Multi-Gauge Surface Box

DataCan User Manual – V1.8

PN: 103648 / 108768 / 110797

www.datacan.ca

Table of Contents

History of Changes

Rev. No.	Date	Pages	Description of Changes
0.1	November 2018		Initial Draft
0.2	December 2018		Major Review
1.1	January 2019		Added SRO Pictures
1.2	February 2019	46	Added Tool Line Vout
1.3	April 2019	46	Updated Warning description, added power cycle timer
1.4	May 2019	48	Updated Modbus Map output
1.5	October 2019	48	Fixed Supervisor mode hotkey
1.6	November 2020	51	Added Rack-Mount SRO 4-20mA
1.7	June 2022	61	Reformatted instructions, Added Product Specifications, Updated formatting, and Updated images
1.8	November 2022	60	Fixed address typos in Modbus test section

1 About This Guide

This document is intended as a supplement to formal training. DataCan is constantly working to improve its products. We must therefore reserve the right to change designs, materials, specifications, and prices without notice. DataCan declines any liability that may arise out of the potential inaccuracies in this guide.

This guide assumes that you have some computing and tool knowledge. For more information, contact your local service representative.

www.datacan.ca

info@datacan.ca

We thank you for any feedback or comments that will help us to continue to improve our products and service.

2 Introduction

DataCan Services Corp. provides technology-driven downhole measurement solutions that deliver productivity, quality, and safety. We design, manufacture, and service 200°C plus hybrid platform instruments, patented multi-cycle instant close shut-in tools, reservoir management systems and a suite of quartz and piezo-resistive pressure measurement instruments. We offer specialized solutions that will help you improve productivity in your applications.

We are the leader in ultra-high temperature circuit design, manufacturing, and packaging.

- Our part selection process ensures the best long-term reliability is provided.
- Our fully automated surface mount assembly procedures ensure the highest quality circuit is constructed every time with minimal heat impact.
- Our Hybrid design and construction techniques will enable DataCan and its customers to reliably enter the 177ºC to 225ºC market.
- Our metal-to-metal seal and fully welded designs prevent potential leaks.

This manual is supplemented by several other manuals depending on the elements of your system:

- DataCan Download Software User Manual – for all features of the software and graphing.
- Surface Transmitter Manual
- Multi-Gauge Telemetry Card Manual
- Permanent Gauge Installation Manual

To answer questions not covered in the manual about a specific component of your system, please refer to the manual for that specific component.

3 Product Overview

3.1 Product Description

The DataCan Multi-Gauge Surface Box is a logging unit capable of storing and displaying data from downhole gauges, telemetry cards, surface gauges, and other sensors. The internal telemetry card can be programmed to communicate with any of DataCan's non-addressable (original style) or addressable (multi-gauge) permanent or SRO gauges. In addition to providing power to the attached equipment, the Surface Box displays the current pressure and temperature readings; also, depending upon user settings, it stores some or all the collected information. A PC can be plugged into the Surface Box to program which data is collected and recorded and to download records from the memory using the DataCan Download Software. The data collected by the box is available to remote monitoring systems through a Modbus output.

3.2 Product Specifications

NOTE: If your product is not one of the part numbers below, please contact a DataCan representative to ensure this manual applies to your device.

3.2.1 Standard Box

Standard Surface Box

Description	Part No.
Multi Gauge Logger	103648

Specifications

Display	Pressure & Temperature
Memory Capacity	More than 44 million Sample Capacity
Download Via	USB, RS-485
Output	RS-485 Modbus RTU (Optional Ethernet Modbus TCP/IP)
Input Voltage	10 – 24 VDC (Optional 120-240 VAC)
Power Consumption	1W typical, 3W max
Sensor Inputs	Up to 8 downhole gauges, up to 9 surface gauges or telemetry cards.

Accessories

Accessory Type	Part No.
Replacement USB Cable, 6ft	PE171UU0012
Replacement Gauge Hookup Cable (Cable head connector and Alligator Clips)	109359
DataCan Download Software (Free from the website)	100872
36VDC to 12VDC converter (for wider input voltage range e.g. 24V solar system)	109112
90-264VAC to 12VDC converter (AC power in)	102189
Modbus RTU to TCP/IP Gateway (Ethernet Modbus)	105656
4 channel 4-20 mA input	103255
4 channel 4-20 mA output (Requires 18-24VDC input power)	105774

3.2.2 Rackmount Unit

Rackmount Unit (Base Model)

Part No.	108768
Display	OLED Character Display
Memory Capacity	20 Million Samples
Download Via	USB
Output	RS-485 Modbus
Power In	10-24 VDC or 120-240 VAC
Sensor Inputs	Up to 8 downhole gauges; Up to 9 surface gauges

Rackmount Unit (With 4-20mA out)

Part No.	110797
Display	OLED Character Display
Memory Capacity	20 Million Samples
Download Via	USB
Output	RS-485 Modbus, four channels 4-20 mA
Power In	10-24 VDC or 120-240 VAC
Sensor Inputs	Up to 8 downhole gauges; Up to 8 surface gauges

Accessories

Accessory Type	Part No.
Replacement USB Cable, 6ft	PE171UU0012
Replacement Gauge Hookup Cable (Cable head connector and Alligator Clips)	109359
AC Power Cable, 10ft	108582
DataCan Download Software (Free from the website)	100872

3.3 Network Connections

The Surface Box connects to 3 different networks, as well as a USB link to a PC.

The 3 networks are:

- Modbus-Out network (SCADA)
- Downhole tool network
- Surface gauge network

The Modbus-Out network is used to connect to a user's SCADA system. The surface box has its own configurable address for this network. Multiple surface boxes can be connected to the same SCADA network.

The downhole network is used to collect data from DataCan Downhole Permanent Gauges or Surface Readout Gauges. Up to 8 addressable gauges can be connected to the downhole tool network or a single non-addressable gauge. Each gauge on the downhole tool network needs a unique tool address. The address of a downhole tool is separate from any Modbus address.

The surface gauge network is a Modbus network, separate from the Modbus-Out network that the surface box can use to poll other Modbus sensors including other DataCan telemetry cards. Each external Multi-Gauge Telemetry Card has its own downhole tool network. Each device connected to the surface gauge network needs its own Modbus address on the network. This can range from 1 to 247, with no two devices having the same address. The internal telemetry in the Surface Box is address 0 (reserved). Addresses on this network are separate from the Modbus-Out network, so devices on this network can have the same addresses as devices on the user's SCADA network.

4 Connecting and Configuring Surface Box with Gauges

Proper installation of DataCan products ensures high-quality performance and long-lasting results. The following section highlights the steps required to configure devices to the Surface Box properly.

FOR MULTI-GAUGE SYSTEMS: The addresses of gauges in a multi-gauge system must be configured so that each address is unique. The first time a set of gauges is connected, the gauges must be connected to the system one at a time while the software is used to configure the Telemetry Card and the gauge. After all gauges have been configured, they may be connected all at once.

4.1 Tools Required

Description	Part No.
USB Download Cable	100682
Gauge to Surface Box Test Hookup Cable (for temporary connections)	109359
Passthru Gauge Test Hookup Cable (comes with passthru gauge for temporary passthrough connection)*	109377
#2 Phillips Head Screwdriver or Flat Head Screwdriver	N/A
Wire stripper	N/A
Adjustable wrench (for installing cable glands on the box)**	N/A
Windows laptop with DataCan Download Software Installed	N/A

*If configuring multiple gauges

**If using cable glands and making a permanent connection

4.2 Connecting Gauges to the Surface Box

Warning: DO NOT have the Surface Box connected to a computer when powering it up, it may damage the computer. Only connect the USB cable after the Surface Box has been powered up.

1. Ensure the power switch is in the **OFF** position. On the Standard Surface Box, the switch is found on the back of the swing panel. On the Rackmount Unit, the switch must be in the middle position.

Surface Box Switch

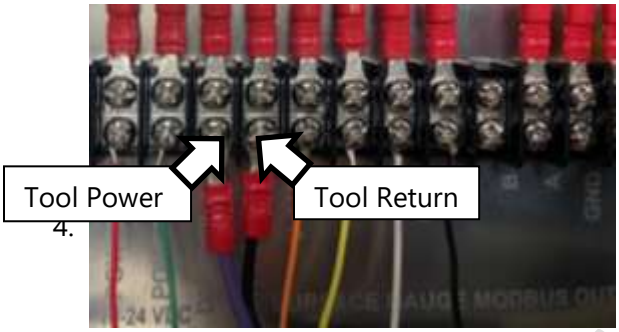
Rackmount Unit Switch

2. Before using the Surface Box, there is a battery disable tag on the battery holder on the back of the swing panel that must be removed to power the backup clock. Rackmount Units have rechargeable clock batteries. If these units are unpowered for 3 months or longer, they may lose track of time.

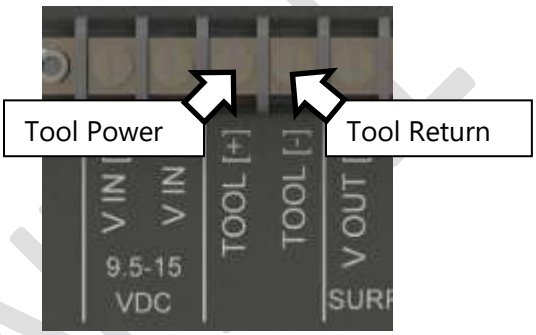
   Note: The battery must be replaced occasionally for the Surface Box to maintain time during power outages. Check the voltage on the battery and replace if below 2.7V as part of regular maintenance.

3. If making a permanent connection to an installed Permanent Gauge System, install the cable gland and run the surface cable into the box. If not, use the provided test cables to connect the Gauges to the Surface Box. Connect surface line/test cables to the **DH TOOL** of the Surface Box. If you are using multiple gauges, connect only one at a time.
    - The **DH TOOL [+]** terminal must be connected to the center pin of the gauge, and the **DH TOOL [-]** must be connected to the housing of the gauge.

4.



Surface Box

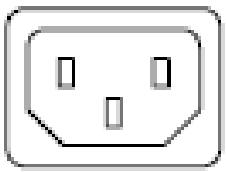


Rackmount Unit

5. DC powered box: connect the positive of your power supply to the **POWER [+]** terminal and the negative to the **POWER [-]** terminal. The Rackmount Unit may be labelled **VIN [+]** and **VIN [-]**.

   AC powered box: plug in the AC power cable to the 3-pronged connector.

DC Power Connection



AC Power Connection

6. Switch the power switch to the **ON** position. For the Rackmount Unit, press the switch on the side to which the power is connected (Up for AC power and Down for DC power).

Power switch in the ON position and DH TOOL COMM INDICATOR for Surface Box

Power switch and DH TOOL COMM INDICATOR for the Rackmount Unit

Note: When power is applied the screen should come on and display:

DataCan

Modbus logger

FW: YYYY Week: WW

Initializing….

If after 10 seconds any warnings have been displayed, see Section 6 – *Screen Warnings and Errors* for a description of warnings and troubleshooting.

If the surface box has already been configured the screen should be displaying pressure and temperature readings of each gauge attached. If it is not displaying a reading for each gauge attached or the readings are incorrect, proceed to the next section for configuring gauges and surface boxes.

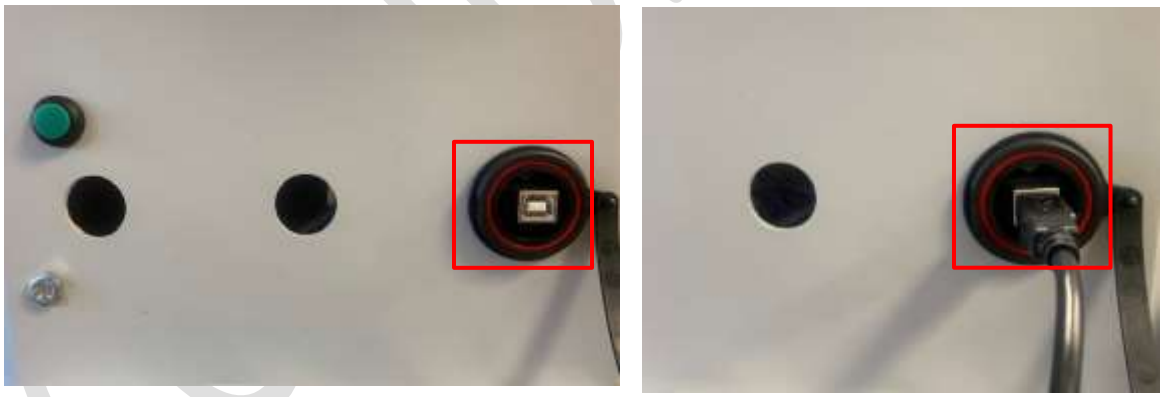
4.3 Instructions for Connecting and Configuring Addressable Gauges

Note: These instructions are for addressable downhole gauges. For non-addressable downhole gauges, see Section 4.4 – *Instructions for Connecting and Configuring Non-Addressable Gauges.*

1. Ten seconds after power-up, ensure that no warnings have been displayed on the screen. See Section 6 – *Screen Warnings and Errors* for a description of warnings and troubleshooting.
2. Connect the Surface Box to a laptop via a USB cable.

Note: The Box draws minimal power from the USB if the main power supply is turned off. If you want to power down the card, you must disconnect the USB cable.

Warning: DO NOT have the Surface Box connected to a computer when powering it up, it may damage the computer. Only connect the USB cable after the Surface Box has been powered up.



USB Connector for Surface Box

USB Connector for Rackmount Unit

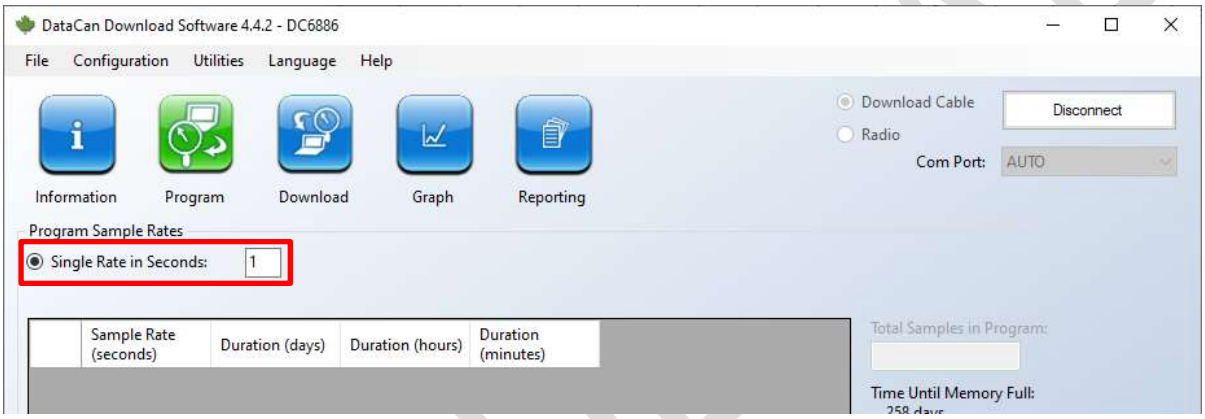
3. Open DataCan Download Software on your Windows PC. The startup page should appear as shown below.

4. Press the **Connect** Button. See Section 5.1 – *Connecting to the Surface Box* for more information about the **Information** screen and what happens when the Card connects.

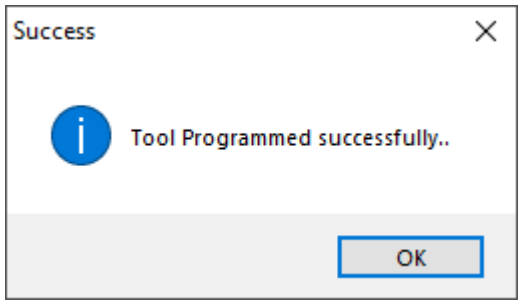
Note: If configuring a multigauge system the sample rate should be set before configuring gauges. The minimum sample rate for multi-gauge systems is 1 second per gauge. E.g. the minimum for a 5 gauge system is 5 seconds. If you set the sample rate faster than that, the system will sample at the best effort speed and the "tool current" diagnostic reading will be affected. Setting the sample rate to 1 second even with a single gauge attached may affect the "tool current" reading.

5. If setting the sample rate click **Program** from the buttons in the top row, otherwise skip to step 9.

6. Beside the **Single Rate in Seconds,** enter an appropriate sample rate. If the rate is already appropriate there is no need to change anything.



7. If you have changed the sample rate, click on the **Program Tool** button found at the bottom left of the screen. A pop-up window should appear with a message confirming success.

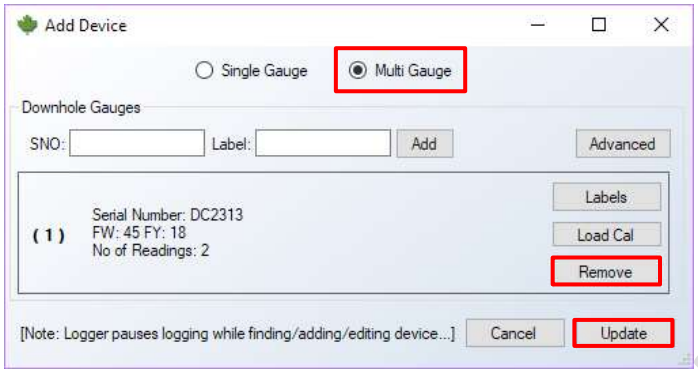


8. Click **Information**.

9. Enter **Supervisor mode** by pressing **Ctrl+SHIFT+D** at the same time. "-Supervisor Mode" should appear in the top bar.

10. Once in Supervisor Mode, press the **Edit** button.

11. In the window that pops up, select **"Multi Gauge"** for addressable gauges, **"Single Gauge"** is for non-addressable gauges. If buttons are not available, supervisor mode was not entered, return to step 5. If there are any gauges listed that will not be connected to this Telemetry Card, press the **Remove** button next to the corresponding gauge. With all unneeded gauges removed, press the **Update** button.



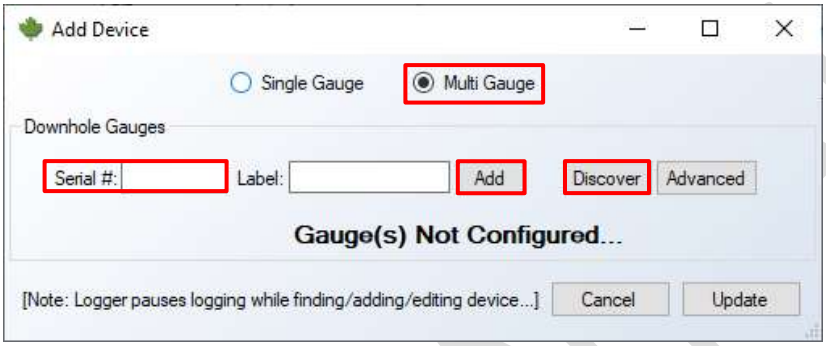
12. If needed, repress the **Edit** button once you have cleared the list of gauges. If needed, reselect **"Multi Gauge"** in the reopened window. It will display the message "Gauge(s) Not Configured…".

Surface Box Display Screen

Rackmount Unit Display Screen

13. To add gauges to the Surface Box list:
    A) If connecting only once gauge to this Box, press the **Discover** button.
    B) If multiple previously configured gauges are connected, press the **Discover** button (This should be the case with installed gauges).
    C) If connecting a set of multiple gauges together that have never been configured:

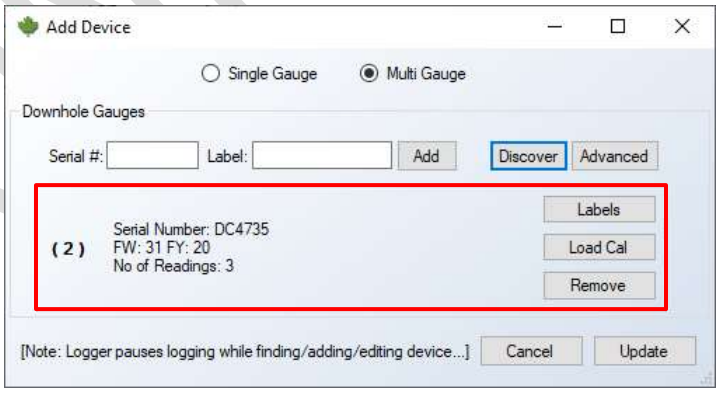
a. Ensure only the gauge that is to be first in the list is attached.
b. Enter the **Serial #** of the gauge and press **Add.**
c. Once the first gauge has been added, connect the next gauge, enter its **Serial #** and press **Add.**
d. Repeat for every gauge to be connected. The software will set the address of each gauge in the order that they are added.



Note: If multiple gauges with the same address are connected, communication errors when adding the gauges may occur.

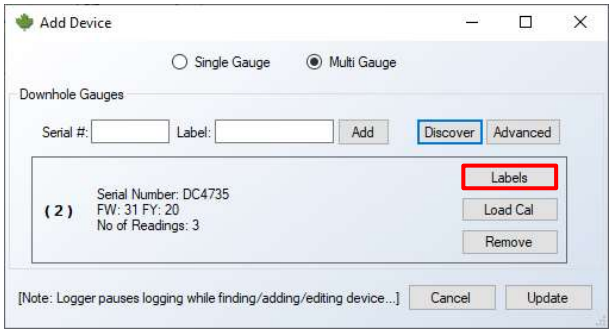
Note: Once a gauge has been added, it does not have to remain connected during the rest of the configuration procedure.

14. Once a Gauge or Gauges have been detected and added, a window will appear displaying the Gauge(s) connected.

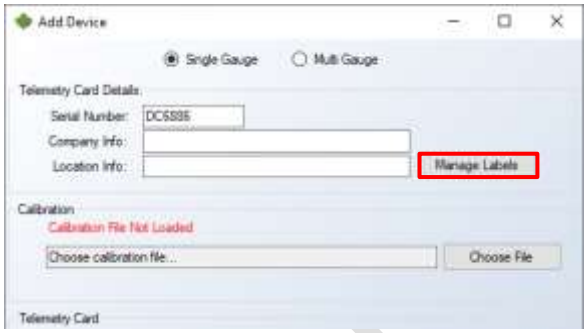


15. If desired, labels can be applied to data that will be downloaded and appear on the screen. This can be done for each Gauge in a Multi-Gauge or Single Gauge System.

Note: Labels can be edited at any time by pressing the **Edit** button.

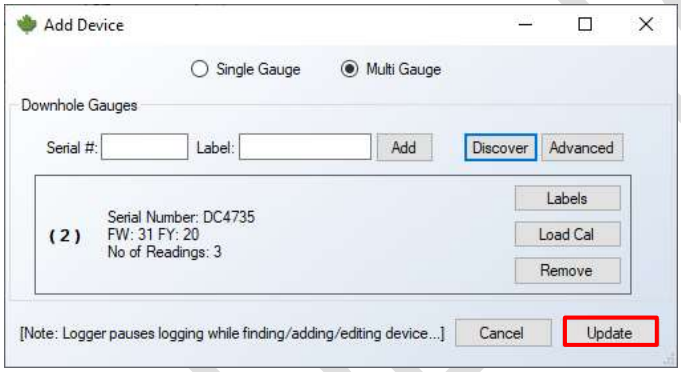


Multi Gauge Window



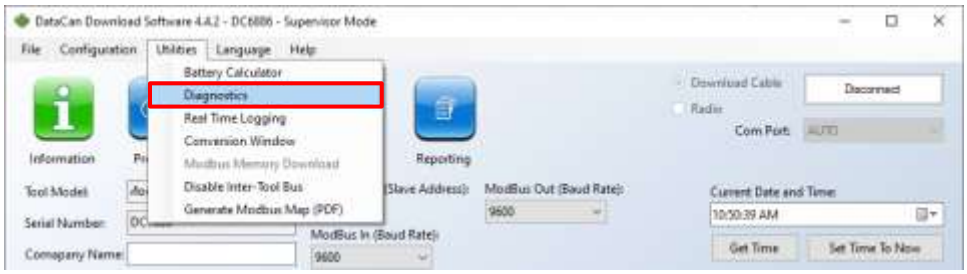
Single Gauge Window

16. When the configuration is complete, press the **Update** button.



17. If you have connected all devices for the system, and are going to use remote monitoring, generate a Modbus map by clicking **Utilities -> Generate Modbus Map (PDF)**, and choosing a location and file name to save the PDF. If you have devices to connect to the Surface Gauges network, wait until those are added to generate the map.

18. Connect all configured gauges and confirm the system is working through the diagnostics screen by clicking **Utilities -> Diagnostics**. For full information on using the diagnostics screen see section 5.2 – Diagnostics.



Data should also be flashing on the main display.

Surface Box Display Screen with Data

Rackmount Unit Box Display Screen with Data

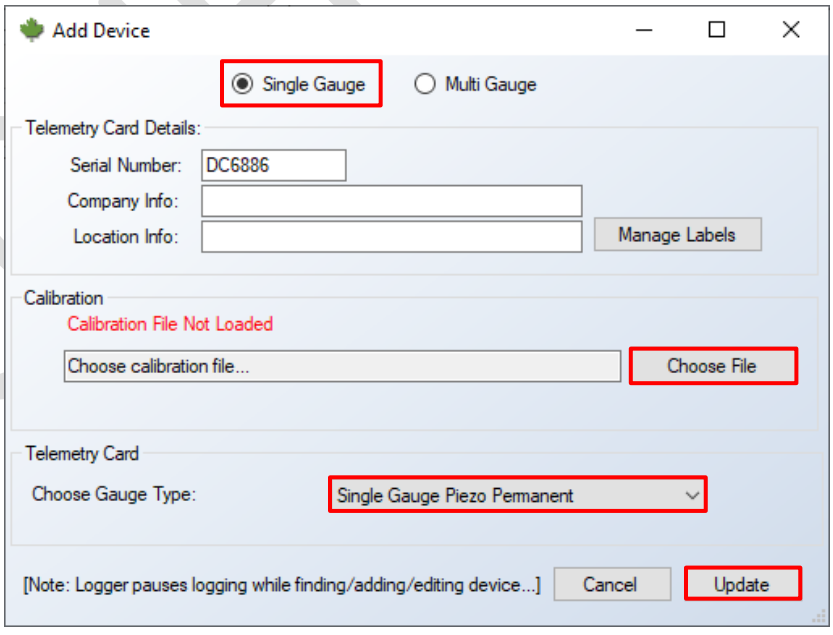
Note: If you have multiple devices connected to your Surface Box, the display screen will switch between data from each device. By default, the display screen will automatically turn off after 1 minute. The green button on the side of the Surface Box or the grey button beside the power switch of the Rackmount Unit turns the display screen on and off. To change the display screen settings, refer to Section 8.3 –*Screen Settings*.

4.4 Instructions for Connecting and Configuring Non-Addressable Gauges

Note: If you are using **Single Gauge** to add a device, you must have the calibration file for the serial number of your gauge. The calibration file can be downloaded from the DataCan website datacan.ca/downloads at any time.

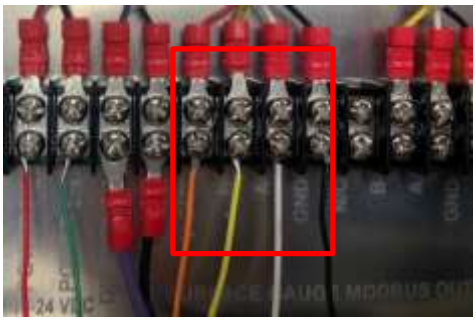
The process for adding the non-addressable gauge is very similar to adding addressable gauges as explained in the previous Section 4.3 – *Instructions for Connecting and Configuring Addressable Gauges.* The only difference is in steps 11-13. Please refer to the following steps instead.

1. Select the **Single Gauge** option.
2. Press **Choose File**.
3. Select the file for the gauge connected and click **Open.**
4. Select the gauge type from the drop-down menu.
5. Press **Update** once all information has been entered.

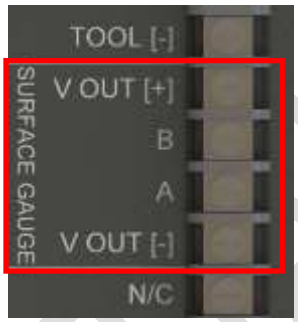


4.5 Connecting to the Surface Gauges Network

1. If there are any Modbus sensors to be connected to the Box, connect the four surface wires to the four **SURFACE GAUGE** terminals of the Surface Box. Below a description of the connections.



Surface Box Terminals



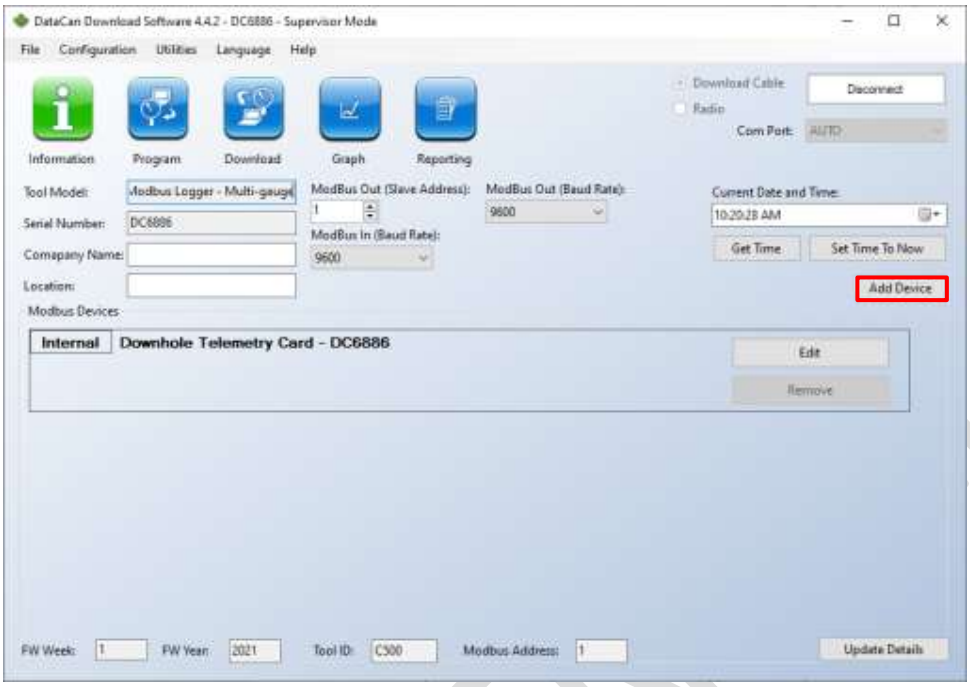
Rackmount Terminals

Terminal	Description	Surface Logger Data Cable Wire Colour
VOUT / VOUT [+]	12 VDC (isolated from Surface Box Input Power)	Red wire
B	Modbus B/D(-) signal	Green/Yellow wire
A	Modbus A/D(+) signal	White wire
GND / VOUT [-]	0 VDC (Isolated from Surface Box Input Power, same as DHTOOL [-]	Black wire

2. If not already in supervisor mode, open DataCan Download Software, press **Connect,** and enter **Supervisor mode** by pressing **Ctrl+SHIFT+D** at the same time. "-Supervisor Mode" should appear in the top bar.

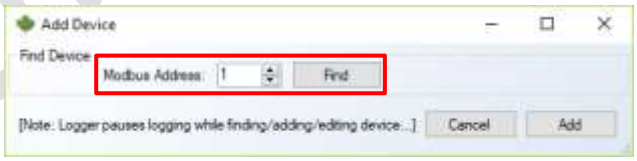
Note: The Internal Telemetry Card always shows up on the **Information** page in the DataCan Download Software as address 0.

3. Once in **Supervisor Mode**, on the **Information** page, press the **Add Device** button.

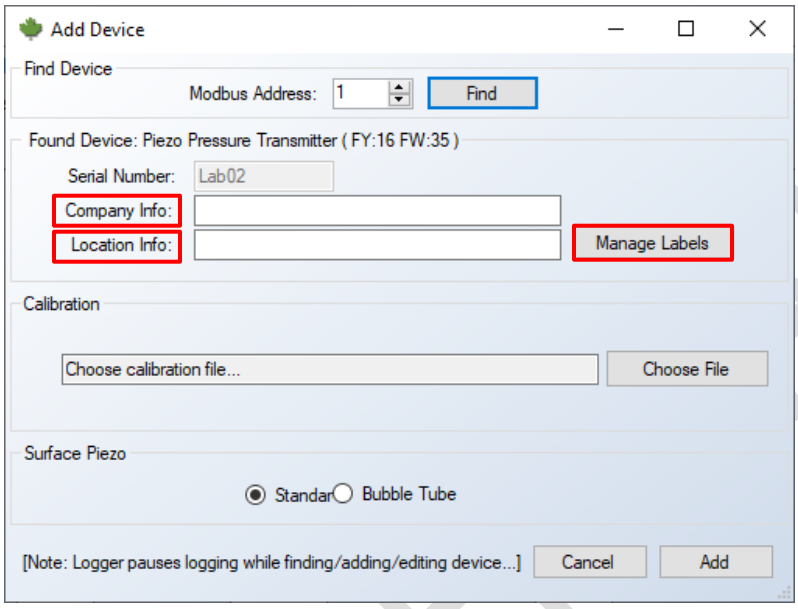


4. In the popup window, enter the "Modbus Address" of the device to be added and then press the **Find** button. See the device manual if the device address is unknown.

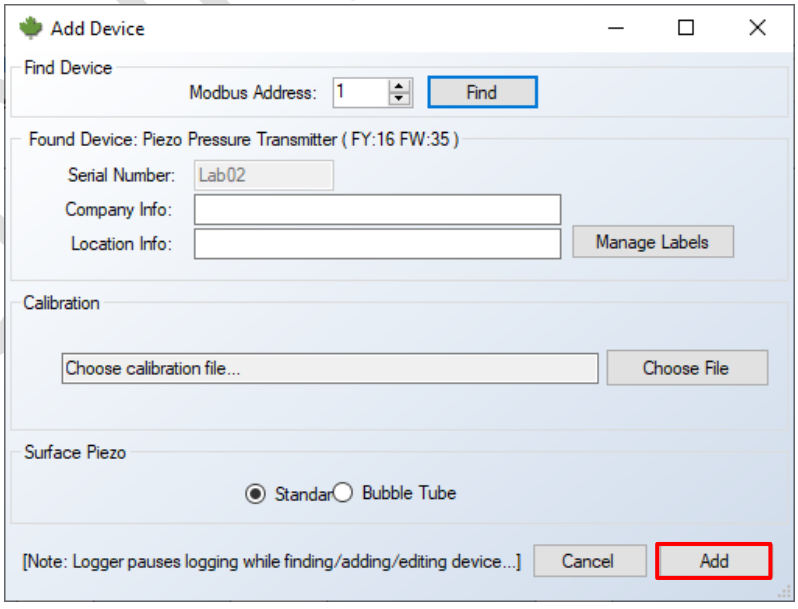
Note: Each external device must have its own unique Modbus address. The device must be configured, including setting the Modbus address, before connecting to the Surface Gauges Network. A device connected to the Surface Gauges network can have the same Modbus address as is on the user's SCADA system.



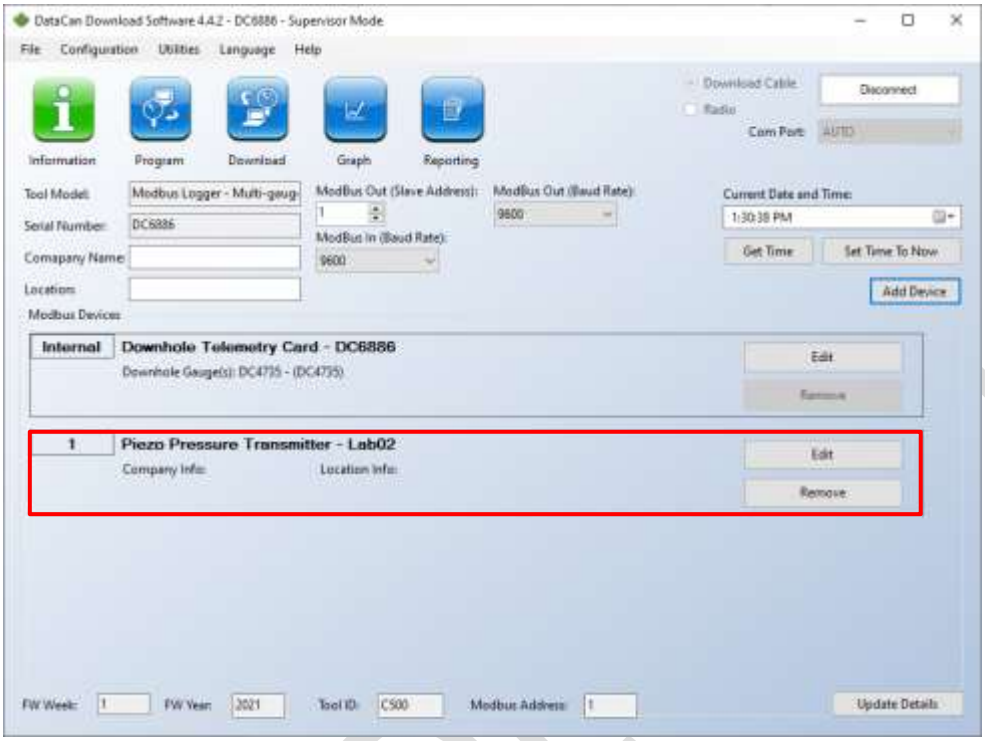
5. Once the device is found the configuration options for that device are shown. For a surface pressure transmitter, the user can change “Company Info”, “Location Info”, or the data label.



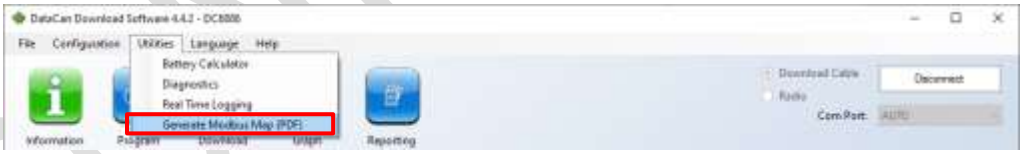
6. After all changes have been completed, press the **Add** button. The logger will add the device to the system and restart the Surface Box.



7. After the device has been added to the system. It should appear in the devices list on the main page.



19. If you have connected all devices for the system, and are going to use remote monitoring, generate a Modbus map by clicking **Utilities -> Generate Modbus Map (PDF)**, and choosing a location and file name to save the PDF. If you have downhole gauges to connect, wait until those are added to generate the map.



8. Connect all configured devices and confirm the setup through the diagnostics screen by clicking **Utilities -> Diagnostics.** See a full description of diagnostics in section 5.2 - Diagnostics

Readings from any pressure or temperature sensor should also flash on the main display.

Surface Box Display Screen with Data

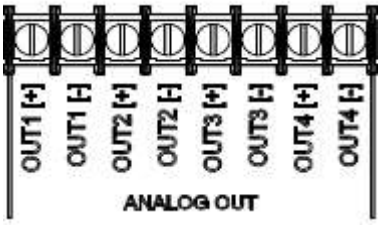
Rackmount Unit Box Display Screen with Data

Note: If you have multiple devices connected to your Surface Box, the display screen will switch between data from each device. By default, the display screen will automatically turn off after 1 minute. The green button on the side of the Surface Box or the grey button beside the power switch of the Rackmount Unit turns the display screen on and off. To change the display screen settings, refer to *Sensor Setup – Screen Settings*.

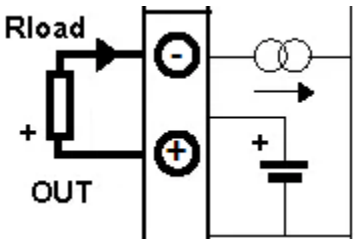
4.6 4-20 mA Analog Output

For Rackmount Multi-Gauge 4-20 mA SRO Logger Units, and Surface Box systems with the 4-20 mA out option, four temperature or pressure readings can be configured as 4-20 mA outputs. The connections on the panel are labelled **OUT1**, **OUT2**, **OUT3**, and **OUT4**, each output having a **[+]** and **[-]** connection.

1. Connect receiver devices to the appropriate connections on the panel.



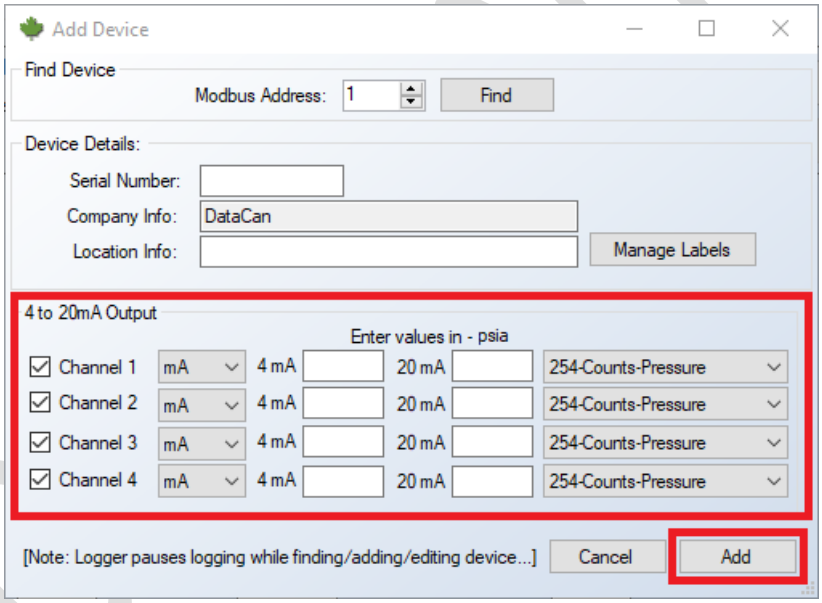
Panel Connections



Connection wiring

2. If not already in supervisor mode, open the DataCan Download software, press **Connect,** and enter **Supervisor mode** by pressing **Ctrl+SHIFT+D** at the same time. "-Supervisor Mode" should appear in the top bar.

3. Click the **Edit** button in the device box on the **Information** page.
4. The popup should contain the configuration for the 4 output channels. In the device configuration elect which channels to use, which readings to output, and the output range in the corresponding units. The value entered in the 4 mA is the minimum output for the channel, and the 20 mA box is the maximum output for the channel.



5. Once all changes are complete, click **Add/Update**.

Note: You may reconfigure any 4-20 mA output at any time by pressing **Edit** for the device, and pressing **Update** when finished.

5 Basic Software Operation

The software used to configure and download the Surface Box is the DataCan Download Software which is available on the DataCan website at datacan.ca/downloads. The software should install on any windows PC. It is recommended that you install the software when connected to the internet to allow any needed driver updates to be automatically completed.

5.1 Connecting to the Surface box

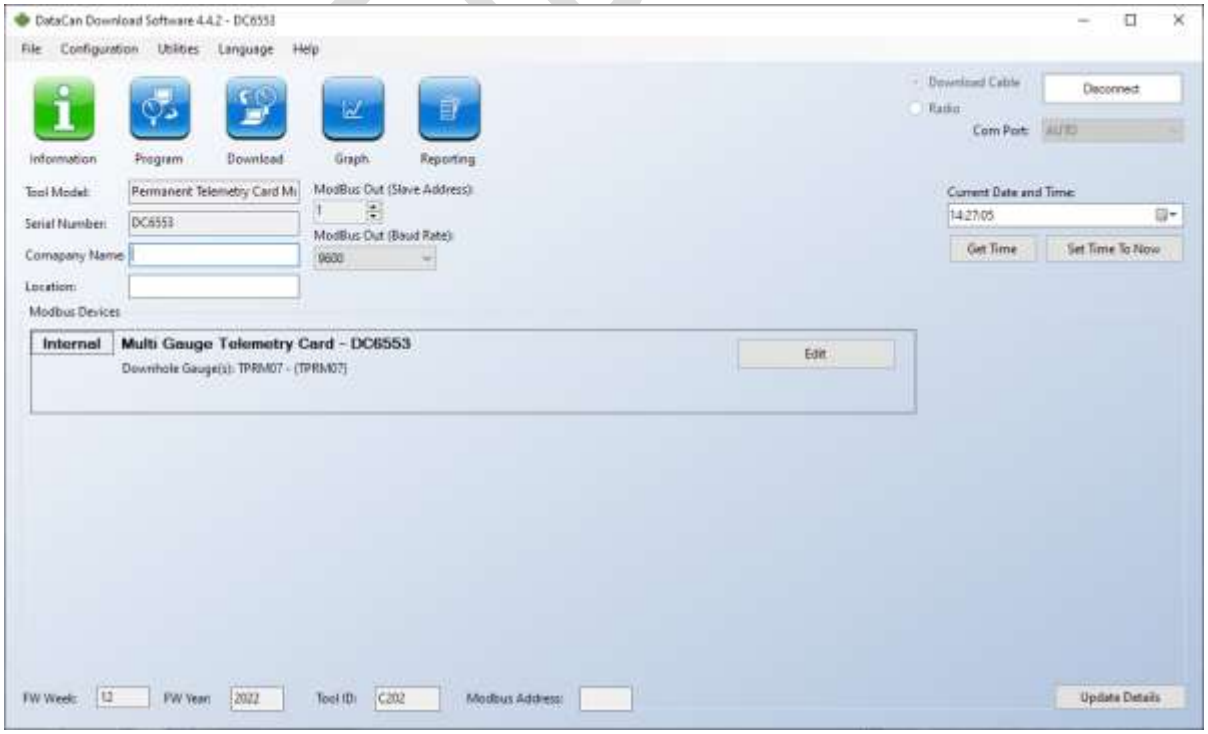
The first step in using the Surface Box is connecting the box to the DataCan Download Software.

1. Open DataCan Download Software on your Windows PC. The startup page should appear as shown below.

2. Press the **Connect** Button.

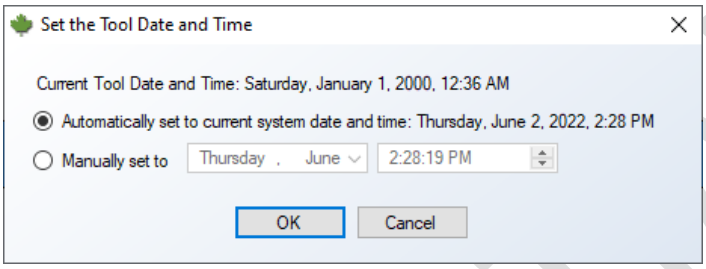
Note: After a successful connection, the page should appear as shown below with the following details:

- Tool Model of the Telemetry Card
- Serial Number of the Telemetry Card
- Company Name (User writeable)
- Location Info (User writeable)
- Modbus-Out Network Address and Baud Rate
- Modbus In Network Baud Rate
- Date and Time of the card's clock
- Details of downhole tools connected to the logger
- Details of devices connected to the Surface Gauges Network
- Firmware Week & Year
- Tool ID



Note: The Internal Telemetry Card always shows up on the **Information** page in the DataCan Download Software as address 0

If the Telemetry Card has not been powered up since the removal of the backup battery disable tag, you will be prompted to set the time from your computer; this is normal. Press **OK** when you have finished setting the time.



Note: The standard Surface box uses a primary coin cell battery. The coin cell should be tested and if needed replaced as part of regular maintenance to ensure time is kept when power is not applied to the box. The Rackmount Box uses a rechargeable backup clock battery. It should function for the lifetime of your device and never need to be replaced. If your device is not powered on for months, the battery may drain completely and the clock may lose time. If the Rackmount Box does not retain its time on power-up, simply leave the device powered on for 24hrs and the battery will recharge.

If even after charging, the Rackmount Box does not retain its time through power losses, please return to DataCan for servicing.

5.2 Diagnostics

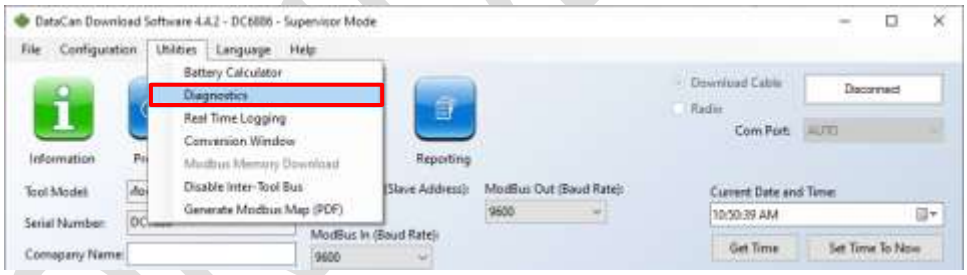
The diagnostics screen shows the latest reading collected by the Surface Box from all devices the Surface Box is configured to read. This is useful for confirming the connectivity and configuration of the gauges and other devices connected to the Surface Box.

NOTE: The gauges must be connected to the box and the gauges and box configured before data will be collected. See Section 4 – Connecting and Configuring Surface Box, for more information.

Warning: DO NOT have the telemetry card connected to a computer when powering it up, it may damage the computer. Only connect the USB cable after the telemetry card has been powered up.

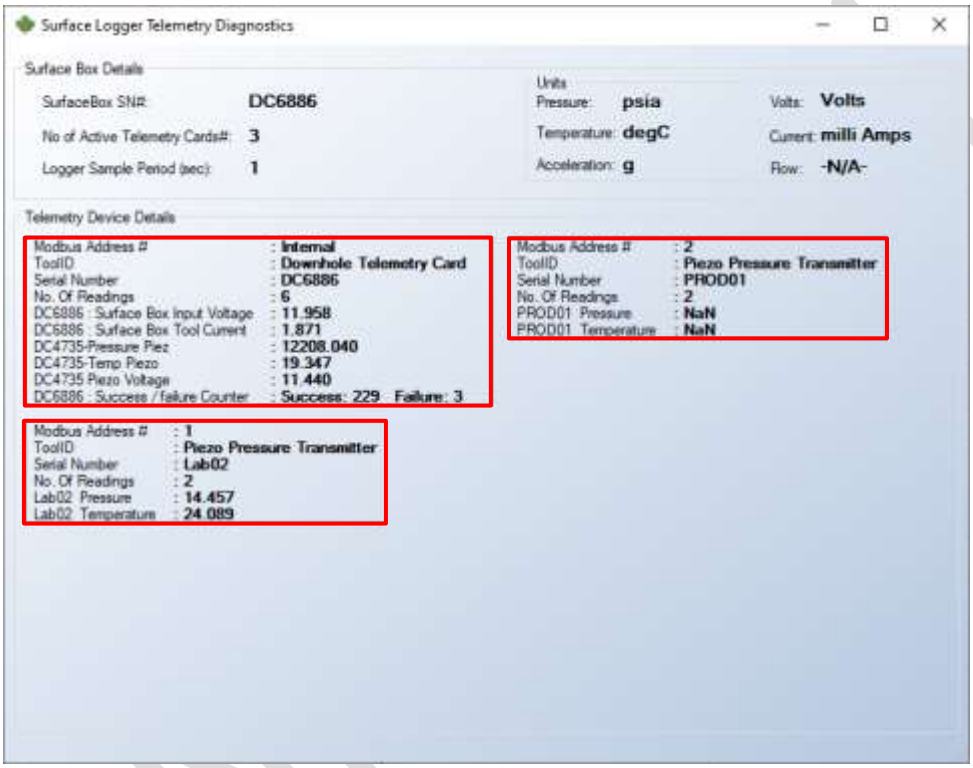
In the Download Software once you have connected to the Surface Box, to view the Diagnostics screen:

1. click **Utilities -> Diagnostics.**



2. The Diagnostics screen will open, ensure that each connected gauge is providing data. The **Surface Box Input Voltage** should be between 10V and 24V and the **Surface Box Tool Current** should appear as expected. Each 0.75" Piezo gauges draw 1.8 mA, and Quartz gauges draw between 3.9 and 7.5 mA.

   Note: If you have devices connected to the Surface Gauges network, separate boxes indicate the diagnostics of individual devices.



5.3 Programming Sample Rate

Programming Sample Rate sets how often the data is collected and stored to memory. For example, if the sample rate is set to 60 seconds, data will be sampled and recorded every 60 seconds. The default rate is 5 seconds.

If configuring a multigauge system the sample rate should be set before configuring gauges. The minimum sample reliable rate for multi-gauge systems is 1 second per gauge. E.g. the minimum for a 5 gauge system is 5 seconds. If you set the sample rate faster than that, the system will sample at the best effort speed and the "tool current" diagnostic reading will be affected. Setting the sample rate to 1 second even with a single gauge attached may affect the "tool current" reading.

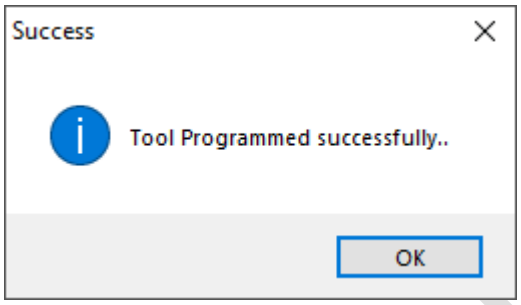
NOTE: Changing the sample rate does not start a new job.

The following instructions outline how to program the sample rate:

1. Click on the **Program** icon to get to the programming page.

2. Besides the **Single Rate in Seconds,** enter an appropriate sample rate.

3. Click on the **Program Tool** button found at the bottom left of the screen. A pop-up window should appear with a message confirming success.



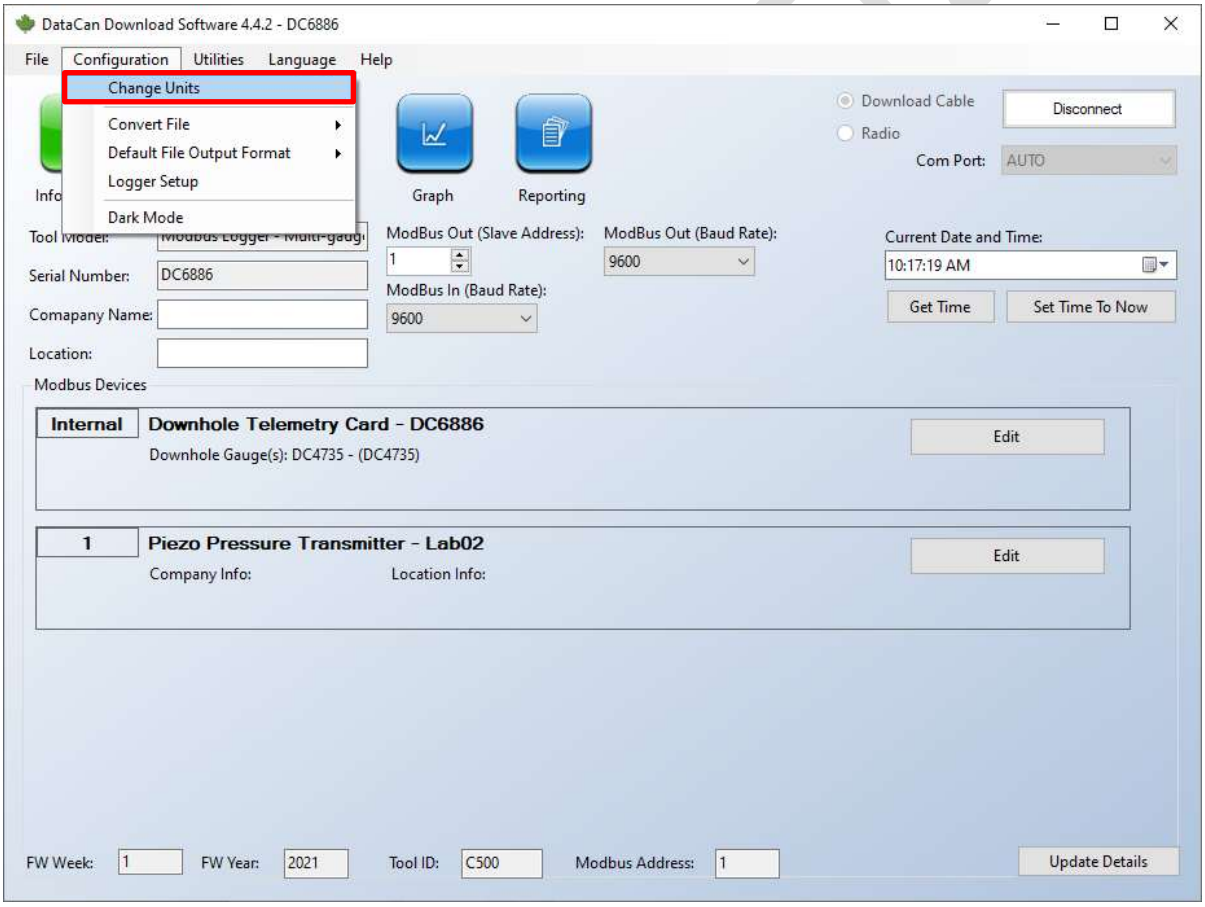
5.4 Changing Units

The DataCan readout can display units in a wide variety of formats. The units of the readout may be changed at any time.

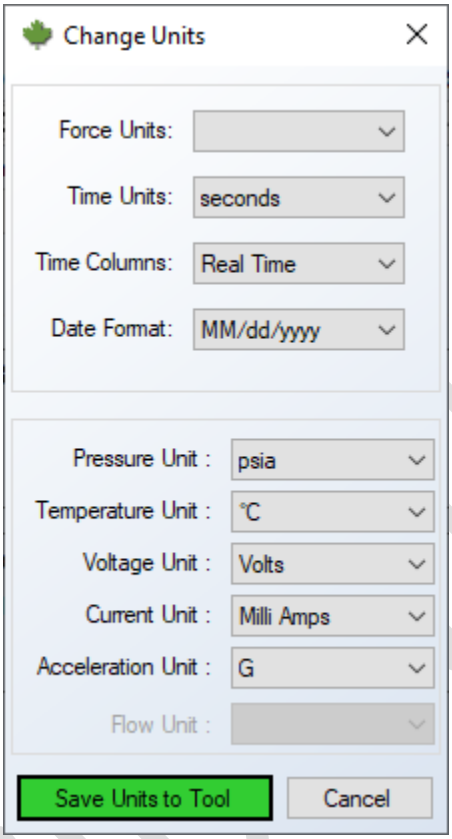
NOTE: Changing units starts a new job.

The following instructions outline how to change the readout units:

1. Click on **Change Units** under the **Configuration** drop-down list.



2. In the pop-up window, you may select your desired units.



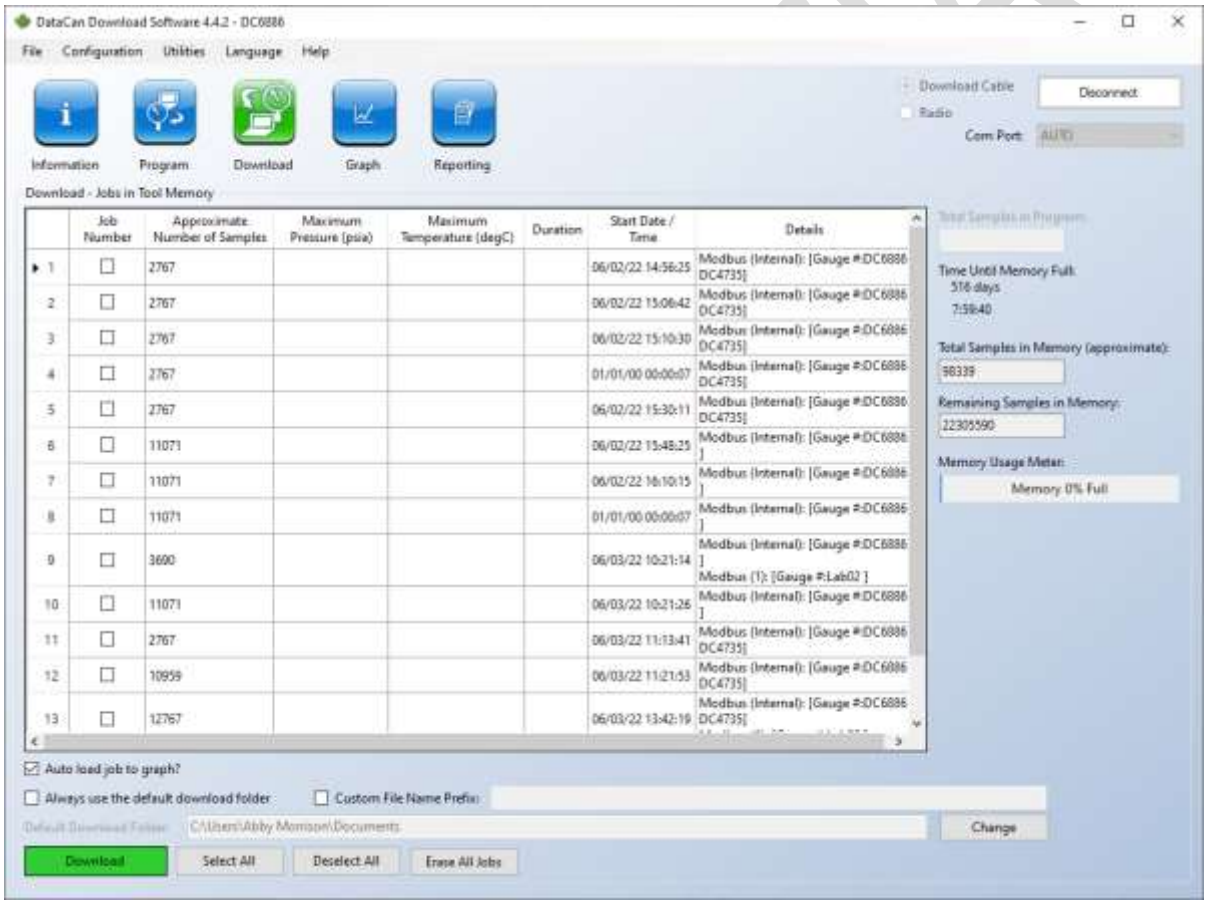
3. Once all changes have been made, press **Save Units to Tool**.

5.5 Downloading and Erasing Jobs

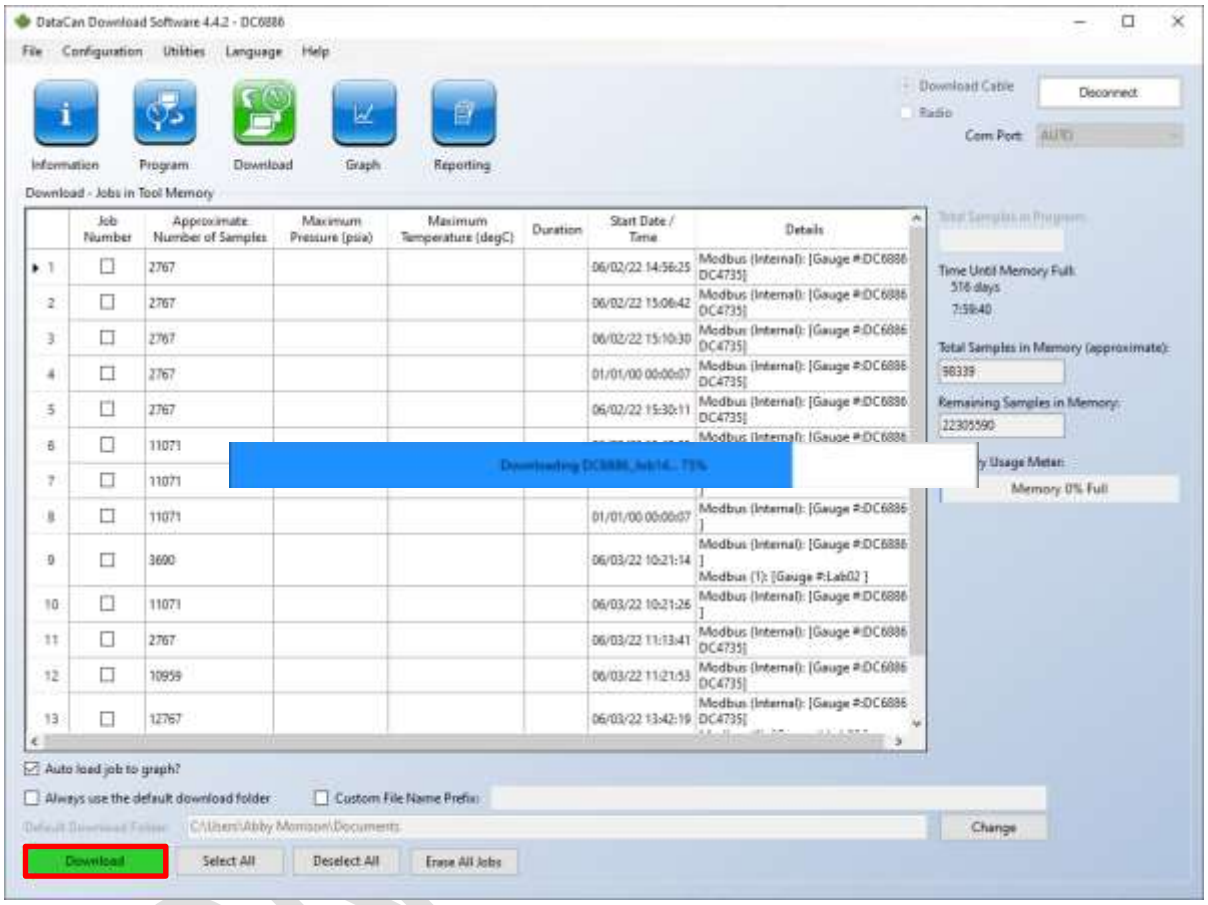
Data records are recorded in the logger as jobs. The Surface Box creates a new job every time it is powered up and can collect data. It also creates a new job anytime the settings are changed.

To download jobs after connecting to the software, proceed with the following steps:

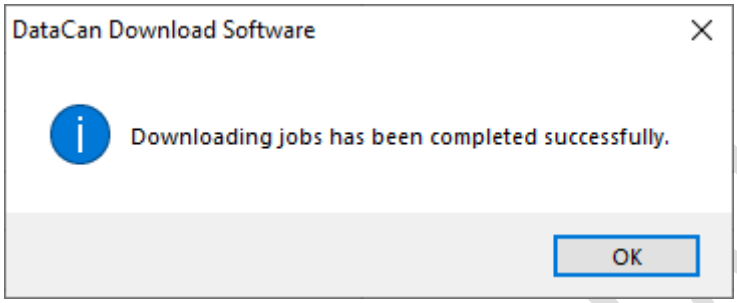
1. Click on the **Download** button to go to the download page.

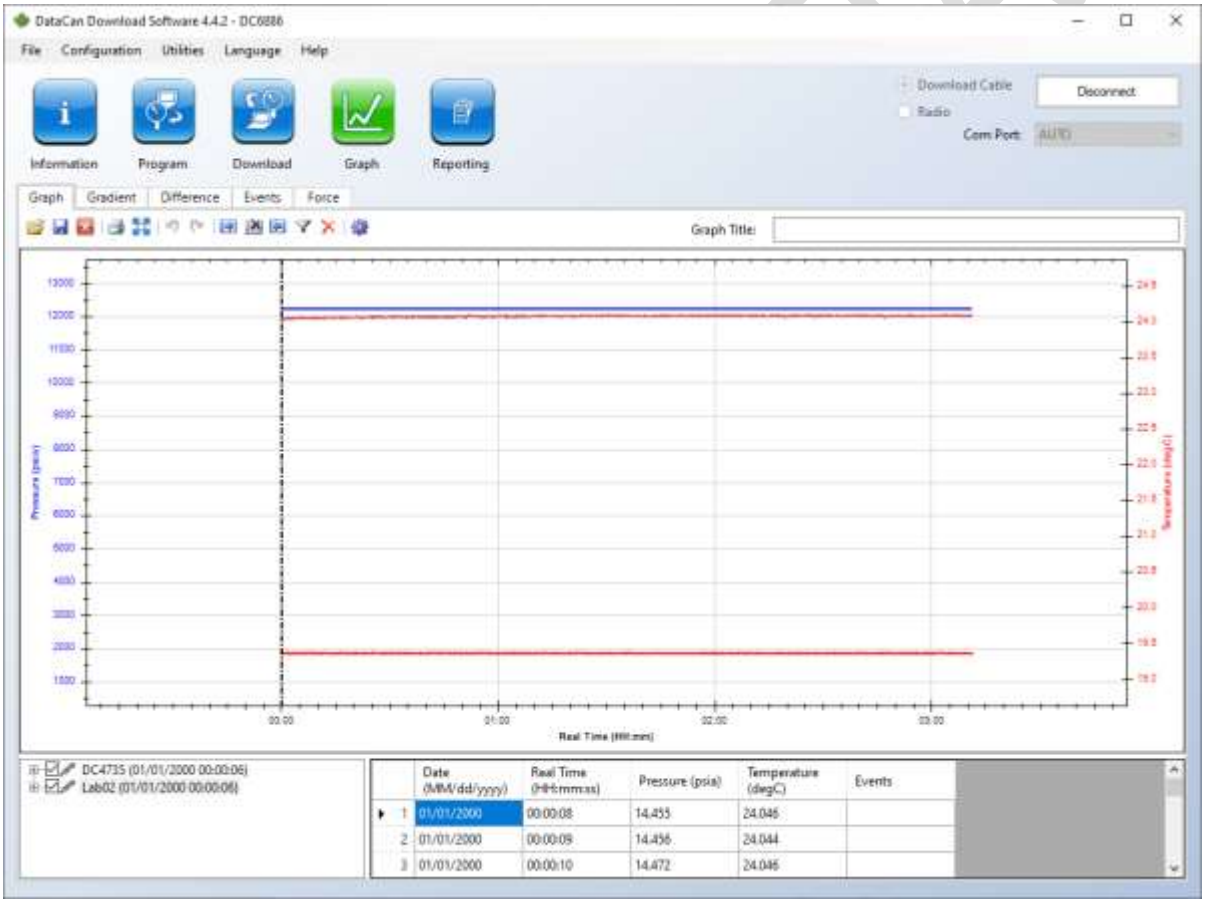


2. Select jobs that need to be downloaded and click on the **Download** button. You will be prompted to save a binary file for each job selected. Choose a location to save to and click **Save.** Once it succeeds, you will see a progress bar with the download progress.



3. Once the data has been downloaded, a pop-up window will confirm success and, if you have **Auto load job to graph?**, you will be automatically directed to the graph page with the downloaded data displayed.

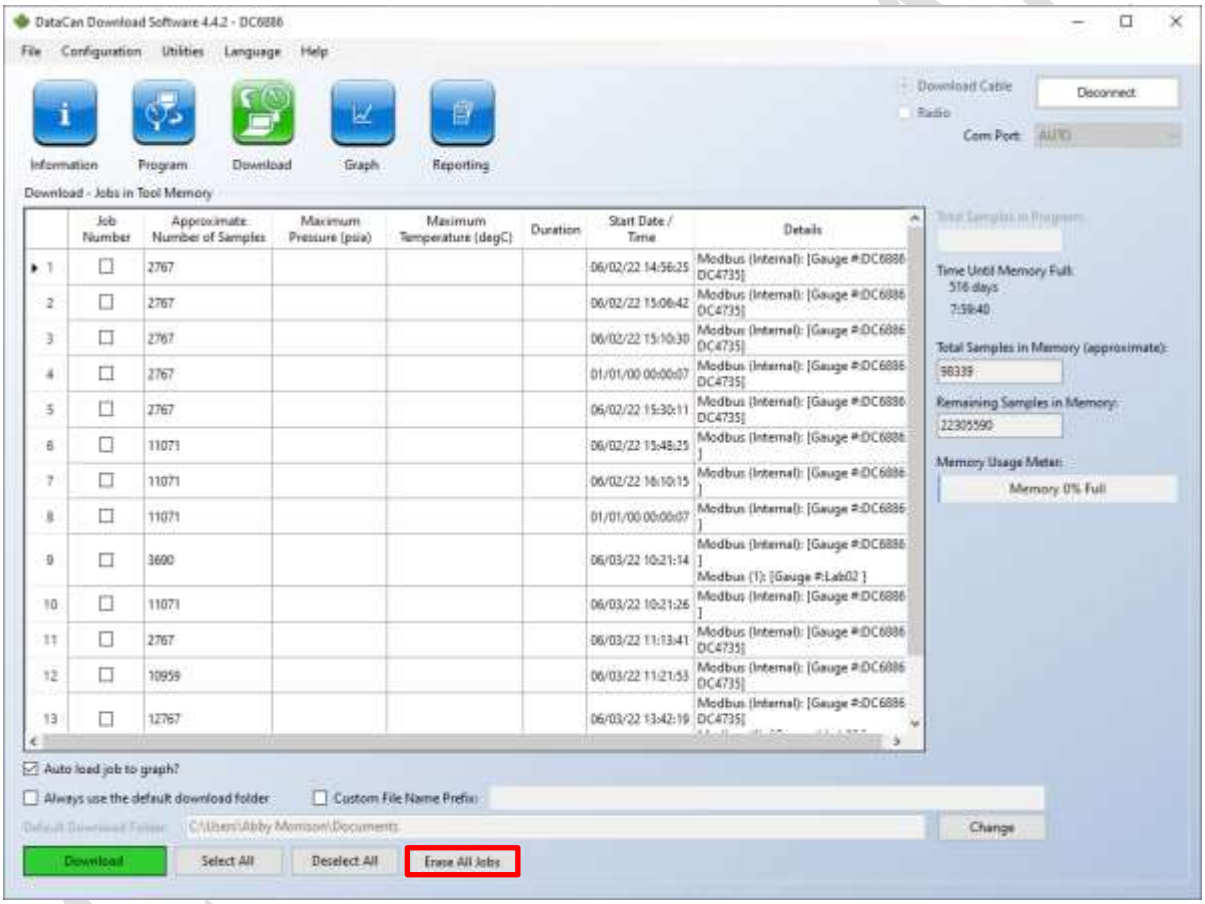


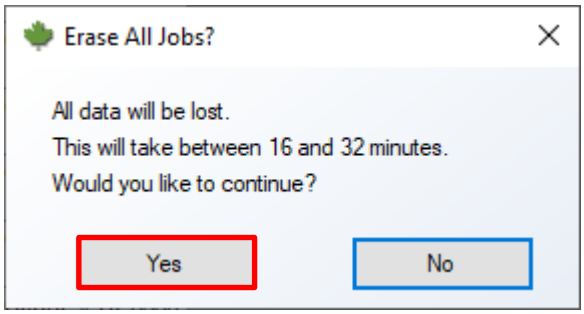


To erase jobs, proceed with the following steps:

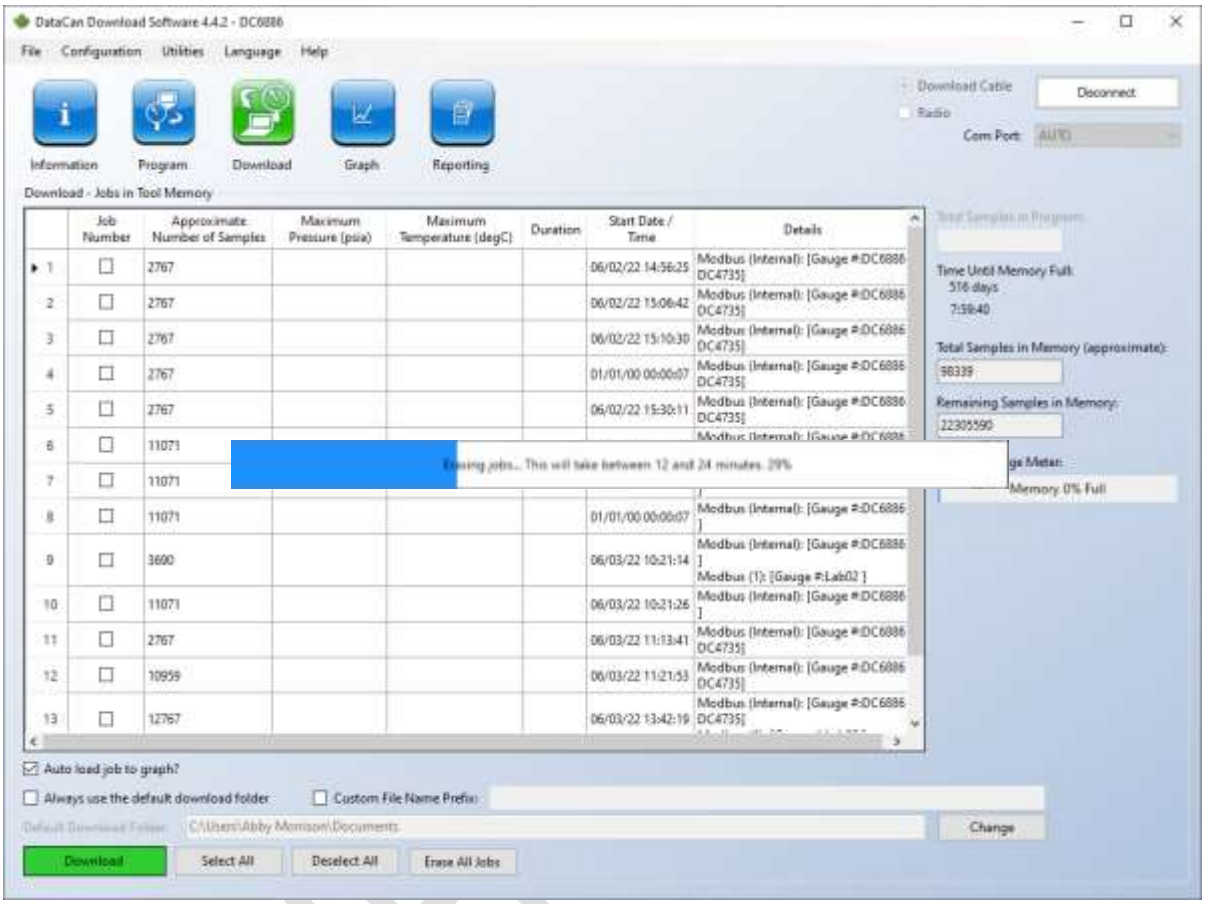
NOTE: It is recommended to erase jobs while not in supervisor mode, it is likely to be significantly faster. Erasing jobs while in supervisor mode formats the entire memory.

1. On the **Download** page, click on **Erase All Jobs.** A confirmation prompt will appear to confirm whether you would like to continue with this action and states the approximate time to erase all jobs to memory depending on the memory filled. Click **Yes** to continue.

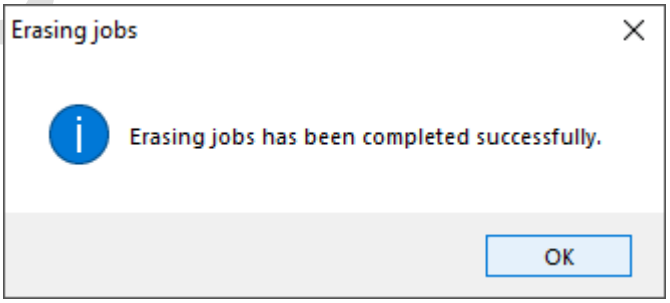




2. A progress bar will appear with the approximate time remaining.



3. After the erase is completed, a dialogue box will appear confirming success.

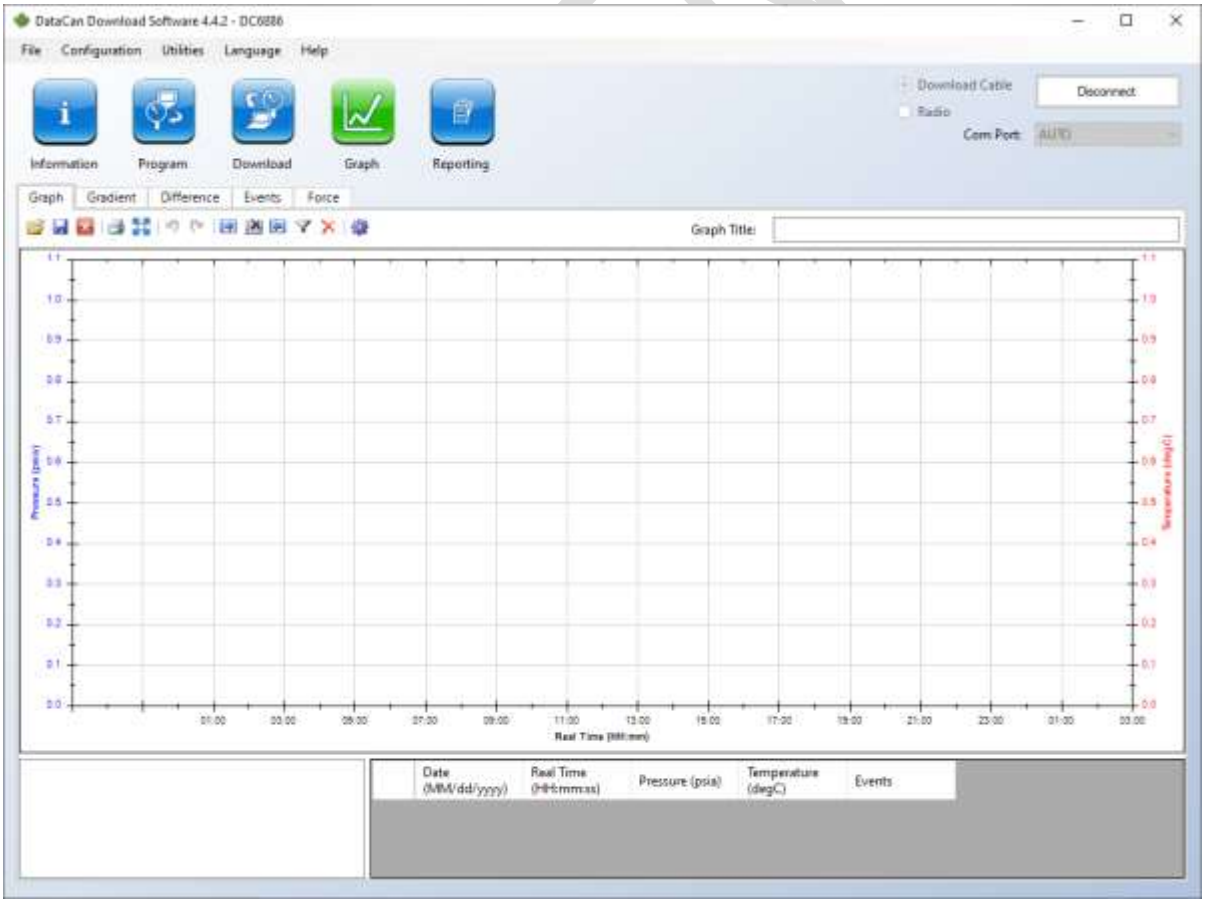


5.6 Graphing Data

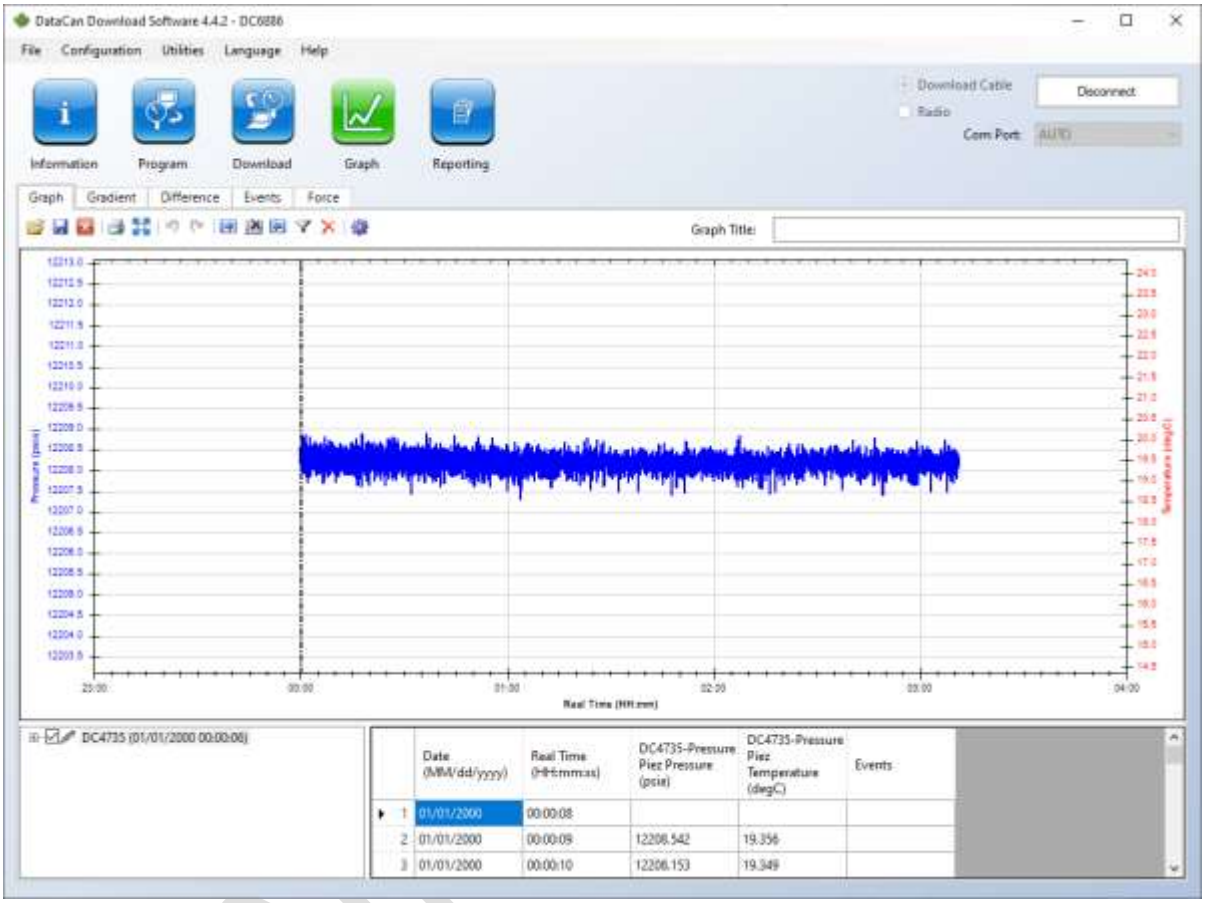
If you wish to display downloaded jobs, you can use the graphing feature. If more than one gauge was connected during a job, the data downloaded is divided into one file per device and one summary file. The summary file has "_Summary(FilesList).txt" at the end of the file name. This summary file can be opened in the graphing software if the user would like to view all gauges from one job at the same time. Alternatively, each file can be opened and viewed individually.

Note: Please refer to the *DataCan Download Software Guide* for a description of all the graphing functionality.

1. Click on the **Graph** button to get to the Graph Page. The page should appear as follows.



2. Press the open file icon  . Once you select your downloaded job, the graph will automatically appear along with the job details in the table below.



5.7 Company Name and Location

Using the DataCan Download Software, you may input the company name and location.

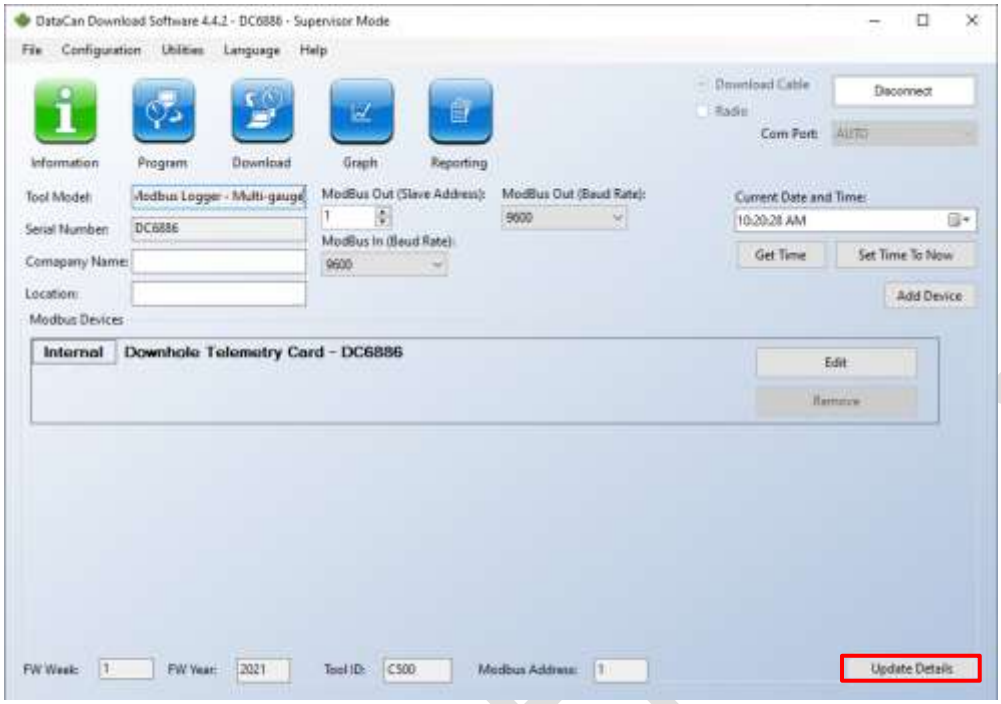
The following instructions describe how you can input this information:

1. Open the DataDan Download software and connect to the Surface box, or if already connected click the **Information** icon.

2. If not already in **Supervisor mode**, enter **Supervisor mode** by pressing **Ctrl+SHIFT+D** at the same time. "-Supervisor Mode" should appear in the top bar.

3. Once in Supervisor Mode, you can edit the fields for "Company Name" and "Location".

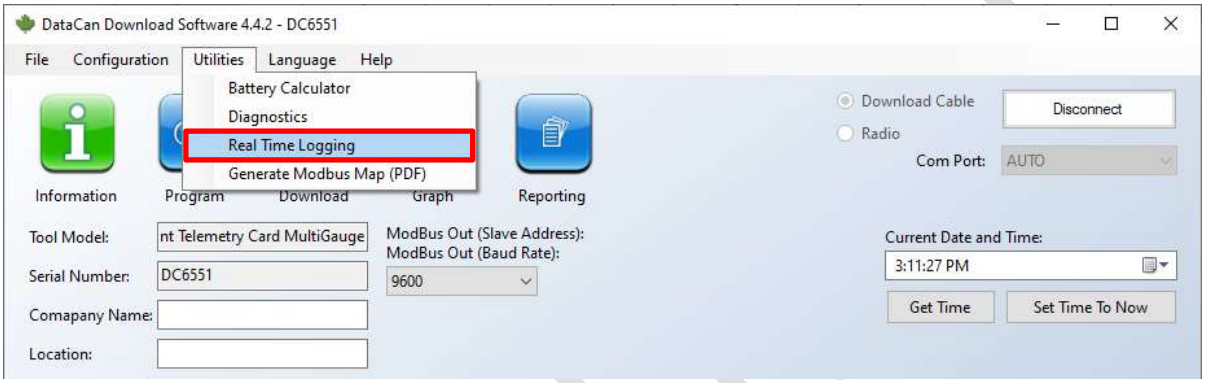
4. Once you are finished, press **Update Details.**



5.8 Real-Time Data Display

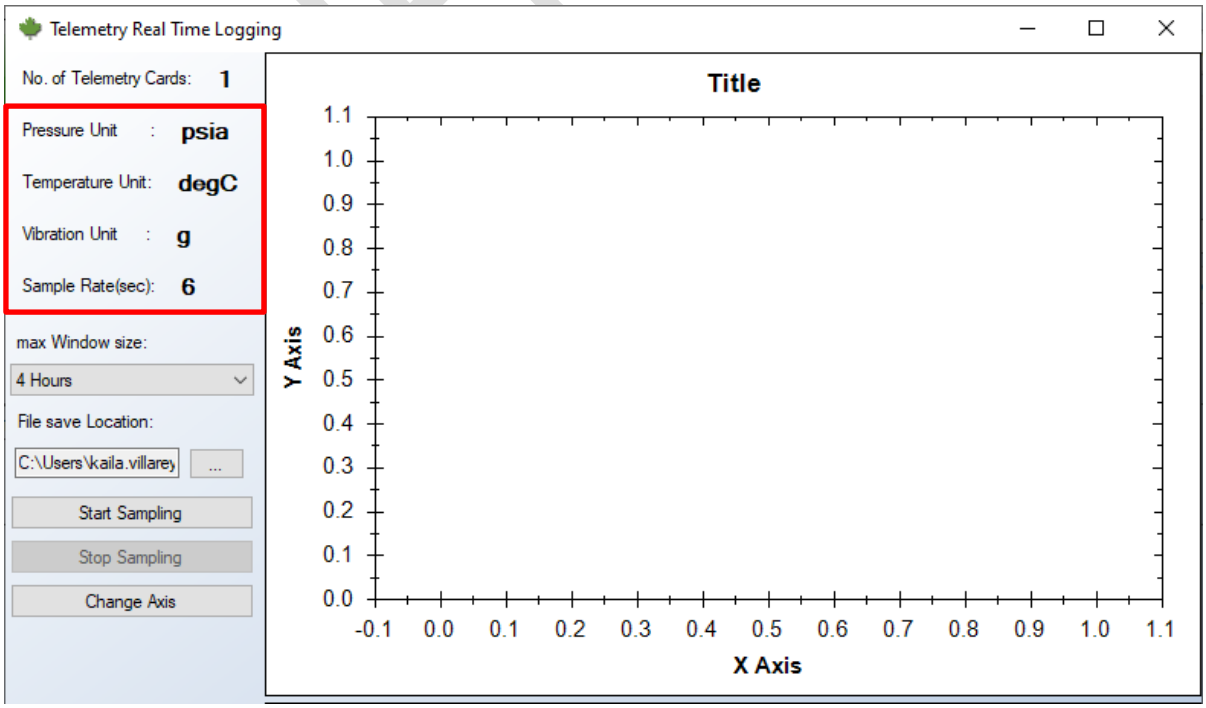
The DataCan Multi-Gauge Telemetry Card can graph data in real-time on a PC and save that graph to the computer.

1. After confirming that all gauges are connected and communicating, and programming the desired sample rate, select **Utilities -> Real-Time Logging**.



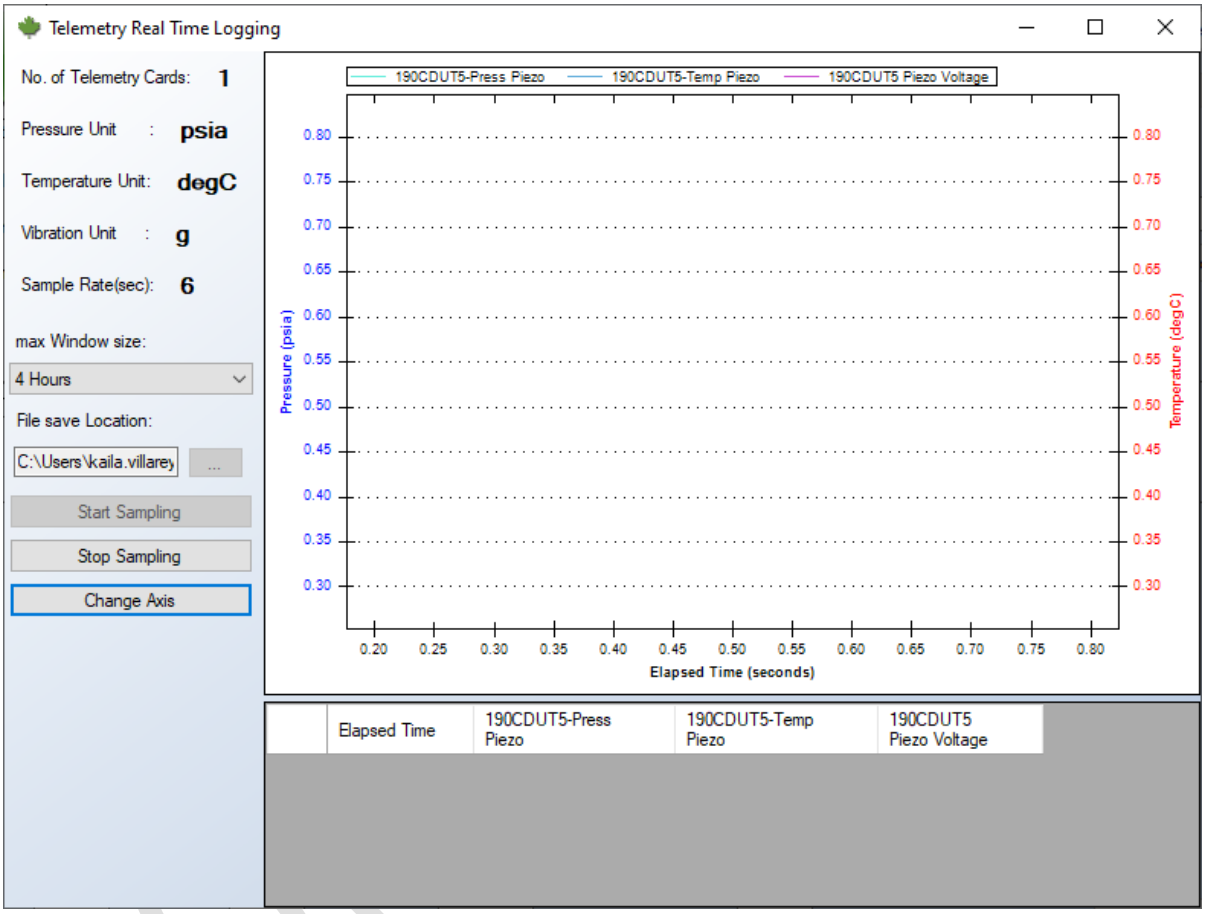
2. A Telemetry Real-Time Logging pop-up window will appear. Ensure the correct units are listed and the Sample Rate is set.

   Note: If you wish to change the units or sample rate, please refer to *Changing Units* and *Programming Sample Rate* respectively.



3. To begin graphing, press **Start Sampling**. The graph will start once the first complete sample set has been collected, and then update every sample interval, displaying a graph of the collected data in real-time.

   Note: The axis of the graph may be changed by clicking **Change Axis** or using your mouse to zoom in by hovering the pointer over the graph and scrolling.



4. To end graphing, click **Stop Sampling.**

   Note: The log is saved to an auto-generated file at the location specified. If you click start sampling when the file location is the same as a previous recorded job, you will OVERWRITE the old file. The data is still recorded in the Telemetry Card memory, but the timing of the Start Sampling and Stop Sampling button presses are lost.

6 Modbus-Out Network (SCADA)

The Surface Box can be connected to a customer SCADA network using RS485 Modbus RTU. This allows for remote monitoring of all the data the Surface Box is collecting. The Modbus-Out port can only connect to one network.

NOTE: If your device is equipped with an ethernet gateway the Modbus-Out network is connected to the gateway and cannot be used to connect to another network. Contact your DataCan representative to confirm the device settings of the gateway. Do not change any of the Modbus-Out Settings unless directed to by DataCan or the gateway will no longer function.

6.1 Modbus-Out Communication Settings

The baud rate and address for the Modbus Out network are visible on the **Information** page when the Surface Box is connected to the DataCan Download Software. The baud rate may be set to 9600, 19200, 38400, 57600, or 115200, and the address may be set to 1-247. The other Modbus communication settings cannot be changed. They are:

Data Bits	8
Parity Bits	None
Stop Bits	1

To change the baud rate or address:

1. Connect the Surface box to a Windows Laptop with the DataCan Download software installed using a USB cable.
2. Open DataCan Download Software and press **Connect.**
3. Enter **Supervisor mode** by pressing **Ctrl+SHIFT+D** at the same time. "-Supervisor Mode" should appear in the top bar.

4. Once in **Supervisor Mode**, you will be able to change the **Modbus Out (Salve address)** and **Modbus Out (Baud Rate).**
5. Once all changes are made, press the **Update Details** button.

6.2 Connecting to the Modbus-Out Network

Connect the data wires from the SCADA system to the **MODBUS OUT** terminal.

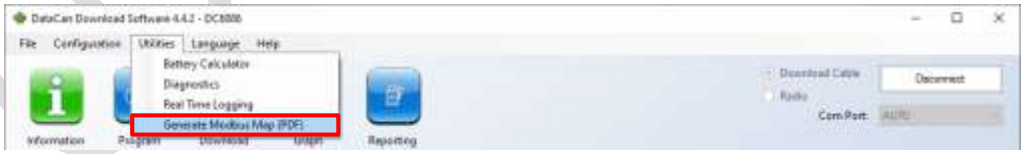
Terminal	Description
B	Modbus B/D(-) signal
A	Modbus A/D(+) signal
GND	Same as VIN [-]/Power[-], only connect if connecting system is on isolated power from surface box

6.3 Modbus-Out Register Map

The location of sensor data in the Modbus map depends on the number and type of gauges the Surface Box is configured to log. The map for a single pressure Permanent Downhole Gauge is shown on the next page. Once all the sensors are connected and configured to the Surface Box, a map of the Modbus registers can be generated.

Note: A copy of the Modbus Map should be saved after setup.

1. Open the DataCan Download Software and click **Connect.**
2. Click **Utilities -> Generate Modbus Map (PDF)**. A file window pop-up will appear.



3. Choose a location and file name then save the PDF.

Note: The PDF will include all the Box setup information, sensor reading registers, and reading types.

Note: The holding and input registers are mapped to the same information. This means polling 3XXXX and 4XXXX give the same number. The map is given in the format 3XXXX, but 4XXXX can also be used.

Modbus Map

Configuration Date & Time		12 Aug 2022 13:06:43	
Modbus Address		2	
Tool Details			
Serial #			
FY:	21	FW:	1
No of Cards	1	Sampling Period	5 Sec(s)
Location Info		Company Info	
Units			
Pressure		psia	
Temperature		degC	
Flow		-N/A-	
Acceleration		g	
Voltage		Volts	
Current		milli Amps	
Modbus Write Locations			
30065		Set Sample Period in seconds format: Low byte followed by high byte Example: 0x0300 for 3 seconds 0x302A for 3 hours(10800 seconds)	
Card Details			
Internal Card			
Serial #			
FY:	21	FW:	1
No of Readings	6	No of Guages	1
Location Info		Company Info	
Guage(s)	TPRM07		
Modbus Reading Locations			
Register	Gauge(Label)	Reading Type	Data Type
31128		Surface Box Input Voltage	Swapped Float
31130		Surface Box Tool Current	Swapped Float
31132	TPRM07 (TPRM07-Pressure Piez)	Multi-Gauge Piezo Permanent - Pressure	Swapped Float
31134	TPRM07 (TPRM07-Temp Piezo)	Multi-Gauge Piezo Permanent - Temperature	Swapped Float
31136	TPRM07	Multi-Gauge Piezo Permanent - Voltage	Swapped Float
31138		Success Counter	Decimal
31139		Failure Counter	Decimal

Example of Modbus Map for Surface Box with Single Downhole Piezo Gauge

6.4 Modbus Data Format

DataCan provides sensor readings in IEEE floating-point format. The number is stored in the Modbus registers in a swapped float. The register given is the location of the Most Significant Word and the Least Significant Word is stored in the register with the next highest address. From the example Modbus map above, the pressure reading will be in registers 30133 and 30134.

Below is a complete breakdown of a request packet and response from the Telemetry Card configured for the above Modbus Map.

Request from SCADA: 03 03 00 80 00 0B 04 07

Talking to the device at address 3, read holding registers starting at register location 0x0080 which is register 30129 and going for (0x0B) 11 registers.

Response from card:

03 03 16 41 3F B2 86 3F D5 BD 00 C6 17 E7 8C 43 26 8B 0E 41 35 F5 6F 00 09 A0 F7

Reply with (0x16) 22 bytes:

30129-30130 (0x413FB286): 11.981 (Surface Box input voltage)

30131-30132 (0x3FD5BD00): 1.670 (Tool Current)

30133-30134 (0xC617E78C): -9721.887 (Pressure)

30135-30136 (0x43268B0E): 166.543 (Temperature)

30137-30138 (0x4135F56F): 11.372 (Tool Voltage)

30139 (0x09): 9 successful tool communications

6.5 Modbus Test Mode and Modbus Debugging

DataCan has two features to aid in setting up and debugging Modbus polling. These features are only available on Firmware versions Y:2022 W:27 and later.

The first register, 30049, is set to a swapped float value of 234.5678. This allows a user to confirm Modbus communication and data formatting with a known value.

Register	Address (HEX)	Contents (HEX)	Contents (Dec)	Content Description
31048	0x417	0x436A	17258	High word of 234.5678
31049	0x418	0x915B	37211	Low word of 234.5678

The second feature is a test mode that, when started, sets the values of registers 30133, 30134, 30135, and 30136 to known values for 120 seconds. The known values are a swapped float reading 123.4567 in register 30133, and a swapped float reading 456.7890 in register 30135. This allows a user to confirm the formatting of the first pressure and temperature readings of the most common sensor setups.

Register	Address (HEX)	Contents (HEX)	Contents (Dec)	Content Description
31132	0x46B	0x42F6	17142	High word of 123.4567/ Usually high word of Press 1
31133	0x46C	0xE9D5	59861	Low word of 123.4567/ Usually low word of Press 1
31134	0x46D	0x43E4	17380	High word of 456.7890/ Usually high word of temp 1
30135	0x46E	0x64FE	25854	Low word of 456.7890/ Usually low word of temp 1

To enter the Modbus test more either:

1. Connect the Surface Box to the downloaded software.
2. Select **Configuration -> Modbus Test Mode.**

OR

Write 0 x 0000 to register 40051.

After 120 seconds, the contents of the registers will return to their regular content. The value of pressure and temperature readings that are recorded to memory is unchanged.

7 Screen Warnings and Errors

Shown on Display	Meaning
"Found internal telemetry only. No external devices found."	The user has only programmed an internal telemetry card and no other devices such as pressure transmitters or external telemetry cards. This message is just informational and a warning only if the user thinks the message is incorrect.
"Found X device(s)."	The Surface Box was able to connect to X devices (including itself) programmed by the user, devices such as pressure transmitters or external telemetry cards.
"Erasing all jobs…"	The user has selected to erase all jobs in the Surface Box memory using the DataCan Download Software, and it is currently in progress.
"Restarting…"	The DataCan Download Software has requested to restart the Surface Box, and it is in progress.
"Logging paused."	The DataCan Download Software has paused logging so that it can complete some user-requested actions. This will clear itself within 10 seconds of the software actions completing.
"No data."	The Surface Box has not received good data from a connected device or no devices are connected. Check electrical connections and power.
WARNING: Tool Current is too low. The tool may be disconnected	The tool's current monitor is reading less than 0.3 mA. Most likely this means a loss of connection to the downhole gauge. Check the connections to the downhole gauge.
"ERROR: Telemetry power fault. Possible short circuit"	The Surface Box has detected a power fault or short circuit on the telemetry connection to the down holes gauge(s). Check the electrical connection to the downhole gauge(s).

WARNING: Input voltage may be too low for telemetry operation.	The Surface Box firmware has measured the input voltage to the Surface Box and determined that it is too low. Please check the input power.
"Updating firmware…"	The user has selected to update the Surface Box firmware, and it is in progress.
"No devices connected or programmed."	The initial setup of the Surface Box has not been completed. Please connect to the DataCan Download Software and set up the system.
"Error – Number of devices found is too large."	The user has programmed more than 100 external devices. Please connect to the DataCan Download Software and correct this.
Data from some gauge(s), but not all.	If a gauge is not responding, its data will not show up on the display. Check the electrical connection to the downhole gauge(s).

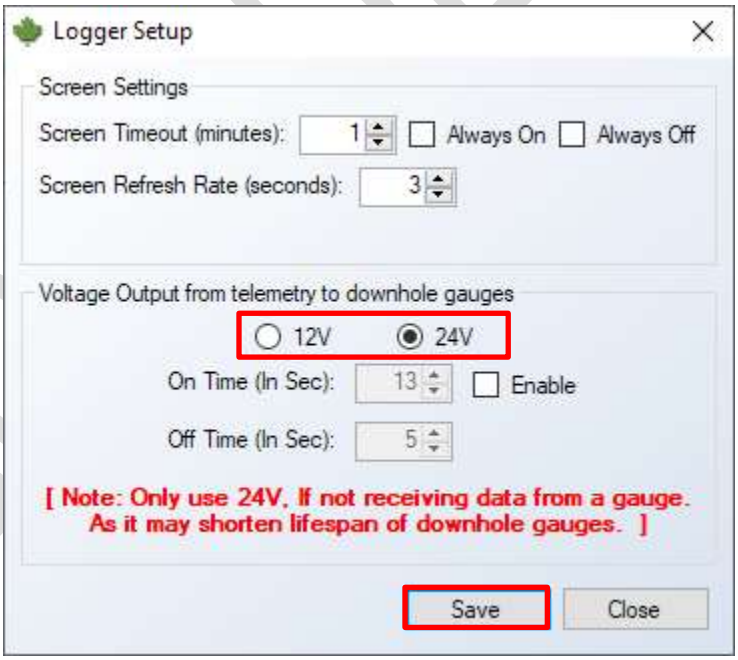
8 Advanced Surface Box Setup

8.1 Output Voltage

The Surface box can output either 12 V or 24 V to the tool line. Lower voltage requires less power and puts less stress on the tools, extending their life. A single tool on a line less than 7 000 m (23000 ft) should be run on 12 V. A pair of tools run on a line less than 4 000 m (13 000 ft) should be run on 12 V. If you have more than 2 tools or depths deeper then described above, you will likely need to run the system at 24 V output.

The following instructions outline how to change the tool line voltage:

1. In the **Logger Setup** window, under the **Voltage Output from telemetry to downhole gauges** heading, you have the option to choose between 12 V and 24 V.



2. Once you have selected the desired output voltage, click **Save.**

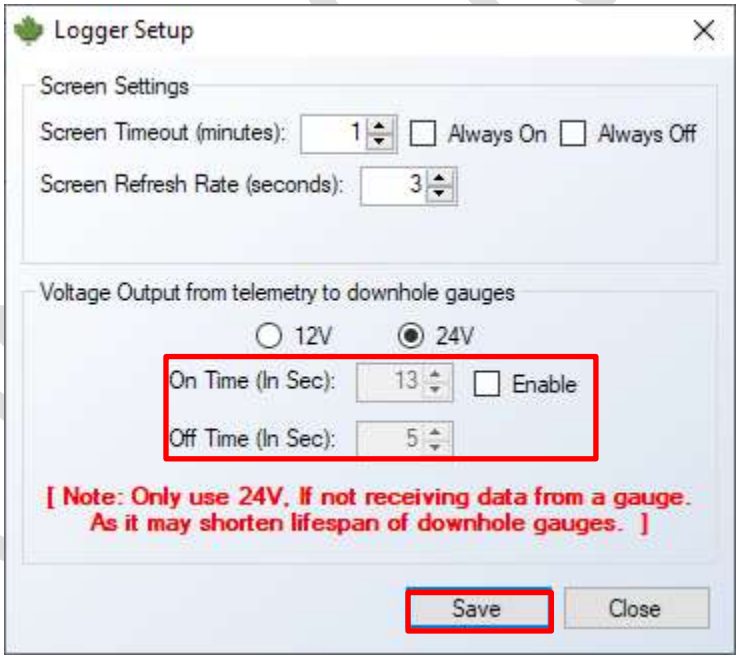
8.2 Power Cycle Timer

Warning: Do not set this timer until after you have finished setting up the sensor and sampling. Trying to change settings when the power is in the off phase, will not work.

The telemetry unit can turn off the power to the connected gauges. The user can set a timer to turn the gauge power on for a time and then off for a time. Turning the power off to the gauges will lower the power to 0.5W of power consumption, extending battery life if needed.

The following instructions outline how to change the power cycle time:

1. In the **Logger Setup** window, under the **Voltage Output from telemetry to downhole gauges** heading, click the **Enable** box. Set the on and off time in seconds.
   Note: The minimum **On Time** is 11 seconds.



2. Once the On and Off times are set, press the **Save** button to store them in the logger.

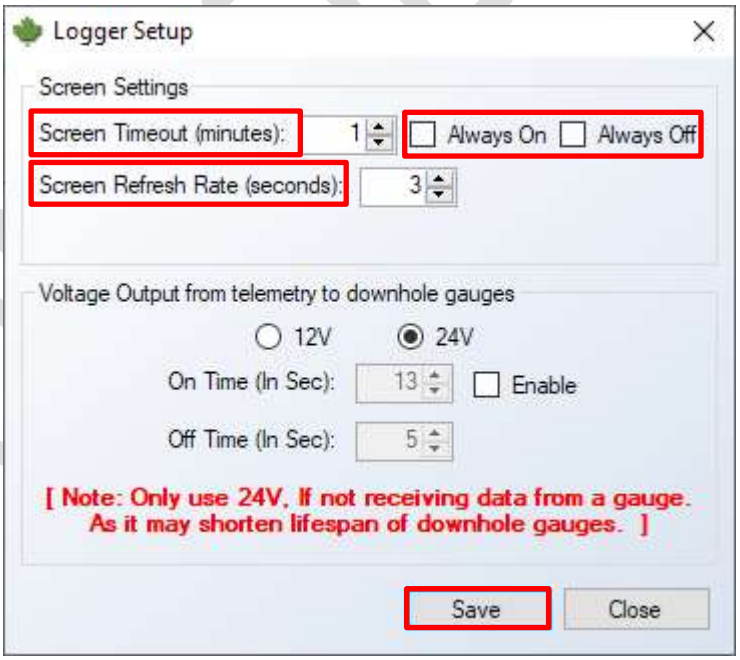
8.3 Screen Settings

The screen on the Surface Box shows a maximum of two readings at a time. The readings also have a label (optional) that can be shown. The green button on the bottom of the Standard Surface Box or the grey button beside the power switch of the Rackmount Unit turns the display screen on and off.

By default, the display screen will automatically turn off after 1 minute. The amount of time before the screen turns off can be changed, or the screen can be set up to be **Always On** or **Always Off** (for data security).

To change the settings:

1. In the **Logger Setup** window, under the **Screen Settings** heading, choose your desired settings.



2. Press the **Save** button to store them to the logger.

9 Surface Box Commissioning Checklist

Surface box serial #: _____

☐ Surface line/test cables are properly connected to Box.

☐ Power is connected and the "DH TOOL COMM INDICATOR" is flashing Blue.

☐ Surface Box is connected via USB cable to DataCan Download Software installed.

Diagnostics screen information:

Sample Period _____ (Sec) Pressure Units _____ Temperature Units _____

Input Voltage _____(V) Tool Current: _____mA

Gauge Information:

1: Serial # _____ Label _____ Press_____ Temp _____ Volt_____

2: Serial # _____ Label _____ Press_____ Temp _____ Volt_____

3: Serial # _____ Label _____ Press_____ Temp _____ Volt_____

4: Serial # _____ Label _____ Press_____ Temp _____ Volt_____

5: Serial # _____ Label _____ Press_____ Temp _____ Volt_____

6: Serial # _____ Label _____ Press_____ Temp _____ Volt_____

7: Serial # _____ Label _____ Press_____ Temp _____ Volt_____

8: Serial # _____ Label _____ Press_____ Temp _____ Volt_____

Surface device readings:_____

Information Page: Modbus Out Address _____ Modbus Out Baud Rate: _____

☐ Modbus Map Generated

Completed By: _____ Date: _____

Location: _____