MEDCO

Modelling Engineering & Development Company Limited

Real Time Electronic Acquisition & Monitoring

& Human Machine Interface

REAM HMI

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System Overview

The REAM HMI is a user-friendly data acquisition system that reads and displays data from electronic sensors. Data is recorded on solid-state Compact Flash memory and remote monitoring of the data is enabled.

The system is made of two main parts, REAM is a microprocessor based data acquisition board, which collects data from electronic sensors, digitise the readings, and supply the appropriate excitation voltage to the sensors. The HMI communicates with the REAM board to retrieve, display, and store the data.

There are four versions of the REAM board, with some variations between them. The table below shows the main features for REAM V4.0.

REAM Version	Number of Channels	Other Features
4.86	8 x 16-bits analogue 6 x frequency Up to 4 quadrature	• 4 of the frequency channels can be used as quadrature channels. • 16 Gbyte SD card for storing backup data. Up to 3.5 years of data recording at once per second non-stop. • Relay for use with alarms

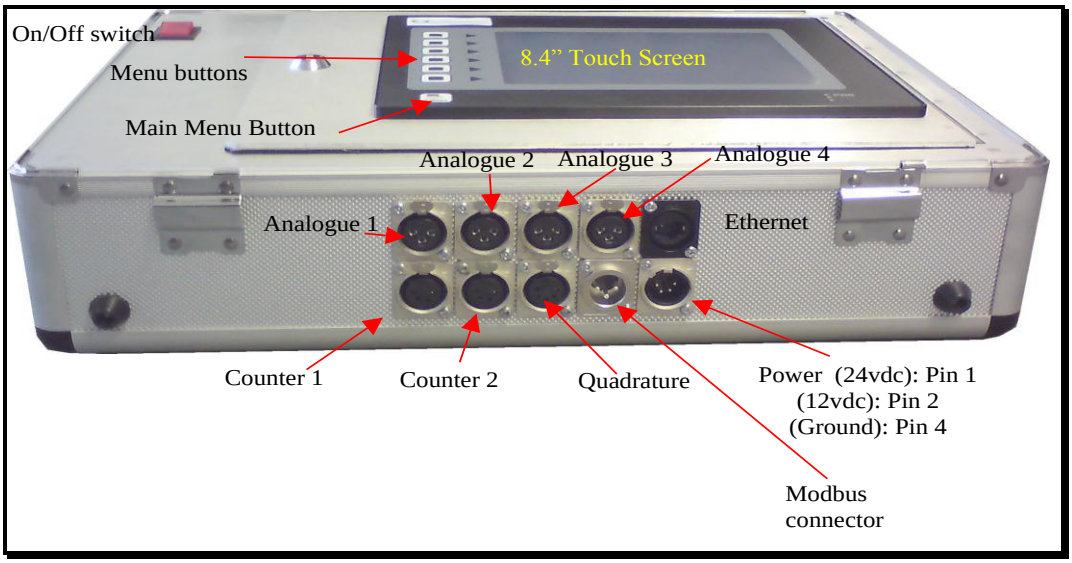
The HMI can communicate with up to 4 REAM boards simultaneously and many other controllers or data acquisition modules. In addition to the signals that can be acquired by the REAM board, the HMI can also communicate with up to 256 MODBUS devices.

The outputs are available on Web Pages, which means that they can be viewed remotely on a Local Area Network (LAN) or even a Wide Area Network (WAN), provided that proper Internet connections are made. This feature means that the data can be viewed simultaneously from several terminals. There are many other features in the HMI and these can be tailored to client's request.

Hardware Description

As a first step to using this manual, the user is advised to identify the system from the different configurations listed below.

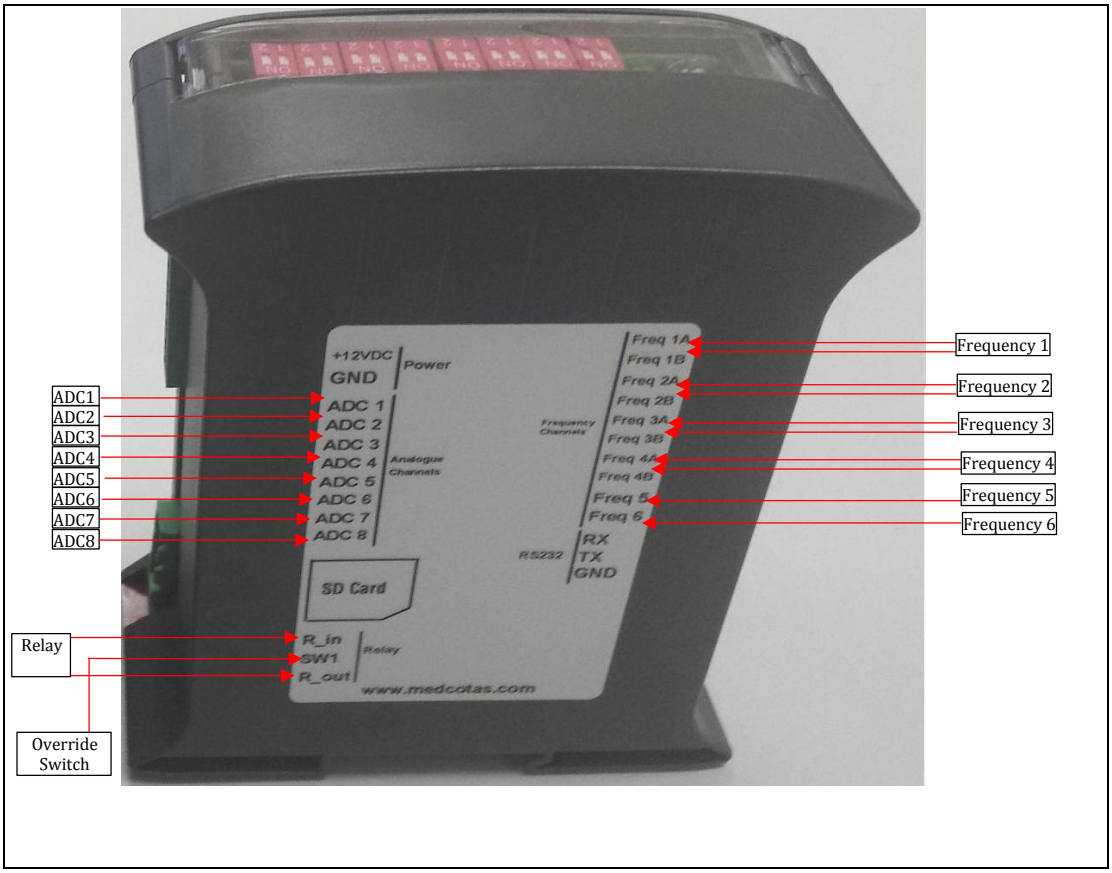
The picture below describes the various components of a portable flight-case REAM HMI.



Channel Assignment

This section will describe the channel assignments per REAM board version. Note though, the HMI will produce different outputs not necessarily in the same order as per the REAM board.

REAM v 4



Measured Parameter	Channel No.	Type
Weight Indicator	1	ADC1 Analogue 16 bits resolution
Spare Analogue Channel Commonly used as Light Weight or Casing Pressure	2	ADC2 Analogue 16 bits resolution
Wellhead Pressure	3	ADC3 Analogue 16 bits resolution
Circulation Pressure	4	ADC4 Analogue 16 bits resolution
Spare Analogue Channel	5	ADC5 Analogue 16 bits resolution
Spare Analogue Channel	6	ADC6 Analogue 16 bits resolution
Spare Analogue Channel	7	ADC7 Analogue 16 bits resolution
Spare Analogue Channel	8	ADC8 Analogue 16 bits resolution
Depth	9	Frequency 1 - Total
Fluid Total	10	Frequency 2 - Total
N2 Total	11	Frequency 3 - Total
Spare Frequency Total	**12**	Frequency 4 - Total
Spare Frequency Total	**13**	Frequency 5 - Total
Spare Frequency Total	**14**	Frequency 6 - Total
Tubing Speed	**15**	Frequency 1 - Rate
Fluid Flow	16	Frequency 2 - Rate
N2 Flow	17	Frequency 3 - Rate

Spare Frequency Rate	18	Frequency 4 - Rate
Spare Frequency Rate	19	Frequency 5 - Rate
Spare Frequency Rate	20	Frequency 6 - Rate

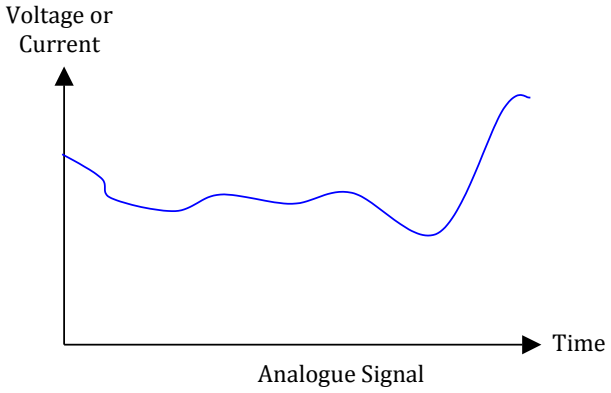
NOTE: Frequency 1 to 4 can take two inputs signals which makes them suitable for use with quadrature encoders signals.

Analogue and Frequency (Counter) Channels

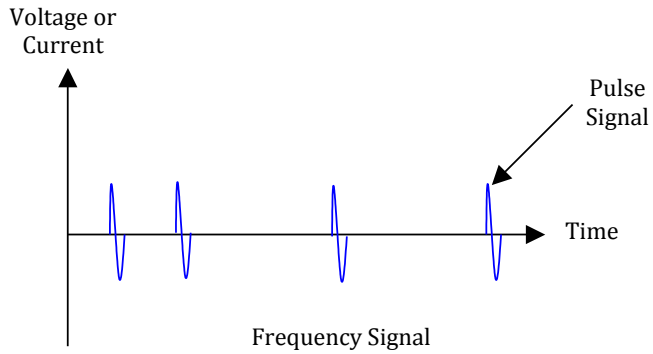
There will be several analogue channels and several frequency channels per system. The number of these channels will depend on the REAM board version. Details of each version channel assignments are listed in the next section.

Analogue channels are used for measuring analogue signals and will accept output signals from sensors with 0-5 vdc, 0-10 vdc, or 0/4-20 mA. An analogue signal is defined as a continuous electrical signal versus time. The electrical signal may vary in magnitude, but will always be present.

The counters (or frequency channels) accept pulse signals produced from proximity switches or magnetic pickups (with amplifier). The quadrature channel accepts quadrature signals (up/down counter such as depth) and is also considered a frequency channel. Frequency channels (or counters) measure number of pulses generated by sensors when an event occurs. When there are no events, there will be no electrical signal. The diagrams below explain the concept.



Analogue Signal



Frequency Signal

Analogue sensors are typically used for measuring such parameters as weight, pressure, temperature, density, and several others. The resolution will generally be 16-bits (except in REAM v 2, 11-bits). With 11-bit resolution, the signal can be subdivided to a maximum of 2^{11} = 2048 divisions, while with 16-bit it is 2^{16} = 65,536 divisions. For example, if using a 11-bit channel to measure fluid density ranging from 0 to 20 ppg, then the minimum change in density

that can be detected will be 20.00 ppg / 2048 which is approximately 0.01 ppg. If using a 16-bit channel to measure weight in the range of -20,000 lbs to +60,000 lbs, then the minimum change in weight that can be detected will be (60,000 – (-20,000)) = 80,000 lbs / 65,536, approximately 1.22 lbs.

For analogue channels, the sensor electrical response is expected to be linear within the specified range for the sensor. This implies that the relationship between the actual value and the electrical output will be a straight line. A straight line will have a slope and an intersect, these are referred to as GAIN and OFFSET respectively.

Pulse generating sensors (frequency) are typically used for measuring pump strokes or flow turbine blade movement or rotation of a wheel (using quadrature encoder). The frequency channels will count the number of pulses, therefore the total is the sum of the number of pulses and will always be increasing, except in the case of a quadrature encoder where the count can be up or down (hence used for measuring depth). The rates (fluid flow rate, N2 rate, and speed) are computed by the system automatically. There are no special channels for the rates; they use the same channels as for the Fluid Total, N2 Total, and Depth (i.e. frequency total and frequency rate are measured by a frequency channel).

For counter (frequency) channels, pulses are generated by events. For example, a proximity switch on a pump drive-shaft could generate n number of pulses per revolution, and each revolution corresponds to a quantity Q of fluid pumped. The number of pulses per unit of quantity is known as the *K-Factor,* in this case = n/Q. This implies that counter/frequency channels have no GAIN or OFFSET (mathematically, K-Factor is the inverse of the GAIN).

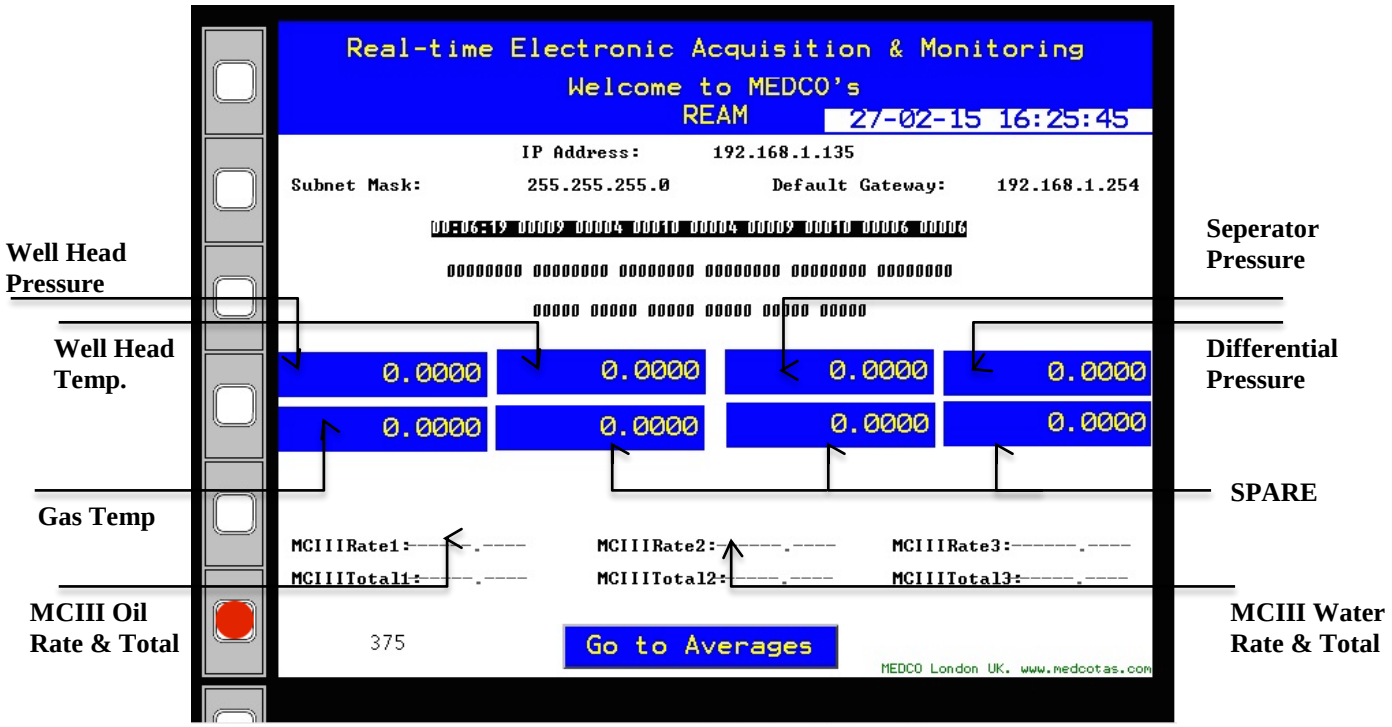
On shipping, the default values are:

- Date and Time: As per the UK date and time.
- ADC channels (Analogue to Digital Convertors):
    - Gain: Unity.
    - Offset: Zero.
- Pulse counters (frequency channels) and quadrature: K-factor = 1.

Software Description

REAM HMI starts by displaying the default web page, REAM RAW DATA. To access the other pages in the REAM HMI use the buttons on the left hand side of the touch screen. The REAM RAW DATA can always be accessed by pressing the top button.

The default page shows MEDCO's logo and a Welcome message, including the HMI software version. In addition, the system IP Address, Subnet Mask, Gateway, date and time are shown as well as the data stream from REAM and Mini REAM. There is an option button to display MCIII data, if applicable.



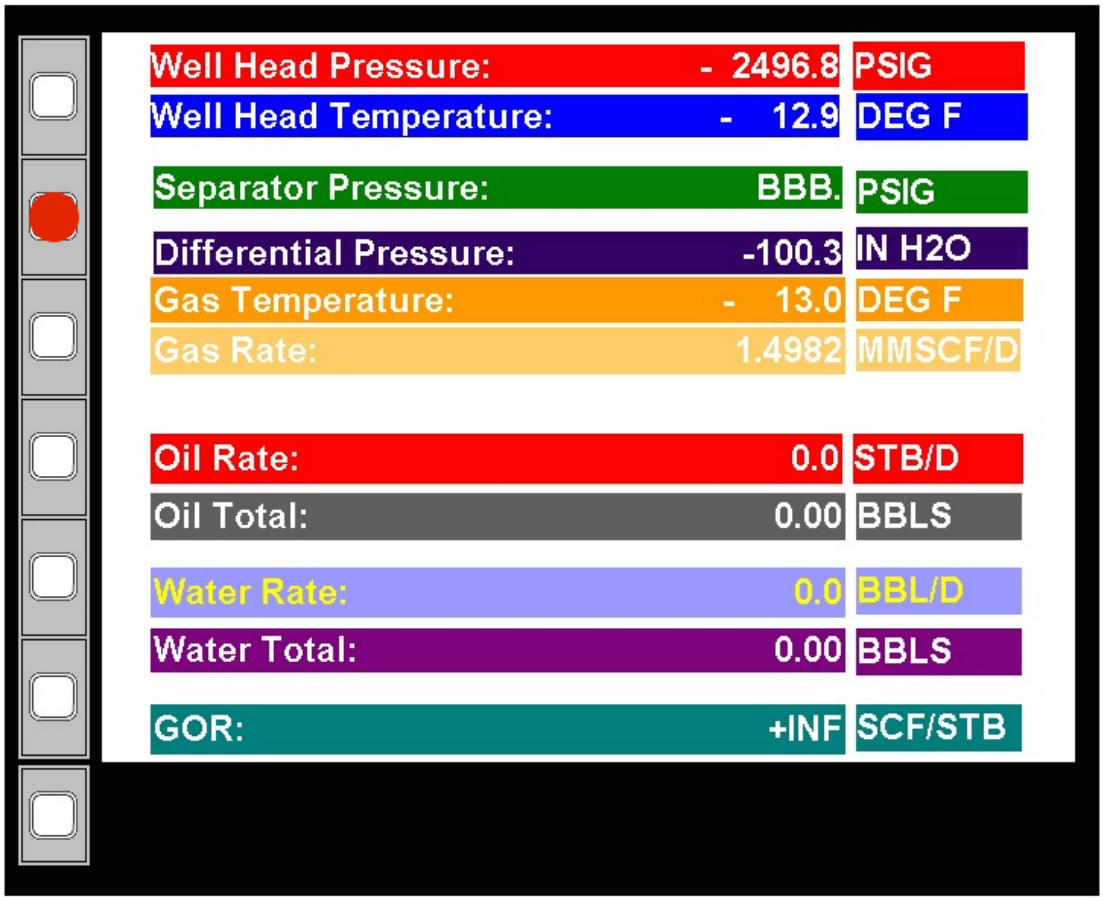
Raw Data Page: REAM v4 and 4-Channel Mini-REAM

This page displays some important information. The information shown is as follows:

- Software version: In the picture above, the current version is 1.06.
  Ethernet settings: These are the current Ethernet settings, including the *IP Address*, *Mask*, and *Gateway*. To change the Ethernet settings, refer to the MAIN MENU > Set Ethernet Port.
- To display MCIII data from MODBUS devices
  MODBUS is a protocol used to communicate with several devices via their address. Different devices can be connected through the MODBUS such as MCIII. Some of the counter channels can be assigned to display the data from the MODBUS.
- The system current Date and Time.
- Raw Data: The raw data is that received by the HMI from the REAM/MiniREAM attached.
  - REAM v 3 or REAM v 4: The displayed data is in 3 lines, 1st line showing the system time, followed by 8 analogue channels raw values, 2nd line showing counter (frequency) channels totals, and 3rd line showing counter (frequency) channels rates.

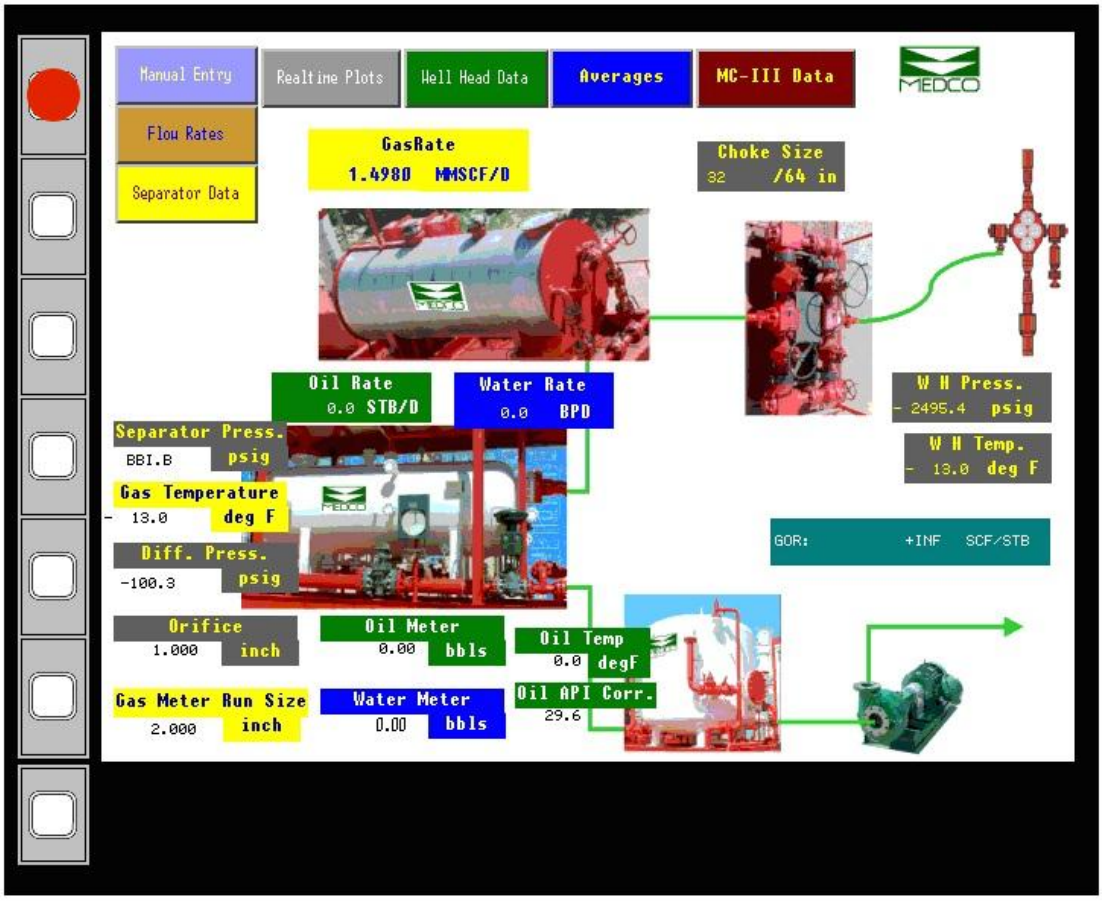
Displaying the Data

The second button is used to display the data page. This page will display the parameter names, current values (adjusted according to calibration data), and units.



Display Schematic

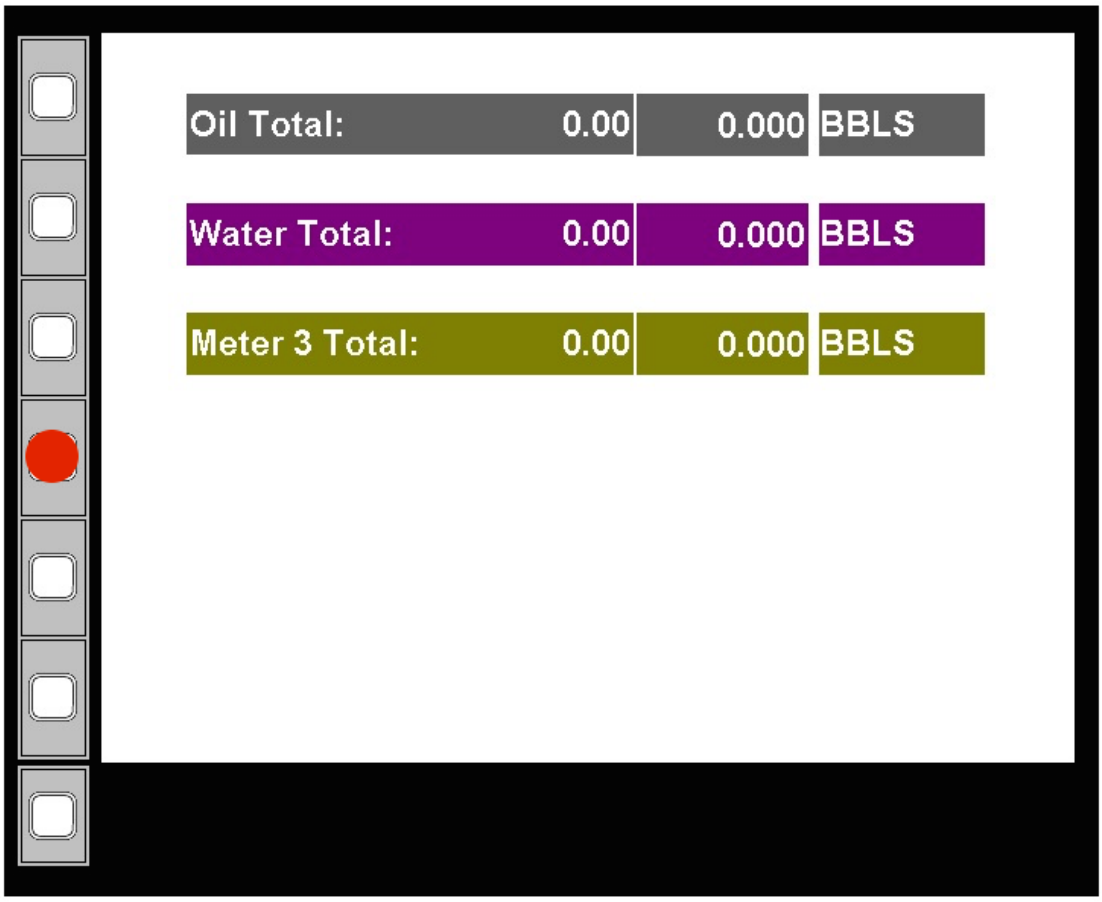
A gauge schematic can be displayed by selecting the third button. The gauges scales are determined in the MAIN MENU – Change Units section.



Resetting Counters/Quadrature (depth) And Analogue Channels

The fourth button will display a page dedicated to resetting counters and/or quadrature (depth). The actual value will be shown on the left-hand-side column (Current Value) while the user can enter the new value on the right-hand-side column (Reset To).

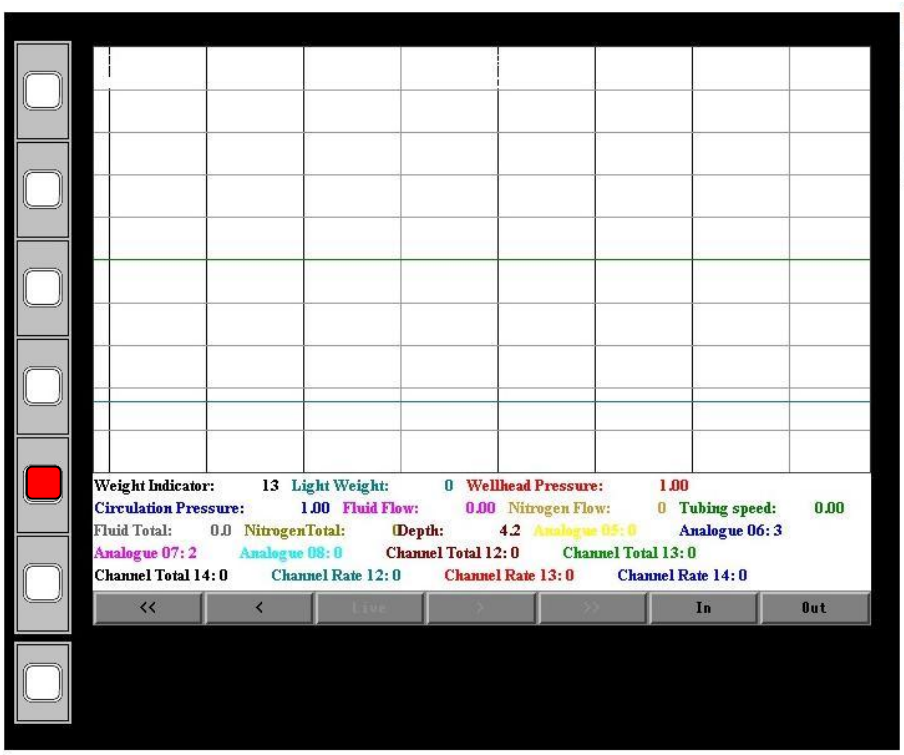
When resetting is used in conjunction with an analogue channel, such as Weight, it has the effect of changing the Offset of the particular channel.



To reset values of the programmable channels, click the NEXT button.

Real Time Graphs

The fifth button will display a real time graph the width of which is, by default, set to 4 minutes. The Y-axis scales are determined in the MAIN MENU – Change Units section. To scroll back use the < button, to scroll back faster use the << button. To zoom-in (smaller time interval), use the IN button and to zoom-out use the OUT button.



Options – Data Logs

There are several data logs that can be created by the REAM HMI. A One-Hour log will have files of a maximum length of 3600 records, thus will record data every one second for one hour. The naming convention of the files is "yymmddhh.csv", where *yy* represents the year, *mm* the month, *dd* the day, and *hh* the hour. The One-Day log @ 1 second will have a maximum length of 86400 records, which is the number of seconds per day. Again, the naming convention is similar to that of the One-Hour log. In addition, the user may also opt to record One Day Log @ 10 seconds, 20 seconds, or 30 seconds. Though, **for coiled tubing applications, it is strongly recommended to use the One Day Log @ 1 second**.

The data logs are stored in ASCII formatted files (text files) with comma separators; hence the file extension will be "csv" (Comma Separated Values).

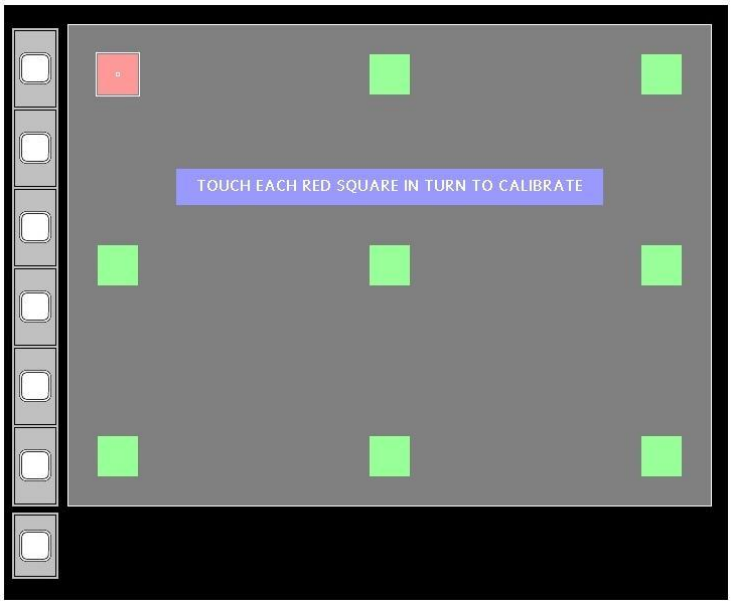
Note that the data logs are stored on the CompactFlash. There is a limit of 200 files of the One-Hour log, which corresponds to more than one week, and 20 files of the One-Day log, clearly corresponding to 20 days. If the CompactFlash is full, then the older files will be automatically removed to make room for new ones. However, it is probably a good practice to copy the files to a computer for safe storage and make room on the CompactFlash. This does not need to be done too frequently, but once a week or every two weeks will be sufficient and depending on how often the system is used.

IMPORTANT

The data is captured once per second and stored in the system memory (in a buffer), then written to the CompactFlash card once every two minutes. When the system is writing to the CompactFlash, the amber LED will flicker, indicating that the writing is taking place. It is important to know this because at the end of usage it will be necessary to wait until the amber LED stops flickering indicating the end of the writing, otherwise data since the last *Write* will be lost.

Options – Calibrate Screen

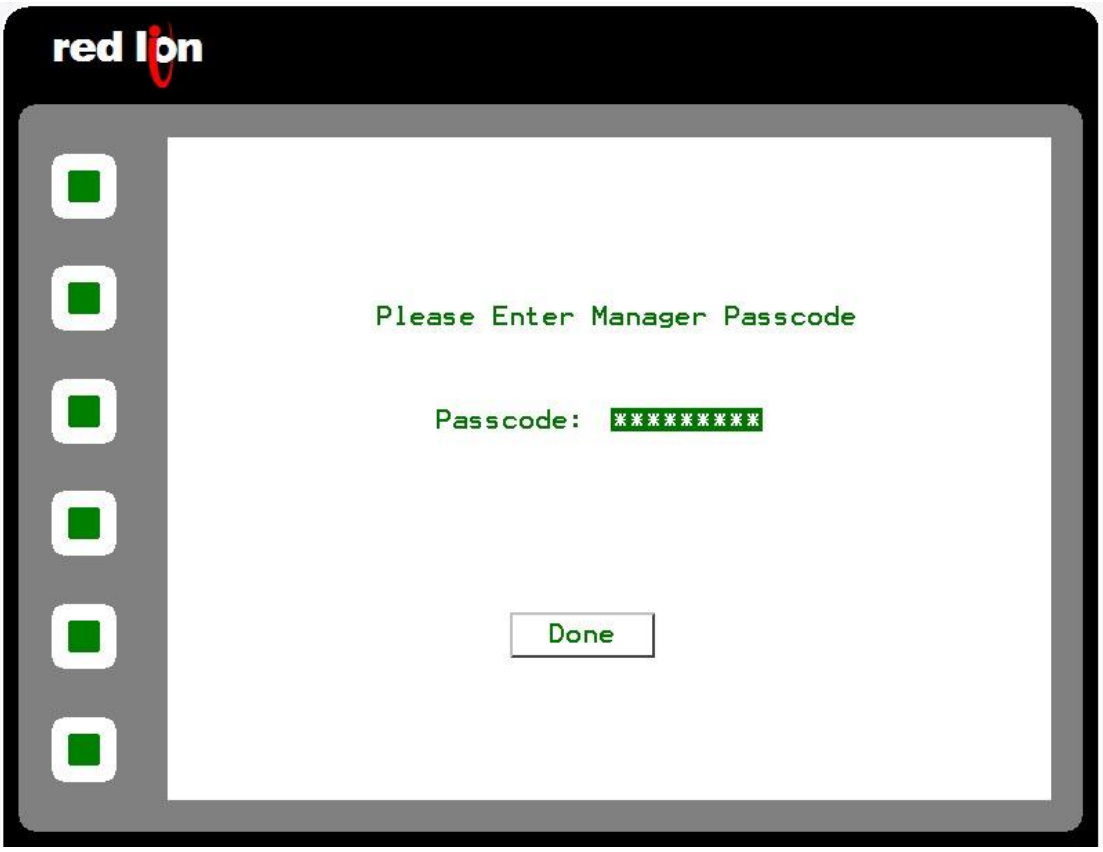
If the touch screen of the HMI is felt not responsive to touching at some parts of the screen, then it is a good idea to calibrate the touch screen. Simply click the CALIBRATE SCREEN button and go through the nine points as required by the HMI.



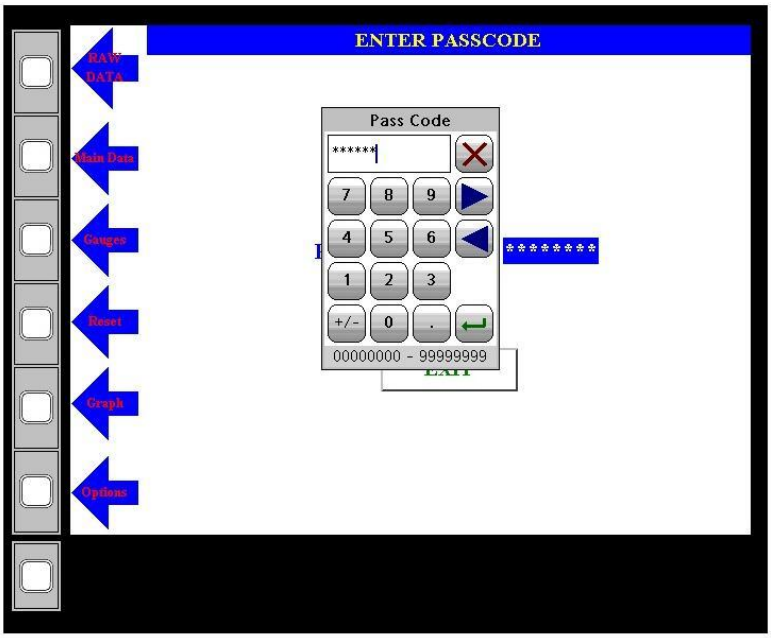
After the Touch Screen has been calibrated, it is a good idea to test the response. Click the TEST SCREEN button and check to ensure that the touch screen is responding to the touches in the right place.

Main MENU Button

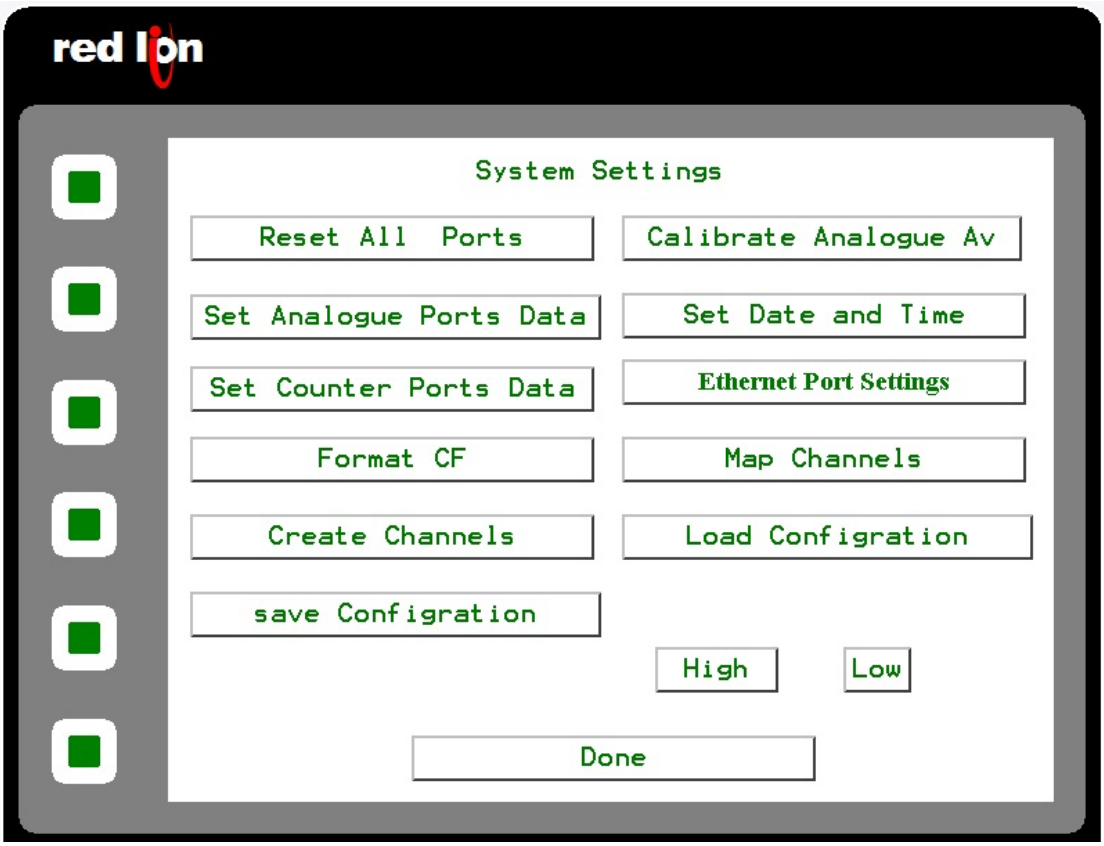
When this button is selected, the user will be prompted to enter the password. The password is "290992" which can be easily remembered as the date MEDCO was founded.



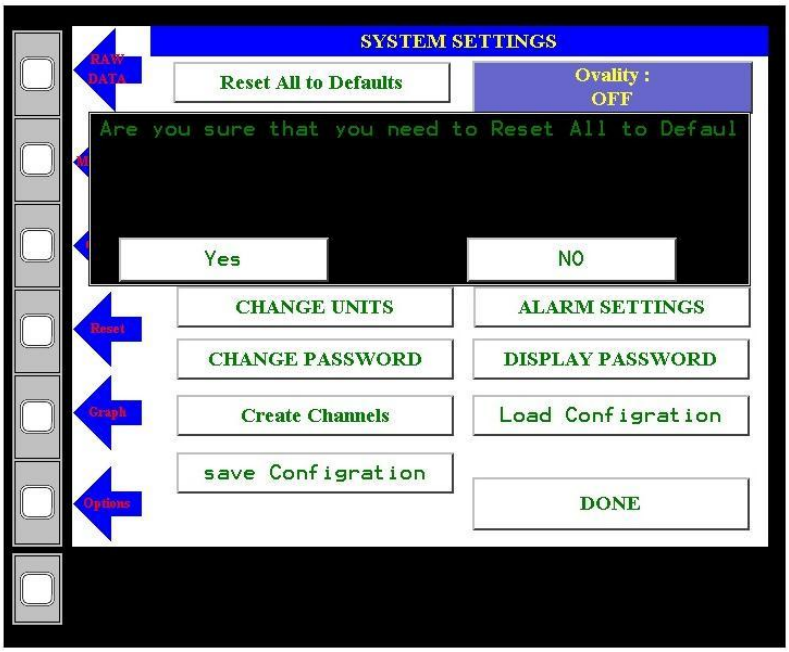
By pressing on the password a popup numeric keyboard will appear which can be used to enter the password.



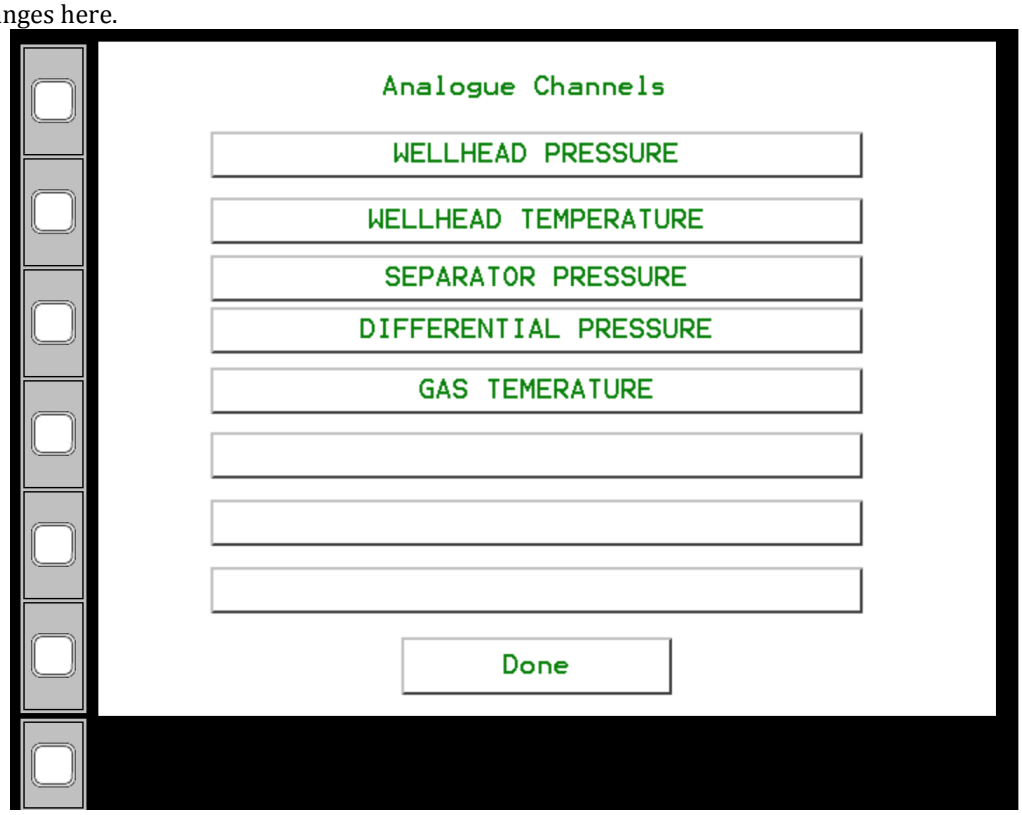
Once the correct password has been entered, another screen will appear with some more options.



MENU Option - Reset All to Defaults
This will reset all the ports (channels) to have Gain or K-Factor of unity (1) and Offset of zero (0). As this function will remove all the calibration data already stored in the system, the user will be prompted to confirm this action.



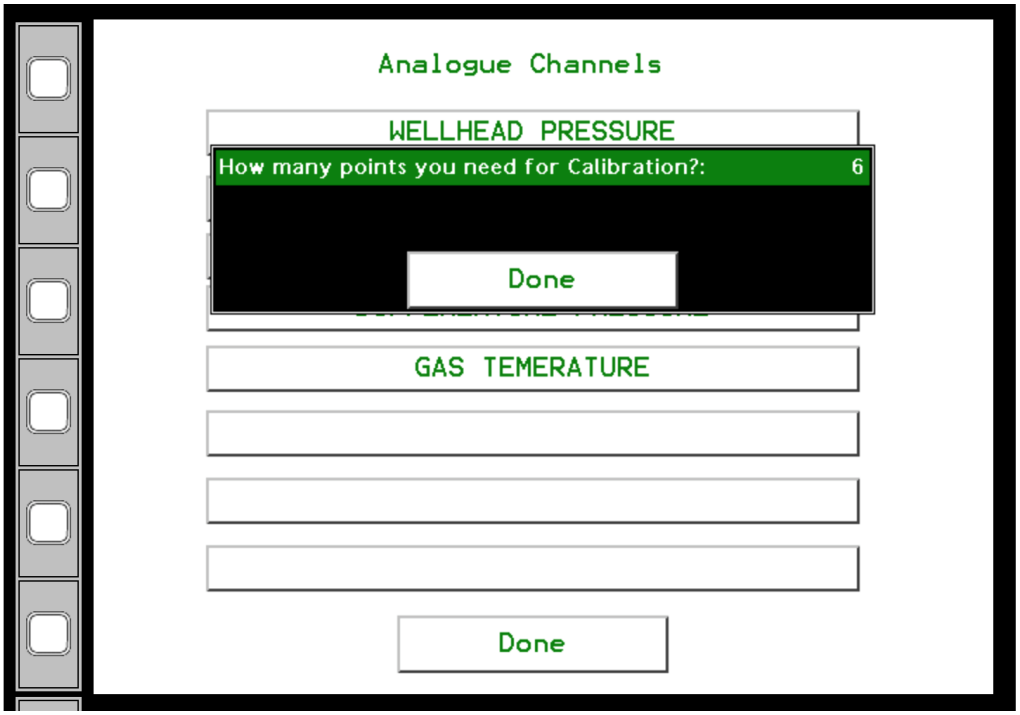
MENU Option - Set Analogue Ports Data
The page will display the settings of the analogue channels. The user can make the necessary changes here.



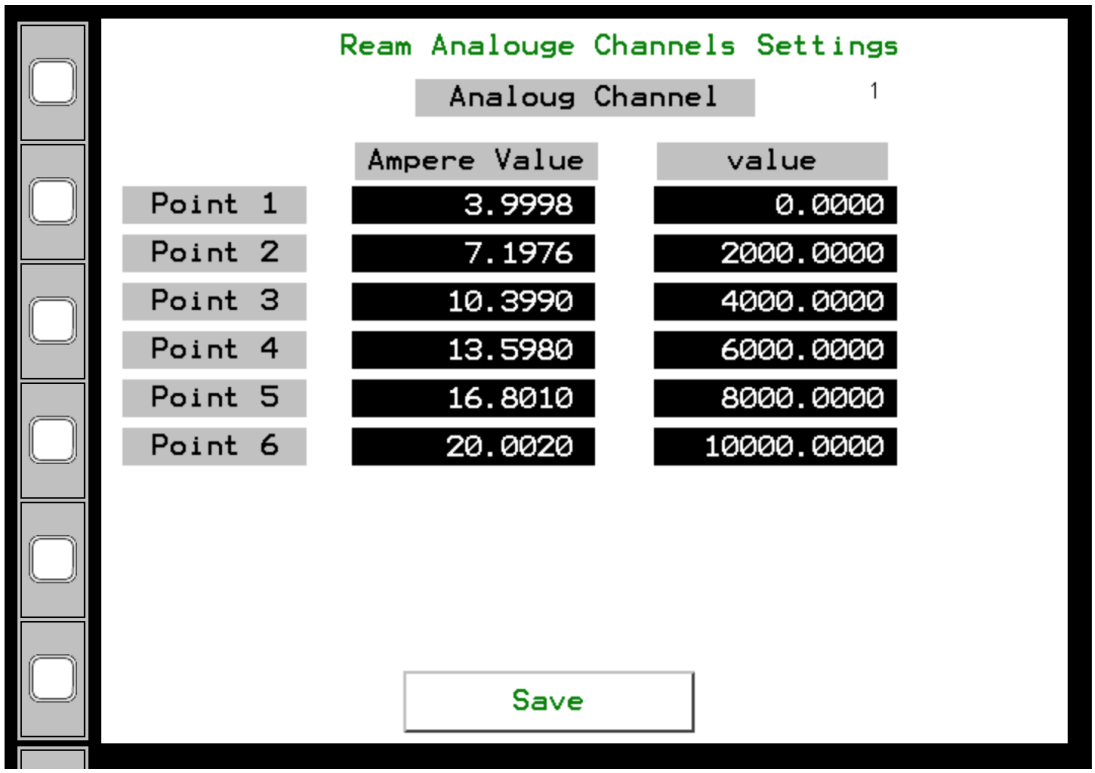
Calibration
Note that, selecting any port will allow the user to calibrate it by a preferred number of points (see below)

Analogue sensors produce an electrical signal proportional to the physical input. This sensor response is valid only within the range specified for the sensor. For example, a pressure sensor could have a range of up to 400 bars (5,800 psi), this implies that the sensor will have a linear response between 0 to 5,800 psi, outside this range the sensor may produce an output but there are no guarantees that this response is accurate. Further, the sensor will generally have a maximum pressure beyond which physical damage will occur.

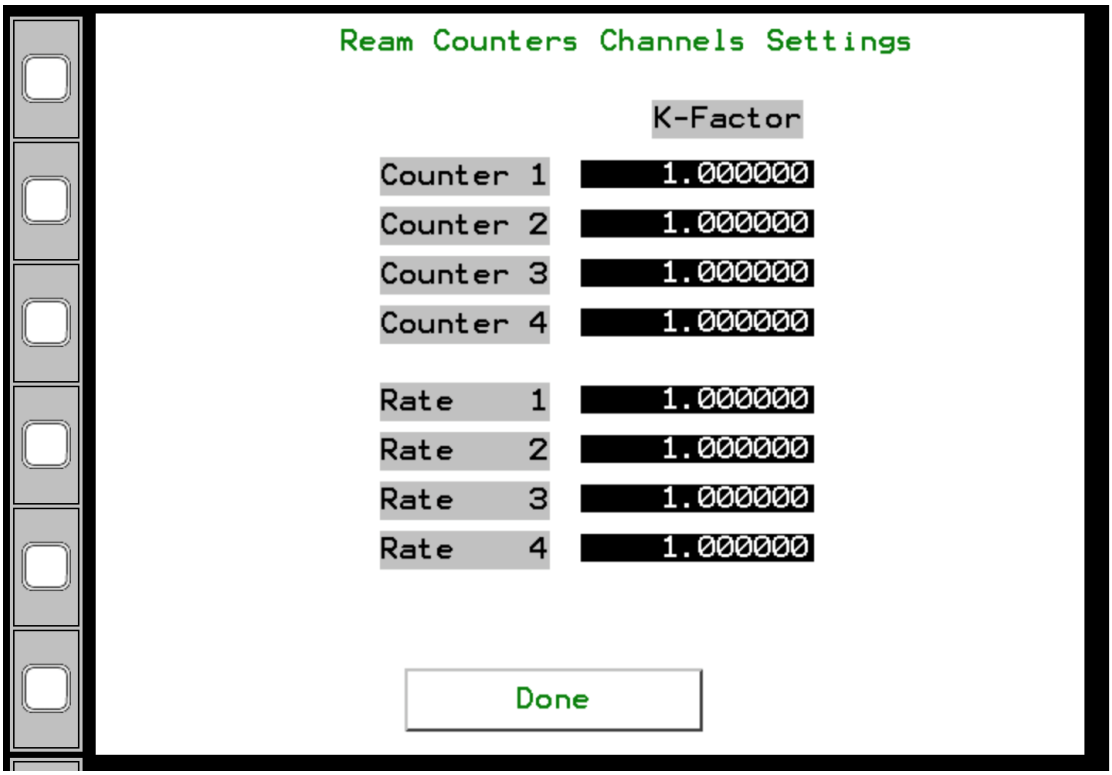
To interpret the sensor signal, a calibration procedure is required. In essence, the procedure is required to determine a mathematical relationship between the sensor output and the physical quantity being measured. Most commonly, the response is linear, thus the mathematical relationship will be a straight line. This procedure only need to be carried out once in a while, which, generally speaking is due to change in component characteristics.



To calibrate the channel, value pairs of electrical outputs vs actual values must be entered for each point to ensure accuracy. This can be repeated for each channel.



MENU Option - Set Counters Ports Data
The page will display the settings of the Counters channels. The user can make the necessary changes here.



For the counters and the quadrature channels, you only need to change the K-factor. If you already know the K-factor, for example from the manufacturer of the sensor, then you can enter the value directly. There is no need for a K-Factor for "rates", as these are the same as the K-Factors for the total, the HMI software will compute the rates per minute, for example if depth is in "feet" then speed will be "feet/min".

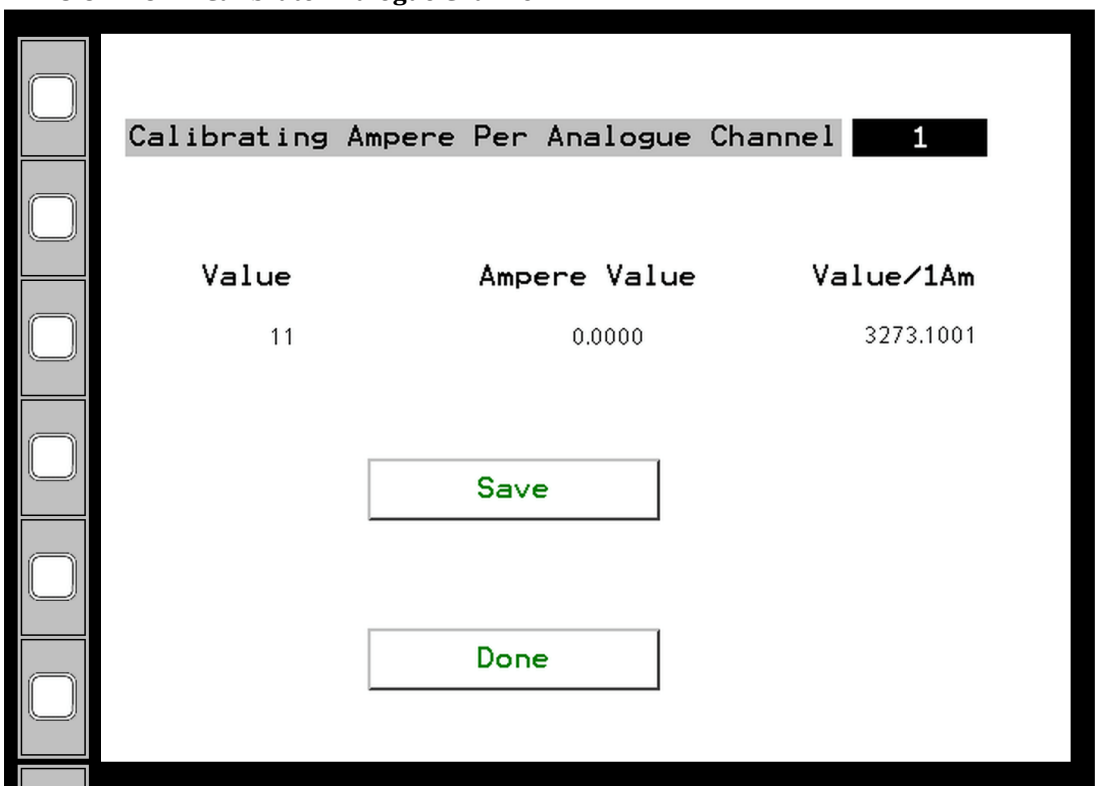
For example, if your quadrate encoder (for measuring depth) produces 600 pulses per revolution and each revolution represents 2 ft of depth, then the K-factor for depth would be 600 ÷ 2 = 300.

If, on the other hand, you do not know the K-factor for your sensor, then you will need to calculate the K-factor using the following procedure:

1. Ensure that the counter/depth channel has a K-factor of unity.
2. Ensure that the channel reading is zero. If necessary, reset the value to zero.
3. Physically, apply a known total. Example: If this a depth channel, then turn the sensor for a known number of revolutions (has to be exact) then calculate the equivalent depth in ft or meters. If this is a flow total channel, then pump a known quantity of the fluid/gas.
4. Take note of the channel final reading. This is the number of pulses that your sensor will produce for the physical quantity. The K-factor is thus calculated as (Number of Pulses, i.e. final reading) ÷ (Physical quantity). Example: If you pumped 2 barrels of water and your channel reading is 4600, then your K-factor is 4600 ÷ 2 = 2300 (pulses per barrel).

It is recommended that the values saved in this screen are recorded elsewhere in case the system is reset accidentally or deliberately.

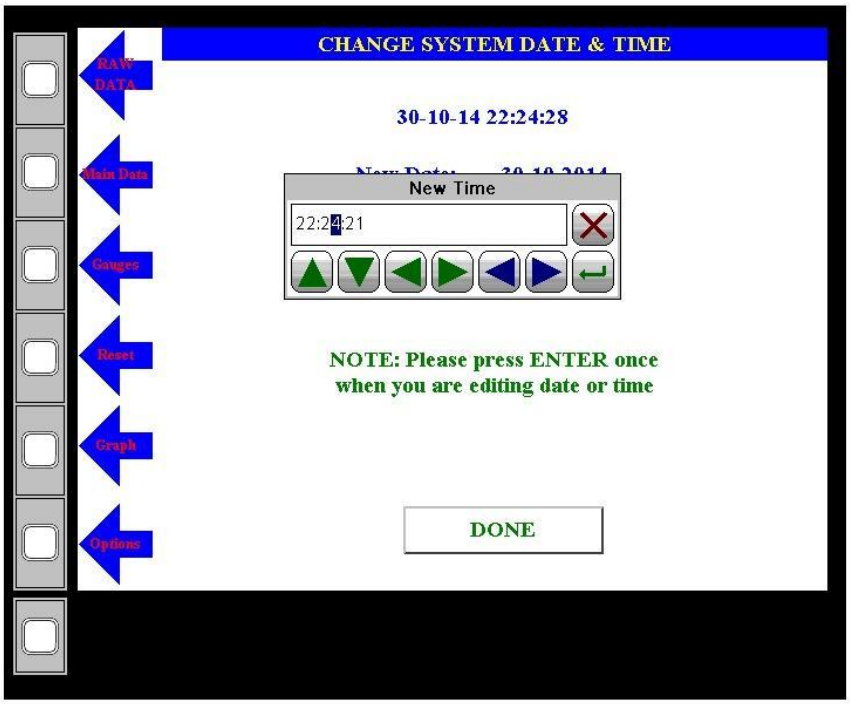
MENU OPTION – Calibrate Analogue Channel



Another option to carry out a single point calibration as shown above. Users may select the channel number before entering the actual physical value, the ampere value and the value at 1Am. This offers adequate calibrations for may sensors used in the field.

MENU OPTION – Set Date and Time
If the HMI date and time need to be changed, then use this option. A popup window will appear showing the system current date and time. To alter the date, click on the date and then enter the new date, and similarly for the time.

Another popup window will appear, to start making changes, click the ENTER button first then use the up/down arrows to increment or decrement the values, and use the left/right arrows to move to next/previous field.



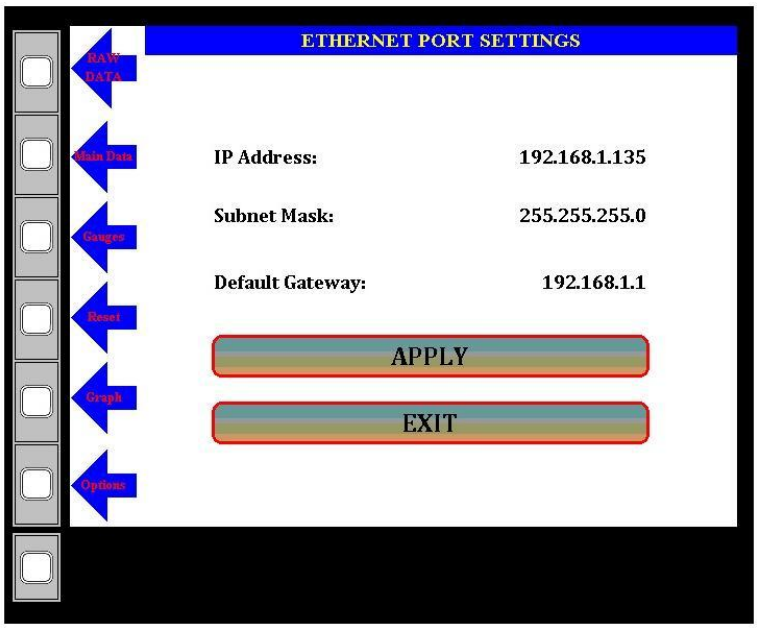
MENU OPTION - Set Ethernet Port
This button will display a page with the Ethernet settings. Should only be used if it is necessary to change these settings. The reason for this is that the system will restart itself automatically. Users should avoid changing the Ethernet settings frequently.

The REAM HMI is shipped with a default IP Address of 192.168.1.xxx (where xxx can be any number between 2 and 254, most likely 135) , Subnet Mask 255.255.255.0 and Default Gateway 192.168.1.1. These addresses will be valid in the case of using a router, as most routers will have a default IP address of 192.168.1.1. Note that all the numbers will range from 0 to 255.

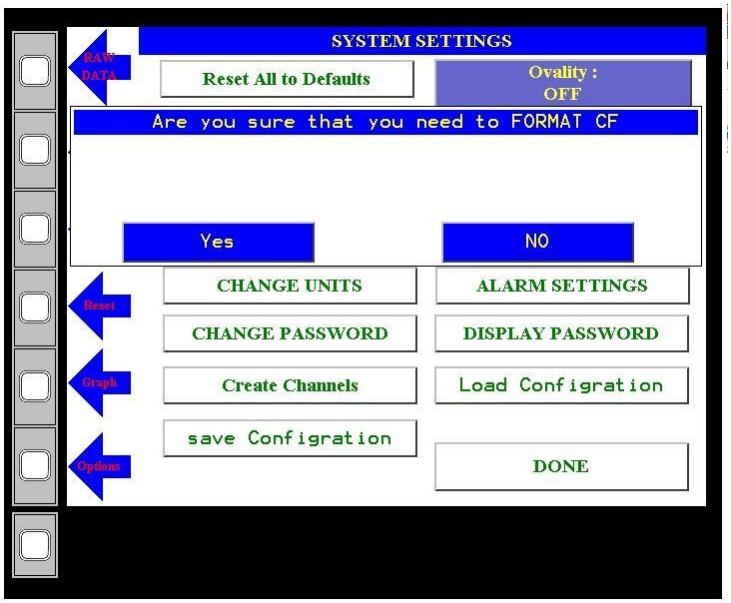
If using the REAM HMI with a direct connection to a computer, a crossed Ethernet cable should be used. The IP addresses should conform to the rules of a local area network, that is they should start with 192.168 and the following can be either 0 or 1 then a different number for the computer than that for the HMI. For example, the HMI can have an IP address of 192.168.1.135 and the computer can be 192.168.1.136. The default subnet mask is 255.255.255.0, and there is no need to worry about the default gateway.

If a local area network (LAN) is used with a router, wired or wireless, then you will need to ascertain that the default gateway is properly entered. Consult your router manual to find out the appropriate gateway, most likely 192.168.1.1.

For use in a wide area network (WAN), IP Service provider will provide a range of IP addresses that are valid. WAN settings will require a competent IT/Networking technician to configure.

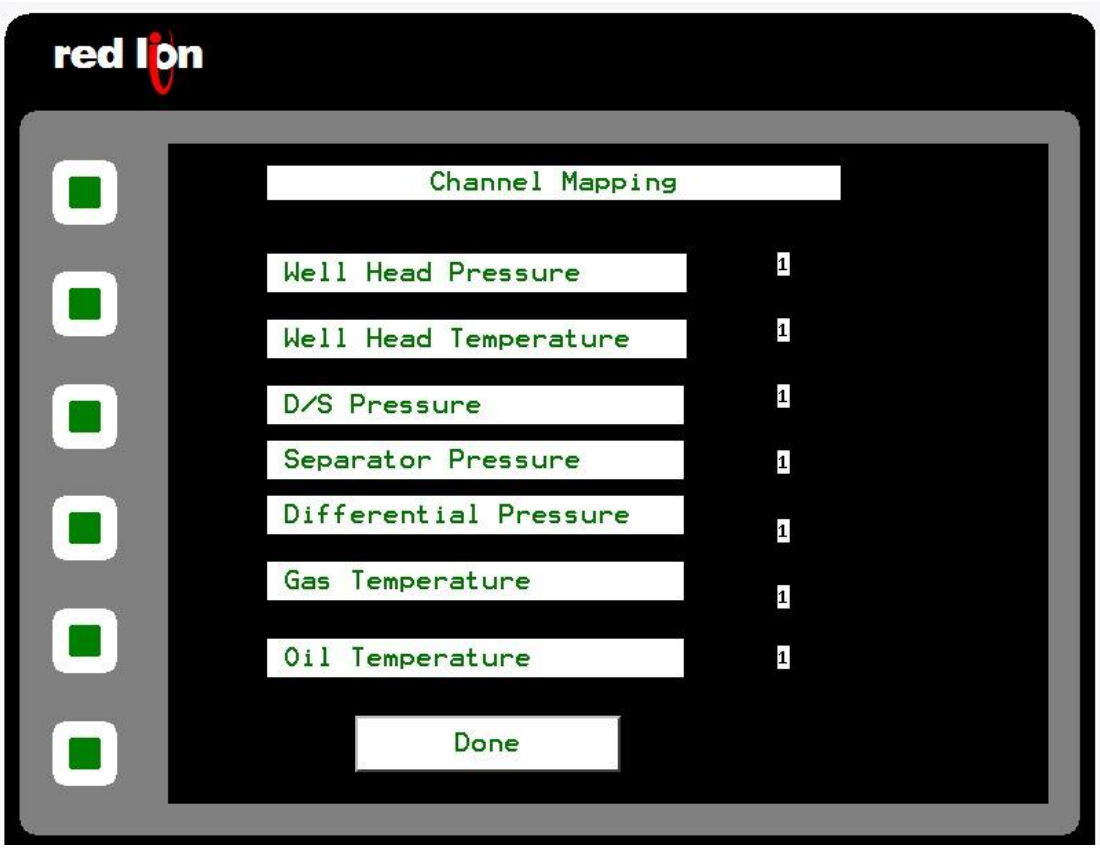


MENU OPTION – Format CF
Only use this option if you wish to format the Compact Flash. A pop-up window will appear to confirm that you wish to proceed with the formatting.



MENU OPTION - Channel Mapping
This option should only be used if it is desired to change the channel assignments. Users are advised to consult with MEDCO before making changes here.

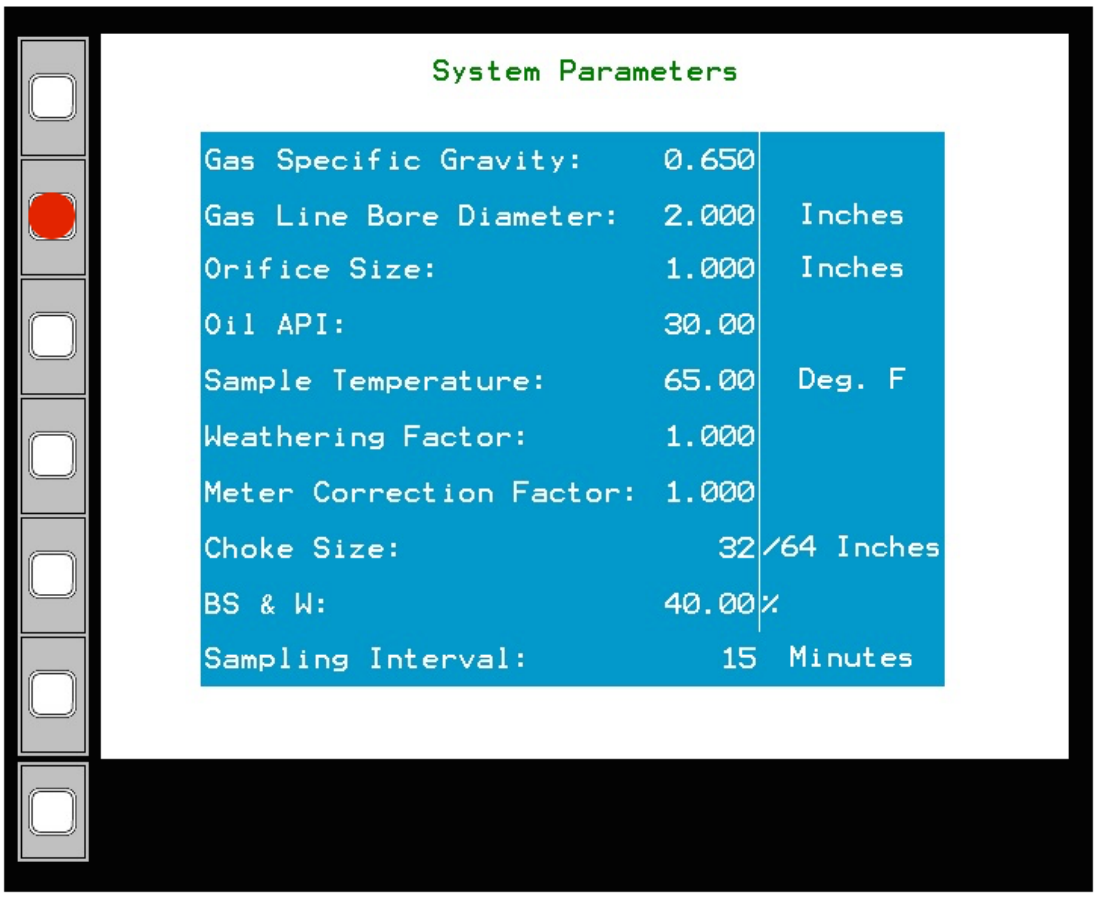
Furthermore, if an MC-III Flow Analyser is available for reading Fluid Flow or Nitrogen Flow, then the option to dictate to the HMI that the readings will come from the MC-III Flow Analyser is available here. If using MC-III Flow Analyser for measuring Fluid Flow, then MC-III should be set to *Salve Address* 242, and if used for Nitrogen Flow then the *Slave Address* is 243.



MENU OPTION - Change Units

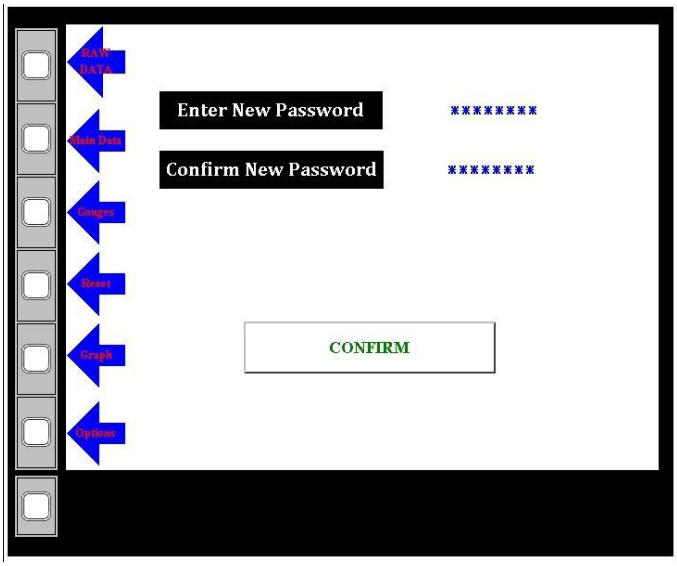
For users in different world locations, it is possible to change the units of measure for any or all the parameters, as well as changing the scales for the real-time graph and schematic displays. Note that the system will not change the calibration data to reflect any changes made here, it assumes that the calibrations and settings are appropriately set by the user using the appropriate measure units. For example, if the user calibrates the Weight Indicator using LBF as the units of measure, then change the Weight Indicator units to KgF or daN, the Weight Indicator channel should be re-calibrated.

By default, the system will be set in API English units, and the scales will be those shown in the picture below.



MENU OPTION – Change Password

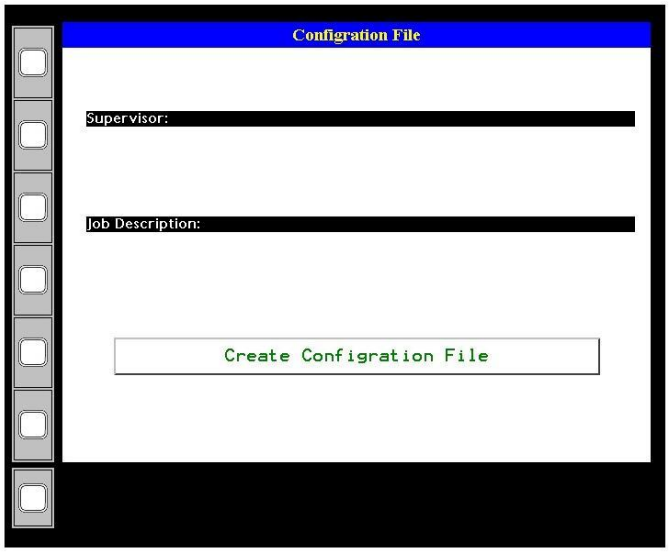
When the system is shipped, the password is set to "290992". This password can be remembered as the date of MEDCO's incorporation, 29th September 1992. As this password becomes known to all users who are reading this manual, the supervisor may wish to change it to prevent others altering the system configuration.



MENU OPTION – Display Password
If the password has been changed and the supervisor forgot the password, then MEDCO can still access the system and display the password. This is only for MEDCO use, and will require access to the system via Team Viewer. MEDCO staff are not allowed to disclose the master password.

MENU OPTION – Create Channels
The REAM HMI often comes with spare channels. Users may decide to use these channels to measure some parameters, which may not be included in a standard configuration. The user is free to name the channel by any name, set a minimum and maximum value, as well as associate any units with the particular channel. The channels available for renaming do not include the standard parameters channels.

MENU OPTION – Save Configuration
Once the REAM HMI has been completely configured, it is a good idea to save the configuration. The configuration will be saved on the Compact Flash memory.



MENU OPTION – Load Configuration
If for any reason the configuration has been altered but need to revert back to the older, then Load Configuration can be used to retrieve Configuration Data from a previously saved file (see MENU OPTION – Save Configuration).

System Memory

REAM HMI has a 4 Gbyte CompactFlash memory that is used for storing data. The data storage is done automatically at a once per second sampling rate. The maximum length of time for continuous recording of data is variable and depends largely on the number of logs being used.

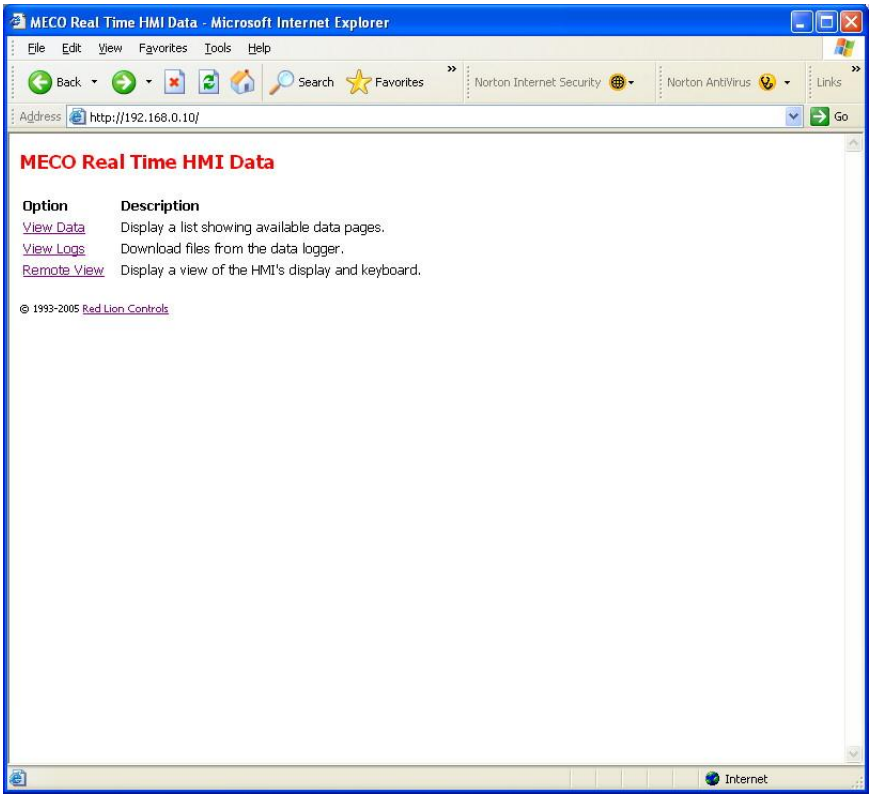
To read data from the Compact-Flash, the user can do this by going to Web Browser and enter the HMI IP Address, then select the VIEW LOGS and then list of logs will be available. Alternatively, the Compact Flash can be taken out of the HMI (power must be OFF) and inserted into the supplied card reader which can then be used with any computer to read the data. As a caution, never use the computer to format the Compact Flash, always use the FORMAT CF command on the HMI.

Communication

The user can access the data in REAM HMI using the IP Address of the system. The IP Address, subnet mask, and Gateway information can be found on the *Raw Data Page* (top button). The user can access the pages simply by typing the IP Address in the address bar of a web browser,

example in Internet Explorer. The default html page is “auto/001/”, which is used to display the actual data. Other programs, such as DART software, use this page to capture the data from the HMI.

A local area network has to be present to enable browsing the pages. When crossed RJ45 cable is used a direct connection to a computer (laptop) is possible. Alternatively, if a router is used, then a straight RJ45 cable should be used.



The first page that will appear will have the following hyperlinks:

View Data
Will display data with variable names. This is not meant for end users, it is meant for transmitting data to other devices capable of logging data through TCP/IP, example DART software on a laptop.

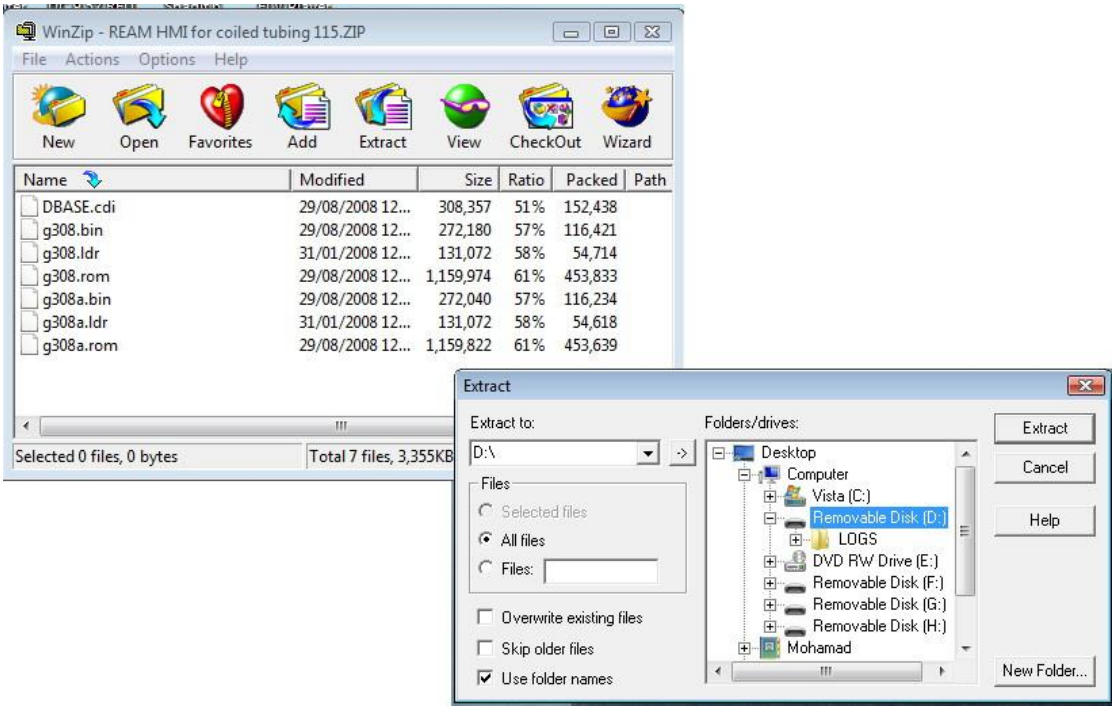
View Logs
Will display all the data logs available. "Onehour" will contain all the one-hour long files. The files format is Comma Separated Variables (extension CSV) and this can be opened directly by Microsoft Excel. The log files follow a naming convention, which is made up of the year, month, day, and hour. Each file contains 1 hour worth of data as a maximum. The CompactFlash memory can hold anything up to 200 files (more than a week worth of data recorded from all channels at 1 per second). The other logs available are the "Oneday" and Ovality. For the one-day logs, a maximum of 10 files are stored, while for the ovality, 100 files. The OneDay logs are recommended.

Remote View
Gives access to all the pages described earlier in this manual. The current page being displayed on the HMI is the page that will be shown.

Updating the HMI Software

Occasionally, MEDCO will release new versions of the HMI software. One of the major advantages of the HMI hardware is that it may be easily re-programmed or updated. The following is a step-by-step procedure for updating the HMI software:

1. Ensure that you have a copy of all your system settings, such as Gains, Offsets, and K-Factors.
2. Ensure that the REAM HMI is switched off.
3. Remove the Compact Flash card. Ensure that you remember the card's orientation, this will help you when re-inserting the card back into the HMI.
4. Insert the Compact Flash card into the card reader supplied with the system.
5. Connect the card reader to your computer (USB port).
6. Download the new software version from MEDCO's web site by going to http://www.medcotas.com/reamhmi.htm. Look for the latest version, download it to your computer and remember where you saved it.
7. The new software files will be packed together in Zipped file. Extract all the files to the root folder of the Compact Flash.
8. Ensure that you stop the card reader, then disconnect the card reader from the computer.
9. Remove the Compact Flash card from the card reader and insert it back into the HMI.
10. Power up the HMI, you will see a message "Loading from CF", wait until the system starts then wait for at least two minutes to allow the system to write to the Compact Flash.
11. Note that you may need to re-configure the system, for example, your old calibration data may be lost. Here, we deliberately say that you MAY need to re-configure the system because if the changes in the software are significant from the version that you already have, then there is a good chance that some of the settings will be lost.

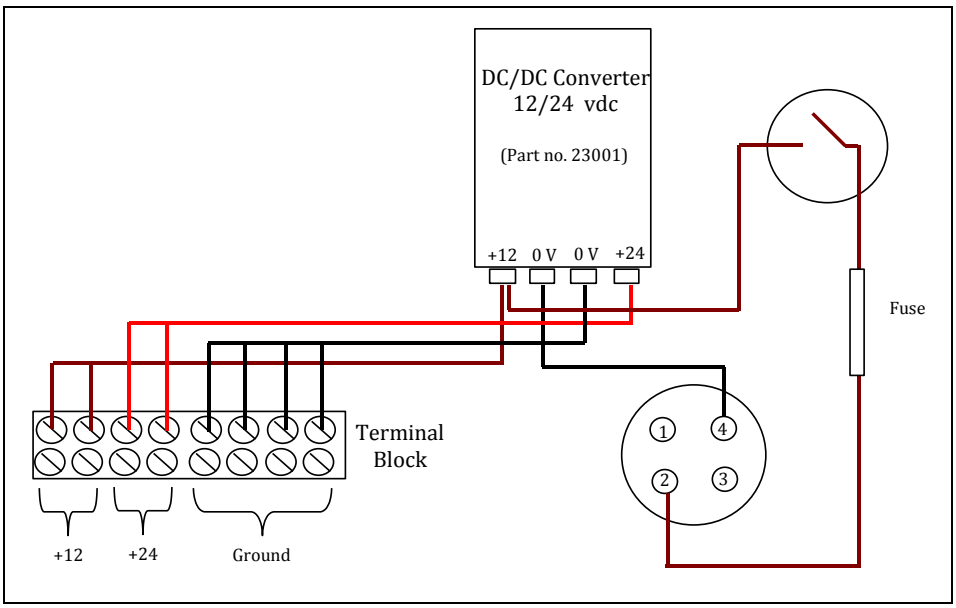

WinZip - REAM HMI for coiled tubing 115.ZIP
File Actions Options Help
New Open Favorites Add Extract View CheckOut Wizard
Name Modified Size Ratio Packed Path
DBASE.cdi 29/08/2008 12... 308,357 51% 152,438
g308.bin 29/08/2008 12... 272,180 57% 116,421
g308.ldr 31/01/2008 12... 131,072 58% 54,714
g308.rom 29/08/2008 12... 1,159,974 61% 453,833
g308a.bin 29/08/2008 12... 272,040 57% 116,234
g308a.ldr 31/01/2008 12... 131,072 58% 54,618
g308a.rom 29/08/2008 12... 1,159,822 61% 453,639
Selected 0 files, 0 bytes
Total 7 files, 3,355KB
Extract
Extract to:
D:\
Folders/drives:
Desktop
Computer
Vista (C:)
Removable Disk (D:)
LOGS
DVD RW Drive (E:)
Removable Disk (F:)
Removable Disk (G:)
Removable Disk (H:)
Mohamad
Files
Selected files
All files
Files:
Overwrite existing files
Skip older files
Use folder names
Extract
Cancel
Help
New Folder...

Power Supply

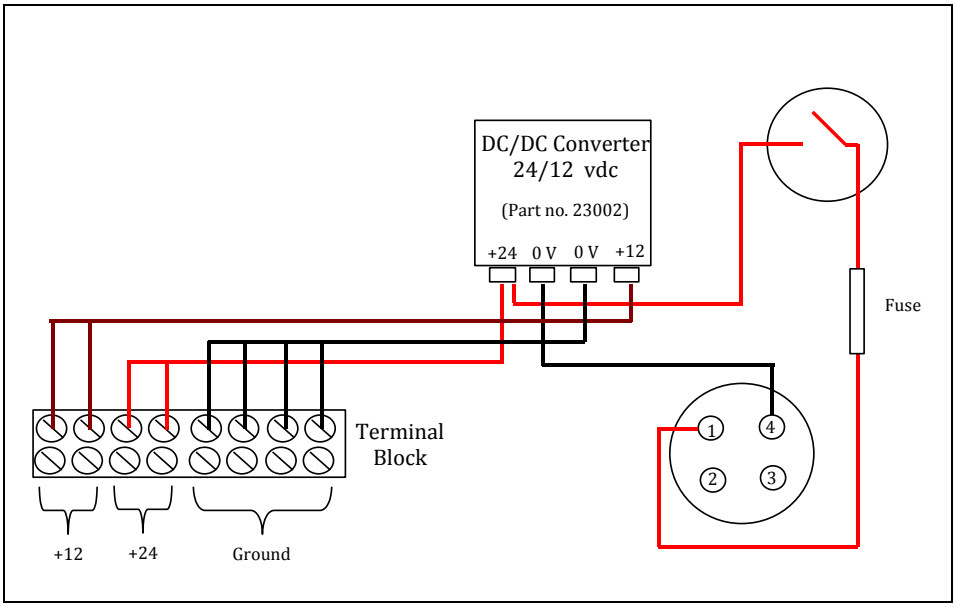
Customers can choose the REAM HMI to be operated by 12 or 24 vdc. The system comes with an AC to DC converter, which takes 95-250 VAC and outputs the required dc voltage. The complete system will require less than 20-watt.

Internally, various parts will require either 12 or 24 vdc to operate. Therefore, a DC/DC converter will be used to ensure that the complementary voltage is available. The REAM board requires 12 v (except earlier REAM v 2 boards, which require 24 v). The HMI requires 24 v. If there are IS Barriers or other components, these will require either 12 or 24 v, depending on the model.

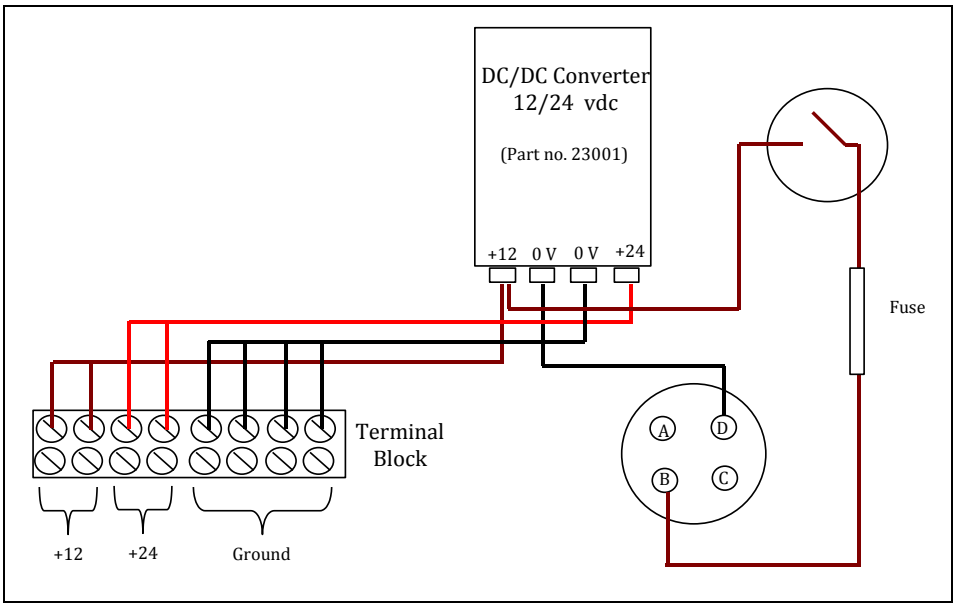
Below are the wiring diagrams for the DC voltage conversion and distribution inside the REAM HMI enclosure.



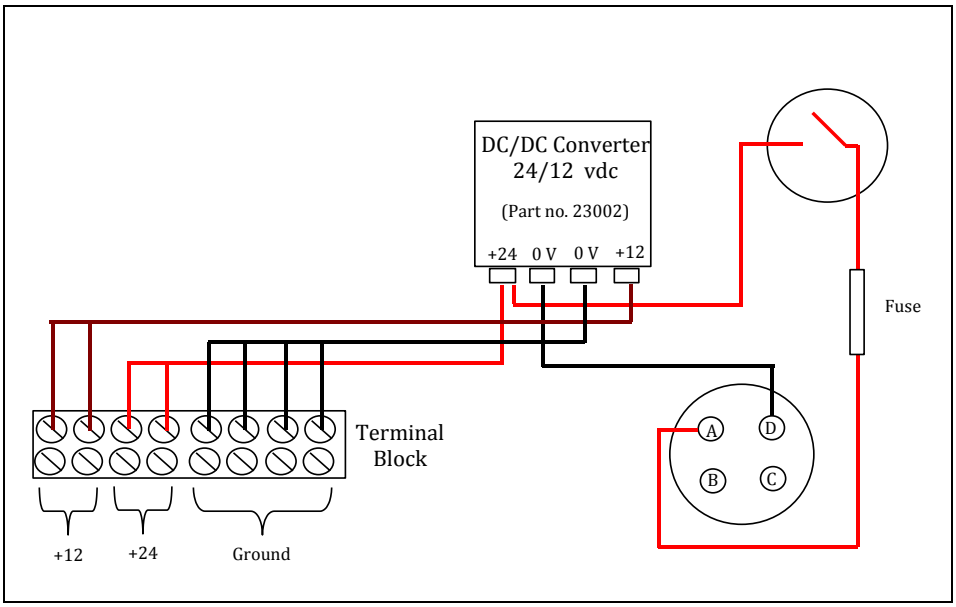
System Operated by +12 vdc Power Supply
With XLR Connectors



System Operated by +24 vdc Power Supply
With XLR Connectors



System Operated by +12 vdc Power Supply
With Military Connectors



System Operated by +24 vdc Power Supply
With Military Connectors

Sensors

Shaft (Depth)Encoder

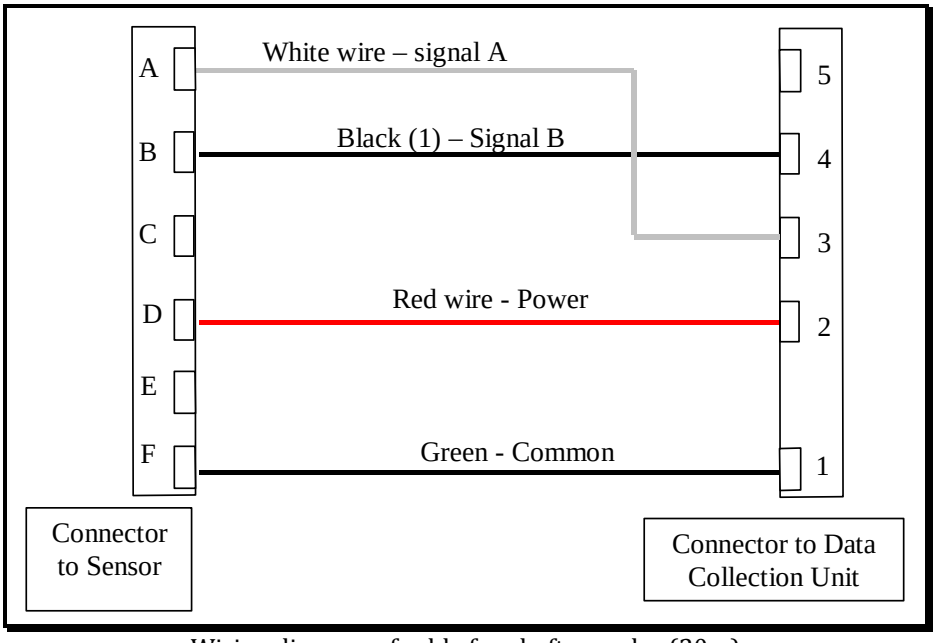
Quadrature Optical Encoder (Shaft encoder)
(Part No. 01007)

Specifications

Pulses per revolution:	600
Operating Voltage:	5 – 24 vdc
Mounting:	Flange mount 1.181"
Shaft size:	3/8"
Ingress:	IP65

Connectors for Shaft Encoder Cable

	
Connector - data collection unit side (Part No. 08154)	Connector - sensor side (Part No. 01003)



Wiring diagram of cable for shaft encoder (20m)

(Part No. 10022)

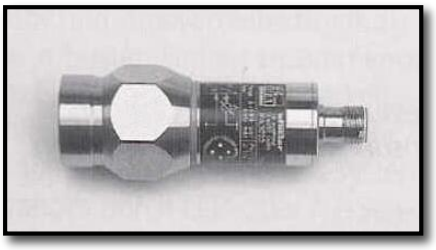
Pressure Sensors

There are a variety of pressure sensors that may be used. Some will have a voltage output, while others will have a current output. Below, some of the most popular types are listed and users who have sensors not listed below are advised to check with MEDCO for the wiring diagram.

A. MEDCO's part number: 04004, 04005, and 04006:

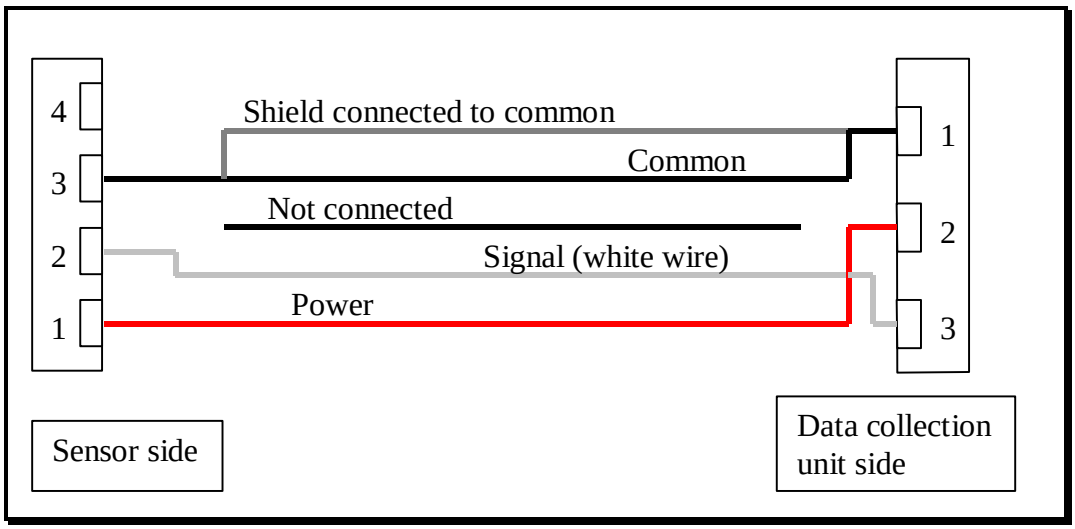
Specifications:

Part No.	Output	Measuring Range	Operating Voltage	Temp. Range	Protection	Mechanical Connection
04004	0-10 vdc	0-100 bar (0-1450 psi)	18-30 vdc	-25 to 80 °C	IP67	G ¼" Female
04005	0-10 vdc	0-250 bar (0-3625 psi)	18-30 vdc	-25 to 80 °C	IP67	G ¼" Female
04006	0-10 vdc	0-400 bar (0-5800 psi)	18-30 vdc	-25 to 80 °C	IP67	G ¼" Female



Pressure sensor type – A
(Part No. 04004, 04005, and 04006)

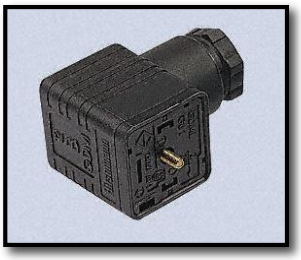
	
Connector - data collection unit side (Part No. 08152)	Connector - pressure sensor (type A) side (Part No. 04002)

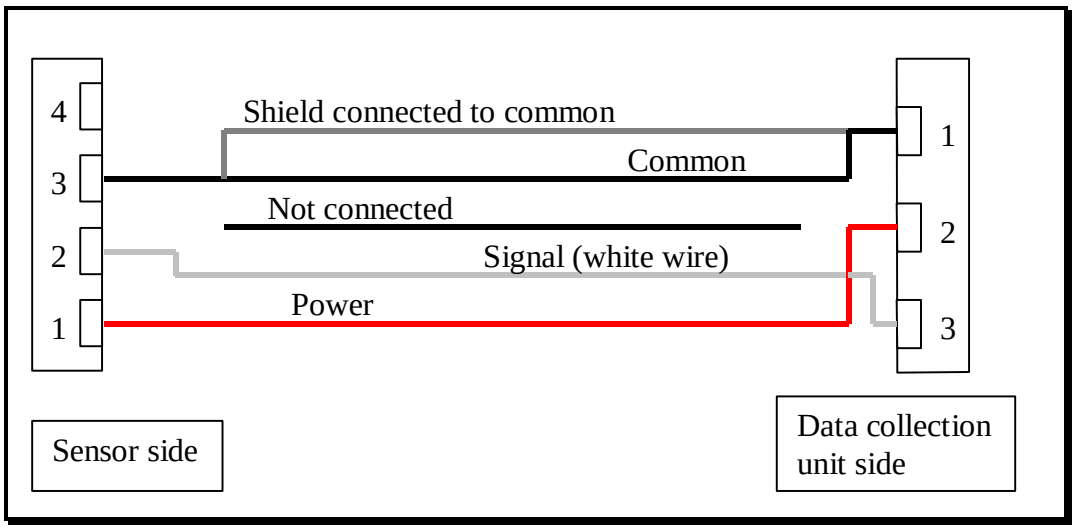


(Part No. 10025 for Pressure sensors 04004, 04005, and 04006)

B. MEDCO's part number 09001:

Specifications: Output: Measuring range: Operating voltage: Temperature range: Mechanical connection:	 0-5 vdc To client's requirement, up to 15,000 psi 18-30 vdc -29 to 94 °C G ¼" Female	

	
Connector - data collection unit side (Part No. 08152)	Connector – pressure sensor (type B) side (Part No. 08128)



(Part No. 10026 for Pressure sensor 09001)

Proximity Switch

Proximity Switch Sensor
(Part No. 04012)

Specifications:

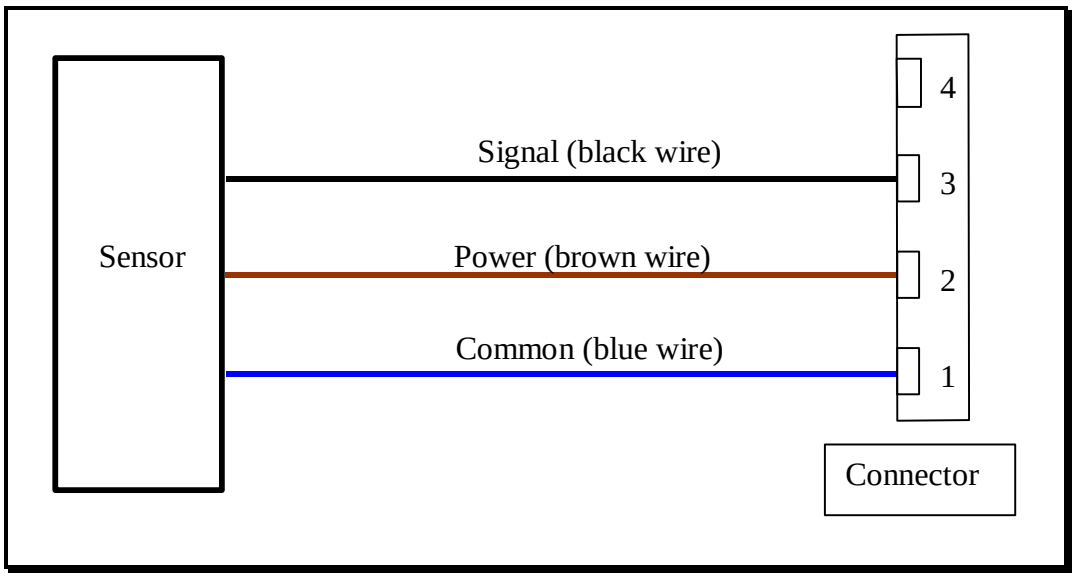
Operating voltage:	10 – 36 vdc
Current rating:	250 mA
Switching frequency:	800 Hz
Temperature range:	-25 to 80 ^{o}C
Thread size:	M12

Electrical Connection for Proximity Switch:

The proximity switch comes with a short cable and a 4-way in-line sensor plug connector.

Connector for Proximity Switch
(Part No. 08153)

The wiring inside the connector is as shown in the diagram below.



Wiring diagram for proximity switch
(Part No. 10017)

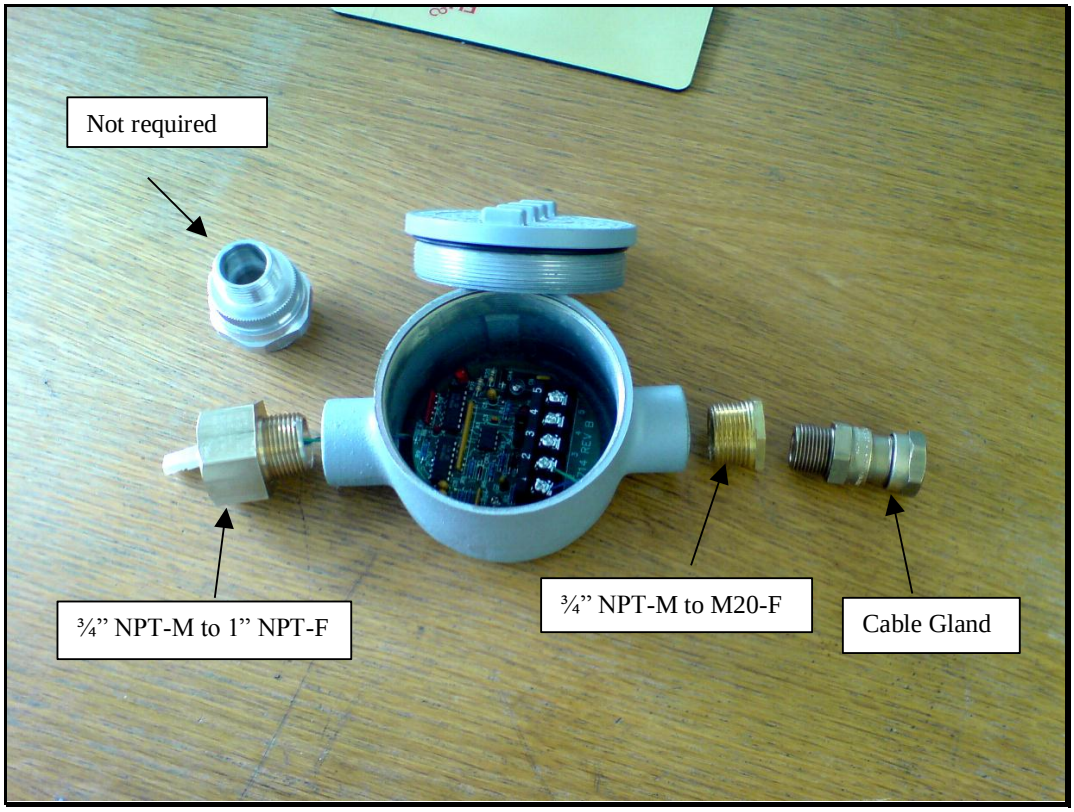
Magnetic Pickup

Magnetic Pickup Sensor
(Part No. 16002)

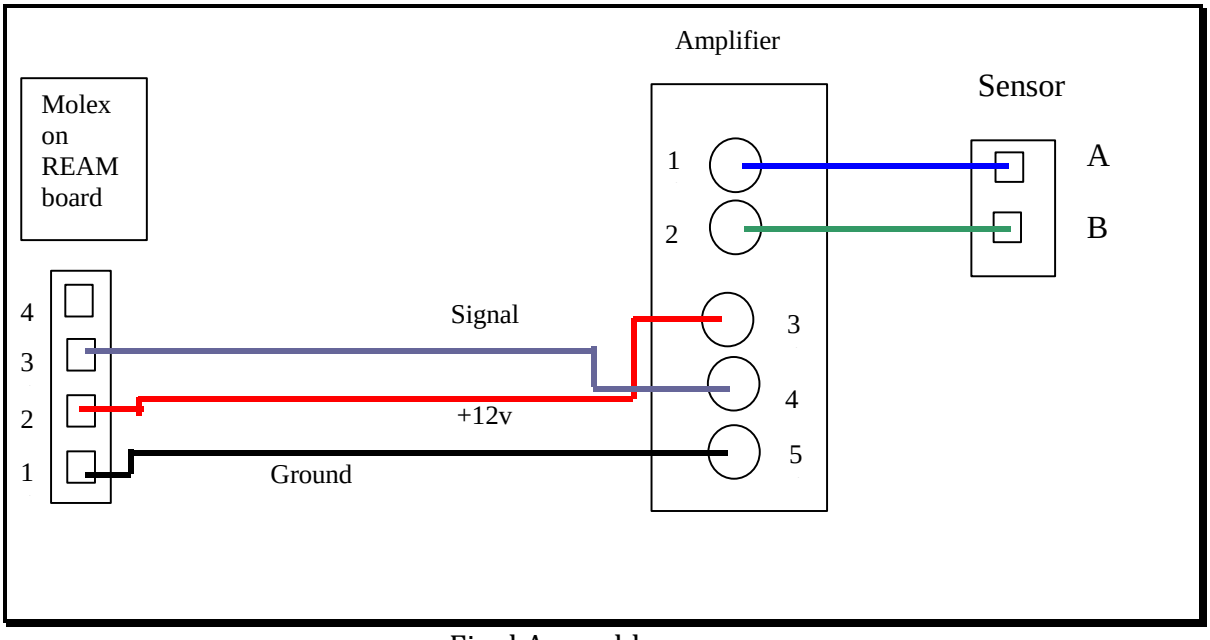
Magnetic Pickup Amplifier

The magnetic pickup amplifier shown above is supplied with the following adaptors:

1. ¾" NPT-M to 1" NPT-F. This adaptor is to be used to connect the amplifier to the flow meter.
2. Wires connector: The wires connector connects directly to the magnetic pickup sensor. Most likely, the blue wire should connect to the left pin of the magnetic pickup when viewing the magnetic pickup pins with the alignment notch on the topside. If no signal is received, then reverse the connection.
3. ¾" NPT-M to M20-F: This connector is used to connect the amplifier to the cable gland.
4. M20 Cable Gland: Use this to hold the cable and stop it from rotating.



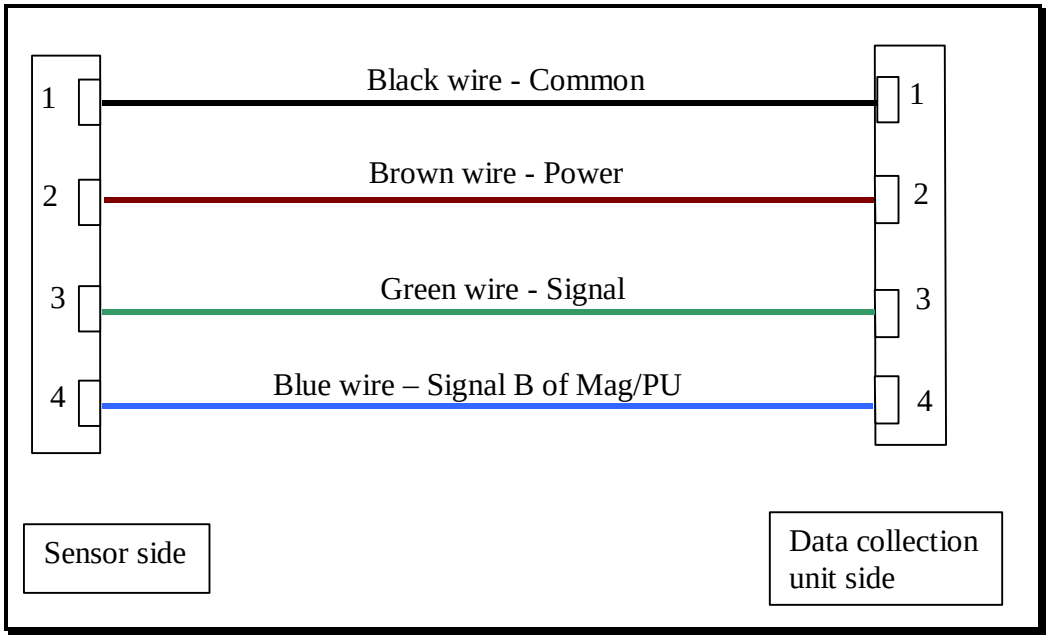
Magnetic Pickup Amplifier
(Part No. 18001)



Final Assembly

Cable for Proximity Switch/Magnetic Pickup to Data Collection Unit:

The wiring of the cable (30m) to the data collection unit is as shown in the diagram below:



(Part No. 10023)

Connectors on Cable for Proximity Switch/Magnetic Pickup:

Connector - sensor side
(Part No. 08155)

Connector - data collection unit side
(Part No. 08153)

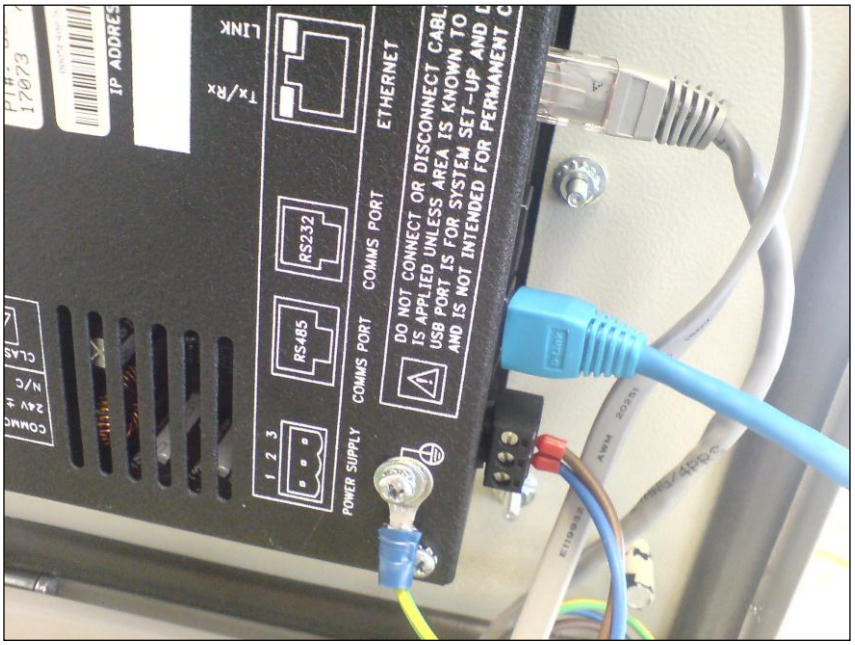
MC-III Flow Analyser

Overview

With the new REAM HMI software version 1.23, the user has the choice of reading data directly through the MC-III flow analyser instead of using a magnetic pickup amplifier. This applies to both Fluid Flow and Nitrogen Flow (rates and totals).

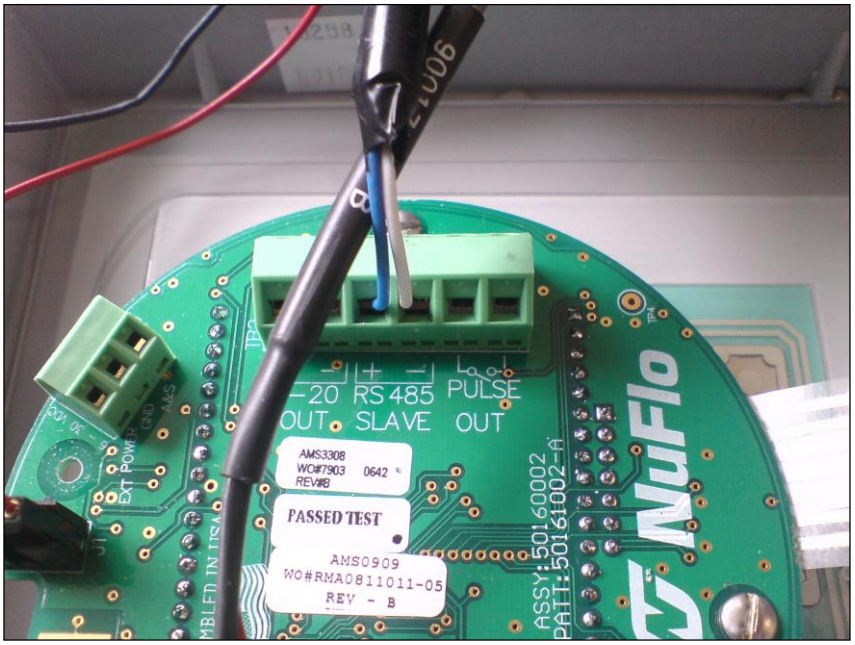
The readings that will be reported on the REAM HMI will be exactly the same as those reported by the MC-III flow analyser. This means that if the K-Factor of MC-III flow analyser is wrong, or the MC-III is mal-functioning, then the REAM HMI will report the same data regardless, i.e. the accuracy will be solely dependent on the MC-III accuracy. Note also that the data will be reported in the same units of measure as those specified in the MC-III.

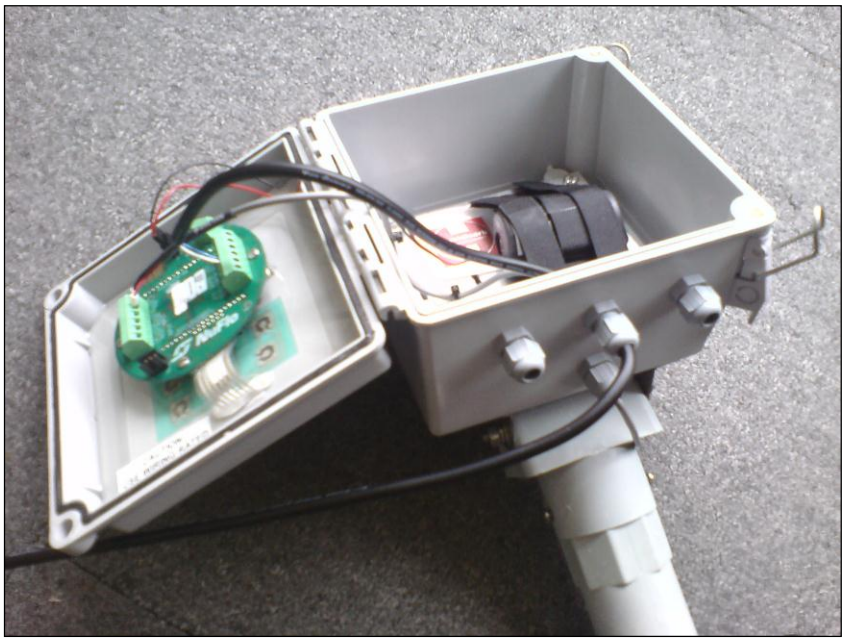
From the outside, the REAM HMI has a XLR 3-pin male plug for connecting to the MC-III, and internally from the RJ45 through a UTP cable to the RS485 port on the HMI.



Connect to MC-III

A long cable (approx. 15m) is provided. One side of the cable has an XLR 3-pin cable mount socket to connect to REAM HMI. The other side of this long cable has three wires. Feed this cable through one of the cable glands on the body of the MC-III then connect such that Pin2 on the XLR goes to RS485+, Pin1 on the XLR goes to RS485- inside the MCI-III, and Pin3 is earth and must be connected to the next MC-III. The cable from the magnetic pickup is connected across the TFM terminals.





Programming the MC-III

If using this modification to measure Fluid Flow, then the MC-III should be re-programmed to have a slave address of 242. On the other-hand, if this modification is intended for use with Nitrogen Flow, then the MC-III slave address needs to be 243.

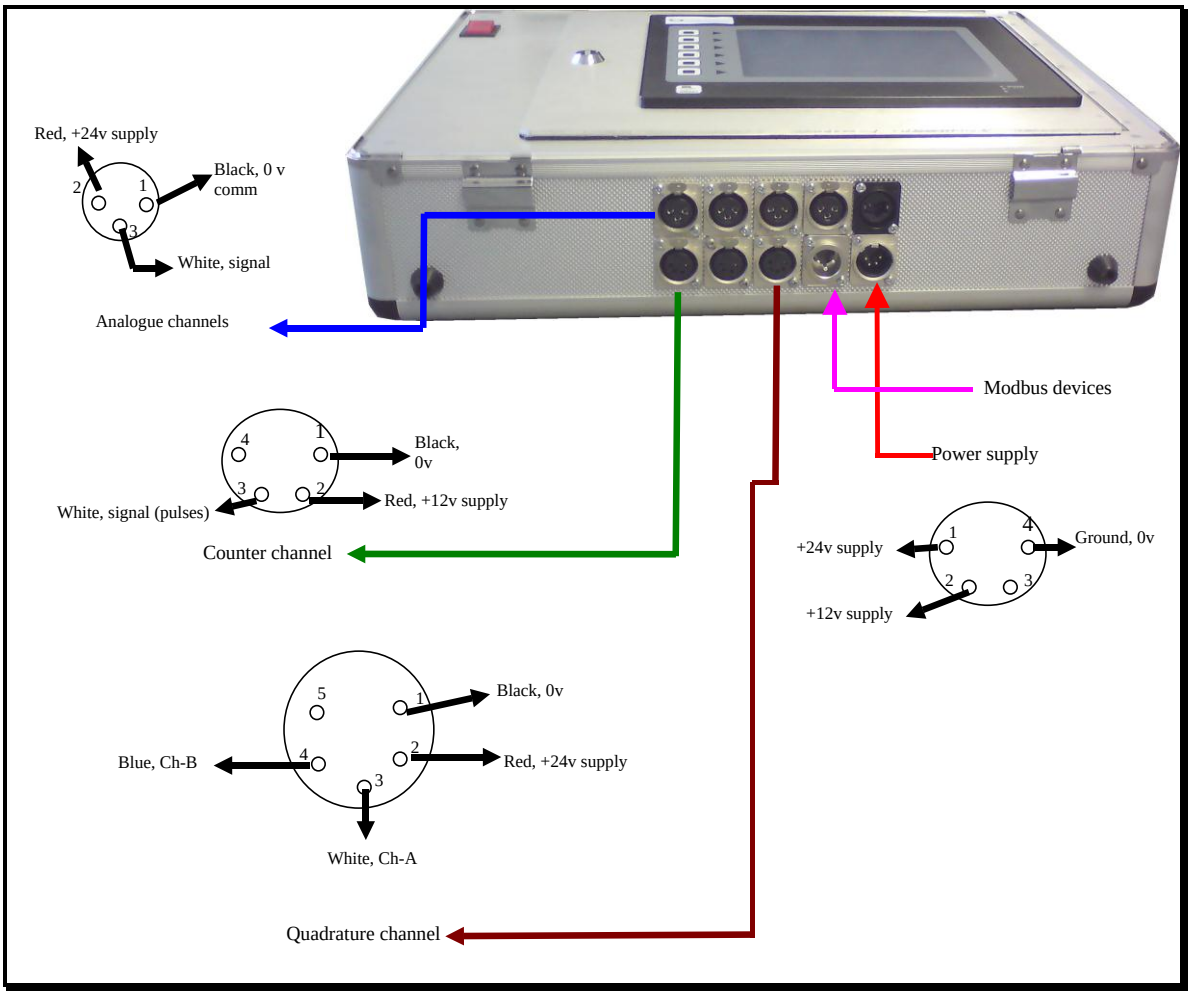
1. Enter the Output menu. Press OUTPUT MENU.
2. Locate the Slave Address setting: Press ENTER repeatedly until the words "Slave Address" appear in the lower display. The right-most digit in the upper display will begin blinking.
3. Enter the Slave Address: Press UP ARROW until the correct digit is displayed. Then press LEFT ARROW to select the next digit to the left. Repeat using UP and LEFT arrows to enter all remining digits.
4. Save the changes: Press ENTER.

All other settings of the MC-III should remain as per manufacturer's default values. If any has been changed, then refer to the MC-III manual for instructions on how to change back to manufacturer defaults. Of particular interest here, is the BAUD RATE which should be 9600.

Configure REAM HMI Software to read from MC-III

On the HMI, go to MENU, enter the passcode "290992", then select the button "Channel Mapping". In the column titled "Use MC-III", turn ON the appropriate field, i.e. if using MC-III to measure Fluid Flow, then on the row with FLUID FLOW on left-hand-side, toggle the button on the right hand side of the row to "ON", then click DONE.

Wiring Diagram



Trouble Shooting

This part of the manual is intended to help the user resolve problems. Troubleshooting is a process of elimination, thus this section will give some details of common problems and how to troubleshoot. If after checking the procedure below, you are still unable to find and resolve the fault, then contact MEDCO for further advice.

No data:

The system is not displaying data on the first page, the "Raw Data Page" accessed through the first button. This implies that there is no communication between the HMI and the REAM board. The possible causes could be one of the following:

1. Missing link on the RS232 cable between the HMI and the REAM board.
    a. First ensure that the cable is connected to the RJ11 socket on the HMI labelled "RS232 PGM PORT".
    b. Ensure that the other side of the same cable is connected to the REAM board. Three wires are used, Yellow goes to Pin 1 on the Molex connector, Black goes to Pin 3, and Red goes to Pin 4. Also ensure that these wires are securely connected in the Molex connector.
    c. If you have access to another REAM HMI, try swapping the RS232 cable. Do not remove or connect the cable while the system is on.
2. No power: Check that the REAM board is actually powered. To do this, do the following steps:
    a. On any of the analogue channels connectors, check to see if there is +24vdc power between Pin 2 (+ve) and Pin 1 (Ground).
    b. On any of the counters (not the quadrature), check to see if there is +12vdc power between Pin 2 (+ve) and Pin 1 (Ground).

Raw Data Available:

If the data on the "Raw Data Page" is making sense, for one or more channels, but with one or more channels not making sense, then probably the REAM board needs to be re-configured. The data here should be as follows:

1. Analogue channels: As these are 11-bit ADC channels, in theory they should display values in the range of 0 to 2047, where 0 corresponds to 0 vdc and 2047 corresponds to 10 vdc or 5 vdc. If using 4 to 20 mA sensors, then the values should be 409 to 2047. Due to some variations in resistors and other electronic components, most systems will actually give approximately 1900 for a 10 vdc signal. To check that a particular channel is displaying the correct value:
    a. Apply a physical measurable quantity to the sensor. For example, if using a pressure sensor with a range of 0 to 5,800 psi and output of 0 to 10 vdc, then at 0 psi the reading should be approximately 0, and at 2,900 psi the reading should be approximately 950.
    b. It is also possible to apply voltage directly using some battery or another source for voltage. Compare the results and the ratio should be approximately the same. That is, if applying 5 vdc, then should get a

reading of approximately 950. Care should be taken when applying voltage directly, ensuring that the +ve voltage is applied to Pin 3 (signal) on the connector while ground should be connected to Pin 1 (Ground).

2. Counter Channels: These should display a value of 0.01 for every pulse applied. The easiest way to check either of these channels is to connect a proximity switch to the channel and with a small metal object, such as the tip of a screw driver, generate one pulse at a time and check that the reading corresponding to the channel is incrementing by 0.01.
3. Quadrature Channel: Again, this channel should display 0.01 for every pulse applied. The depth encoder will have a Pulses Per Revolution (PPR) value written on the encoder body, for example the most common is 600 PPR. Thus for every revolution the readings should change by 6.00. Again, this figure will be approximate as it is not always possible to turn the encoder by hand exactly one revolution with an accuracy of 1 in 600.
4. If the readings of counter and/or encoder channels are not 0.01 per pulse, then it is sometimes possible to reset these from the HMI. The procedure is as follows:
   a. Go to MENU, enter the passcode.
   b. Select the RESET REAM K-FACTORS, then go back and check 2 and 3 above. If one or more of these channels is still not displaying 0.01 for every pulse, then repeat until all are responding appropriately.

Individual channels having a problem

If an individual channel is exhibiting a problem, then there are a few steps to take to determine the cause of the problem:

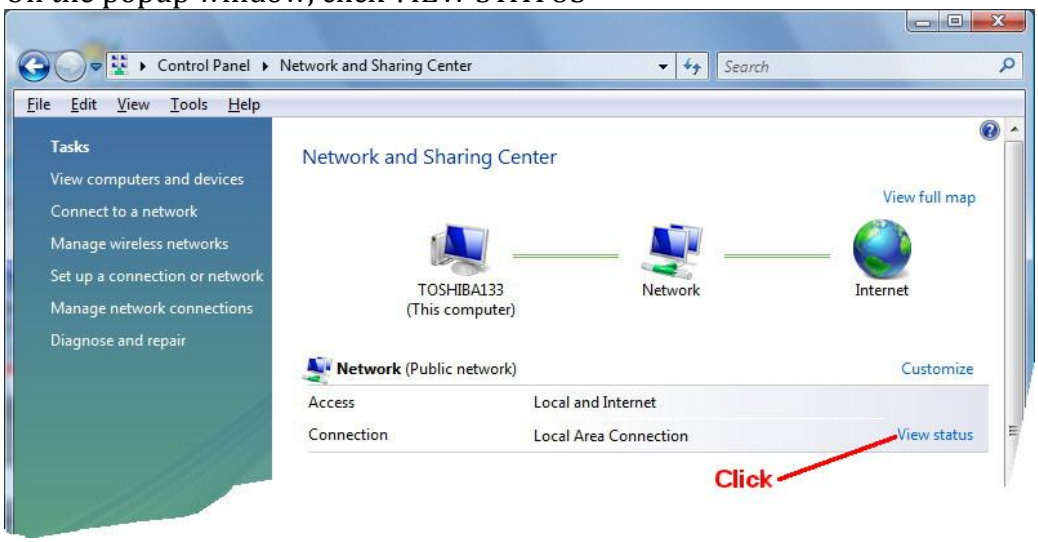
1. Note that Fluid Flow (Flow Rate) and Fluid Total are both obtained from the same sensor. Thus, if there is a problem with both of these then it is likely to be one problem and not two. Similarly for the N2 Rate & N2 Total, and Depth & Speed.
2. In the REAM RAW DATA page, check to see if the readings for the channel are making sense, i.e. in accordance of the description above. If they do make sense, then you probably need to correct the calibration or the K-factor, otherwise go to step 3 below.
3. If there is no data relating to this channel in the REAM RAW DATA page, or the values are not changing when you vary the physical quantity, then it is likely that you have a hardware problem. Since, other channels are working properly then it is unlikely that the problem is inside the REAM HMI, rather it could be either the cable or the sensor itself that is causing a problem. It is very simple to determine the source of the problem by getting another sensor of the same type that you know works well and try it, if that still does not resolve the problem then try another cable.
4. When you have determined that the problem is in the sensor, then you will need to replace the sensor. If you already have one in stock, then simply replace it, otherwise contact MEDCO for replacement parts.
5. If, on the other hand, you have determined that the problem is in the cable, then most of the time you will be able to repair the cable. Use the wiring diagrams for the relevant cable and re-solder the wires. Note here that you should always check a cable by performing two tests:

a. Continuity: If you measure the resistance between two pins that are supposed to be connected, then it should be near zero, allowing for the cable resistance.
b. Insulation: If you measure the resistance between two pins on one side the cable that are not supposed to be connected to each other, then it should be infinite.
c. Example: Take the depth encoder cable. This should have the wiring as follows:
    i. Pin 1 on REAM side to Pin F on sensor side – do a continuity test
    ii. Pin 2 on REAM side to Pin D on sensor side – do a continuity test
    iii. Pin 3 on REAM side to Pin A on sensor side – do a continuity test
    iv. Pin 4 on REAM side to Pin B on sensor side – do a continuity test
    v. Insulation tests on the sensor between Pin F and D, A, & B
    vi. Insulation tests on the sensor between Pin D and A, & B
    vii. Insulation tests on the sensor between Pin A and B

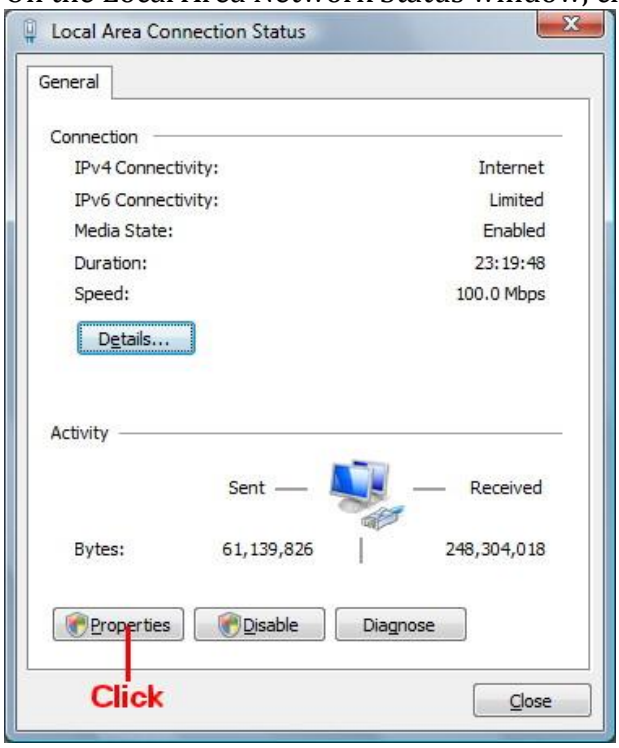
Other Types of Problems

- No data recorded on CompactFlash:
    a. Go to DATA LOGGERS AND COMMENTS page by clicking button 6 and ensure that you have either the ONE HOUR or ONE DAY LOG turned on.
    b. Ensure that you have a CompactFlash card inserted correctly in the slot on the side of the HMI.
    c. Ensure that the CompactFlash is either 512 Mbytes or if using 1 Gbytes then only use SanDisk make.
    d. Never format the CompactFlash on the computer.
    e. Ensure that there is sufficient space on the CompactFlash. If not, then delete some of the old files to make space for recording new files (you can this by connecting the CompactFlash to your computer).
- Unable to see REAM HMI on Computer: There are two possible ways to connect the HMI to Local Area Network:
    a. If using the crossed Ethernet cable supplied by MEDCO, then follow these steps:
        i. On your computer, click START > CONTROL PANEL > NETWORK AND SHARING CENTER

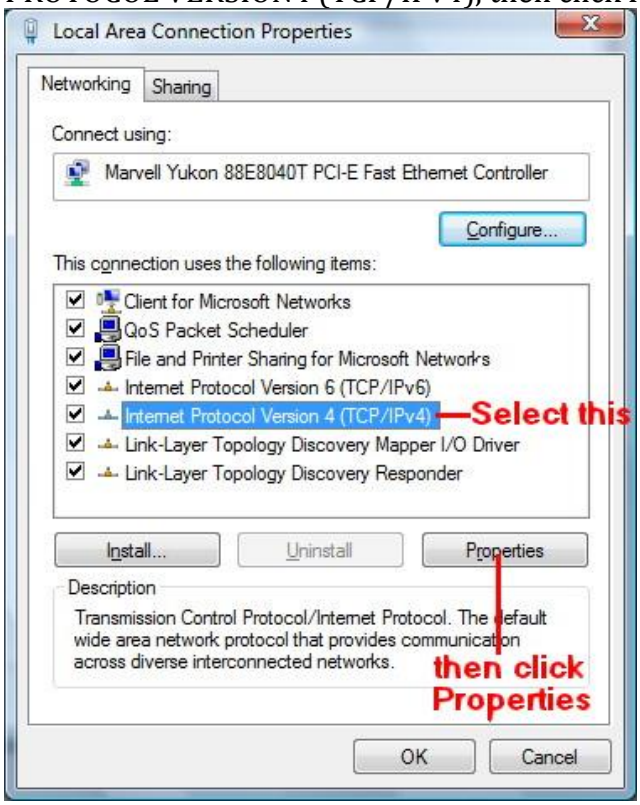
ii. On the popup window, click VIEW STATUS



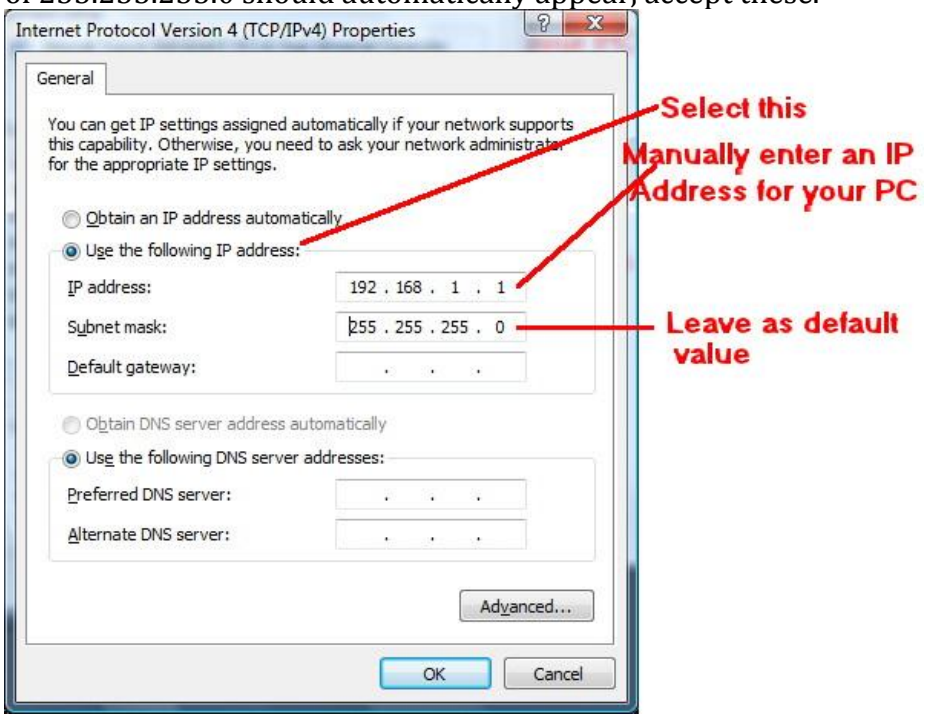
iii. On the Local Area Network Status window, click PROPERTIES



iv. On the Local Area Network Properties window, select INTERNET PROTOCOL VERSION4 (TCP/IPv4), then click PROPERTIES



v. On the Internet Protocol Version 4 (TCP/IPv4) Properties, select USE THE FOLLOWING IP ADDRESS, then enter the IP Address as 192.168.1.1, when you move to the SUBNET MASK, the default values of 255.255.255.0 should automatically appear, accept these.



vi. Click OK on all opened windows and they are all closed. Now, start your Internet Explorer and in the address bar enter the IP Address of the REAM HMI, 192.168.1.10.

b. If using a router, then you should procure a straight Ethernet cable to connect the HMI to the router. Follow the same steps above, but in step (a.v.) select the option OBTAIN AN IP ADDRESS AUTOMATICALLY. You also need to ensure that the first three blocks of the HMI IP Address match those of the router, i.e. 192.168.1.xx.