



Rapidlogger User Manual

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1 Introduction

The Rapidlogger is a rugged and compact job monitoring system for the oilfield and offshore environments. The unit is specially designed for use in the rough oilfield environment. The unit powers the sensors, displays their data, run calculations, and records job information. In addition, the sensor data can be transmitted to a PC in real-time or after the completion of the job. The Rapidlogger panel has been designed to be installed and used in harsh environments. The unit will operate well in direct sunlight, rain, and salt water spray, however protecting it from the elements will extend its life and maintain its appearance. The display on the unit is suitable for viewing in the direct sunlight and is equipped with a backlight for nighttime use.



Figure 1: Rapidlogger Standard Unit

The unit records data to the internal SD memory card any time it is powered on. The user does not have to take any action to start job recording. The job recording capacity varies based on the number of parameters being recorded and the size of the memory card installed. But for reference, if eight parameters are being recorded at a one second interval to a 1 GB memory card then the unit can record continuously for more than two months. An internal battery backed clock maintains job date and time. The clock can be set from the front panel or remotely synchronized to the PC over Ethernet. The standard Rapidlogger can be interfaced with up to sixteen milli-ampere sensors, two depth encoders, and four frequency sensors. Additional sensors can be added via an expansion board.

Internally the Rapidlogger unit is powered by 24 Volts DC. However, based on the installation, the unit may be externally powered from 10-30VDC power supply. Optionally a 90-240VAC power supply is also available. The standard Rapidlogger power supply is shown below. The supply has internal over current protection. A green LED on the power supply indicates the presence of power. The Rapidlogger unit is internally protected by a 1 Amp fuse. This fuse is field replaceable, but it should only be replaced by an electronic technician or an advanced user.

The Rapidlogger Unit is available in five versions. The Rapidlogger Standard, Rapidlogger Max, Rapidlogger Mini, Rapidlogger SE, and Rapidlogger ExD.



Figure 2: From Left to Right Rapidlogger Max, Standard, Mini, SE and ExD

The Rapidlogger is available in two installation configurations. The first is the unit by itself. This is a weatherproof unit suitable for installation on oilfield equipment. In the second configuration the Rapidlogger unit is mounted inside a secondary polycarbonate enclosure. This is the more common configuration. It provides an even greater degree of protection from the elements and is suitable for the very rough duty in extreme weather conditions. The clear front allows for viewing the screen while providing a secondary barrier to ice, rain, sand, and chemicals.

The [RapidVu](#) software for the PC can be used to display the job data in real-time or playback a previously recorded job, and the data downloaded from the Rapidlogger unit is stored in Comma Separated Value (CSV) format for advanced plotting and analysis in programs such as Microsoft Excel. It can also be used to prepare a job report for the client if needed.

The Rapidlogger has five different operation modes for the different job types that the system is meant to be used on. These are the cementing, slickline, N2 and Fracturing pumping, and coiled tubing modes. Different sensors are used in each of these services and the Rapidlogger accommodates the use of all of these sensors. The menu options on the front panel and internal calculations also differ based on the operating mode. In all of the modes the operator has the option to run the Rapidlogger in a standalone manner or with a PC running [RapidVu](#) software. Basic sensor configuration for each operation mode is preprogrammed in to the unit. This sensor configuration allows the Rapidlogger to know about each of the different sensors that is attached. It consists of information about the type of sensor, its range, offset, pulse count, etc. The sensor configuration can be modified in the field from the front panel. More extensive changes to the sensor setup can be done in the field by using the [Rapidlogger Utility](#) program. This program allows an electronic technician or an advanced user to add new sensors, edit the sensor parameters, change configuration, save and load complete configuration settings from configuration backup files, change the time on the unit clock, calibrate the analog inputs and test network connectivity.

1.1 System Certifications

The ATEX Hazardous area certified version of the Rapidlogger System carries an Ex rating as detailed below. Note that the units that carry the certification are identified with ATEX labels.

The Main Rapidlogger enclosures is marked: **CE** II 3GEx nA IIC T5 Gc $-20^{\circ}\text{C} \leq T_a \leq +60^{\circ}\text{C}$, this allows the use of the system where the main enclosure is placed in a Zone 2 environment. The barrier enclosures is marked: **CE** II 3(1)(2) G Ex e nA nC [ia] [ib] IIB T4 $-20^{\circ}\text{C} \leq T_a \leq +60^{\circ}\text{C}$. The maximum temperature is based on testing but cannot be greater than $+60^{\circ}\text{C}$. See certificate in Appendix A. Note that while the system may continue to operate at temperatures exceeding $+60^{\circ}\text{C}$ but the certification is only valid for the stated temperature ranges.

All of the sensors accompanying an ATEX certified Rapidlogger System are marked: see their certificate in Appendix A.

For repair please contact: sales@rapidlogger.com

1.2 System Specifications

Analog Inputs	16 x 24bit, 8 4-20mA, 8 0-10V
Analog Outputs	4 x 16bit, 4-20mA
Frequency/Depth Inputs	8 max 32bit
Digital Outputs	8 PWM capable
Display	LCD w/ Backlight
Computer Interface	Ethernet, Serial
Sensor Bus	Modbus/RTU, Modbus/TCP, CAN
Power	12/24DC, 110/240AC
Program Memory	64MB RAM, 32MB Flash
Job Memory	1GB-16GB SD card
Operating Temperature	-40°C to 70°C
Ingress Protection	NEMA 4X - IP67
Drop Specification	4 ft drop to concrete
Shock Rating	40g per MIL-STD 810F
Vibration Rating	28g Peak per MIL-STD 810F

1.3 Mode Selection

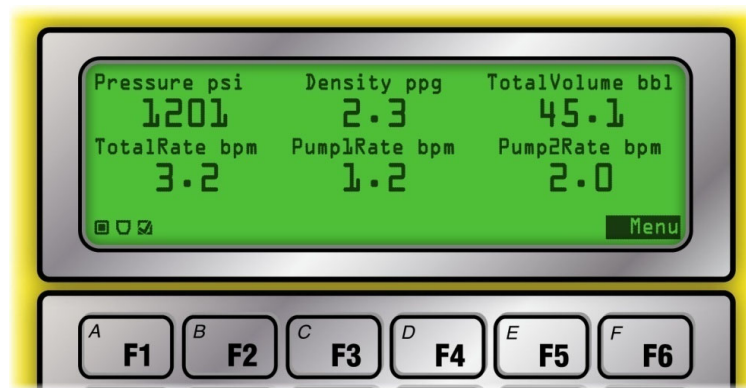
The Rapidlogger has five different operation modes for the different job types that the system is meant to be used on. These are the cementing, slickline, N2 and Fracturing pumping, and coiled tubing modes. These modes can be selected through the menu using the following short cuts.

- F6 Menu
 - Press F6 System menu
 - F4 Generic Set-up
 - F5 RST (Reset to any of the following mode)
 - F1 Cement mode
 - F2 Slickline mode
 - F3 N2 Pump mode
 - F4 Coiled Tubing mode
 - F5 Fracturing pumping mode
 - F6 > F6 > F4 Drilling mode
 - F6 ► for more options (Reset to any of the following mode)
 - F1 ◀ Go Back to previous screen
 - F2 Sim Cement mode
 - F3 Sim Slick mode
 - F4 Sim CT (Coil Tube) mode
 - F5 Rock
 - F6 ► for more options (Reset to any of the following mode)
 - F1 ◀ Go Back to previous screen
 - F2 SimRoc mode
 - F3 Generic mode
 - F4 Drill mode
 - F5 ModeR
 - F6 ► for more options (Reset to any of the following mode)
 - F1 ◀ Go Back to previous screen
 - F2 J19Dmo
 - F3 Mode Y

1.4 Monitoring and Recording Data

Upon power up, the Rapidlogger unit automatically starts acquiring data from the attached sensors. The data is also recorded automatically on the internal SD memory card. This means that no user input or intervention is required for a simple job. The job data will be automatically displayed and recorded.

Once the Rapidlogger has been powered up, its screen displays job information in the following format. While the system only shows up to 6 parameters on the LCD panel, many more parameters can be recorded to the SD memory card and transmitted to the PC over the network.



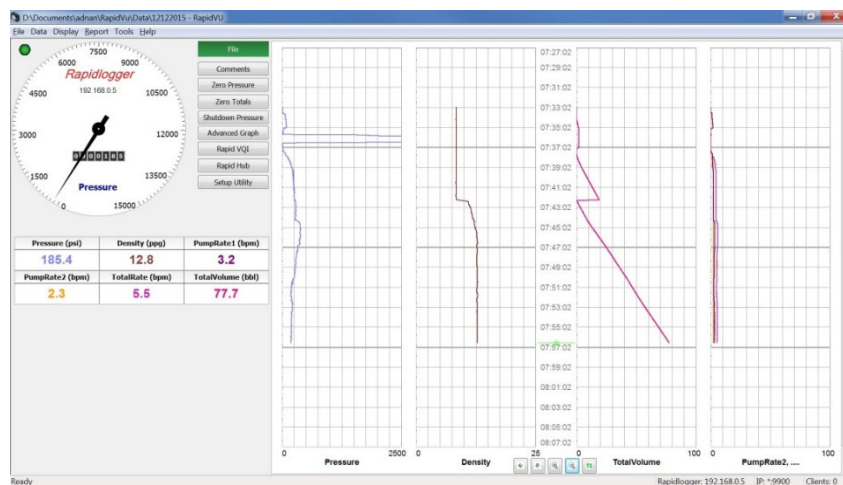
Here each of the displayed parameters has its name and units shown above the data. On the bottom left of the screen there are three status indicator icons. The left most icon flashes every time data has been read or acquired from the sensors. The middle icon flashes to indicate that data has been transmitted over the network to

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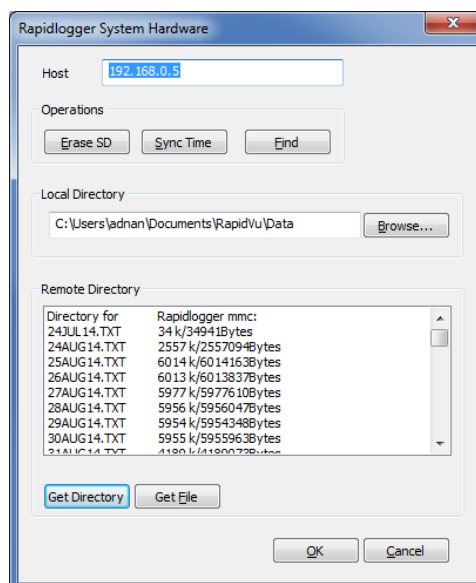
the PC, while the rightmost icon indicates proper data recording activity. If data is being successfully recorded this icon shows a check mark. In case the SD flash memory card is full, missing or not operational the check mark is replaced by an 'X'. The menu indicator on the bottom right shows that the user can to press the **F6** key below the legend "Menu" to activate the user menus.

Job data can be downloaded during the job in real-time using the **RapidVu** program. This program can be used to display job data, plot graphs, and generate job files. The Rapidlogger PC program can also be used to play back previously recorded jobs that have been downloaded from the SD Memory card or those that have been recorded on the PC. The Rapidlogger records data to its internal memory card in plain text format. This **RapidVu** program records the data in the same format but also creates a copy of every job file it plays back in CSV format and stores it in the same folder on the PC as the other job files. The CSV format is text files that has comma separated values which can be directly imported into excel for advanced plotting and analysis.

Note: In Windows 7, XP, 2000, and Vista it is possible to change the "List Separator" character from a comma to another character, this will cause problems in reading the CSV files generate by Rapidlogger. For example, if the Windows operating system is configured for the Latin America region the "List Separator" is configured to be a Semi-Colon. In this case for the CSV import to work properly the user would have to change the list separator back to a Comma. This is done from the Windows control panel's region and language settings.



If needed the job data can be downloaded after the job via an Ethernet cable by using the **Rapidlogger Hardware** menu in the **RapidVu** program. After the data has been downloaded, the internal SD card should be periodically erased to keep space available for new job recordings. In general, the SD Memory card should be erased with this program or from the front panel menus at least once every 10-20 jobs. Doing so ensures sufficient space on the SD memory card and prevents data corruption or loss.

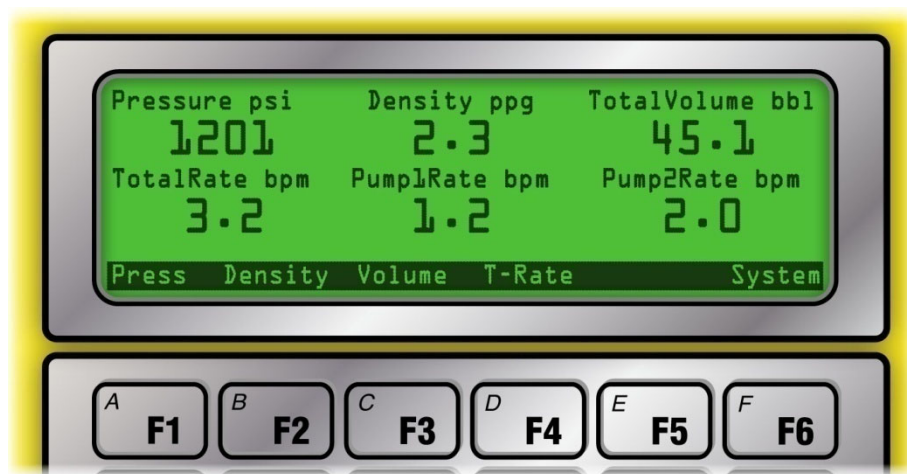


2 Rapidlogger Operation Section

2.1 Cementing and Pumping Mode

When the Rapidlogger unit is operated in the cementing mode, all of the on screen menu options are specifically configured for cementing operations. Pump pressure, density, total volume, total rate, pump rate 1, and pump rate 2 are the parameters that are displayed on the screen. The screen can be configured to show either all six of these parameters or only the first four. While the system only shows up to 6 parameters on the LCD panel, many more parameters can be recorded to the SD memory card and transmitted to the PC over the network.

Once powered on the Rapidlogger starts displaying and recording data automatically. The user can access the cementing menus by pressing **F6**. When **F6** is pressed the following menu appears on the screen and the user can edit settings for pressure, density, total volume, and rate.



Pump Pressure

Pump pressure is the first parameter displayed on the Rapidlogger screen. The pump pressure on a cementing unit is generally measured with a pressure transducer in the main treating line. In order to edit the pressure readings press **F6** and then **F1** from the main screen and the following menu will appear

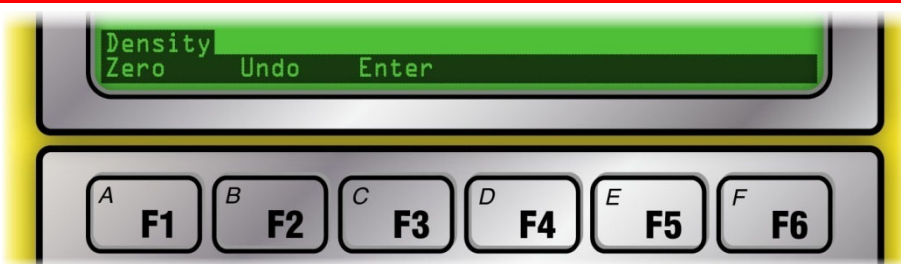


Now press **F1** to zero out the pressure. This option is used to clear out a small pressure offset from the variable when it is known that the pressure should be zero or atmospheric. In order to clear out the pressure offset or undo the zeroing of the pressure variable press **F2**. If the actual pressure is known such as due to a calibration or dead weight test or from a calibrated client pressure gage, and the Rapidlogger reading needs to match that calibrated reading, press **F3** and the system will allow you to enter a new pressure value. Powering the system off and then on again will clear out this pressure offset value.

Slurry Density

The cement slurry density is the second parameter displayed on the Rapidlogger screen. The density is measured by means of a densitometer installed on the treating line. In order to edit the slurry density readings press **F6** and then **F2** from the main screen and the following menu will appear

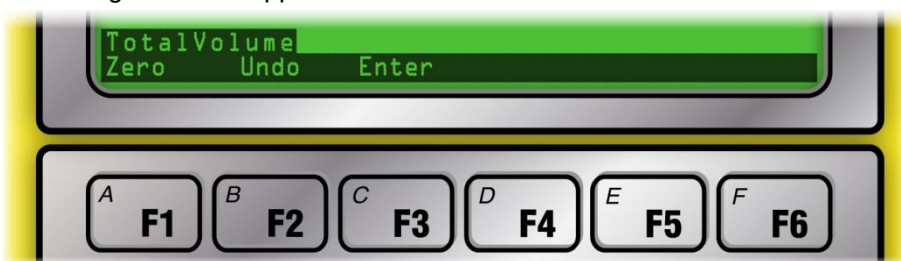
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Now press **F1** to zero out the density. This option is used to clear out any small offset in the density value variable when it is known that the density should be zero. In order to clear out the density offset or eliminate the zeroing process press **F2**. If the actual density is known, such as due to a calibration with pure water or from a calibrated client densitometer, press **F3** and then you can enter a new density value which will be stored in the system only for that particular session. Powering the system off and then on again will clear out this density offset value.

Total Volume

The total volume is the third parameter displayed on the Rapidlogger screen. The total volume is measured by means of a flowmeter or a pump stroke counter. In order to edit the total volume press **F6** and then **F3** from the main menu and the following menu will appear



Now press **F1** to zero out the volume. This option is used to clear out the total volume. This is sometimes needed when the pump has been idling for some time or if some slurry recirculation was performed before the beginning of the actual pumping operation. In such cases the user needs to zero out the volume. The zeroed volume can be undone by pressing the **F2** key. If the pumped volume is known (for example in the beginning of a new stage) or if the user needs to otherwise set the total pumped volume to a new value press **F3**. This will give the user an opportunity to enter the new total volume.

Total Rate

The total rate is the seventh parameter (first on the second page) displayed on the Rapidlogger display. For double pump units the total rate is the sum of the pump rate from both pumps. If the Rapidlogger is used on a single pump unit then the total rate is the same as the pump rate of the first pump. The rate variables in the Rapidlogger cannot be zeroed or modified while the system is running a job. This feature has been intentionally designed to prevent errors in the totalized values.



Pump 1 Total Volume & Pump 2 Total Volume

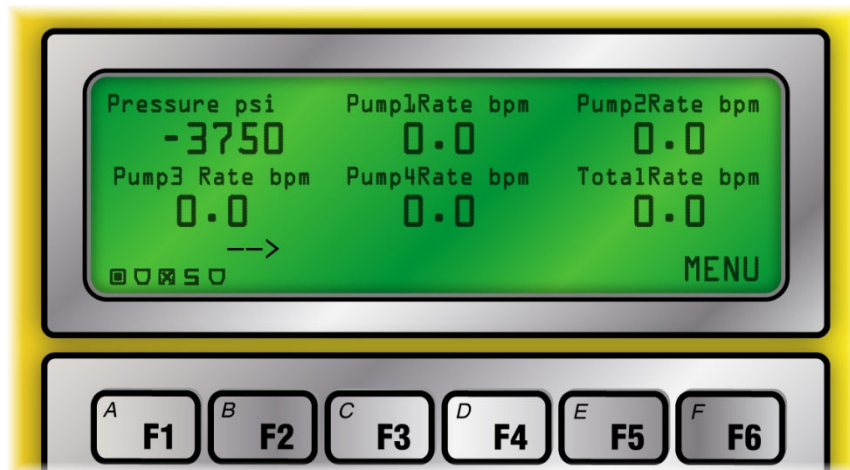
The pump 1 and pump 2 volumes are the fifth and sixth variables displayed on the Rapidlogger display. For double pump cementers these variables display the individual pump volumes. For single pumps the pump1 volume is the only variable used. In order to edit the pump 1 or pump 2 Total volumes, press F6 and then F4 for

pump 1 or F5 for pump 2. Now press F1 to zero out the volume, F2 to undo the effects of zeroing or entering a new value or F3 to enter a new value for the volume,

2.2 Fracturing Mode

When the Rapidlogger unit is operated in the fracturing mode, all of the on-screen menu options are specifically configured for fracturing operations. In this mode each Rapidlogger unit can support up to four pumps, however it is preferred to operate only two pumps for each Rapidlogger unit. Pumping pressure, density, total volume, total rate, pump rate 1, pump rate 2 are the parameters that are displayed on the screen. Pump rate 3, pump rate 4 are not displayed on the screen but are recorded and transmitted to the PC.

Once powered on the Rapidlogger starts displaying and recording data automatically. The user can access the fracturing menus by pressing **F6**. When **F6** is pressed the following menu appears on the screen and the user can edit settings for pressure, density, total volume, and rate.



Pump Pressure

Pump pressure is the first parameter displayed on the Rapidlogger screen. The pump pressure on a fracturing unit is generally measured with a pressure transducer in the main treating line. In order to edit the pressure readings press **F6** and then **F1** from the main screen and the following menu will appear



Now press **F1** to zero out the pressure. This option is used to clear out a small pressure offset from the variable when it is known that the pressure should be zero or atmospheric. In order to clear out the pressure offset or undo the zeroing of the pressure variable press **F2**. If the actual pressure is known such as due to a calibration or dead weight test or from a calibrated client pressure gage, and the Rapidlogger reading needs to match that calibrated reading, press **F3** and the system will allow you to enter a new pressure value. Powering the system off and then on again will clear out this pressure offset value.

Pump 1, Pump 2, Pump 3, and Pump4 Rates

The pump 1 through and pump 4 rates are the next four parameters displayed on the Rapidlogger display. Pump rates cannot be edited during a job. This is necessary to prevent errors in the pump volume calculations being done.

Total Rate

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The total rate is the sixth parameter displayed on the Rapidlogger display. If multiple fracturing pumps are being monitored with one Rapidlogger unit then the sum of the pump rates from the pumps is shown as the total rate. If the Rapidlogger is used on a single pump unit then the total rate is the same as the pump rate of the first pump. The rate variables in the Rapidlogger cannot be zeroed or modified while the system is running a job. This feature has been intentionally designed to prevent errors in the totalized values.



Total Volume

The total volume is the seventh parameter displayed on the Rapidlogger screen. The total volume is measured by means of a flowmeter or a pump stroke counter. In order to edit the total volume press **F6** and then **F3** from the main menu and the following menu will appear



Now press **F1** to zero out the volume. This option is used to clear out the total volume. This is sometimes needed when the pump has been idling for some time before the beginning of the job or if some recirculation was performed before the beginning of the actual pumping operation. In these cases, the user needs to zero out the volume. The zeroed volume can be undone by pressing the **F2** key. If the pumped volume is known (for example in the beginning of a new stage) or if the user needs to otherwise set the total pumped volume to a new value press **F3**. This will give the user an opportunity to enter the new total volume. (can not enter a new value of Total volume)

Proppant Density

The density is measured by means of a densitometer installed on the treating line. The proppant density is normally not displayed on the Rapidlogger screen. However, if the setup has been modified by the user to display proppant density on the local screen then proppant density readings can be edited. In order to do so press **F6** and then **F2** from the main screen and the following menu will appear

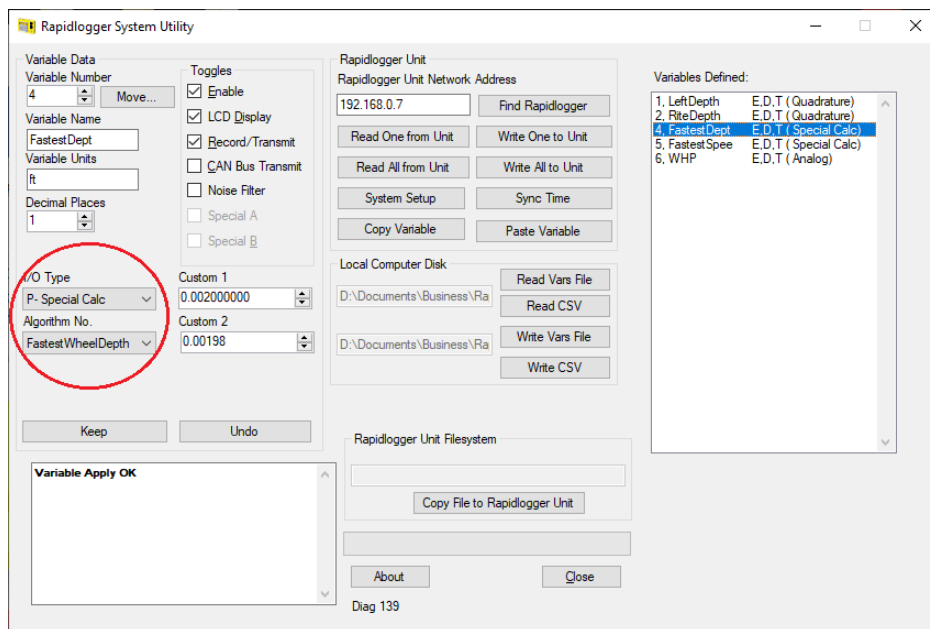


Now press **F1** to zero out the density. This option is used to clear out any small offset in the density value variable when it is known that the density should be zero. In order to clear out the density offset or eliminate the zeroing process press **F2**. If the actual density is known, such as due to a calibration with pure water or from a calibrated client densitometer, press **F3** and then you can enter a new density value which will be stored in the system only for that particular session. Powering the system off and then on again will clear out this density offset value.

2.3 CT Injector Mode

When the Rapidlogger is used as an explosion proof CT Injector remote device (Rapidlogger ExD). The same software and firmware will be used on the Rapidlogger ExD as the standard Rapidlogger. However, the setup would be different.

In this mode the Rapidlogger ExD is interfaced to one or two depth encoders and a wellhead pressure sensor. If two encoders are connected the Rapidlogger ExD runs the fastest wheel algorithm. This results in a much more accurate depth measurement than simply using one encoder and depth wheel.



In order to wire up the CT Injector mode, the A and B signal from one encoder would be wired in to the Q1A and Q1B terminals on the Digital Inputs terminal block. The second encoder should be wired in to the Q2A and Q2B terminals on the Digital Inputs terminal block. The power and ground of the encoder should be wired in to the GND and +V of the same terminal block.

The Well head pressure sensor should be wired in to the A1 terminal and the +V terminal of the Analog input terminal block.



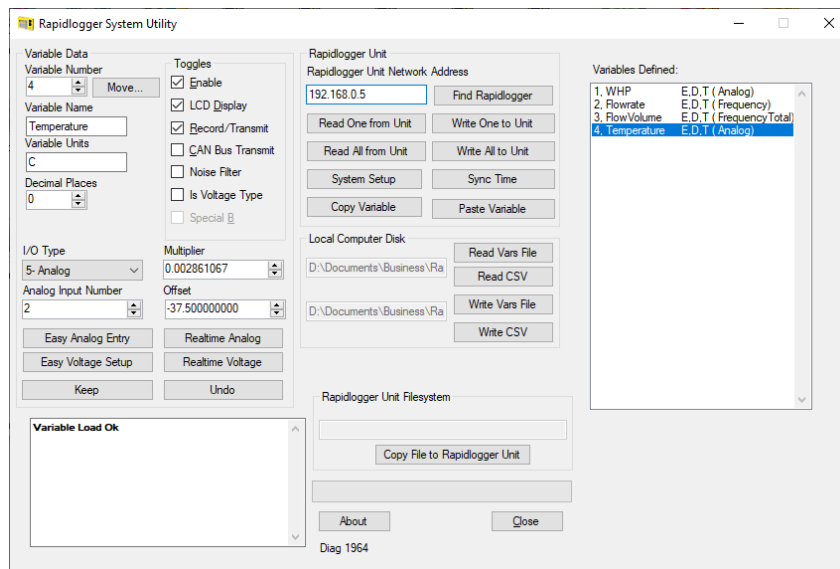
The fastest wheel algorithm can be programmed using the Rapidlogger Utility. It is available on the IO type drop down menu under Special Calc. Use Algorithm No FastestWheelDepth. The Custom 1 entry box should contain the Kfactor for the first encoder. The Custom 2 entry box should contain the Kfactor for the second encoder. Similarly, the speed should be selected using the algorithm FastestWheelSpeed. There are no multipliers required for speed.

The fastest wheel algorithm is available in Rapidlogger firmware starting from Version 9.9AP. Rapidlogger Utility version 4.67 or newer is required to setup the algorithm.

A four-conductor armored cable can be used to bring the wellhead data back to the safe area or monitoring station. This can be wired to use CAN bus or MODBUS RTU (as needed by the user). Alternatively, the ethernet connector inside the Rapidlogger ExD can be utilized to transmit the data over an armored ethernet cable. If an ethernet connection is utilized then the data can be transmitted using MODBUS-TCP, Rapidlogger Protocol, or WITS-0 as needed.

2.4 Wellhead Monitoring Mode

When the Rapidlogger is used as an explosion proof wellhead device (Rapidlogger ExD). The same software and firmware is used on the Rapidlogger ExD as the standard Rapidlogger. However, the setup would be different. In Wellhead Monitoring Mode the Rapidlogger is programmed for WHP, Flowrate and Valve position.

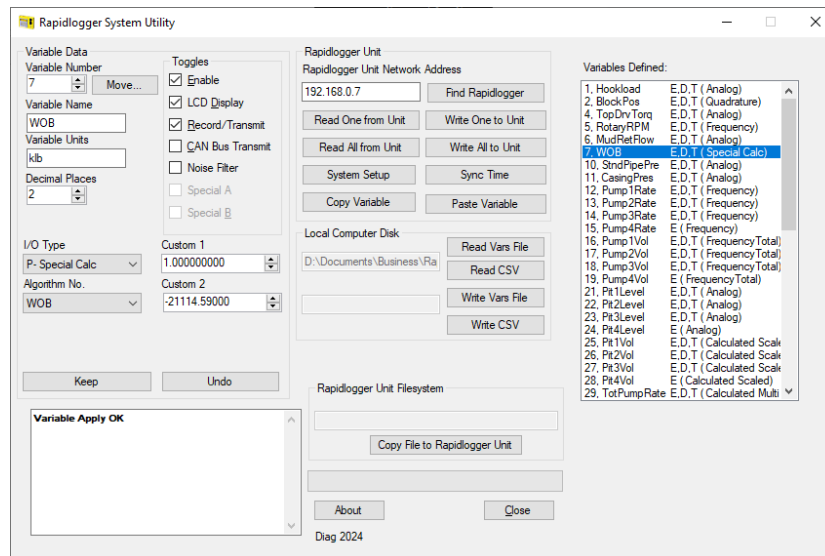


A four-conductor armored cable can be used to bring the wellhead data back to the safe area or monitoring station. This can be wired to use CAN bus or MODBUS RTU (as needed by the user). Alternatively, the ethernet connector inside the Rapidlogger ExD can be utilized to transmit the data over an armored ethernet cable. If an ethernet connection is utilized then the data can be transmitted using MODBUS-TCP, Rapidlogger Protocol, or WITS-0 as needed.



2.5 Drilling Mode

When the Rapidlogger Max is used as a drilling EDR then the setup is done at the Rapidlogger factory. This is because of the complexity of the setup. If the user wants to setup the drilling mode themselves then they can request a sample drilling mode setup file from Rapidlogger support.



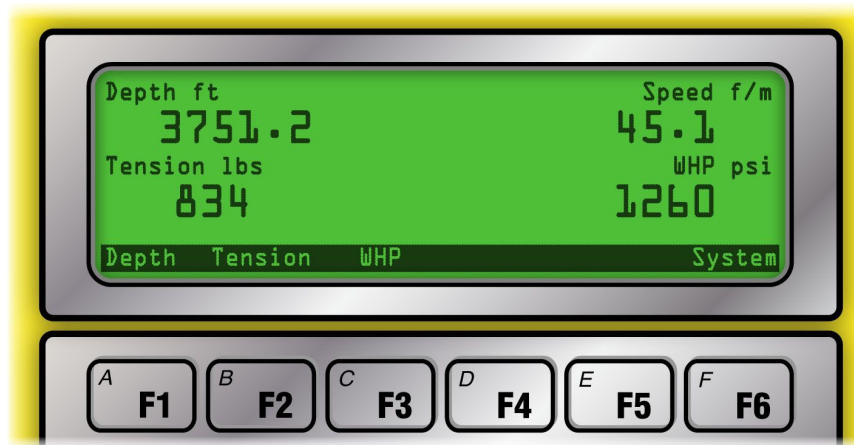
The drilling specific special calculation algorithm that can be used are

```
ALGORITHM_SLIP_POS
ALGORITHM_PIPE_DPT
ALGORITHM_SLIP_LOAD
ALGORITHM_BIT_DPT
ALGORITHM_HOLE_DPT
ALGORITHM_TON_MILE
ALGORITHM_ROP
ALGORITHM_ROP_AVG
ALGORITHM_WOB
ALGORITHM_WOB_AVG
ALGORITHM_WOB_MAX
ALGORITHM_ROP_MAX
ALGORITHM_TDRPM
ALGORITHM_TDRPM_AVG
ALGORITHM_TDRPM_MAX
```

ALGORITHM_SPPress_MAX
ALGORITHM_CasePres_MAX
ALGORITHM_DiffPres
ALGORITHM_CircTime_Tot
ALGORITHM_TDTorq_AVG
ALGORITHM_MudVol_IN
ALGORITHM_MudVol_OUT
ALGORITHM_FastestWheelDepth
ALGORITHM_FastestWheelSpeed

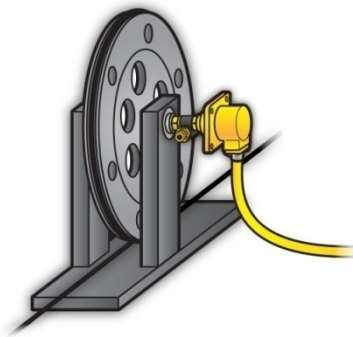
2.6 Slickline Mode

When the Rapidlogger unit is operated in the slickline mode all of the on-screen menu options are specifically configured for slickline operations. Depth, speed, tension and wellhead pressure are the parameters that are displayed on the screen. The screen is configured to show these four parameters. However, the user can program additional parameters and configure the screen to show up to 6 parameters. More than 6 parameters can be recorded to the SD card.

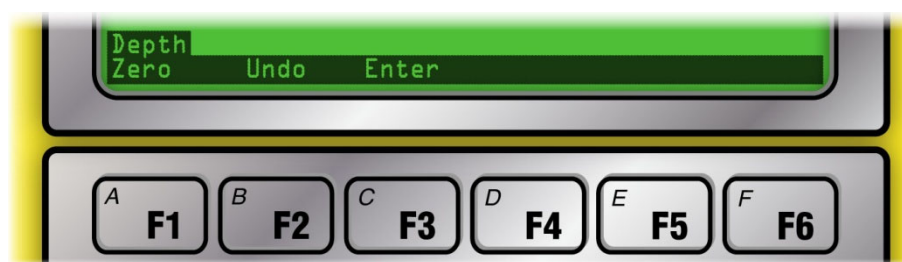


Depth

Depth is the first parameter displayed on the Rapidlogger screen when it is in the slickline mode. On a slickline unit depth is usually measured with a depth encoder mounted on the friction wheel. This encoder turns with the friction wheel and records the length of the slickline that has been paid out from the winch.



In order to edit the Depth variable on the Rapidlogger press **F6** and then **F1** from the main menu and the following menu will appear.

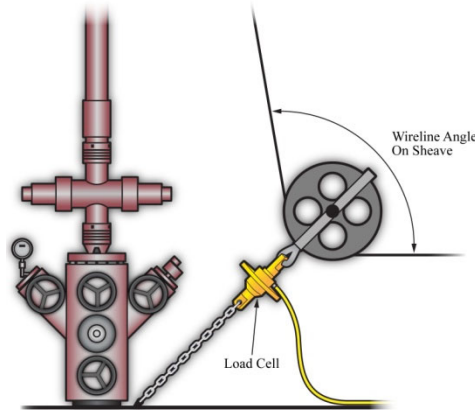


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Now press **F1** to zero out the depth. This is useful at the beginning of a job when the slickline drum has been rotated and the depth is not zero or when the tool is tagged to the Kelly bushing or any other reference depth. The zero offset is applied to that job only and is not stored in the system once it is powered down. The zeroed depth value can be undone by pressing **F2**. This causes the applied depth offset to be erased and the depth becomes the same as before the zeroing. If a new depth needs to be entered such as when the tool is tagged to a known downhole depth, then pressing **F3** from this menu allows the operator to enter a new depth. This new depth is stored as the depth offset in the system for this job only and is erased when the unit is powered down.

Speed

Speed is the second parameter displayed on the Rapidlogger screen when it is in the slickline mode. On a slickline unit speed is calculated from the change in depth. The speed variable in the Rapidlogger cannot be zeroed or modified while the system is recording a job. This feature has been intentionally designed to prevent errors in the depth value.



Tension

Tension is the third parameter displayed on the Rapidlogger screen when it is in the slickline mode. On a slickline unit, line tension is usually measured by means of a load cell mounted on the bottom sheave. The slickline passes under the bottom sheave, pulling tension on to the load cell.

This electrical signal for line tension is transmitted to the Rapidlogger unit, where it is digitized, displayed and recorded. The tension variable on the Rapidlogger can be adjusted to account for small variation in the tension reading due to calibration error or temperature. In order to edit the tension variable on the Rapidlogger from the main menu, press **F6** and then **F2** and the following menu will appear.



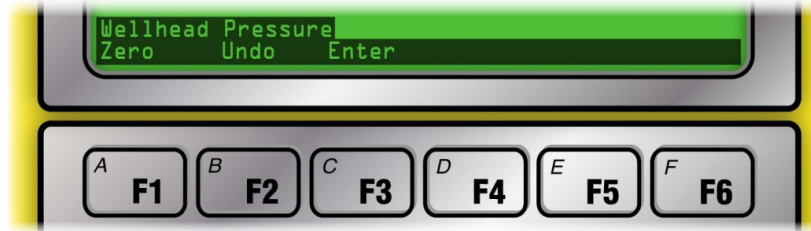
Now press **F1** to zero out the tension. **Care must be taken while zeroing out the line tension. If a large number is zeroed out then the slickline unit operator will no longer be aware of the true line tension.** Zeroing out line tension is useful at the beginning of a job when the slickline tension is off by some small amount. The zeroed tension value can be undone by pressing **F2**. This causes the applied tension offset to be erased and the tension becomes the same as before the zeroing. If a new tension needs to be entered, pressing **F3** from this menu allows the operator to enter a new tension. This new tension is stored as the tension offset in the system for this job only and is erased when the unit is powered down.

Wellhead Pressure

Wellhead pressure (WHP) is the fourth parameter displayed on the Rapidlogger screen when it is in the slickline mode. The wellhead pressure on a slickline unit is generally measured with a pressure transducer installed on a

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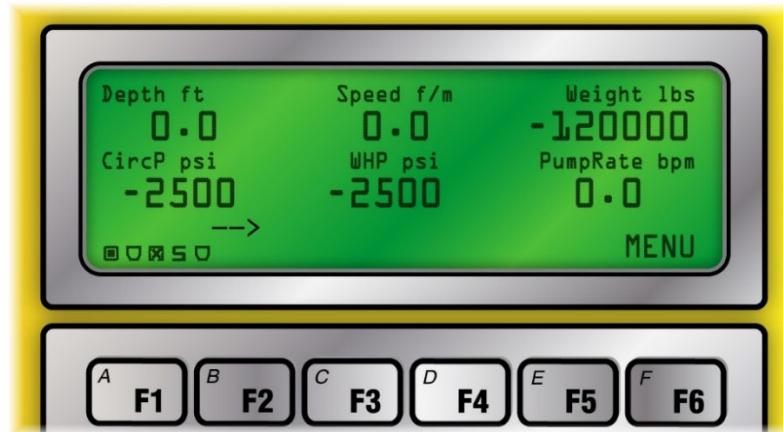
pressure line connected to the wellhead. In order to edit the wellhead pressure readings, press **F6** and then **F3** from the main screen and the following menu will appear



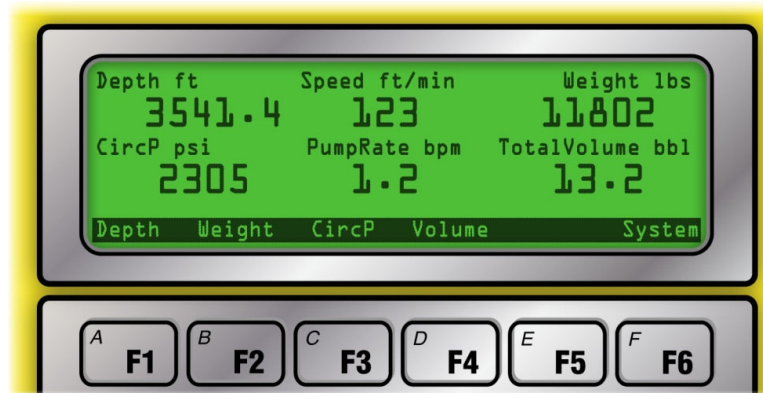
Now press **F1** to zero out the WHP. The zeroed WHP value can be undone by pressing **F2**. If an accurate value of WHP is known such as from a calibrated client sensor, then the new WHP can be entered in to the Rapidlogger by pressing **F3** from this menu. This new WHP is stored in the system for this job only and is erased when the unit is powered down.

2.7 Coiled Tubing Mode

When the Rapidlogger unit is operated in the coiled tubing mode all of the on-screen menu options are specifically configured for coiled tubing operations. Depth, speed, weight, circulating pressure, pump rate, and pump volume are the parameters that are displayed on the screen. The screen is configured to show these six parameters.



However optionally the user can choose to show only 4 parameters and setup the system in this manner. Once the user presses the **F6** key the following menu appears and the user can then proceed to make further selections.

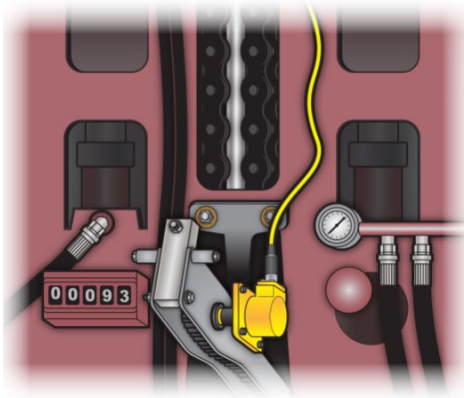


Depth

Depth is the first parameter displayed on the Rapidlogger screen when it is in the Coiled Tubing mode. On a coiled tubing unit depth is usually measured with a depth encoder mounted on a friction wheel that runs against

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on the coiled tubing. The encoder turns with the friction wheel and records the length of the coiled tubing that has passed through the CT injector. A typical coiled tubing injector encoder installation is shown below.



In order to edit the Depth variable on the Rapidlogger press **F6** and then **F1** from the main menu and the following menu will appear.



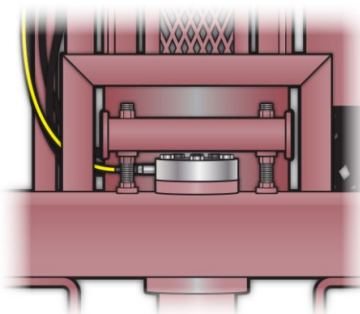
Now press **F1** to zero out the depth. This is useful at the beginning of a job when the coiled tubing is being moved up and down while trying to install a BHA assembly on the end. Thus, the depth is not zero when the coiled tubing BHA or connector is tagged to the stripper or other reference depth. The zero offset is applied to that job only and is not stored in the system once it is powered down. The zeroed depth value can be undone by pressing **F2**. This causes the applied depth offset to be erased and the depth becomes the same as before the zeroing. If a new depth needs to be entered such as when the tool is tagged to a known downhole depth then pressing **F3** from this menu allows the operator to enter a new depth. This new depth is stored as the depth offset in the system for this job only and is erased when the unit is powered down.

Speed

Speed is the second parameter displayed on the Rapidlogger screen when it is in the coiled tubing mode. On coiled tubing units speed is calculated from the change in depth. The speed variable in the Rapidlogger cannot be zeroed or modified while a job is being recorded. This feature has been intentionally designed to prevent errors in the depth value.

Weight

Weight or coiled tubing hanging weight is the third parameter displayed on the Rapidlogger screen when it is in the coiled tubing mode. On a CT unit the weight is measured by means of a load cell mounted on the injector. Thus, part of the combined weight of the coiled tubing and injector sits on the load cell. A typical load cell installation on a coiled tubing injector is shown below.



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Sometimes on a high pressure well (snubbing operation) well pressure can push up on the coiled tubing causing negative weight readings on the load cell.

This electrical signal for the weight is transmitted to the Rapidlogger unit, where it is digitized, displayed and recorded. The weight variable on the Rapidlogger can be adjusted to account for small variation in the weight reading due to calibration error or temperature. In order to edit the weight variable on the Rapidlogger from the main menu press **F6** and then **F2** and the following menu will appear.



Now press **F1** to zero out the weight.

WARNING: Care must be taken while zeroing out the CT Weight. If a large number is zeroed out then the coiled tubing unit operator will no longer be aware of the true CT weight.

Zeroing out CT weight is useful at the beginning of a job when the CT weight is incorrect by a small amount. The zeroed weight value can be undone by pressing **F2**. This causes the applied weight offset to be erased and the weight becomes the same as before the zeroing. If a new weight needs to be entered, then pressing **F3** from this menu allows the operator to enter a new weight. This new weight is stored as the tension offset in the system for this job only and is erased when the unit is powered down.

Circulating Pressure

Circulating pressure or pump pressure is the fourth parameter displayed on the Rapidlogger screen. The pump pressure on a CT unit is generally measured with a pressure transducer in the main treating line installed before the CT reel swivel. In order to edit the pressure readings, press **F6** and then **F3** from the main screen and the following menu will appear



Now press **F1** to zero out the pressure. This option is used to clear out a small pressure offset from the variable when it is known that the pressure should be zero or atmospheric. In order to clear out the pressure offset or eliminate the zeroing of the pressure variable press **F2**. If the actual pressure is known such as due to a calibration or dead weight test or from a calibrated client pressure gage, and the Rapidlogger reading needs to match that calibrated reading, press **F3** and the system will allow you to enter a new pressure value. Powering the system off and then on again will clear out this pressure offset value.

Pump Rate

The pump rate is the fifth parameter displayed on the Rapidlogger display. The rate variables cannot be zeroed or modified during a job. This feature has been intentionally designed to prevent errors in the totalized values.

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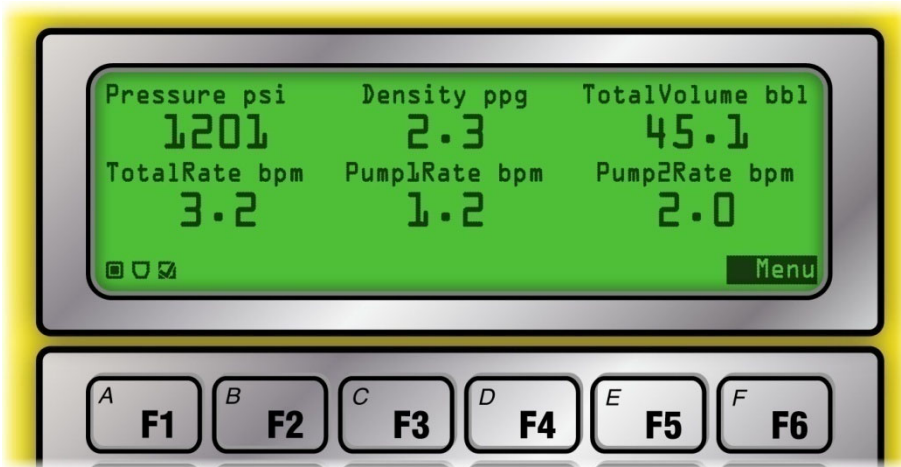
Total Volume

The total volume is the seventh parameter (first on next screen) displayed on the Rapidlogger screen (not shown in menu page). The total volume is measured by means of a flowmeter or a pump stroke counter. In order to edit the total volume press **F6** and then **F4** from the main menu and the following menu will appear



Now press **F1** to zero out the volume. This option is used to clear out the total volume. This is sometimes needed when the pump has been idling for some time or if some recirculation was performed before the beginning of the actual pumping operation. In these cases, the user needs to zero out the volume. This can also be used to zero out the pumped volume before the beginning of the next stage. The zeroed volume can be undone by pressing the **F2** key. If the pumped volume is known (for example in the beginning of a new stage) or if the user needs to otherwise set the total pumped volume to a new value press **F3**. This will give the user an opportunity to enter the new total volume.

2.8 Common operations



Regardless of the operating mode that the Rapidlogger is in, the common system options are always available. The common operation options include

USB
Network Settings
Display Settings
Time Setting

Variable Settings Factory Reset Diagnostics

Pressing **F6, F6** from the main screen brings up the following system menu. This menu allows access to the common system options.



USB

In order to copy job data files from the Rapidlogger to an external USB memory stick, insert a USB memory stick into the USB port. This USB stick should be empty and should have been formatted with FAT file system on a PC. Press **F6** to bring up the main menu, **F6** again to select USB options. From here it is possible copy the last job file or select a file from all of the job files.

In order to copy just the last job file to the USB flash drive press **F6** from this menu again to select the Copy Last File option. The copy process can take several minutes depending on the size of the file. The USB stick should not be removed until the screen indicates that the file copy is complete. Removing the USB stick while in the middle of the copy process and may require the unit to be reset before it can properly copy files to USB sticks again.

In order to select the file to copy from the list of all of the job files recorded on the SD card, press **F4** from this menu again to go to the Copy Select File option. Now the screen will display the name of a job file. If this is the file you want to copy press **Enter**, if you want to exit the copy process press **F6**. Pressing any other key select and displays the name of the next job file. Keep pressing a key until you see the name of the file that you would like to copy to the USB flash drive. Once you see the file name you want to copy press **Enter**. The copy process for a file can take up to 2 minutes. Once the screen indicates that the copy is complete and the activity light on the flash drive has stopped flashing, the stick can be removed.

The file names on the Rapidlogger internal SD card are meant to indicate the date of the job file. So, a file name 15Jul08.TXT means that it is for a job that took place on July 15, 2008. This allows the user to easily know the file name for a job that took place on a certain day.

Network Settings

Changing network settings is an advanced user option and should not be done by users who are not familiar with Ethernet network settings. In order to edit or change the network setting press **F6, F6, F1** from the main menu. The system will now give menu options to enter the IP address, gateway address, and the network mask. Press enter after entering each number. Press **F6** in order to skip entering a number at any prompt. The previous value is retained for that number. The newly entered network settings come in effect after a system power cycle. The default network settings for the Rapidlogger system are as follows.

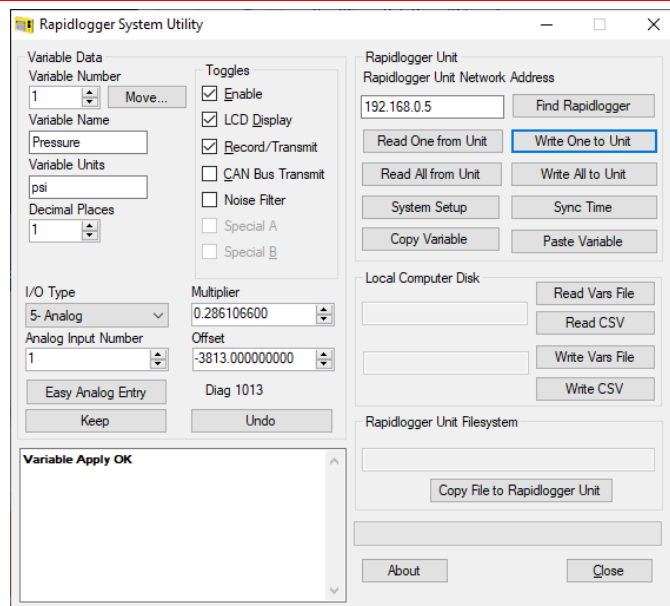
IP: 192.168.000.005 Gateway: 192.168.000.001 Netmask: 255.255.255.000

These settings are also restored after a factory reset. Entering an IP address of 000.000.000.000 puts the Rapidlogger in DHCP mode. This mode should only be used when there is a router or server available on the network that has DHCP server capabilities.

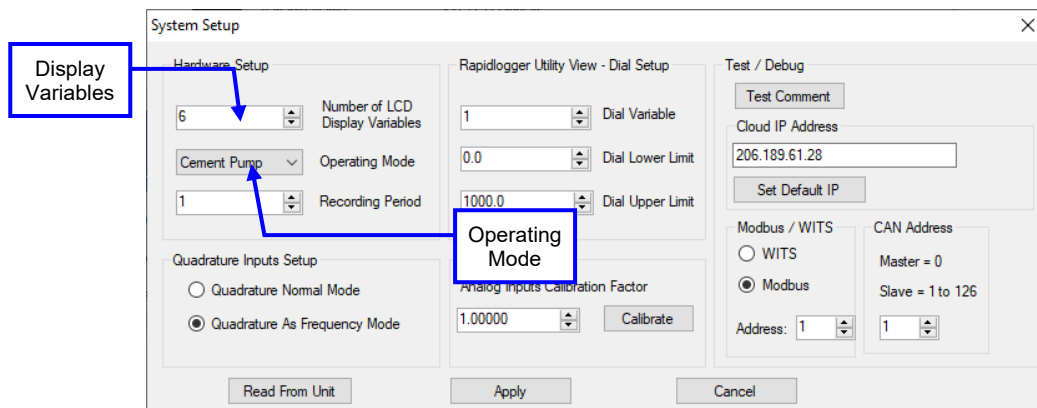
Display Setting

The display settings can be modified from both the **Rapidlogger Utility** program and the Rapidlogger front panel.

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When using the **Rapidlogger Utility** program, pressing the **System Setup** button from the main window brings the user to the following screen. Here they can change the number of displayed variables and the Operating Mode. The valid options are 2, 4, and 6 variables to be displayed on the Rapidlogger LCD screen. Enter the number of parameters that you would like to see displayed on the LCD screen.



The display setting can also be changed from the Rapidlogger front panel. In order to change the display settings from the front panel press **F6, F6, F2** from the main menu. The system will now prompt you to enter the number of display parameters. Enter the number of variables and press **Enter**.

Time Setting

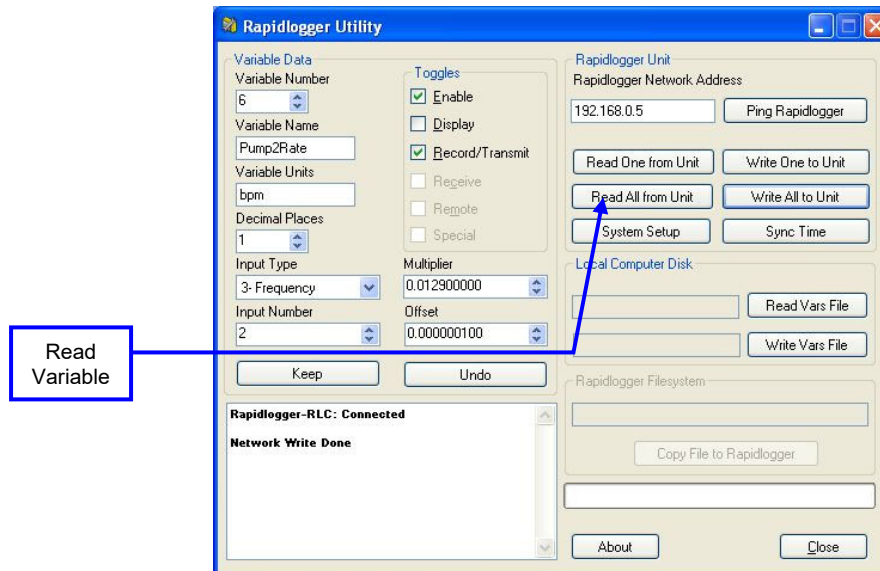
The date and time can be synchronized easily from the PC via the **RapidVu** and **Rapidlogger Utility** programs. From the **Rapidlogger Utility** program main screen the user can press **Sync Time** button to synchronize the Rapidlogger internal clock to the PC system clock. In order to edit or change the Rapidlogger job clock press **F3**. The system will now prompt you to enter the date and time. Normally there is no need to enter the time on the Rapidlogger system from the keypad. The system clock is battery backed and retains the correct time and date for up to 5 years.

Variable Settings

The variable settings should not be attempted by novice Rapidlogger users.

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Changing variable settings and programming or erasing variables can be done both from the **Rapidlogger Utility** program and Rapidlogger front panel. The **Rapidlogger Utility** program allows very easy setup of the various variables and settings on the unit. The front panel option should only be utilized by an expert user.



From the **Rapidlogger Utility** main screen the variable number to be viewed or modified can be selected. This variable can then be read in from the Rapidlogger unit by pressing the **Read One from Unit** button. The settings for the selected variable will then be displayed on the screen. The various parameters associated with the variable can then be changed as needed. Each variable number has a name, unit label, number of decimal places, input type, input number, multiplier, and offset associated with it. In addition, the enable, display and record settings can be toggled on each variable. Another option that the user has is to use the **Read All from Unit** button and retrieve all variables at once from the Rapidlogger unit. The variables can be modified and saved either one by one or all at once using the Write buttons.

It is also possible to edit or change the Rapidlogger job variables from the front panel. To do this press **F6, F6, F4** from the main menu. The following system menu will now be displayed.



Press **F3** to show the setting for a given variable and Press **F4** to edit the variable settings.

WARNING: The option to edit variable settings from the front panel is for advanced users only and even then, it should only be used if the Rapidlogger Utility program is not available. Incorrect use will cause the variable setting to be incorrect and WILL cause the recorded variable values to be very different from the real values.

Press **F5** to reset the Rapidlogger setup to one of the preset setups. Selecting one of the options available would overwrite and erase the current setup and replace it with the new selected one.

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It is also possible to read the entire set of variables from the SD card. Press **F1** to load the complete system variable setup file from the SD card. A file named "**SETUPIN.RLV**" is read from the SD memory card and its contents are loaded in the system.

WARNING: The settings for all job variables will be loaded from the SD card and will overwrite the existing variable setup.

Normally, this option is only used during system setup. In order to save the entire setup to the SD card, press **F2**. This will save the complete set of system variables to the SD card. A file named "**SETUPOUT.RLV**" is written to or created on the SD memory card.

WARNING: The contents of the SETUPOUT.RLV file on the SD card are overwritten and replaced by the copy of the job variables from the system.

Normally this option is only used during system setup to back up a system that has been properly set up.

Factory Reset

In order to perform a factory, reset of the Rapidlogger system press **F6** from the system menu. The following menu will now be displayed.

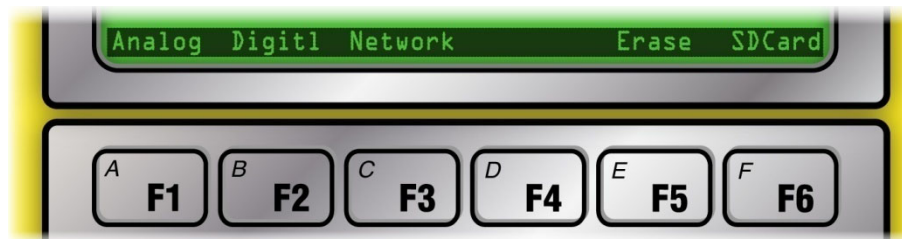


By pressing the appropriate key, the user can perform a factory reset of the Rapidlogger to one of the preprogrammed factory modes. These include Cementing, Slickline, Coiled Tubing, Nitrogen, and Fracturing.

WARNING: The customization and settings for all job variables will be erased and the system will be reset to the selected factory programmed mode.

Diagnostics

The Rapidlogger Unit has a built-in diagnostics mode in which the raw sensor inputs can be viewed to ease troubleshooting. G



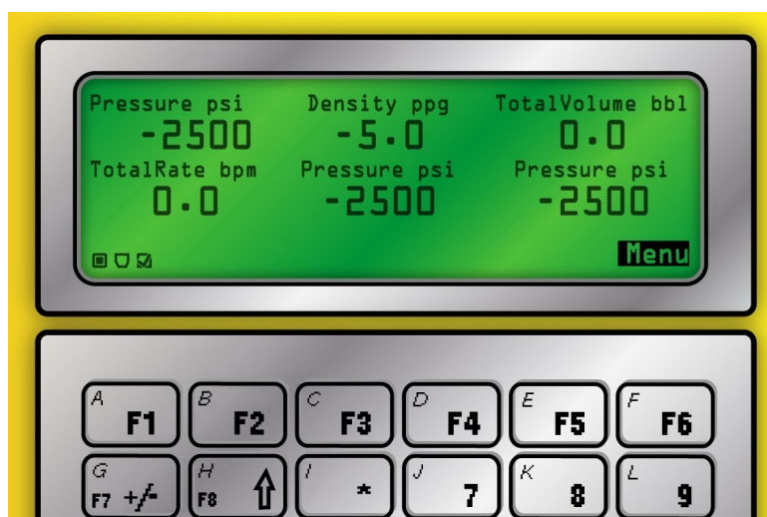
The diagnostics mode for analog sensors can be accessed from the front panel keypad (Press **F6, F6, F5, F1, F1**). The diagnostics mode for frequency sensors can be accessed from the front panel keypad (Press **F6, F6, F5, F2**). The diagnostics mode for Ethernet networks can be accessed from the front panel keypad (Press **F6, F6, F5, F3**). In each case a screen appears on the LCD that displays the various sensor values.

2.9 Entering and Recording Job Comments

During a cementing, CT, slickline or pumping job it can be beneficial to log comments in the data file to indicate the beginning, or ending of different activities or events. There are a large number of commonly used job

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comments preprogrammed into the Rapidlogger Unit that can be logged by simply entering the comment number from the front panel.



From the main menu the user can press **F7** (which is also the **G** key). A prompt appears on the bottom of the screen instructing the user to enter the comment number. The user can then enter the comment number that they would like to log and then press **Enter**. If the user waits too long to enter the comment number then the prompt erases itself and the display goes back to the main menu. Any comments that are logged in this manner are stored in the job data file and printed automatically with the **RapidVu** job reports. The following comments are available in the Rapidlogger Unit.

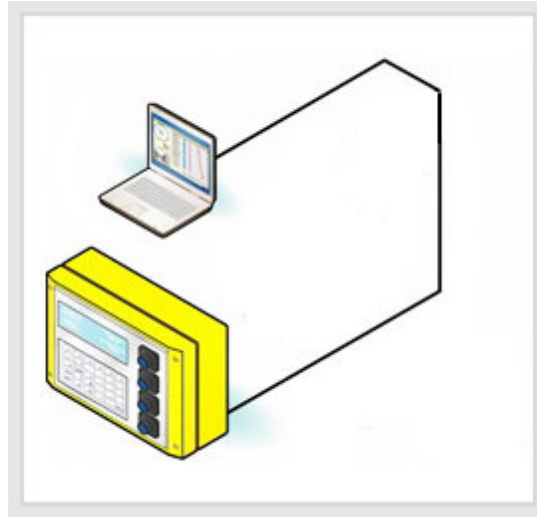
#	Job Comment Message	#	Job Comment Message	#	Job Comment Message
1	Bump Closing Plug	62	Remark	123	Started Water
2	Bump Dart	63	Reset Selected Totals	124	Started Wiper Trip
3	Bump Plug	64	Reset Stage Totals	125	Stopped Acid
4	Bump Stage Plug	65	Reset Volume	126	Stopped Brine
5	Bump Top Plug	66	Screened Out	127	Stopped Cement Slurry
6	Change Mud Weight	67	Sensor Calibrated	128	Stopped Circulation
7	Change Parameter Name	68	Sensor Zeroed	129	Stopped Diesel
8	Change Pump Rate	69	Set Rams	130	Stopped Displacement
9	Change Sensor Calibration	70	Shutdown	131	Stopped Diverter
10	Decrease Rate	71	Stage t Perfs	132	Stopped Drilling/Milling
11	Depth Corrected	72	Stage Changed	133	Stopped First Stage
12	Depth Correlation Event	73	Started Acid	134	Stopped Fluid
13	Depth Modified	74	Started Brine	135	Stopped Flush
14	Depth Reset	75	Started Cement Slurry	136	Stopped Injection
15	Depth Zeroed	76	Started Circulation	137	Stopped Inject nonreact Fluid
16	Dropped Ball/Dart	77	Started Diesel	138	Stopped Inject reactive Fluid
17	Dropped Bottom Plug	78	Started Displacement	139	Stopped Job
18	Dropped Closing Plug	79	Started Diverter	140	Stopped Logging
19	Dropped Opening Plug	80	Started Drilling/Milling	141	Stopped Mixing Lead Slurry
20	Dropped Stage Plug	81	Started First Stage	142	Stopped Mixing Scav Slurry
21	Dropped Top Plug	82	Started Fluid	143	Stopped Mixing Tail Slurry
22	Dropped Wiper Plug	83	Started Flush	144	Stopped next PPA Proppant
23	Ended Acid	84	Started Injection	145	Stopped Next Stage
24	Ended Brine	85	Started Injection Nonreact Fluid	146	Stopped Nitrogen

25	Ended Cement Slurry	86	Started Injection Reactive Fluid	147	Stopped Pad
26	Ended Circulation	87	Started Job	148	Stopped POOH
27	Ended Diesel	88	Started Logging	149	Stopped Pressure Test
28	Ended Displacement	89	Started Mixing Lead Slurry	150	Stopped Proppant
29	Ended Fluid Stage	90	Started Mixing Scav Slurry	151	Stopped Pull Test
30	Ended Job	91	Started Mixing Tail Slurry	152	Stopped Pumping Acid
31	Ended Logging	92	Started next PPA Proppant	153	Stopped Pumping Brine
32	Ended Mud Acid	93	Started Next Stage	154	Stopped Pumping Foam
33	Ended Mud	94	Started Nitrogen	155	Stopped Pumping Gel
34	Ended Nitrogen	95	Started Pad	156	Stopped Pumping Mud Acid
35	Ended Nitrogen	96	Started POOH	157	Stopped Pumping Mud
36	Ended Oil	97	Started Pressure Test	158	Stopped Pumping Next Fluid
37	Ended Over-flush	98	Started Proppant	159	Stopped Pumping Nitrogen
38	Ended Pre-flush	99	Started Pull Test	160	Stopped Pumping Oil
39	Ended Reverse Circulation	100	Started Pumping Acid	161	Stopped Pumping Over-flush
40	Ended Slurry	101	Started Pumping Brine	162	Stopped Pumping Pre-flush
41	Ended Spacer	102	Started Pumping Foam	163	Stopped Pumping Proppant
42	Ended Stage	103	Started Pumping Gel	164	Stopped Pumping Spacer
43	Ended Wash	104	Started Pumping Mud Acid	164	Stopped Pumping Spacer
44	Ended Water	105	Started Pumping Mud	165	Stopped Pumping Wash
45	Maximum Depth	106	Started Pumping Next Fluid	166	Stopped Pumping Water
46	Maximum Pressure	107	Started Pumping Nitrogen	167	Stopped Pumping
47	Maximum Rate	108	Started Pumping Oil	168	Stopped Reverse Circulation
48	Modified Pump Schedule	109	Started Pumping over-flush	169	Stopped RIH
49	Modified Totalizer	110	Started Pumping pre-flush	170	Stopped Second Stage
50	Pause	111	Started Pumping Proppant	171	Stopped Selected Totals
51	Perforating	112	Started Pumping Spacer	172	Stopped Sensor Check
52	Plug Balanced	113	Started Pumping Wash	173	Stopped Squeeze
53	Remark BHA	114	Started Pumping Water	174	Stopped Tripping
54	Remark Bleed Off Pressure	115	Started Pumping	175	Stopped Water
55	Remark Cementing Event	116	Started Reverse Circulation	176	Stopped Wiper Trip
56	Remark CT Event	117	Started RIH	177	Weight Modified
57	Remark Fracturing Event	118	Started Second Stage	178	Weight Zeroed
58	Remark Milling	119	Started Selected Totals		
59	Remark Pumping Event	120	Started Sensor Check		
60	Remark Rig Event	121	Started Squeeze		
61	Remark Slickline Event	122	Started Tripping		

2.10 Using the RapidVU Program

RapidVU is software that can be used to gather data directly from a Rapidlogger connected to the computer with an Ethernet cable. With **RapidVU**, you can view a job's progress, analyze previous jobs and generate automatic job reports for different types of jobs. Although you can use the program at any screen resolution, **RapidVU** is set up to display best on screens that are 1280x1024 pixels or higher.

RapidVU can communicate with WITS and ModBus, or it can read data directly from a file.



Installing and Starting RapidVU

You can install **RapidVU** on a personal computer with Windows 10, Windows 8 or Windows 7. The Rapidlogger device includes a flashdrive with the RapidVU software.

To install **RapidVU**:

1. Insert the **Rapidlogger** Flash drive into your computer's USB drive.
2. Open the Flash drive and double-click the `setup.exe` file.
3. In the installer, follow the instructions on screen to complete the installation.

To start **RapidVU**:

- Choose Windows **Start > All Programs > Rapidlogger Systems > RapidVU**.

TIP: If you use RapidVU frequently, create a RapidVU shortcut and place the icon on the Windows desktop. If you have a RapidVU icon on the desktop, double-click it to start RapidVU.

Periodically, the **RapidVU** software gets updated. You can download updates from the www.rapidlogger.com site.

To update **RapidVU**:

1. Visit <http://www.rapidlogger.com>.
2. Click **Support** and then **Downloads**.
3. Click the **RapidVu Data Acquisition Software** link.
4. In the **File Download** dialog box, click **Save**.
5. In the **Save As** dialog box specify where to save the downloaded file and click **Save**.
6. In the **Download complete** dialog box, click **Run** or click **Open Folder** and then double-click the `*.exe` file.

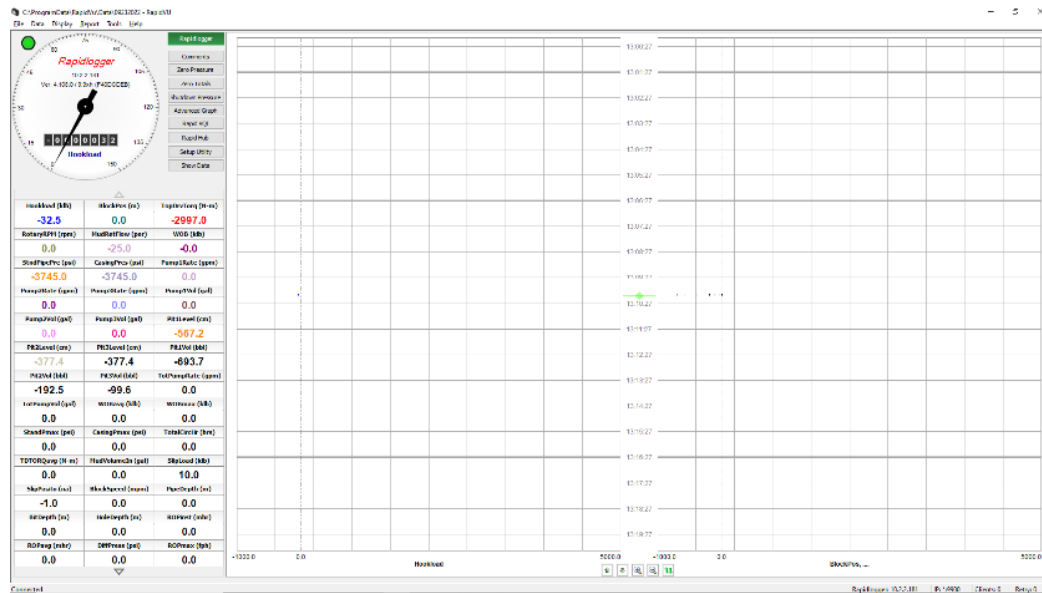
Setting Up RapidVU

The **RapidVU** software was developed as a data viewer for Rapidlogger. You can also use it to view data collected with other devices.

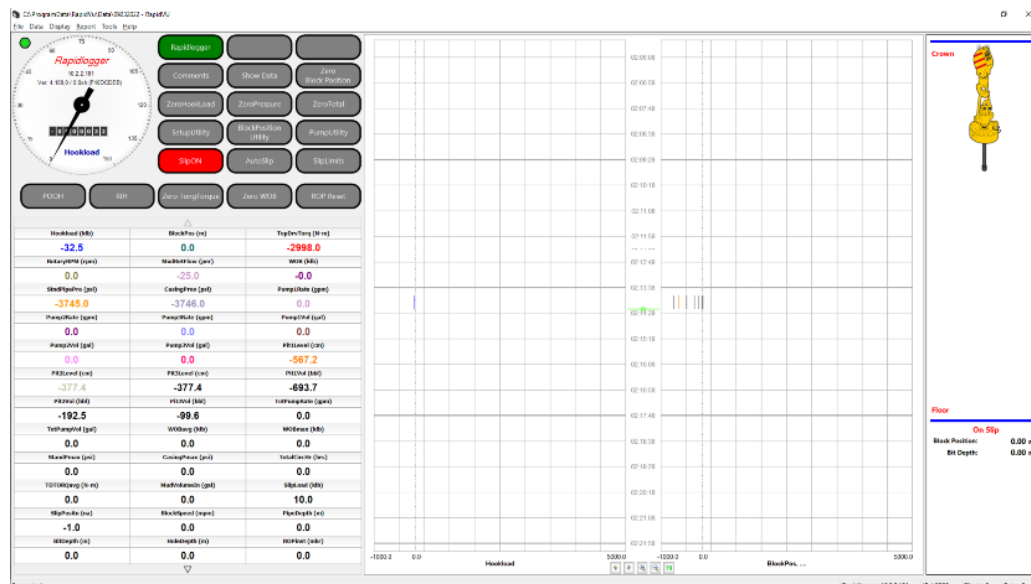
User Modes of the RapidVU software

The **RapidVU** software has 4 main modes of operation.

The **Standard mode** is used for most normal operations

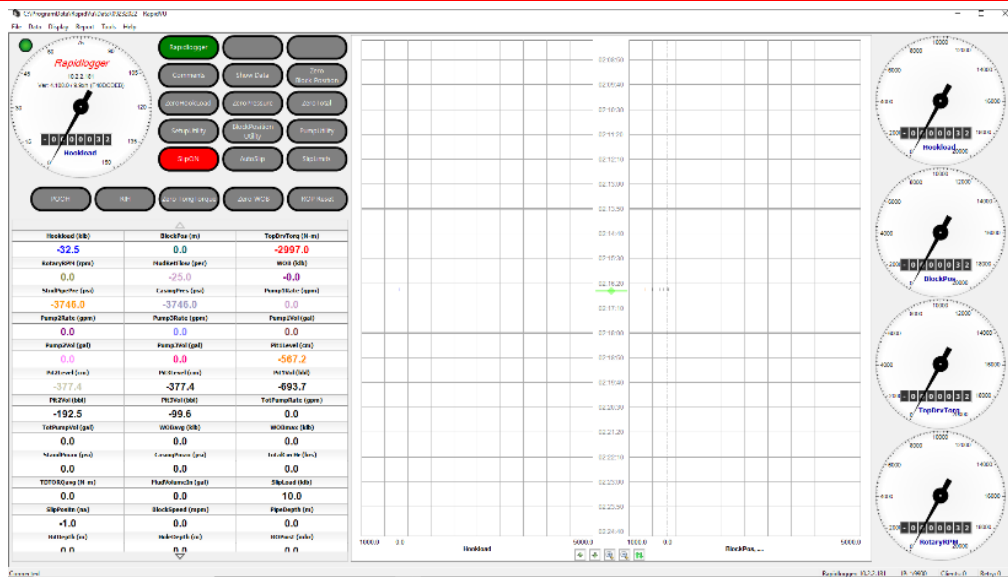


The **Drilling Depth mode** is used by the driller on a touch screen display to conduct drilling operations

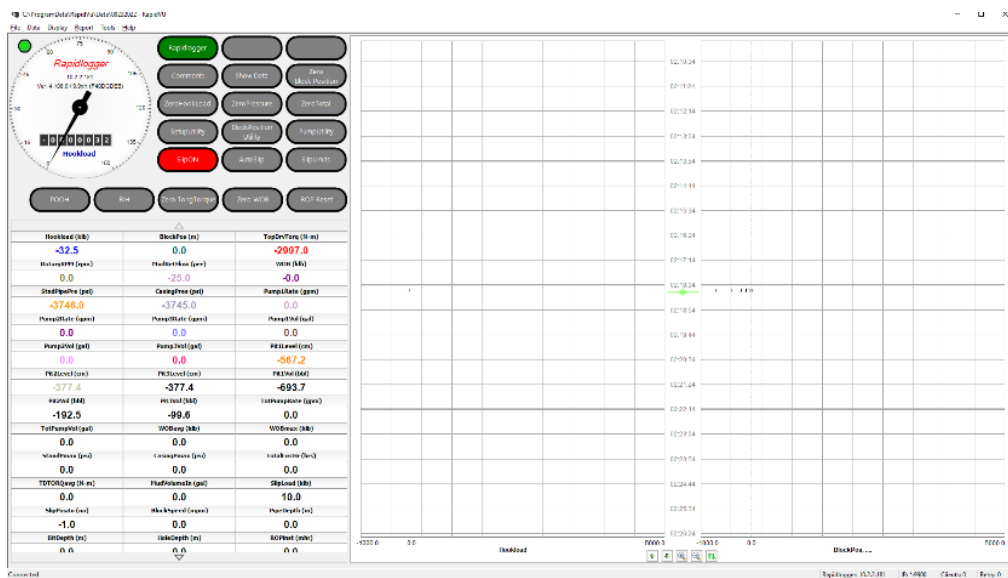


The **Drilling Multidial mode** is used by the tool pusher and other personnel on a touch screen display to conduct support operations

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The **Drilling Backoffice mode** is used by the backoffice personnel on a touch screen display to prepare job reports etc.



Using RapidVU with Rapidlogger

There are several ways to use **RapidVU** with Rapidlogger:

- **Direct Connection:** Have the Rapidlogger device directly connected with an Ethernet cable to a computer with **RapidVU** installed.
- **Data File:** Have **RapidVU** read the data from the Rapidlogger's SD card or from a text file of the data.
- **Network:** If the computer connected to the Rapidlogger device is on a network, users on other computers can access that data through the network.

To use **RapidVU** on a networked computer, you must know the IP address of computer directly connected to Rapidlogger and a password. (Once you enter the network password, RapidVU remembers it.)

- Server:** If Rapidlogger is connected to a router or server on a network that has DHCP server capabilities, users can access the data through the server.
 To use **RapidVU** with a server, you must know the IP address of server or router directly connected to Rapidlogger and a password. (Once you enter the server password, **RapidVU** remembers it.) The first time you access Rapidlogger through a server, you must supply the Rapidlogger's serial number.

To learn the IP address of a computer:

1. On the computer, choose Windows **Start > Control Panel > Network and Internet**.
2. Click **View network status and tasks**.
3. Click **Change adapter settings**.
4. Right-click the active computer and choose **Status**.
5. Click **Details**.

NOTE: This procedure is for Windows 7. Other versions of Windows may have a different procedure.

WARNING: Only knowledgeable users and IT personnel should change network settings. These settings should not be changed by users who are not familiar with Ethernet network settings.

To set up Rapidlogger as a direct connection to a computer with **RapidVU** installed:

1. Connect one end of the provided Ethernet cable to the Ethernet port on the Rapidlogger device.
2. Connect the other end to the computer's Ethernet port.
3. Turn on Rapidlogger.
4. Start the computer.
5. Choose Windows **Start > All Programs > Rapidlogger Systems > RapidVU**.

By default, **RapidVU** is set up to work with Rapidlogger with a default IP address of 192.168.0.5. To make adjustments to the IP address, see "Using RapidVU Tools" later in this section.

To receive data from a directly connected Rapidlogger device:

1. Choose Windows **Start > All Programs > Rapidlogger Systems > RapidVU**.
2. In the **RapidVU** window, choose **Data > From Rapidlogger**.

RapidVU starts recording data from Rapidlogger. To stop recording data, choose **Data > Stop Recording**.

You can save data from the Rapidlogger SD card or other devices and read the data in **RapidVU**. To learn how to save data from the SD card, see "Using RapidVU Tools" later in this section.

To read data from a *.txt file:

1. Choose Windows **Start > All Programs > Rapidlogger Systems > RapidVU**.
2. In the **RapidVU** window, choose **Data > From File**.
3. In the **Rapidlogger Data File** dialog box, click **Browse**.
4. In the **Open** dialog box, locate and select the file.
5. Click **Open**.
6. If necessary, change the **Data Rate** value.
7. Click **OK**.

RapidVU starts recording data from the data file. To stop recording data, choose **Data > Stop Recording**.

To record data from a Rapidlogger device on a network or server:

1. Choose Windows **Start > All Programs > Rapidlogger Systems > RapidVU**.
2. In the **RapidVU** window, choose **Data > From Network** or **Data > From Server**.
3. In the dialog box, type the IP address of the host computer.
4. If necessary, in the **Network Download Options** dialog box, adjust the **Port** number.
In the **Download From Server** dialog box, type the serial number for the Rapidlogger device.
5. If this is the initial connection through the network or server, type the **Password** needed to connect.
6. Click **OK**.

RapidVU starts recording data from the Rapidlogger. To stop recording data, choose **Data > Stop Recording**.

Using RapidVU with WITS

If you have devices that use the WITS 0 standard, **RapidVU** can read and interpret the data. **RapidVU** assumes that any WITS device is connected to the first available COM port. The COM port number can be changed from the pull-down menu.

Rapidlogger™

NOTE: By default, RapidVU shows most recently saved mapping in the Dialog dialog box.

To receive data from a WITS 0 device:

1. Choose Windows **Start > All Programs > Rapidlogger Systems > RapidVU.**
2. In the *RapidVU* window, choose **Data > From WITS0 Serial OR WITS0 Network.**
3. In the *Dialog* dialog box, specify the **Baud Rate** for the data.
4. If you have a mapping saved, click **Load Mapping**. In the *Open* dialog box, locate and select the mapping file (*.wcg file). Then click **Open**.
5. If you don't have a mapping saved, adjust the values in the dialog box for the data input. (To change settings, double-click any cell in the white area except for the **Var No** column and edit the information.)
6. Note that the Variable Name entered in the column "Field Name" must match exactly with one of the variables in the RapidVu. If the variable name that is entered here does not match one of the RapidVu variable names or if there is a typing error then that variable will not be transmitted on the WITS data stream.
7. The WITS table number and WITS DATA ID need to match the settings expected by the device receiving the WITS data stream.
8. Click **Start Acquisition**.

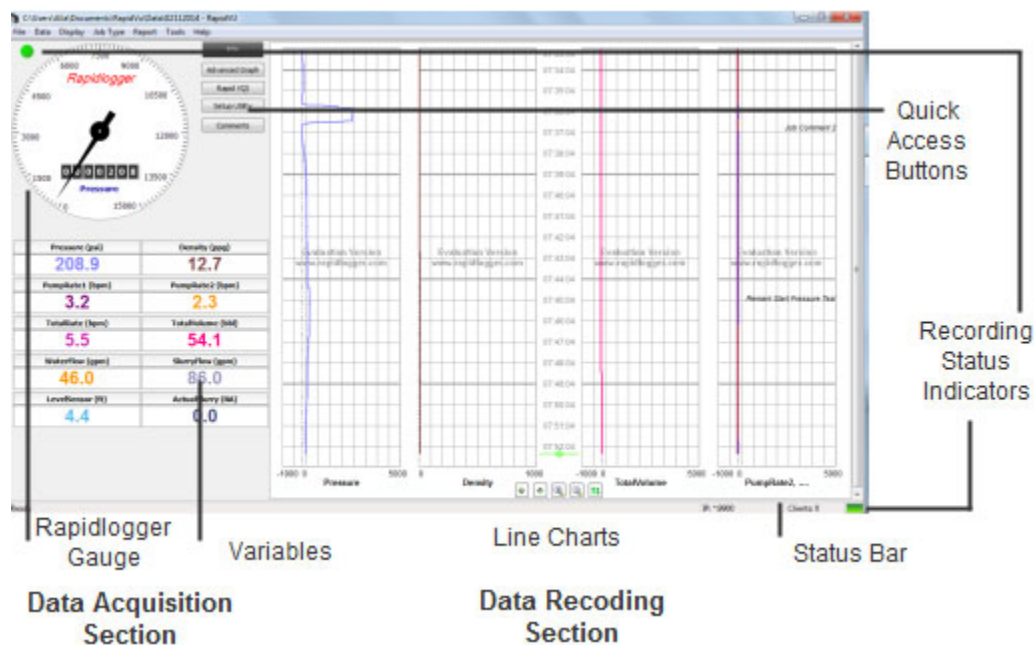
To save an edited mapping to use again:

1. In the *Dialog* dialog box, click **Save Mapping**.
2. In the *Save As* dialog box, locate and open the folder for the file.
3. Name the file. (**RapidVU** appends the .wcg extension to the file name.)
4. Click **Save**.

Viewing Data

By default, the main *RapidVU* window has two sections: the data acquisition section on the left and the data recording section on the right.

The main window, by default, also shows a status bar at the bottom.



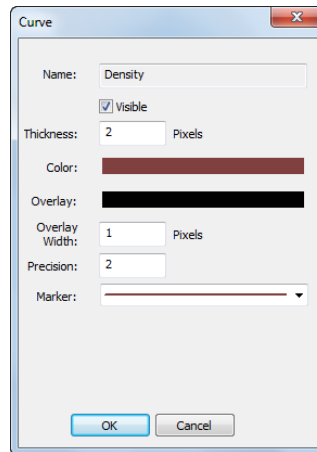
Data Acquisition Section

The data acquisition section has a gauge at the top showing the measurement that was set up in the Rapidlogger. The round gauge shows the general value and the numeric indicator gives the specific value. You determine

which measurement shows in the gauge by using the [Rapidlogger Setup Utility](#). Above the gauge on the left, a green indicator shows that **RapidVU** is recording data. The indicator is red when not recording.

The variable boxes below the gauge show data from each sensor used with Rapidlogger. (For example, you may have sensors for the pump pressure and the pump rate.)

If you click the value in a **Var** box, you can reset the value to zero, change the value or undo any change you've made.



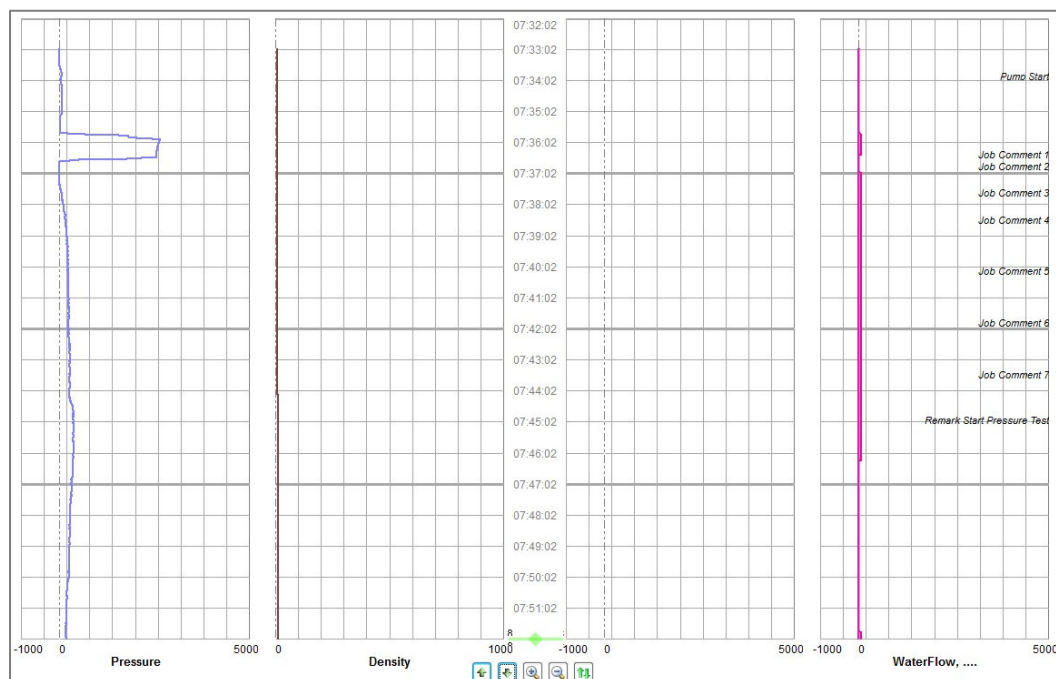
If you right-click a **Var** box, you open the *Curve* dialog box where you can specify options for showing that variable on a graph. For example, you can change the line's color, marker and thickness for representing that variable in the line chart.

You can also specify the number of decimal places that appear for the value in its **Var** box by adjusting the **Precision** value. (For example, a **Precision** value of 1 shows one decimal place.)

To not view the variable's data on a line chart, clear the **Visible** check box.

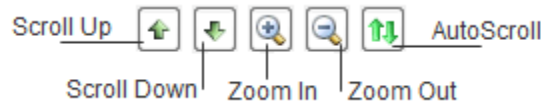
Data Recording Section

By default, **RapidVU** shows four line charts. If there are more than four variables to display, you can have **RapidVU** show multiple lines on a specific chart (or track) to see plots of data from all sensors.



NOTE: RapidVU also has an Advanced Graph view that consolidates the charts. For details about viewing it, see “Using RapidVU Tools” later in this section.

At the bottom of the Data Recording section, you can use the buttons to control how you view the charts.



You use the commands on the **Display** menu to customize the Data Recording section.

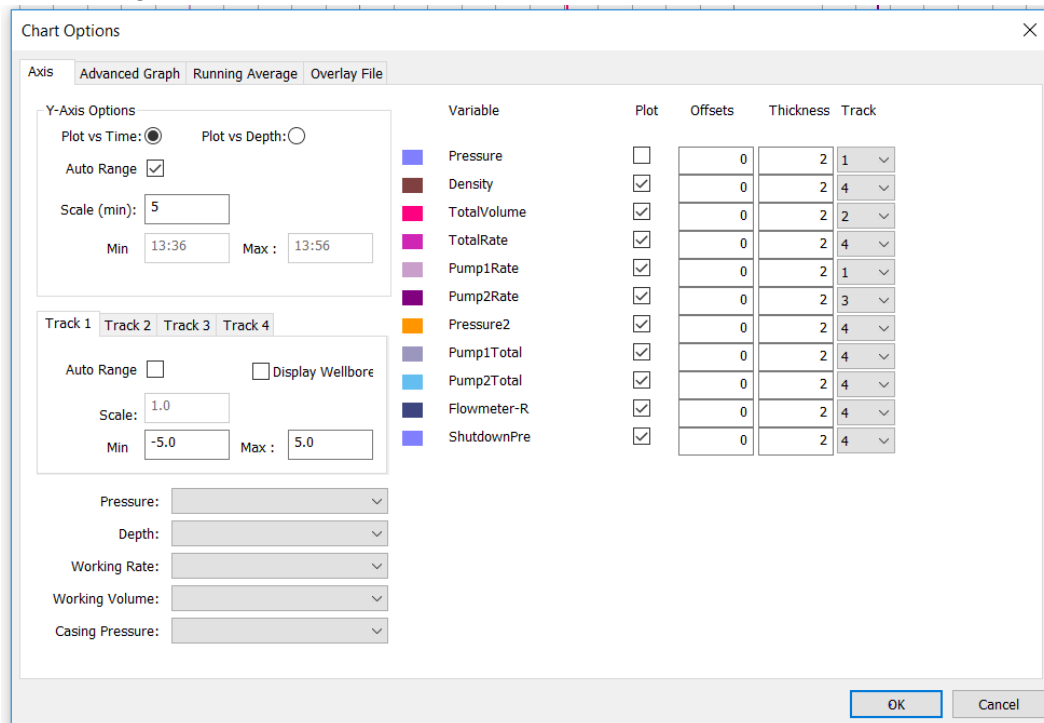
Choosing **2 Charts** on the **Display** menu replaces the four charts with just two. To return to the four charts view, choose **4 Charts**. When you change the number of charts, you must restart **RapidVU** to have the change take effect.

You can also switch to full screen mode by choosing **Display > Full Screen** or by pressing **F11**. Full screen mode removes the Windows title bar, the menu bar, the status bar and the scroll bar. To return to normal display mode, press **Esc**.

To clear the data from all charts, choose **Display > Clear Chart**.

To refresh all charts, choose **Display > Refresh Chart**.

You use the options on the **Axis** tab in the **Chart Options** dialog box to customize the appearance of the charts. **RapidVU** automatically lists all sensor variables that it reads and assigns a color and a track for each sensor on the right side of the **Axis** tab.



To customize the y axis for all charts:

1. Choose **Display > Chart Options**.
2. In the **Chart Options** dialog box, on the **Axis** tab, specify whether to set the y axis for the charts based on time (**Plot vs Time**) or depth (**Plot vs Depth**).
3. To specify the range for plotting the data, clear the **Auto Range** check box. (By default, **RapidVU** automatically determines the range.)
4. To adjust the calibration, change the **Scale**.
5. If you cleared the **Auto Range** check box, specify the **Min** and **Max** values to be plotted.
6. Click **OK**.

To customize the x axis for individual charts:

1. Choose **Display > Chart Options**.
2. In the *Chart Options* dialog box, on the **Axis** tab, click the tab for the track to customize. (The charts in the Data Recording section show tracks 1-4 from left to right.)
3. To have **RapidVU** determine the minimum and maximum range to display, select the **Auto Range** check box.
To manually specify the minimum and maximum values, clear the check box.
4. If you cleared the **Auto Range** check box, type the minimum and maximum values for that track's x axis.
If you selected the **Auto Range** check box, adjust the **Scale** value as needed.
5. To show or hide Wellbore information, select or clear the **Display Wellbore** check box.
6. Click **OK**.

On the right side of the **Axis** tab, you can customize how each variable appears on the charts.

To customize how **RapidVU** plots a variable:

1. Choose **Display > Chart Options**.
2. In the *Chart Options* dialog box, on the right side of the **Axis** tab, to change the color for a variable, click the color box. Specify a different color and click **OK**.
3. To not display a variable, clear its check box.
To show a variable, select its check box.
4. To adjust an offset, select the **Offset** value and type a new value.
(This can be useful if you have multiple variables showing on one line chart. You can separate similar values by assigning offsets to one or more.)
5. To adjust the thickness of the plotted line, select the **Thickness** value and type a new value.
6. To specify the track for a variable, click the **Track** list and select a different number.
(You may want to assign variables to tracks that have relevant minimum and maximum values.)
7. Click **OK**.

On the bottom left are the customization tabs. The tabs for Pressure, Depth, Working Rate, Working Volume and Casing Pressure and can be customized to be labeled as follows:

- Pressure
- Density
- Total Volume
- Total Rate
- Pump Rate1
- Pump Rate2
- Pressure2
- Pump1Total
- Pump2Total
- Flowmeter-R
- ShutdownPre

In the *Chart Options* dialog box, you can also customize the Advanced Graph view, adjust the running average, and specify an overlay file. For information about the Advanced Graph view, see “Using RapidVU Tools” later in this section.

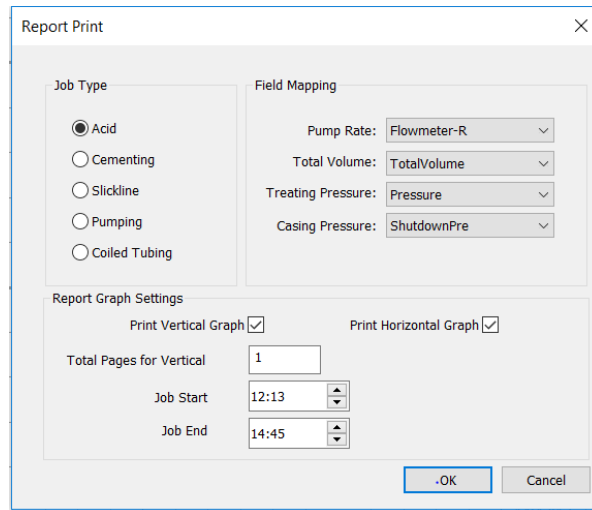
Status Bar

A status bar appears at the bottom of the **RapidVU** window. On the right side of the status bar, a green indicator shows that **RapidVU** is recording data. The indicator is red when not recording. To the left of the recording status indicator, the status bar shows the IP address and other information about the most recent data recording. The left side of the status bar shows **RapidVU**'s status.

Switching Job Types

Rapidlogger and **RapidVU** provide four different job types: **Cementing**, **Slickline**, **Pumping** and **Coiled Tubing**. See sections 2.1 – 2.4 in this chapter for information about these Rapidlogger modes. **RapidVU** automatically determines the job type from Rapidlogger. You may need to adjust the job type before generating a report.

To change the job type, choose **Report > Report Generate > Job Type**.

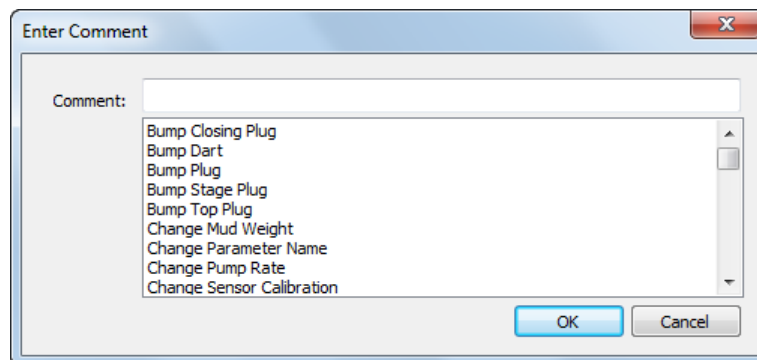


Adding Comments

With **RapidVU** you can add one or more comments to a chart at any point. **RapidVU** provides a range of default comments that you can add, such as “Bump Closing Plug” or “Change Mud Weight,” but you can add your own comments if you wish.

NOTE: The default comments are common for Rapidlogger and RapidVU. You can specify default comments directly with the hardware. See Section 2.6 in this chapter for a list of default comments.

With **RapidVU** you can add default comments, add custom comments, edit existing comments or remove comments.



To add a comment:

1. Double-click the chart where you want to add the comment.
For adding a comment to all charts at the current time, click the **Comment** button next to the gauge or choose **Report > Comment**.
2. In the *Enter Comment* dialog box, select a default comment in the list.
Alternatively, type a custom comment in the **Comment** box.
3. Click **OK**.

To edit or remove a comment:

1. Double-click the comment on the chart.
2. To replace it with a default comment, in the *Enter Comment* dialog box, select the default comment to use.
3. To adjust the existing comment, edit the contents of the **Comment** box.
4. To remove a comment, delete the contents of the **Comment** box
5. Click **OK**.

Generating Reports

RapidVU creates reports based upon the recorded data, the information in the *Job Information* dialog box and the active chart view (the main window or the *Advanced Graph* window). Each report is a Microsoft Word *.docx file with a name based on the specified job type and the current date (for example, *Cementing-02062014.docx*).

RapidVU saves each report in the *Documents/RapidVu/Reports* folder.

NOTE: A RapidVU report is compatible with Microsoft Word 2007-2013 (*.docx files).

In addition to the *.docx file generated as a report, **RapidVU** automatically saves the recorded data in a CSV file (comma-separated value file) in the *Documents/RapidVu/Data* folder. You can use this CSV file to import data into Microsoft Excel (or any spreadsheet program that reads CSV files) for advanced plotting and analysis.

RapidVU names the data file with the current date (for example, *02072014.csv*). If there are multiple data files with the same date, **RapidVU** appends a number (-n) to the file name.

The screenshot shows the 'Job Information' dialog box with the following sections and fields:

- Location / Report Information:** Client, Well, Field, Lease, State, County, Country, Type of Operation, Comments, Date (12/12/2018).
- Service Company / Crew Information:** Service Company, Company Logo (with Browse... button), Address, Representative 1, Supervisor, Specialist 1 / Technician, Specialist 2 / Trainee, Operator1, Operator2, Operator3, Onshore Contact.
- Geographical Information:** Longitude E, Latitude N.

Buttons at the bottom include 'Load From File...', 'Save As...', 'Save', 'OK', 'Cancel', 'Apply', and 'Help'.

To enter new information about a job:

1. Choose **Report > Job Information**.
2. In the *Job Information* dialog box, on the **Job Information** tab, enter the information about the location and the crew.
3. Click the **Tubing Casing** tab.
4. Supply information about the Completion String and the Tool string.
5. Click **Well Information** tab.
6. Supply information about the Well, Pressure Control and Operation.
7. Click **Completion Diagram** tab.
8. Supply information about each Wellbore Completion Item as needed.
9. To save this job's information, click the **Job Information** tab. Click **Save**. In the message box, click **OK**.
10. Click **OK**.

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NOTE: RapidVU saves job information in the Documents/RapidVu/Data folder. These files are *.rlg files.

To re-load existing job information for a report:

1. Choose **Report > Job Information**.
2. In the *Job Information* dialog box, on the **Information** tab, click **Load From File**.
3. In the *Open* dialog box, select the job file.
(By default, **RapidVU** automatically shows the *.rlg files in the *Data* folder.)
4. Click **Open**.
5. Verify that the correct information appears in the *Job Information* dialog box.
6. Click **OK**.

To generate and view a report:

1. Verify that the correct job type is active.
2. Verify that the correct job information is active.
3. To include the Advanced Graph view of the data, click the **Advanced Graph** button or choose **Tools > Advanced Graph**.
4. If the *Advanced Graph* window is active, click the main **RapidVU** window to make it active.
5. Choose **Report > Report Generate**.
6. In the message box, click **OK**.
7. To view the report, switch to Microsoft Word on the Windows taskbar.

Client: Well: State: Country:	Oil Wells Unlimited 84 in the main field TX USA
Field: County: State: Country:	Main Field TX TX USA
Client Rep: Date Prepared:	 02/11/2014
Prepared By: Service Company:	 Data Acquisition Specialists

Cementing Treatment Report

Rapidlogger

Client: Well: State: Country:	Oil Wells Unlimited 84 in the main field TX USA						
Recorded Job Parameter Summary:							
Total Slurry Volume (bbl)	Total Displacement Volume (bbl)	Total Pump Time (min)					
2.00		1922					
Maximum Treatment Pressure: 2877.70 psi Maximum Slurry Rate: 2.30 bbl/min Maximum Hydraulic Horsepower:							
Average Treatment Pressure: 10.53 psi Average Slurry Rate: 2.91 bbl/min Average Hydraulic Horsepower:							
Minimum Treatment Pressure: 11.40 psi Minimum Slurry Rate: 0.00 bbl/min Minimum Hydraulic Horsepower:							
Job Message Summary:							
#	Time	Message	Treating Pressure (psi)	Slack (min)	Slurry (bbl)	Slurry (bbl)	Total (bbl)
1	01:20:00	Start	1400	0.00	0.00	0.00	0.00
2	01:20:00	Stop	1400	0.00	0.00	0.00	0.00
3	01:20:00	150 PSI Pressure	2000	0.00	0.00	0.00	0.00
4	01:20:00	150 PSI Pressure	1700	0.00	0.00	0.00	0.00
5	01:20:00	150 PSI Pressure	1100	0.00	0.00	0.00	0.00
6	01:20:00	150 PSI Pressure	1400	0.00	0.00	0.00	0.00

Notice:

This information is presented in good faith, but no warranty is given. No liability is assumed for advice or recommendations made. The Operator has superior knowledge of the well, the reservoir, the field and conditions affecting them. If the Operator is aware of any conditions whereby a neighboring well or wells might be affected by the treatment proposed herein it is the Operator's responsibility to notify the owner(s) of the well or wells accordingly.

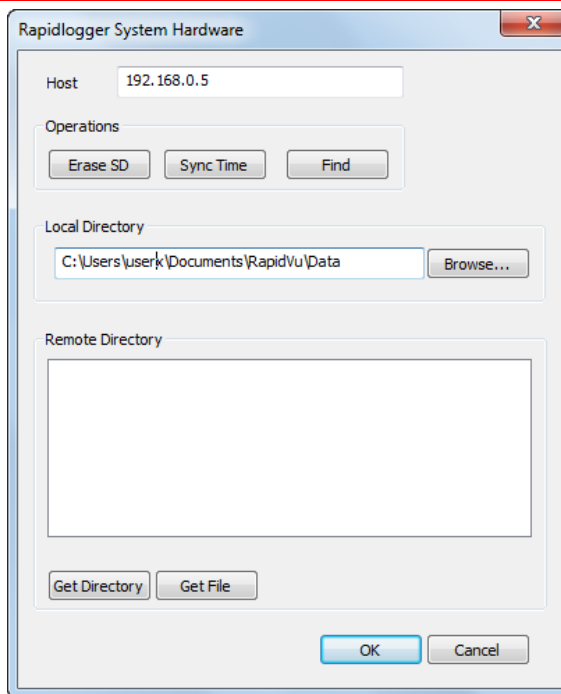
Using RapidVU Tools

The **Tools** menu has commands for interfacing with Rapidlogger, for viewing consolidated charts and for using special utilities (**Rapid VQI** and **Rapidlogger Setup Utility**).

Adjusting Rapidlogger

After you have downloaded data from Rapidlogger, you should erase the internal SD card periodically to keep space available for new job recordings. In general, the SD memory card should be erased with RapidVU (or from the front panel menus on Rapidlogger) at least once every 10–20 jobs. Erasing the SD card ensures that sufficient space is available and can prevent data corruption or loss.

By default, the *Rapidlogger System Hardware* dialog box shows an IP address of 192.168.0.5 for Rapidlogger. If, for some reason, that is not the IP address for Rapidlogger, you can adjust the IP address in the **Host** box.



To erase the SD card:

1. Choose **Tools > Rapidlogger System Hardware**.
2. In the *Rapidlogger System Hardware* dialog box, click **Erase SD**.
3. In the confirmation message box, click **Yes**.
4. Click **OK**.

Occasionally, when actively recording, Rapidlogger may get out of sync with **RapidVU**. To re-synchronize Rapidlogger, click the **Sync Time** button in the *Rapidlogger System Hardware* dialog box.

If you have changed the IP address for the Rapidlogger in the **Host** box, you may need to click the **Find** button for **RapidVU** to connect to the Rapidlogger. **RapidVU** indicates whether the Rapidlogger responds or not to the provided IP address.

By default, **RapidVU** saves data to the *Data* folder. You can change the default folder if you wish.

To change the folder for storing the Rapidlogger data:

1. Choose **Tools > Rapidlogger System Hardware**.
2. In the *Rapidlogger System Hardware* dialog box, click **Browse**.
3. In the *Browse for Folder* dialog box, locate and select the folder to use.
4. Click **OK**.
5. In the **Local Directory** box, verify that the correct directory's path appears.
6. Click **OK**.

You can use **RapidVU** to download job data from the Rapidlogger SD card. When you download data from the SD card, **RapidVU** saves the data as a *.txt file in the default folder.

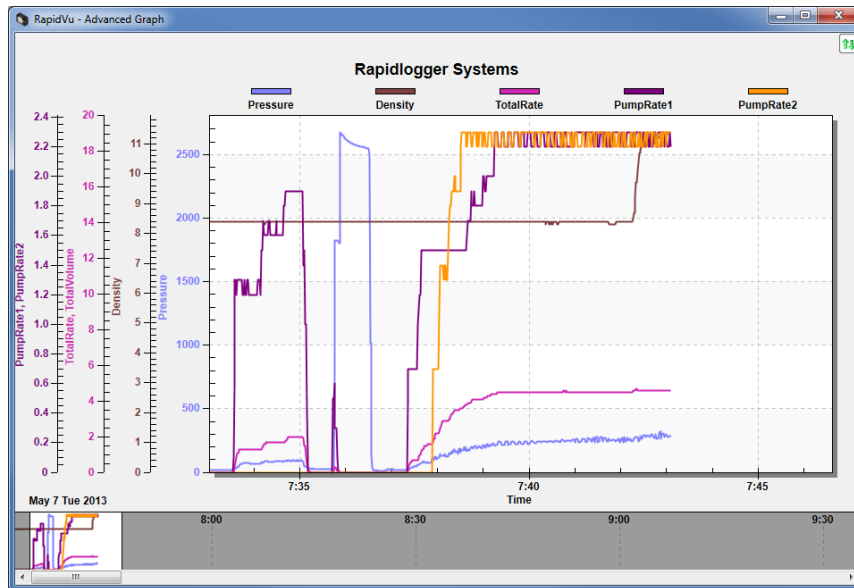
To download data from the Rapidlogger SD card with Rapidlogger connected:

1. Choose **Tools > Rapidlogger System Hardware**.
2. In the *Rapidlogger System Hardware* dialog box, click **Get Directory**.
3. In the **Remote Directory** box, select the file.
4. Click **Get File**.
5. Click **OK**.
6. To load the file, choose **Data > From File**. In the *Open* dialog box, locate and select the file in the *Data* folder. Click **Open**.

Viewing Advanced Graphs

Rapidlogger™

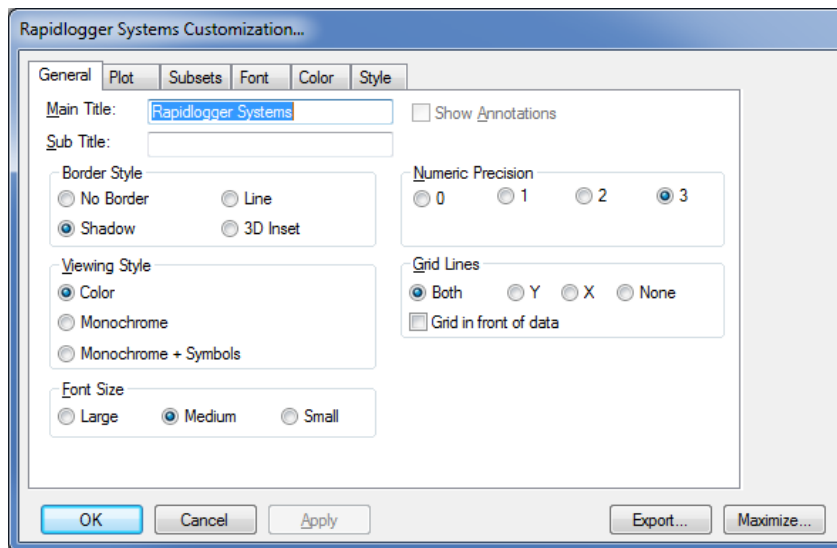
The *Advanced Graph* window shows a consolidated chart of the data that appears in the Data Recording section of the main *RapidVU* window. By clicking **Advanced Graph** next to the gauge or by choosing **Tools > Advanced Graph**, you can view this consolidated graph of the data.



The *Advanced Graph* window has a scroll enable and disable buttons above the title to allow the users to stop or start the graph scrolling.



You can customize the *Advanced Graph* window if you wish by right clicking anywhere in the graph window



The dialog box that appears allows you to select line type, color, background and line style etc. Numerous graph customization options are given that allow the user to configure the graph to his liking.

The advanced graph X Y axis and scale are setup from the same main dialog box that is used to setup the scales for the regular graph.

To customize the *Advanced Graph* window:

1. Choose **Display > Chart Options**.
2. In the *Chart Options* dialog box, click the **Advanced Graph** tab.

3. To add a title under Rapidlogger Systems text in the window, type the custom title in the **Sub Title** box.
4. To specify start and end points for the X axis, type values in the **Start** and **End** boxes.
5. To not have the axis scaled automatically, clear the **Auto Scale** check box.
6. To add a title to a track, type a title in the appropriate **Track n: Title** box.
7. Click **OK**.

Using Other Tools

The **Rapid Volumetric Qualitative Index (Rapid VQI) Control System** has its own manual. See its manual for how to use the Rapid VQI tool in **RapidVU**.

The **Rapidlogger Setup Utility** has its own chapter in this manual. See the next section for information about using the **Rapidlogger Setup Utility** with **RapidVU**.

2.11 Using the RapidHub Program

RapidHub is software that can be used to connect to up to 16 Rapidlogger devices. This software can be used with **RapidVU** to gather data directly from the Rapidlogger devices connected to the same network as the computer.

Installing and Starting RapidHub

You can install **RapidHub** on a personal computer with Windows XP, Windows Vista or Windows 7. The Rapidlogger device includes a disc with the RapidHub software.

To install **RapidHub**:

1. Insert the **Rapidlogger** disc into your computer's disc drive.
2. Open the disc and double-click the `setup.exe` file.
3. In the installer, follow the instructions on screen to complete the installation.

To start **RapidHub**:

- Choose Windows **Start > All Programs > Rapidlogger Systems > RapidHub**.

TIP: If you use RapidHub frequently, create a RapidHub shortcut and place the icon on the Windows desktop. If you have a RapidHub icon on the desktop, double-click it to start RapidHub.

Setting Up RapidHub

The **RapidHub** software was developed to connect to up to 16 Rapidlogger devices connected to the same network as the computer running the software.

1. Open **RapidHub**
2. Enter IP addresses for up to 16 Rapidlogger devices

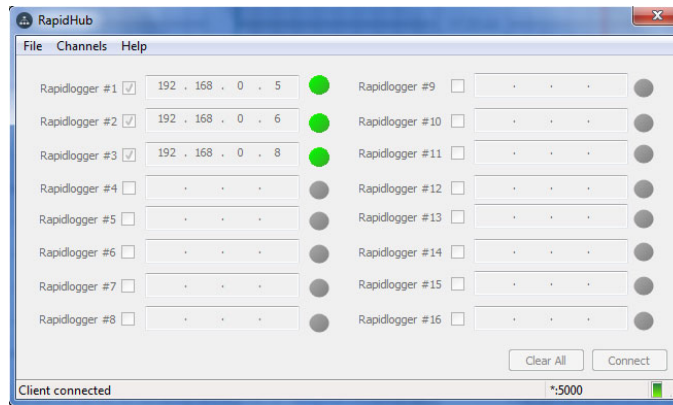
The default IP address for a Rapidlogger is 192.168.0.5. To change the IP address of the Rapidlogger see instructions from section 2.5 Common Operations under Network Settings.

3. Select the Rapidlogger device(s) using the checkbox to the left of each IP address
4. Select **Connect**
5. For each Rapidlogger: If a connection was established, the indicator LED will turn green
6. The Rapidlogger selections and IP addresses will be saved for the next time the **RapidHub** software is opened.

To deselect all Rapidlogger devices and delete all IP addresses, select **Clear All**.

7. Close the **RapidHub** software.

Rapidlogger™



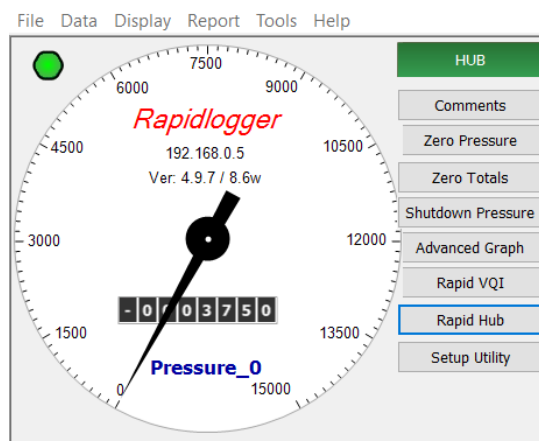
Using RapidHub with RapidVU

1. Open **RapidVU**
2. Click **Data > From RapidHub**

The data from the Rapidlogger device(s) will auto-populate the data display and graphs. Rapidlogger #1 from **RapidHub** corresponds to data display and graphs in **RapidVU** with parameter name in the format *Parameter_0*, Rapidlogger #2 corresponds to *Parameter_0 format* and so on. For example, as shown below, Rapidlogger #1 corresponds to the following data parameter names: Pressures_0, Density_0, TotalVolumes_0, TotalRate_0, Pump1Rate_0 and Pump2Rate_0.

Pressures_0 (psi)	Density_0 (ppg)	TotalVolumes_0 (bblm)
424.0	9.6	2436.3
TotalRate_0 (bpm)	Pump1Rate_0 (bpm)	Pump2Rate_0 (bpm)
1.0	0.0	0.0
Pressure_1 (psi)	Density_1 (ppg)	TotalVolume_1 (bbl)
-3750.0	0.0	0.0
TotalRate_1 (bpm)	Pump1Rate_1 (bpm)	Pump2Rate_1 (bpm)
0.0	0.0	0.0
Pressure_2 (psi)	Density_2 (ppg)	TotalVolume_2 (bbl)
-3750.0	0.0	0.0

3. **RapidHub** can be opened from **RapidVU** by pressing the **Rapid Hub** button on the main screen.

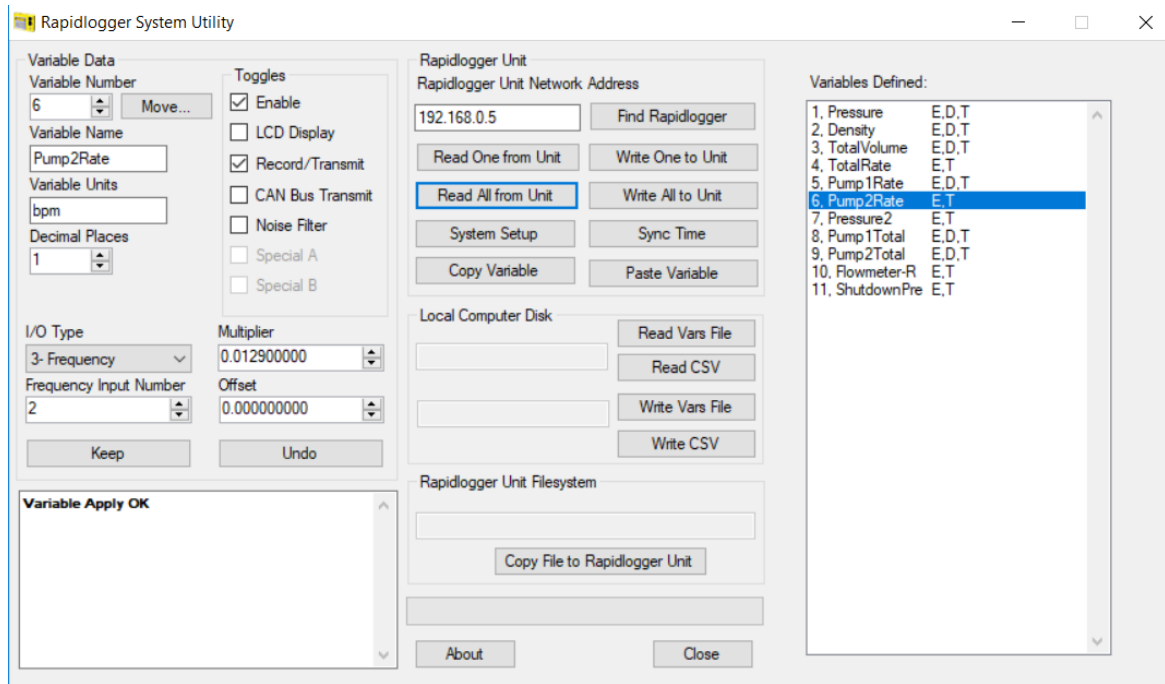


2.12 Using the Rapidlogger Utility

The Rapidlogger Utility is a program that can be run on a PC and allows the user to make changes to the Rapidlogger setup and configuration. It is not used in normal operation but only when there is a need to

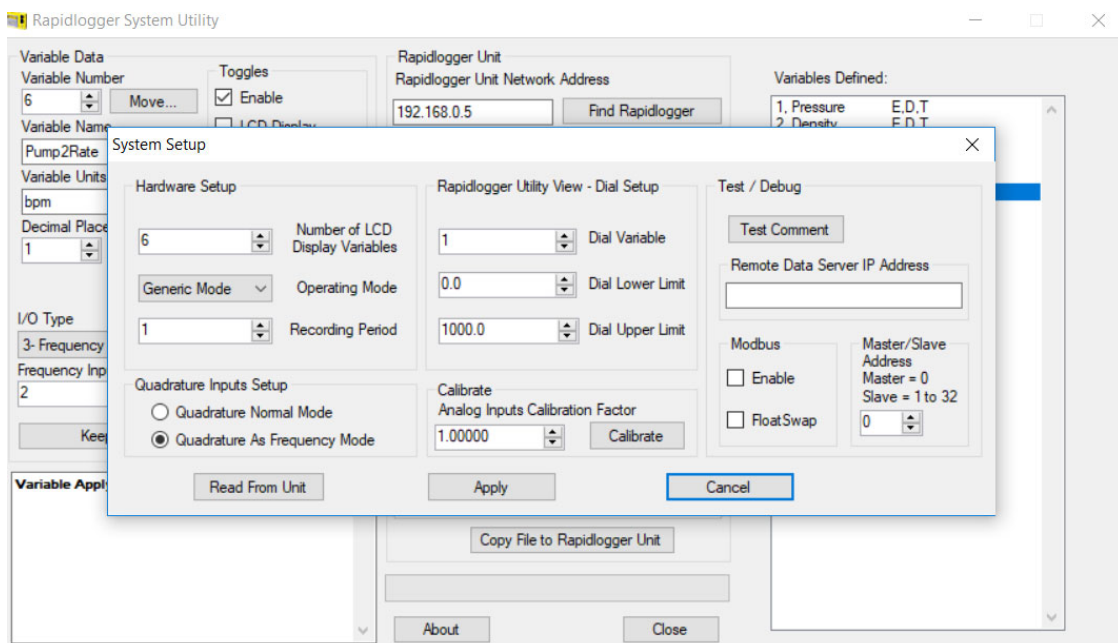
reconfigure some aspect of the Rapidlogger setup. This program has to be run on a PC that is on the same Ethernet network as the Rapidlogger Unit. It can be used to configure variables and system settings on the Rapidlogger unit.

To begin using the utility, click the button labeled “Find Rapidlogger”, after entering the unit’s IP address. If the correct IP address is entered then the presence of the unit at that address is confirmed by the software. Click “Read All from Unit” will open a screen on the right that shows the “Variables Defined”



Changing System Settings

To begin changing system settings, click the button labeled “System Setup” to access the System Setup dialogue. In order to begin changing settings, the unit’s current settings must be retrieved by clicking the button labeled “Read from Unit” button. Note that the dialog updates to reflect the Rapidlogger’s current settings.



The options available from this dialogue are:

Number of LCD Display Variables – Choose how many variables the Rapidlogger unit will display on its LCD front panel.

Operating Mode – Change the Rapidlogger's operating mode between Cement Pump, Slickline unit, N2 Pump, Coiled Tubing, Fracturing Pump, Simulate Cement, Simulate Slickline, Simulate CT, InRock, Simulate InRock, Generic Mode.

Recording Period – Set the frequency at which the Rapidlogger writes data to its job file. The options are data recording every 1, 5, 10, and 60 seconds.

Dial Variable – Choose the variable that will be displayed on the analog dial in the RapidVu program.

Dial Lower/Upper Limit – Set the range that the RapidVu dial will cover.

Analog Inputs Calibration Factor – Set the calibration multiplier for the Rapidlogger's analog inputs. This option should be used with care. In order to recalibrate the analog inputs on a Rapidlogger Unit a precision calibrated current source is required. To prevent unintentional re-calibrations this option has no effect unless the calibration mode is explicitly enabled on the Rapidlogger unit from the front panel.

The configuration of the two quadrature inputs on the Rapidlogger unit can be modified based on the application. In the normal mode these inputs are used to read the quadrature (A and B channels) from a quadrature or depth encoder. However, by checking the option "Quadrature as Frequency mode" these two quadrature inputs can also be used as two high-speed frequency inputs. This is useful for interfacing to devices such as a micro-motion and Endress-Hausser densitometers and flow computer.

The other settings on this page pertain to Modbus communication and are discussed in more detail in the Modbus section.

Creating and Configuring Variables

All of the Rapidlogger data is based on calculations performed on input data. The results of the calculations are stored in the system variables. The settings of the input variables can be viewed and edited from the front panel and by using the PC based [Rapidlogger Utility](#).

From the main screen, the following options for variable configuration are available:

Read One / Read All From Unit – These buttons control the loading of variables from the Rapidlogger. Typically, the Read All From Unit button is clicked before making any changes, as this allows the user to retrieve and review the configuration of all variables on the Rapidlogger from within the Rapidlogger Utility.

Write One / Write All To Unit – These buttons allow new variable setups to be exported to the Rapidlogger unit. Typically, each variable will be written one at a time as it is configured, although if the user is confident in their setup, all variables may be written at one time. Note that it may take several seconds for the unit's front panel to reflect a change in the variable setup.

Sync Time – Updates the Rapidlogger's internal clock to reflect the time on the PC running the Rapidlogger utility.

Write Vars File – Save the current variable configuration to a location on the PC running the Rapidlogger utility. The vars file can be used to save a complex setup for later use or back up the current variable configuration. Note that writing the current configuration to a vars file does not affect the Rapidlogger unit in any way.

Read Vars File – Load a variable setup from a previously-written vars file. Note that reading a vars file does not affect the Rapidlogger unit in any way – the variables must still be written to the unit.

Variable Number – Controls which variable is currently being edited.

Variable Name – Sets the name that identifies the variable on the Rapidlogger front panel and in the RapidVu program.

Variable Units – Determines the units (lbs, bpm, etc.) that the current variable is measured in. Note that the units are a label only – the Rapidlogger unit does not automatically perform the any calculations to convert sensor data from one unit system to another. Those calculations must be set up manually using the Multiplier and Offset options.

Decimal Places – Controls how many decimal places are displayed on the Rapidlogger front panel and the RapidVu program. Note that this setting does NOT affect the precision with which data is recorded and calculated.

Input Type – Choose what type of input this variable accepts. Most variables will be Analog, Frequency, or Frequency Total. The choice of variable type depends on the physical sensor that is being used, and affects the remaining options displayed in the Rapidlogger Utility. Other more advanced, or computed variable types are also available.

Analog Variables

Input Number – Choose which analog input channel this variable will use.

Multiplier – Change how the analog input is scaled to correspond to a certain reading in the chosen units.

Offset – Change the shift applied to analog input to correspond to a certain reading in the chosen units.

Frequency and Frequency Count Variables

Input Number – Choose which frequency input channel this variable will use. Typically, both a Frequency variable and a Frequency Count variable will be assigned to the same channel.

Multiplier – Change how the variable is scaled into the chosen units. Note that the multiplier will typically be off by a factor of 60 between a Frequency variable and its associated Frequency Count variable.

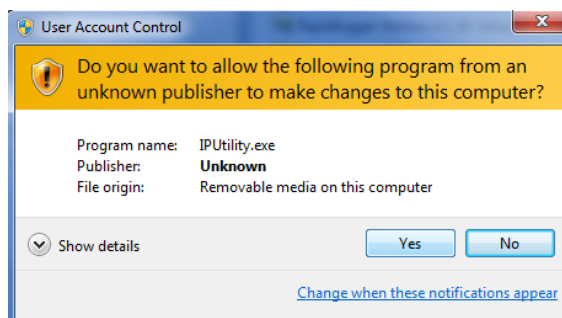
Offset – For Frequency type variables, this will almost always be 0.

2.13 Possible Misuse

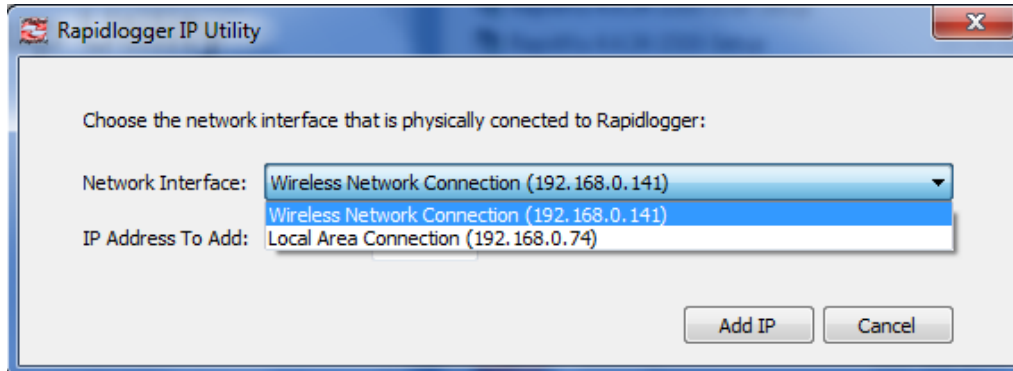
While the utmost care has been taken in creation of the variable setup and configuration program it is possible to improperly setup the unit causing data to be incorrectly recorded and displayed. Note that this can be avoided by using the factory supplied setup files and making modifications to the calibration coefficients only as defined in the manual.

2.14 Using the IP Setup Utility

The **IP Setup Utility** needs to be run as administrator to function properly. This can be done by right-clicking on the application and selecting “Run as administrator”. The following popup will appear. Select **Yes** to continue.



Once the application is open select the network interface that is physically connected to the Rapidlogger device. There is usually both a wireless and local area network option as shown below.



Enter in the IP address To Add. This step will not interfere with the current IP address or change the network settings. Select **Add IP**.

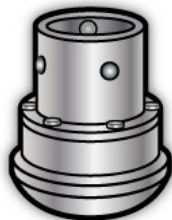
3 Advanced User Section

3.1 Using Sensors with Rapidlogger

This section describes the use and setup of various types of sensors with the Rapidlogger system. The example calculations are meant for advanced users that have a good understanding of sensor setup and associated calculations. If there is any doubt please contact the factory for support on calculating the scale and offset factors for a specific type of sensor.

Pressure Transducer

Pressure is measured by means of a pressure transducer. In general, two types of pressure transducers are used in the oilfield: Hammer union type and threaded type. Both type of pressure transducers are analog sensors. Their output can be in the form of a current, a voltage or a millivolt signal. In all cases the analog output is proportional to the pressure that is applied to the pressure transducer. The output of a current type pressure transducer ranges from 4 to 20 milliamperes. These are the most common type of pressure transducers used in the oilfield and are sometimes called current loop, 4-20mA or milliamperes sensors, these sensors can be directly connected to one of the milliampere inputs of the Rapidlogger. The output of a voltage type pressure sensor can range from 0-10Volts and this type of sensor can be attached to a Rapidlogger unit's analog input if they have been configured at the factory for Voltage input. A millivolt type pressure sensor can only be connected to the Rapidlogger analog inputs via a signal conditioner or current amplifier.



Analog sensors such as pressure transducers can be interfaced to one of the system's four high resolution analog inputs. All four analog inputs support 4-20mA signal inputs and both 2 and 3 wire sensors. The scale and offset values for a 15,000 psi pressure transducer can be calculated as follows.

Rapidlogger mA input setup

0-20mA full range = 65535 (A/D counts)

4-20mA scaled range = 52428 (A/D counts)

0-4mA scaled range = 13107 (A/D counts)

Scale Factor = 15000 (psi) / 52428 (AtoD counts) = 0.2861066 (psi/count)

Offset Value = $0.2861066 \times 13107 = -3750$ (psi)

Proximity Sensors

Pump stroke sensors are proximity switches that sense the rotation of some moving part of a pump. Both 2 and 3 wire type proximity switches ranging from 12-24V can be interfaced to the Rapidlogger. Proximity sensors or stroke counters as they are sometimes called can be one three common types. The most commonly used type of proximity sensor is in inductive proximity switch that generates a signal every time a piece of metal is within range. Other type of sensors can be a reed switch that causes a switch closure every time it is exposed to a magnet. The Rapidlogger can accommodate most types of DC proximity switches (Pulse type, open collector type and dry contact/switch closure type).



Software setup for all of these sensors would be the same but they may have to be wired differently based on their manufacturer's documentation. Two of the Rapidlogger frequency inputs (F1, and F2) are meant strictly for proximity switches and can accommodate both square wave and sinusoidal type inputs from -24 to 24V. The other two frequency inputs (Q1A, and Q2A) are shared between the frequency input and quadrature inputs and can only accommodate positive DC square wave inputs (such as the ones generated by the majority of proximity sensors). The usage of these two inputs (Q1A, and Q2A) can be configured from the front panel to be for frequency or Quadrature. Each of the four frequency inputs is automatically totalized by the system and the totals are available to be displayed and can be recorded. The conversion factor for a pump equipped with a 2000 pulse per barrel proximity switch can be calculated as follows.

Rapidlogger total counts input setup

Pulses per barrel = 2000 pulses/barrel

Scale Factor = $1 / 2000$ pulses/barrel

Offset Value = 0 barrels

Rapidlogger rate setup (for barrels / minute)

Internal rate time base = 1 seconds

External rate time base = 1 minute = 60 seconds

Pulses per barrel = 2000 pulses / barrel

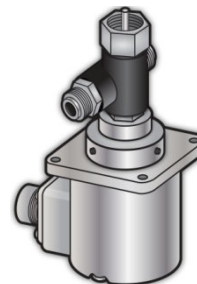
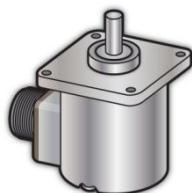
Internal to external rate conversion = $60/1 = 60$

Scale Factor = $1 / 2000 \times 60 = 0.03$

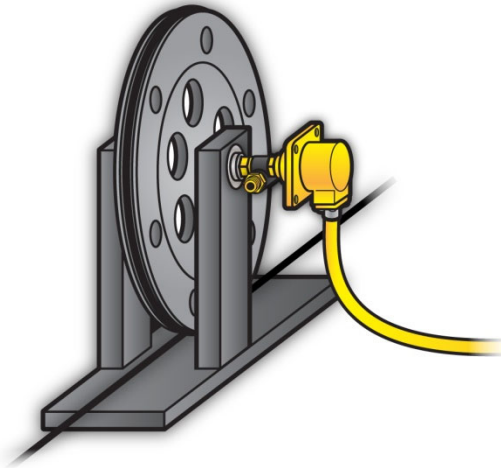
Offset Value = 0 barrels / minute

Depth Encoder

A depth encoder is used on slickline, electric line, and coiled tubing operations to measure the length or depth of wire or pipe in the hole. This is usually done by running a friction wheel on the wire or pipe. The friction wheel is connected to the shaft of the depth encoder. A depth encoder is shown below along with one with a slickline depth friction wheel adapter attached.



The output of a depth encoder is in the form of two sets of pulse signals (usually labeled A and B signals) that are 90 degrees out of phase with each other. These are called quadrature pulses and the encoders are called quadrature encoders. The output pulses from a depth encoder are usually 5Volt however some types of depth encoders have 12 volt output pulses. The Rapidlogger can be interfaced with up to two quadrature encoders with output pulses ranging from 5 to 24 Volts. In order to calculate the scaling factor of a depth encoder some information about its mounting scheme is also required. A depth encoder attached to the friction wheel on a slickline unit is shown below.



In the previous diagram the depth encoder is connected to the friction wheel through a 1:1 ratio. So for each turn of the encoder slickline equal to one circumference of the wheel will pass through. Different depth encoders can have different number of pulses per revolution. The scale factor for a 300 pulse/revolution depth encoder mounted on a 2 foot circumference wheel can be calculated as follows.

Rapidlogger total quadrature input setup

Pulses per revolution = 300 (pulses / revolution)

Pulses per foot = 300 (pulses) / 2 (ft) = 150 (pulses per foot)

Scale Factor = 1 / 150 (feet / pulse) = 0.0066667

Offset Value = 0 (feet)

Rapidlogger quadrature rate setup

Internal rate time base = 1 seconds

External rate time base = 1 minute = 60 seconds

Internal to external rate conversion = 60/1 = 60

Scale Factor = 1 / 150 x 60 (feet / pulse/minute) = .4000

Offset Value = 0 (feet/minute)

If the wheel diameter is used to calculate the wheel circumference rather than a calibration run in the shop or yard, then the diameter of the slickline should also be taken into account in the calculation of the circumference.

Rapidlogger slickline friction wheel circumference calculation

Diameter of the wheel at bottom of slickline groove in wheel = 1.0 ft

Diameter of the slickline = 0.125 inch = 0.0104167 ft

Effective diameter of the wheel = 1 ft + 2 x (0.0104167 / 2) ft

Effective diameter of the wheel = 1.0104167ft

Circumference of wheel = Pi x diameter = π x diameter = 3.1743176

Rapidlogger total quadrature input setup

Internal to external rate conversion = 60/1 = 60

Pulses per revolution = 300 (pulses / revolution)

Pulses per foot = 300 / 3.1743176 = 94.5085 (pulses per foot)

Scale Factor = 1 / 94.5085 (feet / pulse) = 0.01058106

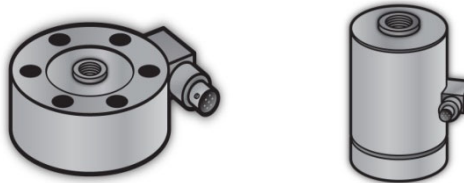
Offset Value = 0 (feet/minute)

Rapidlogger quadrature rate setup

Scale Factor = $1 / 94.5085 \times 60$ (feet / pulse/minute) = 0.63486352
Offset Value = 0 (feet/minute)

Load Cell

Tension and compression on slickline, wireline and coiled tubing units are measured by means of load cells. Load cells come in many different shapes and sizes. Two different types of load cells are shown below. The output of load cells can be in the form of a current, a voltage or a millivolt signal. In all cases, the analog output is proportional to the tension or compression that is applied to the load cell.



An analog load cell can be connected to any of the four milliamp inputs of the Rapidlogger. The scale and offset values for a 50000 lbs compression only load cell can be calculated as follows.

Rapidlogger mA input setup

0-20mA full range = 65535 (A/D counts)

4-20mA scaled range = 52428 (A/D counts)

0-4mA scaled range = 13107 (A/D counts)

Scale Factor = $50000 \text{ (lbs)} / 52428 \text{ (A/D counts)} = 0.95369 \text{ (lbs/count)}$

Offset Value = $0.95369 \times 13107 = -12500 \text{ (lbs)}$

The scale and offset values for a 50000 lbs tension/compression load cell can be calculated as follows.

Rapidlogger mA input setup

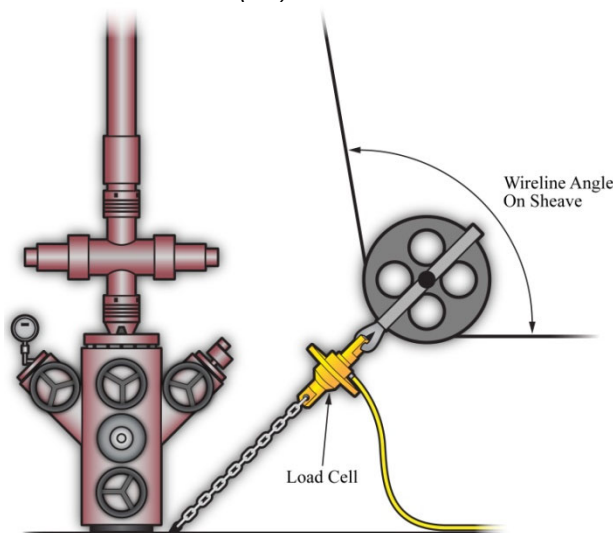
0-20mA full range = 65535 (A/D counts)

4-20mA scaled range = 52428 (A/D counts)

Zero for a tension compression cell would be at 12mA or 39321 counts

Scale Factor = $(50000 + 50000) \text{ (lbs)} / 52428 \text{ (counts)} = 1.907378 \text{ (lbs/count)}$

Offset Value = $1.907378 \times 39321 = -75000 \text{ (lbs)}$



For slickline and electric line work the load cell is often attached to the bottom sheave at the wellhead. In such an installation the load cell sees a different load than the tension in the line. This changes the calculation for the scale factor and the offset of the load cell. This type of an installation is shown earlier in this section. If the wireline angle over the bottom sheave is 90 degrees then the scale and offset values for a 5000 lbs tension load cell installed on a wireline or slickline unit on the sheave shackle can be calculated as follows.

Rapidlogger mA input setup for sheave wheel attachment

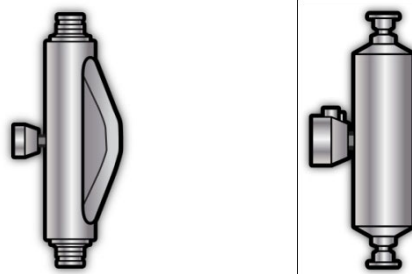
0-20mA full range = 65535 (A/D counts)
4-20mA scaled range = 52428 (A/D counts)
0-4mA scaled range = 13107 (A/D counts)
Wireline Angle on sheave = 90 degrees
Sheave factor = $2 \times \cos(90 / 2) \text{ degrees} = 2 \times 0.707106 = 1.4142135$
Scale Factor = Loadcell capacity / Sheave factor / 4-20mA scaled range
Scale Factor = $5000 / 1.4142135 / 52428 = 0.0674359866 \text{ (lbs/count)}$
Offset Value = $0.0674359866 \times 13107 = -883.883 \text{ (lbs)}$

The wireline angle over the sheave is not always 90 degrees. In the following calculation example, the scale factor and offset for a 2000 lbs load cell installed on a sheave with a wireline angle of 95 degrees is calculated.

Rapidlogger mA input setup for sheave wheel attachment
0-20mA full range = 65535 (A/D counts)
4-20mA scaled range = 52428 (A/D counts)
0-4mA scaled range = 13107 (A/D counts)
Wireline Angle on sheave = 95 degrees
Sheave factor = $2 \times \cos(95 / 2) \text{ degrees} = 2 \times 0.6755902 = 1.3511804152$
Scale Factor = Load cell capacity / Sheave factor / 4-20mA scaled range
Scale Factor = $2000 / 1.3511804152 / 52428 = 0.0282327621 \text{ (lbs/count)}$
Offset Value = $0.0282327621 \times 13107 = -370.04 \text{ (lbs)}$

Coriolis Flowmeter and Densitometer

Many modern cement units are equipped with a Coriolis-type densitometer (Micro Motion, Endress+Hauser, etc.). These densitometers can measure the flow-rate, volume, and density of the treatment fluid. The output from the densitometers is generally in the form of an analog output for density and a frequency output for the flow rate. These signals can be interfaced to the Rapidlogger unit and the data can be displayed and recorded. The milliamper outputs from the flowmeter transmitter unit can be connected to one of the milliamper inputs, and the frequency outputs from the flowmeter can be connected to one of the frequency inputs of the Rapidlogger. The flow and density meters from Micro Motion and Endress+Hauser allow the scaling of the output signal. These scale factors are configurable on the output transmitters made by the manufacturers. This is usually accomplished by a PC based setup program that is provided by the manufacturer of the flowmeter. The output scale factor must be known in order to properly interface the flow and density meters to the Rapidlogger.



Once these scale factors are known, the analog and frequency scale and offset settings of the relevant Rapidlogger inputs can be calculated as shown in the previous sections. Generally, the flowmeter output the density on a milliamp output and the flow rate is transmitted on a frequency output from the flowmeter transmitter. Contact the factory for more support on interfacing flowmeters to the Rapidlogger system.

Shutdown Relay for Over-pressure conditions

Many modern pumping units are equipped with a pump shutdown system. These systems normally can operate on a pneumatic, electric or hydraulic circuit. In case it is desired that the Rapidlogger System shutdown the pump in case of an overpressure condition then the output relay can be configured as follows.

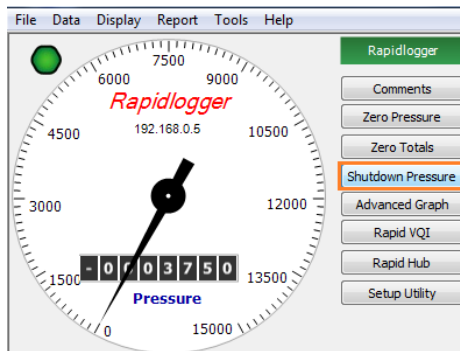
The control output wiring on the Rapidlogger is normally connected to output Relay 7. This can be programmed using the [Rapidlogger System Utility](#) as follows:

Rapidlogger Relay output setup
I/O Type = Relay Output
Input number = 7
Limit Value = 5000 (where 5000 is the desired overpressure shutdown pressure)

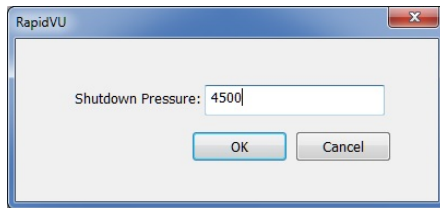
Compare Variable = 1 (where variable 1 is the pump pressure)

The pressure shutdown can be programmed in the **RapidVU** software as follows:

1. Select the **Shutdown Pressure** button and a popup will appear.



2. Enter the desired shutdown pressure (default: 14900.00 psi). Select **OK**.



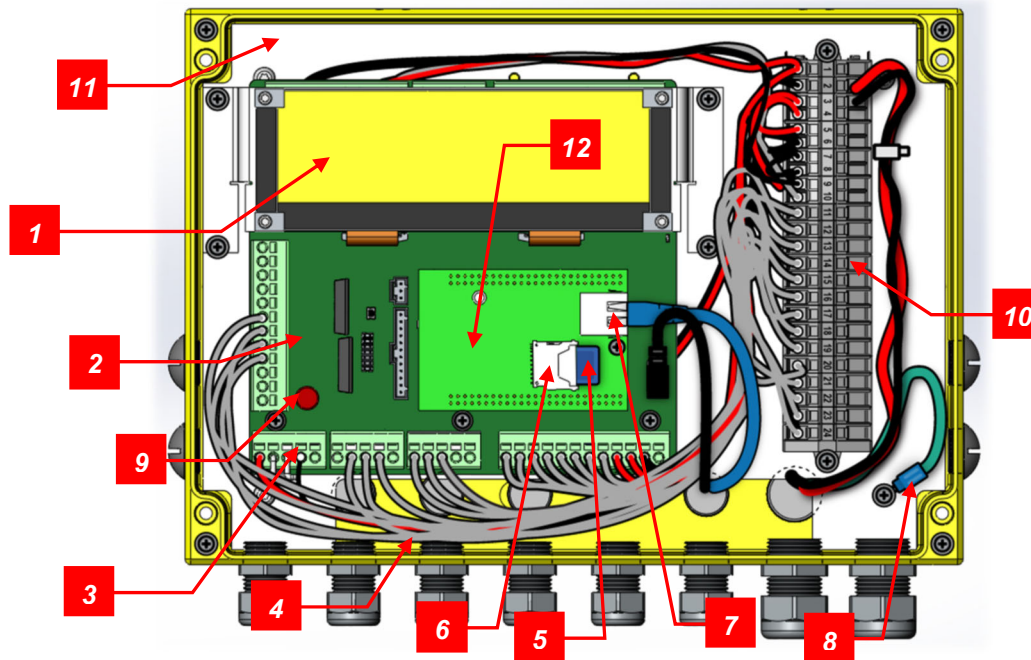
3.2 Installing and removing SD Memory card

The SD Memory card (5) installed in the Rapidlogger unit records all job data when it is powered on. The operator does not need to do anything to start the job recording, other than turning the unit on. In normal use the data is retrieved from the SD Memory card via Ethernet link using the supplied PC programs “RapidVu” or the “Rapidlogger System Utility”. As more and more data is recorded on the SD Memory card it starts getting full. It is strongly recommended that the SD Memory card be erased or formatted every few weeks to prevent data corruption. This can be done by using the “Rapidlogger System Utility” program or from the front panel keypad of the (Press **F6, F6, F6, F5**). Please make sure all old job data has been transferred from the SD Card to the PC.

WARNING: The SD card on the Rapidlogger can be corrupted by repeated improper power shutdowns and fluctuations. The user should download all important job data after every job. The SD card should be formatted / erased either from the front panel or by using the RapidVu program every few jobs (10 - 15 jobs) after they have been downloaded.

3.3 Components of the Rapidlogger System

The various components of the Rapidlogger system are shown in the diagram below.



- 1) LCD screen
- 2) Main board
- 3) Power connector
- 4) Serial port connector
- 5) SD Card
- 6) SD Card connector
- 7) Ethernet Connector
- 8) Grounding connector
- 9) Field Replaceable 1 Amp Fuse
- 10) Wiring terminal
- 11) Mounting plate
- 12) CPU Module

3.4 Interfacing Rapidlogger to a PC via WiFi

When using the Rapidlogger system with the supplied Rapidlogger WiFi Access Point connection is simple. Simply connect your Computer or Laptop to the WiFi access point named **Rapidlogger**. All network settings will be automatically configured.

3.5 Interfacing Rapidlogger to a PC via Ethernet

The Rapidlogger is equipped with a weatherproof Ethernet connector. If a cable is installed in this connector and connected to a network port, the Rapidlogger can communicate with a PC computer. Most Ethernet cables that are used are wired straight through and are meant to attach a device to an Ethernet Hub or Switch. This is the type of cable that is installed on the Rapidlogger. The second type of Ethernet cables that are used are wired in a crossover manner and are meant to connect two devices to each other without the need for a hub. A short crossover patch is supplied with the Rapidlogger and can be installed in between the Ethernet socket (7) and cable connector.

Thus, if the installation requires the Rapidlogger to communicate with a PC through a Hub/Switch as in the majority of the cases, then the Ethernet cable should be used without any changes. If, however the installation requires the Rapidlogger to communicate with a PC without a Hub/Switch then the crossover patch should be installed inside the Rapidlogger unit.

The second part of communicating with a PC is setting up of the correct IP address, gateway address and network mask. There are two types of address setup mechanisms, automatic/dynamic/DHCP and static. The Rapidlogger unit uses static IP addresses. The current IP address and gateway address setup in the unit is displayed on the screen on the bottom left and bottom right of the screen for a few seconds after the unit is powered up. Both or these are numbers are a sequence of four three digit numbers of the form (192.168.000.005). In order for the Rapidlogger to communicate properly with a PC over the Ethernet connection, the PC and Rapidlogger should have compatible IP addresses that are within the same subnet. If the user is unfamiliar with IP addresses then it is recommended that they use the following.

PC / Laptop	IP: 192.168.000.001	Gateway: 192.168.000.001	Netmask: 255.255.255.000
Rapidlogger	IP: 192.168.000.005	Gateway: 192.168.000.001	Netmask: 255.255.255.000

IP settings on a PC are done from the Windows control panel in the IP setting field within the properties of the LAN Connection Dialog box. On the Rapidlogger these settings are done from the front panel keypad. Press **F6**, **F6**, **F1** and then enter the IP address, Gateway and Netmask when prompted on the screen. Perform a power cycle to verify and activate the IP address from the LCD screen. The default IP address of 192.168.000.005 is setup in the system at the factory. This is also the IP address that the system goes back to whenever a factory reset is done. Advanced users should select and utilize the IP addresses appropriate for their network.

Once the IP addresses are setup then the PC and the Rapidlogger are able to communicate with each other. Proper communication can be verified by performing a PING from the PC to the Rapidlogger IP address. Do note that some PC firewall programs block Ethernet communication that they are not familiar with. If you have such a firewall running on your PC then you may either need to disable it or specifically setup it up to allow full two way communication to the Rapidlogger IP Address.

3.6 Sensor Input Diagnostics

The Rapidlogger Unit has a built-in diagnostics mode in which the raw sensor inputs can be viewed to ease troubleshooting. The diagnostics mode for analog sensors can be accessed from the front panel keypad (Press **F6**, **F6**, **F5**, **F1**, **F1**). The diagnostics mode for frequency sensors can be accessed from the front panel keypad (Press **F6**, **F6**, **F5**, **F2**). In each case a screen appears on the LCD that displays the various sensor values.

3.7 Editing Input Variables

All of the Rapidlogger data is based on calculations performed on input data. The results of the calculations are stored in the system variables. The settings of the input variables can be viewed and edited from the front panel and by using the PC program **Rapidlogger Utility**.

In order to view a system variable, select the view option (Press **F6**, **F6**, **F4**, **F3**) and then enter the variable number to view. To edit a system variable, select the view option (Press **F6**, **F6**, **F4**, **F4**) and then enter the variable number to edit. The system will prompt you with the current value of each of the settings for that particular variable and then allow you to enter a new value. For any values that need to remain unchanged press **F6** and the system will skip to the next value. Editing system variables is a feature that should only be done by advanced users and then too it should be done by using the **Rapidlogger Utility**.

3.8 Modbus Communication

The Rapidlogger unit is capable of communicating with other third party devices HMIs, SCADA, systems, and PLCs using Modbus. The Modbus protocol is a messaging structure, widely used to establish master-slave communication between intelligent devices. A Modbus message sent from a master to a slave contains the address of the slave, the 'command' (e.g. 'read register' or 'write register'), the data, and a check sum. Since the Modbus protocol is just a messaging structure, it is independent of the underlying physical layer. On the Rapidlogger Unit it is implemented in Ethernet and it used the Modbus-TCP/IP protocol. The Rapidlogger operates in Modbus slave mode. Both Read and Write to Modbus Holding registers are allowed.

Rapidlogger™

In order to enable modbus, use the Rapidlogger Utility and on the System Setup dialog box enable Modbus and select a slave address.

The System Setup dialog box is divided into several sections. The 'Hardware Setup' section includes fields for 'Number of LCD Display Variables' (set to 5), 'Operating Mode' (set to 'Cement Pump'), and 'Recording Period' (set to 1). The 'Rapidlogger Utility View - Dial Setup' section includes 'Dial Variable' (1), 'Dial Lower Limit' (0.0), and 'Dial Upper Limit' (15000.0). The 'Test / Debug' section includes a 'Test Comment' field, a 'Cloud IP Address' field (206.189.61.28), and a 'Set Default IP' button. The 'Modbus / WITS' section has radio buttons for 'WITS' and 'Modbus' (selected), and an 'Address' field (1). The 'CAN Address' section has 'Master = 0' and 'Slave = 1 to 126' options. The 'Calibrate' section includes an 'Analog Inputs Calibration Factor' field (1.00000) and a 'Calibrate' button. The 'Quadrature Inputs Setup' section has radio buttons for 'Quadrature Normal Mode' (selected) and 'Quadrature As Frequency Mode'. At the bottom are 'Read From Unit', 'Apply', and 'Cancel' buttons.

Restart the Rapidlogger Unit. All variables defined on the Rapidlogger will now be automatically available via Modbus. So Rapidlogger Variable #1 will be available as Modbus Holding Register 1, as a 32 bit floating point value in Big-endian format. Rapidlogger Variable #2 will be available as Modbus Holding Register 3, as a 32 bit floating point value. Rapidlogger Variable #3 will be available as Modbus Holding Register 5 and so on.

If there is a need to write a variable to the Rapidlogger using Modbus then the first step is to create a Modbus Receive type variable on the Rapidlogger as follows.

The Rapidlogger System Utility dialog box shows the configuration of a variable. The 'Variable Data' section includes 'Variable Number' (12), 'Variable Name' (ModbusInp1), 'Variable Units' (na), and 'Decimal Places' (1). The 'I/O Type' dropdown is set to '7- Modbus Receive'. The 'Toggles' section includes checkboxes for 'Enable', 'LCD Display', 'Record/Transmit', 'CAN Bus Transmit', 'Noise Filter', 'Special A', and 'Special B'. The 'Rapidlogger Unit' section includes the 'Rapidlogger Unit Network Address' (192.168.0.3) and a 'Find Rapidlogger' button. The 'Local Computer Disk' section includes buttons for 'Read One from Unit', 'Write One to Unit', 'Read All from Unit', 'Write All to Unit', 'System Setup', 'Sync Time', 'Copy Variable', and 'Paste Variable'. The 'Rapidlogger Unit Filesystem' section includes buttons for 'Read Vars File', 'Read CSV', 'Write Vars File', and 'Write CSV'. The 'Variables Defined' list on the right includes: 1. Pressure E.D.T, 2. Density E.D.T, 3. TotalVolume E.D.T, 4. TotalRate E.T, 5. Pump1Rate E.D.T, 6. Pump2Rate E.T, 7. Pressure2 E.T, 8. Pump1Total E.D.T, 9. Pump2Total E.D.T, 10. Flowmeter-R E.T, 11. Shutdown E.T, and 12. ModbusInp1 E.D.T. The 'Rapidlogger-RLC2: Connected' status is shown at the bottom left.

Now if a Modbus Master device writes a 32 bit floating point number to Modbus Register # 23 then the Rapidlogger Variable 12 will be updated with this value.

Note that either Modbus or WITS0 protocol can be enabled at one time. All Modbus polling on the Rapidlogger is limited to a 1Hz acquisition rate.

3.9 WITS Communication

The Rapidlogger unit is capable of communicating with other third party devices HMIs, SCADA, systems, and PLCs using WITS. The WITS or Wellsite Information Transfer Standard communication protocol is used to transfer drilling and geology data between systems at a wellsite. This protocol serially streams data by using a pre-defined record with channels and values. The pre-defined record used with the Rapidlogger unit is a subset of the WITS0 or WITS level 0 record.

WITS0 Network Output Screen can be reached through Data menu

WITS from Network

WITS Network Output

WITS

Add WITS Connection... Delete Connection

TCP: 0 Device ID: 1

TCP: 0 Device ID: 2

195.168.0.141

WITS Record 1 - GENERAL TIME-BASED

Display	WITS Item #	Variable Name in RapidVU	Modbus Reg #
☒	1 - Well Identifier	WellIdentifier	40000 - 40007
☐	2 - Sidetrack/Hole Sect No.	Sidetrack/HoleSectNo.	40008
☐	3 - Record Identifier	RecordIdentifier	40009
☐	4 - Sequence Identifier	SequenceIdentifier	40010 - 40011
☒	5 - Date	Date	40012 - 40013
☒	6 - Time	Time	40014 - 40015
☐	7 - Activity Code	ActivityCode	40016
☒	8 - Depth Bit (meas)	DepthBit(meas)	40017 - 40018
☐	9 - Depth Bit (vert)	DepthBit(vert)	40019 - 40020
☐	10 - Depth Hole (meas)	DepthHole(meas)	40021 - 40022
☐	11 - Depth Hole (vert)	DepthHole(vert)	40023 - 40024
☐	12 - Block Position	BlockPosition	40025 - 40026
☐	13 - Rate of Penetration (av	RateofPenetration(avg)	40027 - 40028
☐	14 - Hookload (avg)	Hookload(avg)	40029 - 40030
☐	15 - Hookload (max)	Hookload(max)	40031 - 40032
☐	16 - Weight on Bit (surface)	WeightonBit(surface)	40033 - 40034

Copy Configuration Paste Configuration Clear All Clear

Modbus

☐ Send WITS Data to Modbus Modbus Port #: 0

OK Cancel

WITS0 Network Output

Network Port:

Enabled	Field Name	WITS Table	WITS Data ID
☒	Date	1	5 - Date
☒	Time	1	6 - Time
☒	Pressure	2	13 - Standpipe Pressure (avg)
☒			
☒			
☒			
☒			
☒			
☒			
☒			

3.10 Rapidlogger J1939 Protocol

The Rapidlogger unit supports communication over the J1939 protocol. This allows it to get data from engines and transmissions that have J1939 capable ECUs. In order to setup the use of J1939 data from the engine or transmission, three steps need to be completed.

The first step is to enable the J1939 protocol in the Rapidlogger System by using the Rapidlogger Utility. The protocol setup can be done in system setup dialog box as shown below

System Setup

Hardware Setup

Number of LCD Display Variables:

Cement Pump:

Operating Mode:

Recording Period:

Quadrature Inputs Setup

☒ Quadrature Normal Mode

☐ Quadrature As Frequency Mode

Rapidlogger Utility View - Dial Setup

Dial Variable:

Dial Lower Limit:

Dial Upper Limit:

Calibrate

Analog Inputs Calibration Factor:

Test / Debug

Test Comment:

Cloud IP Address:

Modbus / WITS

☐ WITS

☒ Modbus

Address:

CAN Address

Master = 0

Slave = 1 to 126

Protocol

☐ SDS

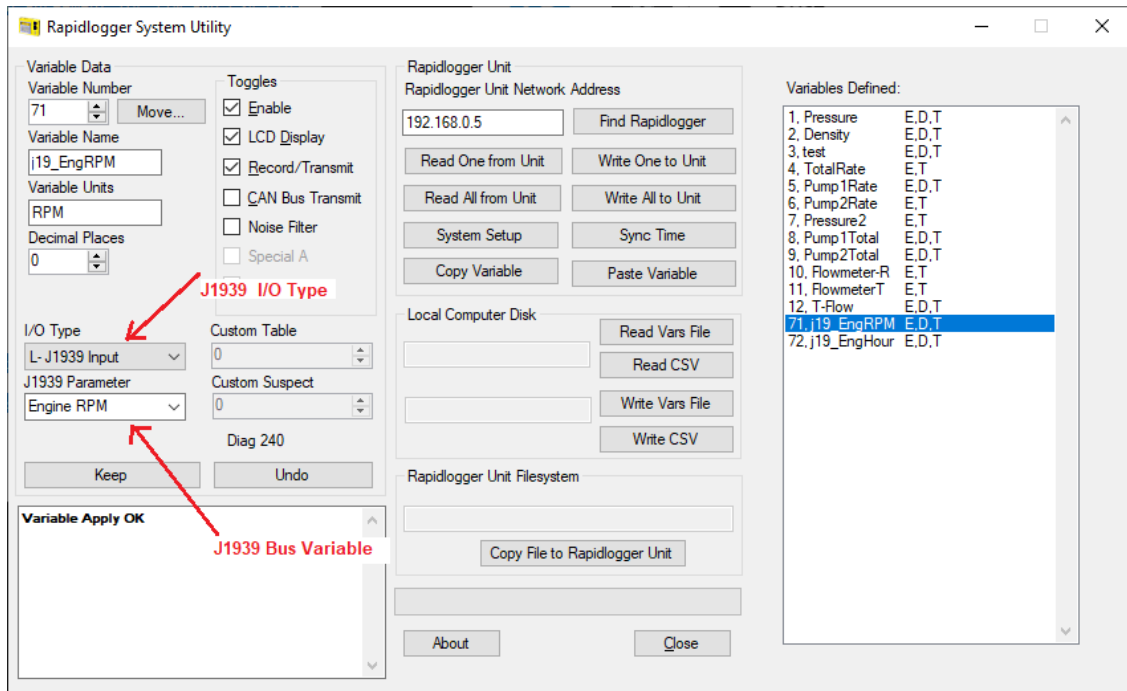
☒ J1939

☐ CANOpen

The second step is to place a “_j1939cfg.csv” file in the Rapidlogger System sd-card. This file must be placed in the root directory of the sd-card. This file can be downloaded from the Rapidlogger Systems website in the downloads area. This file instructs the Rapidlogger System to create temporary variables numbered 71 through 85 in the system memory and then fill them with CAN bus J1939 data as it comes in from the J1939 devices. A sample copy of the file is shown below.

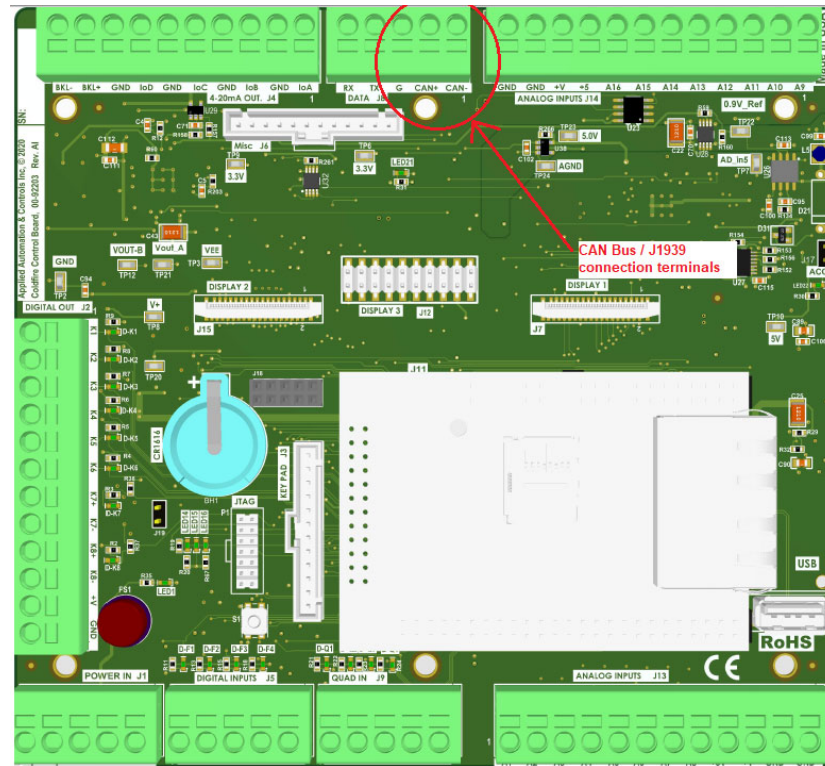
```
# J1939 Rapidlogger System Configuration file,,,,,,,,,,,,,
# File needs to be placed in root directory of SD card on Rapidlogger System
# Column A is DAQ Var Number 1-100,,,,,,,,,,,,,
# Column B is J1939 PGN (parameter group number); non-standard PGNs:
# Column C is the cyclic request/write time if request column is set to Y
# Column D is 'request': N or Y,,,,,,,,,,,,,
# Column E is the address: N= no, E= engine, T=transmission, A= ABS, S= Summary from
multiple
# Column F is the map: start byte, bit and length: byte.bit.len",,,,,,,,,,,,,,
# Column G is the Read/Write Direction, Value 'R' OR 'W' means J1939 read or write
# Column H is a J1939 gain
# Column I is a J1939 offset
# Column J is a J1939 label
# Column K is a comment,
#70,61444,0,n,N,0,R,0.0000000000,0.00,Custom,Custom Parameter,
71,61444,0,n,N,4.1.16,R,0.1250000000,0.00,RPM,Engine RPM
72,65253,2000,Y,E,1.1.32,R,0.0500000000,0.00,hr,Engine Hrs
73,65271,0,n,N,7.1.16,R,0.0500000000,0.00,V,Batt.Poten.Voltage,
74,61443,0,n,N,3.1.8,R,1.0000000000,0.00,%,Engine Load at RPM,
75,65262,0,n,N,1.1.8,R,1.0000000000,-40.00,degC,Coolant temperature,
76,65263,0,n,N,4.1.8,R,4.0000000000,0.00,kPa,Engine Oil Pressure,
77,65266,0,n,N,1.1.16,R,0.0500000000,0.00,L/h,Fuel Rate
78,61443,0,n,N,2.1.8,R,0.4000000000,0.00,%,Accel.Pedal Position,
79,65270,0,n,N,3.1.8,R,1.0000000000,-40.00,degC,Intake manif.temperature,
80,65266,0,n,N,3.1.16,R,0.0019531250,0.00,km/kg,Inst.Fuel Economy
81,65272,0,n,N,4.1.8,R,16.0000000000,0.00,kPa,Transm. Oil Pressure,
82,65272,0,n,N,5.1.16,R,0.0312500000,-273.00,degC,Transm. Oil Temperature,
83,65226,0,n,S,1.2.1,R,0.0000000000,0.00,x,RED lamp: JMAP byte.bit.len n
84,65226,0,n,S,2.2.1,R,0.0000000000,0.00,x,AMBER lamp,
85,61441,0,n,N,1.1.2,R,1.0000000000,0.00,x,ASR Eng.CtrlAct - at least one PGN required
# 1, 99999,1000,n,N,1.1.8,W,0.0085000000,0.00,psi,RL's pressure to broadcast
```

The third step is to configure the Rapidlogger Variables as needed to utilize the J1939 data in the job recording or job report file. For example if one wants to setup Variable 71 to show the engine rpm they would configure the variable 71 as follows.



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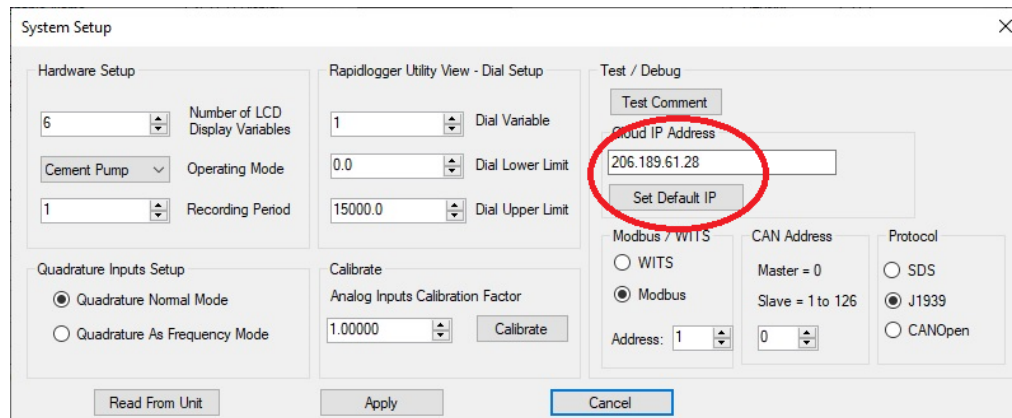
This completes the J1939 software and configuration setup. A reboot of the Rapidlogger System is required after this to enable all of the settings correctly. CAN bus data connections are to be made to the Rapidlogger Main board terminal block J8-1 J8-2 and J8-3. This terminal block is located below the LCD panel of the Rapidlogger and is moderately difficult to access.



A CAN bus termination resistor may or may not be required depending on whether or not termination resistors are part of the CAN bus wiring that is used for connecting the Rapidlogger to the Engine/Transmission.

3.11 Rapidlogger Cloud Link

Data from the Rapidlogger Unit can be sent to a cloud server and accessed in realtime at a remote location. The cloud server address can be set up using the Rapidlogger Utility as follows



The default Cloud Server IP address connects the Rapidlogger to the Rapidlogger Systems cloud server. If a client has chosen to setup their own private cloud server they can enter the IP address of their server. Once this setup is complete then the next step is to connect the ethernet cable of the Rapidlogger Unit to a router or gateway that allows connectivity to the internet.

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If using the Rapidlogger Cloud server go to the Rapidlogger Cloud server access page at the following link

<http://www.rapidlogger.com/pages/RapidCloud.html>

The following page will appear on your browser

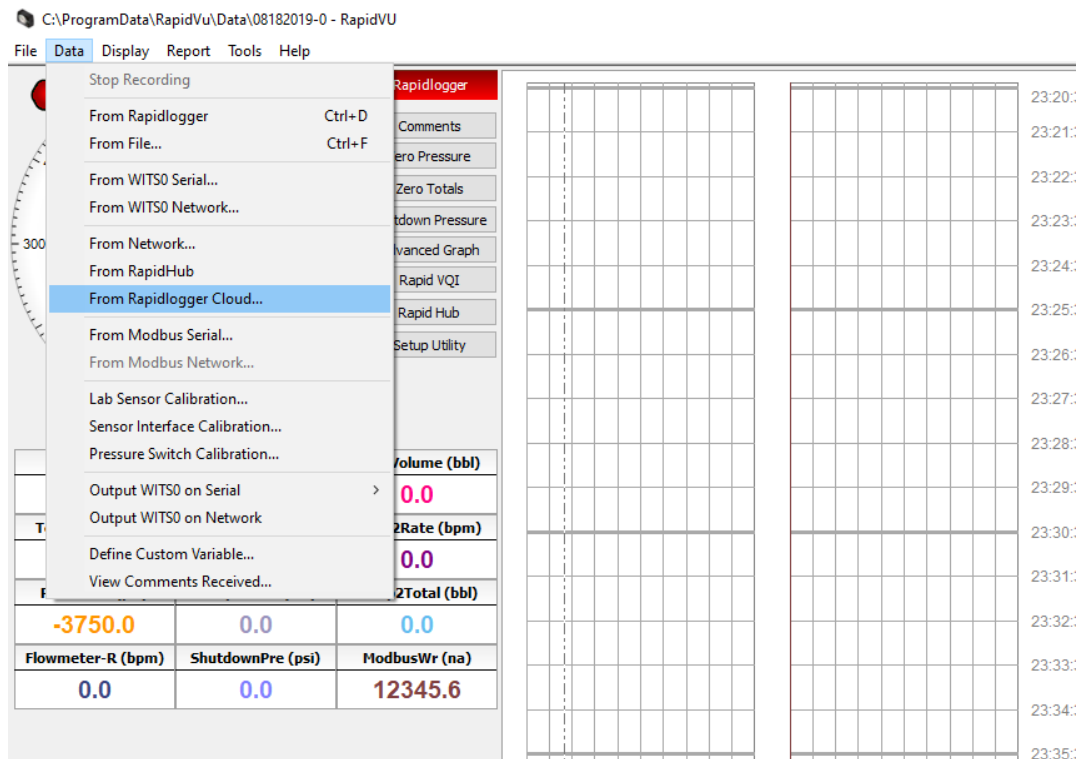
Enter your company name and password. Company names and passwords are setup free of charge by contacting the Rapidlogger Systems support via email at support@rapidlogger.com.

Once on your company page on the Rapidlogger Cloud server the following appears on your browser

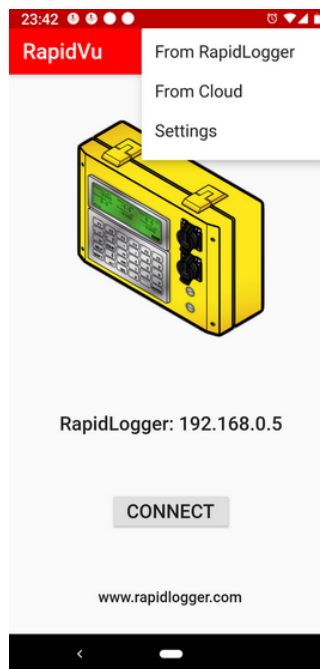
This page shows all of the Rapidlogger Units registered to the company. Clicking on “Detail” gives the live data in the browser.

Rapidlogger unit data sent to the cloud can also be accessed via the RapidVu program as follows

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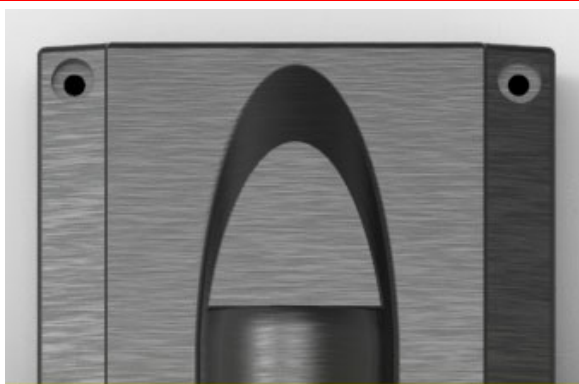
If one is using the Android or iPhone app then cloud data can be accessed as follows



3.12 Wi-Fi Access Point

This Wi-Fi access point will allow you to wirelessly communicate between your Rapidlogger system and computer. The Wi-Fi kit for the Rapidlogger system comes with a high-powered, long range 2.4 GHZ outdoor access point (AP) and an enclosed power supply as shown below.

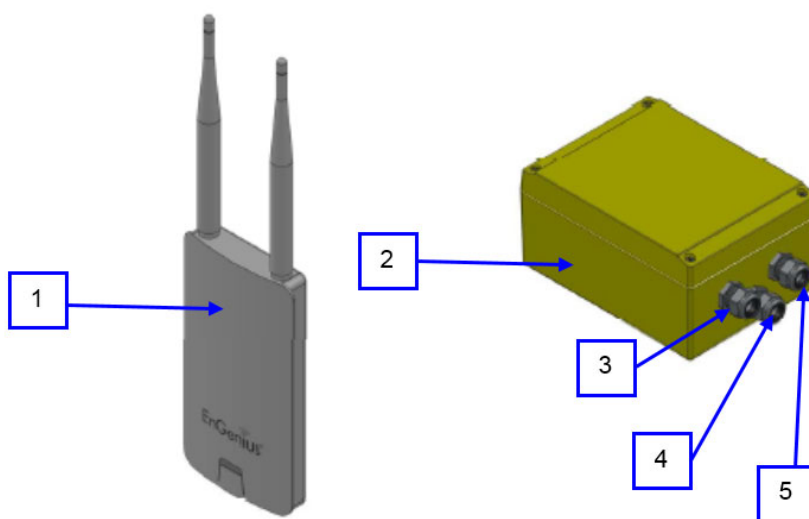
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The 3rd Generation Rapidlogger Access Point



The 2nd Generation Rapidlogger Access Point

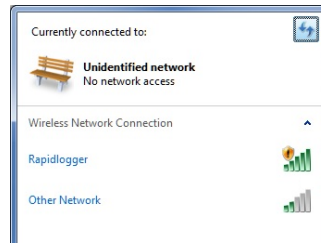


The 1st Generation Rapidlogger Access Point

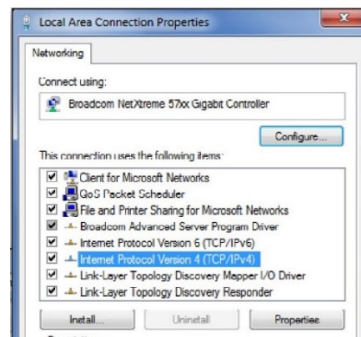
- 1) Wi-Fi access point device
- 2) Wi-Fi power supply
- 3) Power in connector
- 4) Ethernet to Rapidlogger connector
- 5) Ethernet to access point device connector

3.12.1 Connecting the Access Point (AP)

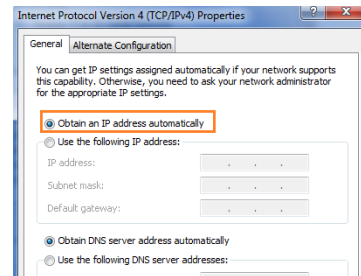
1. Turn on the Rapidlogger Unit.
2. Click on the internet symbol located on the bottom right hand corner of your laptop screen. Switch your network to Rapidlogger (Rapidlogger Accesspoint).



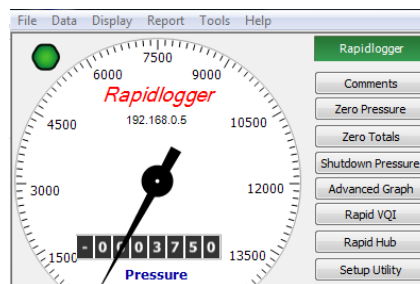
3. Click on the internet symbol again and click **Open Network and Sharing Center**.
4. Select **Change adapter settings** located on the left. Click the **local area connection** and under properties select **Internet Protocol Version 4 (TCP/IPv4)**.



5. Switch the setting to **obtain an IP address automatically**.



6. Click **OK**. And again Click **OK**.
7. To verify this setup open the **RapidVU** software and try to run by clicking **Data > From Rapidlogger**. If the Rapidlogger word and circle light up green, then you are connected.

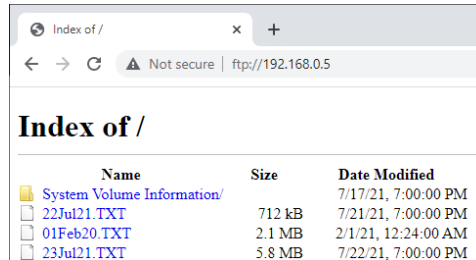


8. You should now be able to communicate to the Rapidlogger system from your computer. The 2nd and 3rd Generation WiFi APs come preinstalled in the Rapidlogger and do not require any installation.

3.13 Rapidlogger Web Page Access

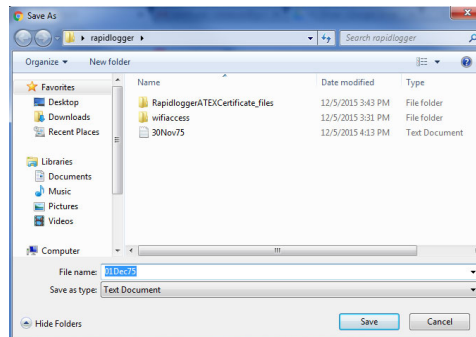
The web page access will allow you to have read-only access to all the Rapidlogger files that have been saved to the Rapidlogger device SD card. Once a Rapidlogger file is saved to your PC this allows you to read the data using the **RapidVU** software.

1. On your PC that is connected via Ethernet to the Rapidlogger enter the IP address of the Rapidlogger device (default IP address: 192.168.0.5). In the address bar type **ftp://192.168.0.5**



2. The web page will appear and contain all the Rapidlogger files with the following information: file save date and time, size in bytes and name of the file in link form for read-only access.
3. To save a Rapidlogger file right-click on the file and select **Save link as....** The file name defaults to the same name shown on the web browser. Select the **Save** button after selecting the desired location to save the file.

Note: To read the data in this recently saved *.txt file refer to the instructions “To read data from a *.txt file:” in section 2.7 Using the RapidVU Program.



4. To view a file in the web browser, double-click on any available file. The file will appear with read-only access as shown below.

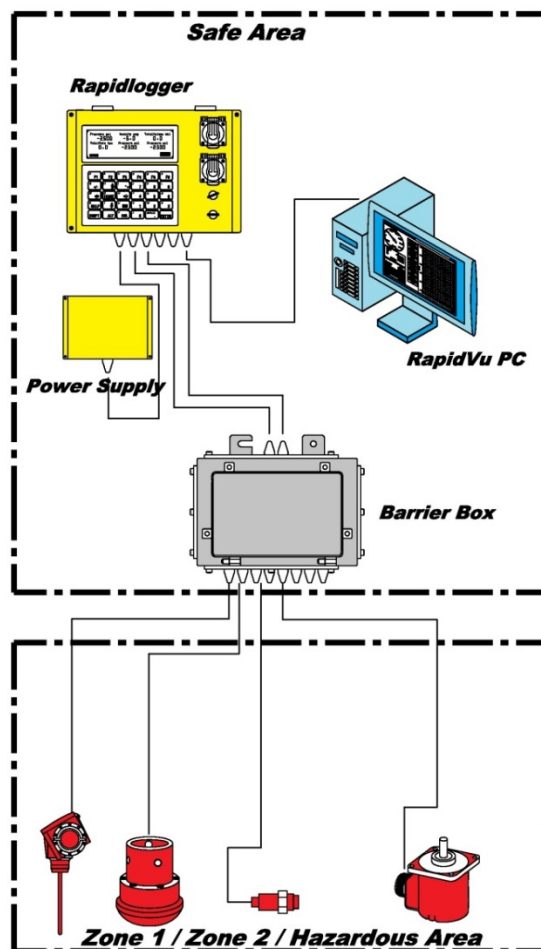
```
# Rapidlogger Job Data
#
# SerialNumber F4075D21
# Firmware Version 8.6j
# FPGA Version v.0117,20151012
# JobType Cementing
# DialVariable Pressure Min 0 Max 15000
# VQIData 120 0 0 0 0 0 0 1 63 128 0 0 0 0 0
# VariableList 0 1 2 3 4 5 6 7 8 9 10 59 60 61 62 63 64 65 66 67 68 69 70 71 72
# ScaleList 0.286107 0.000477 8.000000 5.000000 0.012900 0.012900 0.286107 0.000215 0.000215 0.002000 14900.000000 0.000000 0.000000 0.000000
0.000000 1.000000 0.026623 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 1.000000 1.000000
# OffsetList -3750.000000 -6.250000 0.000000 0.000000 0.000000 0.000000 -3750.000000 0.000000 0.000000 1.000000 0.000000 0.000000 0.000000
0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
# UnitList psi ppg bbl bpm bpm psi bbl bbl bpm psi ppg per per per bpm bpm bpm per ppg per per * per per
# Pressure Density TotalVolume TotalRate Pump1Rate Pump2Rate Pressure2 Pump1Total Pump2Total Flowmeter-R ShutdownPre mixdensity mixtnklvl
bulkvlvpos watervlvpos mixflow waterbigflo waterflow bulkvlvsp densitysp mixtnklvlsp watervlvsp slurvyqlt bulkopensp bulkclosesp
01/06/12 23:07:21 -3750 -6.2 0.0 0.0 0.0 0.0 -3750 0.0 0.0 0.0 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000
01/06/12 23:07:22 -3750 -6.2 0.0 0.0 0.0 0.0 -3750 0.0 0.0 0.0 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000
```

5. To return to the file list, click the back button in the web browser.

4 Installation Section

4.1 Installation in hazardous Areas

The installation of hazardous area ATEX certified equipment shall be done in accordance with the latest applicable edition of EN 60079-14. For overall installation details see installation drawing in Appendix A.



The summary illustration above shows that the installation of the Rapidlogger System in the hazardous areas involves installing certain components in the safe area and some components in the hazardous area. The installation of the ATEX certified Rapidlogger System can only be done by electrical installers that are properly certified to work in the specific area. These certifications are specific to the countries where the installation is taking place.

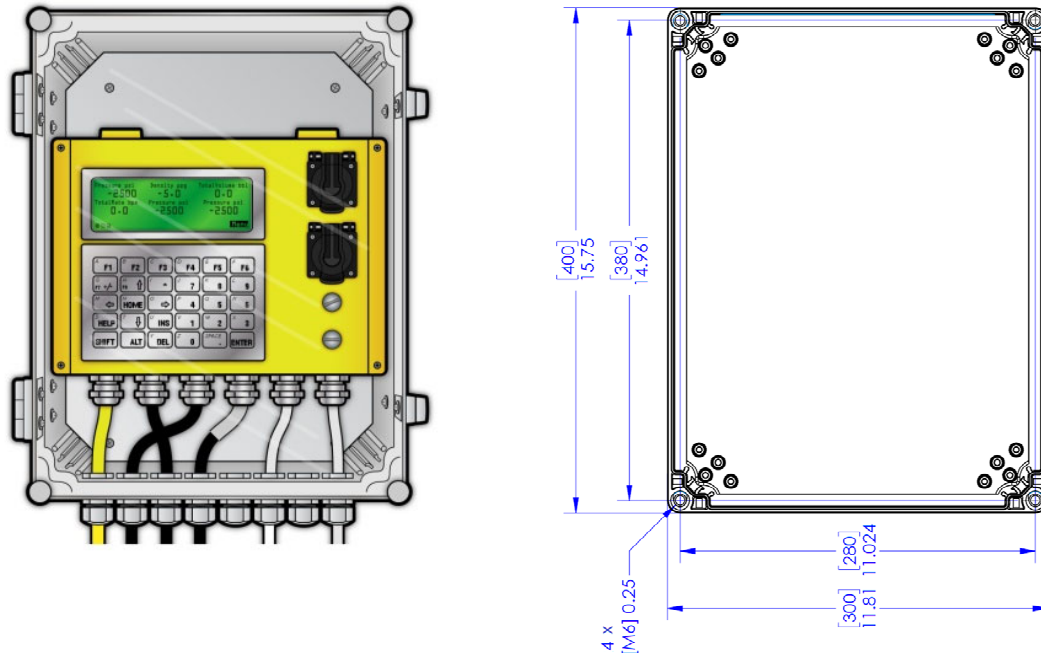
4.2 Mounting the Rapidlogger Unit

The Rapidlogger panel has been designed to be installed and used in harsh environments. The unit will operate well in direct sunlight, rain and sea water spray; however, protecting it from the elements will extend its life and maintain the appearance. Installation will vary slightly depending on whether the single box unit or the double boxed outdoor unit is being installed.

Installation of the double box unit

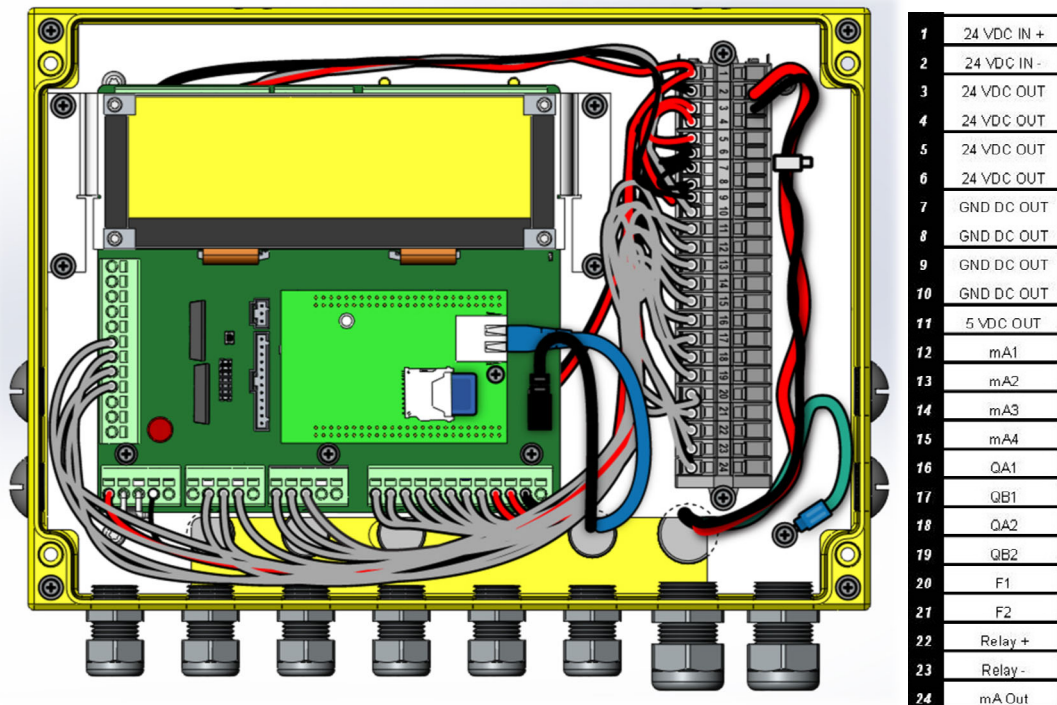
The double boxed Rapidlogger unit is the more common assembly that is supplied. This consists of metal Rapidlogger unit enclosed inside a larger polycarbonate box with a clear front. The secondary enclosure provides a very high degree of protection to the electronics in the unit from rain, dirt, physical damage, and pressure wash sprays. An illustration of this unit and a multi voltage power supply appears below.

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The first step in the installation is to identify an appropriate mounting location on the equipment to mount the Rapidlogger and the power supply. Next place the unit in the spot to be mounted and mark the location of the four mounting holes with a center punch or use the hole pattern drawing.

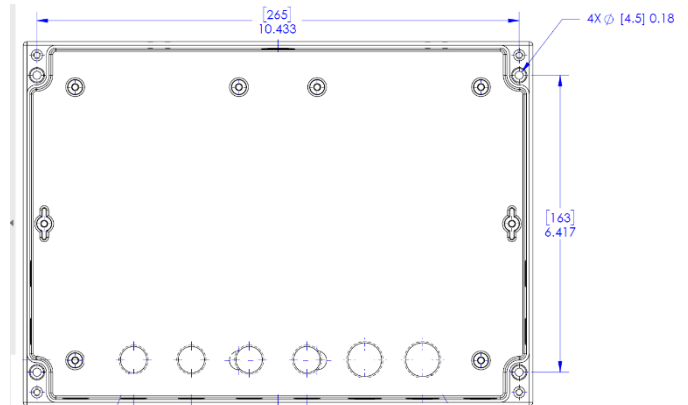
Make sure that the unit is level. Drill holes in the panel with a drill bit sized for 1/4" clearance (9/32" would be appropriate). Next do the same for the holes for the power supply unit. Use the supplied (2" long 1/4"-20 size socket head) bolts and lock nuts to fasten the unit to the control panel. Do the same for the power supply unit. Next route the power and sensor cables as needed around the equipment and connect them to the power source and the sensors. All required cables come prewired to the unit generally only minimal wiring has to be performed.



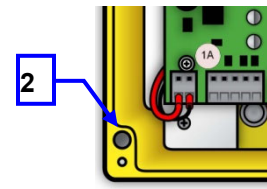
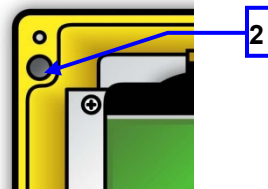
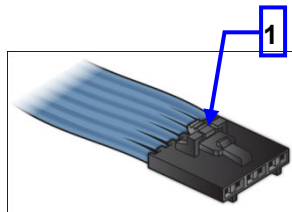
Wire Terminal Layout – Standard Unit

Installation of the Single boxed unit

If installing a single boxed Rapidlogger unit follow these instruction and steps. An illustration of the regular unit appears below. The Rapidlogger Single box unit can be mounted in outdoor environments such as on the side of oilfield trucks and skids without any weather protection. However, in such applications the Rapidlogger unit lid should be kept tightly closed and the inside protected with a dry desiccant pouch.



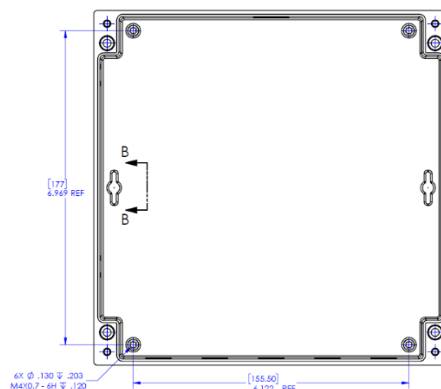
If you need to remove the hinged Rapidlogger lid from the back of unit to install then the keypad cable needs to be detached. This can be done by carefully detaching the keyboard cable from the unit lid by depressing the small locking tab (1) on the keypad connector and gently pulling and rocking the connector back and forth. The mounting holes (2) used to mount the unit to a control panel are visible once the lid has been opened.



Find a place on the panel to mount the Rapidlogger panel. Place the unit in the area to be mounted and mark the location of the four mounting holes with a center punch or use the hole pattern drawing. Drill the holes in the panel with a 1/4" drill bit. If you want to route the cables using the rear cable exits on the Rapidlogger then you must drill holes to clear the cable and cord grips also. Thread the cables through the holes, and use the supplied (10-24 size) bolts and nuts to fasten the unit to the control panel.

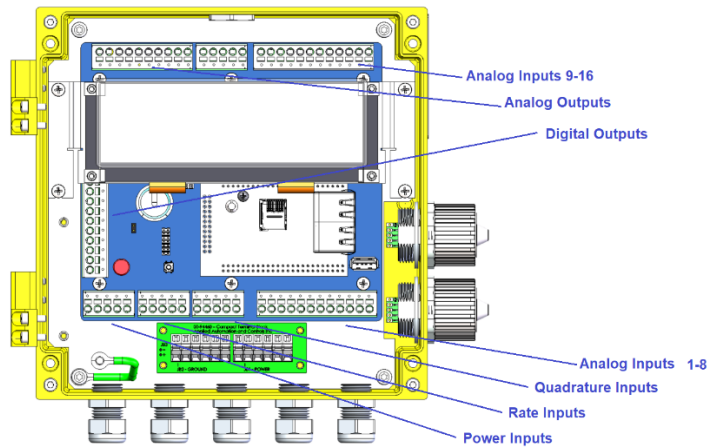
Installation of the Rapidlogger Mini unit

If installing a Rapidlogger Mini unit follow these mounting holes



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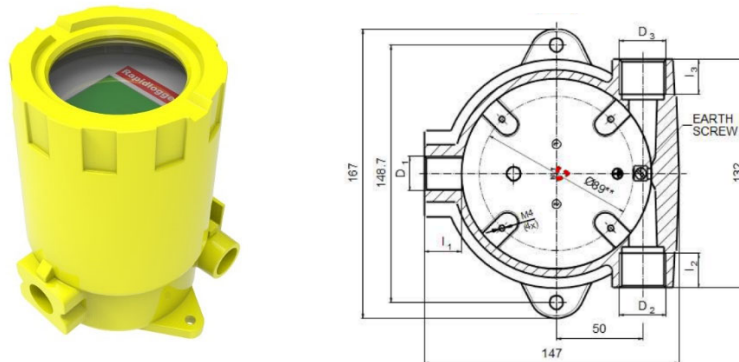
The Rapidlogger Mini can be mounted in outdoor environments such as on the side of oilfield trucks and skids without any weather protection. However, in such applications the Rapidlogger unit lid should be kept tightly closed and the inside protected with a dry desiccant pouch.



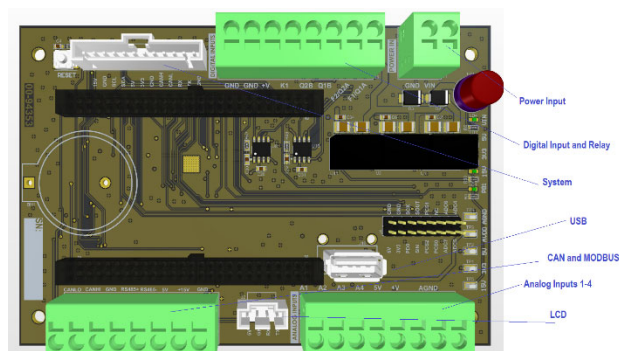
Wire Terminal Layout – Mini Unit

Installation of the Rapidlogger ExD unit

The Rapidlogger ExD unit is used for acquiring data in Hazardous Zone 1 and Zone 2 locations. It can be used as a standalone data logger. When installing a Rapidlogger ExD unit, use the following mounting holes.



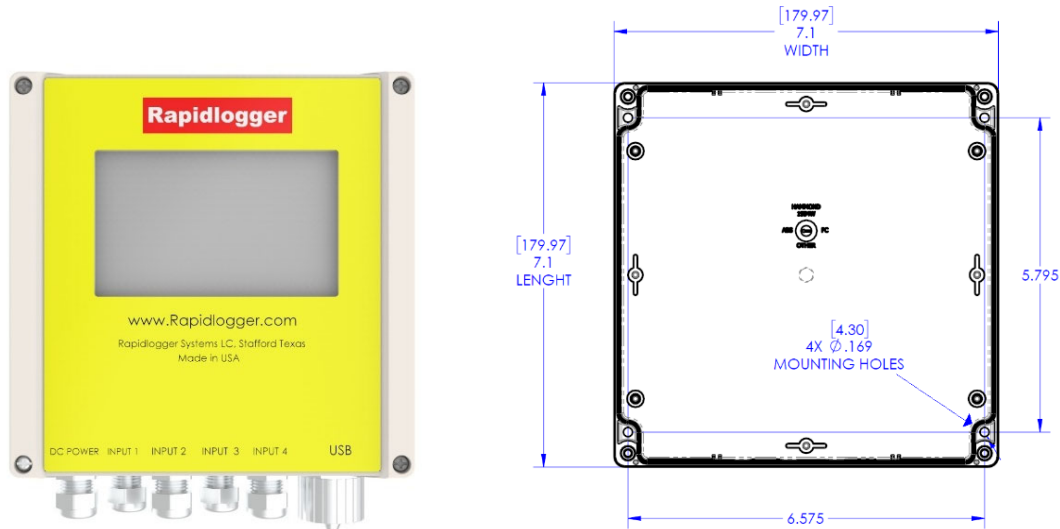
The Rapidlogger ExD can be mounted in outdoor environments such as near wellheads, CT injectors, and Mud tanks. However, in such applications the Rapidlogger ExD lid should be kept tightly closed and the inside protected with a dry desiccant pouch. Only armored cables can be used with the Rapidlogger ExD when it is installed in Hazardous areas.



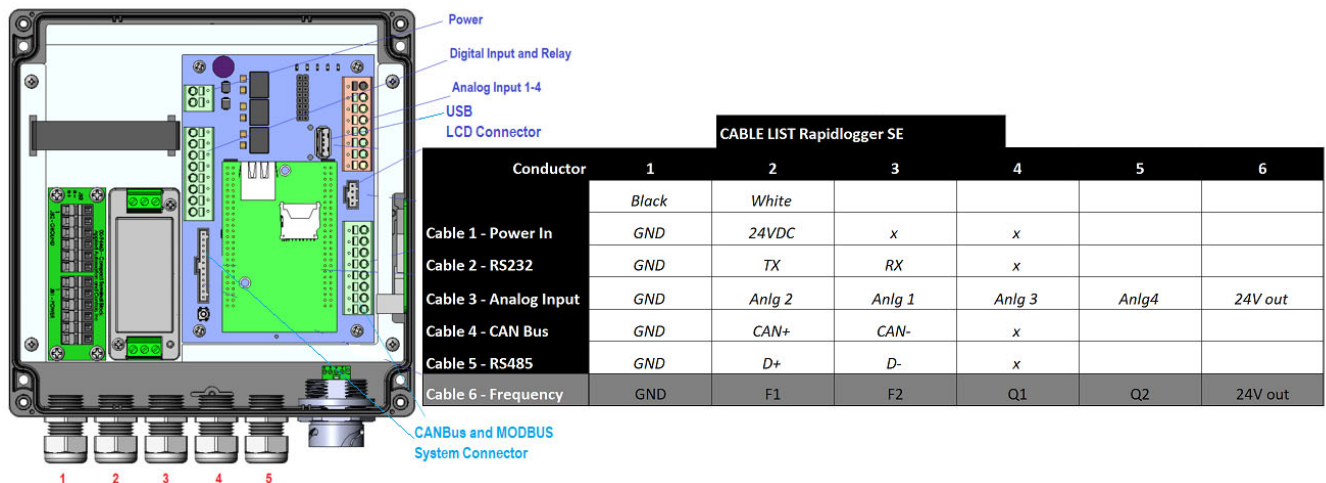
Wire Terminal Layout – ExD Unit

Installation of the Rapidlogger SE unit

The Rapidlogger SE unit is an economical version of the Rapidlogger Unit. This type of unit is used for acquiring data in protected and safe locations such as control cabins, pump containers, and labs. The Rapidlogger SE unit is NEMA 4 and IP66 sealed but is made of polycarbonate and not quite as tough as the regular cast aluminum Rapidlogger Units.



The Wiring Terminals of the Rapidlogger SE are shown below

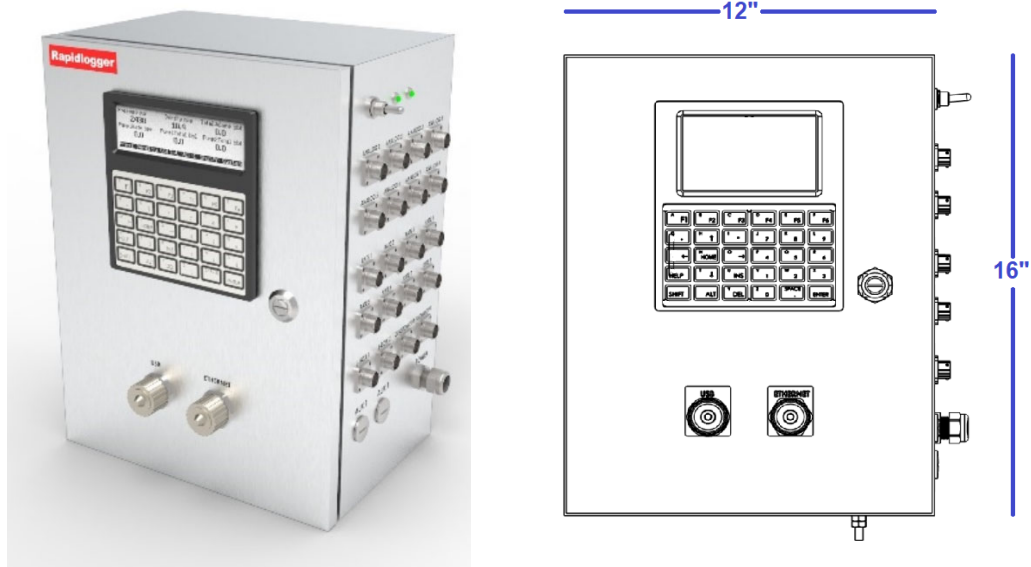


Wire Terminal Layout – SE Unit

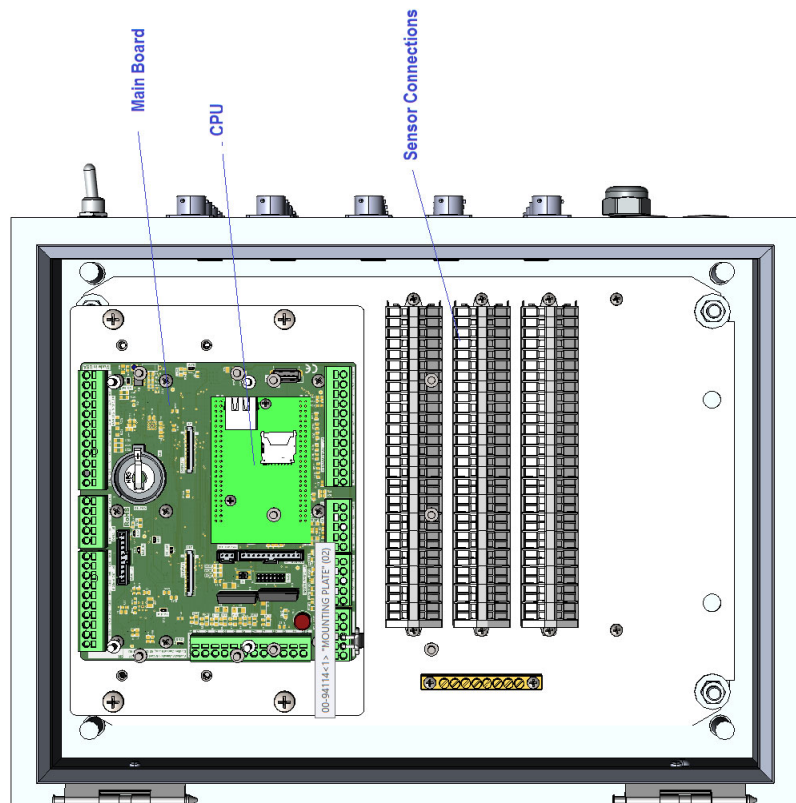
Installation of the Rapidlogger Max unit

The Rapidlogger Max unit is a larger Rapidlogger Unit that allows for the connection of a large number of analog and digital channels. The Rapidlogger Max unit mounting holes are shown below. In all applications the Rapidlogger Max lid should be kept tightly closed and the inside protected with a dry desiccant pouch. Use the following mounting dimensions.

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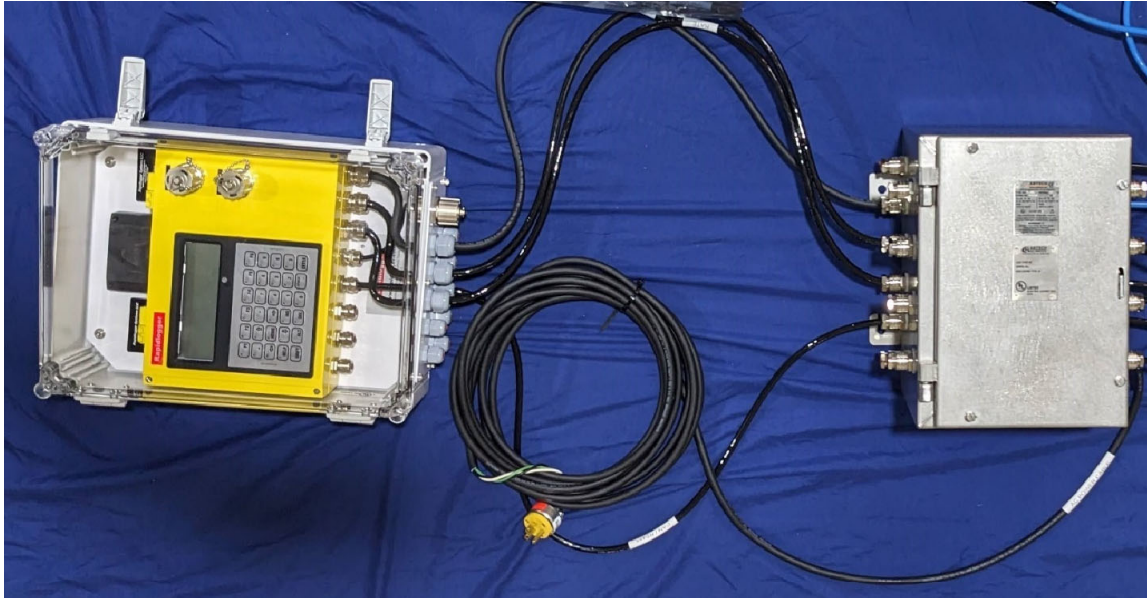
The Wiring Terminals of the Rapidlogger Max are shown below



Wire Terminal Layout – Max Unit

Installation of the Hazardous Area Barrier box

The hazardous area barrier box (if included) needs to be permanently mounted on a vertical surface. The box can be mounted in either orientation (long side vertical or short side vertical). For electrical details of the mounting refer to the installation drawing included in the Appendix A and the latest applicable edition of EN 60079-14 standard.



ATEX Barrier Box Location and Arrangement

The fuse sizes and must be followed. The Rapidlogger ATEX system utilizes a 1 ampere fuse. Do not substitute with a larger value. In case the fuse blows repeatedly, the source of the problem needs to be found and corrected instead of simply utilizing a larger fuse.

Power is supplied to the barrier box (12V DC, 24VDC, or 110/240VAC depending on the type of unit purchase) only via a cable suitable for Zone 1 or Zone 2 area, depending on the location of the unit. Cables for the standard intrinsically safe sensors come pre-terminated inside the barrier box. In case explosion proof sensors such as densitometers or turbine flowmeters, the cables need to be armored or suitable for the Zone 1 or Zone 2 area where they are routed.

4.3 Interfacing to a Pressure Transducer

The cement pumping pressure is measured by means of a pressure transducer interfaced to one of the system's four high resolution analog inputs. All four analog inputs support 4-20mA signal inputs and both 2 and 3 wire sensors. Based on factory standard programming the pressure transducer is interfaced to the first analog input on the system (mA1). All sensors are wired in to the terminal block JB1. For a 2 wire 4-20mA sensor the mA+ wire from the sensor should be connected to JB1-3 and the mA- signal wire from the transducer is connected to JB1-12.

All of the manufacturer installation instructions for the pressure transducer should be followed in order to retain the ATEX certification.



4.4 Interfacing to a Densitometer

Many modern cement units are equipped with a Coriolis type densitometer (Micro Motion, Endress+Hauser, etc.). These densitometers can measure the flow-rate, volume, and density of the treatment fluid. The output from the densitometers is generally in the form of an analog output for density and a frequency output for the treatment rate and volume. These signals can be interfaced to the Rapidlogger unit and the data can be displayed and recorded.

The Micro Motion densitometer outputs density on its first 4-20mA output. Based on factory standard programming the density is interfaced to the second analog input (mA2) of the Rapidlogger. Both the analogs signals and the frequency signals from the Micromotion densitometer are electrically isolated. This means that the ground wire is not common between them. The mA+ wire from the densitometer transmitter should be connected to JB1-4 (24VDC +) and the mA- signal wire from the transmitter to JB1-13 (millampere input 2).



The Micro Motion densitometer outputs flow rate on one of its frequency output channels. This output is read into the Rapidlogger using one of its frequency inputs. The total volume is calculated and displayed by the Rapidlogger based on the total number of frequency pulses on this same channel. Based on factory standard programming the flow rate from the densitometer is interfaced to the first quadrature input (QA1). The FO+ (Frequency Output +) wire from the densitometer transmitter should be wired to JB1-16 and the FO- (Frequency Output -) wire to one of the available DC ground outputs such as JB1-7.

All of the manufacturer installation instructions for the densitometers should be followed in order to retain the ATEX certification.

4.5 Interfacing to pump stroke sensors

Pump stroke sensors are proximity switches that sense the rotation of some rotating part of a pump. Both 2 and 3 wire type proximity switches (14) ranging from 12-24V can be interfaced to the Rapidlogger. Based on factory standard programming the pump stroke counter 1 is interfaced to the first frequency input (F1) of the Rapidlogger. It is generally not recommended to use Mag pickups with the Rapidlogger since the weak signal from them can cause loss of pulses over long cable runs.



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The frequency output wire from the proximity switch should be wired into to JB1-20. The output from the second pump stroke counter should be wired to (F2) JB1-21.

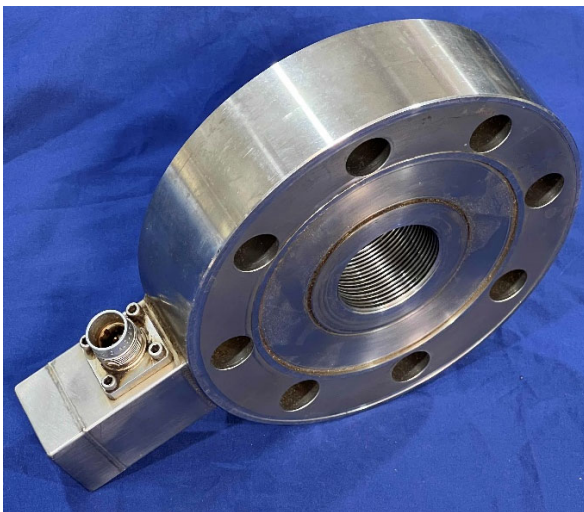
All of the manufacturer installation instructions for the inductive proximity sensor should be followed in order to retain the ATEX certification.

4.6 Interfacing to Load cells

Tension and compression on slickline, wireline and coiled tubing units are measured by means of load cells. 4-20 milli ampere type load cells can be used with the Rapidlogger system. It is possible to use compression, tension, or bi-directional load cells with the Rapidlogger. Based on factory standard programming the load cell is interfaced to the first analog input on the system (mA1). All sensors are wired in to the terminal block JB1. For a 2 wire 4-20mA load cell the mA+ wire should be connected to JB1-3 (24VDC +) and the mA- signal wire to JB1-12 (milliampere input 1). The second load cell or pressure transducer can then be connected to the second milli ampere input on the system and so on.

For a 3 wire 4-20mA load cell the 12/24 V power wire should be connected to JB1-3 (24VDC +) the GND wire should be connected to JB1-9 (DC GND) and the mA signal wire should be connected to JB1-12 (milliampere input 1).

All of the manufacturer installation instructions for the load cell should be followed in order to retain the ATEX certification.

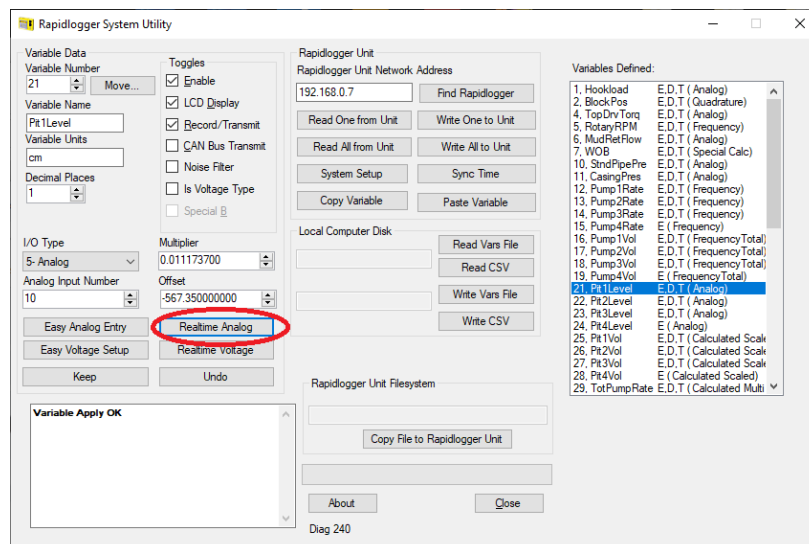


4.7 Interfacing to Tank level sensors

Tank level sensors are often used with the Rapidlogger System for instrumenting tanks, tubs, and pits in oilfield application. These can be used to measure cement slurry, water, and mud levels. Some tank level sensors work on the radar wave reflection principle, while others work on ultrasonic echo principle.



Most level sensors have a two wire 4-20mA output and can be directly interfaced to one of the Rapidlogger Analog inputs. The sensor's power terminal should be connected to one of the (+24V) sensor power terminals on the Rapidlogger while the sensor's signal terminal should be connected to one of the mA / analog inputs. The calibration of the level can be done using the Realtime Analog calibration function in the Rapidlogger System Utility.



Empty out the tank and use the utility to set the low desired output value. Then fill up the tank and set the high desired output value and Write Settings.

4.8 Interfacing to Depth Encoder

The Depth Encoder is used to measure the length or depth of wire or pipe in a hole for slickline, electric line, and coiled tubing operations. The wire/pipe is run on a friction wheel, which is connected to the shaft of the depth encoder, allowing the Depth Encoder to gather data.

The output of the Depth Encoder is a set of A and B pulse signals which are 90-degrees out of phase from each other. These pulses can either be 5V or 12V levels.

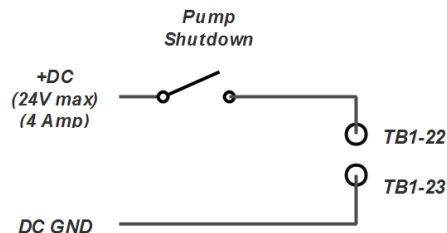
The Rapidlogger can be interfaced with up to two encoders and pulses ranging from 5V to 24V.



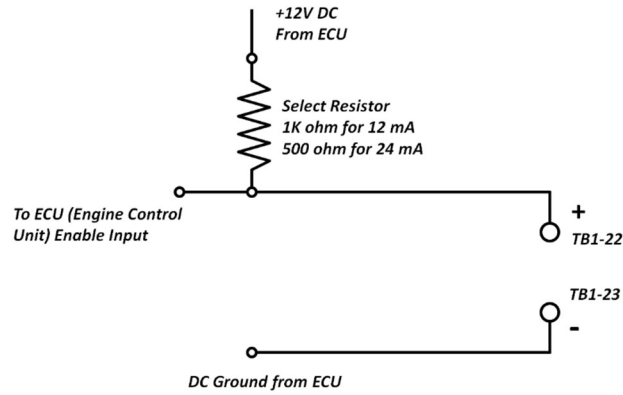
4.9 Interfacing to Shutdown Systems and Control Relays

The Rapidlogger System can be used to actuate relays and valve solenoids in order to shut down a pumping unit when a dangerous condition is detected. This can include over pressure and over speed situations.

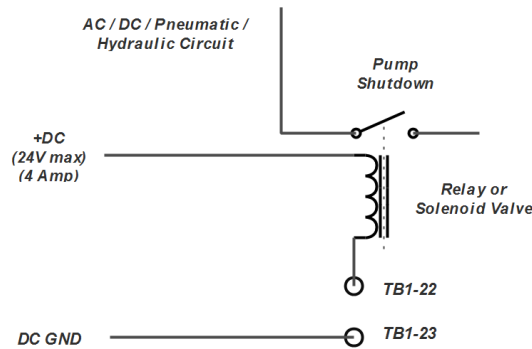
If the shutdown system on the pump is operated with DC Normally Open Contact then it can be wired as follows



For a shutdown system connected to an Engine control Unit with an Enable Input the shutdown can be wired as follows.



Other shutdown systems can be wired by means of an electrical relay or solenoid valve wired as follows.



4.10 Placing ATEX equipment in to service

Before powering up the system an inspection in accordance with EN 60079-17 latest applicable edition should be conducted. Notably it needs to be verified that all the cables glands and connectors are properly installed and sealed. No special adjustments are needed before startup. Once the safety inspection in accordance with EN 60079-17 is complete the unit can be powered up with the power switch.

The first power up must not be conducted in the presence of any hazardous atmospheres. In case a fuse blows immediately power down the system and locate the source of the fault before replacing the fuse and attempting to power up again.

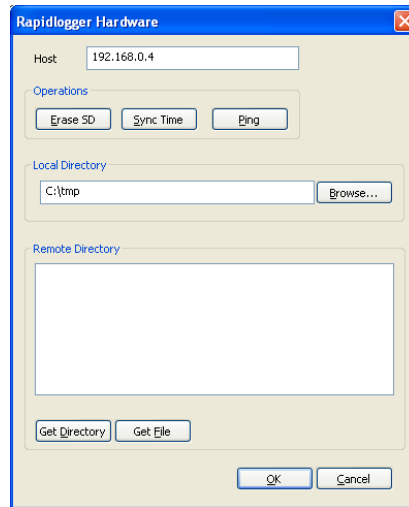
5 Maintenance

For ATEX installations all electrical and electronic maintenance to the system needs to be performed in accordance with the EN 60079-17 latest edition standard. Software and firmware maintenance is detailed below.

5.1 Reformatting SD flash memory card

The SD card installed inside the inner enclosure of the Rapidlogger records data continuously when the system is powered on. Data points are recorded at 1, 5, 10 or 60 second intervals depending on the recording rate selected by the user. Depending on the recording rate and the number of data variables selected, the internal SD card can get filled up in anywhere from a few days to a month. Once the card is filled up internal data recording stops until the data from the card is downloaded and the card erased.

In order to download files and erase the card the menu option Rapidlogger Hardware should be selected from the Rapidlogger PC program. The PC needs to be connected to the Rapidlogger system via an Ethernet cable and be able to communicate with it. Once the menu option is selected the following window appears on the PC screen.



Clicking on the Ping button allows the user to ensure that a Rapidlogger Unit is present at the IP address specified in the "Host" box. In order to erase the SD memory card simply press the Erase SD button on the [Rapidlogger Utility](#).

Alternately the user can also erase the SD card from the Rapidlogger front panel by pressing **F6, F6, F5, F5**. This erases the SD card in the Rapidlogger Unit.

5.2 Calibration

All of the sensor inputs on the Rapidlogger are factory calibrated to be best industry practice. The unit can be recalibrated by the users if proper calibration equipment is available.

If traceable calibration is required it is available at the factory. This is only needed by customers requiring an NIST traceable certification due to contractual obligations with their client.

In order to perform a normal calibration to correct or prove the sensor inputs on the Rapidlogger Unit the following equipment is required.

- A PC with Rapidlogger Utility installed and operations
- A frequency generator or calibrator
- A calibrated current source (4-20mA) or milli-ampere current generator
- Miscellaneous hookup wires to inject the calibrated signals into the Rapidlogger signal inputs

Calibrating the Analog Sensor Inputs

The first step is to remove all sensors etc. attached to the analog inputs. After this connect the milli-ampere calibrator to the analog input on the Rapidlogger. For a three-wire current calibrator connect the power wire to the Rapidlogger 24V DC output, connect the ground wire to the Rapidlogger DC ground connector, and the milliamp signal wire to the Rapidlogger mA1 input. For a two-wire current calibrator connect the positive terminal to the Rapidlogger 24VDC output and the signal/ground connector to the Rapidlogger mA1 input. Turn the analog current calibrator on at the 4mA setting.

Now place the Rapidlogger unit in the Analog Diagnostics mode (Press **F6, F6, F5, F1**). A screen will appear on the Rapidlogger unit that would display the current analog input values. The first analog input should read 4mA or a value very close to it. Change the settings of the analog current calibrator to generate 16mA, the analog reading on the Rapidlogger screen should now read 16mA or a number close to it. If the error is in an acceptable range then no calibration is required. For example, for a 10000psi (4-20mA) pressure transducer connected to the analog input an error of 0.01mA represents a 6.25 psi error in the sensor reading at full scale. This number was calculated by dividing 10000 (the sensor range in psi) by 16 (the signal full scale output in mA) and again by 0.01(the signal error in mA). If the error is not acceptable then calibration is required.

To start the calibration process, make sure that the **Rapidlogger Utility** is running and ready. Press **System Setup** to reach the following screen.

The screenshot shows the 'System Setup' window with several tabs. The 'Calibrate' tab is active, showing 'Analog Inputs Calibration Factor' set to 1.00000. Other tabs include 'Hardware Setup', 'Rapidlogger Utility View - Dial Setup', and 'Test / Debug'. The 'Hardware Setup' tab shows 'Number of LCD Display Variables' set to 6, 'Coiled Tubing' selected, and 'Recording Period' set to 1. The 'Rapidlogger Utility View - Dial Setup' tab shows 'Dial Variable' set to 3, 'Dial Lower Limit' set to -5000.0, and 'Dial Upper Limit' set to 80000.0. The 'Test / Debug' tab shows 'Cloud IP Address' set to 206.189.61.28, 'Modbus / WITS' with 'Modbus' selected, and 'CAN Address' with 'Master = 0' and 'Slave = 1 to 126'. Buttons at the bottom include 'Read From Unit', 'Apply', and 'Cancel'.

On this screen enter 1.000 as the Analog Calibration Factor, Do not press the calibrate button yet.

On the Rapidlogger screen place the Rapidlogger unit into calibration mode by pressing **F8** from the analog diagnostics screen. The screen on the Rapidlogger Unit will now indicate that it is in calibration mode. It will also display the current calibration constant. Write this number down. Now press the calibrate button of the **Rapidlogger Utility**. The new calibration factor will now appear on the Rapidlogger Unit screen. The next step is to calculate the correct calibration factor on the screen. A suggested calibration factor would be automatically displayed on the screen. Enter the suggested value in the Analog Calibration Factor box on the **Rapidlogger Utility** and press the Calibrate button.

The suggested calibration factor value is calculated by the system assuming that a calibrated 16mA current source is being used as input to the mA1 terminal on the Rapidlogger Unit. Other calibration current values can be used but then it is up to the user to calculate the calibration factor.

Verifying calibration on the Frequency Sensor Inputs

The first step is to remove all sensors etc. attached to the frequency inputs. After this connect the ground wire from the calibrated frequency input to the DC Ground terminal on the Rapidlogger unit. Now connect the frequency output wire from the calibrated frequency generator to the F1 input on the Rapidlogger Unit. Set the signal voltage level to between 12 to 24 VDC, and output a 1 kHz square wave.

Now place the Rapidlogger unit in the Digital Diagnostics mode (Press **F6, F6, F5, F2**). A screen will appear on the Rapidlogger unit that would display the current digital and frequency input values. The reading for frequency 1 should read 1000Hz. If the signal is very different then calibration of the frequency input signals is required. Please consult technical support at the factory for help.

Verifying calibration on the Totalizer Inputs

The totalizer inputs on the Rapidlogger do not need to calibrate in the field. Their proper calibration can be verified in the field as follows.

The first step is to remove all sensors etc. attached to the frequency inputs. After this connect the ground wire from the calibrated frequency input to the DC Ground terminal on the Rapidlogger unit. Now connect the frequency output wire from the calibrated frequency generator to the F1 input on the Rapidlogger Unit. Set the signal voltage level to between 12 to 24 VDC, and output a 1 kHz square wave. Now place the Rapidlogger unit in the Digital Diagnostics mode (Press **F6, F6, F5, F2**). A screen will appear on the Rapidlogger unit that would display the current digital and frequency input values. The reading for Total 1 should read increase by exactly 1000 counts every second. If the user has access to a pulse generator that can generate a fixed number of pulses then this can be used to confirm the totalizer operation also.

Verifying calibration on the Encoder Inputs

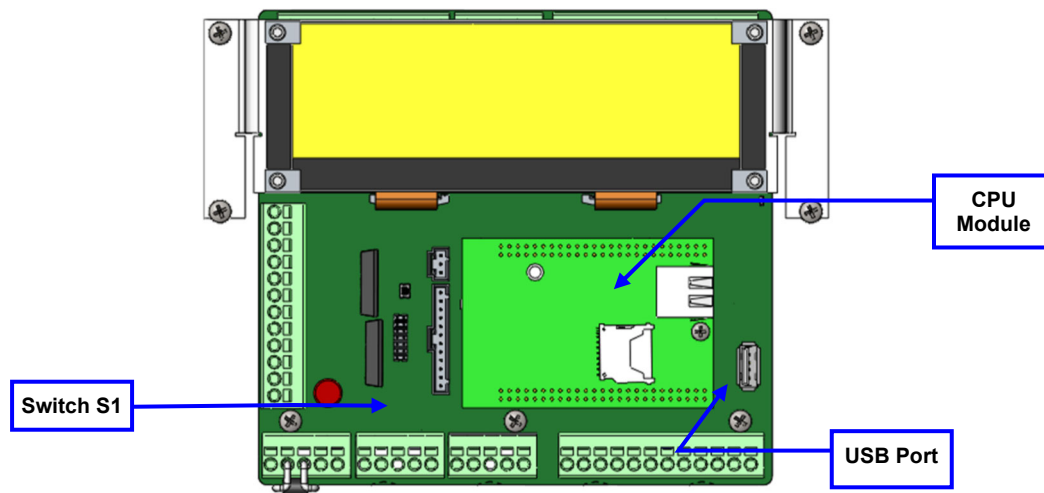
The first step is to remove all sensors, etcetera attached to the encoder inputs. After this connect a known good rotary encoder to the Rapidlogger as follows. The ground wire from the encoder should connect to the DC Ground terminal on the Rapidlogger unit. The power wire from the encoder should connect to the 5VDC output terminal on the Rapidlogger. The encoder channels A and B should be connected to the Q1A and Q1B terminals on the Rapidlogger.

Now place the Rapidlogger unit in the Digital Diagnostics mode (Press **F6, F6, F5, F2**). A screen will appear on the Rapidlogger unit that would display the current digital and frequency input values. The reading for Quadrature 1 should read exactly 0. Now rotate the encoder exactly 1 complete turn. The number of quadrature counts shown on the screen should be exactly equal to 4 times the rated encoder resolution.

5.3 Uploading new system software

In order to upload new firmware to the NextGEN Rapidlogger an Ethernet cable and a firmware download program is required. Do not attempt to upload new firmware to the Rapidlogger unless specifically instructed by the technical support contact. Connect the interface cable to the Ethernet port connector on the Rapidlogger. Now connect the other end of the Ethernet cable to the Ethernet port of the PC or via an Ethernet hub.

Now run the AutoUpdate program on the PC, this program is included on the CD that accompanies the unit. Select the IP address of the Rapidlogger System to be updated. This is normally 192.168.0.5. Now select the replacement firmware file and click the update button. The program will update the firmware and display a dialog box to this effect once the update is complete. This will only take about 1-2 minutes.



5.4 Replacing a CPU module

The Rapidlogger CPU module is replaceable in case there is damage to the CPU or you need to replace the module to use new firmware. The replacement of the CPU module is a delicate process that can only be done by an experienced electronics technician. The CPU module is static sensitive. It should only be replaced when the unit is on a static safe workbench.

Do not attempt to replace the CPU module on the Rapidlogger unit unless specifically instructed by the technical support contact. In order to replace the module make sure that the power to the unit is off and the power cable has been disconnected. Now using a very small screwdriver remove the two white plastic screws that hold the module in place. Note the orientation of the CPU module on the board. With very little force and using a slight rocking motion remove the CPU module. Gently install the new CPU module after lining up its pins with the socket holes being careful to align the two connectors on the bottom and making sure that the module orientation is correct. The module should install easily without excessive force. The bottom surface of the module circuit board should be flush with the top of the two white spacers. Install the two white plastic screws. The unit is now ready to be powered up.

5.5 Recommended Spare parts

The following is a list of recommended spare parts for supporting between 1 and 5 systems:

00-91903	Rapidlogger Main Board with CPU
00-91713	Rapidlogger LCD display
00-92041	Rapidlogger DC UPS 12V Battery
00-92011	Rapidlogger DC UPS Power board
00-91929	Pressure Sensor
00-92192	Inductive proximity sensor
00-92168	Cable common overmolded, detachable
00-92169	Cable Prox overmolded, detachable 100ft
00-92167	Cable Viatran overmolded, detachable 100ft

5.6 Repair and Service

For repair and service of the unit please contact sales@rapidlogger.com

5.7 ATEX certificates for System, Sensors and Accessories

Complete ATEX Certificates for the system its sensors and related equipment can be downloaded from the Rapidlogger website at the following URL.

<http://www.rapidlogger.com/downloads/ATEX.pdf>



6.2 ATEX Certificate

			
TYPE EXAMINATION CERTIFICATE			
1.	Equipment or Protective System Intended for use in Potentially Explosive Atmospheres Directive 94/EC		
2.	Type Examination Certificate Number: ITS15A/TE48283X		
3.	Equipment or Protective System:	Titan NetGen DAQ	
4.	Manufacturer:	Applied Automation and Controls Inc / Rapidlogger	
5.	Address:	10700 Corporate Drive, Suite 100, Stafford, TX, 77477 U.S.A.	
6.	This equipment or protective system and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.		
7.	Intertek Testing and Certification Limited certifies that this equipment or protective system has been found to comply with the requirements of the Explosive Atmospheres Directive 94/EC and the relevant standards referred to in Annex II to the Directive 94/EC of 23 March 1994		
8.	The examination and test results are recorded in confidential Intertek Report 102090041DAL-2011. Dated 29 July 2015.		
9.	Compliance with the Essential Health and Safety Requirements has been assumed by compliance with standards EN 60070-2:2014+11:2015, EN 60079-15:2010 except in respect of those requirements referred to at item 10 of the Schedule.		
10.	If the sign "X" is placed after the certificate number, it indicates that the equipment or protective system is subject to special conditions for safe use specified in the schedule to this certificate.		
11.	This Type examination certificate relates only to the design, examination and tests of the specified equipment or protective system in accordance with the requirements of the Explosive Atmospheres Directive 94/EC. Any approval applies only to the design, examination and tests of the specified equipment or protective system. These are not covered by this certificate.		
12.	The marking of the equipment or protective system shall include the following:-  II 3 G Ex nA IIC T5 Gc IP 54 -20°C ≤ Ta ≤ 60°C		
Intertek Testing & Certification Limited Intertek House, 10000 Rockingham Road, Lutterworth, Leicestershire, LE17 4JH Tel: +44 (0)1532 370900 Fax: +44 (0)1532 370977 www.intertek.com Email: certification@intertek.com UKAS 9001 No. 15054, ISO 9001:2015 Registered Office: Academy Place, 1-8 Brook Street, Borewood, Essex, CM14 4NQ. This certificate may only be reproduced in its entirety and without any change, schedule included and is subject to Intertek Testing and Certification's Conditions for Granting Certification.			
 Michael Spencer Certification Officer 7 Aug 2015			

Sheet 1 of 3

		Description of Equipment or Protective System The Titan Nucleon DAQ is data acquisition and control system. The unit powers the sensors, displays their data on a 10" LCD screen and controls the test cell. The unit is powered by a 24VDC power supply. The DAQ is a PC in real-time or after the completion of the job. Enclosure is provided with piezoelectric keypad with no electrical make or break connection. Titan Nucleon DAQ contains terminal block for cable connectors. The unit is not for use in hazardous area. LCD used has no internal arcing or sparking parts. The equipment is rated for 10-230VDC, 175Watt.
13.	Report Number Intertek Report Ref: 10230504 DAL-011, Dated 25 July 2015.	Conditions of Certification (a). Special Conditions for safe use - The equipment enclosure provides IP54 protection for the electronics inside. Shells must be taken by the installer to control and humidity inside the equipment to maintain a Pollution Degree 2 environment as defined in EN 6054-1 is maintained inside the enclosure of the equipment. - For fixed installation only WARNING – POTENTIAL ELECTROSTATIC CHARGING HAZARD – SEE INSTRUCTIONS - End user has responsibility to use ATEX certified cable glands providing minimum IP 54 protection
14.	Conditions of Manufacture A routine dielectric strength test shall be carried out. Test Vp: 500 Vrms (+5% tolerance) or 700VDC (140% of 500Vrms) for 60 or 65 seconds, alternatively 600Vrms for minimum of 100 rms.	Test points: Input connection to Grounding Terminal
15.	Essential Health and Safety Requirements (EHSR's) The relevant EHSR's have been identified and assessed in Intertek Report 10230504 DAL-011, Dated 25 July 2015	Essential Health and Safety Requirements (EHSR's) The relevant EHSR's have been identified and assessed in Intertek Report 10230504 DAL-011, Dated 25 July 2015
16.	Intertek Testing & Certification Limited Intertek House, Cleve Road, Lutterhead, Surrey, KT22 9SB www.intertek.com Registered No 3732281 Registered Office: Academy Place, 1-9 Brook Street, Brentwood, Essex, CM14 9NQ.	This certificate may only be reproduced in its entirety and without any change, schedule included and is subject to Intertek Testing and Certification's Conditions for Granting Certification.
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SCHEDULE

TYPE EXAMINATION CERTIFICATE NUMBER ITS15ATEX46263X

Drawings and Documents

17.

Title: NextGenDAQ, Titan Certification Drawing (Total Sheets:6)	Drawing No.: 00-92412	Rev. Level: F	Date: 7/7/2015
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Schedule drawing contains total 6 sheets that details enclosure general arrangement drawing, including ATEX label and warning copies.

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Sheet 3 of 3

0401-01 - Type examination certificate
Template revision 4
0075-01-000-001 0-0-14

