Modelling Engineering & Development Company Limited

Real Time Electronic Acquisition & Monitoring & Human Machine Interface

REAM HMI FOR PUMPING/CEMENTING

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System Overview

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

The system is made of two main parts, REAM (Real-time Electronic Acquisition & Monitoring) 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 (Human Machine Interface) communicates with the REAM board(s) to retrieve, display, and store the data.

For pumping services, REAM has 4 analogue channels, and 2 counters or frequency channels. The number of channels is doubled in the case of a double REAM. The analogue channels accept output signals from sensors with 0-5 vdc, 0-10 vdc, or 4-20 mA. The counters accept pulse signals produced by proximity switches or magnetic pickups with amplifier.

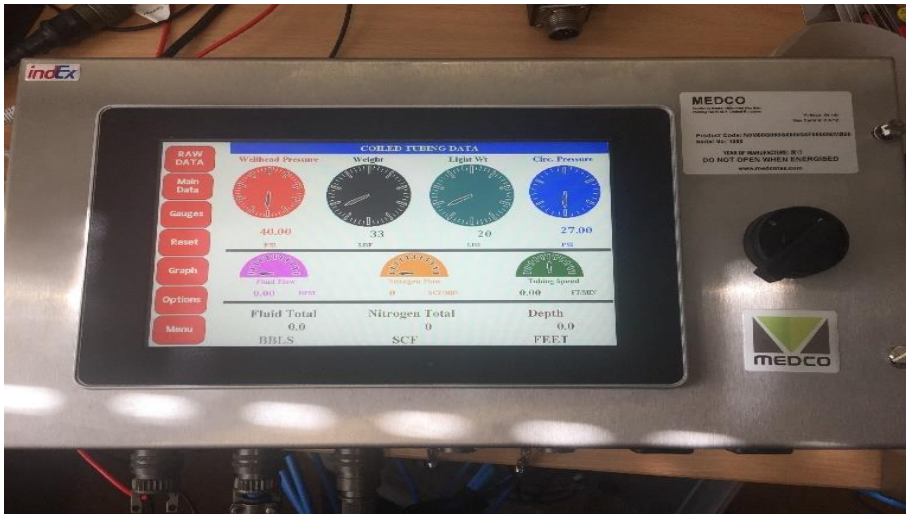
HMI can communicate with up to 4 REAM boards simultaneously in addition to many other controllers or data acquisition modules, such as alarm systems by MEDCO and MC-III Flow Analysers by Cameron, etc. The outputs are available on Web Pages, which means that they can be viewed remotely on a Local Area Network (LAN) or even a Wide Area Network (WAN), provided that proper Internet connections are available. This later 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.

System Description

The REAM HMI for pumping is available in different enclosures. These are explained below in detail,

1. Stainless Steel Enclosure with Ream in Stainless Box and HMI separate to be installed on control panel. The number of ports depend upon the user requirement. This system is also ATEX certified.

2. Stainless steel Enclosure with HMI mounted on it. The number of ports depend upon the user requirement.



3. Flight Case with HMI mounted on it. This his further 3 options G07 (7-inch HMI) G09 (9-inch HMI) and G013 (13-inch HMI). The number of ports depend upon the user requirement.

Default System Settings

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.
- Rates of counters and quadrature: K-factor = 1.

These values do NOT represent the real values that should be used for applications. The user will need to perform proper calibrations to obtain actual values of the physical values being monitored (see calibrations section below).

USING Ream HMI

Raw DATA Page

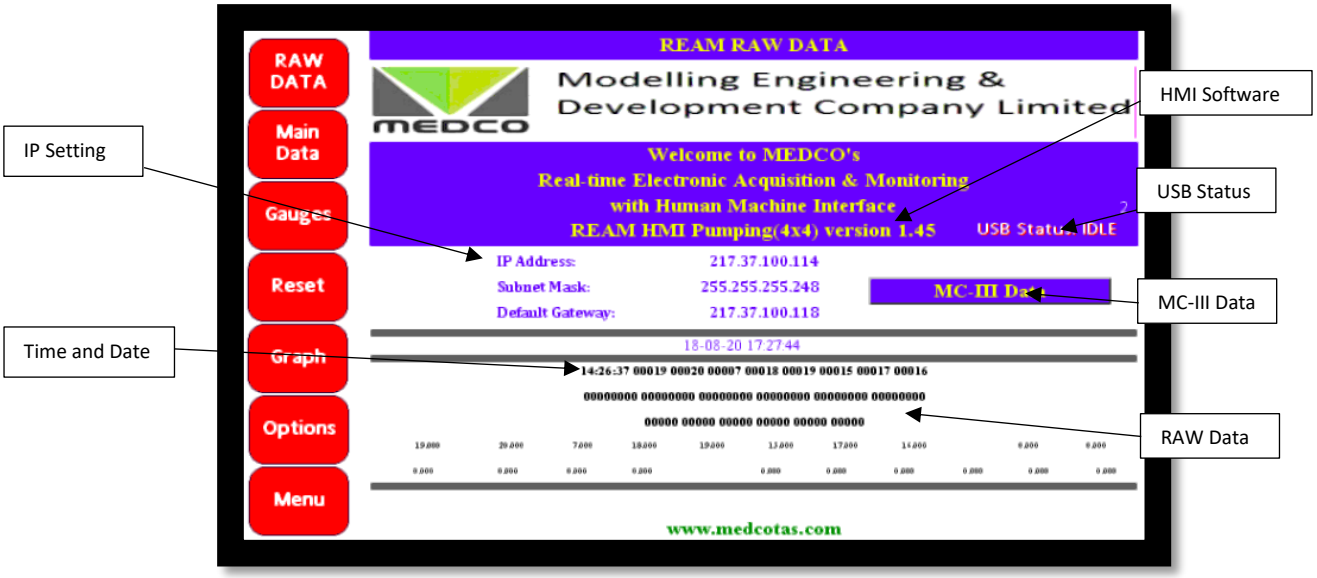
When the user starts the REAM HMI. The HMI displays the RAW Data page. This page shows the user basic information on HMI and Communication between Ream Board and HMI.

Software Version

This shows the software version that is on HMI. It can be upgraded by copying the image file obtained from MEDCO on SD card. This will be discussed in detail later.

RAW DATA

The Raw values are the values coming from Ream ports to HMI. These values are displayed even if no sensor is connected but when a sensor is connected, these will change as the input to Ream Board is different then. These values are without any calibration factor. They represent that the communication between REAM Board and HMI has been established and data can be acquired. The values for Analogue channels i.e. pressures, will always be changing whereas for digital channels i.e. Fluid Flow these valves will only change when a sensor is connected, and pulses are being generated.



IP Setting

This shows the default IP configuration of HMI. These can be changed from settings; this will be explained later in settings option.

Time and Date

Time and Date by default is set to London time. These can be changed from settings; this will be explained later in settings option.

USB Status

This shows the status of USB i.e. when the data is being copied to USB. The user does not need to press any button to initiate the data copying process. Only plug in the USB and the system will automatically copy the entire data stored on SD Card (HMI).

MC-III

This option shows the configuration for MC-III input.

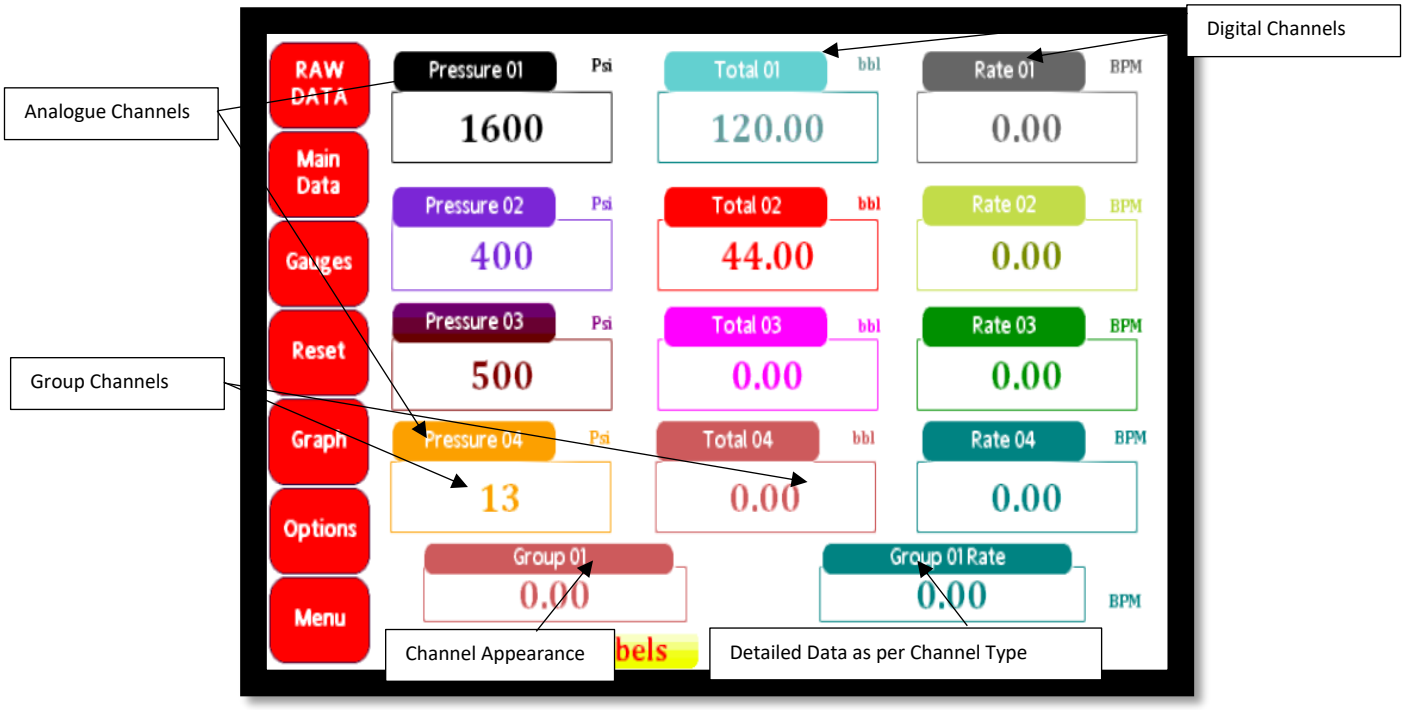
This page be accessed at any time by pressing the RAW Data Button on left side of HMI.

Main DATA

This page shows the values of all the parameters as well as the group channels. These are the exact values of parameters after calibration. The data recorded on Laptop and SD Card also records these values. The types of channels on this screen are explained below,

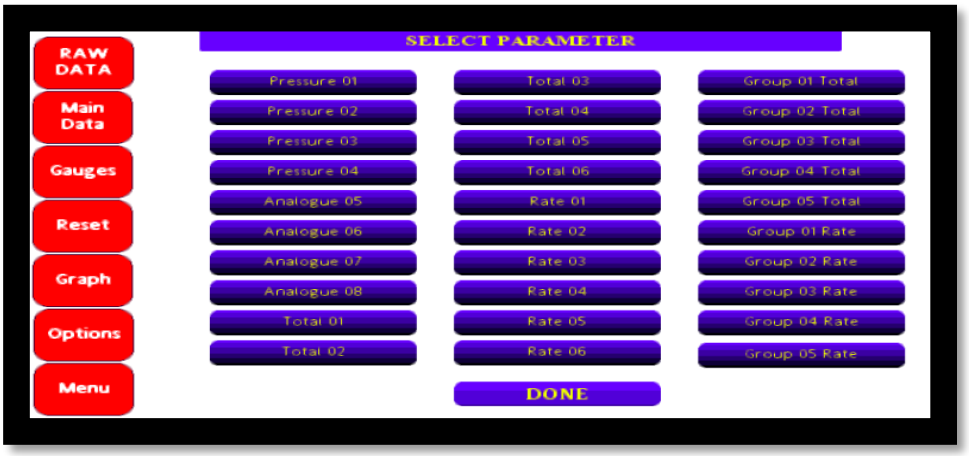
1. Analogue Channels: - These channels represent the Pressure channels. Ream Board 4 has 8 analogue channels on it, by default first 4 channels are configured, and the other 4 channels are spared. On user requirement all 8 channels can be configured and ready to use.

2. Digital Channels: - These channels represent the Fluid Total as well as Fluid Flow. Ream Board 4 has 6 digital channels and they are also configured as per the user requirement.
3. Group Channels: - These channels are not on hardware rather they are on software i.e. these can be configured by users and normally represent the Total Rate as well as Total Volume incase if multiple digital channels are being used.



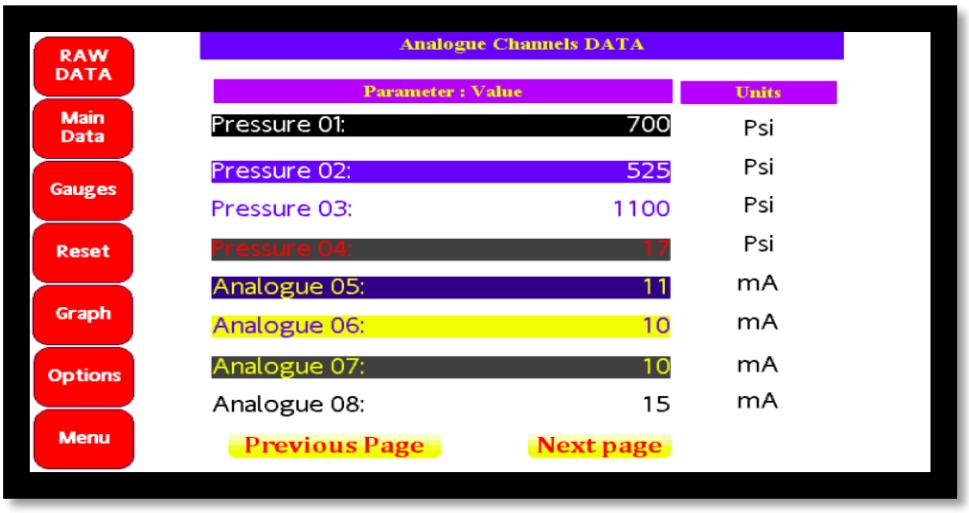
Labels

This option allows the user to setup the parameters to be displayed as well as advance setup for parameters data that is to be communicated to DART software. To access this the user must click labels and the new screen will appear.

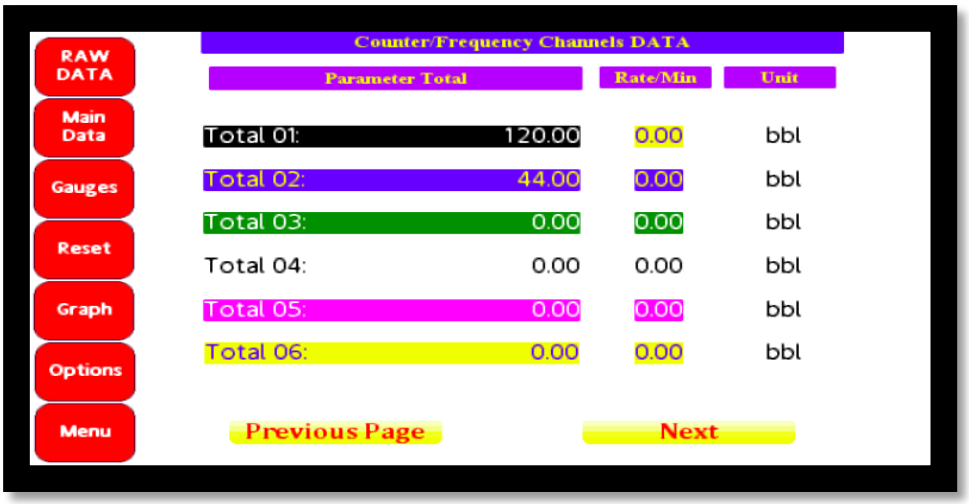


User Page

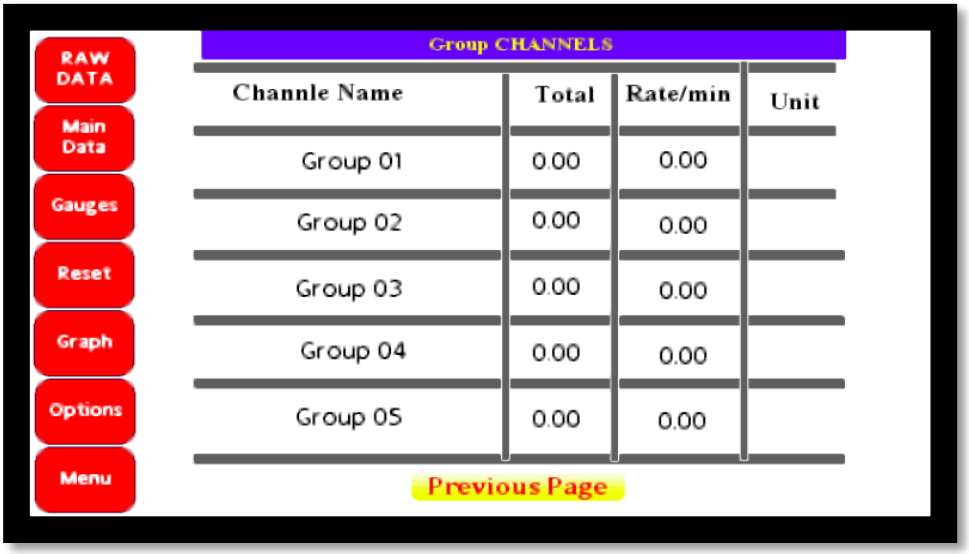
This option enables the user to view the data separately as per the channel type i.e. analogue, digital and group channels.



If the User Click the Previous Page, the software displays Main Data. If Next Page is clicked the Software goes to the next page i.e. Digital Channels.



If the user clicks Previous page, the software goes to the previous page i.e. Analogue Channels and if the user clicks Next Page, the software goes to the last page of this option i.e. group channels.

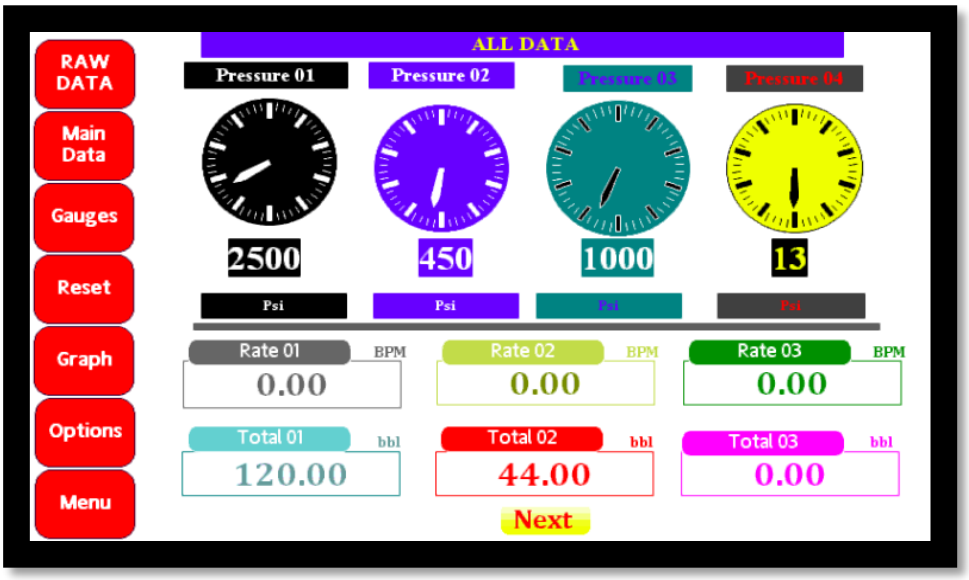


The user now has option to go back to main data by either clicking previous page and keep going back till the user reaches main data page or just by clicking on Main Data button (2nd button) on left side.

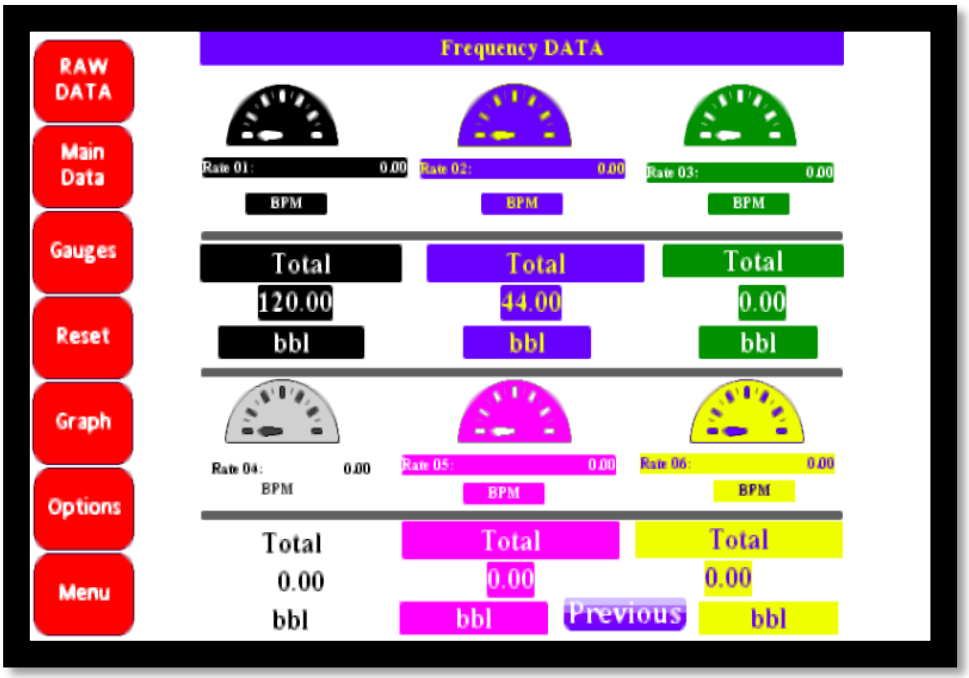
Gauges

This option allows the user to view the Data in gauges form. This page also has 2 further options i.e. All Data (This will display the 10 main parameters displayed on Main Data 1st page) and Frequency data (This is the second page in gauge display, and it shows all 6 digital channels).

When the user clicks on Gauges. The display will be as shown below in the picture,



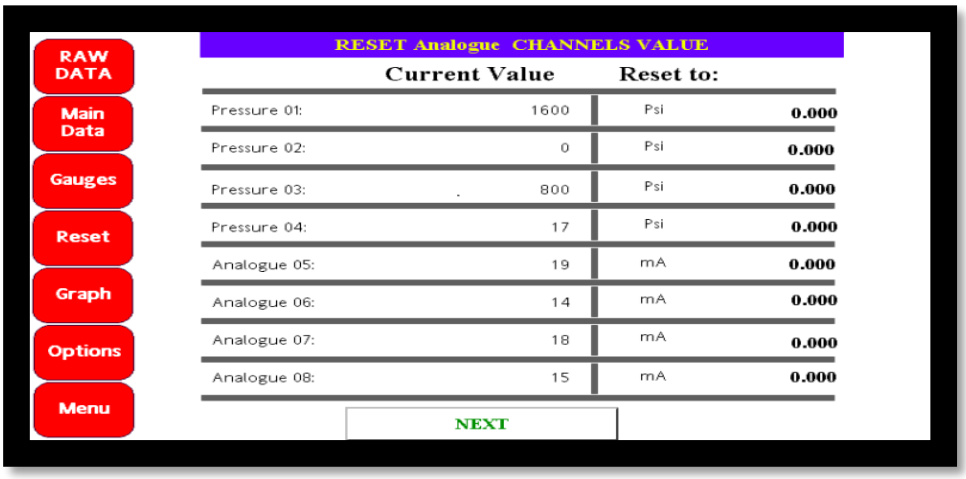
When the user clicks Next, the Frequency (Digital) Data is displayed. As shown in the picture below,



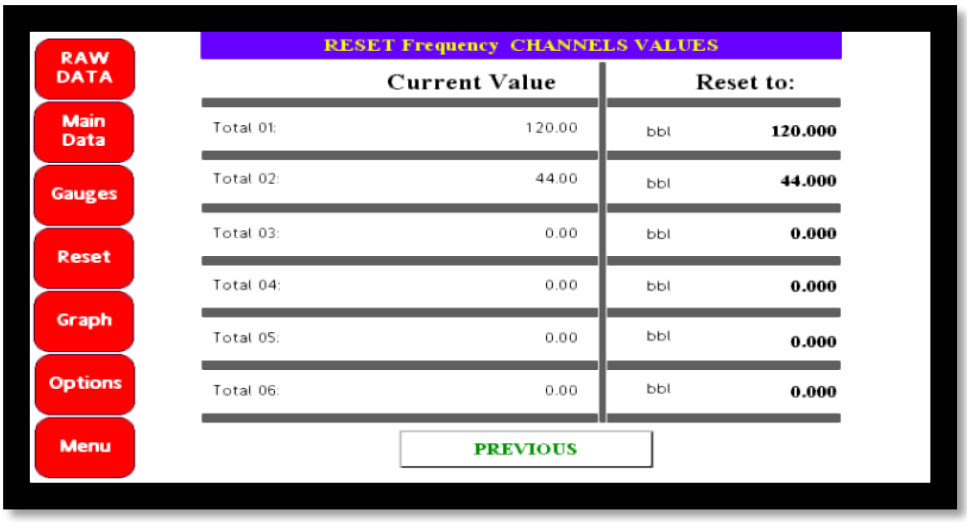
Reset

This option allows the user to reset the value of any parameter i.e. If the user pumped 50 bbl and now he wants to start again from 0, the reset option can be selected and the desired value can be inserted on right side by simply clicking in the box and then entering the value by the keypad which appears. Once a new value is entered it will be displayed on the left side under Current Value Tab.

This menu also has 2 pages i.e. Analogue Channels and Digital Channels. The first page is shown in the picture below which includes all the 8 Analogue Channels,

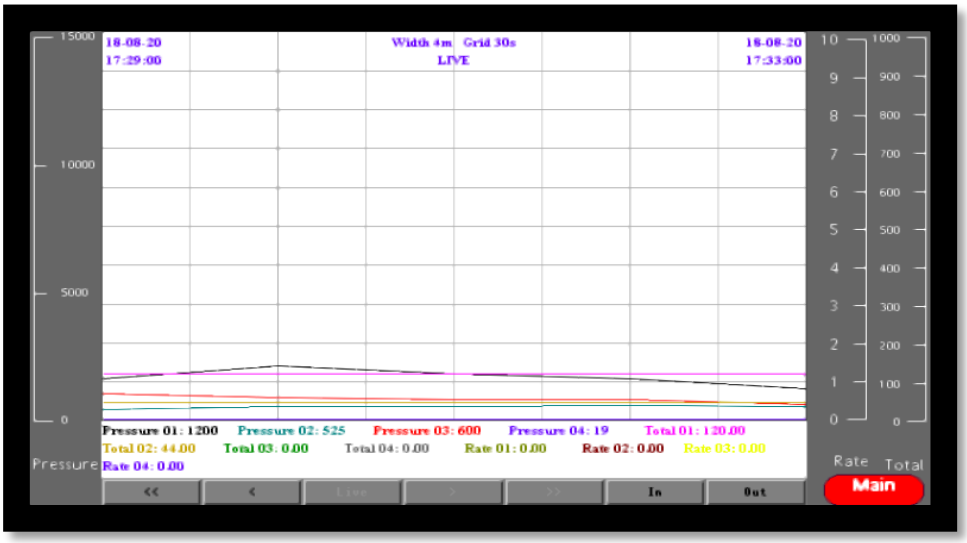


If the user needs to adjust the digital channels (Frequency Channels), Click on next and then enter the value of desired value as required. Once a new value is entered it will be displayed on the left side under Current Value Tab.



Graph

This page displays the data in graphical form. The parameters are the main 10 parameters and the minimum maximum values are as per the values of parameters. The picture below shows this screen,



Options

This page gives the user multiple options as the name illustrates. These will be explained in detail below,

Logs

This option allows the user to select the time interval for the data that is to be recorded on SD Card which can later be converted to mdb file for printing the graph. It is recommended to keep **One Day Log @ 1 Second ON** as this value save the data per second. Also note that only one option can be activated at anytime.

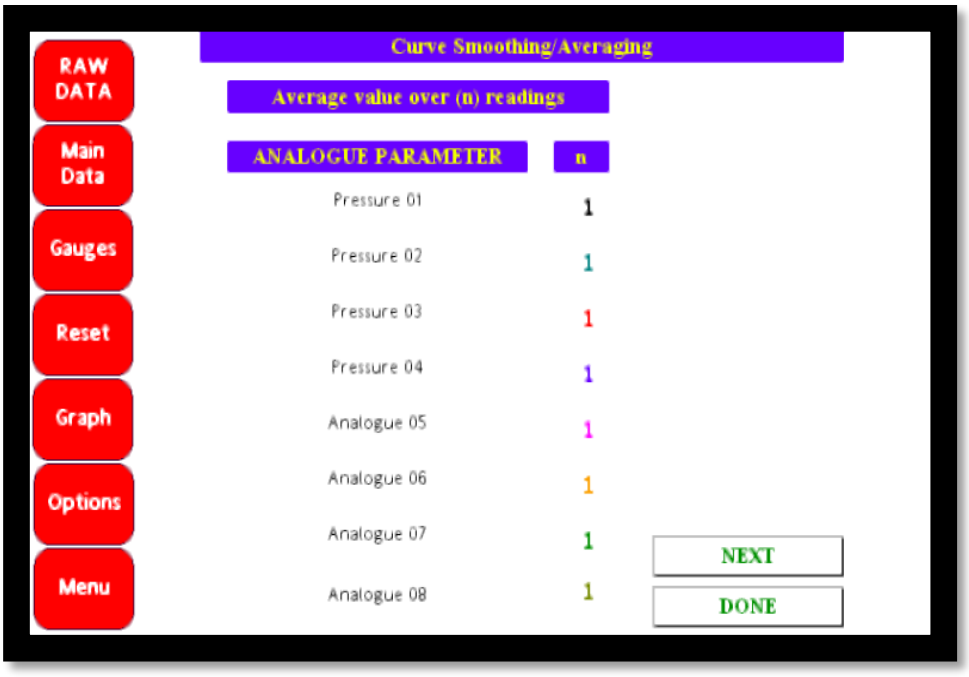
Custom Report

This option allows the user to enter the Data for report generation. The user can click on any option i.e. Client and this will launch a keypad to enter the value and then press enter to feed this data. Keep repeating the process until the data has been entered. Whichever option is clicked the keypad launched will enter the values against it. Once everything is done, Click Create & LOG FILE. This will save the values on SD Card.

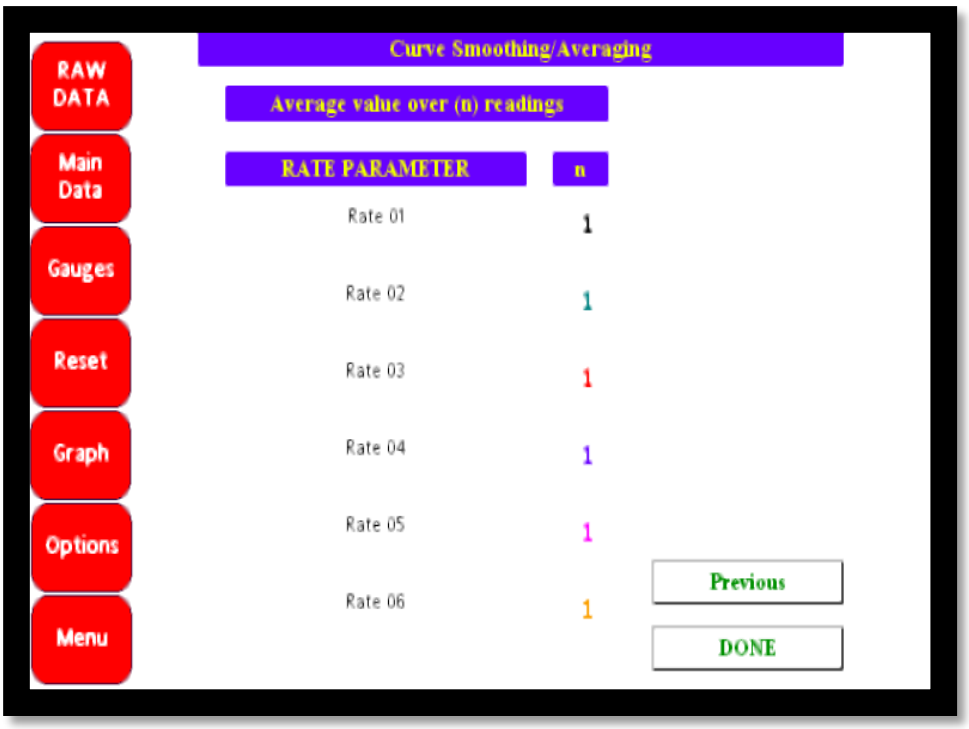
Curve Smoothing/Averaging

This option allows the user to enable the data averaging for any desired channel to remove noise or fluctuation in data. The menu has 2 options i.e. 1st page allows the user to enter the values for Analogue parameters and the 2nd page allows the user to enter the values for Digital Channels (Frequency Channels). The picture below shows the display for analogue channels.

The user needs to click the value against desired channel by default this value is 1. To change this just click on 1 against the channel and this will launch a keypad, Enter the new value for averaging and click Done.

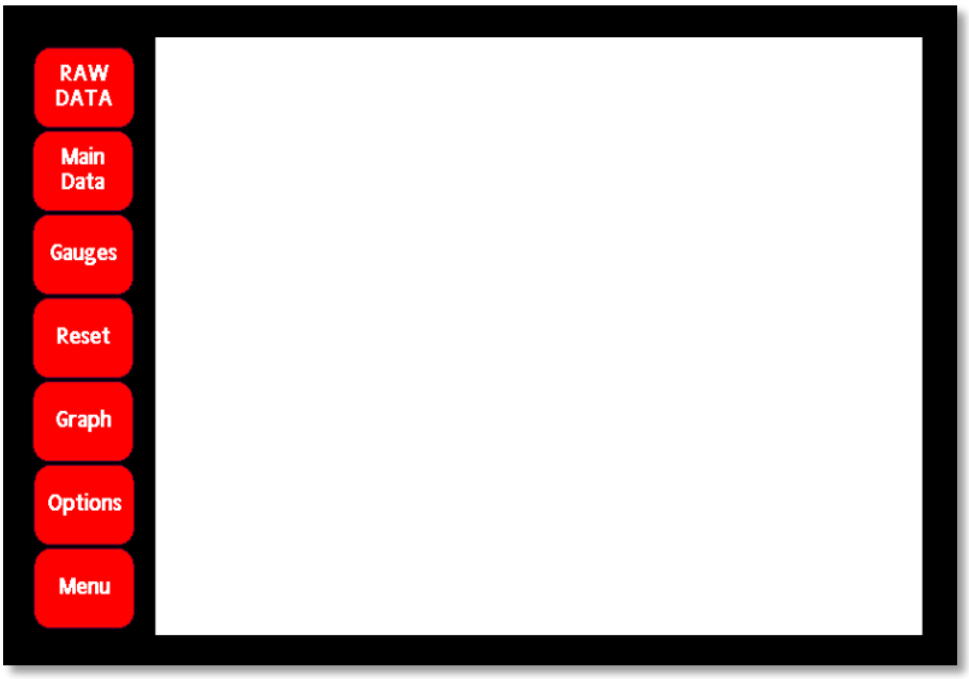


In case the user needs to enable averaging in Rate Parameters. Click Next and the new page will display the rate parameters. To change these values again click on values under **n** and edit the value. Once everything is completed click Done. The values will be saved, and the Data on Main Display will be updated as per the values entered on Averaging Data.



Test Screen

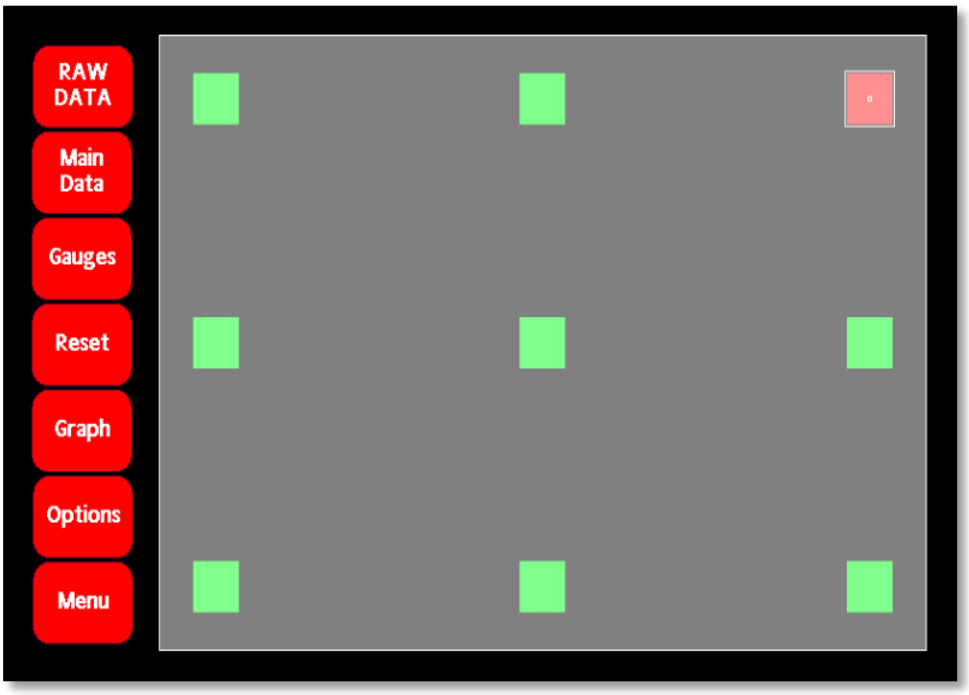
This option allows the user to troubleshoot if touch screen is still functional. When the user clicks on this option, a blank white screen will be displayed, and the user can touch any where on the screen and red dots will appear. If it does not appear that means the touch screen is damaged on a specific spot.



To go back from this screen the user must click any of the buttons on left side of the screen.

Calibrate Screen

This option allows the user to calibrate the screen. The picture is shown below,



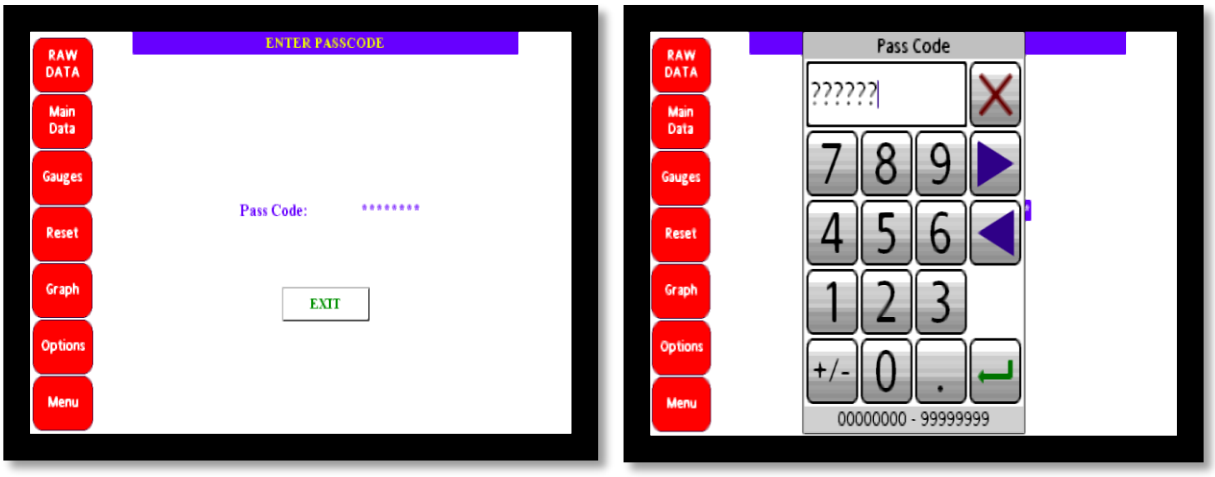
To exit this screen calibration, the user needs to click any button on left side.

Configuration of REAM HMI

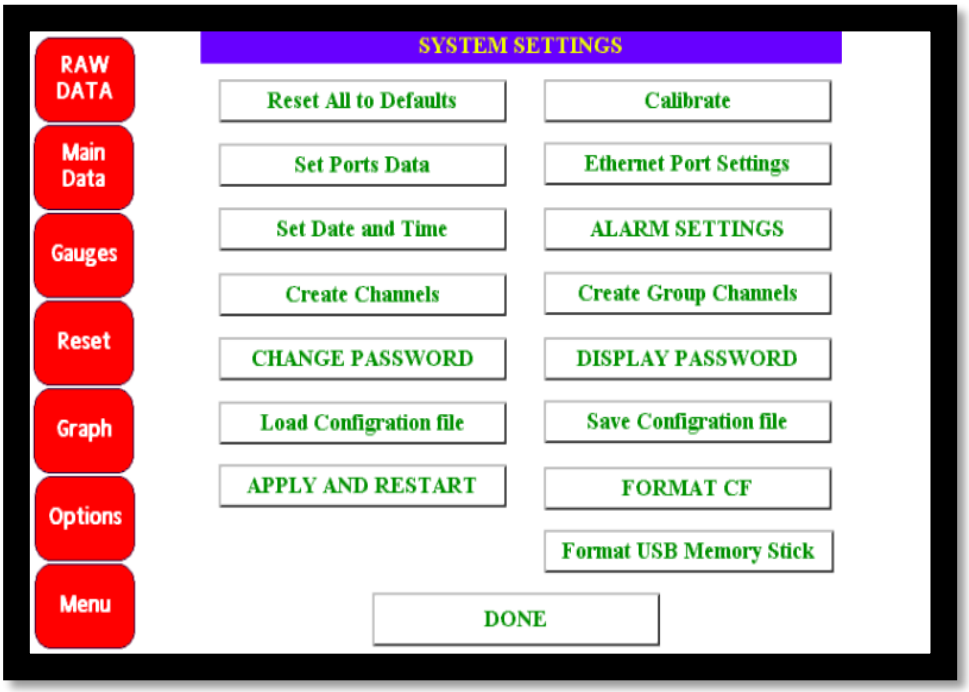
Menu

This option allows to configure all the options regarding REAM HMI. When the user presses Menu button, the software prompts the user to enter the password as this configuration is password protected. To enter the password the user needs to click on

password and a keypad appears to enter the password. Note the password for this Menu is **290992**. The below picture shows these both options,



After entering the password, the user presses Enter. This will launch the configuration menu. All the options are explained in detail below,

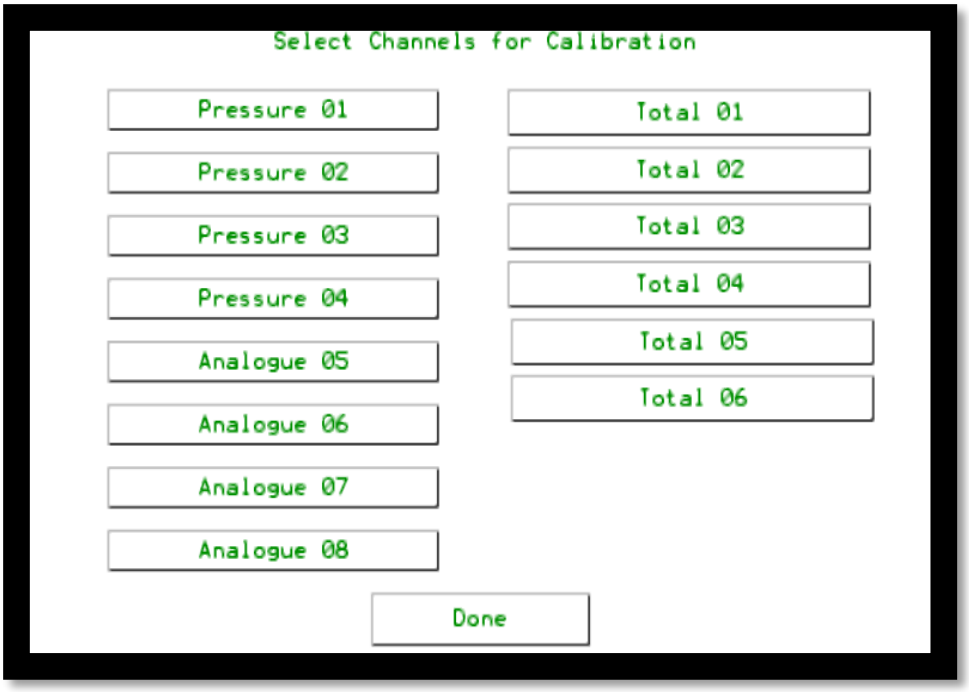


Reset All to Defaults

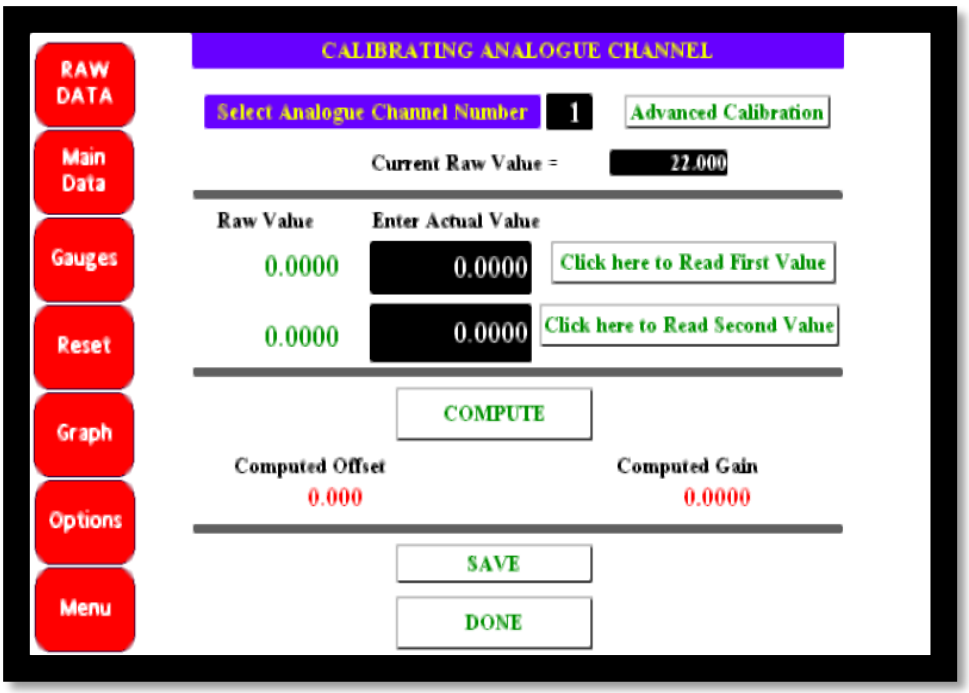
This option should not be used as this will delete all the configuration that is done by the user and restores all the settings that are in the system by default.

Calibrate

This option allows the user to calibrate any desired parameter. The parameters in REAM HMI are of 2 types i.e. Analogue Channels (4-20mA,0-5V or 0-10V signal) and Digital Channel (Pulses from Magnetic Pickup or Proximity Switch).



Analogue Channel Calibration: The analogue channels are calibrated by calculating 2 values against 2 signals to find the offset and gain of the parameter. To start the calibration process, Press the Analogue channel that is to be calibrated. This will launch a new menu shown in the picture below and explained as well,

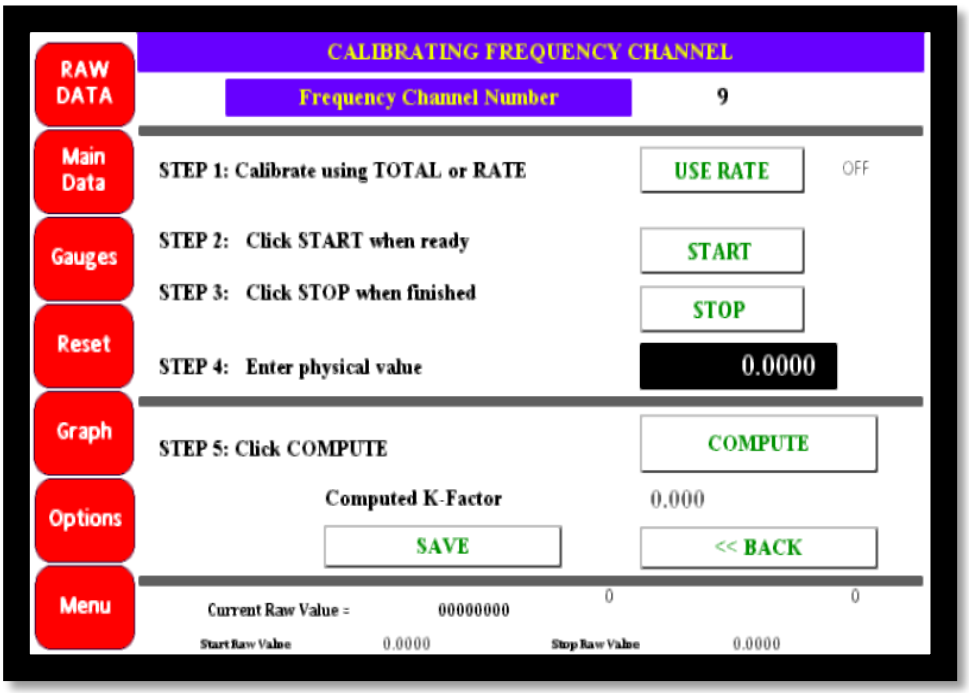


1. Select Analogue Channel Number: This shows the parameter number selected it is as per the channel mapping of the specific parameter.
2. Current Raw Value: This value is the Raw Data coming from the sensor to Ream HMI. This is used to calibrate the parameter.
3. Actual Value: This value is the physical value against Raw value i.e. Pressure.
4. Calibration Process:
    a. Connect the sensor and see the raw value.

b. Under enter the Actual Value, enter 0 as first value while the pressure is 0.
c. After entering the value Press Click here to Read First Value.
d. Increase the Pressure to say 5000 psi.
e. Enter the pressure achieved in box with second value.
f. After entering the value Press Click here to Read Second Value.
g. See the Raw values displayed as they should be different.
h. Click Compute. The software will compute the values and display an offset and gain.
i. Click on Save this will save the calibration factors i.e. offset and gain in software.
j. Press Done and the user will be back on main options screen.
k. These values can be later seen in Ports Data.

5. Save the configuration on main options screen as explained later. This will save the values in HMI and even after restart or incase if the data is lost, settings can be restored if they were saved.

Frequency Channel Calibration: This option allows the user to calibrate the digital channels i.e. rate or total. To use this option, select the desired frequency channel from the calibration menu. The user has option to either calibrate rate or total. Calibrating one will result in both channels being calibrated as the software calculates total and then divides this value by 60 to obtain the rate. The below picture shows the calibration screen for digital channel calibration and the calibration steps are explained in detail below,

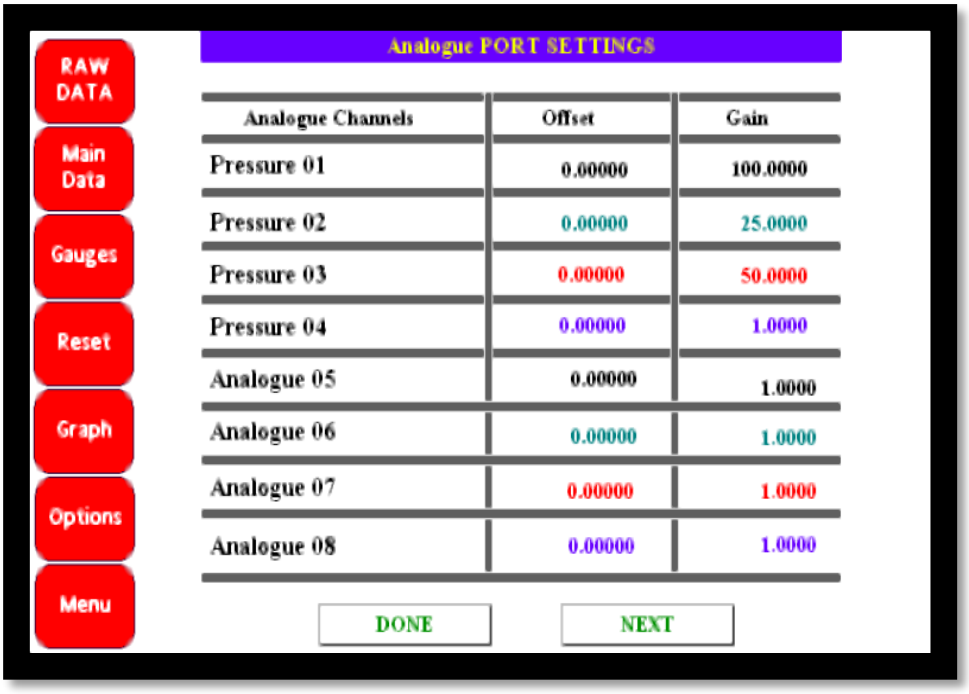


1. Select the Channel: On the main calibration screen select the channel that is to be calibrated.
2. A new screen as picture above will appear.
3. The channel Number will be displayed on top, this number depends upon the channel mapping.
4. Select if the calibration is to be done using rate or total.
    a. If total is to be used keep the rate Off as default and if the rate is to be used simply click on use rate and the value in front of it will change from **OFF** to **ON**.
    b. Now Press START and start fluid pumping. When the volume used for calibration has been pumped i.e. 5 bbl stop the pump. When the shaft stops click on STOP, Enter the physical value of fluid and press Compute button.
    c. This will compute the K-Factor (The number of pulses generated by a sensor for every 1 bbl pumped).
    d. Press Save, this will save the values in HMI. Press back to go to previous menu.
    e. These values can be later seen in Ports Data.
5. Save the configuration on main options screen as explained later. This will save the values in HMI and even after restart or incase if the data is lost, settings can be restored if they were saved.

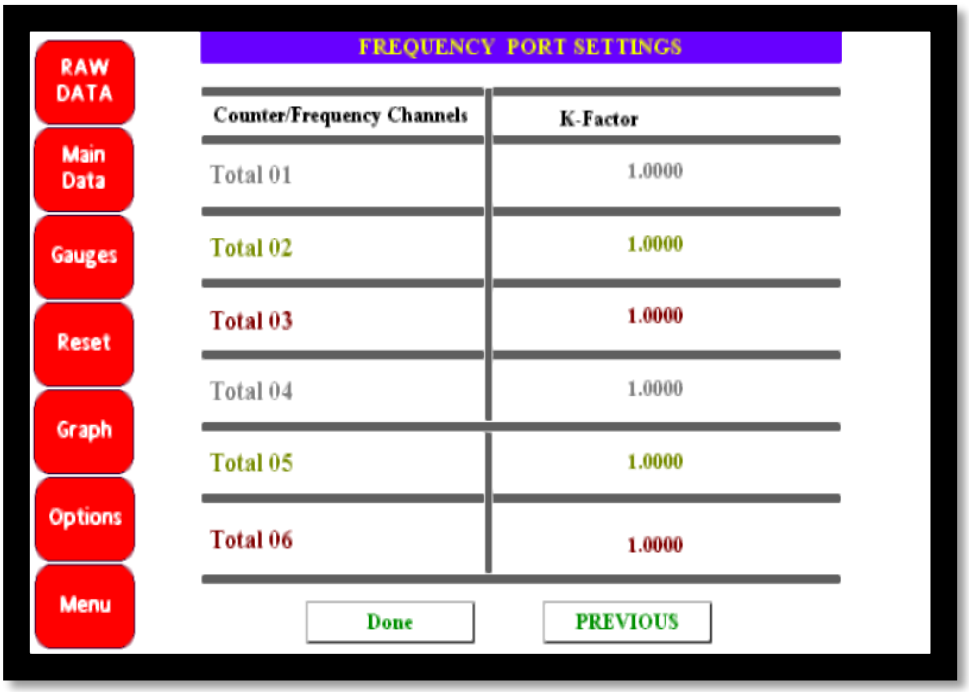
Ports DATA

This option allows the user to see as well as enter the calibration factors for all channels. All the calibration factors after calibration are saved on this screen. It is recommended to save these values either by noting in tele book or by taking a screen shot as if the data is lost, the user can enter the values manually and the software will recognize these factors. This option has 2 screens in it.

Analogue Port Settings: The first page of Ports Data is dedicated to all the Analogue Channels i.e. Pressure and their calibration factor i.e. Offset and Gain are displayed.



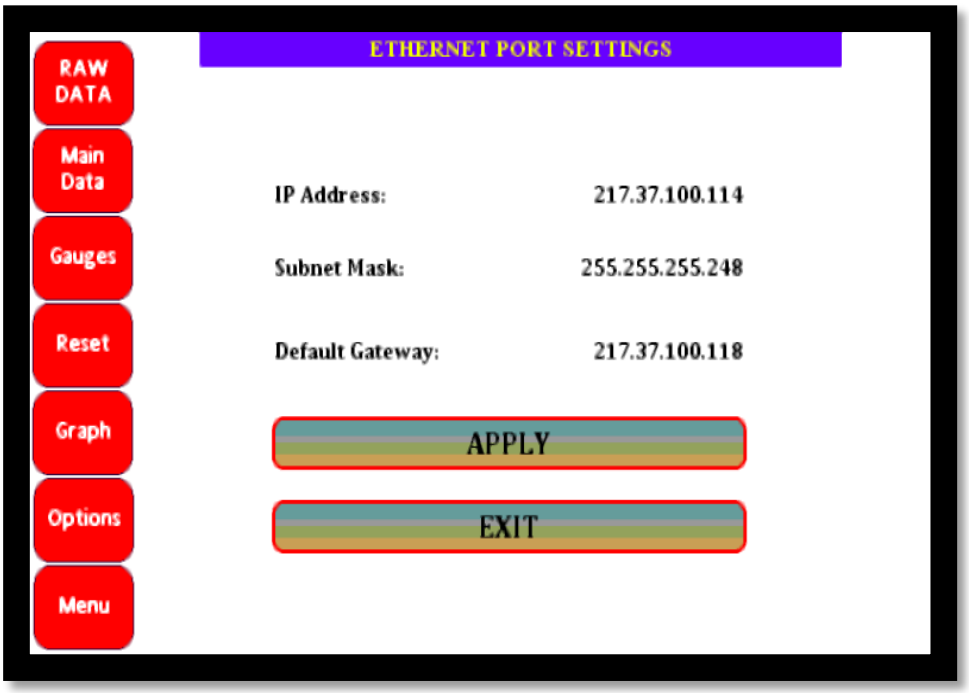
Frequency Port Settings: This is the second page in ports data. It can be accessed by clicking Next on analogue port settings. All the K-Factors for frequency channels can be seen or edited here.

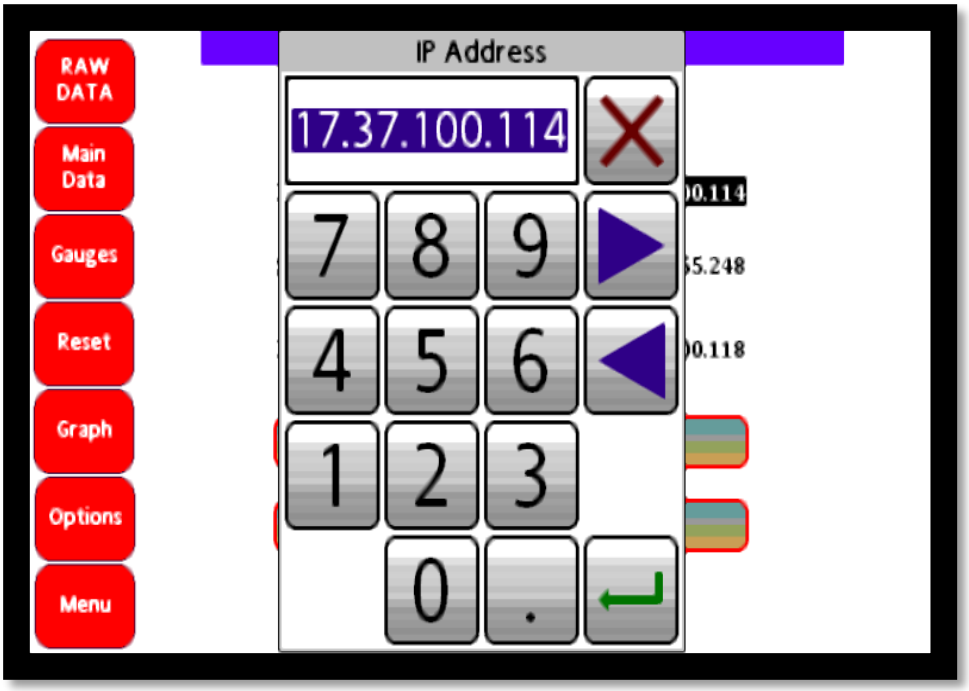


Save the configuration on main options screen as explained later. This will save the values in HMI and even after restart or incase if the data is lost, settings can be restored if they were saved.

Ethernet Port Settings

This option allows the user to change the default IP of HMI for data transmission to any external device using LAN protocol. The HMI can communicate with a laptop directly by connecting to Ethernet port or by connecting HMI to a Wi-Fi router and the obtaining the data through Wi-Fi on laptop. In case if another device is using the same IP, the IP address can be changed as per the user requirements. To change the IP just press the IP and when the keypad appears, Enter the new IP, and Press Enter. If subnet mask and default Gateway is to be changed use the same process to change them. When everything is done, Just Press Apply. The HMI will store the values and restart for these values to take effect. On the 1st Page or Raw Data screen this new IP address will be displayed.

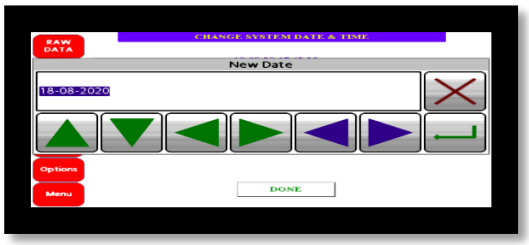




Save the configuration on main options screen as explained later. This will save the values in HMI and even after restart or incase if the data is lost, settings can be restored if they were saved.

Date and Time

By default, the date and time displayed on HMI are as per UK time zone which is GMT +1. The user has the option to change the date and time zone to the desired time zone. To edit this simply click on date displayed and when the keypad appears to enter the new Date, enter the new Date in same format i.e. DD-MM-YEAR. After entering the date click on time displayed and enter the time in same format i.e. 24hrs-min-sec. After Date and time have been updated, press done. The data on SD card on HMI and copied to USB through the USB port will have this date and time on it. The below pictures show these settings,



Save the configuration on main options screen as explained later. This will save the values in HMI and even after restart or incase if the data is lost, settings can be restored if they were saved.

Alarm Settings

The Ream HMI V.4.86 has a built-in alarm system. Which consists of a relay on Ream Board as well as a buzzer (Audio and Visual Output) as well as an override switch for bypassing the Alarm system for specified time interval.

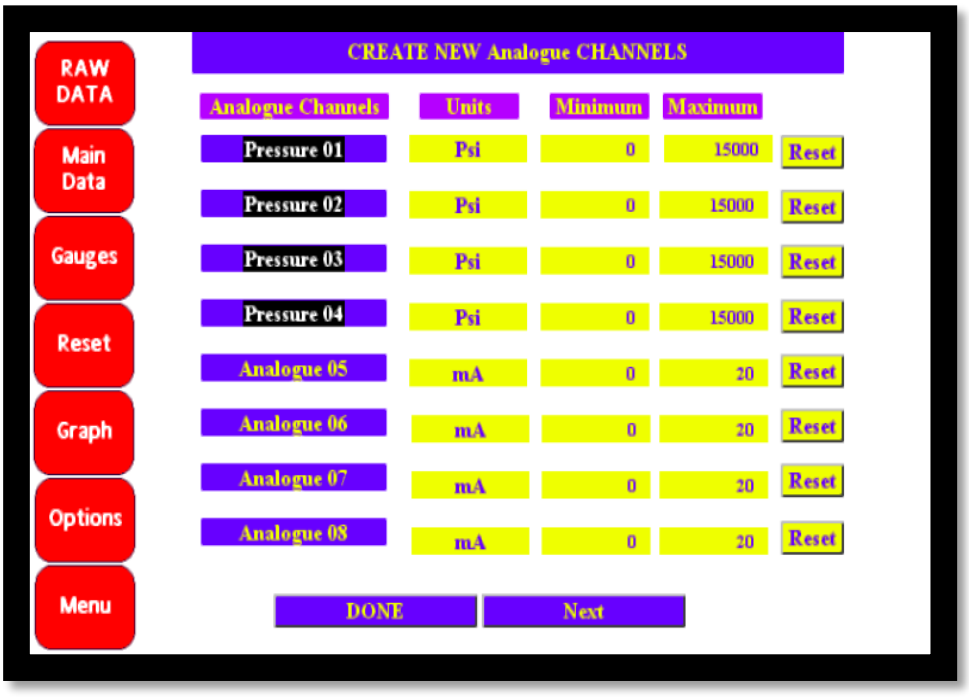
To setup the alarm setting the user needs to follow the following step,

1. The Alarm system can be tested by pressing TEST Alarm.
2. This will trigger the buzzer which will display red light as well as a beep sound. Just as it would incase if any parameter were above or below its range.
3. To stop this Alarm the user can Press the Override switch (Hardware button) or Click on Deactivate Alarm.
4. Click on the channel for which the Alarm is supposed to be activated.
5. Now a new screen will appear as shown in the picture below.
6. Enter the upper value i.e. maximum value, by clicking on the value displayed and then entering the new value by the keypad that appears.
7. Once the value has been entered. Press Update and this value will be stored in the software.
8. Now repeat step 3 and step 4 for lower value i.e. minimum value.
9. Once the values have been entered and updated. The alarm for the parameter is activated and it can be seen on the Alarm Screen that status turns from OFF to ON.
10. To disable the alarm. Click on the desired parameter and when the new screen appears, Click on Turn Off and this will change the status of Alarm from ON to OFF, for the parameter that was selected.
11. Reset All Alarms will change all the values entered to default values.
12. The override interval can also be changed by clicking on the numeric value displayed against it. This will launch the keypad to enter the value for override interval.
13. When all the settings are done, Press Done. This will save the settings on HMI.
14. The override interval is the number of seconds for which the Alarm will be disabled, If the hardware button is pressed incase of Alarm trigger. After the override interval as passed if the operator must fix the problem, the Alarm will again be triggered.
15. Save the configuration on main options screen as explained later. This will save the values in HMI and even after restart or incase if the data is lost, settings can be restored if they were saved.

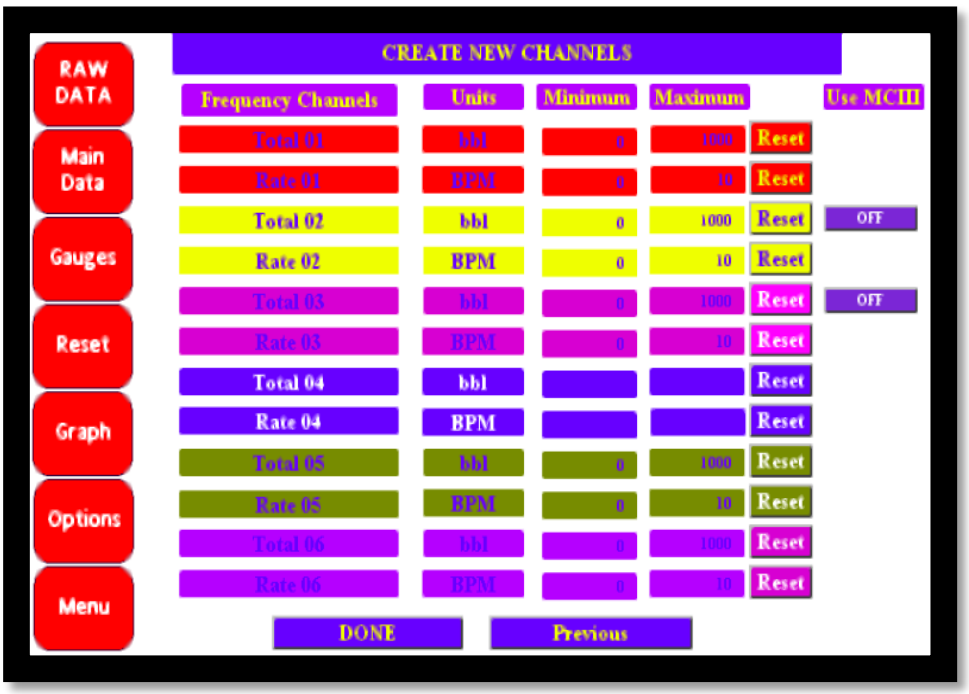
Create Channels

This Option is used to configure the spare (expandable) channels on REAM HMI. Ream Board V.4.86 has 8 analogue channels as well as 6 digital (frequency channels). 4 analogue channels and 3 digital channels are being used by default; they can be increased on user requirement. To create a new channel page has 2 further views i.e. Analogue and Digital channels. The below pictures show these both views. The steps to create a new channel are explained in detail below,

1. To rename the Parameter, Press the name of Parameter and when the keypad appears enter the new name of parameter and click Enter when done.
2. Now press the units displayed in front of it and again enter the units by keypad and click Enter.
3. To enter the minimum value of parameter, click on numeric value under Minimum Tab and enter the value using keypad.
4. To enter the maximum value of parameter, click on numeric value under Maximum Tab and enter the value using keypad.
5. The new Channel has been created click Done.
6. Save the configuration on main options screen as explained later. This will save the values in HMI and even after restart or incase if the data is lost, settings can be restored if they were saved.

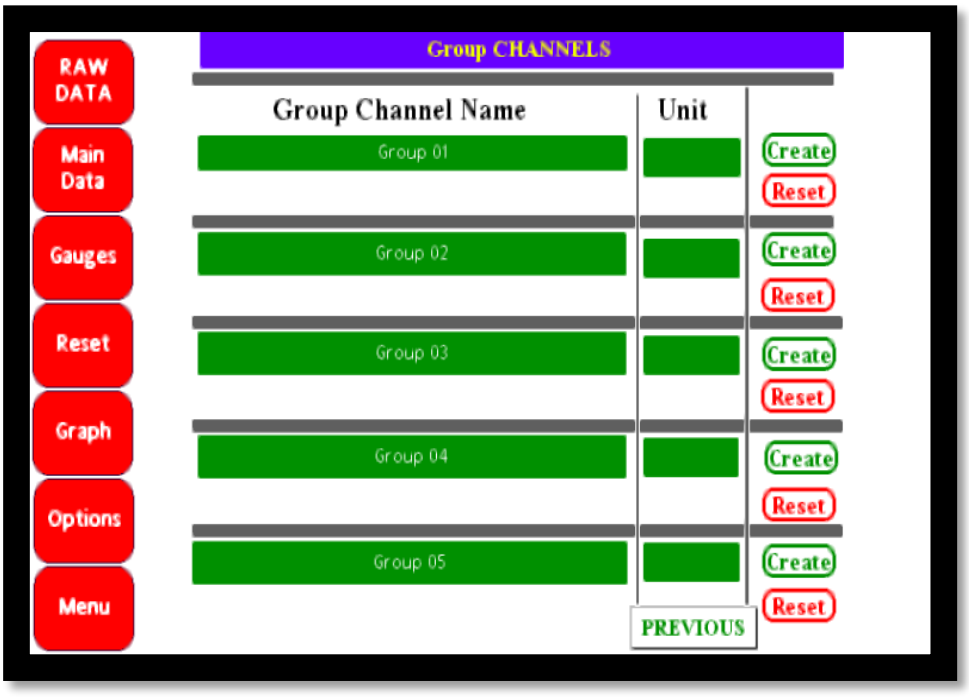


For Digital Channels, Press the Next button this will launch the Digital Channel creation page. The process is same as analogue channel creation except another channel is linked to it i.e. Total has Rate with it. These channels can be created using the same process explained above for analogue channels. The picture below shows the display for creation of digital channels,



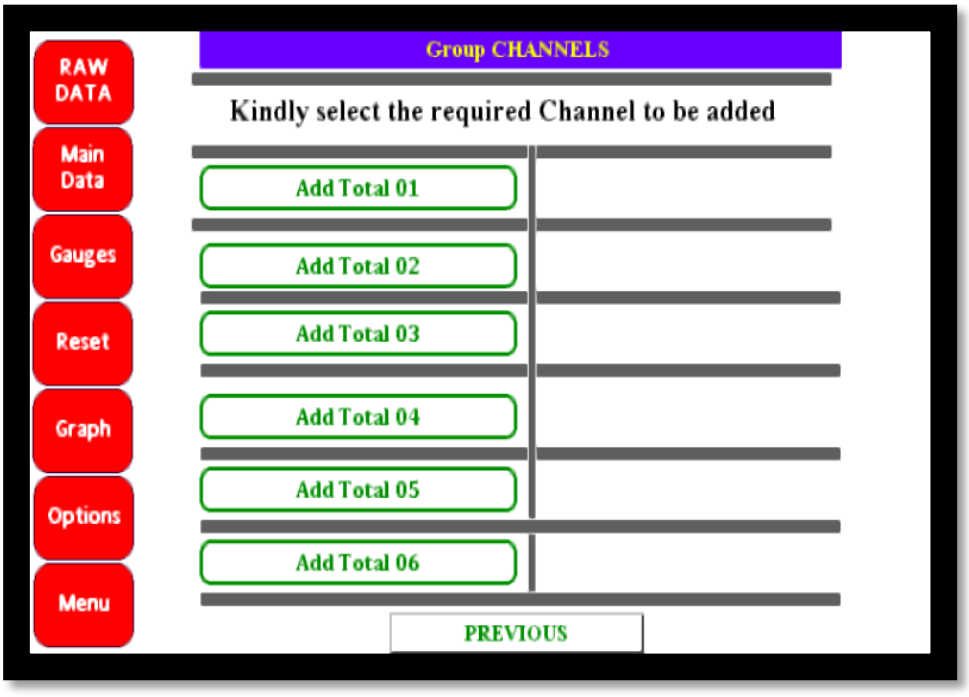
Create Group Channels

This option is used to merge different channel values and display them together i.e. All the digital channels have a separate total displayed, incase the user needs to see the Total Volume of all channels, this option will be used to create a group channel and merge the values of all in it. Up to 5 group channels can be created. The group channel function can only be used for digital channels as analogue channels cannot be merged. The main display of this option is shown in picture below,



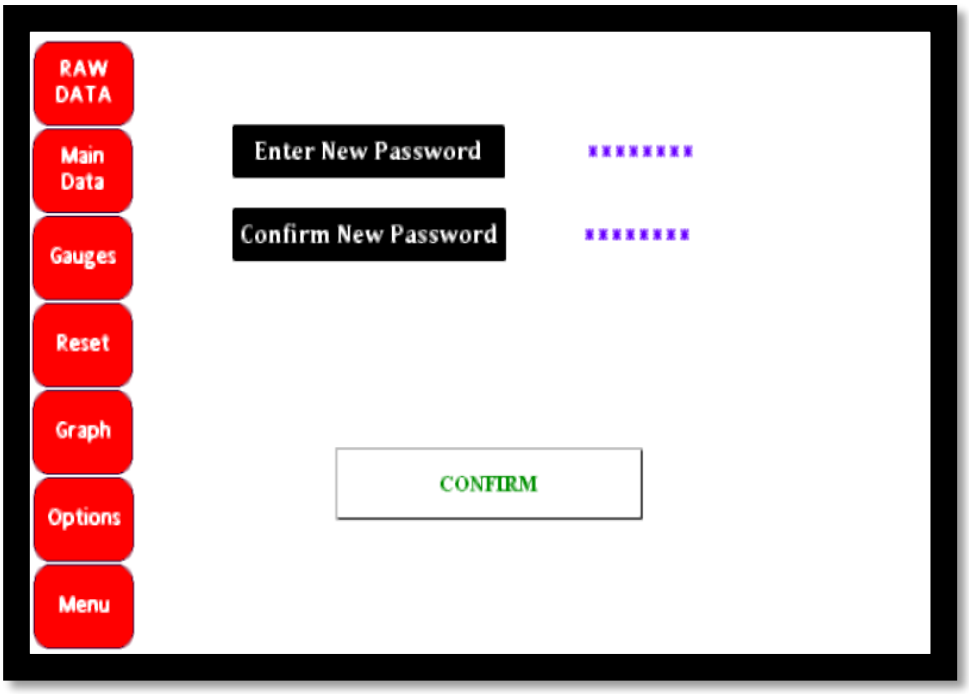
To create a new group channel, follow the steps below,

1. Click on group Channel i.e. Group 01, Group 02 etc.
2. A new screen will be displayed as shown in picture below.
3. Press channels on left side of screen that are to be added in desired group channel.
4. When all the channels have been selected, press previous this will add all the selected channels to group channel that was selected.
5. Now press create and all these channels will be linked in software and display the combined values.
6. Save the configuration on main options screen as explained later. This will save the values in HMI and even after restart or incase if the data is lost, settings can be restored if they were saved.
7. This channel can be selected for display using the labels option on Main Data Page.



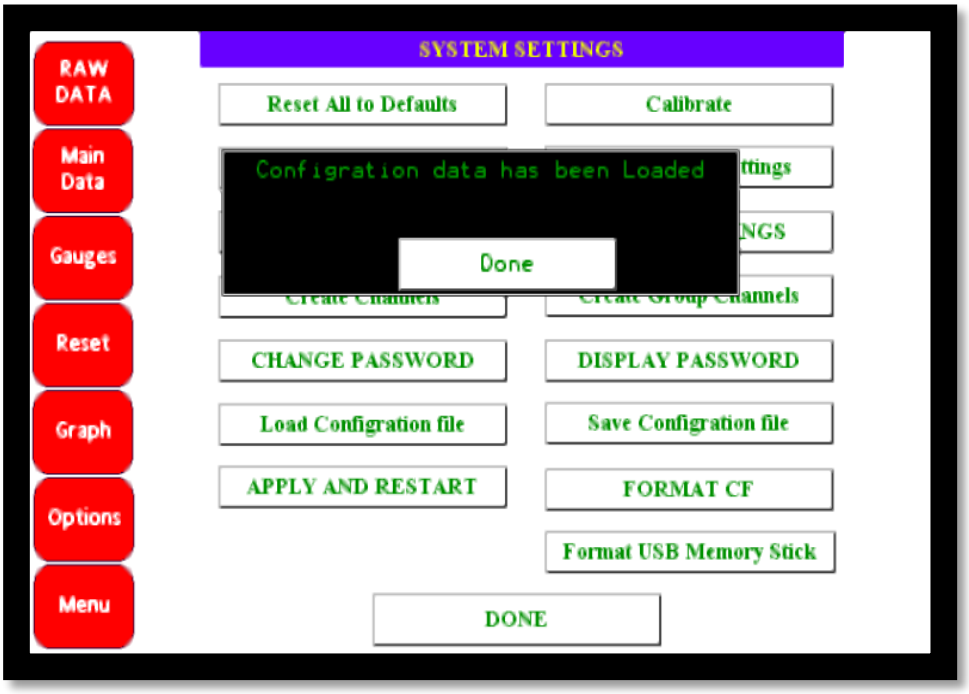
Change Password

This option is used to change the HMI password for editing the configuration. By default, this password is **290992**.



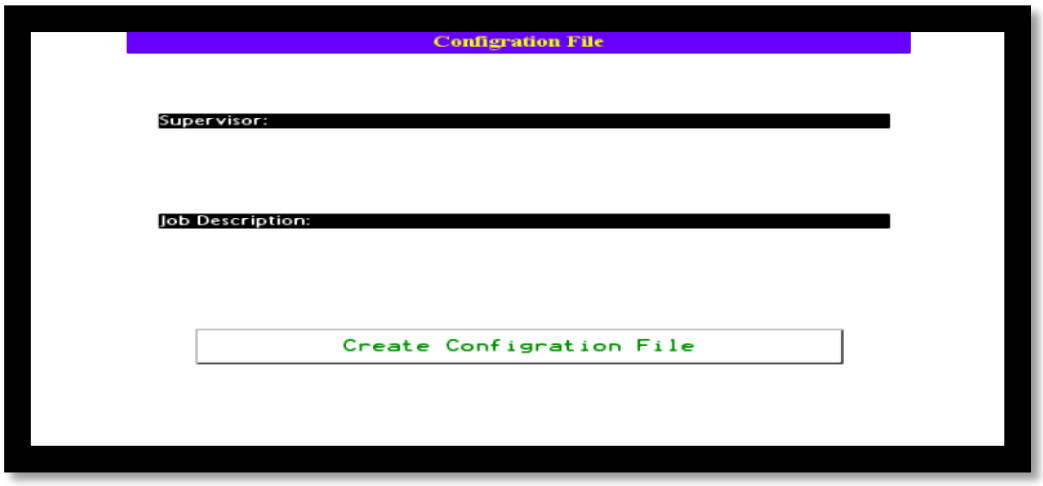
Load Configuration

This option is used to load a pre saved configuration incase of data loss. To use this option the user just clicks Load configuration File and the file is loaded. After the configuration has been loaded the software will prompt the user to click Done.

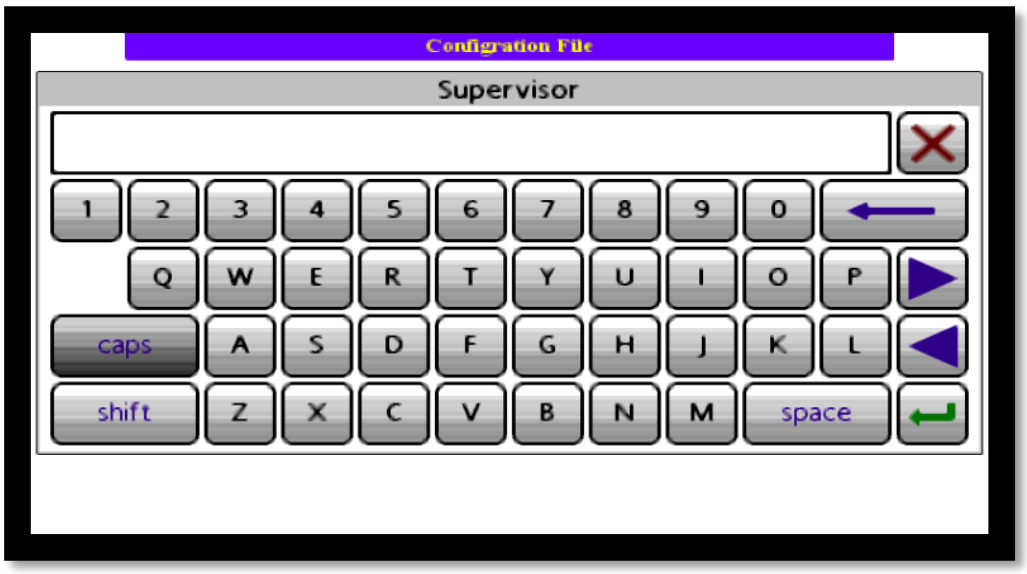


Save Configuration

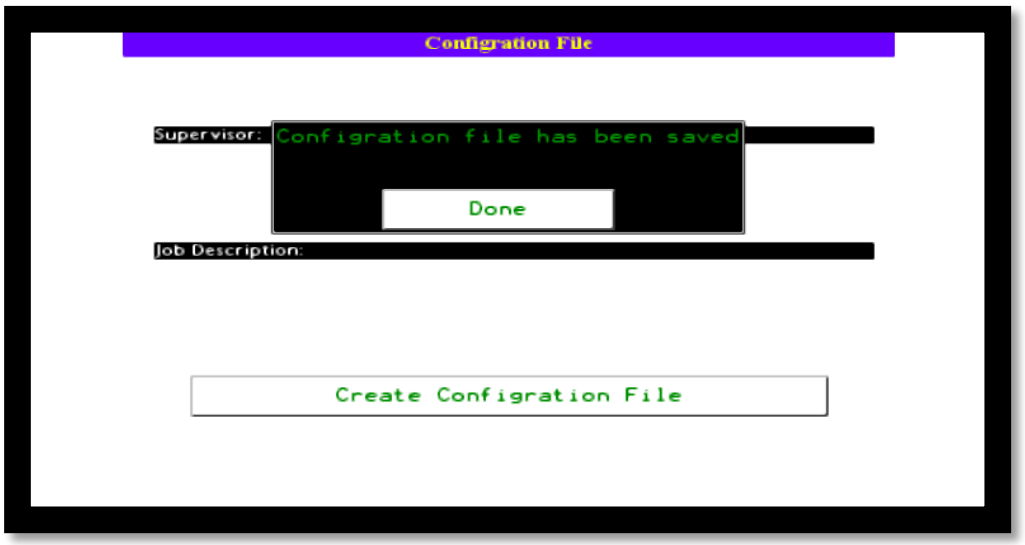
It is recommended to save the configuration file after doing anything in The Options menu as this will save the data on SD card in configuration file and can be loaded at any time. Note the HMI saves only 1 configuration file. So, any changes done cannot be undone. To use this option just click on create configuration and a new display will appear as shown in picture below,



The user can name the file via supervisor name or just click on create configuration file without any name and the software will store this configuration. To enter the supervisor name, click on supervisor and a new screen will appear as shown below. Now enter the name of supervisor using the keypad and click Enter. Now click create configuration file.



The software will prompt the user to click Done. When Done is Clicked the save is complete.



Updating the HMI Software Version

The software version displayed on the RAW Data page of HMI can be updated. Below mentioned are steps for software update,

1. Contact MEDCO to inquire about any new software available for HMI. The client will need to provide the following information,
    a. Company Name.
    b. Ream HMI serial Number (Can be found written inside Ream Box).
    c. If HMI is G09 or G07.
2. Once the software is received from MEDCO. It will be a .rar file extract it. Save the image.ci3 file.
3. Now switch of Ream Hmi and remove the SD card. Insure that write lock is disabled, as if this is enabled no data can be written on SD card. This can be checked from the slide option on side of HMI. It should be on unlock position.
4. Copy all the data that is on SD Card to computer.
5. Now copy image.ci3 file to the root directory of HMI i.e. do not put it inside any folder just open the SD card and copy the file.
6. Plug in the SD card in HMI.
7. Now start the HMI. The user will see HMI displaying different message for software upgradation.
8. When the HMI starts the new software version will be shown and all the new functions will be added.
9. Now again switch off the Ream HMI and copy all the data that was copied from SD Card to computer, back to SD Card.
10. Start the Ream Hmi, go to Options and load configuration. All the data will be restored on the new software version.