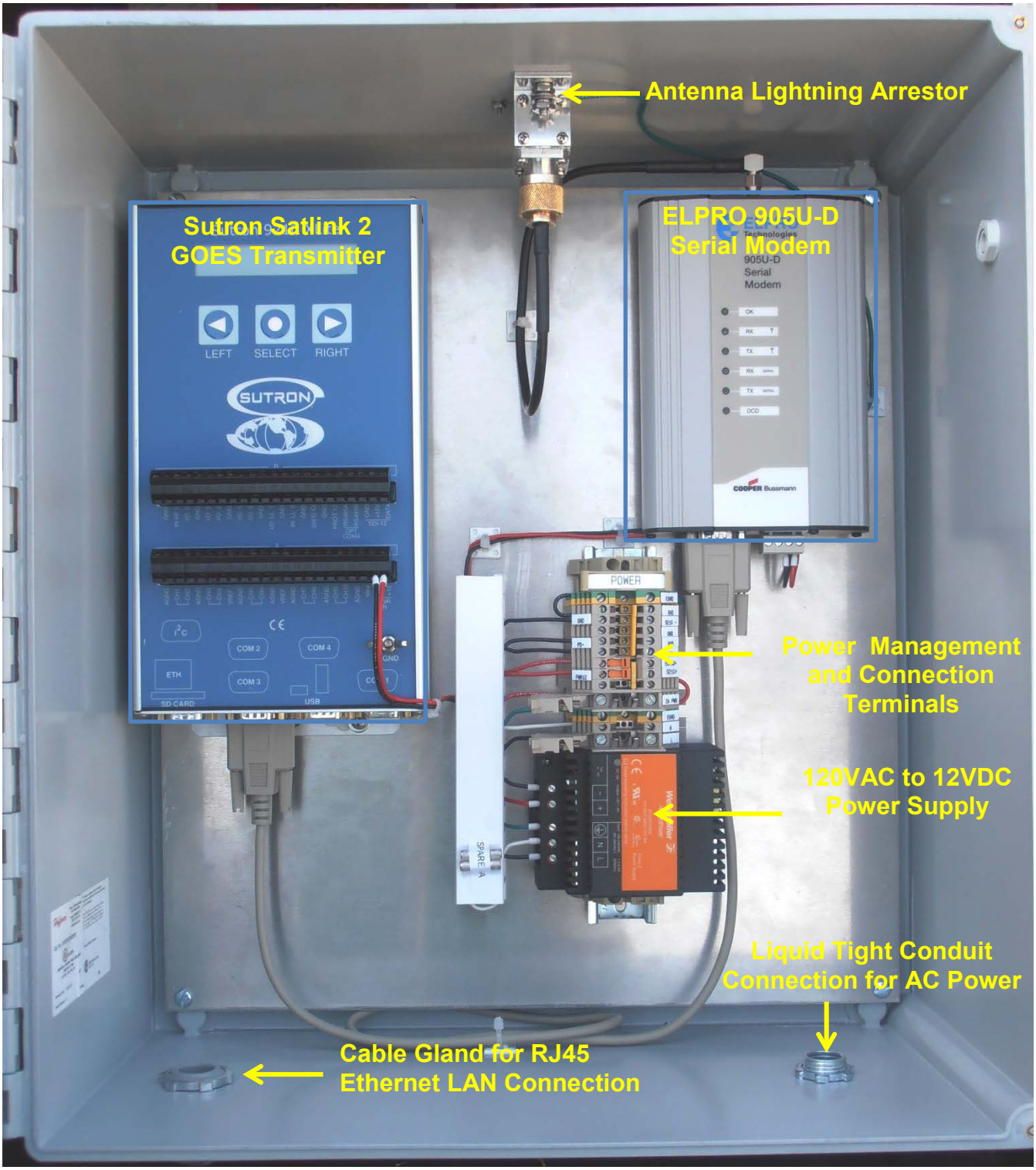
Muskrat Falls SCADA System Architecture



Rev.	1	Hoskin Scientific Systems Integration	Title: Physical Layout
Date	September 13, 2016	Muskrat Falls Corporation	Drawn By: Chintan Patel

Muskrat Falls Master Station



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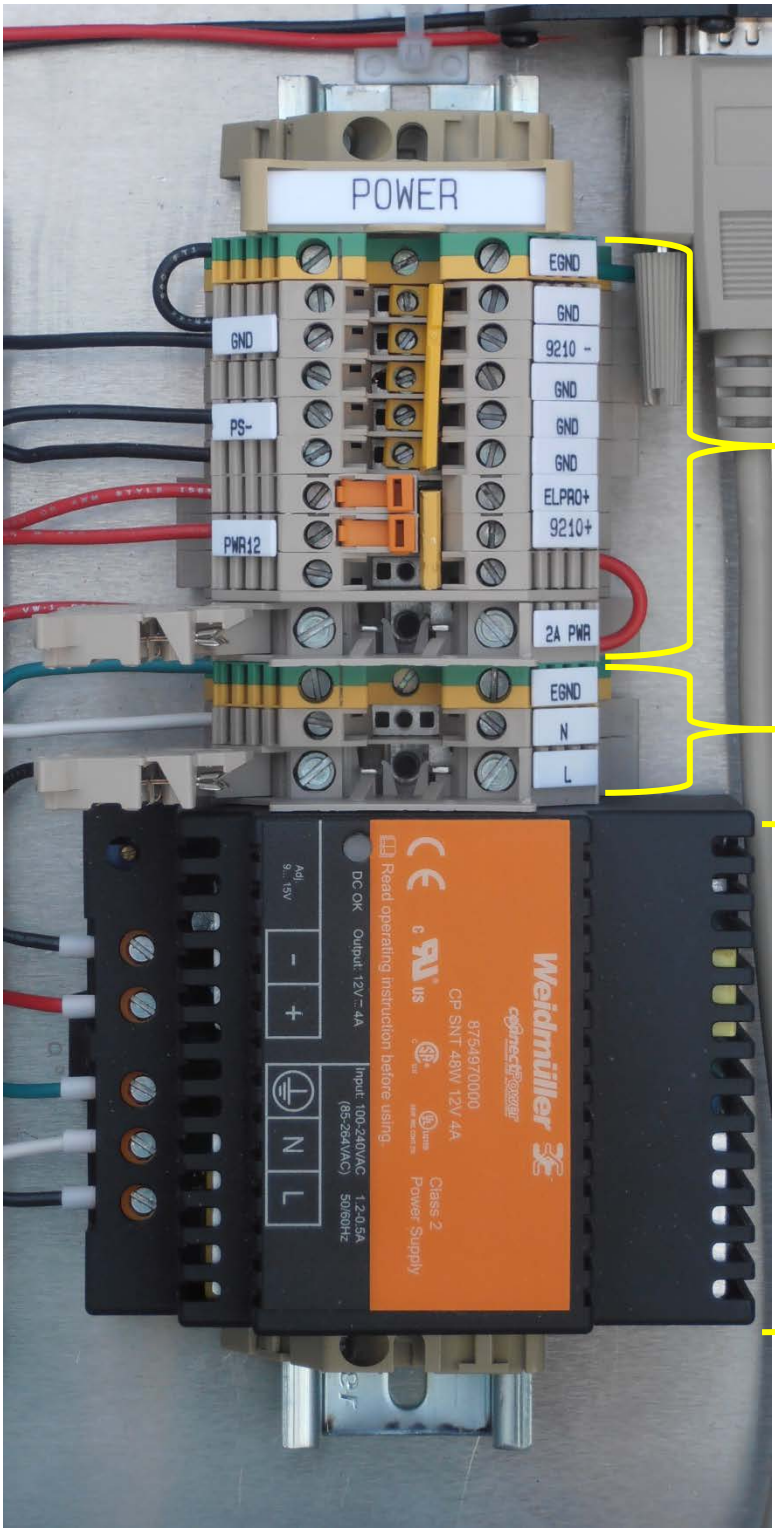
Enclosure Terminals



Power Management Terminals and Connections

A/C Power Connections

12VDC Power Supply

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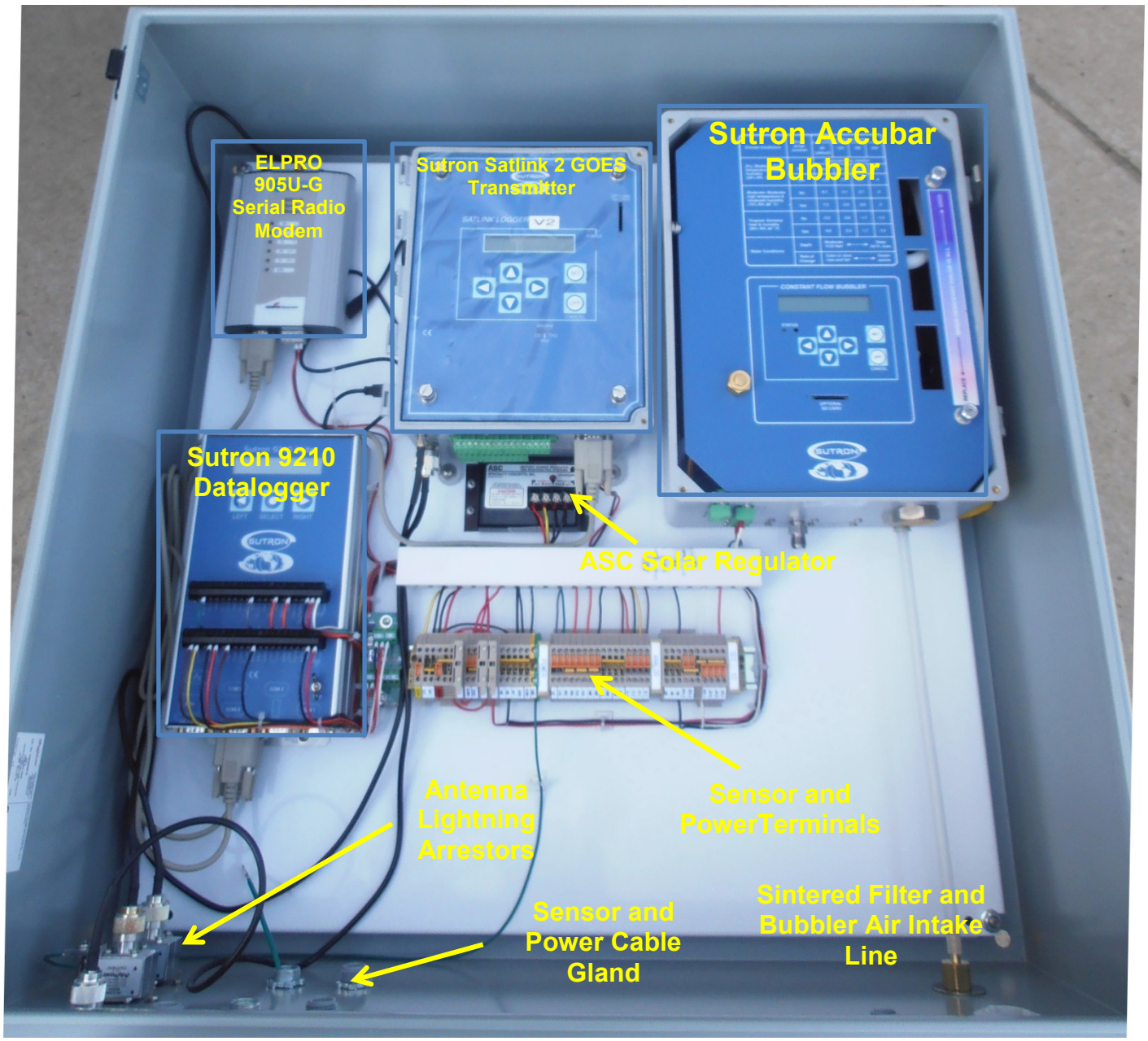
Slave Station



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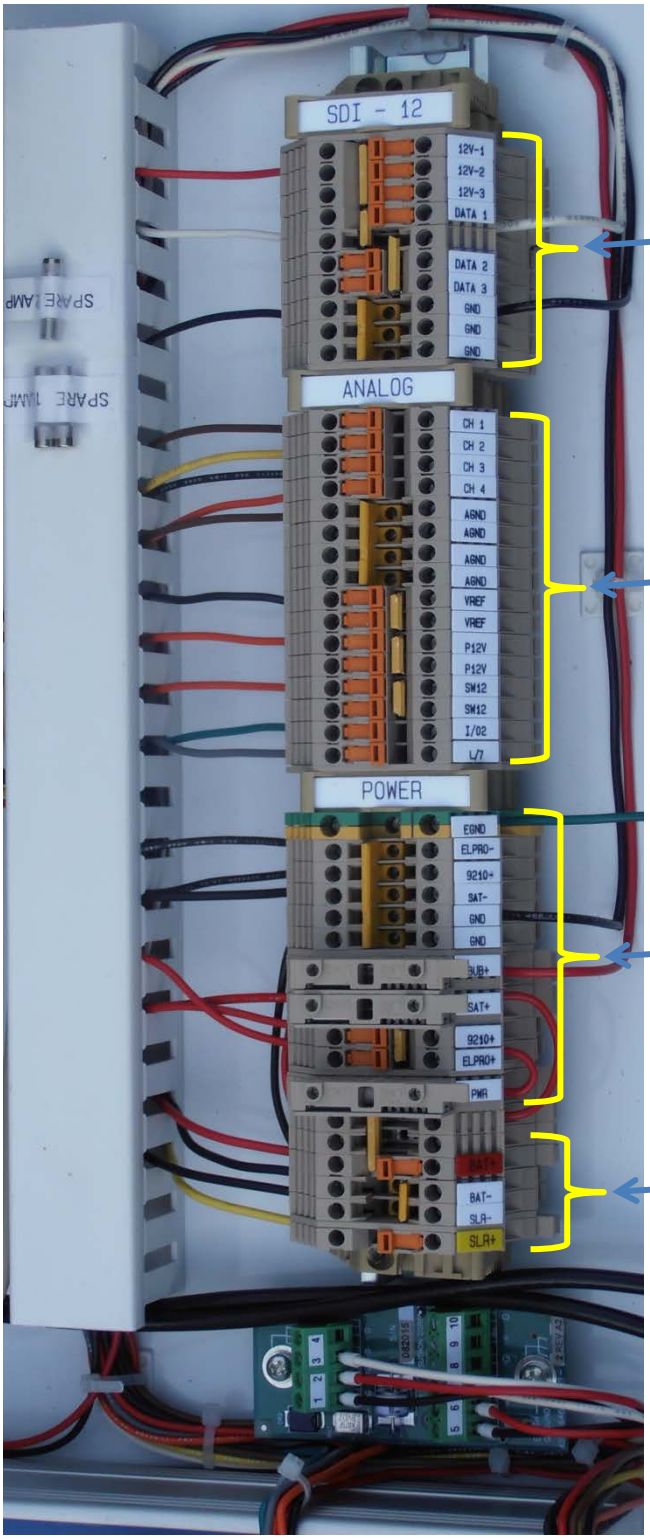
Hydrometric Station Enclosure Terminals



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Slave- Sutron 9210 Remote Station Commissioning Guide

Connect Battery

- Open terminal switches SLR+, BAT+, ELPRO+, 9210+, SAT+ and Fuse terminal BUB+
- Connect Battery(+) ---->BAT+
- Connect Battery(-) ---->BAT-
- Close terminal switch BAT+
- Measure Battery voltage between BAT(+) & BAT(-)
- Battery should be 12V to 14V)

Connect Solar Panel

- Open terminal switch SLR(+)
- Connect SOLAR+ ----> SLR(+)
- Connect SOLAR- ----> SLR(-)
- Measure the voltage between SLR(+) & SLR(-)
- Open circuit voltage should be between 14-22VDC
- Close terminal switch SLR(+) then solar charging LED should turn on (measure the voltage between BAT(+) & BAT(-) and note that the voltage should slowly increase indicating solar charging)

Install GPS Antenna

- Install GPS Bullet antenna & Connect to enclosure bulkhead connector. Wrap GPS antenna connector with electrical tape for sealing

Install GOES Antenna

- Install GOES antenna & connect to enclosure bulkhead connector.
- Wrap GOES antenna connector with electrical tape for sealing

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Install ELPRO Antenna

- Install Elpro Yagi Antenna on the mast. Connect antenna cable to enclosure bulkhead connector.
- Aim Antenna by pointing to Master Antenna
- Wrap Antenna connector end with electrical tape to make it waterproof.

Install Bubbler Orifice

- Install Orifice line through the enclosure gland and connect to bubbler
- Make sure fitting is tight

Connect Sensors

- Connect sensors to enclosure terminals as per wiring chart and sensor wire tags
- Seal all Conduit Connections with provided conduit puddy

Start Datalogger and Bubbler

- Close terminals switch 9210+ & logger powers ON
- Close fuse terminal switch BUB+ & bubbler powers ON
- Close terminal switch ELPRO+ & Radio modem powers ON
- Close terminal SAT+ & Satlink powers ON

Confirm System Operation

- Open Xterm software and connect ethernet or serial cable to 9210 datalgoger
- Confirm operation of logger and sensors
- Confirm Satlink settings e.g. Satellite ID, transmission time window
- Verify sensor readings
- Verify that logs in remote and master dataloggers match, veryify wireless data Tx messages (radio, GOES, Autopoll, SutronWIN)

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Remote Site Sensor and Power Connection

Battery Connections

Enclosure Terminals	Wire Color	Battery Terminal
BAT(+)	White	POS(+)
BAT(-)	Black	NEG (-)

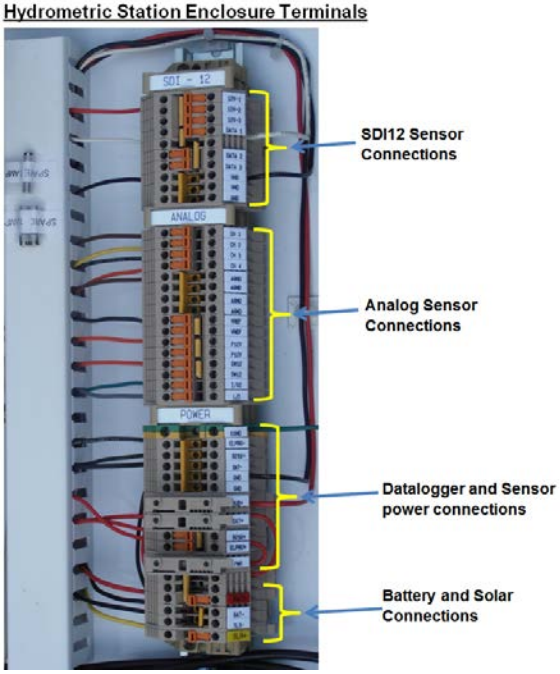
Solar Panel Connections

Enclosure Terminals	Wire Color	Solar Panel Terminals
SLR (+)	White	Solar Panel (+)
SLR (-)	Black	Solar Panel (-)

Hydrolab Sonde Connections

Enclosure Terminals	Wire Color	Datalogger Terminals
DATA	TBD	DATA
+12V	TBD	12V
GND	TBD	GND

Hydrometric Station Enclosure Terminals



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Master-Sutron 9210 Station Commissioning Guide

Connect AC Power Line

- Open Fuse terminals PWR, 2A PWR and L(120VAC)
- Connect 120VAC power as per wiring chart (licensed electrician require)
- Close Terminal L(120VAC).
- Wait for Green LED on the Power Supply to come on .

Connect Sensors and Start Datalogger

- Connect sensors to enclosure terminals as per wiring chart and sensor wire tags
- Close fuse terminal 2A PWR to enable 12V supply system power
- Close switch terminal 9210+ & datalogger powers ON
- Close terminal ELPRO+ & radio modem powers ON

Install ELPRO Antenna

- Install Elpro Yagi Antenna on the mast. Connect antenna cable to enclosure bulkhead connector.
- Wrap Antenna connector end with electrical tape to make it waterproof.

Confirm System Operation

- Open Xterm software and connect ethernet or serial cable to 9210 datalogger
- Confirm operation of logger
- Confirm Operation of ELPRO radio.
- Comfirm data by polling through autopoll software, SutronWIN, log files

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Master Station Sensor and Power Connection

AC Input Power

Wire Color	Description	Terminal
White	AC N	N
Black	AC L	L
Green	GND	Earth Ground Terminal

Sensor Configuration Overview Table

Remote Hydrometric Station

	Accubar Constant Flow Bubbler						
Description	**SHEF CODE**	**SDI-12 Address**	**SDI12 Cmd**	**SDI12 Para**	**Slope/off set**	**units**	**Logging Interval**
Water Level	HG	2	M	1	1/0	mH2O	15min
Restrictor Pressure	RP	2	M8	1	1/0	PSI	15min
Tank Pressure	TP	2	M8	2	1/0	PSI	15min
Battery Under Load	BL	2	M1	1	1/0	V	15min

	9210 Xlite Internal Parameters						
Description	**SHEF CODE**	**SDI-12 Address**	**SDI12 Cmd**	**SDI12 Para**	**Slope/off set**	**units**	**Logging Interval**
System Battery voltage	BV	N/A	N/A	N/A	1/0	V	15min
WatchDog	WD	N/A	N/A	N/A	1/0	Cnts	15 Min
	Hydrolab Water Quality Sonde						
Description	**SHEF CODE**	**SDI-12 Address**	**SDI12 Cmd**	**SDI12 Para**	**Slope/off set**	**units**	**Logging Interval**
Water Temperature	TW	0	M	1	1/0	mH2O	1 Hr.
Water Pressure	WP	0	M	2	1/0	PSI	1 Hr.
Conductivity	WC	0	M	3	1/0	uS/CM	1 Hr.
WZ	WZ	0	M	4	1/0	V	1 Hr.
Dissolved Oxygen % SAT	WX	0	M	5	1/0	%SAT	1 Hr.
Dissolved Oxygen m/g/L	WO	0	M	6	1/0	mg/L	1 Hr.
Turbidity	WT	0	M	7	1/0	NTU	1 Hr.
Chlorophyl	WY	0	M	8	1/0	ug/L	1 Hr.

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Station Name										
MuskratSlave										
Date	Time	BubblerRecID	WL	Restrictor Pressure	Tank Pressure	Battery Load	System Battery	WatchDog Counter		
Date	Time	HydrolabRecID	TW	WP	WC	WZ	WX	WO	WT	WY
9/13/2016	11:14:20	Bubbler	0.4703	8.51	9.49	13.7	14.22	2		
9/13/2016	11:29:20	Bubbler	0.47	8.53	9.5	13.8	14.21	3		
9/13/2016	11:44:20	Bubbler	0.4697	7.35	8.33	13.7	14.22	4		
9/13/2016	11:59:20	Bubbler	0.4694	7.61	8.58	13.7	14.22	5		
9/13/2016	12:00:00	Hydrolab	321	0.03	22	44	7.45	75	22	23
9/13/2016	12:14:20	Bubbler	0.4693	7.69	8.67	13.7	14.21	6		
9/13/2016	12:29:20	Bubbler	0.4692	7.83	8.81	13.7	14.22	7		
9/13/2016	12:44:20	Bubbler	0.4692	7.83	8.8	13.8	14.22	8		
9/13/2016	12:59:20	Bubbler	0.4693	7.95	8.93	13.7	14.22	9		
9/13/2016	13:00:00	Hydrolab	241	0.05	22	44	7.45	75	22	23
9/13/2016	13:14:20	Bubbler	0.4686	7.84	8.81	13.8	14.21	10		
9/13/2016	13:29:20	Bubbler	0.4686	8.67	9.64	13.8	14.22	11		

Example Data String from Muskrat Slave 9210 Log:

Master SCADA Station

	Accubar Constant Flow Bubbler		
Description	**TAG**	**units**	**Logging Interval**
Water Level	HG	mH2O	15min
Restrictor Pressure	RP	PSI	15min
Tank Pressure	TP	PSI	15min
Battery Under Load	BL	V	15min
Battery Voltage	BV	V	15 Min
Watch Dog *	WD	Cnts	15 Min

Example Data String from Muskrat Master 9210 Log:

Station Name								
MuskratMaster								
Date	Time	MuskratRecID	HG	RP	TP	BL	BV	WD
9/13/2016	11:30:00	Muskrat	0.47	8.53	9.5	13.8	14.21	3
9/13/2016	11:45:00	Muskrat	0.4697	7.35	8.33	13.7	14.22	4
9/13/2016	12:00:00	Muskrat	0.4694	7.61	8.58	13.7	14.22	5
9/13/2016	12:15:00	Muskrat	0.4693	7.69	8.67	13.7	14.21	6
9/13/2016	12:30:00	Muskrat	0.4692	7.83	8.81	13.7	14.22	7
9/13/2016	12:45:00	Muskrat	0.4692	7.83	8.8	13.8	14.22	8
9/13/2016	13:00:00	Muskrat	0.4693	7.95	8.93	13.7	14.22	9
9/13/2016	13:15:00	Muskrat	0.4686	7.84	8.81	13.8	14.21	10
9/13/2016	13:30:00	Muskrat	0.4686	8.67	9.64	13.8	14.22	11
9/13/2016	13:45:00	Muskrat	0.4686	8.67	9.64	13.8	14.22	11
9/13/2016	14:00:00	Muskrat	0.4686	8.67	9.64	13.8	14.22	11
9/13/2016	14:15:00	Muskrat	0.4686	8.67	9.64	13.8	14.22	11

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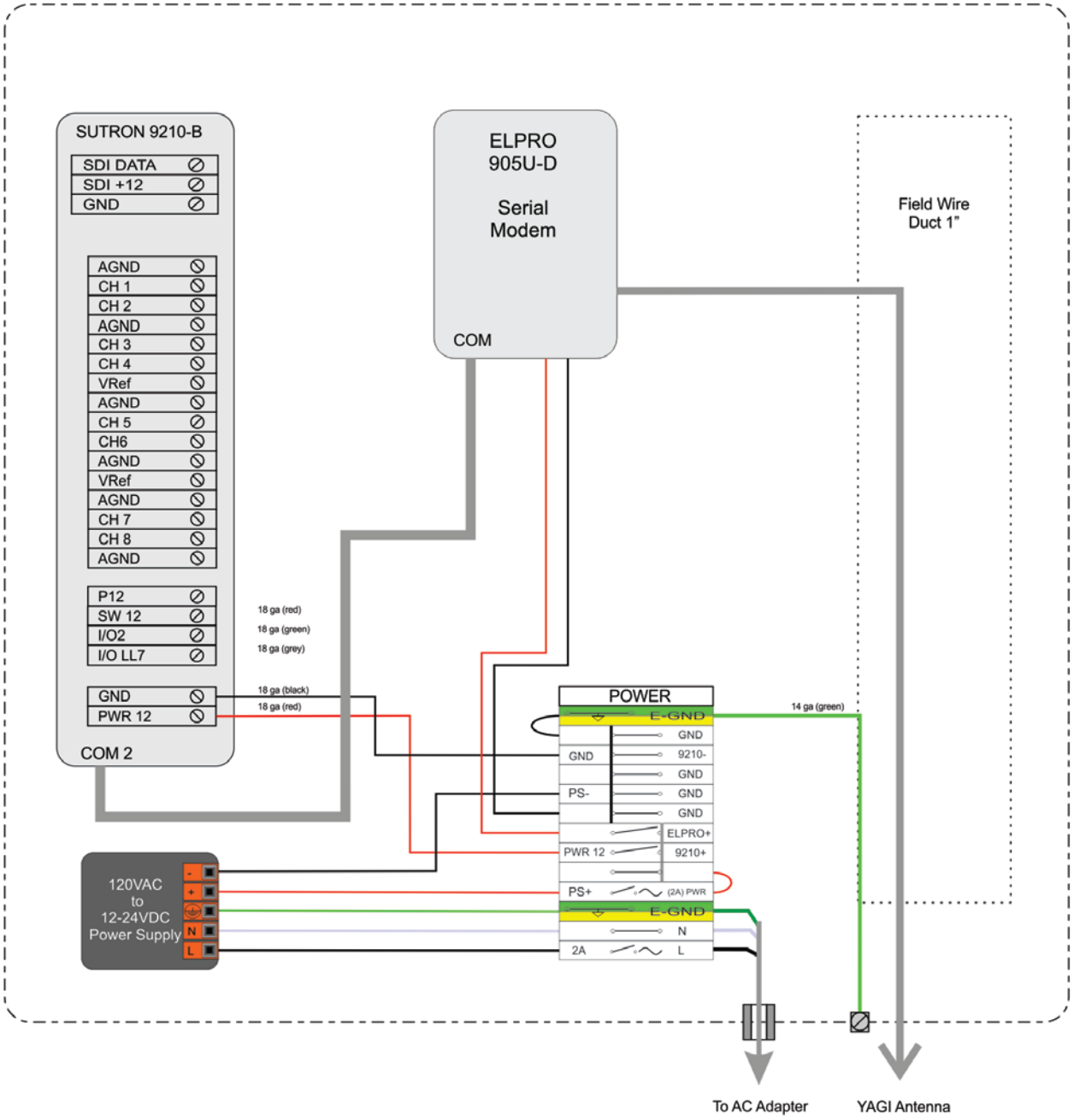
Master Station Panel Schematic



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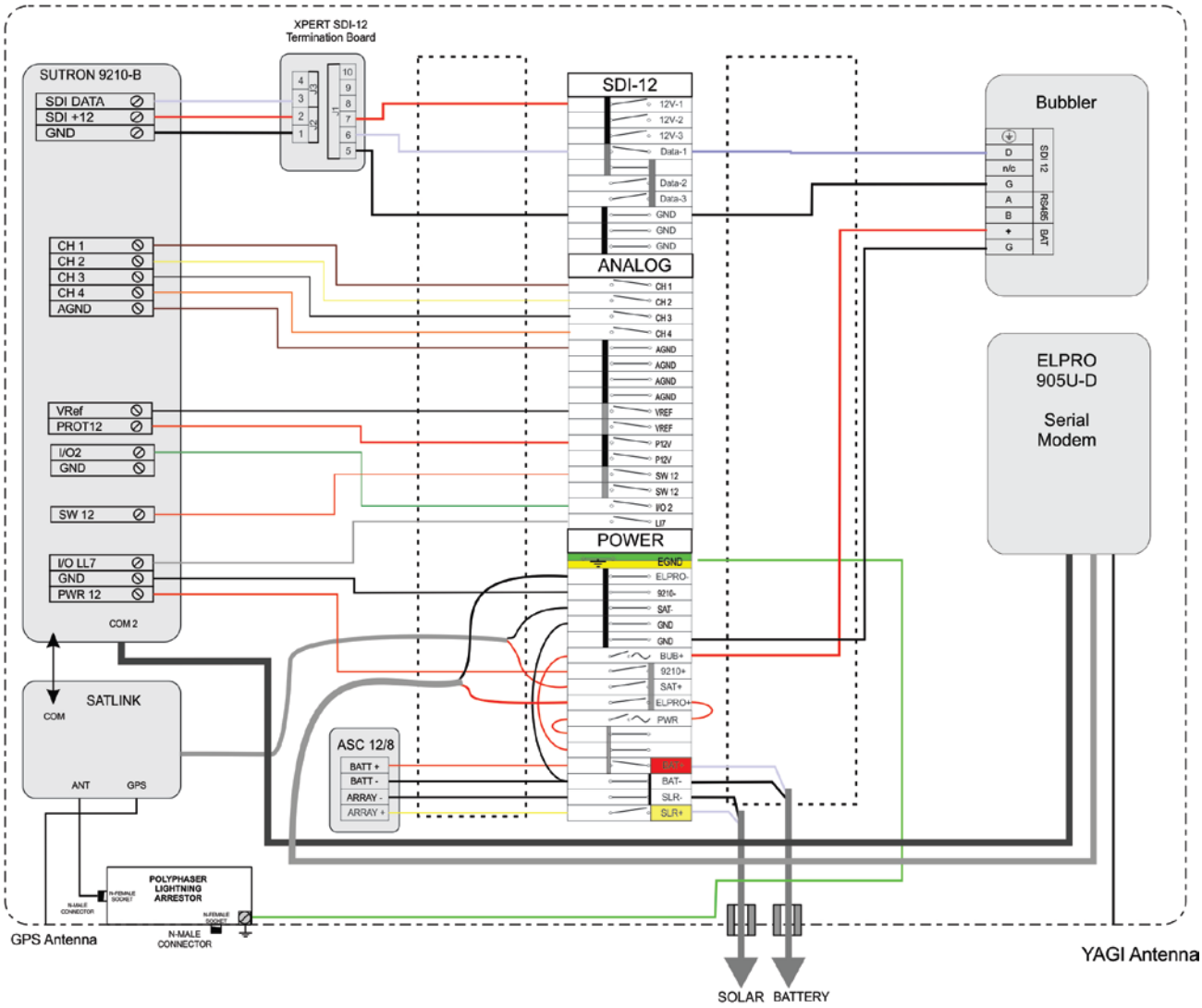
Slave Station Panel Schematic



Sutron 9210 Datalogger Xterm Software Configuration

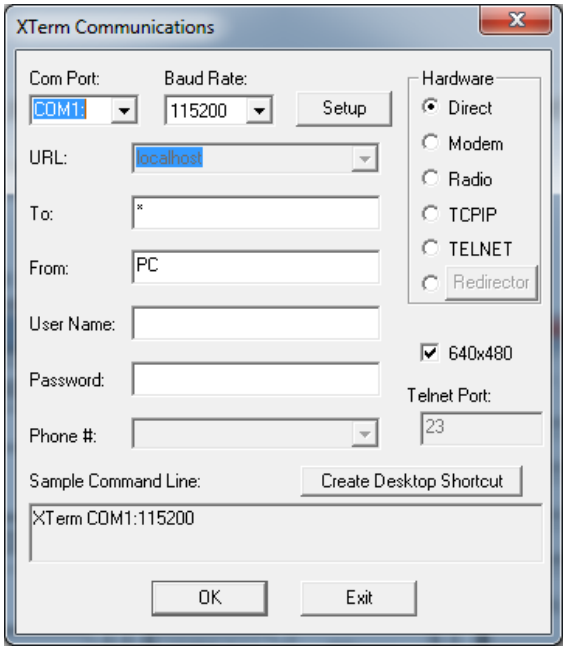
Overview

www.sutron.com/documents/xterm-for-pc.exe (Software Download link).
The Xlite performs control and interface functions for the system. Hoskin Scientific has set up the 9210 logger as outlined in the scope of work. Access and programming is done through windows based Xterm software using a serial connection.

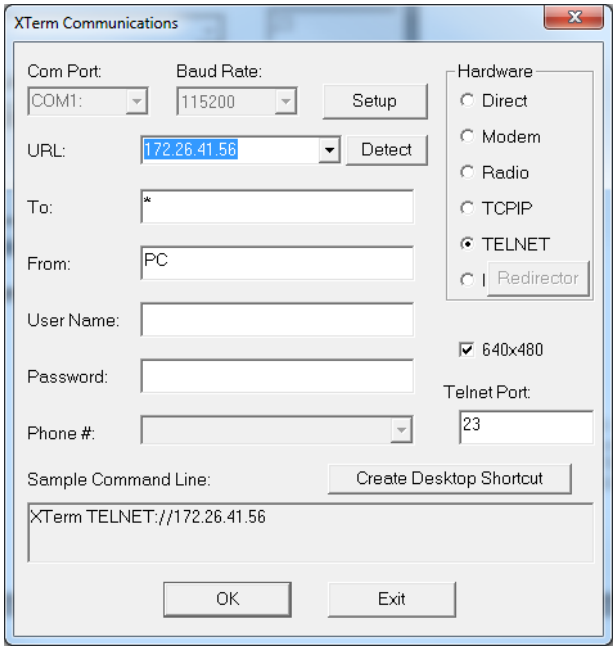
Software Configuration

Connecting Xterm through Direct Serial & LAN connections

Serial RS-232



Ethernet LAN with DHCP



Select desired com port / IP Address and baud rate as shown above and hit connect.

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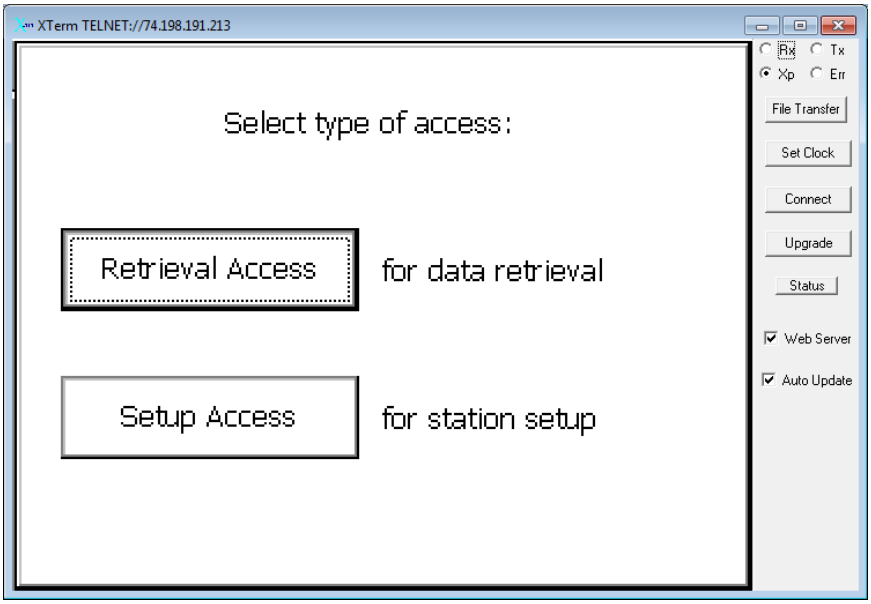
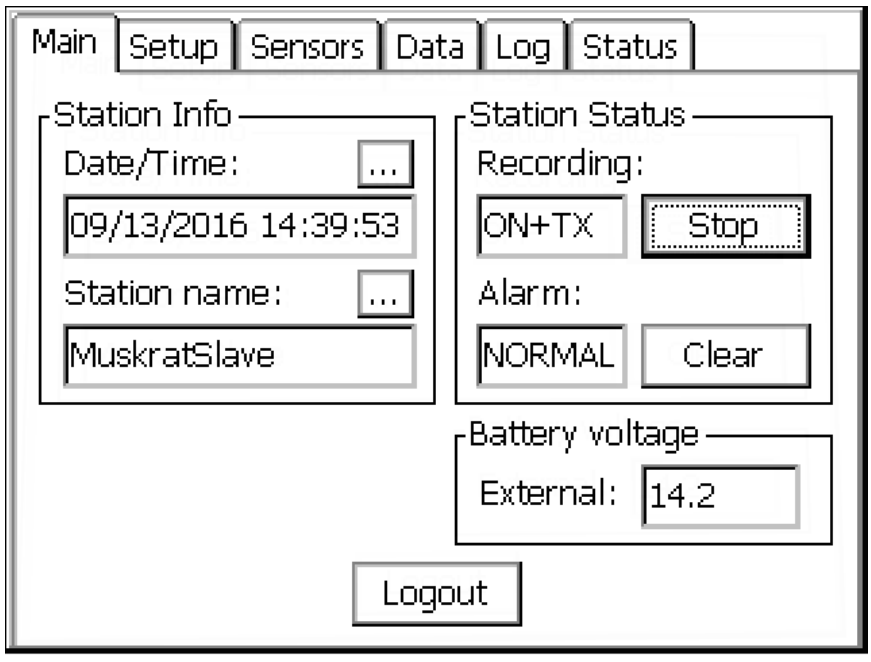
Sutron 9210 Xlite Data Logger Software Configuration

A successful log on with Xterm takes you to the Access page of the logger. Setup Access opens all available tabs. The following screen captures show the custom setup.

The Main tab lets to set up time and station information and status.



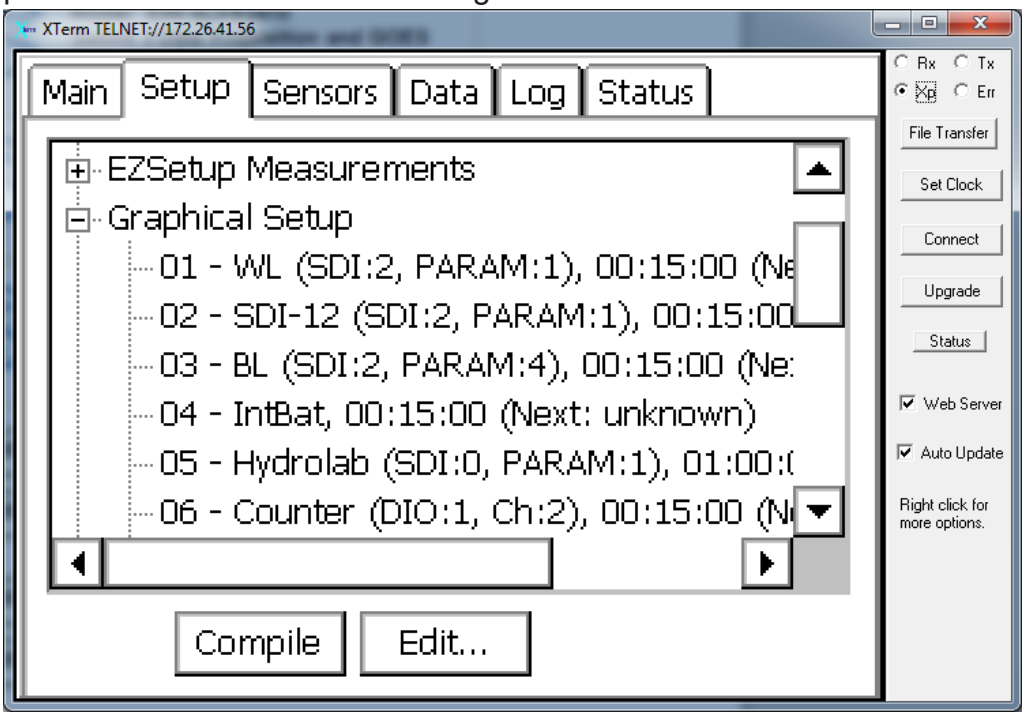


Note that there must be a "MuskratSlave.ssf" Or "MuskratMaster.ssf" file in the logger's Flash directory; the station and setup file names must match.

+TX Indicates Satlink Transmissions enabled

Sutron 9210 Xlite Data Logger

Choosing the Setup tab and EZSetup Measurements takes you to the window where parameters from the sensor configuration table can be entered.



The 15 minute interval is set here for bubbler and 1 hour for the water quality sonde. Sensor names, measurement protocols, reported precision can all be set here. Editing sensor entries takes you to a configuration screen.

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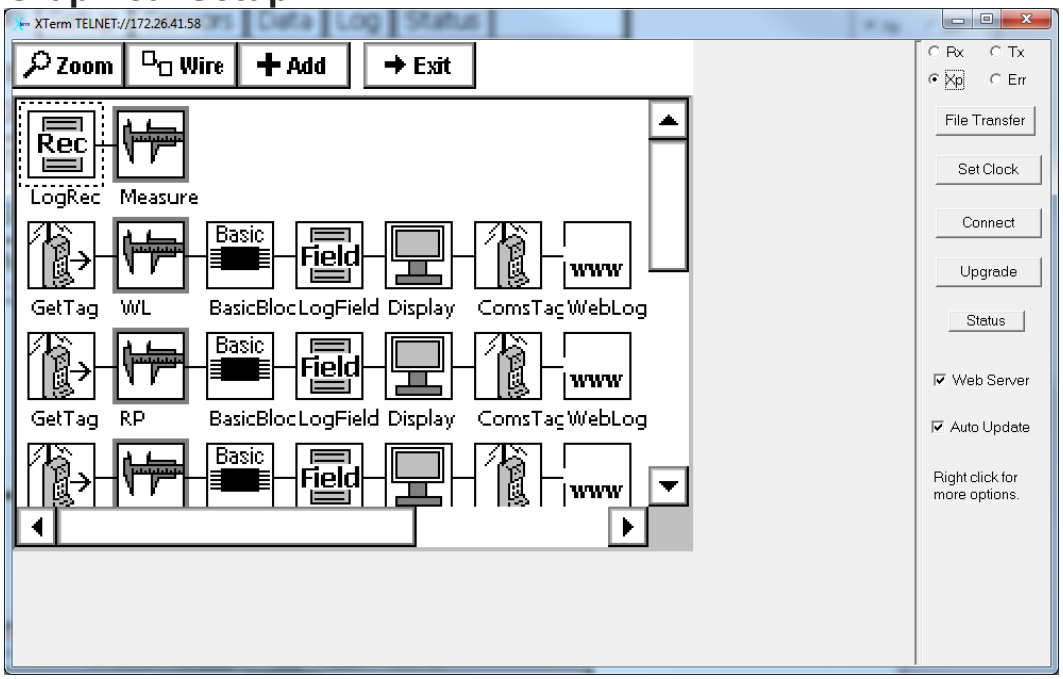
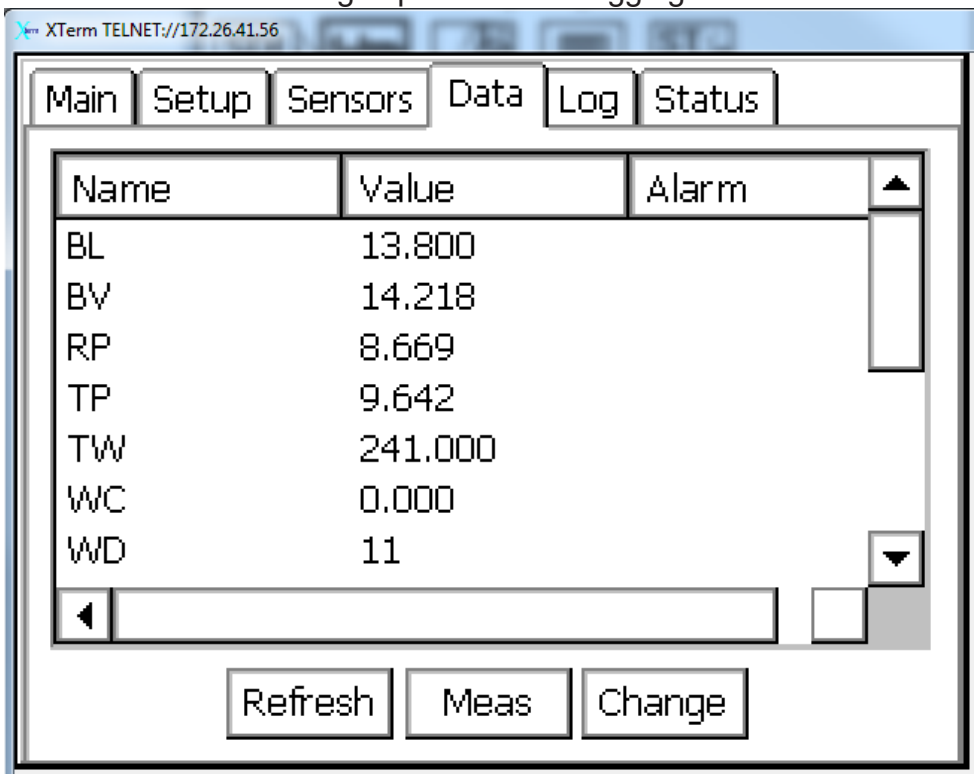
Graphical Setup



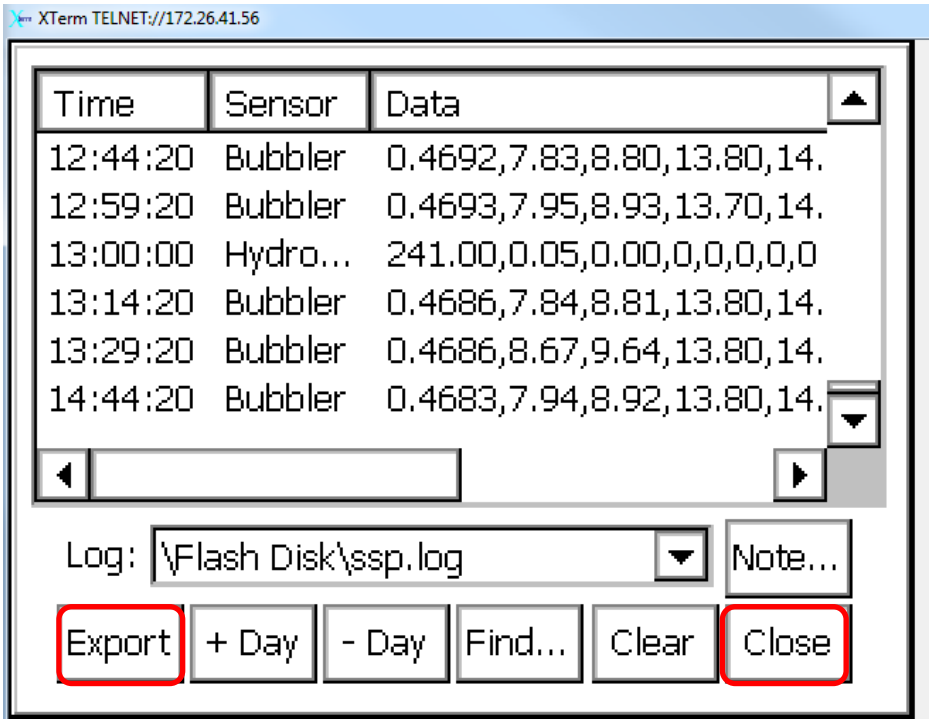
Xterm Data Tab

Shows Sensors Readings updated each logging interval



Backing out of Graphical Setup and selecting the data tab displays the results of the setup steps taken earlier.

Sutron 9210 Xlite Data Logger



Selecting the Log tab shows the contents of log file as it would be exported as a CSV file.

"Export" initiates data download while in an Xterm session.

Data String Formats in Log

Station Name								
MuskratMaster								
Date	Time	MuskratRecID	HG	RP	TP	BL	BV	WD
9/13/2016	11:30:00	Muskrat	0.47	8.53	9.5	13.8	14.21	3
9/13/2016	11:45:00	Muskrat	0.4697	7.35	8.33	13.7	14.22	4
9/13/2016	12:00:00	Muskrat	0.4694	7.61	8.58	13.7	14.22	5
9/13/2016	12:15:00	Muskrat	0.4693	7.69	8.67	13.7	14.21	6
9/13/2016	12:30:00	Muskrat	0.4692	7.83	8.81	13.7	14.22	7
9/13/2016	12:45:00	Muskrat	0.4692	7.83	8.8	13.8	14.22	8
9/13/2016	13:00:00	Muskrat	0.4693	7.95	8.93	13.7	14.22	9
9/13/2016	13:15:00	Muskrat	0.4686	7.84	8.81	13.8	14.21	10
9/13/2016	13:30:00	Muskrat	0.4686	8.67	9.64	13.8	14.22	11
9/13/2016	13:45:00	Muskrat	0.4686	8.67	9.64	13.8	14.22	11
9/13/2016	14:00:00	Muskrat	0.4686	8.67	9.64	13.8	14.22	11
9/13/2016	14:15:00	Muskrat	0.4686	8.67	9.64	13.8	14.22	11

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Station Name										
MuskratSlave										
Date	Time	BubblerRecID	WL	Restrictor Pressure	Tank Pressure	Battery Load	System Battery	WatchDog Counter		
Date	Time	HydrolabRecID	TW	WP	WC	WZ	WX	WO	WT	WY
9/13/2016	11:14:20	Bubbler	0.4703	8.51	9.49	13.7	14.22	2		
9/13/2016	11:29:20	Bubbler	0.47	8.53	9.5	13.8	14.21	3		
9/13/2016	11:44:20	Bubbler	0.4697	7.35	8.33	13.7	14.22	4		
9/13/2016	11:59:20	Bubbler	0.4694	7.61	8.58	13.7	14.22	5		
9/13/2016	12:00:00	Hydrolab	321	0.03	22	44	7.45	75	22	23
9/13/2016	12:14:20	Bubbler	0.4693	7.69	8.67	13.7	14.21	6		
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9/13/2016	12:44:20	Bubbler	0.4692	7.83	8.8	13.8	14.22	8		
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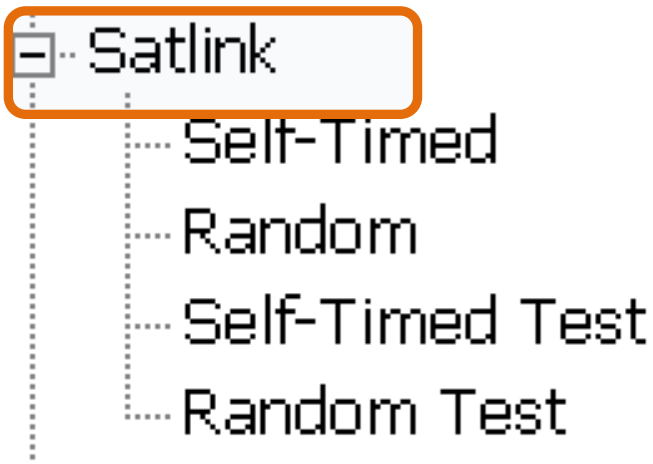
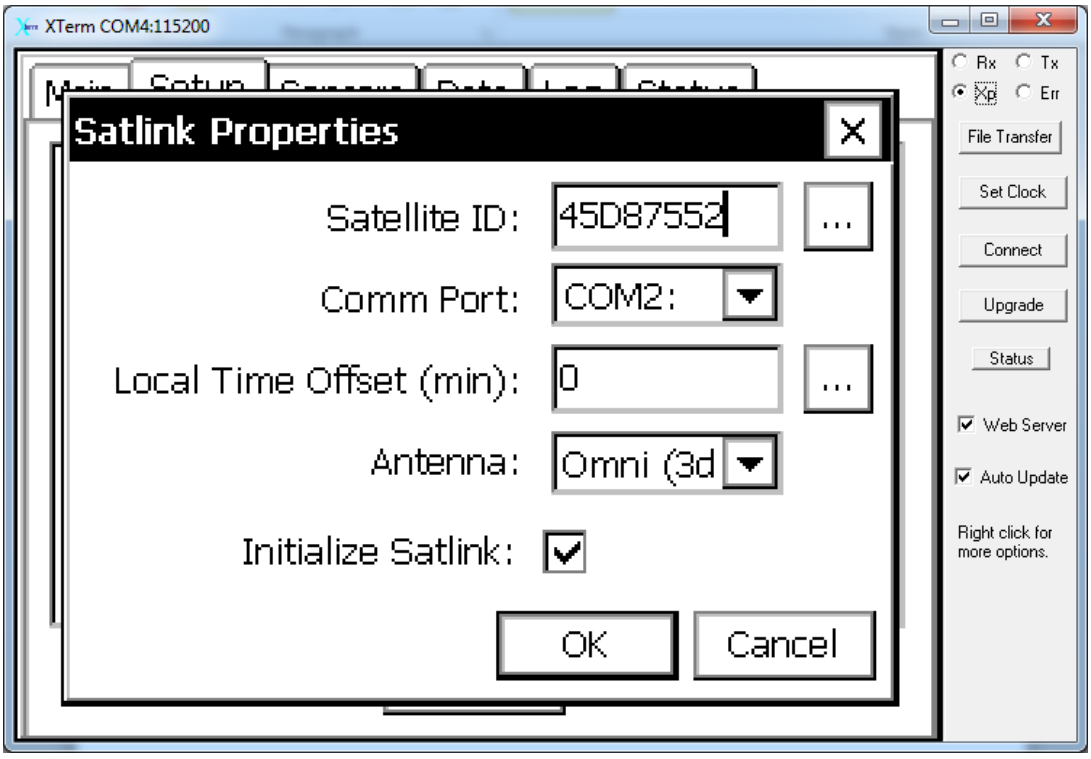
9/13/2016	13:00:00	Hydrolab	241	0.05	22	44	7.45	75	22	23
9/13/2016	13:14:20	Bubbler	0.4686	7.84	8.81	13.8	14.21	10		
9/13/2016	13:29:20	Bubbler	0.4686	8.67	9.64	13.8	14.22	11		

Xterm Satlink GOES Set-Up tab (view and change Satlink GOES settings)

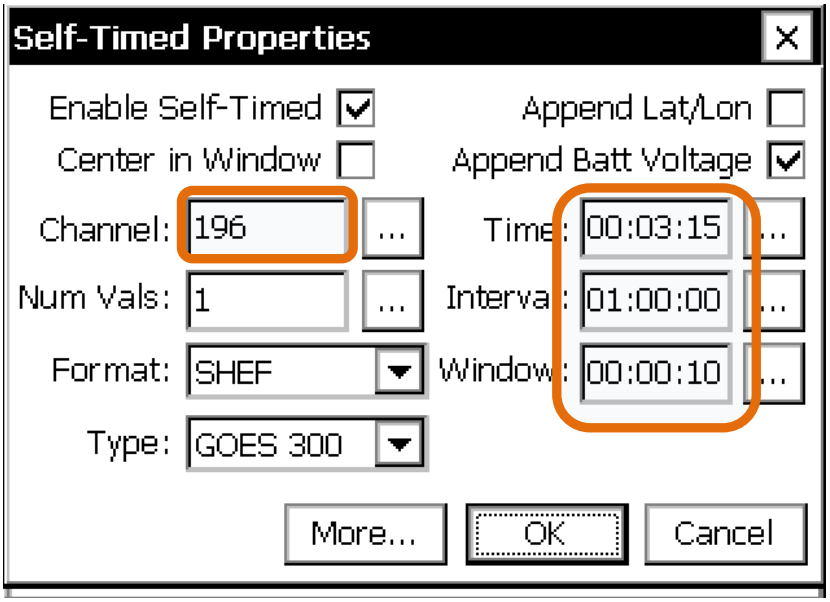


Change Satlink ID and Local time offset from GMT Time if required

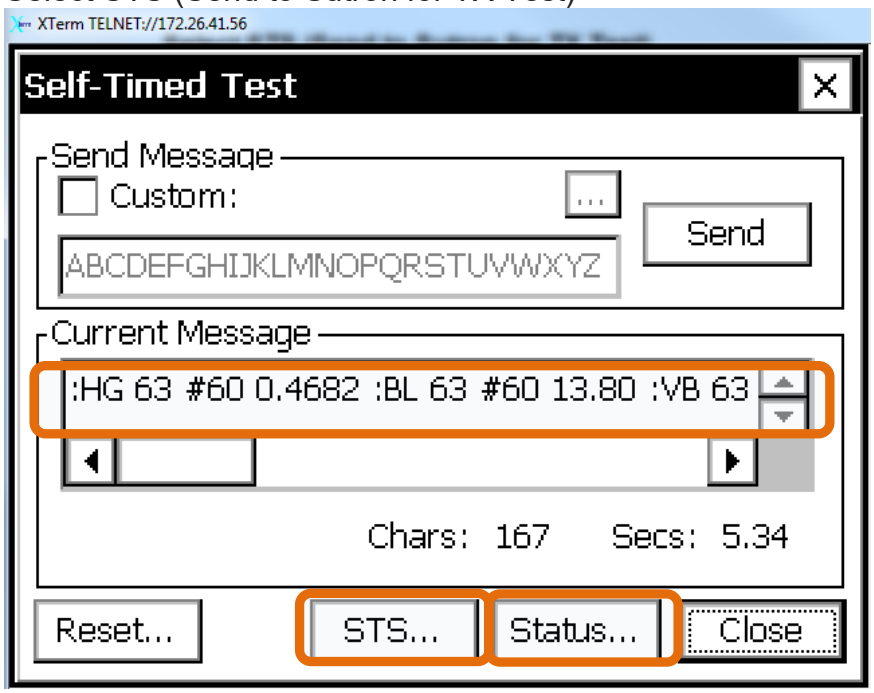
Select Antenna Type which Effects Satlink TX Power



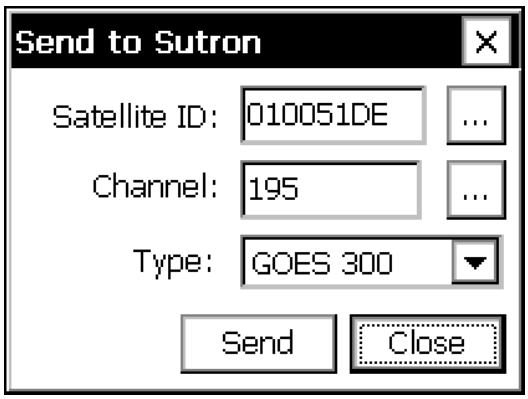
Change Satlink Channel and Tx Time, Data Format as provided by NOAA



Satlink Status and View Data Message, Estimated TX Time
Select STS (Send to Sutron for TX Test)



STS Send to Sutron Test (after test view successful Tx message at :
http://sutronwin.com/dcpmon/



DCP Monitor for Online GOES Data Verification

DCP Message Status

UTC: Wed Sep 09 20:50:08 2015

195 for 09 September 2015

DCP address	DCP name	Agency	First xmit time	Failure codes by hour of transmission 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Channel 195																											
)10051DE	010051DE	SUTRON	00:00:00	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_			
)104C186	0104C186	CAMSCI	00:00:00	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_			
)1056384	01056384	SUTRON	00:00:00	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_				
)105E590	0105E590	KAYMET	00:00:00	_	_X	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_				
:2345678	12345678		00:00:00													_I	_I	_I	_I	_I	_I	_I	_I	_I			
:7EC5780	17EC5780	USGS01	00:00:00	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_F	_	_	_	_X	_			
)0207792	90207792	SEIMAC	00:00:00																_	_	_	_	_				

010051DE - 09/09/2015 20:50:14 UTC

HERNDON,VA, No Matching TransportMedium for Channel 195

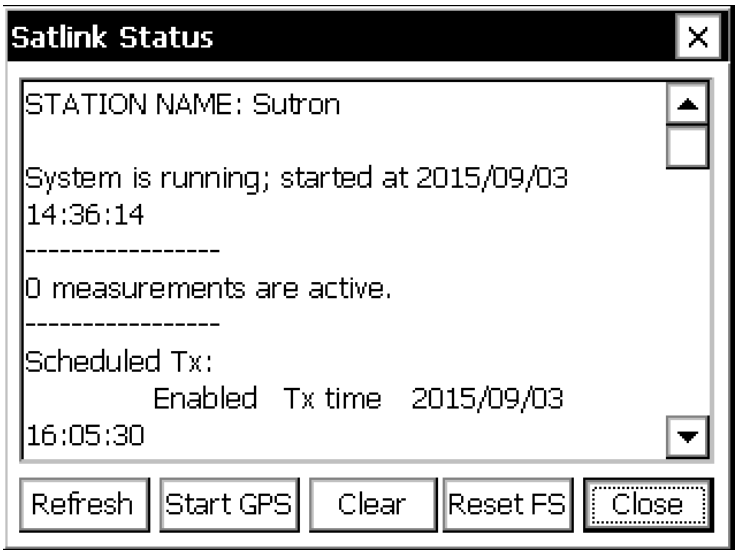
lessage Parameters:

DCP Address: 010051DE	Message Quality: Good
Signal Strength: 47 dBM	Frequency Offset: 0 (0 Hz)
GOES Channel: 195E	Message Length: 227
DRGS code: XE	DRGS Description:
Carrier Start (UTC): 20:50:13.272	Carrier Stop (UTC): 20:50:20.86
Additional Flags: (none)	

aw Data:

```
010051DE152522050l4G47+0NN195EXE00227":Battery 0 #1 13.2 :Excitation 0 #1 4.999 :Ground 0 #1 0.001 :Reference 0 #1 5.001 :Battery 0 13.2 :BL 12.81 N38o59'48.70"W77o25'24.68":NAME RMA-0077
```

Self timed Test (Status) Check Satlink Status, look for GPS Synch, TX Messages, Errors

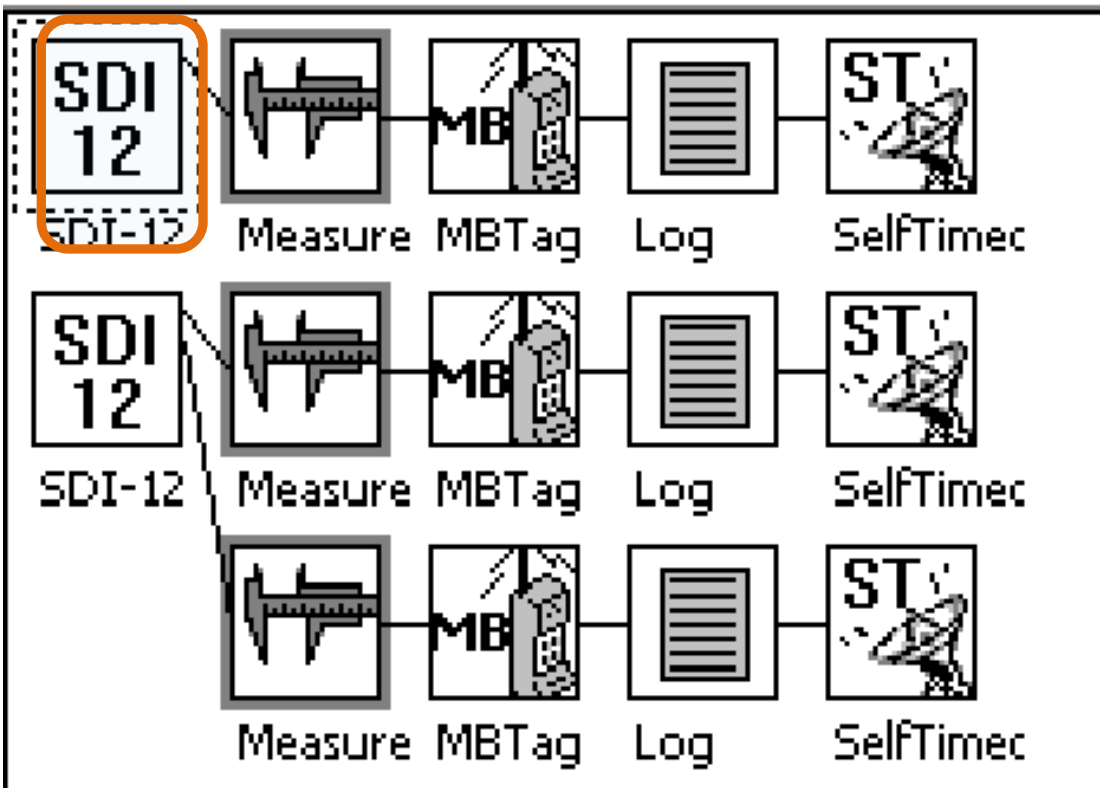


HOSKIN SCIENTIFIC

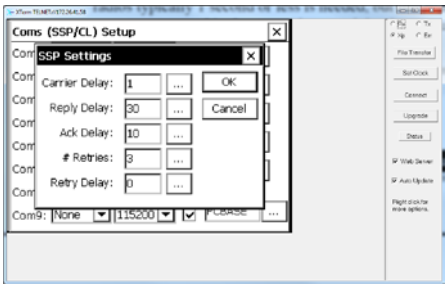
Xterm Graphical Set-up

Xterm is a software utility for programming the Sutron 9210 datalogger. It is also required for viewing real time statrus information and for downloaded the internal memory from the 9210. The PC/Laptop is connected to the 9210 using a serial connection. Typically this is accomplished using a USB to Serial converter.

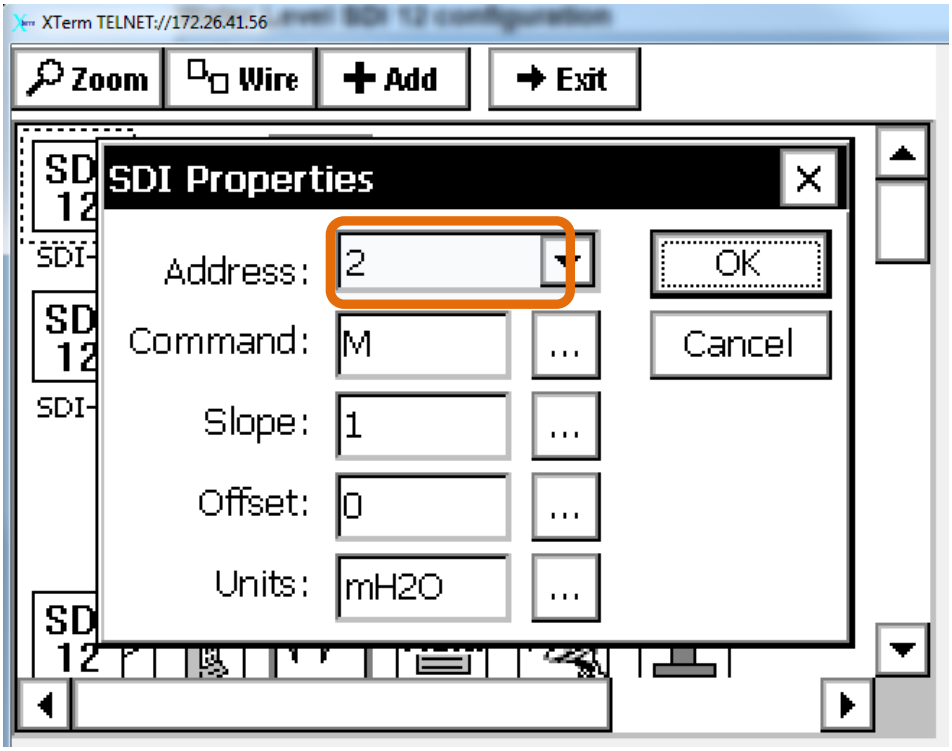
Bubbler Configuration



SSP Settings

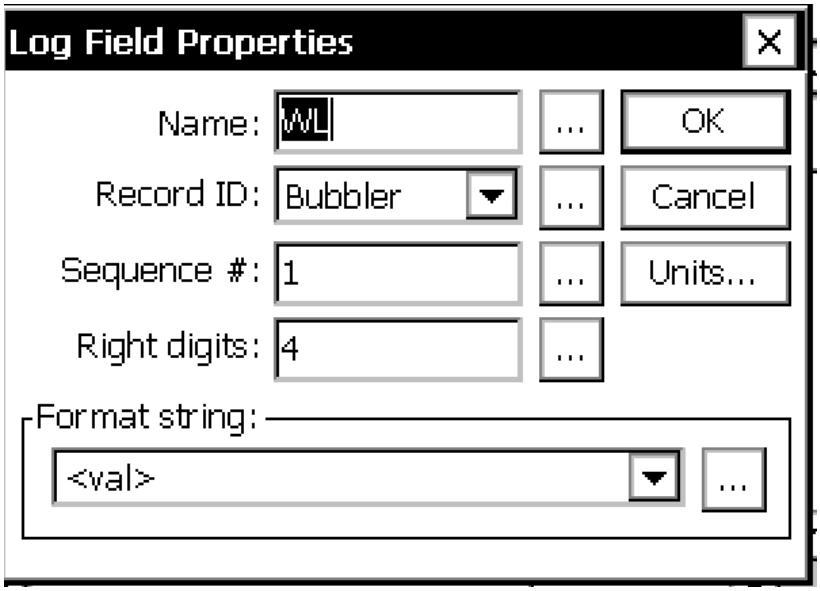


Water Level SDI 12 configuration



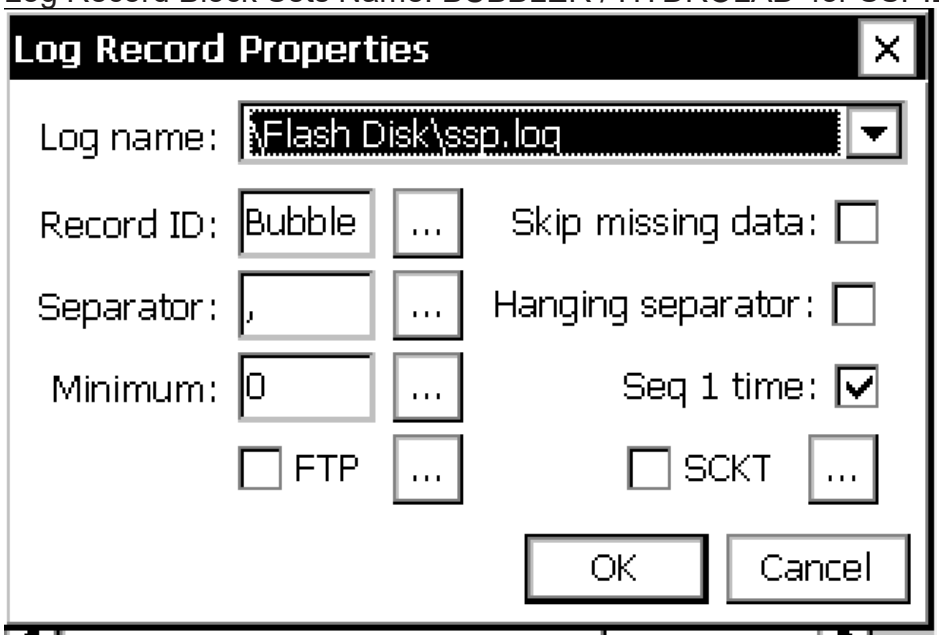
Water Level, 15 Minute Logging Interval, Data String Sequence #1

Log Field Setting Data Sequence for Text file Data String

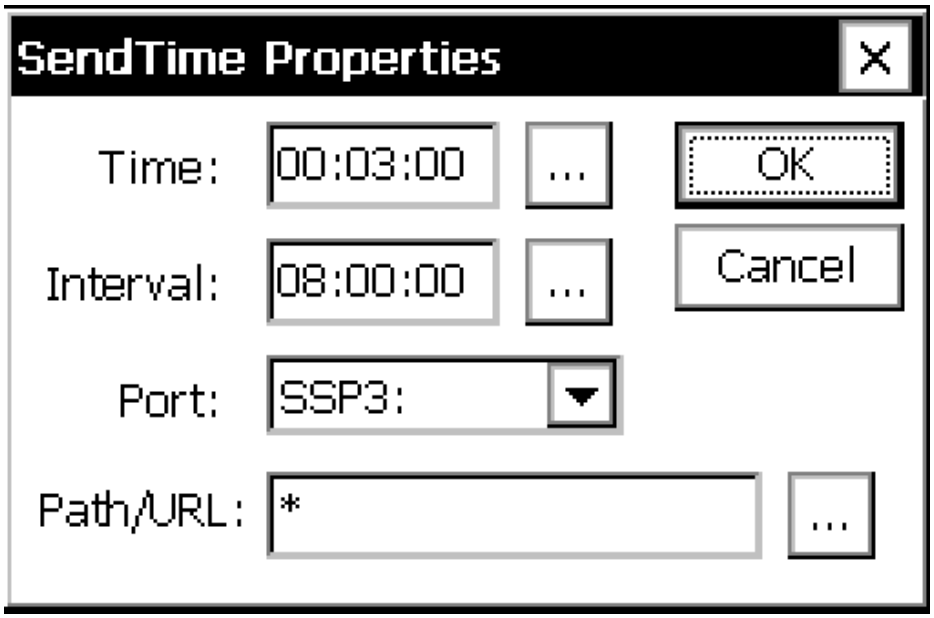


HOSKIN SCIENTIFIC

Log Record Block Sets Name: BUBBLER / HYDROLAB for SSP.LOG



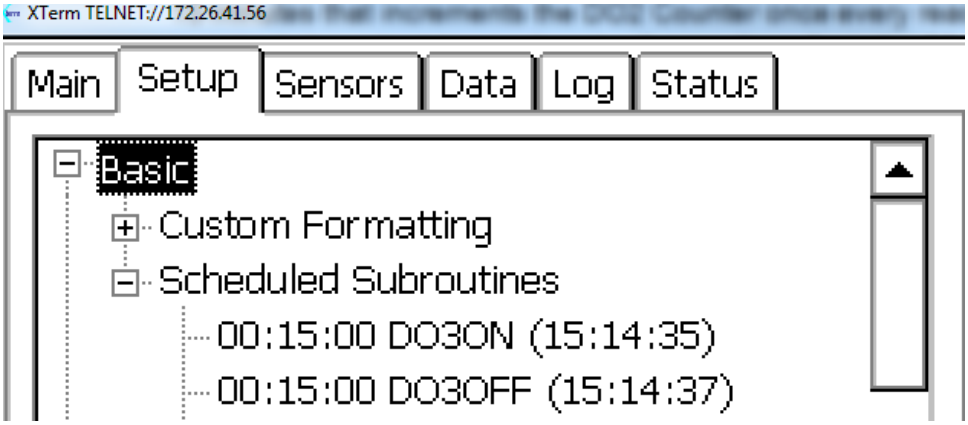
Send Time Block **(the remote 9210 logger will send a GPS synchronized time every 8 hours to the master 9210 station using SSP protocol)**



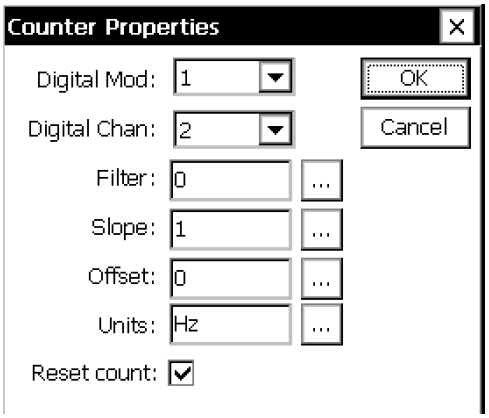
Watch Dog Counter

The remote station has a Basic programming running that increments the DO2 counter every reading. This watchdog counter is important to be able to synchronize the readings from the 9210 master and slave log files. It is also important to ensure that every log record has properly updated. That is each reading should increment by a count of one so if the counter reading at the master station stays frozen or jumps by more than one this indicates that the logging and wireless transmissions are not working properly. The SCADA system at the plant should be setup to monitor the counter input to alarm for communication and logging problems.

Scheduled Basic Program to increment watch dog counter every reading



Digital Counter Properties

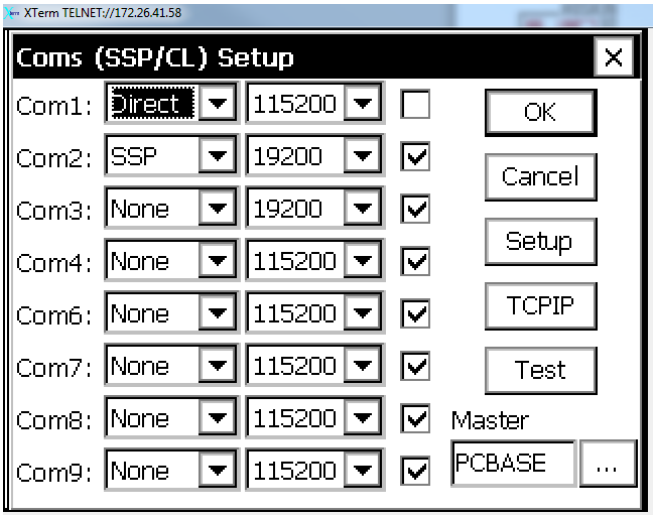


HOSKIN SCIENTIFIC

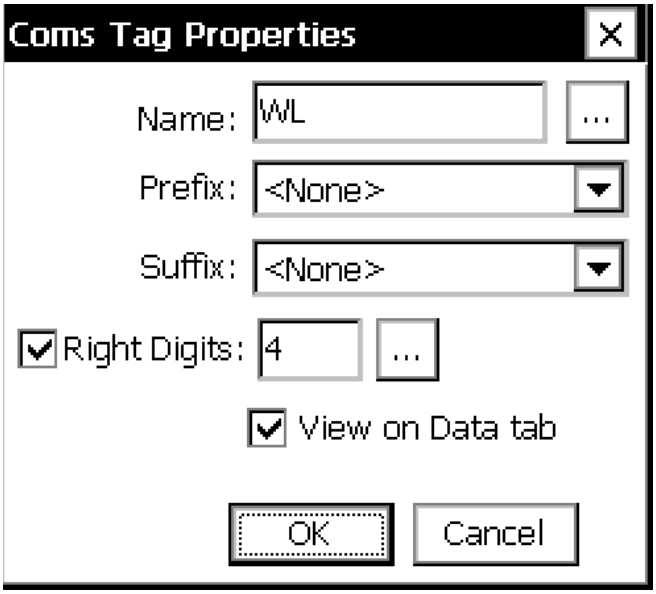
Master Station Polling

The Master 9210 station is programmed to poll the remote 9210 stave station using the radio modem and Sutron SSP protocol. Each sensor reading that needs to be logged and monitored at the remote site has an associated COMS TAG. The Master 9210 station then uses a GETTAG command to get the latest readings from the Slave station.

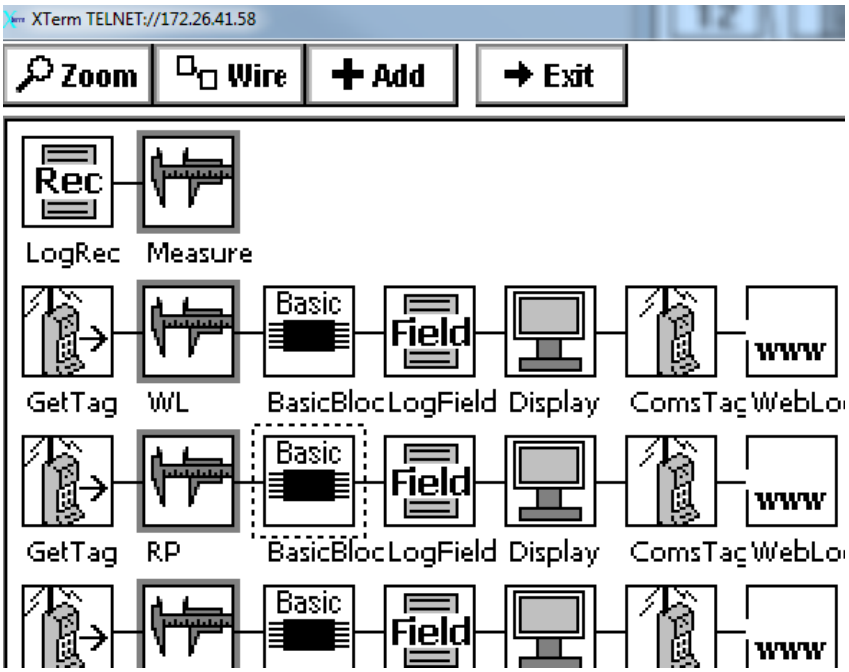
Master COM Port Settings Showing Radio Modem SSP Protocol on COM 2



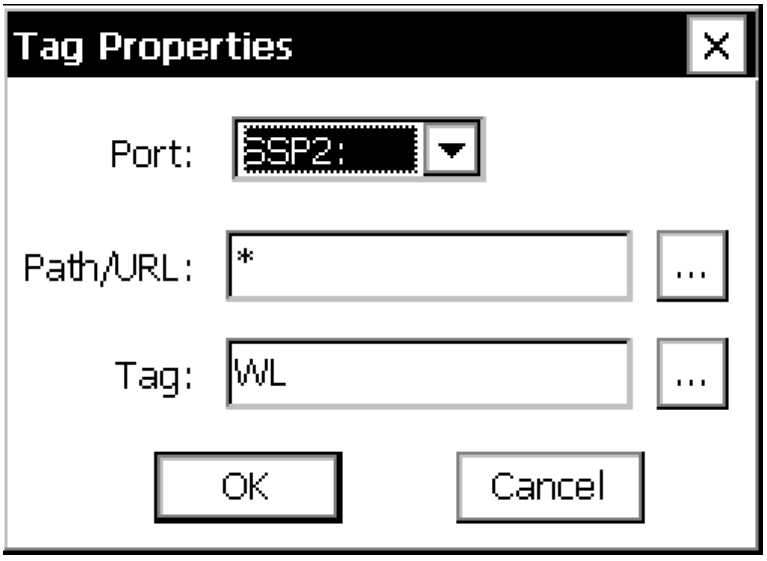
Remote site COMS Tag Properties for Water Level



Master Station Xterm Graphical Setup Showing GetTag Blocks

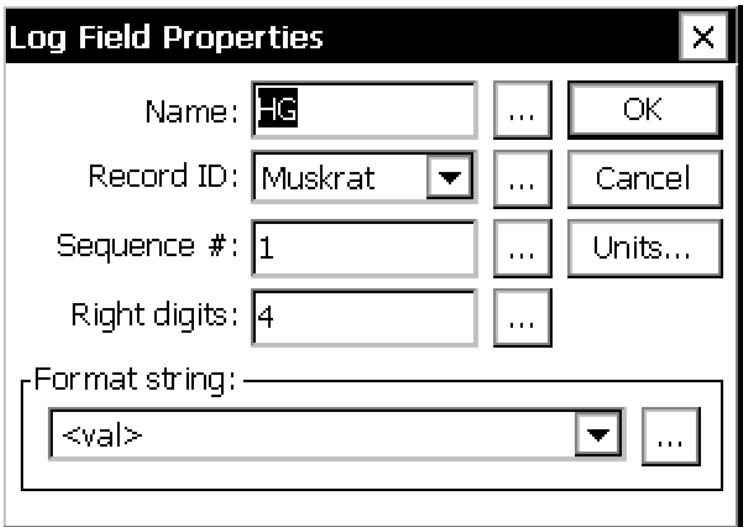


GetTag Block for Water Level



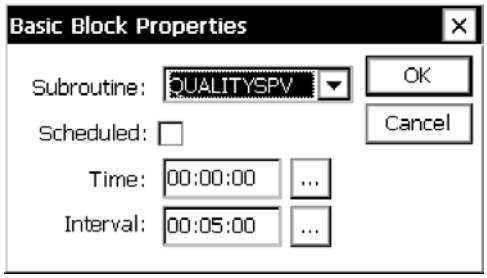
HOSKIN SCIENTIFIC

Log Field Block Used to assemble the data strings at the Master Station

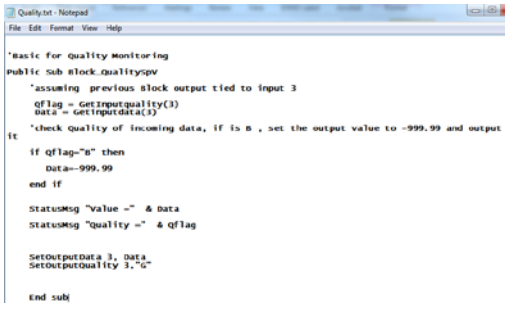


Basic Sensor Block to used to determine data quality

If communications fails between Master and Remote site the data quality is tagged as B. QualitySPV sets the B bad data point to -999.99



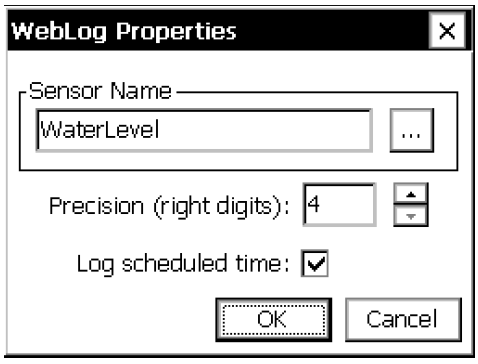
QualitySPV BAS File



```
'Basic for Quality Monitoring
Public Sub Block_QualitySpv
    'assuming  previous block output tied to input 3
     Qflag = GetInputquality(3)
     Data = GetInputdata(3)
    'check Quality of incoming data, if is B , set the output value to -999.99 and output
it
    if Qflag="B" then
       Data=-999.99
    end if

    StatusMsg "Value =" & Data
    StatusMsg "Quality =" & Qflag


    SetOutputData 3, Data
    SetOutputQuality 3,"G"


    End sub
```

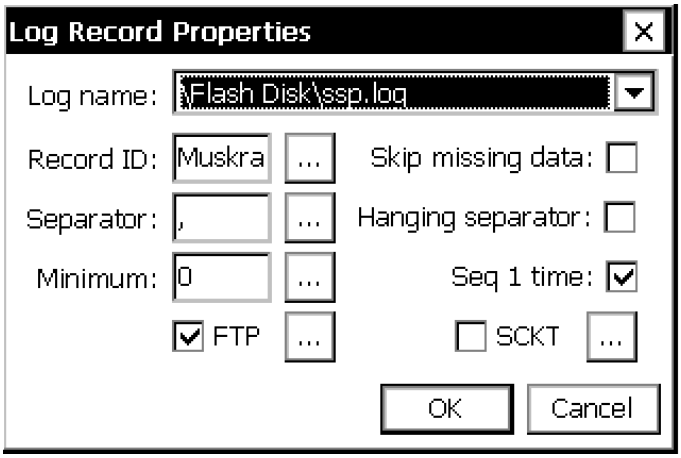
Web Log Properties for Water Level

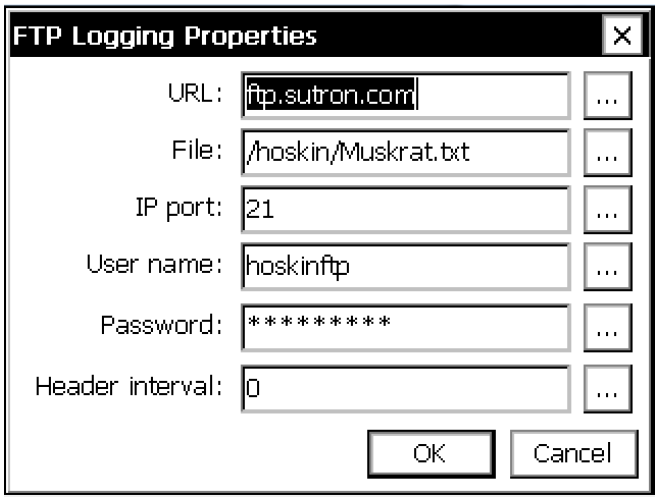
The latest sensor readings can be viewed on the 9210 web page. From the browser type in the IP address of the 9210 on the LAN and the web page will come up showing the latest readings



Master Log Record Block and FTP to SutronWin

The log record block is used to assemble the Master data string in the SSP Log. This block has a FTP option that will send the data to a FTP site. The data is sent to SutronWin web site after each logging interval. FTP credentials are entered in the FTP logging properties block



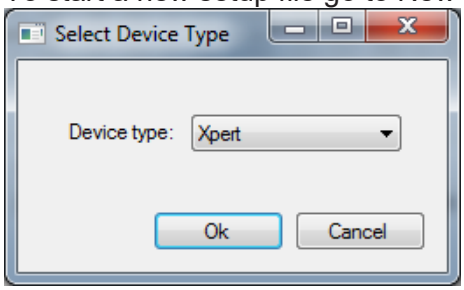


HOSKIN SCIENTIFIC

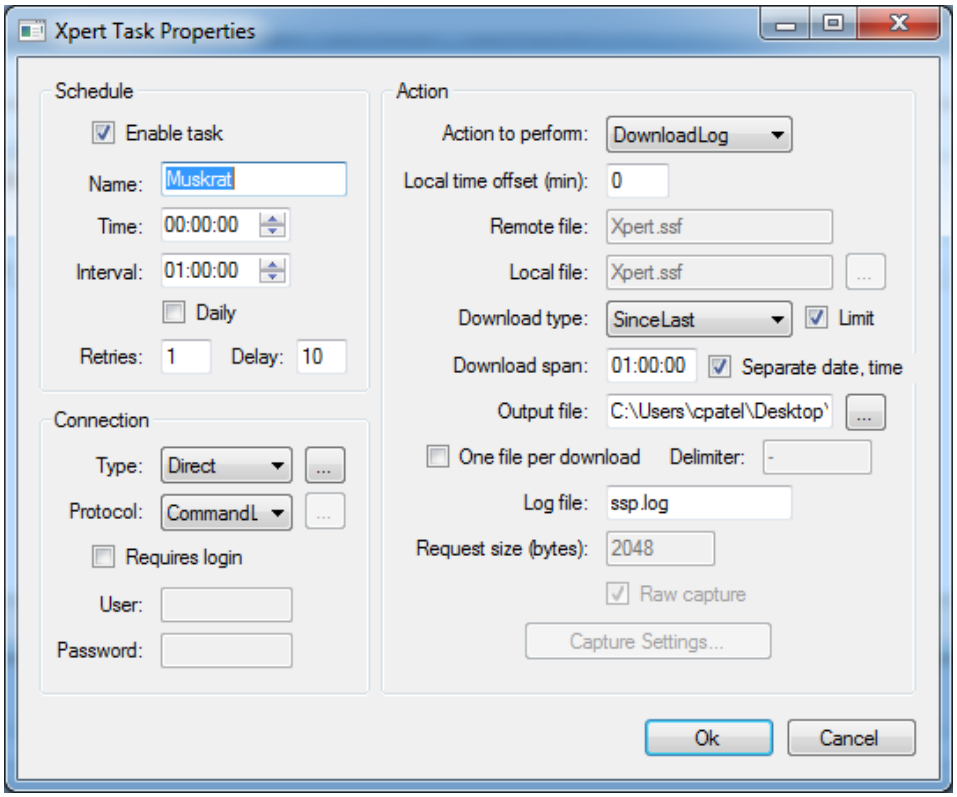
Autopoll Configuration

Using Autopoll to Automatically Download Data from 9210 logger using Serial or Ethernet Connection

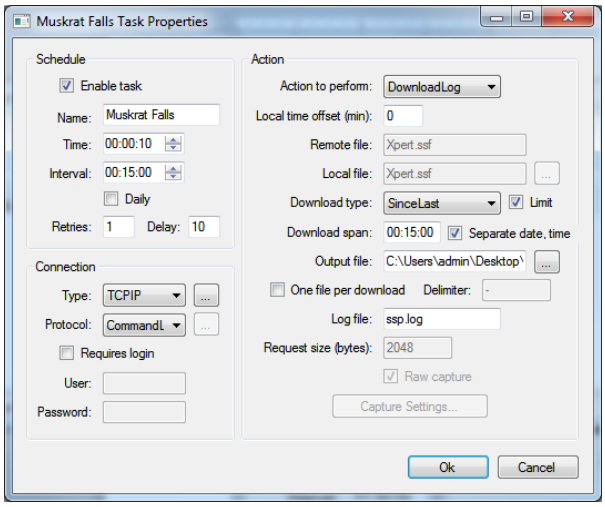
Download the Autopoll software from Sutron (http://www.sutron.com/products/autopoll_software.htm). Note this software does require a license that can be obtained from Sutron)
To start a new setup file go to New Setup. Go to Task and select 'NEW'

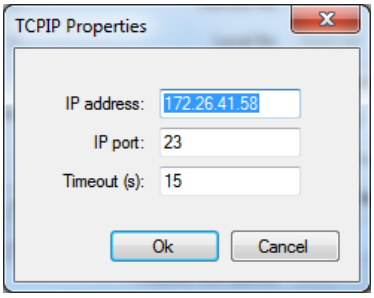


Choose 'Xpert' as device type from the drop down menu. Hit Okay.



Change the Name of the Schedule to reflect the Station name of the 9210 logger. To set up a New a schedule you can enable the task to draw the information from 9210logger at a set time interval.

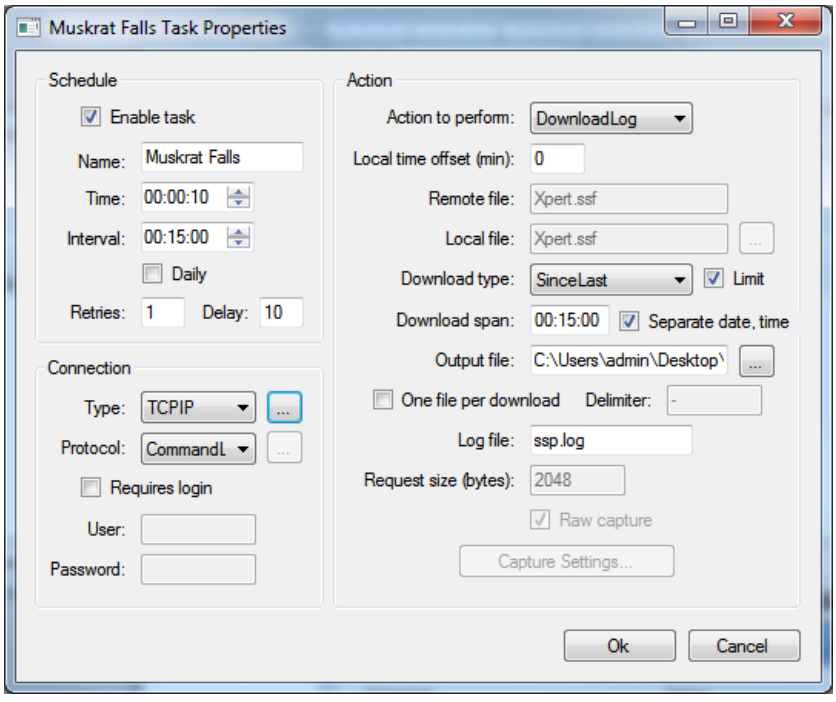




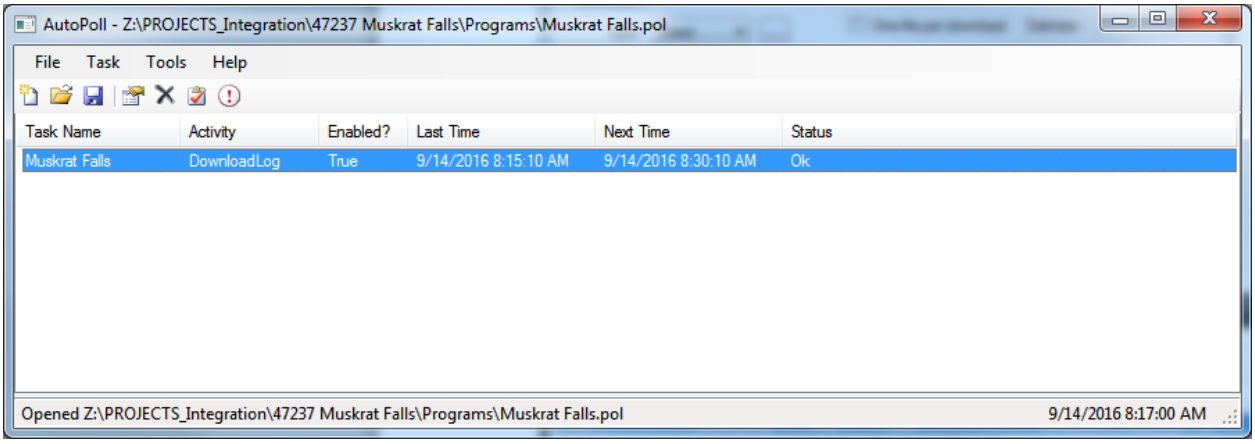
Enter the IP address of the Master 9210 datalogger in TCPIP Properties

Choose which action is required; Download Log will enable Autopoll to remotely download the data from the 9210 logger.

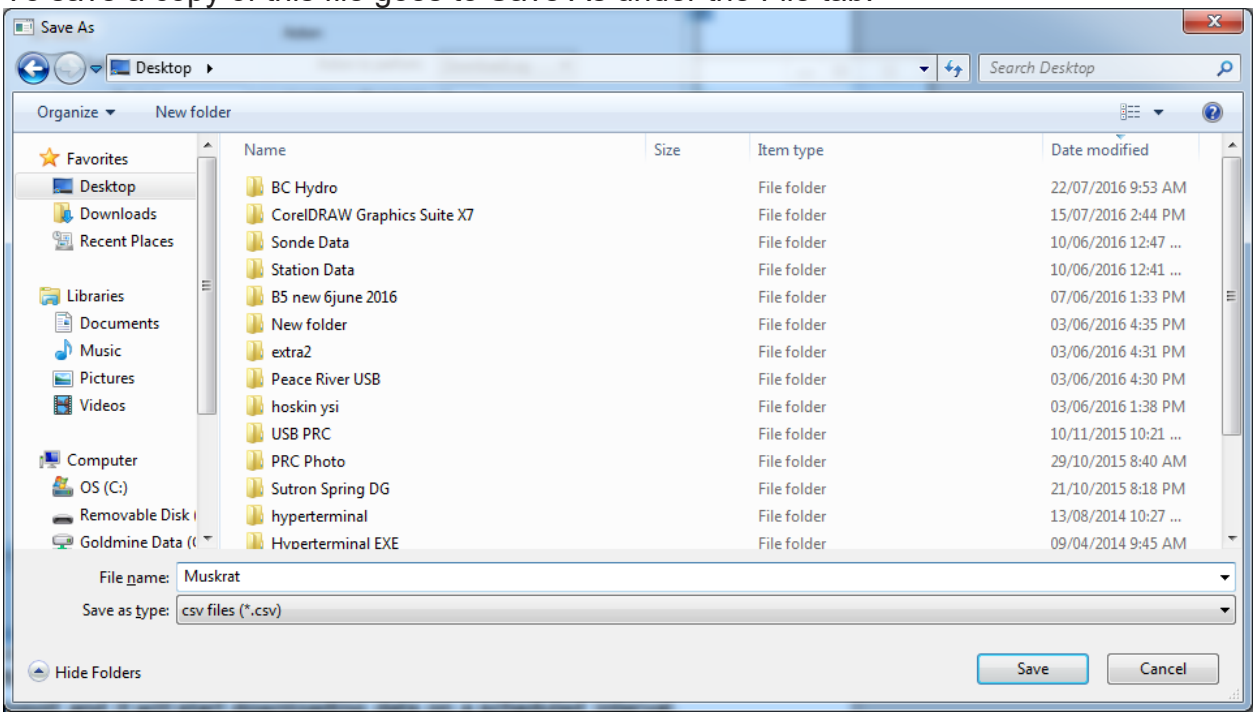
Set downloading interval to 15 minutes and the path for the CSV file



Set where the data files will be sent by hitting the "…" button on by the Output file. Once properties for the new schedule have been set hit the Ok button.



To save a copy of this file goes to Save As under the File tab.



Repeat steps until all systems are setup on Autopoll.

(Note: All Autopoll Pol files for this project are provided in USB drive (Pre Programed). Just load that POL file in Autopoll and then input the IP address of the Master 9210 datalogger and the path to store the CSV file. Autopoll will automatically start downloading data on the scheduled interval.

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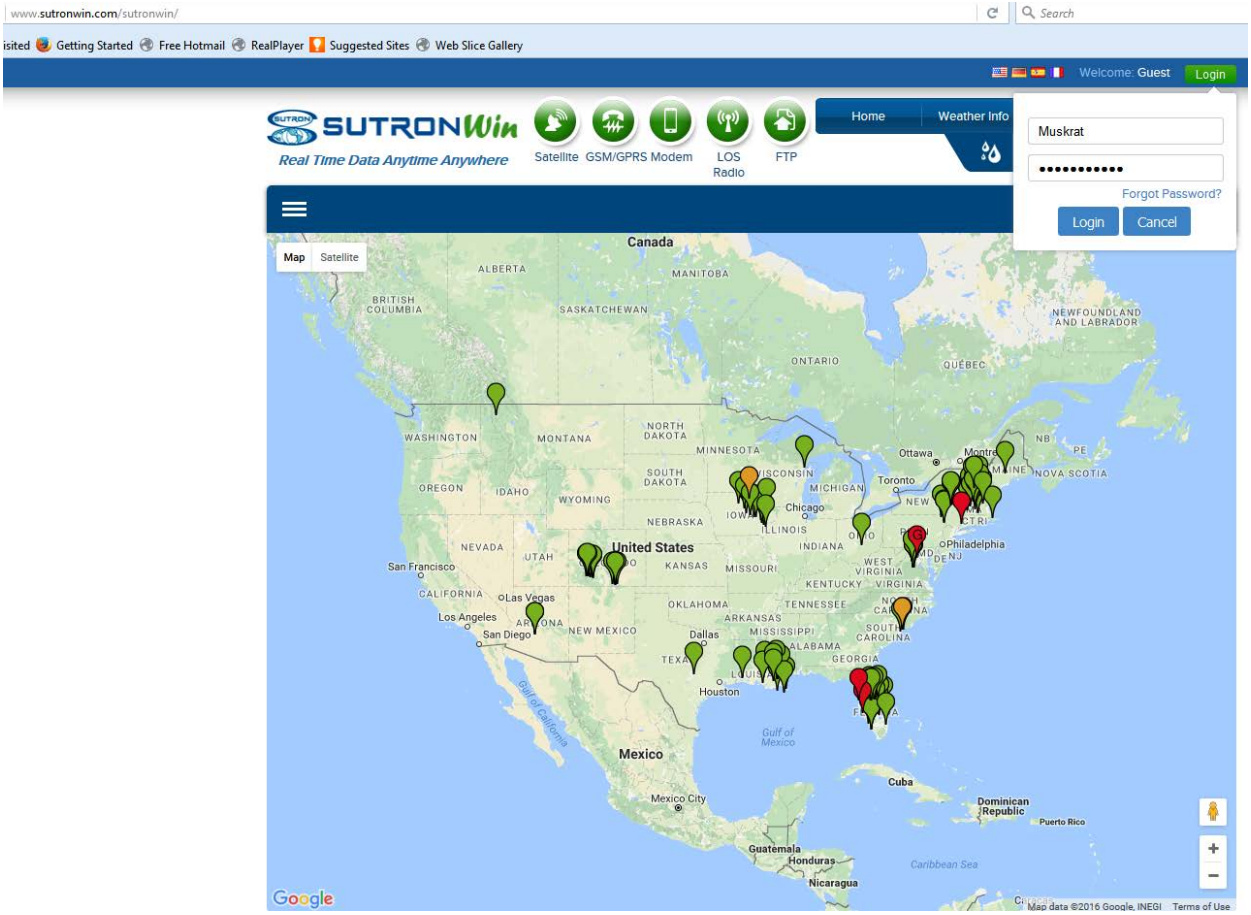
SutronWin Web Hosting

The 9210 datalogger connected to the plant LAN with Internet is programmed to FTP the data to SutronWIN for web hosting after each logging interval. SutronWin is a powerful web hosting and data management system which provides graphs, alarms and data downloading.

Web Site: www.sutronwin.com
Enter the username and password for Muskrat Falls as listed below:



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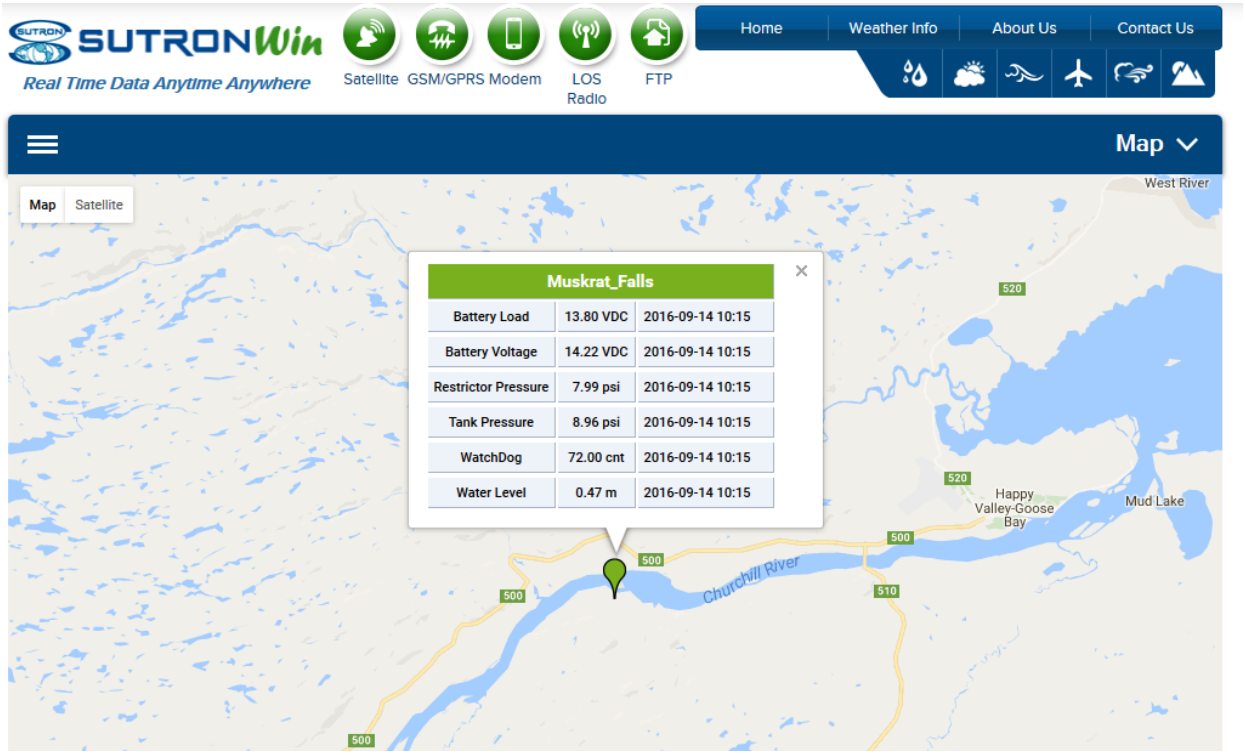
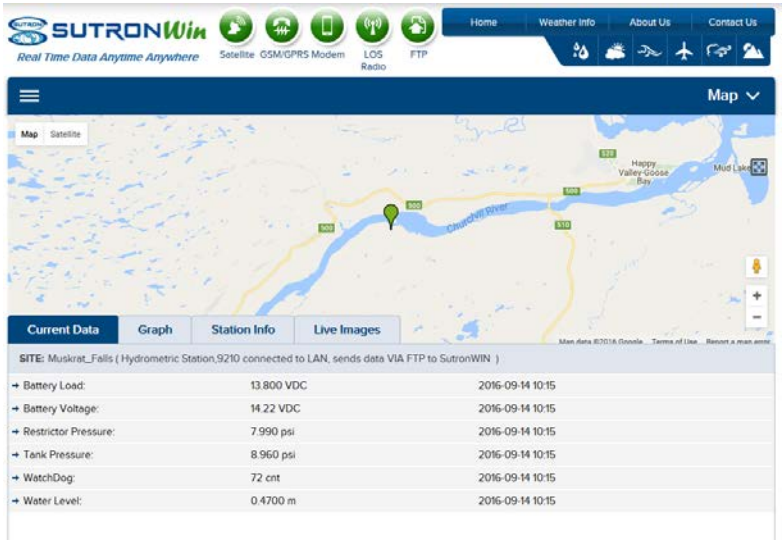
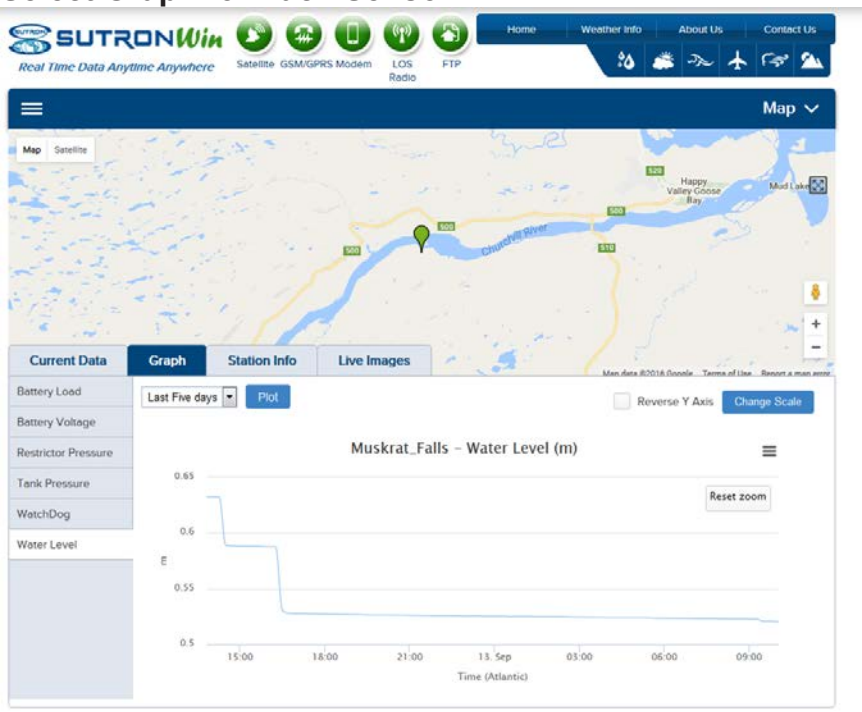
SutronWin Map Base Screen for Muskrat Falls showing Dash Board



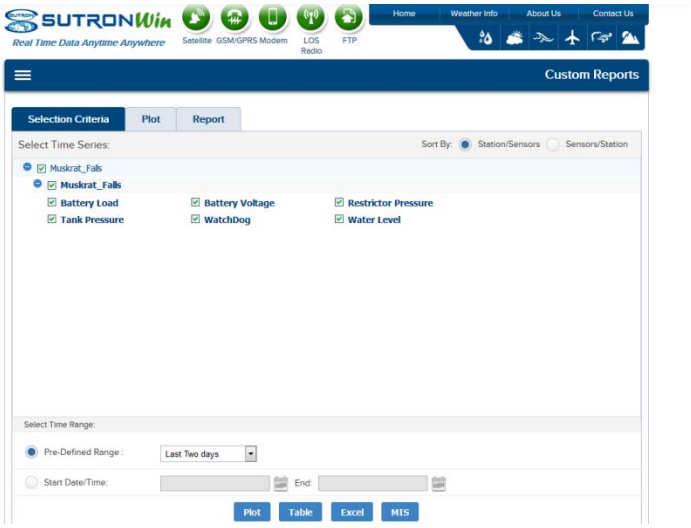
Select the Map Icon

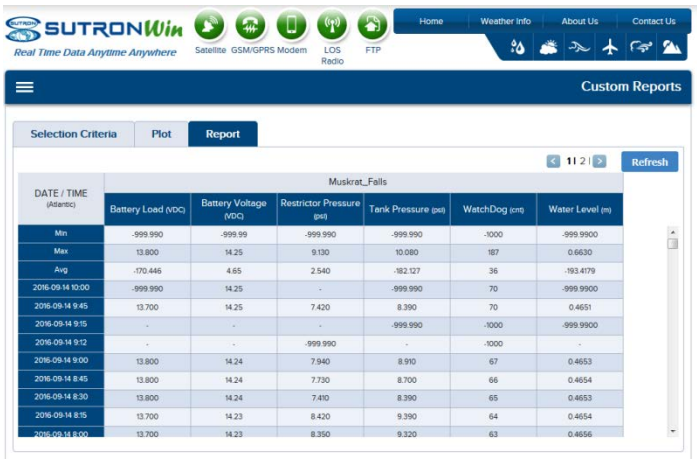


Select Graph for Each Sensor



Select Custom Report for View Time Series Data in Graph, Table, Excel Format

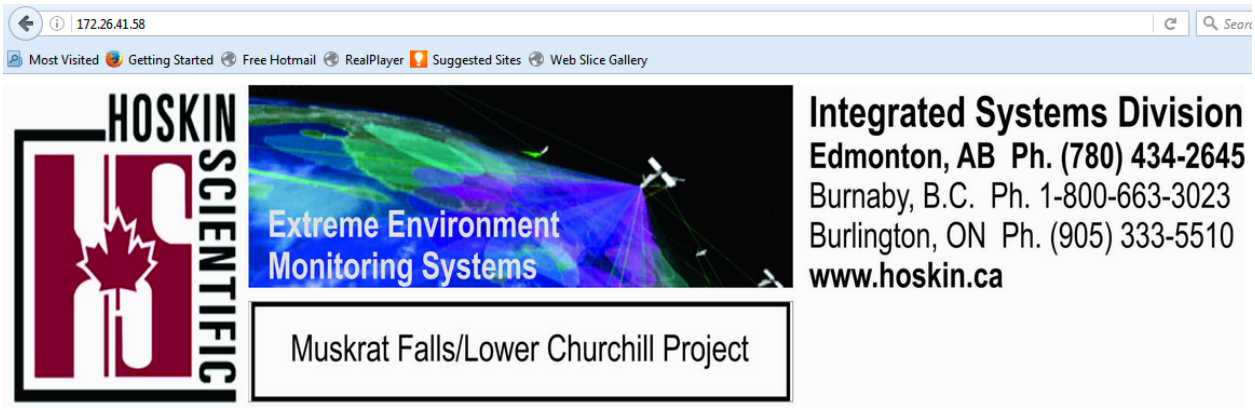




HOSKIN SCIENTIFIC

Master 9210 Web Page

To view the current data from the 9210 Master Station from a web browser enter the IP address of the 9210.



Data acquired at 09-14-2016 10:40:18 from MuskratMaster

WebLog	Sensor ID	Time	Date	Quality	Data
WaterLevel	WaterLevel	10:30:00	09/14/2016	BAD	0.4651 M
RestrictPressure	RestricPressure	10:30:00	09/14/2016	BAD	8.090 PSI
TankPressure	TankPressure	10:30:00	09/14/2016	BAD	9.062 PSI
BatteryLoad	BatteryLoad	10:30:00	09/14/2016	BAD	13.800 V
BatteryVolt	BatteryVolt	10:30:00	09/14/2016	BAD	14.231 V
WatchDog	WatchDog	10:30:00	09/14/2016	BAD	73 CNT

Hoskin Scientific Ltd.

Hoskin Scientific Ltd ◆ Unit 100, 18138 105 Avenue ◆ Edmonton, Alberta ◆ T5S2T4 ◆ Tel #780 434 2645 ◆ Fax #(XXX)XXX-XXXX ◆ Customer Support

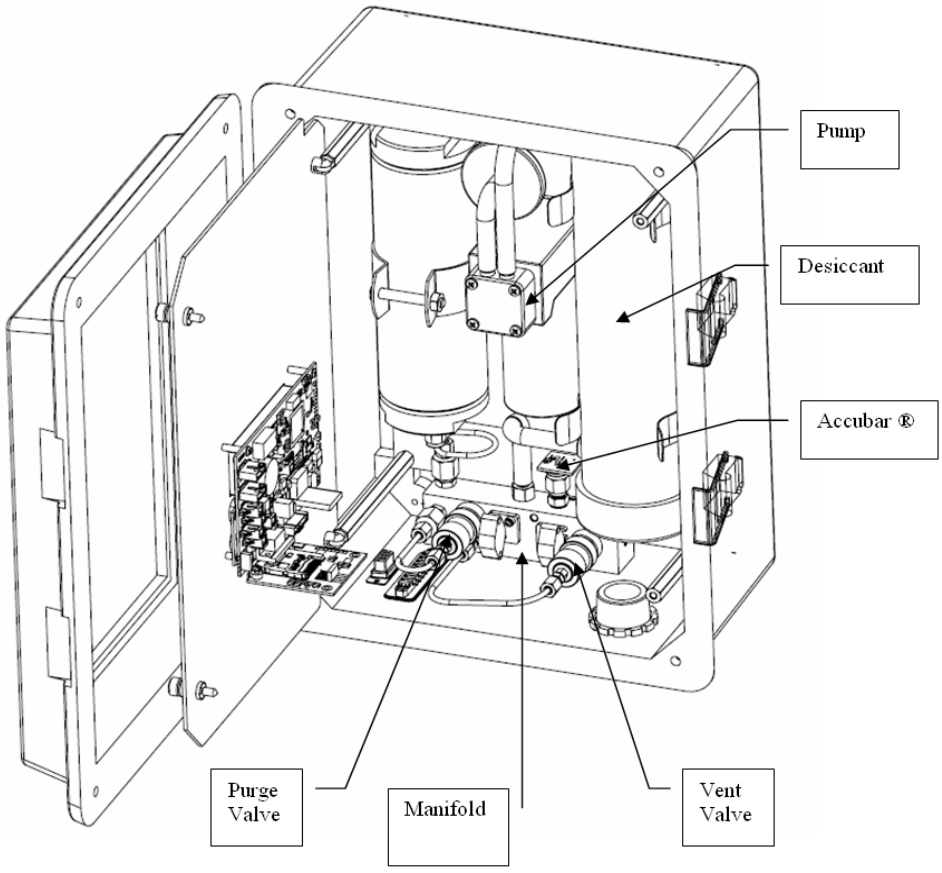
Bubbler System Components

Sutron Accubar Compact Constant Flow Bubbler

Layout: the diagram shows the sub-systems within the bubbler. It has its own controller and is capable of semi-autonomous operation.

Air is drawn through the desiccant from the space within enclosure. Pre-drying the air assures no moisture of frost buildup that might adversely affect operation of the device. The blue indicator dye in the desiccant will turn pink as it saturates. Replace the desiccant before the color changes completely.

A sensor on the output side of the pump measures the back-pressure required for air to exit from the bottom of the orifice tube. Measurements require only a brief burst of air. Periodic long bursts for purging obstructions from the orifice outlet can be scheduled by frequency and duration



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Sutron Single Orifice Constant Flow Bubbler

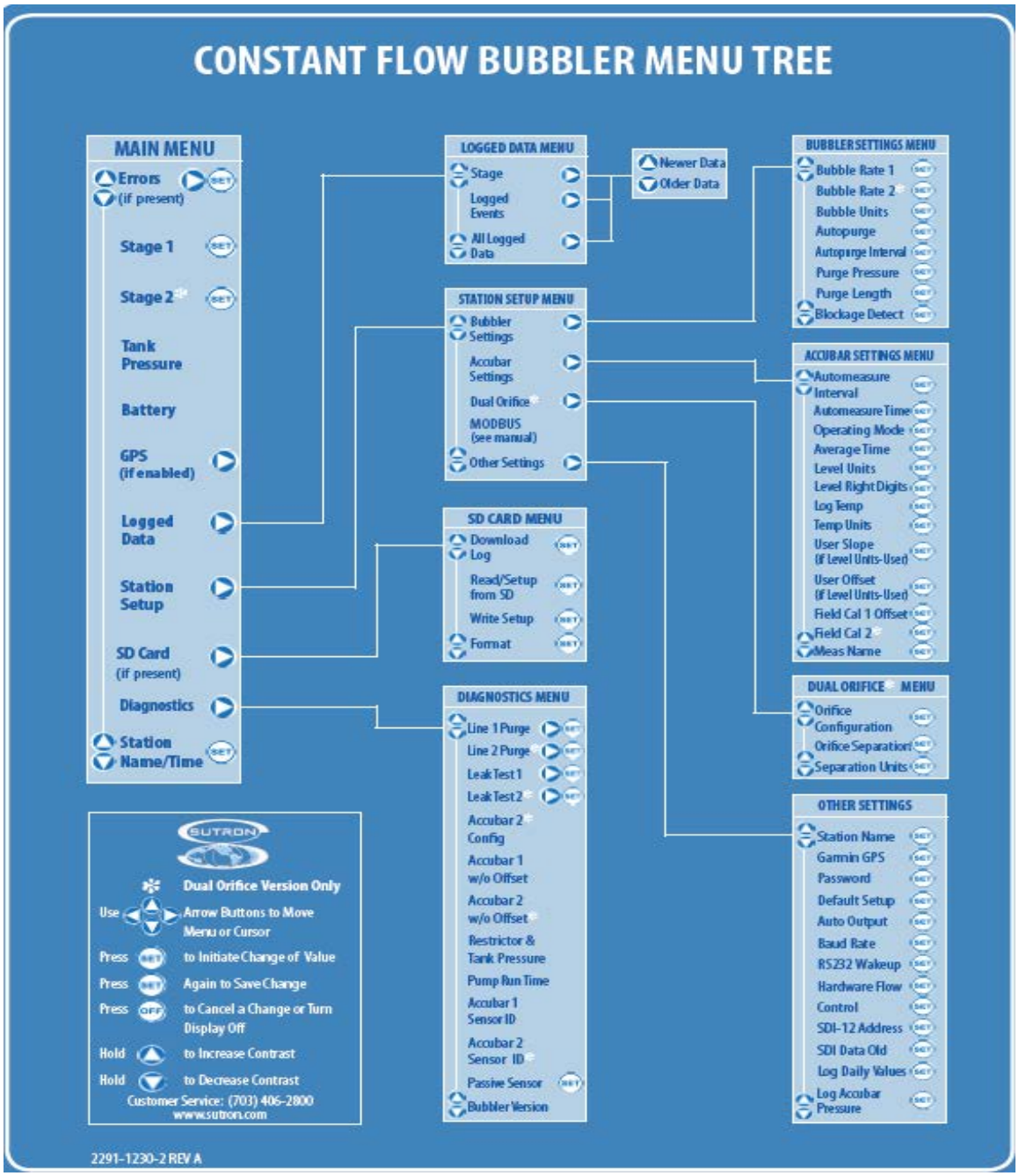
Layout (cont.): the photo shows details of the front panel and internal components. Note the electronics mounted of the back of the swing out panel. All mechanical and pneumatic parts are mounted within the space of the enclosure.

Refer to the full manual for more complete information concerning operation and maintenance schedules.

HOSKIN SCIENTIFIC

Sutron Single Orifice Constant Flow Bubbler Menu Tree

Setup Menu: This is the set up menu map to be followed for keyboard input of bubbler operating parameters: Hoskin Scientific Ltd. System Integration Division sets the unit according the scope of work before shipment to the client.



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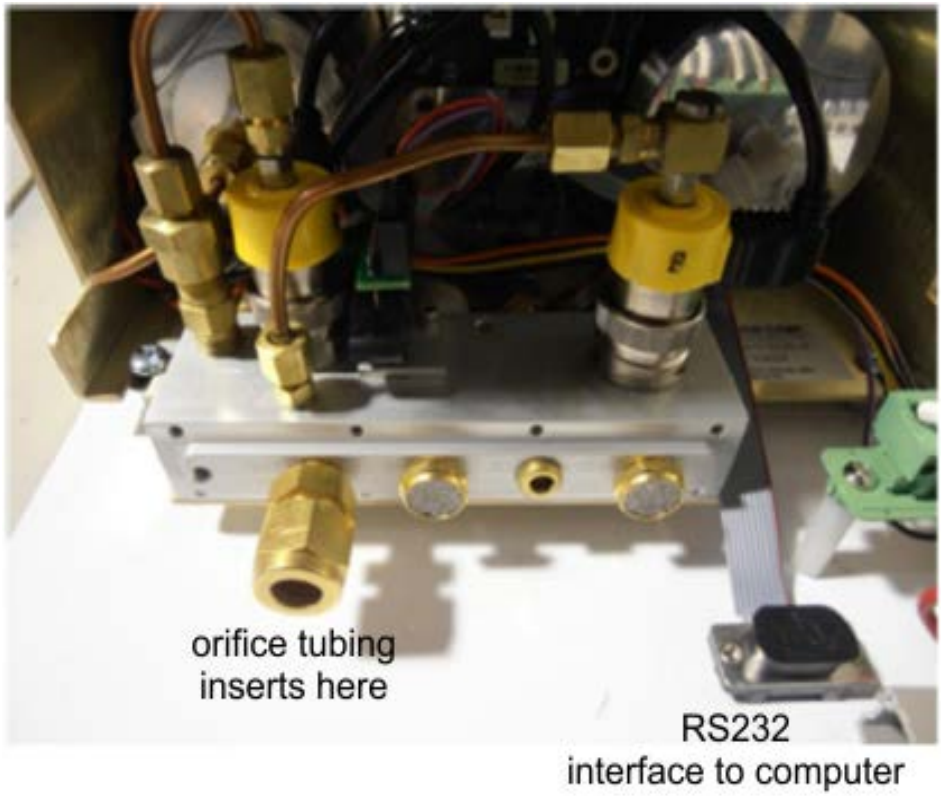
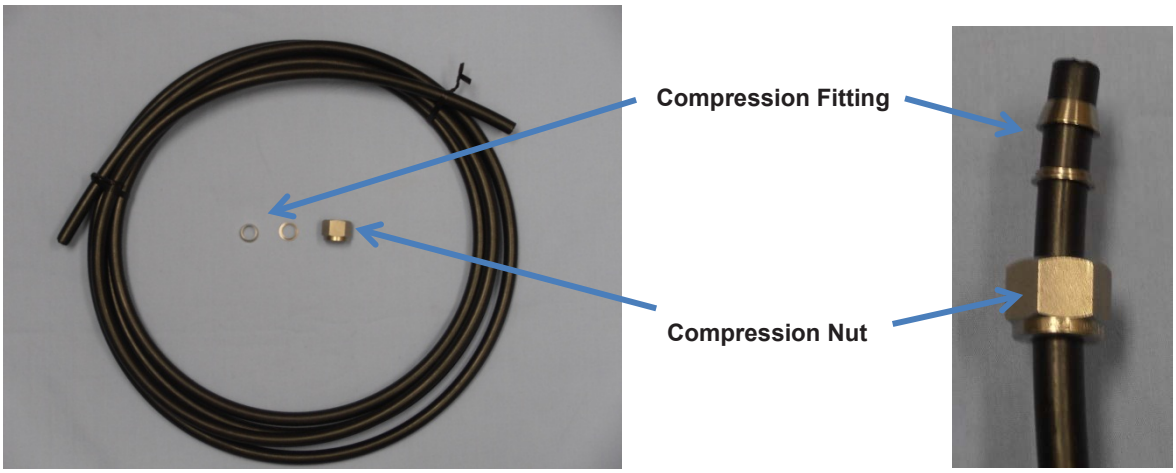
Bubbler Orifice Connector and Air Intake Valve



The Orifice Line connects as shown in picture to the left. Pass the orifice line through enclosure strain relief gland.



Insert compression fitting and compression nut as shown in picture above and tighten the nut on bubbler orifice tubing fitting.

Sutron Single Orifice Constant Flow Bubbler Log

The Bubbler datalog is capable of holding more than 300,000 readings, and allows the recording of status and water level data. The Bubbler has an SDI-12 interface as well as RS232/RS485 so it can provide data to data loggers or other communication equipment.

Starting the Bubbler

The Bubbler starts operating as soon as power is applied. The display will turn on. If an Accubar is installed, the measurement will commence and the front panel will be updated with a water level reading. While the bubbler is operating, the status LED will flash occasionally to let you know that the bubbler is operational.

Green LED flashes every five seconds to indicate the Bubbler is operating normally
Red LED flashes if the Bubbler has encountered a problem

Check for Leaks

Leaks inside the Bubbler can be a source of inaccuracy and/or excessive pumping and use of desiccant. To check for leaks, you must cap the outlet or orifice and run the built-in leak test routine. Leak test cap comes with each unit that can be used to cap the outlet for the leak test. When the leak test completes, the system will display a status indicating whether the unit has passed or failed the leak test along with a score.

Bubbler Rate

The Bubble rate is the measure of the amount of air going down the orifice line per unit of time. Bubbler supports two units for bubble rate: Bubbles per minute (BPM) and Standard Cubic Centimeters per minute (SCCM).

The Correct bubble rate is station dependent
Sites measuring a deeper water level will require a higher bubble rate.
Sites with rapidly changing water levels will require a higher bubble rate.

Auto-Purge

The Purpose of the purge is to clear the orifice line of any obstructions, such as dirt and silt. Purging turns on the pump and builds to *purge pressure* (default 50 PSI for 25PSI units/ 70PSI for 50PSI units) and then opens the restrictor bypass valve to force the pressurized air to the outlet.

The purge may be done automatically by the bubbler. It can be done periodically, whenever the Bubbler detects a blockage, and whenever initiated by the user.
The system is preconfigured with Auto purge once a day. Blockage Detection Is also enabled.

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SD Card Interface

The Bubbler supports SD card usage for downloading logged data and setup changes. An SD card is a portable media storage that is widely available on the commercial market. MMC cards may also be used with the Bubbler**.**

SD Card Log Download (2GB Max. SDHC is not supported)

To download the log using an SD card, simply plug the card in.

- If the front panel is off when the card is plugged in, an automatic log download will start in 10 seconds. The automatic download will download since last download.
- If the display is on when the card is plugged in, the download log menu will appear. Navigate the menus and choose the appropriate log download type.

There is a red LED that will light up while the SD card is in use. Please do not remove the card when it is in use.

Automatic Log Backup

If an SD card is left plugged in, the unit will perform an automatic backup of the log to the SD card. All the user needs to do is leave the SD card plugged in, and the Bubbler will periodically download the log and save it to a file on the SD card.

With an SD card left plugged in, four hours after the user stops using the display, and every four hours afterwards, the unit will download the logged data and append it to a file. Once the file exceeds about 2MB, a new file will be started. The backup will work until the SD card gets full, at which point it stops downloading.

When visiting the station for maintenance to retrieve the log, it is only necessary to remove the card that was left plugged in.

RS-232 Command Line Interface

The RS232 interface provides a simple way to connect the unit to PCs, modems and other communications devices. Microsoft Windows usually comes with a program called HyperTerminal. It can be found by going to the Windows start menu, Programs, Accessories, and Communications.

By default the RS232 interface operates at 115200 Baud, no parity, 8 data bits, 1 stop bit. Changing the baud rate can be done via the front panel: Station Setup > Other Settings, or via the command line by typing “BAUD RATE”.

If connecting to a PC, use a standard DB9 serial cable. To start command line mode, send carriage return or line feed (or both). If using HyperTerminal or a similar program, simply press ENTER. The unit will respond with a prompt >
Once in command line mode, type “HELP” to get a list of supported commands.
Please check Bubbler manual for full list of instruction.

ELPRO 905U-D Serial Radio Modem

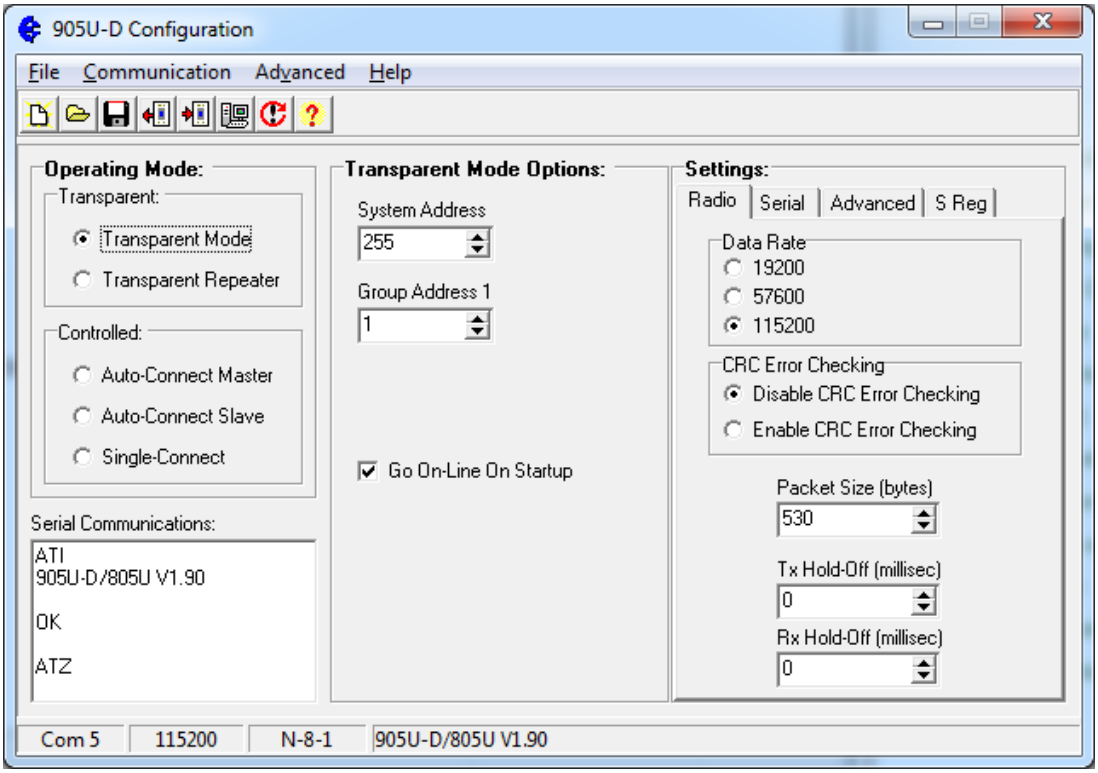
Elpro 905U-D radio modems transmit serial data over a long distance via radio. 905U-D module connects to a host device by RS-232 serial connection. The radio is licensed free at 902-928 MHz.

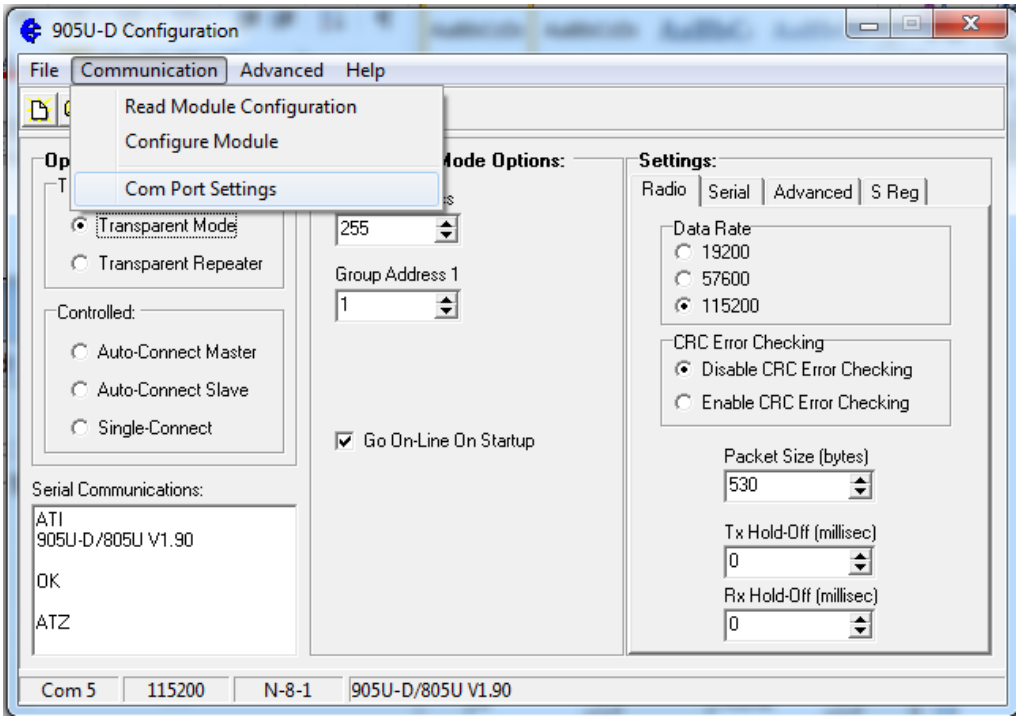
Configuration Software

Download 905U-D configuration software from EATON website or by clicking following link.
http://www.cooperindustries.com/content/dam/public/bussmann/Wireless/Resources/ConfigurationSoftware/BUS_WIR_Config_Software_CFG_905UD.1.60.zip

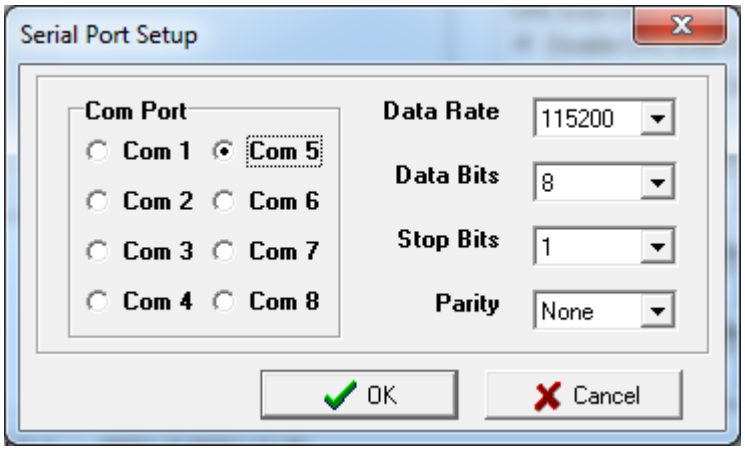
After successful download open CFG 905UD software. Connect serial cable from radio to PC/laptop.

To read configuration from the radio go to communication and select com port setting.

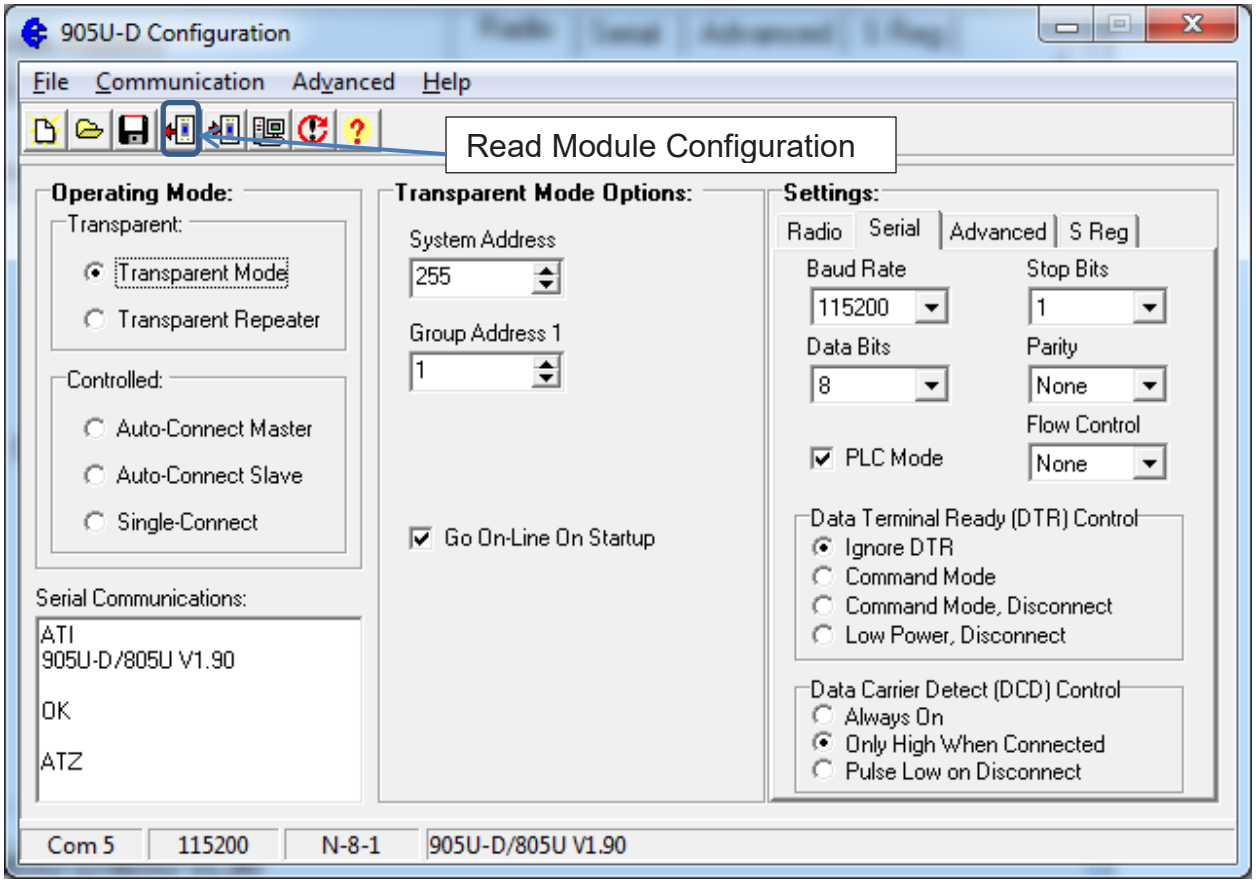




Select com port and baud rate here and hit ok



Now select read module configuration button to readout current setting from modem



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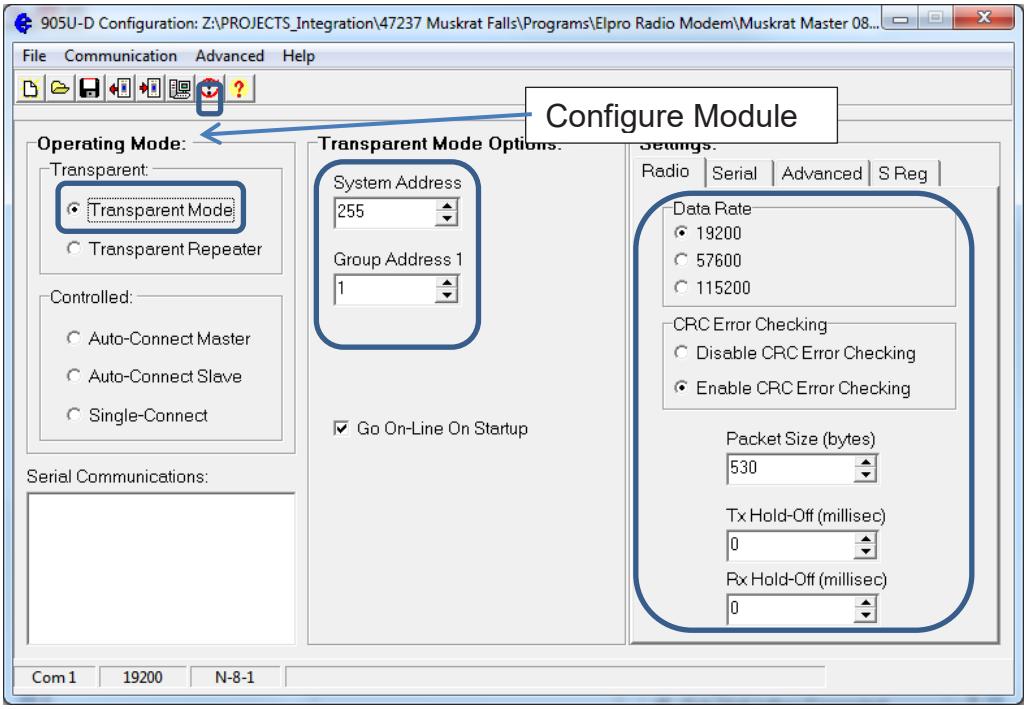
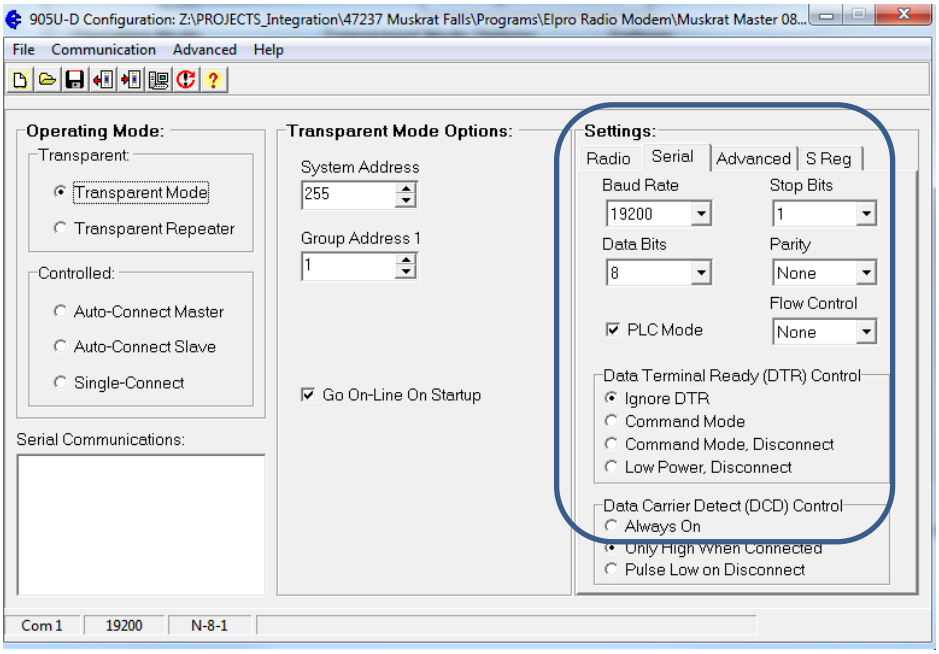
Make sure Master and slave both station have same configuration setting. Once setting is changed select configure module to send changes to modem



Serial Configuration



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