Newflow

NÅNO

Master Meter
Prover Application

Configuration & User
Manual

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No Alarms Present	i

Start Prove

Master Meter Volume Flow Rate	
	18001.16 US Gal/h

Stage	
Complete	

	In Use Meter Factor
	1.1100

Operational Overview

This application is designed for master meter proving using pulses from both the Master Meter and Meter Under Test. Both meters can be either Volume or Mass based with Mass to Mass, Mass to Inferred Mass and Volume to Volume proving modes being supported.

If the Meter Under Test is volumetric, API 11.1 or TP27 liquid volume corrections can be applied, as can meter body corrections for process temperature and pressure corrections. The density at the Meter Under Test can be derived from the Master Meter, a Densitometer or an operator entered Base Density, and the inferred mass computed and used in comparison with the Master Meter, to generate the Prover Meter Factor.

Master Meter Prove runs can be terminated by a manual trigger or by reaching a specified Pulse Count, Time or Quantity through the Master Meter.

Repeatability is calculated by average meter factor method, and the number of good runs and repeatability are user selectable. Alternatively the Uncertainty calculation can be used.

Features

API 11.1 or TP27 can utilize the US Customary Calculation to a 60°F base, or in Metric mode a 15°C or 20°C base can be selected.

Vapor Pressure corrections can be applied, using either TP15 or an operator entered Pe.

Prove cycles can be initiated using the Local Panel, the web interface or communications.

Table of Contents

1   Introduction

The Master Meter Application is one of a range of applications designed specifically for fiscal measurement of Oil & NGLs utilizing pipelines:

►Unified Prover Application   For use with all captive piston Provers, Bi-Dir and Unidirectional ball Provers

►Liquid Flow Computer Application   Designed for use with Volumetric or Mass pulse based meters such as Turbine, PD, Ultrasonic and Coriolis meters

►LACT-Pro® Metering Application   Flow Meter based Truck Loading Applications and off-loading to day tanks with measurement of produced water

►LACT-Pro® Tank Application   Loading using gauging from Bullet & Cylindrical tanks

►LACT-Pro® Scales Application   Weighbridge tanker loading

►LACT-Pro® PI   For pipeline injection

In addition to this manual, a range of further documentation is available, which includes:

- NÅNO Installation Manual
- Master Meter Modbus Manual
- NÅNO XML Comms Manual Rev20

2   Loading the Application

If the required version of the application is already loaded into the NÅNO and the IP address of the unit is known, then skip this section and proceed to Section 3 Configuration Overview.

Loading of applications, and a host of additional tasks, can be accomplished with the NÅNOConf program. Please refer to the NÅNOConf manual (NF_NANOConf-UM) for further information.

This section of the manual assumes that the application has been installed, and the IP address of the machine is known. This document explains how the application is configured to match the site.

There are a number of site specific options that need to be configured before the NÅNO will provide useful results. These options can be grouped as:

- Choose if an integrated NÅNO Prover is used, or if a DCS / HMI utilized.

- Initial Site report data, such as the Site Owner/Operator, Reference, Location and Device ID

- System Setup - these NÅNO specific items include Network Settings, Printers, Time & Date

- User Information - allows additional users & technician login details to be added / configured

- Configuring the measurement units to be used

- Matching the application to the site Piping and Instrumentation Diagram (P&ID)

- Setting the I/O assignments - these have rational default values, but may be changed to suit local wiring requirements, or for fault diagnostic purposes

- Product Configuration - setting up the parameters for up to 12 products

- Prover Integration

- Final Field Set-up and Analog Calibration, if applicable

- Back-up the configured application and print or download the constants log

The following configuration sequence is recommended, but not obligatory. The menu structure is dynamic, and as items are selected or deselected, associated information may appear or be hidden.

Once you had identified the physical NÅNO using the NÅNOConf deployment tool, you can right click on the unit you wish to set-up and select "Start Web Interface". Alternatively, take a note of the IP address, open a web browser (Firefox, Chrome or Safari are preferred), type the NÅNO's IP address into the browser's address bar and press ENTER.

Liquid Flow Computer	ALARM	2021/02/08 15:54:38

Enter Login ID

Username : admin

Password : ••••••••

Login

The default Login screen will be displayed, as shown above.

Unless someone has already configured the machine, and changed the login credentials, the user name will be **admin**, and the password will be **00000000** (that is the number zero repeated 8 times).

After typing the password, you can press the [↵ Enter] key on the keyboard (works with most

browsers) or click the Login button, which will work for all browsers.

If the Password and/or Username have been changed from the default, then you will see this:

Liquid Flow Computer	ALARM	2021/02/08 15:57:45

<div align="center">

Login failed ... Re-enter Login ID

Username : [   ]

Password : [   ]

[Login]

</div>

NOTE: If the Password & Username combination for the machine cannot be determined, there is no back-door method of logging into the NÅNO. The passwords cannot be recovered, but the machine can be reset to factory defaults but this will remove the application, and stored reports. The SD Card information is preserved.

NOTE: The maximum number of concurrent web browser connections is 4. If this is exceeded, the a lock icon will be displayed and the message "Too many users already logged in" shown.

Liquid Flow Computer	ALARM	2021/02/08 16:02:21

<div align="center">

Too many users already logged in

🔒

</div>

Assuming that the user limit has not been exceeded and you login correctly, then the home screen will be displayed.

NOTE: The home screen below is just an example screen used to highlight the various screen areas and icons. For any particular application, the System ID or Device ID will be different, as will the Hierarchical Menu Items, however the position and layout of the home screen will be similar

System ID / Device ID	The System ID / Device ID is configured in the application. The Device ID is initially unset, so the System ID (the MAC Address) is shown to ensure each machine is unique, but can be changed by administrator level users in the Home ▸ System ▸ Initial Setup ▸ Site/Location Setup Menu.
Left Banner and Right Banner	These areas are used to give information to the user of modes or operation. In the example above, the left banner is showing that a prove is in progress and the right banner is showing that some settings and operational control is being performed by a NÅNO running the station application.
Alarm Notification	Clicking on this item will take you to the Alarms page. The color of the alarm indicator shows the current alarm status: Flashing red - there are unaccepted alarms. Solid red - there are only accepted but not cleared alarms. Grey - there are no alarms present.
Time / Date	This area of the screen displays the current machine time. Clicking on this item will jump to the Time / Date settings page (see Section 5.1 Time / Date).
Site Map	Clicking this icon takes you to a page showing all of the displays. The menu structure is dynamic and as items are selected or deselected, associated configuration information may appear or be hidden. This enables rapid navigation of the display tree, for users who are familiar with the layout of the data and sub menus. It is possible to get all menu entries in no more than two clicks, using the site-map feature.

Breadcrumb Bar	This navigation aid shows the hierarchical location of the current page: Home ▸ MyMenu ▸ Another Menu Clicking on any of the breadcrumb items will jump to the relevant page.
User Logout	Clicking this icon immediately logs out the current user and returns you to the default login screen.
Sub Menu	A line on the menu with a leading triangle ► is the entry to the next sub menu. Clicking on a sub menu line will take you to the next level in the Hierarchical Menu. The browser "back" button will take you back up a level
Data Point	The left hand side will show the name of the display point and the right hand side will show the current value of this data. **NOTE:** The home screen does not have any Data Points, only Sub Menus.
Gear Icon	A blue gear icon indicates that the value of the Display Point can be edited by the current user. If the gear icon is gray, this indicates that the display point can be edited, but the current user does not have the required user level. If no icon is show, the display point is read-only and shown for information only.

3.1   Conventions used in this manual

NOTE: The Glossary shows all the icons used in the App.

The browser can show a range of different screen types, such as menus, items names and associated value or status, dialog boxes for editing parameters, previews of reports, and other types of pages.

When a data point is being described in this manual, it will be shown in Bold Italics, as is **Application Type** in the next paragraph.

Menu locations will be shown as Home ▸ System ▸ Initial Setup in this manual.

Any line which has a gear icon at the end of the line, is an editable line.

Clicking anywhere on a line with the gear icon will open an edit dialog box. The original web page is then grayed out and the appropriate dialog box overlays the background.

The type of dialog depends upon the context. In this example, if you navigate to Home ▸ System ▸ Initial App Setup and click the top line **Application Type,** a Radio Button dialog box will open, which only allows one choice from several options. This type of dialog box is shown below.
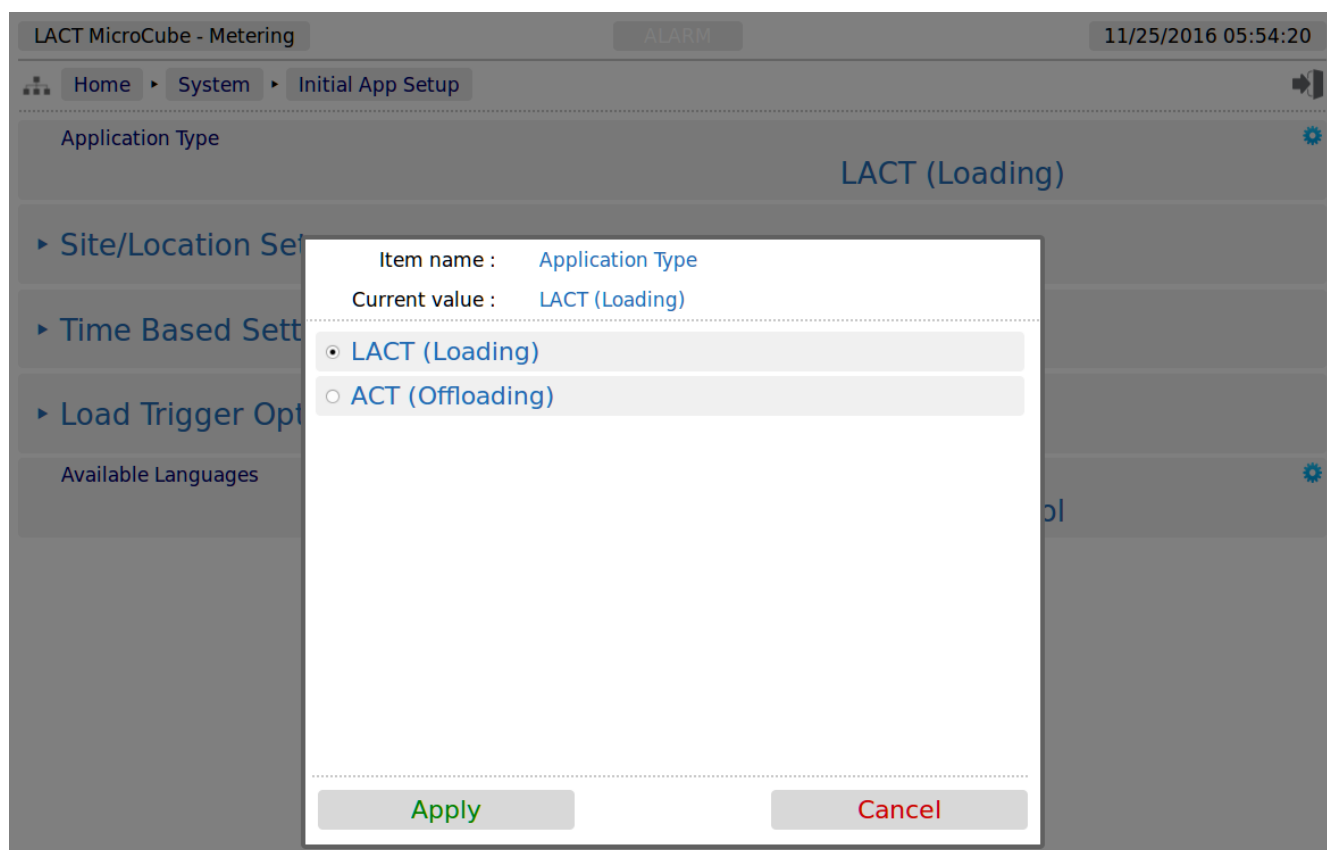
In this example the radio button type dialog box only has two choices, click the line that matches your requirement and click on the **Apply** button, to make the selection, or **Cancel** to lose any change made.

There are a range of other dialog boxes, for example the Edit value dialog box shows the name of the item being edited (Item name) and it has a large data entry entry area, which shows "Old Company Name" being replaced with "New Corporation Name" in the screenshot below.

The user can accept the new value by clicking the green *Apply* button, or reject the changes by clicking the red *Cancel* button, at which point the Edit value dialog box closes and the main screen is displayed as normal.

NOTE: If you have changed the Master Meter Micro ID, you will need to refresh the page view before the System ID/Device ID Name on the top Left Hand Side of the screen will be updated.

NOTE: The format of the data entered is checked, but not the validity of that data. In the case of the Master Meter Micro ID, the format is free and you can enter any numbers, characters or Unicode Symbols as you wish, up to the equivalent of 32 ASCII characters.

NOTE: The following configuration sequence is recommended, but not mandatory. The menu structure is dynamic, and as items are selected or deselected, associated information may appear or be hidden. The Initial Setup screen is sub-menu of the System screen.

The default or home page that will be displayed in the browser is shown below:

Site Panel Mimic	This is a mimic of the Local Panel and can be used instead of a local panel, to support operators or as a training aid.
System	This is the entry point to the system configuration sub-menus.
Reports	This section will contain all of the reports produced by the Application.
Logs & Info	All the information supplementary to the reports will be found in the section.

To start the configuration, click the line containing the ▸ System sub menu. This will take you to the top of the System menu page Home ▸ System.

On this menu, click the top line, Initial Setup to start the configuration process.

‣ Site/Location Setup

‣ Time Based Settings

4.1 Site/Location Setup

| Prover Owner/Operator | | ⚙ |
| Newflow | | |

| Prover Location | | ⚙ |
| Malton, UK | | |

| Site Reference | | ⚙ |
| Office | | |

| Master Meter Micro ID | | ⚙ |
| Master Meter Application | | |

| Prover Type | | |
| Master Meter | | |

| Proving Method | | ⚙ |
| Volume to Volume | | |

| Density Mode | | ⚙ |
| Measure Line Density at Meter Under Test | | |

| Calculation Standards | | ⚙ |
| Metric | | |

| Atmospheric Pressure | | ⚙ |
| 1.01325 bara | | |

Prover Owner/ Operator	This is an alphanumeric text field of up to 32 ASCII characters. Unicode characters can be used, but this will reduce the total number of characters supported. The Site Owner/Operator is printed on all reports.
Prover Location	This is an alphanumeric text field of up to 32 ASCII characters. Unicode characters can be used, but this will reduce the total number of characters supported. The Site Location is printed on all reports.
Site Reference	This is an alphanumeric text field of up to 32 ASCII characters. Unicode characters can be used, but this will reduce the total number of characters supported. The Site Reference is printed on all reports.
Master Meter Micro ID	This is a text field, like the Company Name above. It appears on all reports and is also shown on the top left of all web browser pages if it is set. **NOTE:** If no Master Meter Micro ID name is set then the hardware unique System ID will be used instead.
Prover Type	This will always state Master Meter.
Proving Method	There are three choices, Mass to Mass, Mass to Inferred Mass (for a volumetric Meter Under Test) or Volume to Volume.
Density Mode	This is not applicable therefore not shown in Mass to Mass mode. There are 3 possible sources of density, these are: **Use Base Density** - An operator Entered Base Density. **Measure Line Density at Meter Under Test** - Densitometer installed at Meter Under Test conditions. **Enter Sample Density** - Manually entering a Sample Density and associated Sample Temperature and Pressure
Calculation Standards	There are two choices, US Customary and Metric. If using 60°F as the temperature base, select US Customary and °F as the Temperature Unit (shown below) otherwise select Metric.
Atmospheric Pressure	This data point allows the user to set the default Local Atmospheric Pressure, in absolute pressure units determined in the Measurement Units setup page.

4.2   Time Based Settings

Auto Web Logout (0 = Disabled)	By default, if you do not interact with the website for 10 minutes the user will be logged out and you will have to re-enter the User Name and Password. This auto-logout is a safety feature to ensure that if a user forgets to logout, it will be less likely that someone else can take control of the machine. On occasion, such as configuring a machine for the first time, the auto-logout feature can be an annoyance so you can either change the period by selecting a different number of minutes for the timeout or, if you enter zero, the timeout is disabled. **NOTE:** In this instance only a number can be typed into the Edit Value Dialog box. **NOTE:** It is recommended that a reasonable number is used once the machine is commissioned, to limit unauthorized access.
Trend Sample Period	This sets the interval between trend data points being recorded in the Continuous Trending Historical Data. The period can be set to 5, 10, 15, 20, 30 seconds, or once every minute. This data is recorded 24/7
Trend Sample Period - When Proving	This sets the interval between trend data points being recorded in the Trending When Proving Historical Data. The period can be set to 1, 5, 10, 15, 20, 30 seconds, or once every minute. This data is only recorded when a prove cycle is active
Weights & Measures Screen Active Time	From the Local Panel (or Local Panel Mimic), pressing the 'i' button shows the Weights & Measures information of the application. This timer sets how long this is visible for before reverting to the original display.

This completes the ▶ **Time Based Settings**.

5   Stage 2 of 5: RTU Setup

The RTU setup configures the computer aspects of the NÅNO controller. The screenshot below shows the four sub-menus.

Clicking the ▸ **Time / Date** sub-menu will show the screen on the next page.

NOTE: Clicking on the time and date shown on the top-right of the browser screen is a shortcut to the Time / Date menu.

5.1 Time / Date

The NÅNO controller has a very high stability clock source which is used for a variety of measurement tasks, such as period measurement, as well as driving the internal time & date system. The internal clock will have an error of less than one second per day when running from a DC power source.

The time facilities in the NÅNO controller can be used in two ways.

5.1.1 The Local Time Method

The Administrator can decide to use a very simple time setting method. Ignore the *TimeZone* setting, and set the *Time Offset (HH:MM)* to 00:00. Note that the *TimeZone* value will now state Unknown.

The Date and Time fields should then be set to the local time.

The Daylight Saving Time option may still be used if required. If not required, set the *Start Date* to be the same as the *End Date* and this feature will be disabled.

5.1.2 The NTP Time Method

Alternatively, to synchronize the NÅNO controller to the Internet time using the Network Time Protocol (NTP) you must input a time offset which represents your geographical timezone, as Internet time is always expressed in UTC. This is because the NTP server has no knowledge of where the client resides and local time is derived from adding or subtracting the local timezone time offset. The timezone offset can be input manually, for example, during the winter months in Houston, you would set the *Time Offset (HH:MM)* as -06:00 (subtract 6 hours from UTC time).

Similarly in Mumbai, India, you would set the *Time Offset (HH:MM)* as +05:30 (add 5 Hours and 30 minutes to UTC time). For convenience, the US timezones have been built in so in most of Texas, for example, click on *TimeZone* and select Central, and the *Time Offset (HH:MM)* value will be set to -06:00.

The following system settings are shown:

TimeZone	The dialog box above shows the options available. Alaskan zone is -9 Hours, Pacific is -8 Hours, Mountain is -7 Hours, Central is -6, Eastern is -5 Hours and UK is no offset from UTC. Clicking an option pre-loads the Time Offset (HH:MM) item with the relevant timezone offset.
Time Offset (HH:MM)	This shows the current time offset (in hours:minutes). Clicking on the line will open the Time Offset dialog box which allows the user to input the time offset associated with the local timezone. The : (colon) character is used to separate hours and minutes. The minutes is optional hence if only whole hours are needed, then you can just enter -6 for US Central time during the winter.

Date Format	Shows the current date format. The three following formats are available and each shows an example of the date for Christmas Day for the year 2015: YYYY/MM/DD Example: 2015/12/25 DD/MM/YYYY Example: 25/12/2015 MM/DD/YYYY Example: 12/25/2015 Clicking on the line opens a selection box with the 3 options, and clicking any of the lines selects the appropriate option and indicates the selection with the radio style button. As usual, select Apply or Cancel to exit the selection box.
Date	Shows the current date (using the format defined above). Clicking on the line containing the gear icon allows the user to enter a date, in the format specified above. The / (slash or forward-slash character) is used to separate the day, month and year.
Time	Shows the current local time in 24 hour military time format. Clicking on the line takes you to the Edit Value screen where the user can enter the time. **NOTE:** The : (Colon) symbol must be used to separate the hours from the minutes and seconds.
Daylight Saving Time - This is the heading for the Daylight Savings options. This bar also indicates if Daylight Saving Time is in effect.	
Start Date	This should be the date in the Spring when the hour is moved forward. Once the start date is reached, at either 1am or 2am (as set in the Changeover Hour), the NÅNO controller time will jump forward by one hour to 2am or 3am. **NOTE:** The format to enter this information is determined by the **Date Format** above, so could be in MM/DD or DD/MM format. The expected format will be displayed in the name. **NOTE:** It is not recommended that you load during this period as report times and averaged data may be confusing. However, no pulses will be lost and the accumulators and totals will be correct.
End Date	This is the date in the Fall, when the hour moves back. At the changeover hour, the time will go back from say 2am to 1am and appear to repeat for an hour. When it reaches 2am for the second time, it will NOT jump back another hour. **NOTE:** The format to enter this information is determined by the **Date Format** above, so could be in MM/DD or DD/MM format. The expected format will be displayed in the name.
Changeover Hour	This can be either 1am or 2am, and determines the time of the day, on the selected date, that the time will spring forward by one hour or back by one hour in the Fall.
NTP - This is the heading for the NTP options	

Mode	Four NTP operating modes are available:
	Disabled No NTP synchronization will be performed.
	Automatic Sync At a pseudo-random time within the minute around 03:33 (local time), an NTP sync will be performed.
	Sync On Startup An NTP sync will be performed when the unit is powered on or restarted.
	Sync On Startup & Automatic An NTP sync will be performed when the unit is powered on or restarted and at a pseudo-random time within the minute around 03:33 (local time).
	Whenever an NTP sync is performed, if the time difference is less than 15 minutes and greater than 0.5 seconds, the machine time will be adjusted accordingly (with the Time Offset applied). Otherwise no action takes place.
	NOTE: Time changes are logged in the System Event Log.
Server IP Address	Specifies the IP address of the NTP Server to use. The IP address must be entered in IPv4 human readable quad-dotted format. There are large numbers of time servers, from government bodies and larger companies. A number of oil companies have their own time server.
	The NIST time server list can be found at http://tf.nist.gov/tf-cgi/servers.cgi
	For example: NIST, Boulder is 132.163.96.1
	Google also has a series of time servers at 216.239.35.0, 216.239.35.4, 216.239.35.8 and 216.239.35.12
Last Sync	This field records the time & date of the last NTP synchronization, and the time offset between the computer and Network time.
Manual Sync	Clicking the **Manual Sync** line will force the NTP server to request an immediate time update. The time will be applied directly.
	NOTE: No checking is provided on a manual sync, so it is the operator's responsibility to sanity check the result. We advise clicking the **Manual Sync** a second time, checking that the Last Sync message shows a very small correction, and check that the **Date** and **Time** information looks correct.

This completes the ▶ **Time / Date settings**.

For the next phase, click RTU Setup on the breadcrumb bar to go back (or the browser back button) and select ▶ **Network**.

5.2   Network

The NÅNO controller has two 10/100 MHz Ethernet ports. These ports are connected to two independent network controllers. These can be connected to entirely separate networks (for highest reliability systems) or the same physical network. However, in either case, each controller must be configured so that they are on entirely separate subnets.

The Network page shows the current network settings for both network ports.

The settings can be changed only by administrator users. The operation of this page is slightly different to other pages, in that each line is NOT actioned as it is changed. The user pre-loads a consistent set of information (IP address, Netmask & Gateway) and all the information gets applied together, when the *Apply* line is clicked.

If you wish to cancel a setting before the *Apply* is clicked, simply change page by clicking on the breadcrumb bar.

Pre-loaded but not yet applied information is shown in RED text.

In addition to being able to set up the Ethernet interfaces, this page has information on the connections made to the machine and allows a System Administrator to close links if required.

NOTE: When configuring the Ethernet IP addresses, the following MUST be carefully noted:

The IP address for each port must NOT be in the same subnet. Due to the fundamental design of the routing mechanism, Ethernet cannot work reliably if two separate controllers share the same subnet.

IP Method (Port 1)	Static	⚙
IP Address (Port 1)	192.168.1.130	⚙
Netmask (Port 1)	255.0.0.0	⚙
Gateway (Port 1)	192.168.1.254	⚙
IP Method (Port 2)	Static	
IP Address (Port 2)	10.250.250.250	⚙
Netmask (Port 2)	255.255.255.0	⚙
	Apply	⚙

SSL Certificate (Generated : 04/06/2022 07:12:43)

	Generate Certificate	⚙

Connection Info

XML Link	192.168.1.130:592 <-> 192.168.1.75:50343	⚙
ModbusTCP_Slave	192.168.1.130:502 <-> 192.168.1.75:50350	⚙

IP Method (Port 1)	This line indicates that either a Static (manually configured) address or a DHCP (automatic) address setting method has been selected for Ethernet Port 1 (ETH1). Clicking on the line containing the gear icon allows the administrator to select between the two options. **NOTE:** If DHCP is chosen as the IP Method, the current in-use IP address, Netmask and Gateway values are shown but grayed out as they are for information only.
IP Address (Port 1)	If DHCP has been selected, then this field will show, in gray text, the IP address that has been allocated to the unit by the DHCP server. If Static IP method has been selected then the line will contain the gear icon and, if the line clicked, the Edit Value dialog box will be opened so the manual IP address to be entered. The IP address must be entered in commonly used IPv4 quad-dotted decimal representation, as shown by the example screen on the previous page.
Netmask (Port 1)	If DHCP has been selected, then this field will show, in gray text, the Netmask that has been allocated to the unit by the DHCP server. If Static IP method has been selected then the line will contain the gear icon and can be changed by clicking the line and the Edit Value dialog box will be opened so the manual Netmask can be input. The Netmask must be entered in IPv4 quad-dotted decimal representation, like an IP address.
Gateway (Port 1)	If DHCP has been selected, then this field will show, in gray text, the gateway that has been allocated to the unit by the DHCP server. If Static IP method has been selected then the line will contain the gear icon and, if the icon is clicked, the Edit Value dialog box will be opened so the manual Gateway address can be set. The Gateway address must be entered in IPv4 quad-dotted decimal representation.
IP Method (Port 2)	Ethernet Port 2 (ETH2) does not allow DHCP to be used. This eliminates a potential problem where both ports are allocated addresses in the same subnet. The second port is always set to Static.
IP Address (Port 2)	Clicking this line allows the user to input the IP address for the second port.
Netmask (Port 2)	Clicking this line allows the user to input the Netmask for the second port.
Apply	Clicking Apply line will accept and action any of the changes highlighted in red on the Network page. Once the changes are accepted, the lines changed will revert to blue colored text.
Connection Info	
XML Link	In the previous screenshot the XML link information shows that 192.168.1.130 Port 592 (the NÅNO unit) is connected to a SCADA system with an IP address of 192.168.1.75 using port 50343. Up to 10 simultaneous XML links can be supported. Clicking on this line opens a "Close Connections?" dialog box. Selecting Confirm will close ALL the XML links.

ModbusTCP_Slave Link	This line will show how many remote machines are connected via the ModbusTCP_Slave link, and shows the IP addresses and port numbers of the remotely connected machines. Clicking the line opens the "Close Connections?" dialog box, as with the XML link above.

The screen below shows an example Network setup screen that is modified. The items shown in red are changes and when the Apply line is clicked, Ethernet Port 1 will change to the settings currently highlighted in red.

At this point, the browser will no longer appear to function. The user will have to type the new address into the browser address bar, and login once again, to continue configuration.

MicroCube Liquid F/C #47/B/Echo	ALARM	03/10/2019 16:41:37

Home ‣ System ‣ RTU Setup ‣ Network

IP Method (Port 1)	Static	⚙
IP Address (Port 1)	10.0.99.1	⚙
Netmask (Port 1)	255.255.0.0	⚙
Gateway (Port 1)	10.0.0.1	⚙
IP Method (Port 2)	Static	
IP Address (Port 2)	10.250.250.250	⚙
Netmask (Port 2)	255.255.255.0	⚙
	Apply	⚙
Connection Info		
Modbus/TCP_Slave	No connections	⚙
XML Link	No connections	⚙

5.3   User Info

The User Info page shows a list of currently configured users.

User details can be viewed by clicking on the relevant line containing the gear icon. Clicking on the *admin* line opens the Edit Value dialogue box, and you can change the name and password, but not the user level. Note that if you change the admin name to something else, you need to record the new name since you will need this name to log back into the machine.

The second line in the example above has the user details for a manually added 'tech' user. The third line in the example only shows if you are logged in at admin or metrology level and is called "Add new user …". Clicking on the text opens the Add new user dialog box, as shown on the right.

The following details can be changed:-

Username	Sets the username. All usernames must be unique.
Level	Sets the access level of the user, as follows:
	Metrology TBC
	Admin Can change all parameters except those designated as Technician only. One user at Admin level is mandatory.
	Technician The technician can view and drive the Digital I/O diagnostics in this mode.
	Operator/ Not used in this application.
	Management Not used in this application.
	Anyone Allows view only access.
Password	To change the password, enter the new password into both password boxes.

Administrator users can edit any user's details or delete a user by selecting the line and clicking the red **Delete** button

Non-administrator users can only edit their own username or password.

Adding a new user or clicking on an existing user opens the Edit user dialog box.

NOTE: At least one user MUST be set at Admin level and it is not possible to delete the last remaining Administrator account.

We recommend user names use the following characters only:

- Upper and Lower case letters (A..Z) and (a..z)
- Numbers (0..9)
- Hyphen (-)
- Full-stop (.)
- Space

NOTE: As stated previously, there is no back-door to the security. If you lose the Administrator password, it cannot be recovered and the only course of action is reset to factory default, which will clear all reports and data.

5.4   Communications Setup

The Comms menu is used to configure the printers and the mapping of the various reports to the printers available, setting the serial port for the Local Panel, as well as the communications to SCADA and Enterprise systems. The menu is shown below.

5.4.1   Printers / SD Card / FTP

The Master Meter application supports up to 3 physical printers, a virtual printer on the SD Card and remote "push" FTP printer. The FTP printer can push data in both Spreadsheet compatible TSV format in addition to text format, as a physical printer replacement.

TSV is Tab Separated Value format, which is identical to CSV, except it allows commas to be used in data.

One physical printer may be serial or networked (PostScript) and the other two physical printers may be network addressed PostScript printers. The screenshot overleaf shows a configured machine.

In the example, Printer 1 has the default name and Printers 2 & 3 have been renamed. Printer 2 has been named Management Office and Printer 3 named Oklahoma Accounts Dept.

Printer 1 has been configured to be a serial printer, using COM1 (the RS232 port) with 9600 baud. Printers 2 and 3 are configured as Networked printers. The relevant IP address has been added and the default TCP port of 9100 used.

The Printer / SD Card configuration page is a long page, so the screenshot of this menu has been split over two pages.

Print spool	Empty	⚙

Printer 1

Name	Ticket	⚙
Type	Serial (Codepage 437)	⚙
Serial Port	RS232 (COM1) - No handshaking	⚙
Baud Rate	9600	⚙

Printer 2

Name	MGMT Office	⚙
Type	Network (Postscript)	⚙
Network Address	10.0.0.107	⚙
Network Port	9100	⚙
Zoom (%)	100	⚙
	Print Test Page	⚙

Printer 3

Name	OK City Accounts	⚙
Type	Network (Postscript)	⚙
Network Address	10.0.0.11	⚙
Network Port	9100	⚙
Zoom (%)	100	⚙
	Print Test Page	⚙

SD Card

and continued from page above:

SD Card		
Status	Installed (free 1.41 GiB, total 1.87 GiB)	⚙
Archive Alarms/Events	Weekly	⚙
Archive Historicals	Daily	⚙
FTP		
Server IP Address	66.220.9.50	⚙
Port	21	⚙
Username	mpfj	⚙
Password	*******	⚙
Upload Directory	/mob/LP-Oil	⚙
Upload Format	Plain Text	⚙
	Send Test File	⚙
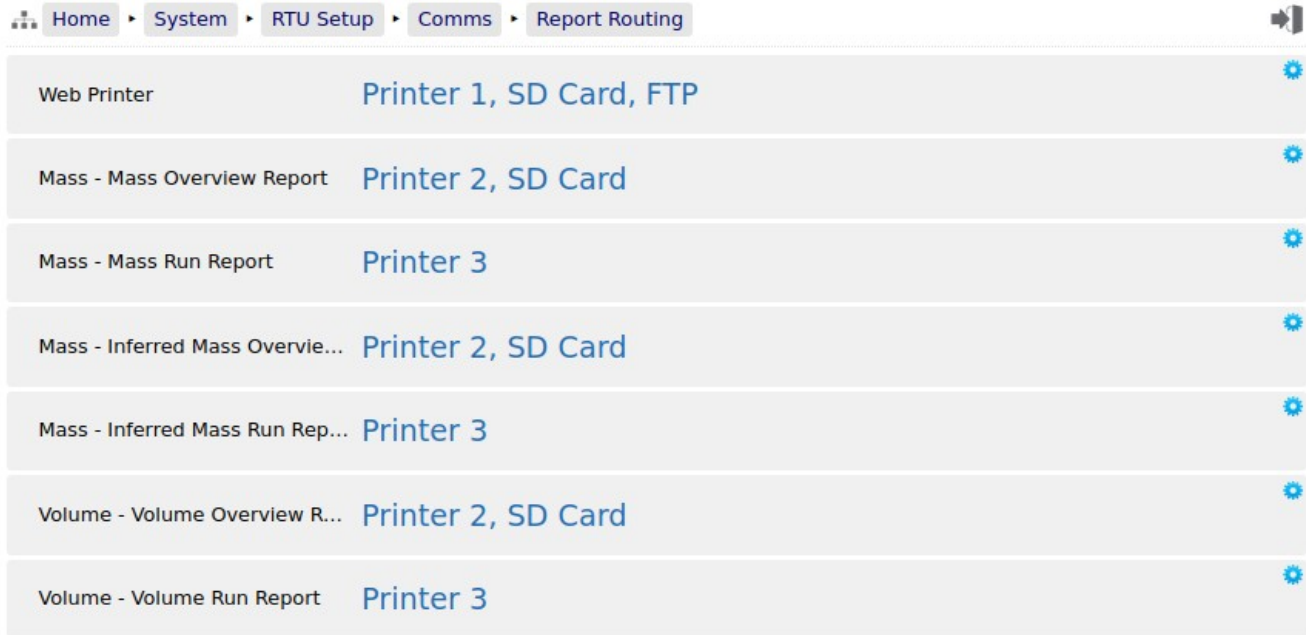
The SD Card is a versatile extension to the on-board non-volatile memory, and can be used as a virtual printer, see Home ▸ System ▸ RTU Setup ▸ Comms ▸ Report/Printer Routing as well as being able to extend the Archive & Events and the Data Logging almost indefinitely.

SD Card	
Status	This will state No Card Inserted, if no SD Card is present or has been dismounted.
	When the NÅNO controller is turned off, SD Cards may be inserted or removed at any time.
	When power is applied, the controller will automatically mount a card if available. When installed, the status line will show the free space and the total card size in GiB (GibiBytes) or MiB (MibiBytes).
	If a card needs to be removed from a running system, the status line should be clicked,and the SD Card Install or Remove dialog box will be presented. Ensure the Remove option is selected and press Apply. Once the Status has changed, you can take out the SD Card.
	To fit a card to a running machine, put the card into the card slot beneath the Ethernet ports, click the SD Card Status line, select Install and click Apply. The status line will now show the SD Card information.
Archive Alarms/Events	In addition to being able to use the SD Card as a 4th virtual printer, the Alarms and Events can also be "archived" to the SD Card a regular intervals, so that in essence, all Alarms & Events over the lifetime of the machine could be stored within the LACT-Pro Controller. The archive can be turned-off by selecting the Disabled option, or the time period between archives can be selected from Daily, Weekly or Monthly, depending upon how often information is generated. The file generated is a ZIP archive file containing six .TSV files containing the Alarm Log, Application Event Log, Metrology Event Log, Operator Event Log, Security Event log and the System Event log.
Archive Historicals	The Historical Data Logger collects data which can be viewed graphically in a browser by navigating to Home ▸ Logs & Trends ▸ Trending, and selecting which data to view. The data from each data logging zone can be viewed or downloaded as a .TSV for viewing in a spreadsheet, but the archive module will generate the TSV for each logging zone and will ZIP these files and place them onto the SD Card. The time period between archives can be selected from Daily, Weekly or Monthly, depending upon how often information is generated.
FTP	
Server IP Address	The IP address of the remote FTP server must be entered in IPv4 human readable quad-dotted format, as shown in the screenshot above.
Port	This is the TCP port number, and depends upon the FTP server settings. Port 21 is the usual TCP port number reserved for the File Transfer Protocol (FTP).
Username	The username and password will be allocated by the FTP server administrator.
Password	See above.
Upload Directory	The upload directory can be a fixed path, for example /Site1123/Unit-AB12, and when a report is generated it is placed within this fixed directory path, using a "report name" + "datestamp" filename format so in the FTP server it appears as:
	`Hourly Report-05052017092716.tsv`
	Alternatively a very flexible, dynamic path method is available using a %TAG format. This method is exceedingly powerful but may require factory support to implement. If you need additional options, ask your distributor for MiniSpec18.

Upload Format	Clicking this line gives the choice of one of two options selected with a radio button. The two options are: **Plain Text** If this Option is selected all reports are transferred to the FTP server as text formatted documents. **TSV** If this Option is selected all reports are transferred to the FTP server as Tab Separated Values. There is a version of the BOL specially formatted for use as a TSV.
Send Test File	Clicking this line causes a test file to be transferred to the designated FTP server. A pop-up window shows the low level transaction information for debug purposes.
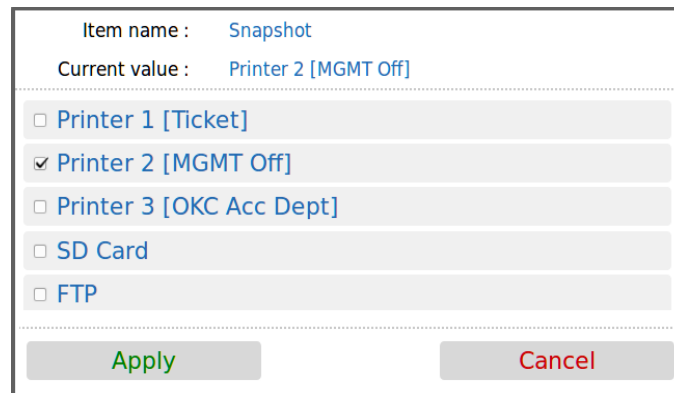
5.4.2   Report & Printer Routing

The Master Meter application is configured to have reports. Each report can be sent to any or all of the printers as required. Depending on the proving type (Volume to Volume etc) selected, will depend on the list of available reports.

Clicking each line opens up the relevant selection dialog. For example:

Clicking on the check boxes causes the report when generated to be directed to the selected printer. Reports can be directed to any or all printers. If no printers are selected, the report will not be printed but will still be generated and stored in the reports archive.

5.4.2.1   Reports Archive

The reports are stored in high reliability and predicable NOR Flash using a robust, check-summed linear file system. The use of NAND type flash (as used in USB memory sticks) is not suitable for industrial applications when a guaranteed lifetime and number of write cycles is needed.

The report archive area consists of 16 zones. The first six zones can store a minimum of 1500 reports and the other 10 zones can store a minimum of 250 reports.

5.4.2.2 SD Card Storage

The removable SD Card is a useful resource allowing virtually unlimited storage of the historical trending information and, since it is removable, the information can be quickly retrieved by a PC or Laptop. Below is a screenshot showing the structure and one day's content.
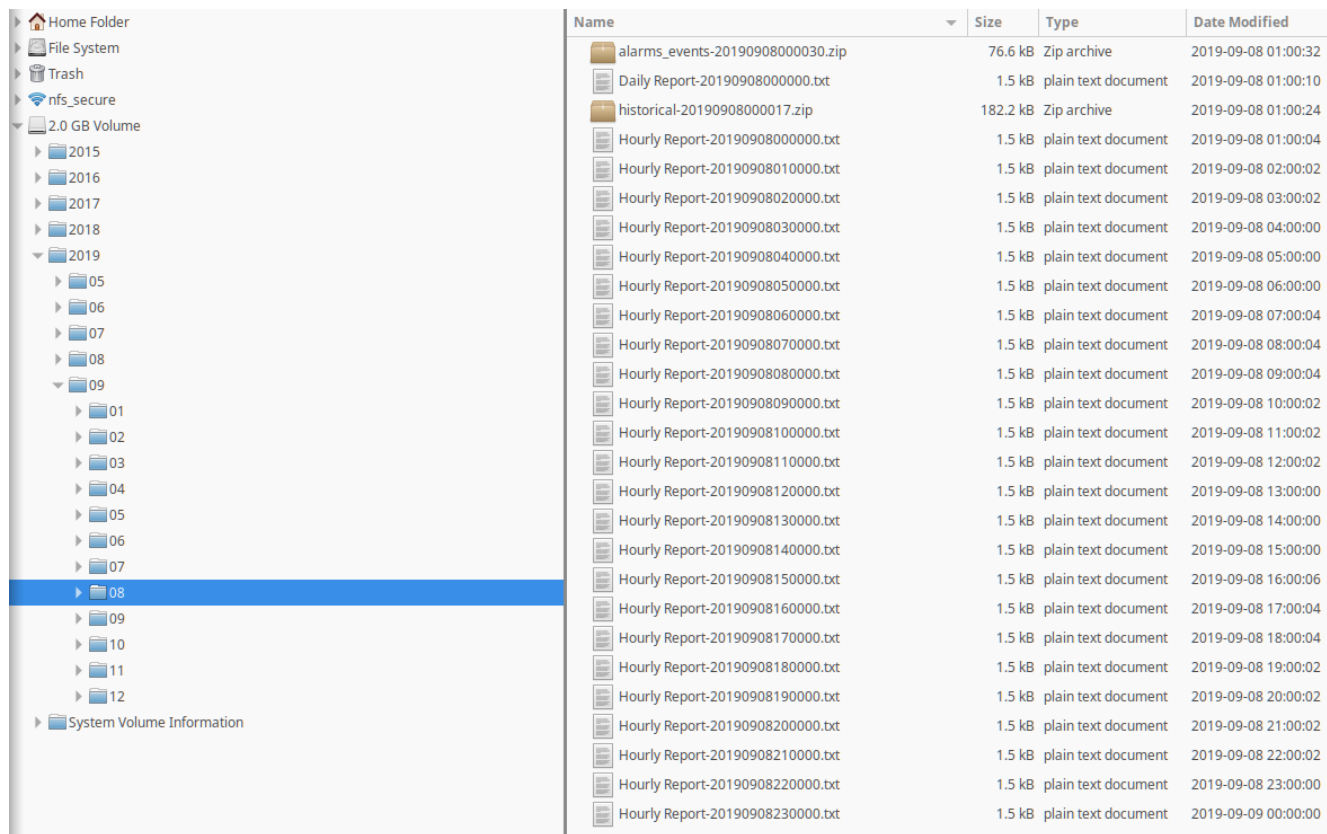
Unlike the Internal Storage/Archive, SD Cards utilize NAND flash and the number of writes is not predicable, nor is any warning given of failure. Therefore, for the best results, we recommend SD Cards are replaced every three years.

5.4.3   XML Comms

XML communications is the preferred method of retrieving data from the NÅNO controller.

All data within the NÅNO controller can be accessed using the XML communications method.

The NÅNO controller can be polled periodically for new information but, to save bandwidth and data usages charges, there is also an XML push notification. The push notification informs that an alarm has changed state or a report generated, and then the machine can be polled to retrieve the required information. This allows remote systems to be informed of new reports or alarms without having to constantly poll the unit.

The full potential of the XML communications can be found in the accompanying NÅNO XML Comms Manual, available from your distributor. In addition, there is a Windows based demonstration program available for test purposes.

The following details can be changed:-

XML TCP Pull Port #	In XML TCP Pull mode, the NÅNO controller acts as a slave device and waits for a remote server to initiate the XML requests. The TCP port number can be set to any number between 0 and 65535 but care must be taken in choosing the port number. We recommend the port number is left as 592, unless there is a good reason for changing it.
XML Push Method	This is where the NÅNO controller acts as a master device and, upon some internal trigger (new report or a change to Alarm status), sends a "status" packet to a remote server. Two "push" connection modes are possible: **Raw** the target sends the status packet as raw XML data to the server. **HTTP** the target uses an HTTP POST request to send the status packet to `http://<server>/notify`.
XML TCP Push IP Address	This is the IP address of the remote server which will receive the push notifications from the NÅNO controller.
XML TCP Push Port #	This is the TCP port number of the remote server which will receive the push notifications from the NÅNO controller. Setting the port number to zero will disable the Push notification.

5.4.4 Modbus/TCP Slave

Modbus/TCP Port #	This is the TCP port number that the Modbus Master device must use to talk to the Modbus Map. The default port number is 502 for the Modbus map. To disable the Modbus Map, set the port number to zero.
Modbus/TCP Slave Address	This is usually set to 1 but can be changed to match the requirements of the Master, as required.

NOTE: The Master Meter Modbus Manual describes all of the Modbus data points available.

5.4.5 Local Panel

The NÅNO can be used "headless" using a web browser for configuration and operation. Alternatively a Local Panel display can be used when a dedicated display is required.

The optional Local Panel display can be connected to COM3 (as this is a full-duplex serial port) or None.

The selection only allows each serial port to be connected to one link at a time. This means that if Printer 1 is allocated to RS422 (COM3), when the options are viewed for the Local Panel above, the RS422 (COM3) option will be grayed out and the wording '(Not available)' will be suffixed to the port description. To resolve this, and allow the Local Panel to use COM3, the port would need to be unassigned from Printer 1 first.

5.4.6   OPC-UA

OPC-UA communications is the preferred method of retrieving data from the NÅNO.

Relevant Datapoints, Reports and Alarms within the NÅNO can be accessed using the OPC-UA communications method.

The following details can be changed:-

OPC-UA Port	The port number is normally set to 4840 however is changeable if required by the client.
ControlWeb Compatibility Mode	Although the OPC-UA interface is defined, we have found that some implementations differ from the standard. Due to differences found with the ControlWeb PC Application, we added this compatibility mode switch to allow ControlWeb to interface and interact with the NÅNO correctly.

This completes the ▸ **OPC-UA** settings.

For the next phase, click ▸ **System** on the breadcrumb bar to go back (or the browser back button) and select ▸ **Measurement Units**. Then go to Section 6 Stage 3 of 5: Configuring the Measurement Units.

6 Stage 3 of 5: Configuring the Measurement Units

The units available in the Master Meter Application are highly configurable. The screenshot below shows the unit selection screen:

Temperature Unit	Select degrees Celsius (°C) or degrees Fahrenheit (°F).
Pressure Unit	There are three options: psi, bar or kPa on radio buttons. Select the appropriate one.
Line Pressure Reference Selection	This selection determines if the measured (line) pressures are in Absolute pressure or Gauge pressure. If the Pressure Unit was set to psi and the Line Pressure Reference Selection is Gauge, then psig will be used and displayed. **NOTE:** The atmospheric pressure at the location in use is set here: Home ▸ System ▸ Initial Setup ▸ Site/Location Setup
Vapor Pressure Reference Selection	This selection determines if the vapor pressure (Pe) is in Absolute pressure or Gauge pressure units. If the Pressure Unit was set to psi and the Pressure Reference Selection is Absolute, then psia will be used and displayed.
Density Unit	There are 6 choices of Density Unit and the selected unit is used throughout the Application: in reports, on displays and as an input parameter. The choices are: kg/m3, SG(RD) °API, lbs/US Gallon, lbs/barrel or g/cc.
Flow Rate Time Unit	This can be set to Seconds (s), Minutes (m), Hours (h) or Days (d).
Master Meter Mass K Factor Unit	If in the Initial Setup, Mass to Mass or Mass to Inferred Mass has been selected as the Proving Method, then Mass K Factors will be shown for the Master Meter. The choices are on a radio button and are: pulses/kg, pulses/tonne, pulses/ton (US Short Ton), pulses/lb or pulses/1000 lbs.
Master Meter Volume K Factor Unit	If in the Initial Setup, Volume to Volume has been selected as the Proving Method, then Volume K Factors will be shown for the Master Meter. The choices are on a radio button and are: pulses/litre, pulses/m3, pulses/bbl or pulses/US Gallon.
Meter Under Test Volume K Factor Unit	If in the Initial Setup, Mass to Inferred Volume or Volume to Volume have been selected as the Proving Method, then Volume K Factors will be shown for the Meter Under Test. The choices are on a radio button and are: pulses/litre, pulses/m3, pulses/bbl or pulses/US Gallon.
Meter Under Test Mass K Factor Unit	If in the Initial Setup, Mass to Mass has been selected as the Proving Method, then Mass K Factors will be shown for the Meter Under Test. The choices are on a radio button and are: pulses/kg, pulses/tonne, pulses/ton (US Short Ton), pulses/lb or pulses/1000 lbs.

7   Stage 4 of 5: Matching the I/O to the P&ID

Home ▸ System ▸ I/O

- ▸ Assignment/Settings - Digital I/O
- ▸ Assignment/Settings - Process Inputs
- ▸ Meter Pulse Inputs
- ▸ Period Inputs
- ▸ Field Calibration
- ▸ I/O Diagnostics
- ▸ Digital I/O Debug

There are seven sub-menus accessible from this screen. They are used to configure the various types of field I/O provided by the NÅNO controller.

7.1   I/O Assignments – Digital Inputs & Outputs

NOTE: The Master Meter application does not check for exclusive assignment of any I/O points. It is recommended to record any changes to the I/O using the I/O schedule drawings available in I/O Schedules.

Run Permit (Interlock) Input	This digital input must be made active to allow a Prove Cycle to start. If this input is inactive, the Local Panel will show "Waiting for Proving Interlock". If the Run Permit input is made inactive during a prove cycle, the prove will be aborted. If the Run Permit is not required, click on the line and select "High" as the input selection, so the input is always active.
Prove In Progress (Output)	When a prove cycle is in progress, this output will be active.
User 1 Alarms	If any User 1 High alarms are exceeded or the value is lower than the User 1 Low alarms, then this Digital Output will become active.
User 2 Alarms	As for User 1 Alarms, but for the second user alarm group, User 2 Alarms.

7.2 I/O Assignments – Process Inputs

Meter Under Test Pulse Source	Raw Pulse Bus
Master Meter Temperature Source	Analog Input 1
Master Meter Temperature Type	Analog Input - 4-20mA
Master Meter Pressure Source	Analog Input 2
Master Meter Pressure Type	4-20 mA
Meter Under Test Temperature Source	Analog Input 3
Meter Under Test Temperature Type	Analog Input - 4-20mA
Meter Under Test Pressure Source	Analog Input 4
Meter Under Test Pressure Type	4-20 mA
Density Source	Analog Input 5 / RTD 2 / Thermistor
Density Analog Type	4-20 mA

NOTE: The Master Meter Application does not check for exclusive assignment of any I/O points. It is recommended to record any changes to the I/O using the I/O schedule drawings available in I/O Schedules.

Meter Under Test Pulse Source	The pulses from the Meter Under Test can either be connected directly to the Master Meter Prover application or come from the Raw Pulse Bus, where multiple meter runs are all connected to the prover.
	In this example, the Raw Pulse Bus is selected.
	Raw Pulse Bus Allows multiple meters to be connected to the Master Meter Prover application.
	Channel B Pulses This setting is used when a single meter is connected and disturbing the wiring to the Meter Under Test is not an issue
Master Meter Temperature Source	The Master Meter Prover application can use a live temperature with an optional Default (fail-over) value (in the case of a transmitter failure) or a user (manual) Override value.
	In this example, the unit is configured assuming that Master Meter temperature is being measured using a 4-20mA transmitter connected to Analog Input 1.
	Clicking this line allows the user to assign different Analog Inputs or to Disable the Measured Temperature Source, if an alternative method is being used.
Master Meter Temperature Type	Once the appropriate Meter Temperature Source has been chosen then the Type of Temperature needs to be selected. A 4-20mA transmitter or 1-5 Volt device can be used with any of the Analog Inputs, and Analog 5 & 6 also allow a 4-wire RTD to be directly connected. Alternatively a Thermistor can be used but this requires an external P554 Thermistor Interface Module.
	If a Measured Temperature Source has been selected as 4-20mA then the Measured Temperature parameters will also need to be set. See Master Meter Temperature.
	On the screenshot above Analog Input 6 has been configured for a 4-wire RTD.
Master Meter Pressure Source	The Master Meter Prover application can use either a live Pressure Source, with an optional default (fail-over) value in the case of a transmitter failure or a user entered Override value. The default has a live measured pressure and Analog Input 1 is assigned to measure this input.
	Clicking this line the assignment can be changed to another Analog Input channel or Disabled if a measured value is not used.
	If a Master Meter Pressure Source has been selected then the Pressure parameters will also need to be set. See Master Meter Pressure.
Master Meter Pressure Type	The Master Meter Pressure Transmitter can be a 4-20mA device or a 1-5 Volt unit.
Meter Under Test Temperature Source	The Master Meter Prover application can use a live Meter Under Test temperature with an optional Default (fail-over) value (in the case of a transmitter failure) or a user (manual) Override value.
	In this example, the unit is configured assuming that line temperature is being measured using a 4-wire RTD and Analog Input 6 has been assigned as the source of the Temperature information.
	Clicking this line allows the user to assign different Analog Inputs or to Disable the Measured Temperature Source, if an alternative method is being used.

Meter Under Test Temperature Type	Once the appropriate Meter Under Test Temperature Source has been chosen then the Type of Temperature needs to be selected. A 4-20mA transmitter or 1-5 Volt device can be used with any of the Analog Inputs, and Analog 5 & 6 also allow a 4-wire RTD to be directly connected. Alternatively a Thermistor can be used but this requires an external P554 Thermistor Interface Module. If a Measured Temperature Source has been selected as 4-20mA then the Measured Temperature parameters will also need to be set. See Meter Under Test Temperature. On the screenshot above Analog Input 6 has been configured for a 4-wire RTD.
Meter Under Test Pressure Source	The Master Meter Prover application can use either a live Meter Under Test Pressure Source, with an optional default (fail-over) value in the case of a transmitter failure or a user entered Override value. The default has a live measured pressure and Analog Input 1 is assigned to measure this input. Clicking this line the assignment can be changed to another Analog Input channel or Disabled if a measured value is not used. If a Measured Pressure Source has been selected then the Measured Pressure parameters will also need to be set. See Meter Under Test Pressure.
Meter Under Test Pressure Type	The Meter Under Test Pressure Transmitter can be a 4-20mA device or a 1-5 Volt unit.
Density Source	The Density meter output can be a scaled Analog output, a pulse type output or digital communications. If analog, select which Analog input the density meter is connected to. If a pulse output meter is used, connect it to one of the two period Inputs. **NOTE:** This option is only shown if the Density mode under Home ▸ System ▸ Initial Setup ▸ Site/Location Setup is set to 'Measure Line Density at the Meter Under Test'.

7.3   Meter Pulse Inputs
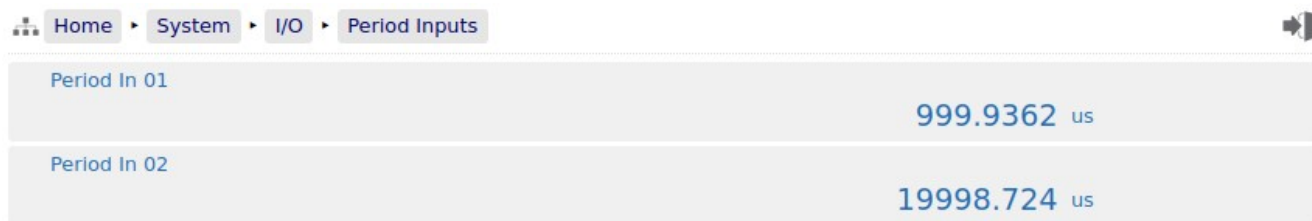
This menu is for information only, and nothing can be changed.
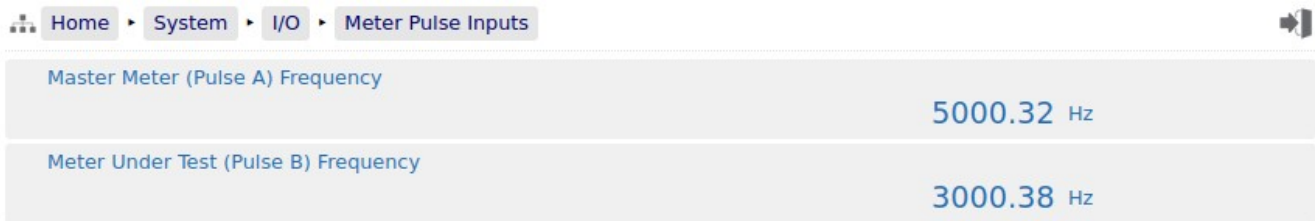
Master Meter (Pulse A) Frequency	This is not configurable but indicates the frequency on the A channel.
Meter Under Test (Pulse B) Frequency	This is not configurable but indicates the frequency on the B channel.

7.4 Period Inputs

This menu is for information only, and nothing can be changed.

The two lines show the period of Period In 1 & 2 in microseconds.

7.5   Field Calibration

The NÅNO controller has very stable, high resolution Analog Input and RTD measurement circuitry which are factory calibrated to a high standard. This will give excellent measurement results without additional user input.

However real-world issues, such as transmitter error, or physical problems, such as a sub-standard design of thermowell, or incorrect placement of a transmitter can lead to the measured value being different to the reality. There are two ways to solve this problem.

The simplest is to apply a one-point bias, or offset adjustment, and this is easily achieved in the transmitter setup section using the web interface. A bias adjustment however may only be reasonable when the operating point does not change too much. If, for example, the bias function is used to adjust a temperature reading, this Bias Adjustment should be checked between Summer and Winter as a minimum.

In addition to the bias or offset for a Process Variable, the Application features a site calibration mode to enable loop calibration of each Analog Input.

This can eliminate certain transmitter errors, such as offset errors and span/gain errors. Loop calibration cannot eliminate problems of non-linearity, although good operating practice can indicate these type of transmitter problems.

The process for calibrating an Analog input is straightforward but remember the user MUST be logged in at Admin Level.

Example:

In this example the pressure input, configured to use Analog Input 1, is to be loop calibrated.

Before the Calibration process can commence, the operator must know the range the transmitter will operate over and the scaling values.

To start the calibration process, navigate to Home ▸ System ▸ I/O ▸ Field Calibration as shown below. This page shows all 6 Analog Inputs. In this example, we are calibrating the loop for 0 to 250 PSI.
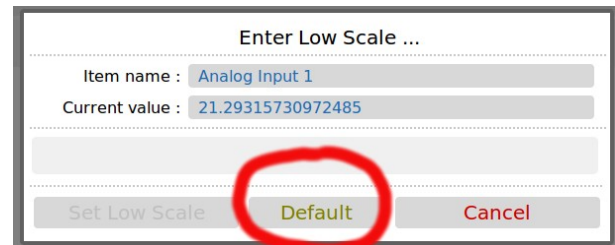
NOTE: Unless logged in at Admin level, the edit icons will be shown in gray and the Analog Inputs cannot be edited.

You can see that **Analog Input 2** through to **Analog Input 6** show (Default) at the beginning of the line. This shows that these inputs are using the factory calibration values. **Analog Input 1** however does not show (Default) hence Analog Input 1 is running with replacement values.

Step 1

The replacement values must be cleared and set back to default. Click the line associated with the relevant input which will open the Enter Low Scale dialog box. Then click the button named Default. You will be asked to Reset Scale to Default and click the Confirm button.
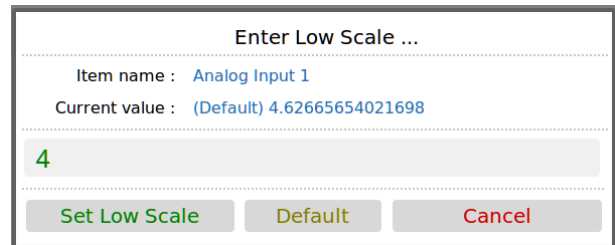
You will be taken back to the previous screen but now **Analog Input 1** will show (Default) in front of the live reading and you are ready to proceed.

Step 2

Once again click the line associated with the input. This will open the Enter Low Scale dialog box again.

Vent the pressure as seen by the Pressure Transmitter to atmosphere and the reading shown as the "current value" in the Enter Low Scale dialog box should be around 4mA. If it is drastically different, the cause should be investigated. Once the pressure has normalized to atmospheric, type 4 into the data entry box and click the Set Low Scale Button.
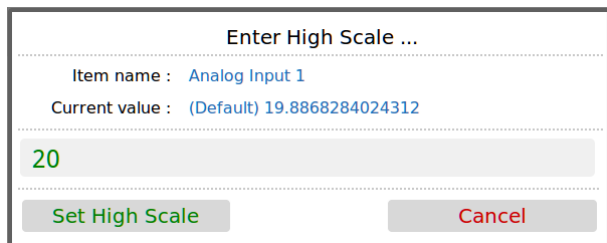
This has pre-loaded 4.0mA into the low scale field. It is not yet being used and will not become active unless confirmed at the end of the process.

The dialog box now prompts you to enter the High Scale value.

Step 3

Now load the dead weight tester until pressure is at the full scale value of 250 PSI in this example.

The live reading should be display numbers around 20mA. Now type 20 into the Enter High Scale dialog box and click the Set High Scale button to set the value.
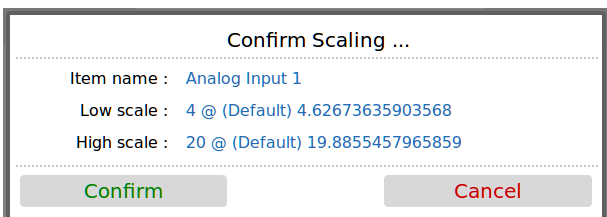
Step 4

The dialog box now changes to "confirm scaling" as shown. The confirm scaling dialog box shows both the low scale and high scale before and after values. If these values appear to be reasonable then pressing the confirm button will accept the field calibration replacement values.

If, subsequently, a problem is found with the field calibration replacement values, the default values can be restored by clicking the relevant line and selecting the **Default** button (as per Step 1 above).

NOTE: Calibration replacement values are stored in the Metrology Event Log. The replacement values are also stored in non volatile memory and retained following a power cycle, update of the Application and update of the firmware.

7.6 I/O Diagnostics


```
 Home ▸ System ▸ I/O ▸ I/O Diagnostics                              ⤓ 🖨↪

I/O Diagnostics
PROCESS INPUTS
                               Source      Raw      Low Scale  High Scale  Calculated  Bias Value  Calculated              Mode       In Use
                                           Value                           Value                   Value                              Value
                                                                           no Bias                 with Bias
Master Meter Pressure          Analog Input 2  13.252 mA    0.000    20.000      11.566      0.000       11.566             Measured   11.566 psig
Master Meter Temperature       Analog Input 1  19.167 mA    0.0     100.0        94.8        0.0         94.8               Measured   94.8 °F
Meter Under Test Pressure      Analog Input 4  12.901 mA    0.000    20.000      11.126      0.000       11.126             Override   10.000 psig
Meter Under Test Temperature   Analog Input 3  13.057 mA    0.0     100.0        56.6        10.0        66.6               Measured   66.6 °F

                               Source      Raw      Low Scale  High Scale  Calculated  DCF Value   Calculated              Mode       In Use
                                           Value                           Value                   Value                              Value
                                                                           no DCF                  with DCF
Meter Under Test Line Density Analog Input 5  11.357  mA    650      1200      902.911293  1.0000      902.91129           Measured   902.91129 lbs/US Gallon

PROVER PULSE INPUTS
                      Count(rollover @ 65535)      Frequency
Master Meter (Pulse In A)          42756          5000.32 Hz
Meter Under Test (Pulse In B)      39149          3000.38 Hz
Raw Pulse In                       0              0.00 Hz

PERIOD INPUTS
Period Input 1          999.9362 us
Period Input 2        19998.724 us

DIGITAL INPUTS                                            DIGITAL OUTPUTS
                      Source          Bit  Status                      Source          Bit  Status
Run Permit Input      Digital Input 1  1    1            User 1 Alarm   Not Routed      0    Off
Proving Interlock Input  Not Installed  0    0            User 2 Alarm   Not Routed      0    Off
                                                         Prove In Progress Digital Output 1  0    No

End of Page
```

The data shown on this page is live and will be updated every heartbeat. However the web page only updates approximately every second, depending upon bandwidth and connection type.

On this page, two additional screen icons are shown:

The Download Icon indicates that the data on the screen can be downloaded to the PC currently viewing the NÅNO controller web page. After clicking on this icon, your browser may ask the user what action should be performed with this file. Normally these options are to Save or View the data.

The Print icon indicates that the data on the screen can be printed, via the web printer configured on via Home ▸ System ▸ RTU Setup ▸ Comms ▸ Report/Printer Routing.

NOTE: To print to the PC running the browser, use the browser's specific printing method or type Ctrl+P on most browsers on most operating systems.

7.7 Digital I/O Debug

When logged in at Administrator level, this menu is a read-only information page and the gear icon on the Digital Output [1..6] line will be showed grayed-out.

The screenshot below shows the display when logged in at Technician level.

Digital Inputs [1..9]	This shows the current status of the Digital Inputs in a very compact manner. A "0" represents the OFF state and a "1" represents the ON state. The left most digit is Digital Input 1.
Digital Outputs [1..6]	There are two aspects to the Digital outputs, a display and an override. The display shows the current status of the Digital Outputs in a very compact manner. A "0" represents the OFF state and a "1" represents the ON state. The left most digit is Digital Output 1. If you click on the line, the following dialog box will be opened: **CAUTION:** Careless use of this feature may cause operational problems, such as inadvertently changing the state of a permissive output, and so this feature should be used with caution. __Do NOT use or disclose Technician Level passwords without careful consideration__ The current state of the Digital Outputs are shown in the Current value field. In the example above Digout1 and Digout2 are "ON" and the rest are "OFF". If you click on the Toggle Digout for any of the output channels, the output state will be inverted each time you click and the Current value field will be updated. In the above example, clicking on Toggle Digout6 would result in Digout 6 changing from "OFF" to "ON", and the current value would then be 110001. Pressing Cancel will restore the previous values.

8 Stage 5 of 5: Process Setup

8.1 Master Meter Setup

Master Meter Type	This is an information only field.
Master Meter Manufacturer	This is free text for information. It is shown on the relevant reports and can be written or read-back via communications
Master Meter Model	As per *Master Meter Manufacture*r as shown above
Master Meter Size	As per *Master Meter Manufacture*r as shown above
Master Meter Serial Number	As per *Master Meter Manufacture*r as shown above
Master Meter ID/Tag	As per *Master Meter Manufacture*r as shown above
Master Meter Nominal K Factor	The K Factor of the Master Meter should be entered into this field, checking the units are selected appropriately.
Master Meter Curve	See section 8.1.1 below

8.1.1   Meter Factor Curve

The performance of the Master Meter can be enhanced by applying a Meter Factor correction. The Calculated Master Meter MF is determined by using a 10 point table with interpolation.

Master Meter MF In Use	1.1100
Use Master Meter MF Override Value	Yes ⚙
Master Meter MF Override Value	1.1100 ⚙
Master Meter MF Calculated	1.1000
Master Meter Volume Flow Rate	18001.15 US Gal/h

	IV Flow Rate US Gal/h	Meter Factor Value
Index 1	1200.0000 ⚙	1.0100 ⚙
Index 2	1300.0000 ⚙	1.0200 ⚙
Index 3	1400.0000 ⚙	1.0300 ⚙
Index 4	1500.0000 ⚙	1.0400 ⚙
Index 5	1600.0000 ⚙	1.0500 ⚙
Index 6	1700.0000 ⚙	1.0600 ⚙
Index 7	1800.0000 ⚙	1.0700 ⚙
Index 8	1900.0000 ⚙	1.0800 ⚙
Index 9	2000.0000 ⚙	1.0900 ⚙
Index 10	2500.0000 ⚙	1.1000 ⚙

Master Meter MF In use	This field indicates the Meter Factor (MF) of the Master Meter currently being used by the Master Meter Prover application.
Use Master Meter MF Override Value	This point indicates the current operating mode. Clicking the line opens the dialog box allowing the user to select which of the two modes to select: **No** - Uses the *Master Meter MF Override Value* at all times. **Yes** - Uses the *Master Meter MF Calculated* value using the current IV Rate and MF Curve regardless of it being within acceptable limits or not.
Master Meter MF Override Value	The Override Master Meter MF is entered into this menu entry.
Master Meter MF Calculated	This entry shows the MF that has been calculated using the current IV Rate and MF Curve.
Master Meter Volume Flow Rate	This menu items indicates if the Modbus Communications to the E+H Promass Coriolis meter is operational. If it link is working, the status will display OK, otherwise it will show FAIL.
Index 'n'	Each Index will have an associated flow rate and meter factor, these should be provided by either the meter manufacturer or calibration house. If fewer than 10 entries are provided, they should be entered sequentially starting at Index 1 and any empty fields should be at the higher end of the table.

8.1.2 Operational Setup

Maximum Number of Runs	⚙
	10
Proving Method	⚙
	Quantity
Required Master Meter Volume	⚙
	100 US Gal
Proving Acceptance Method	⚙
	Repeatability Using Average Meter Factor Method
Required Good Runs	⚙
	3
Repeatability Calculation	
	(Max-Min) / Min
Maximum Repeatability Limit	⚙
	0.025 %
Meter Factor Deviation Check	⚙
	Enabled
Allowable Meter Factor Deviation	⚙
	0.25 %

▸ Pre Prove Checking

Maximum Number of Runs	This is a radio button selection allowing between one and ten runs maximum. Even if repeatability isn't reached, the prover will not exceed this number of runs.
Proving Method	There are four choices for the proving method. They are: 1) Pulse Count 2) Time 3) Quantity and 4) Manual Trigger Depending upon the selection, one of the 3 menu choices below will be shown. If Manual Trigger is selected, no option will be shown.
Required Pulses Count	The minimum number of Master Meter Pulses needed for each pass should be entered into this field. It is only shown when Proving Method 1 is selected. The value should be a whole number between 1 and 2 billion counts.
Required Prove Time	The time in seconds for each pass should be entered into this field. It is only shown when Proving Method 2 is selected. The value should be a whole number between 1 and 2 billion seconds.
Required Master Meter Volume or Required Master Meter Mass (depending on prove type)	The minimum mass which needs to be measured by the Master Meter needed for each pass should be entered into this field. It is only shown when Proving Method 2 is selected. The value should be a whole number between 1 and 2 billion, and the units will be the Mass units determined by the Master Meter K Factor selection in [Configuring the Measurement Units](#).
Proving Acceptance Method	The repeatability method is selectable between Repeatability Using Average Meter Factor Method and Uncertainty.
Required Good Runs	This option is only shown if the Proving Acceptance Method is set to Repeatability. This is a radio button selection allowing between one and ten runs maximum.
Repeatability Calculation	In this application, the (Max - Min) / Min method is always utilized.
Maximum Repeatability Limit	This option is only shown if the Proving Acceptance Method is set to Repeatability. The required maximum repeatability figure, in percentage, should be entered here. The prover will continue to perform runs until either the desired repeatability is reached or the number of runs reaches the Maximum Number of Runs.
Maximum Uncertainty Limit	This option is only shown if the Proving Acceptance Method is set to Uncertainty. The required maximum uncertainty figure, in percentage, should be entered here. The prover will continue to perform runs until either the desired uncertainty is reached or the number of runs reaches the Maximum (this is fixed at 30 runs).
Meter Factor Deviation Check	Set between Disabled and Enabled.

Allowable Meter Factor Deviation	If the Meter Factor Deviation Check is Enabled, enter the maximum deviation that is allowed.
Pre Prove Checking	See below...

8.1.2.1 Pre Prove Checking

The prove sequence can check for stable conditions. This is done be Enabling the Pre Prove Checking option, as detailed below.

Pre Prove Checking	If set to Enabled, before the prove runs are performed, the following checks are made. If set to Disabled, this stage is skipped.
Pre Prove Wait Time	This is the maximum time, in seconds, the stage allows to meet the limits set below. If the process conditions are not within the limits after this time, the current prove will be aborted.
Pre Prove Hold Time	This is time, in seconds, the limits below are checked against the live values to ensure stable conditions. If the process conditions fall outside the limits during this time, the current prove will be aborted.

Allowable Temp Deviation (Master Meter vs Meter Under Test)	This is the maximum difference (during the Pre Prove checks) allowed between the Master Meter Temperature and the Meter Under Test Temperature.
Allowable Pressure Deviation (Master Meter vs Meter Under Test)	This is the maximum difference (during the Pre Prove checks) allowed between the Master Meter Pressure and the Meter Under Test Pressure.
Pre Prove Check Status	This is the overall status of the Pre Prove Checks. The status options are; **Idle –** The Status is Idle when either the Pre Prove Checks are Disabled or they are not currently running **Achieved –** The status will show as Achieved if the Pre Prove Checks are running and the process values are within the specified limits. **Not Achieved –** The status will briefly show as Not Achieved if the Pre Prove Checks are running and the process values are not within the specified limits. This changes back to Idle as the prove will abort.
Temperature Pre Prove Check Status	This is the status of the Pre Prove Checks for temperature. The status options are the same as for *Pre Prove Check Status* above.
Pressure Pre Prove Check Status	This is the status of the Pre Prove Checks for pressure. The status options are the same as for *Pre Prove Check Status* above.

8.1.3 Master Meter Temperature

Master Meter Temperature In Use	94.8 °F
Master Meter Temperature 4mA Scale Value	0.0 °F
Master Meter Temperature 20mA Scale Value	100.0 °F
Master Meter Temperature Operating Status	Measured
Master Meter Temperature Automatically Recover to Measured	Yes
Master Meter Temperature Override Value	60.0 °F
Master Meter Temperature Default Value	55.0 °F
Master Meter Temperature Transmitter Value with Bias	94.8 °F
Master Meter Temperature Bias Value	0.0 °F
Master Meter Temperature Transmitter Value no Bias	94.8 °F
Master Meter Temperature - Raw Transmitter Value	19.1672 mA
Master Meter Temperature Low Alarm Limit	-99999999.0 °F
Master Meter Temperature High Alarm Limit	99999999.0 °F
Master Meter Temperature User 1 Low Alarm Limit	-99999999.0 °F
Master Meter Temperature User 1 High Alarm Limit	99999999.0 °F
Master Meter Temperature User 2 Low Alarm Limit	-99999999.0 °F
Master Meter Temperature User 2 High Alarm Limit	99999999.0 °F
Low Input Fail Point	3.5 mA
High Input Fail Point	20.5 mA

If the system has a measured Master Meter temperature configured and has been set to 4-20mA, the Master Meter Temperature menu will be similar to that shown on the previous page.

Master Meter Temperature In Use	This display point shows the temperature being used in the calculations, FWA & reports. This may be a live value, a manual override value or a (fail-over) default.
Master Meter Temperature 4mA Scale Value	This point indicates the temperature represented by 4mA. Clicking this line opens the dialog box allowing an alternative temperature to be input. **NOTE:** If the ***Master Meter Temperature Type*** was set as RTD or Thermistor, the point will not appear since the RTD & Thermistor give a direct temperature reading.
Master Meter Temperature 20mA Scale Value	This point indicates the temperature represented by 20mA. Clicking the line opens the dialog box allowing a different temperature to be input. **NOTE:** If the ***Master Meter Temperature Type*** was set as RTD or Thermistor, the point will not appear since the RTD & Thermistor give a direct temperature reading.
Master Meter Temperature Operating Status	This point indicates the current operating mode. Clicking the line opens the dialog box allowing the user to select which of the 3 modes to select: **Always Measured** Uses the calculated value from the measured input regardless of it being within acceptable limits or not. **Always Override** Uses the Override value at all times. **Use Default on Failure** Uses the calculated value from the measured input unless it is either lower than the ***Low Input Fail Point*** or higher than the ***High Input Fail Point***, in which case it would use the ***Master Meter Temperature Default Value***.
Master Meter Temperature Automatically Recover to Measured	If Yes is selected, then once the measured value is between the low and high Input Fail Points the measured value will be used instead of the fail-over default value. If No has been selected, then the fail-over default value will continue to be used even when a valid reading is available. Once the fault has been resolved, an engineer can reset the mode to Measured by using the Recover button as detailed below.
Master Meter Temperature Manually Recover to Measured	If the ***Master Meter Temperature Automatically Recover to Measured*** option above is set to No, then once the measured value is between the low and high Input Fail Points this line will appear. To reset the mode to Measured, press the Recover button shown.
Master Meter Temperature Override Value	This is the value used when the ***Master Meter Temperature Operating Status*** has been set to Always Override. If no transmitter has been assigned to the Master Meter Temperature, this override value is always used.

Master Meter Temperature Default Value	This is the value used when the **Master Meter Temperature Operating Status** has been set to Use Default on Failure, and the measured value is NOT between the low and high Input Fail Points.
Master Meter Temperature Transmitter Value with Bias	This is the sum of the **Master Meter Temperature Transmitter Value** and the **Master Meter Temperature Transmitter no Bias Value**.
Master Meter Temperature Bias Value	This is the Bias or Offset value that is being applied to the measured value.
Master Meter Temperature Transmitter Value no Bias	This point displays the live measured temperature value. This item is for information only and cannot be edited.
Master Meter Temperature - Raw Transmitter Value	This shows the instantaneous current flow from the 4-20mA Transmitter. This is NOT shown if a direct transmitter such as RTD or Thermistor is used.
Master Meter Temperature Low Alarm Limit	This point shows the currently configured Low Alarm limit. If the **Master Meter Temperature In Use** goes below the configured value the Low Temperature Alarm will be raised.
	Clicking the line opens the Edit Value dialog box, allowing the user to choose a different value. If an impossibly low default value is used, no Low Temperature Alarm will ever be raised.
Master Meter Temperature High Alarm Limit	This point shows the currently configured High Alarm limit. If the **Master Meter Temperature In Use** goes above the configured value then the High Temperature Alarm will be raised.
	Clicking the line opens the Edit Value dialog box, allowing the use to choose a different value. If an impossibly high default value is used, no High Temperature Alarm will ever be raised.
Master Meter Temperature User 1 Low Alarm Limit	If the **Master Meter Temperature In Use** goes below the User 1 Low Alarm Limit the User 1 Alarm will be set.
Master Meter Temperature User 1 High Alarm Limit	If the **Master Meter Temperature In Use** goes above the User 1 High Alarm Limit the User 1 Alarm will be set.
Master Meter Temperature User 2 Low Alarm Limit	If the **Master Meter Temperature In Use** goes below the User 2 Low Alarm Limit the User 2 Alarm will be set.
Master Meter Temperature User 2 High Alarm Limit	If the **Master Meter Temperature In Use** goes above the User 2 High Alarm Limit the User 2 Alarm will be set.

Low Input Fail Point	If the ***Master Meter Temperature - Raw Transmitter Value*** goes below the ***Low Input Fail Point*** and the ***Master Meter Temperature Operating Status*** is set to Use Default on Failure then the ***Master Meter Temperature In Use*** will be the fail-over ***Master Meter Temperature Default Value***.
	In 4-20mA mode this value will be 3.5mA by default.
	If the Measured Temperature Type was set as RTD then this will be 60 Ohms, as standard and in Thermistor mode it will 3.5mA as standard. Clicking the line opens the Edit Value dialog box, allowing the user to input a different value.
High Input Fail Point	If the ***Master Meter Temperature - Raw Transmitter Value*** goes above the ***High Input Fail Point*** and the ***Master Meter Temperature Operating Status*** is set to Use Default on Failure, then the ***Master Meter Temperature In Use*** will be the fail-over ***Master Meter Temperature Default Value***.
	In 4-20 mA mode this value will be 20.5mA by default.
	If the Measured Temperature Type was set as RTD, then this will be 180 Ohms as standard and 18mA in Thermistor mode. Clicking the line opens the Edit Value dialog box, allowing the user to input a different value.

8.1.4 Master Meter Pressure

Master Meter Pressure In Use	11.566 psig
Master Meter Pressure 4mA Scale Value	0.000 psig
Master Meter Pressure 20mA Scale Value	20.000 psig
Master Meter Pressure Operating Status	Measured
Master Meter Pressure Automatically Recover to Measured	Yes
Master Meter Pressure Override Value	10.000 psig
Master Meter Pressure Default Value	8.000 psig
Master Meter Pressure Transmitter Value with Bias	11.566 psig
Master Meter Pressure Bias Value	0.000 psig
Master Meter Pressure Transmitter Value no Bias	11.566 psig
Master Meter Pressure - Raw Transmitter Value	13.2527 mA
Master Meter Pressure Low Alarm Limit	-99999999.000 psig
Master Meter Pressure High Alarm Limit	99999999.000 psig
Master Meter Pressure User 1 Low Alarm Limit	-99999999.000 psig
Master Meter Pressure User 1 High Alarm Limit	99999999.000 psig
Master Meter Pressure User 2 Low Alarm Limit	-99999999.000 psig
Master Meter Pressure User 2 High Alarm Limit	99999999.000 psig
Low Input Fail Point	3.5 mA
High Input Fail Point	20.5 mA

If the system has a measured Master Meter Pressure configured (see I/O Assignments – Process Inputs) the settings menu will show an item for Master Meter Pressure. If no measured Master Meter Pressure

is configured then an Override Master Meter Pressure is used.

Display points associated with the Master Meter Pressure are shown on the previous page.

Master Meter Pressure In Use	This display point shows the pressure being used in the calculations, FWA & reports. This may be a live value, a manual override value or a (fail-over) default.
Master Meter Pressure 4mA Scale Value	This point indicates the pressure represented by 4mA. Clicking the line opens the dialog box allowing an alternative pressure to be input.
Master Meter Pressure 20mA Scale Value	This point indicates the pressure represented by 20mA. Clicking the line opens the dialog box allowing a different pressure to be input.
Master Meter Pressure Operating Status	This point indicates the current operating mode. Clicking the line opens the dialog box allowing the user to select which of the 3 modes. **Always Measured** Uses the calculated value from the measured input regardless of it being within acceptable limits or not. **Always Override** Uses the Override value at all times. **Use Default on Failure** Uses the calculated value from the measured input unless it is either lower than the **Low Input Fail Point** or higher than the **High Input Fail Point**, in which case it would use the **Master Meter Pressure Default Value**.
Master Meter Pressure Automatically Recover to Measured	If Yes is selected, once the measured value is between the low and high Input Fail Points the measured value will be used instead of the fail-over default value. If No has been selected, the fail-over default value will continue to be used even when a valid reading is available. Once the fault has been resolved, an engineer can reset the mode to measured by changing the **Master Meter Pressure Operating Status** selection.
Master Meter Pressure Override Value	This is the value used when **Master Meter Pressure Operating Status** has been set to Always Override. If no transmitter has been assigned to the Master Meter Pressure, this override value is always used.
Master Meter Pressure Default Value	This is the value used when the **Master Meter Pressure Operating Status** has been set to Use Default on Failure, and the measured value is NOT between the low and high Input Fail Points.
Master Meter Pressure Transmitter Value with Bias	This is the sum of the **Master Meter Pressure Bias Value** and the **Master Meter Pressure Bias Value**.
Master Meter Pressure Bias Value	This is the Bias or Offset value that is being applied to the measured value.

Master Meter Pressure Transmitter Value (No Bias)	This point displays the live measured Pressure value. This item cannot be edited.
Master Meter Pressure - Raw Transmitter Value	This shows the instantaneous current flow from the 4-20mA Transmitter.
Master Meter Pressure Low Alarm Limit	This point shows the currently configured Low Alarm limit. If the measured Pressure goes below the configured value, the Low Pressure Alarm will be raised. Clicking the line opens the Edit Value dialog box allowing the user to choose a different value. If an impossibly low default value is used, no Low Pressure Alarm will ever be raised.
Master Meter Pressure High Alarm Limit	This point shows the currently configured High Alarm limit. If the measured Pressure goes above the configured value the High Pressure Alarm will be raised. Clicking the line opens the Edit Value dialog box, allowing the user to choose a different value. If an impossibly high default value is used, no High Pressure Alarm will ever be raised.
Master Meter Pressure User 1 Low Alarm Limit	If the **Master Meter Pressure In Use** goes below the User 1 Low Alarm Limit, the User 1 Alarm will be set.
Master Meter Pressure User 1 High Alarm Limit	If the **Master Meter Pressure In Use** goes above the User 1 High Alarm Limit, the User 1 Alarm will be set.
Master Meter Pressure User 2 Low Alarm Limit	If the **Master Meter Pressure In Use** goes below the User 2 Low Alarm Limit, the User 2 Alarm will be set.
Master Meter Pressure User 2 High Alarm Limit	If the **Master Meter Pressure In Use** goes above the User 2 High Alarm Limit, the User 2 Alarm will be set.
Low Input Fail Point	If the **Master Meter Pressure - Raw Transmitter Value** goes below the **Low Input Fail Point** and the **Master Meter Pressure Operating Status** is set to Use Default on Failure then the **Master Meter Pressure In Use** will be the fail-over **Master Meter Pressure Default Value**. As standard this value will be 3.5mA. Clicking the line opens the Edit Value dialog box, allowing the user to input a different value.
High Input Fail Point	If the **Master Meter Pressure - Raw Transmitter Value** goes above the **High Input Fail Point** and the **Master Meter Pressure Operating Status** is set to Use Default on Failure then the **Master Meter Pressure In Use** will be the fail-over **Master Meter Pressure Default Value**. As standard this value will be 20.5mA. Clicking the line opens the Edit Value dialog box, allowing the user to input a different value.

8.1.5 Master Meter – Meter Body Corrections

Temperature and Pressure have a very small effect on the measurement made by the meter. Some meters correct for this internally however for those meters that do not, this option is available if required.

Enable Master Meter Body Corrections	This is a Yes or No choice on radio buttons. If No is selected, no compensation for the effects of temperature or pressure on the body of the Master Meter will be applied and the In Use Master Meter Body Correction field (below) will show 1.000000. If Yes, the calculation for the Body Correction will run.
Cubical Temperature Expansion Coefficient	Enter the thermal expansion value for the Master Meter body in the appropriate temperature units.
Expansion Coefficient Reference Temperature	Enter the reference temperature for the Master Meter body being proved.
Master Meter Temperature	This is for information only, and shows the current Master Meter Temperature.

Cubical Pressure Expansion Coefficient	Enter the Pressure expansion coefficient for the Master Meter body in the appropriate pressure units.
Expansion Coefficient Reference Pressure	Enter the reference pressure associated with the Cubical Pressure Expansion Coefficient for the Master Meter body being proved.
Master Meter Pressure	This is for information only, and shows the current Master Meter Pressure.
In Use Master Meter Body Correction	This will show 1.000000 when the Master Meter Body Correction is disabled, and the result of the correction calculation when enabled.
Error Code	This will be a zero unless the meter body correction calculation shows an error with the input data.

8.2　　Meter Under Test Run Setup

This section of the setup configures the Meter Under Test and its process. There are five sub-menus as shown below. Meter Under Test Line Density is only shown if the Proving Mode is Mass to Inferred Mass and the Density Mode is set to Measure Line Density at Meter Under Test in the initial setup menu.

8.2.1　　Meter Under Test Data

The data needed to configure the Meter Under Test depends upon if the meter is a mass meter or a volumetric meter. If the Meter Under Test is a mass meter, then in the initial setup menu, Home ▸ System ▸ Initial Setup ▸ Site/Location Setup then the proving method should be set to Mass to Mass. If the Meter Under Test is a volumetric device, then the proving method should be set to either Mass to Inferred Mass or Volume to Volume mode. See Initial Flow Computer setup to change the setting.

8.2.1.1 Meter Under Test - Mass to Mass Mode

<table>
<tr><td colspan="2" align="center">***Meter Under Test - Mass to Mass Mode Settings***</td></tr>
<tr><td>***Meter Under Test Type***</td><td>In Mass to Mass Proving Mode, this field will always show Mass Meter and is not changeable. See sections Meter Under Test - Mass to Inferred Mass Mode and Meter Under Test - Volume to Volume Mode below for the options in other modes.</td></tr>
<tr><td>***Meter Under Test Meter Serial Number***</td><td>This is an editable field to record the serial number of the meter. This information will be used on reports and can be set and retrieved via communications.</td></tr>
<tr><td>***Meter Under Test Meter Manufacturer***</td><td>This is an editable field to record the manufacturer of the meter. This information will be used on reports and can be set and retrieved via communications.</td></tr>
<tr><td>***Meter Under Test Meter Model***</td><td>This is an editable field to record the model type of the meter. This information will be used on reports and can be set and retrieved via communications.</td></tr>
<tr><td>***Meter Under Test Meter Product Name***</td><td>This is an editable field to record the name of the product. This information will be used on reports and can be set and retrieved via communications.

NOTE: This is just a text field and the name has no influence on the calculations used.</td></tr>
<tr><td>***Meter Under Test Meter Size***</td><td>This is an editable field to record the size of the meter. This information will be used on reports and can be set and retrieved via communications.</td></tr>
<tr><td>***Meter Under Test Mass K Factor***</td><td>The Meter Under Test Mass K factor is entered here, the units will be pulses per mass, The mass unit is set in Home ▸ System ▸ Measurement Units.</td></tr>
</table>

8.2.1.2   Meter Under Test - Mass to Inferred Mass Mode

Meter Under Test - Mass to Inferred Mass Mode Settings	
Meter Under Test Type	This is selectable, with five choices on radio buttons. The information is only used for the reports. The options are: Coriolis, Turbine, PD, Ultrasonic or Other.
Meter Under Test Meter Serial Number	This is an editable field to record the serial number of the meter. This information will be used on reports and can be set and retrieved via communications.
Meter Under Test ID/Tag	This is an editable field to record the ID or Tag of the meter. This information will be used on reports and can be set and retrieved via communications.
Meter Under Test Meter Manufacturer	This is an editable field to record the manufacturer of the meter. This information will be used on reports and can be set and retrieved via communications.
Meter Under Test Meter Model	This is an editable field to record the model type of the meter. This information will be used on reports and can be set and retrieved via communications.

Meter Under Test Meter Product Name	This is an editable field to record the name of the product. This information will be used on reports and can be set and retrieved via communications. **NOTE:** This is just a text field and the name has no influence on the liquid Volume Correction calculations used.
Meter Under Test Meter Size	This is an editable field to record the size of the meter. This information will be used on reports and can be set and retrieved via communications.
Meter Under Test Rounding	This field is used to enable (On) or disable (Off) the rounding control for the Liquid Volume Correction calculations. When On is selected, rounding will be to API specifications.
Meter Under Test Reference Temperature	This field is used to select the reference temperature for the Liquid Volume Correction calculations and is dependent on the Calculation Standards in Site/Location Setup. **US Customary -** fixed at 60°F. **Metric** - selectable by radio buttons between 15°C and 20°C.
Meter Under Test Mass K Factor	The Meter Under Test Mass K factor is entered here, and the units will be pulses per volume, The volume unit is set in Home ▸ System ▸ Measurement Units.
Meter Under Test Vapor Pressure Calculation Mode	This point indicates the calculation mode. Clicking the line opens the dialog box allowing the user to select which of the 3 modes. **Use Override Vapor Pressure** Uses a fixed value of Vapor Pressure, which is entered below. **Calculate Vapor Pressure** Calculates and uses the Vapor Pressure in accordance with API TP-15. **Calculate Vapor Pressure (Extended Limits)** Calculates and uses the Vapor Pressure from API TP-15, however extends the allowable density and temperature range.
Meter Under Test Override Vapor Pressure (Pe)	This is the value used when the *Meter Under Test Vapor Pressure Calculation Mode* above is set to **Use Override Vapor Pressure**.
Meter Under Test Base Density	This is only displayed and can only be entered when the *Density Mode* in Site/Location Setup is set to **Use Base Density**.

8.2.1.3　Meter Under Test - Volume to Volume Mode

Home ‣ System ‣ Meter Under Test Run Setup ‣ Meter Under Test Data

Meter Under Test Type		
	Coriolis	⚙

Meter Under Test Meter Serial Number	⚙	Meter Under Test ID/Tag	⚙
ABC123		Meter Under Test ID/Tag	

Meter Under Test Meter Manufacturer	⚙	Meter Under Test Meter Model	⚙
A.N.Other		XYZ	

Meter Under Test Meter Product Name	⚙	Meter Under Test Meter Size	⚙
Crude		4 Inch	

Meter Under Test Rounding Control		⚙
	On	

Meter Under Test Reference Temperature		⚙
	20°C	

Meter Under Test Volume K Factor		⚙
	1000 pulses/m3	

Meter Under Test Calculation Type		⚙
	2012 API Ch11.1 (Crude Oil)	

Meter Under Test Vapor Pressure Calculation Mode		⚙
	Use Override Vapor Pressure	

Meter Under Test Override Vapor Pressure (Pe)		⚙
	0.00 psia	

Meter Under Test Base Density		⚙
	750.00000 lbs/US Gallon	

Meter Under Test - Volume to Volume Mode Settings	
Meter Under Test Type	This is selectable, with five choices on radio buttons. The information is only used for the reports. The options are: Coriolis, Turbine, PD, Ultrasonic or Other.
Meter Under Test Meter Serial Number	This is an editable field to record the serial number of the meter. This information will be used on reports and can be set and retrieved via communications.
Meter Under Test ID/Tag	This is an editable field to record the ID or Tag of the meter. This information will be used on reports and can be set and retrieved via communications.
Meter Under Test Meter Manufacturer	This is an editable field to record the manufacturer of the meter. This information will be used on reports and can be set and retrieved via communications.
Meter Under Test Meter Model	This is an editable field to record the model type of the meter. This information will be used on reports and can be set and retrieved via communications.
Meter Under Test Meter Product Name	This is an editable field to record the name of the product. This information will be used on reports and can be set and retrieved via communications. **NOTE:** This is just a text field and the name has no influence on the liquid Volume Correction calculations used.
Meter Under Test Meter Size	This is an editable field to record the size of the meter. This information will be used on reports and can be set and retrieved via communications.
Meter Under Test Rounding	This field is used to enable (On) or disable (Off) the rounding control for the Liquid Volume Correction calculations. When On is selected, rounding will be to API specifications.
Meter Under Test Reference Temperature	This field is used to select the reference temperature for the Liquid Volume Correction calculations and is dependent on the Calculation Standards in Site/Location Setup. **US Customary** - fixed at 60°F. **Metric** - selectable by radio buttons between 15°C and 20°C.
Meter Under Test Mass K Factor	The Meter Under Test Mass K factor is entered here, and the units will be pulses per volume, The volume unit is set in Home ▸ System ▸ Measurement Units.
Meter Under Test Vapor Pressure Calculation Mode	This point indicates the calculation mode. Clicking the line opens the dialog box allowing the user to select which of the 3 modes. **Use Override Vapor Pressure** Uses a fixed value of Vapor Pressure, which is entered below. **Calculate Vapor Pressure** Calculates and uses the Vapor Pressure in accordance with API TP-15. **Calculate Vapor Pressure (Extended Limits)** Calculates and uses the Vapor Pressure from API TP-15, however extends the allowable density and temperature range.

Meter Under Test Override Vapor Pressure (Pe)	This is the value used when the *Meter Under Test Vapor Pressure Calculation Mode* above is set to **Use Override Vapor Pressure**.
Meter Under Test Base Density	This is only displayed and can only be entered when the *Density Mode* in Site/Location Setup is set to **Use Base Density**.

8.2.2 Meter Under Test Temperature

Meter Under Test Temperature In Use	86.6 °F
Meter Under Test Temperature Operating Status	Measured
Meter Under Test Temperature Automatically Recover to Measured	Yes
Meter Under Test Temperature Override Value	60.0 °F
Meter Under Test Temperature Default Value	45.0 °F
Meter Under Test Temperature Transmitter Value with Bias	86.6 °F
Meter Under Test Temperature Bias Value	10.0 °F
Meter Under Test Temperature Transmitter Value no Bias	76.6 °F
Meter Under Test Temperature - Raw Transmitter Value	109.6483 Ω
Meter Under Test Temperature Low Alarm Limit	-99999999.0 °F
Meter Under Test Temperature High Alarm Limit	99999999.0 °F
Meter Under Test Temperature User 1 Low Alarm Limit	-99999999.0 °F
Meter Under Test Temperature User 1 High Alarm Limit	99999999.0 °F
Meter Under Test Temperature User 2 Low Alarm Limit	-99999999.0 °F
Meter Under Test Temperature User 2 High Alarm Limit	99999999.0 °F
Low Input Fail Point	60 Ω
High Input Fail Point	180 Ω

Meter Under Test Temperature In Use	This display point shows the temperature being used in the calculations and reports. This may be a live value, a manual override value or a (fail-over) default.
Meter Under Test Temperature 4mA Scale Value	This point indicates the temperature represented by 4mA. Clicking this line opens the dialog box allowing an alternative temperature to be input. **NOTE:** If the **Meter Under Test Temperature Type** was set as RTD or Thermistor, the point will not appear since the RTD & Thermistor give a direct temperature reading.
Meter Under Test Temperature 20mA Scale Value	This point indicates the temperature represented by 20mA. Clicking the line opens the dialog box allowing a different temperature to be input. **NOTE:** If the **Meter Under Test Temperature Type** was set as RTD or Thermistor, the point will not appear since the RTD & Thermistor give a direct temperature reading.
Meter Under Test Temperature Operating Status	This point indicates the current operating mode. Clicking the line opens the dialog box allowing the user to select which of the 3 modes to select: **Always Measured** Uses the calculated value from the measured input regardless of it being within acceptable limits or not. **Always Override** Uses the Override value at all times. **Use Default on Failure** Uses the calculated value from the measured input unless it is either lower than the **Low Input Fail Point** or higher than the **High Input Fail Point**, in which case it would use the **Meter Under Test Temperature Default Value.**
Meter Under Test Temperature Automatically Recover to Measured	If Yes is selected, then once the measured value is between the low and high Input Fail Points the measured value will be used instead of the fail-over default value. If No has been selected, then the fail-over default value will continue to be used even when a valid reading is available. Once the fault has been resolved, an engineer can reset the mode to measured by changing the **Meter Under Test Temperature Operating Status** selection.
Meter Under Test Temperature Override Value	This is the value used when the **Meter Under Test Temperature Operating Status** has been set to Always Override. If no transmitter has been assigned to the Meter Under Test Temperature, this override value is always used.
Meter Under Test Temperature Default Value	This is the value used when the **Meter Under Test Temperature Operating Status** has been set to Use Default on Failure, and the measured value is NOT between the low and high Input Fail Points.
Meter Under Test Temperature Transmitter Value with Bias	This is the sum of the **Meter Under Test Temperature Transmitter Value** and the **Meter Under Test Temperature Bias Value**.

Meter Under Test Temperature Bias Value	This is the Bias or Offset value that is being applied to the measured value.
Meter Under Test Temperature Transmitter Value (No Bias)	This point displays the live measured temperature value. This item is for information only and cannot be edited.
Meter Under Test Temperature - Raw Transmitter Value	This shows the instantaneous current flow from the 4-20mA Transmitter. This is NOT shown if a direct transmitter such as RTD or Thermistor is used.
Meter Under Test Temperature Low Alarm Limit	This point shows the currently configured Low Alarm limit. If the **Meter Under Test Temperature In Use** goes below the configured value the Low Temperature Alarm will be raised. Clicking the line opens the Edit Value dialog box, allowing the user to choose a different value. If an impossibly low default value is used, no Low Temperature Alarm will ever be raised.
Meter Under Test Temperature High Alarm Limit	This point shows the currently configured High Alarm limit. If the **Meter Under Test Temperature In Use** goes above the configured value then the High Temperature Alarm will be raised. Clicking the line opens the Edit Value dialog box, allowing the use to choose a different value. If an impossibly high default value is used, no High Temperature Alarm will ever be raised.
Meter Under Test Temperature User 1 Low Alarm Limit	If the **Meter Under Test Temperature In Use** goes below the User 1 Low Alarm Limit the User 1 Alarm will be set.
Meter Under Test Temperature User 1 High Alarm Limit	If the **Meter Under Test Temperature In Use** goes above the User 1 High Alarm Limit the User 1 Alarm will be set.
Meter Under Test Temperature User 2 Low Alarm Limit	If the **Meter Under Test Temperature In Use** goes below the User 2 Low Alarm Limit the User 2 Alarm will be set.
Meter Under Test Temperature User 2 High Alarm Limit	If the **Meter Under Test Temperature In Use** goes above the User 2 High Alarm Limit the User 2 Alarm will be set.
Low Input Fail Point	If the **Meter Under Test Temperature - Raw Transmitter Value** goes below the **Low Input Fail Point** and the **Meter Under Test Temperature Operating Status** is set to Use Default on Failure then the **Meter Under Test Temperature In Use** will be the fail-over **Meter Under Test Temperature Default Value**. In 4-20mA mode this value will be 3.5mA by default. If the Meter Under Test Temperature Type was set as RTD then this will be 60 Ohms as standard and in Thermistor mode it will 3.5mA as standard. Clicking the line opens the Edit Value dialog box, allowing the user to input a different value.

High Input Fail Point	If the **Meter Under Test Temperature - Raw Transmitter Value** goes above the **High Input Fail Point** and the **Meter Under Test Temperature Operating Status** is set to Use Default on Failure, then the **Meter Under Test Temperature In Use** will be the fail-over **Meter Under Test Temperature Default Value**.
	In 4-20 mA mode this value will be 20.5mA by default.
	If the Meter Under Test Temperature Type was set as RTD, then this will be 180 Ohms as standard and 18mA in Thermistor mode as standard. Clicking the line opens the Edit Value dialog box, allowing the user to input a different value.

8.2.3 Meter Under Test Pressure

Meter Under Test Pressure In Use	10.000 psig
Meter Under Test Pressure 4mA Scale Value	0.000 psig ⚙
Meter Under Test Pressure 20mA Scale Value	20.000 psig ⚙
Meter Under Test Pressure Operating Status	Override ⚙
Meter Under Test Pressure Automatically Recover to Measured	Yes ⚙
Meter Under Test Pressure Override Value	10.000 psig ⚙
Meter Under Test Pressure Default Value	11.000 psig ⚙
Meter Under Test Pressure Transmitter Value with Bias	11.126 psig
Meter Under Test Pressure Bias Value	0.000 psig ⚙
Meter Under Test Pressure Transmitter Value no Bias	11.126 psig
Meter Under Test Pressure - Raw Transmitter Value	12.9009 mA
Meter Under Test Pressure Low Alarm Limit	-99999999.000 psig ⚙
Meter Under Test Pressure High Alarm Limit	99999999.000 psig ⚙
Meter Under Test Pressure User 1 Low Alarm Limit	-99999999.000 psig ⚙
Meter Under Test Pressure User 1 High Alarm Limit	99999999.000 psig ⚙
Meter Under Test Pressure User 2 Low Alarm Limit	-99999999.000 psig ⚙
Meter Under Test Pressure User 2 High Alarm Limit	99999999.000 psig ⚙
Low Input Fail Point	3.5 mA ⚙
High Input Fail Point	20.5 mA ⚙

Meter Under Test Pressure In Use	This display point shows the pressure being used in the calculations, FWA & reports. This may be a live value, a manual override value or a (fail-over) default.
Meter Under Test Pressure 4mA Scale Value	This point indicates the pressure represented by 4mA. Clicking the line opens the dialog box allowing an alternative pressure to be input.
Meter Under Test Pressure 20mA Scale Value	This point indicates the pressure represented by 20mA. Clicking the line opens the dialog box allowing a different pressure to be input.
Meter Under Test Pressure Operating Status	This point indicates the current operating mode. Clicking the line opens the dialog box allowing the user to select which of the 3 modes. **Always Measured** Uses the calculated value from the measured input regardless of it being within acceptable limits or not. **Always Override** Uses the Override value at all times. **Use Default on Failure** Uses the calculated value from the measured input unless it is either lower than the **Low Input Fail Point** or higher than the **High Input Fail Point**, in which case it would use the **Meter Under Test Pressure Default Value**.
Meter Under Test Pressure Automatically Recover to Measured	If Yes is selected, once the measured value is between the low and high Input Fail Points the measured value will be used instead of the fail-over default value. If No has been selected, the fail-over default value will continue to be used even when a valid reading is available. Once the fault has been resolved, an engineer can reset the mode to measured by changing the **Meter Under Test Pressure Operating Status** selection.
Meter Under Test Pressure Override Value	This is the value used when **Meter Under Test Pressure Operating Status** has been set to Always Override. If no transmitter has been assigned to the Meter Under Test Pressure, this override value is always used.
Meter Under Test Pressure Default Value	This is the value used when the **Meter Under Test Pressure Operating Status** has been set to Use Default on Failure, and the measured value is NOT between the low and high Input Fail Points.
Meter Under Test Pressure Transmitter Value with Bias	This is the sum of the **Meter Under Test Pressure Bias Value** and the **Meter Under Test Pressure Bias Value**.
Meter Under Test Pressure Bias Value	This is the Bias or Offset value that is being applied to the measured value.
Meter Under Test Pressure Transmitter Value (No Bias)	This point displays the live measured Pressure value. This item cannot be edited.
Meter Under Test Pressure - Raw Transmitter Value	This shows the instantaneous current flow from the 4-20mA Transmitter.

Meter Under Test Pressure Low Alarm Limit	This point shows the currently configured Low Alarm limit. If the measured Pressure goes below the configured value, the Low Pressure Alarm will be raised. Clicking the line opens the Edit Value dialog box allowing the user to choose a different value. If an impossibly low default value is used, no Low Pressure Alarm will ever be raised.
Meter Under Test Pressure High Alarm Limit	This point shows the currently configured High Alarm limit. If the measured Pressure goes above the configured value the High Pressure Alarm will be raised. Clicking the line opens the Edit Value dialog box, allowing the user to choose a different value. If an impossibly high default value is used, no High Pressure Alarm will ever be raised.
Meter Under Test Pressure User 1 Low Alarm Limit	If the **Meter Under Test Pressure In Use** goes below the User 1 Low Alarm Limit, the User 1 Alarm will be set.
Meter Under Test Pressure User 1 High Alarm Limit	If the **Meter Under Test Pressure In Use** goes above the User 1 High Alarm Limit, the User 1 Alarm will be set.
Meter Under Test Pressure User 2 Low Alarm Limit	If the **Meter Under Test Pressure In Use** goes below the User 2 Low Alarm Limit, the User 2 Alarm will be set.
Meter Under Test Pressure User 2 High Alarm Limit	If the **Meter Under Test Pressure In Use** goes above the User 2 High Alarm Limit, the User 2 Alarm will be set.
Duty Low Input Fail Point	If the **Meter Under Test Pressure - Raw Transmitter Value** goes below the **Low Input Fail Point** and the **Meter Under Test Pressure Operating Status** is set to Use Default on Failure then the **Meter Under Test Pressure In Use** will be the fail-over **Meter Under Test Pressure Default Value**. As standard this value will be 3.5mA. Clicking the line opens the Edit Value dialog box, allowing the user to input a different value.
Duty High Input Fail Point	If the **Meter Under Test Pressure - Raw Transmitter Value** goes above the **High Input Fail Point** and the **Meter Under Test Pressure Operating Status** is set to Use Default on Failure then the **Meter Under Test Pressure In Use** will be the fail-over **Meter Under Test Pressure Default Value**. As standard this value will be 20.5mA. Clicking the line opens the Edit Value dialog box, allowing the user to input a different value.

8.2.4 Meter Under Test Line Density

The density setting menu is a large menu, so has been shown in two sections. The screenshot shown below, shows only the top half of the menu.

Meter Under Test Line Density	The value in this field is either the *Meter Under Test Densitometer* **Override Value**, the *Meter Under Test Densitometer* **Default Valu**e or the **Meter Under Test Density Transmitter Valu**e, depending upon the Operating Status in use.
DCF/DMF	The DCF/DMF value is usually derived from a Pycnometer reading and is used to correct for measurement errors in the Density meter.
Meter Under Test Densitometer 4mA Scale Value	This point indicates the density represented by 4mA. Clicking this line opens the dialog box allowing an alternative density to be input. **NOTE**: This line is only displayed if the Densitometer source is an analog.
Meter Under Test Densitometer 20mA Scale Value	This point indicates the density represented by 20mA. Clicking the line opens the dialog box allowing a different density to be input. **NOTE**: This line is only displayed if the Densitometer source is an analog.
Meter Under Test Densitometer Operating Status	This point indicates the current operating mode. Clicking the line opens the dialog box allowing the user to select which of the 3 modes to select: **Always Measured** Uses the calculated value from the measured input regardless of it being within acceptable limits or not. **Always Override** Uses the Override value at all times. **Use Default on Failure** Uses the calculated value from the measured input unless it is either lower than the **Low Input Fail Point** or higher than the **High Input Fail Point**, in which case it would use the **Densitometer Default Value**.
Meter Under Test Densitometer Automatically Recover to Measured	If Yes is selected, once the measured value is between the low and high Input Fail Points, the measured value will be used instead of the fail-over default value. If No has been selected the fail-over default value will continue to be used even when a valid reading is available. Once the fault has been resolved, an engineer can reset the mode to measured by changing the **Densitometer Operating Status** selection. **NOTE:** This menu item is only visible if an analog Densitometer is in use.
Meter Under Test Densitometer Override Value	This is the value used when **Densitometer Operating Status** has been set to Always Override.
Meter Under Test Densitometer Default Value	This is the value used when the **Densitometer Operating Status** has been set to Use Default on Failure, and the measured value is NOT between the low and high Input Fail Points.
Meter Under Test Densitometer Transmitter Value	The value shown in this field is the output of the Densitometer calculation compensated for the effects of temperature and pressure on the densitometer body (Solatron calculation) and multiplied by the DCF/DMF value.

Meter Under Test Densitometer - Raw Transmitter Value	In period mode, this field will show the period of the selected input in microseconds. If Density Source was selected as an Analog Input it will show the equivalent current scaled 4-20mA.
Meter Under Test Density Low Alarm Limit	If the **Density at Meter** goes below the configured value, the Low Temperature Alarm will be raised. Clicking the line opens the Edit Value dialog box, allowing the user to choose a different value. If an impossibly low default value is used, no Low Temperature Alarm will ever be raised.
Meter Under Test Density High Alarm Limit	If the **Density at Meter** goes above the configured value, the High Temperature Alarm will be raised. Clicking the line opens the Edit Value dialog box, allowing the use to choose a different value. If an impossibly high default value is used, no High Temperature Alarm will ever be raised.
Meter Under Test Density User 1 Low Alarm Limit	If the **Density at Meter** goes below the User 1 Low Alarm Limit, the User 1 Alarm will be set.
Meter Under Test Density User 1 High Alarm Limit	If the **Density at Meter** goes above the User 1 High Alarm Limit, the User 1 Alarm will be set.
Meter Under Test Density User 2 Low Alarm Limit	If the **Density at Meter** goes below the User 2 Low Alarm Limit, the User 2 Alarm will be set.
Meter Under Test Density User 2 High Alarm Limit	If the **Density at Meter** goes above the User 2 High Alarm Limit, the User 2 Alarm will be set.
Low Input Fail Point	This is set to 3.5mA by default, by can be changed by clicking on the line. **NOTE:** This line is only displayed if the Density source is an analog.
High Input Fail Point	This is set to 20.5mA by default, by can be changed by clicking on the line. **NOTE:** This line is only displayed if the Density source is an analog.
Clamp Low Value	This is the lowest Density value that will be passed forward when Period mode has been selected as the Density Source.
Clamp High Value	This is the highest Density value that will be passed forward when Period mode has been selected as the Density Source.

This completes the top-half of the Meter Under Test Densitometer menu. The bottom-half is shown on the following page.

8.2.4.1 The Bottom - Densitometer Coefficient Configuration

NOTE: The bottom of the menu is only visible when the Densitometer Source is selected as Periodic.

Current Process Units are:-		
Temperature Unit °F	Pressure Unit psi	Density Unit lbs/US Gallon

Meter Under Test Densitometer Constants	
K0	0 ⚙
K1	0.001 ⚙
K2	0 ⚙
K18	0 ⚙
K19	0 ⚙
K20A	0 ⚙
K20B	0 ⚙
K21A	0 ⚙
K21B	0 ⚙

Temperature Unit	This is for information only, as a reminder of the chosen temperature unit so that the correct Densitometer constants, consistent with that unit are entered below.
Pressure Unit	This is for information only, as a reminder of the chosen pressure unit so that the correct Densitometer constants, consistent with that unit are entered below.
Density Unit	This is for information only, as a reminder of the chosen density unit so that the correct Densitometer constants, consistent with that unit are entered below.
K0, K1, K2	These are the Solatron calibration constants. Uncompensated Density is: $$K0 + (K1 * T) + (K2 * T^2)$$ Frequently more than one set of K0, K1 & K2 are provided for different ranges of density.
K18, K19	These are the temperature coefficient used to compensate for the effects of temperature on the Densitometer body.
K20A, K20B, K21A, K21B	These are the pressure coefficient used to compensate for the effects of pressure on the Densitometer body.

8.2.5   Meter Under Test - Meter Body Corrections

Temperature and Pressure have a very small effect on the measurement made by the meter. Some meters correct for this internally however for those meters that do not, this option is available if required.

Enable Meter Under Test Body Corrections	This is a Yes or No choice on radio buttons. If No is selected, no compensation for the effects of temperature or pressure on the body of the Meter Under Test will be applied and the In Use Meter Under Test Body Correction field (below) will show 1.000000. If Yes, the calculation for the Body Correction will run.
Cubical Temperature Expansion Coefficient	Enter the thermal expansion value for the Meter Under Test body in the appropriate temperature units.
Expansion Coefficient Reference Temperature	Enter the reference temperature for the Meter Under Test body being proved
Meter Under Test Temperature	This is for information only, and shows the current Meter Under Test Temperature.

Cubical Pressure Expansion Coefficient	Enter the Pressure expansion coefficient for the Meter Under Test body in the appropriate pressure units.
Expansion Coefficient Reference Pressure	Enter the reference pressure associated with the Cubical Pressure Expansion Coefficient for the Meter Under Test body being proved
Meter Under Test Pressure	This is for information only, and shows the current Meter Under Test Pressure.
In Use Meter Under Test Body Correction	This will show 1.000000 when the Meter Under Test Body Correction is disabled, and the result of the correction calculation when enabled.
Error Code	This will be a zero unless the meter body correction calculation shows an error with the input data

This ends the setup of the Master Meter application

NOTE1: Now would be a good time to back up your changes. With the NÅNOConf tool, Application configurations can be uploaded to the PC for back-up purposes and for cloning more controllers. Additionally, printing a constants log will generate a list of configured data points.

NOTE2: The following information details the Reports generated by the controller, the Logs and trending data provided as well as the diagnostic information available in the Controller.

9 Operating the Master Meter

The Master Meter Prover application can be driven from the web interface or from the local panel interface.

The web interface has a mimic of the Local Panel and can be used instead of a local panel, to support operators or as a training aid.

For driving the local panel, see The Master Meter Local Panel below.

To drive by the web interface, start from the home page and click Site Panel Mimic.

10   The Master Meter Local Panel

The NÅNO can be equipped with a Local Panel for operational purposes. The Local Panel is not intended for configuring the Flow Computer. This is done via the web interface or by down loading a pre-configured image using NÅNOConf.

On the Local Panel (or web mimic) the user will be presented with one of the two screens shown below. In the left hand image, the Run Permit / Interlock Input is not active. In the right hand image, the input is active, and proving can be initiated from either source.
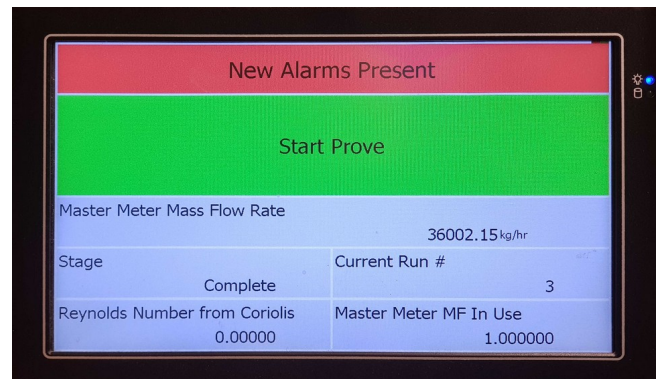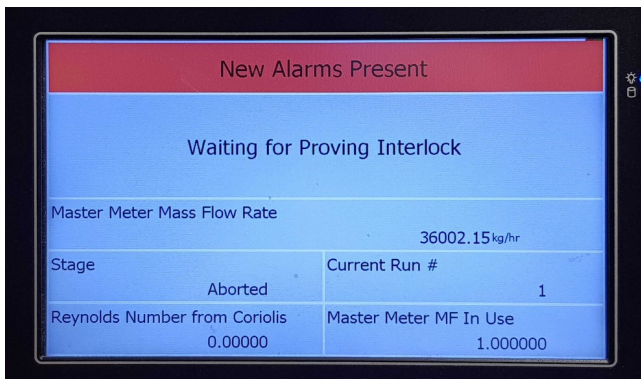
The Operator can start a prove cycle by clicking in the large green colored box. Once a prove has started, the green box will turn red and show Abort Prove, should the operator need to cancel the current prove in progress. Once the prove cycle has completed, the box will return to a green box and the next prove can be requested.

The top line indicates the alarm status, and clicking on the Alarm bar shows the Alarm view as shown below.
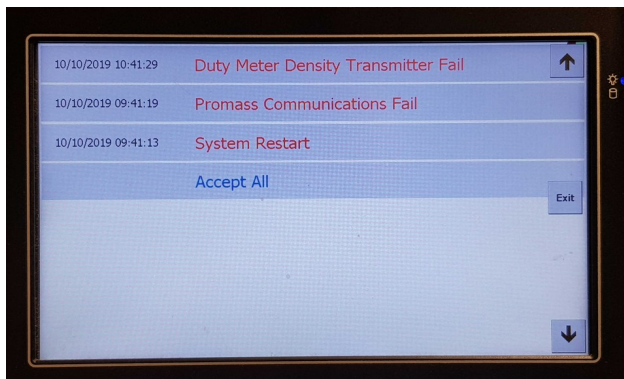
The operator can accept any alarm by clicking on the individual line, or can accept all alarms by clicking the Accept All line.

11   Reports

There are three different sets of reports depending upon Proving Method selected here:

Home ‣ System ‣ Initial Setup ‣ Site/Location Setup

The screenshot below shows the reports when in Mass to Mass mode.
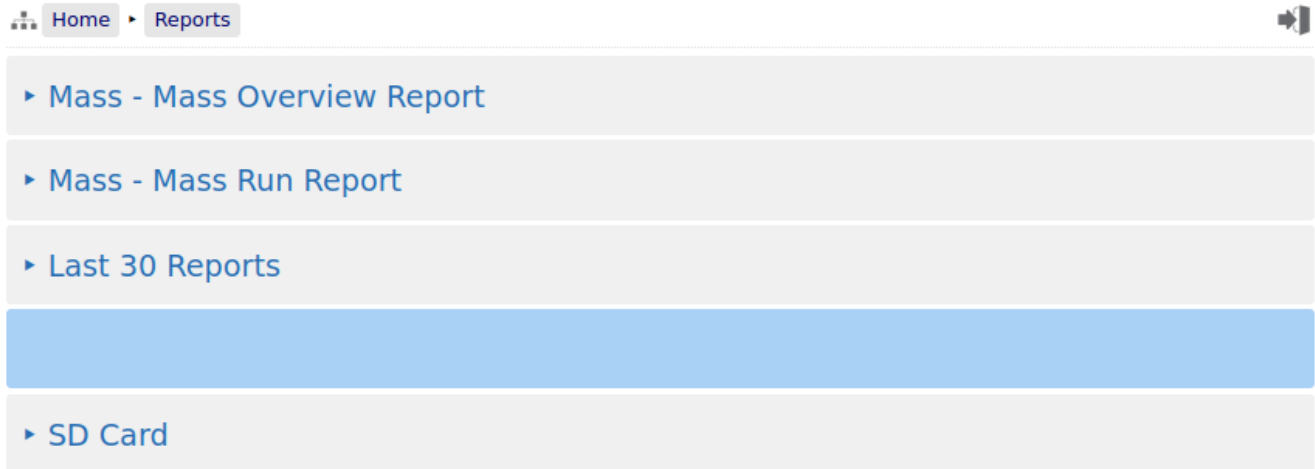
The screenshot below shows the reports when in Mass to Inferred Mass mode.
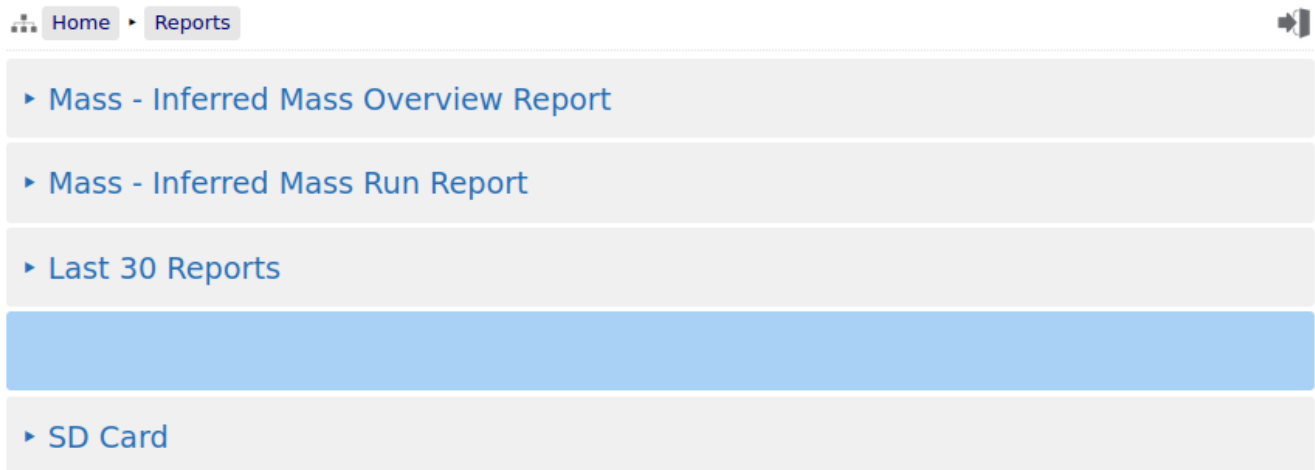
The screenshot below shows the reports when in Volume to Volume mode.
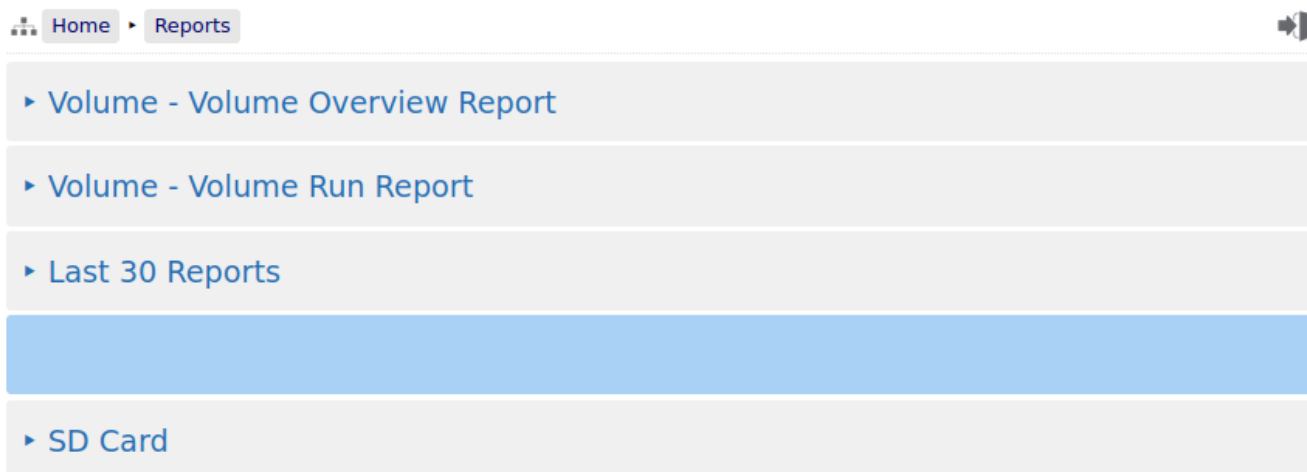
Mass - Mass Overview Report	When the Proving Method is set to Mass to Mass mode, the Overview report will be generated at the end of the proving cycle.
Mass - Mass Run Report	When the Proving Method is set to Mass to Mass mode, the Run report will be generated at the end of the proving cycle.
Mass - Inferred Mass Overview Report	When the Proving Method is set to Mass to Inferred Mass mode, the Overview report will be generated at the end of the proving cycle.
Mass - Inferred Mass Run Report	When the Proving Method is set to Mass to Inferred Mass mode, the run report will be generated at the end of the proving cycle.
Volume - Volume Overview Report	When the Proving Method is set to Volume to Volume mode, the Overview report will be generated at the end of the proving cycle.
Volume - Volume Run Report	When the Proving Method is set to Volume to Volume mode, the run report will be generated at the end of the proving cycle.
Last 30 Reports	This shows the last 30 of all types of report generated in time & date order. A screenshot of the top five entries of the Last 30 Reports is shown below.
SD Card	The SD Card menu is a hierarchical viewer in date order. First select the year, then the month, and finally the day, and all files created on that day will be visible.

11.1   Last 30 Reports

⊹ Home ▸ Reports ▸ Last 30 reports

2019/09/03 09:00:00 (Hourly Report)

2019/09/03 08:37:53 (Meter Tech - MF Acceptance Report)

2019/09/03 08:35:29 (Meter Tech - MF Acceptance Report)

2019/09/03 08:00:00 (Hourly Report)

2019/09/03 07:00:00 (Hourly Report)

By clicking on any of the reports listed, a preview of the report will be shown. When looking at any report preview page, the report can also be downloaded directly to the PC by clicking on the File Download icon. The preview below shows the first few lines of the Bill of Lading ticket for clarity and the arrow indicate the purpose of the additional icons on the breadcrumb navigation bar.

The example report below is from the LACT app, but the report layouts are all consistent.

Reports will be downloaded to the PC as plain text files, but the text attributes will be shown in the downloaded text, for example <b> for bold and <u> for underline.

Clicking the Print icon will cause the file to be printed to the whichever printer has been designated as the web printer during the setup phase.

Alternatively, the screen can be printed from the browser, using the usual method. Frequently Ctrl-P allows printing from a browser.

11.2   Reports Calendar View

Clicking on the reports listed in Home ▸ Reports (except for the Snapshot Report and the Last 30 Reports) will show a year calendar for the current year for the current selected report. The screenshot below shows just the top of the screen.

The « and » arrow icons on the Year header move the currently displayed calendar year backwards or forwards. If there are any downloadable files associated with the selected calendar year, then the Download icon will be displayed in the Year header. Clicking this icon will download all the files for that year as a single .ZIP archive file.

NOTE: This could be a very large file.

Each year is split into months and, by default, each day of the month is shown in a light gray typeface. If there any reports associated with the day, then the day will be shown in a bold blue typeface. If there are any reports in the month, then the download icon will be shown in Month header. Clicking the Month download icon will download all the reports for that month as a single .zip archive file.

Clicking on any day shown in a bold blue typeface, will open the daily view screen, which will show all reports associated with that day. All reports are shown with their date and time of creation. Clicking the associated line will open a report preview. The breadcrumb bar will show the download icon which allows the single report currently previewed to be downloaded.

 The Day header also has « and » arrow icons which will allows the user to move backwards or forwards a day for each click. If there are no reports for the selected day, the screen will show *No reports*.

11.3   SD Card

Clicking the **SD Card** sub-menu item opens a year calendar view, as for the other reports listed above. The difference is that the SD Card view will show multiple file types, so the file name is displayed as well as the date & time information, much as the **Last 30 Reports** view shows. In addition, it will also show the archived historical (trend) data and the alarms & events archives, as shown below:

TAF 12345/ABC@Echo-Delta2	ALARM	2019/09/01 10:05:31

Home ▸ Reports ▸ SD Card ▸ 2019 ▸ September 1

«	2019 September 1	»

2019/09/01 10:02:16	Batch Report-20190901100200.txt
2019/09/01 10:02:10	Daily Report-20190901100200.txt
2019/09/01 10:02:04	Hourly Report-20190901100200.txt
2019/09/01 10:02:34	Meter Tech - Bias Report-20190901100231.txt
2019/09/01 10:02:46	Meter Tech - Bias Report-20190901100243.txt
2019/09/01 10:01:40	Snapshot Report-20190901100139.txt
2019/09/01 00:00:16	alarms_events-20190901000014.zip
2019/09/01 00:00:08	historical-20190901000002.zip

The Logs & Info menu gives the user access to all the accessible data, except for the reports (which are described in Reports).

Live Reports & Diagnostics	This shows the reports being built up during a prove - data is not static on them so they can not be used for official purposes but can be used along with the data on the other sub-menus to help diagnose issues on site.
System Information	Low level information regarding the hardware and software in use, as explained in System Information.
Alarm Logs	The comprehensive Alarm Logs are explained in Alarm Logs.
Events Logs	There are 5 categories of events, detailed in Event Logs.
Constants Log	The constant log is detailed in Constants Log.
Trending	The Master Meter application has an in-built data logger, which runs independently from the running application. The historical data from the logger can be downloaded for analysis, or the trends can be viewed graphically via the embedded web-server. See Trending for more details.

The Master Meter application supports 3 different log files types: Alarms, Events (split into 5 sub-categories) and Constants.

In addition the Master Meter has a powerful historical storage and graphical representation facility for trending data, and can show the most significant information in the machine in real time, from the Home ‣ Logs & Info ‣ Trending pages.

12.1   Live Reports & Diagnostics

▸ Live Run Report

▸ Live Overview Report

▸ CTL_CPL Values

▸ Meter Factor Deviation

Prover Calculation Error	OK
Meter Under Test Calculation Error	OK

▸ XML Specific Datapoints

12.1.1   Live Run Report

The live Run shows the run data for the Master Meter and the Meter Under Test, as each run is completed. When the prove cycle finishes, the information on the page is finalized and becomes the source of information for the relevant Master Meter Run Report.

```
MASTER METER MASS RUN REPORT # 26                              App Version:      1v2r9

Report Date/Time:  11/10/2019 14:19:12

Owner/Operator:  Newflow                      Location:      Malton. UK
Site Reference:  Office                       MM Micro ID:   Coriolis Master Meter

Prove Status:      Complete

===================================================================================

MASTER METER DATA
Master Meter NKF:        1000 pulses/kg
Run     Master Meter   Master Meter   Master Meter   Master Meter   Master Meter   Master Meter   Master Meter
#       Pulse Count    Reynolds       Meter Factor   Temperature    Pressure       Flow Rate      Indicated
                       Number         (Reynolds)     °F             barg           kg/hr          Mass
                                                                                                  kg
01        50003          0.00          1.000000       13.36          3.68          36002.13       50.003000
02        50003          0.00          1.000000       13.36          3.68          36002.11       50.003000
03        50003          0.00          1.000000       13.36          3.68          36002.11       50.003000
04        50003          0.00          1.000000       13.36          3.68          36002.15       50.003000
05        50003          0.00          1.000000       13.36          3.68          36002.11       50.003000
06            0          0.00          0.000000        0.00          0.00              0.00        0.000000
07            0          0.00          0.000000        0.00          0.00              0.00        0.000000
08            0          0.00          0.000000        0.00          0.00              0.00        0.000000
09            0          0.00          0.000000        0.00          0.00              0.00        0.000000
10            0          0.00          0.000000        0.00          0.00              0.00        0.000000

Aves      ------        ------         ------         13.36          3.68          36002.12        ------

DUTY METER DATA
Duty Meter NKF:        1000 pulses/kg
Run       Duty Meter       Duty Meter      Duty Meter       Duty Meter        Test          IMF
#         Pulse Count      Temperature     Pressure         Indicated         Time
                           °F              barg             Mass              secs
                                                            kg
01          50003          19.90           6.14             50.003000          5          1.00000
02          50003          19.91           6.14             50.003000          5          1.00000
03          50003          19.91           6.14             50.003000          5          1.00000
04          50003          19.91           6.14             50.003000          5          1.00000
05          50003          19.91           6.14             50.003000          5          1.00000
06              0           0.00           0.00              0.000000          0          0.00000
07              0           0.00           0.00              0.000000          0          0.00000
08              0           0.00           0.00              0.000000          0          0.00000
09              0           0.00           0.00              0.000000          0          0.00000
10              0           0.00           0.00              0.000000          0          0.00000

Aves        ------         19.91           6.14              ------          ------       1.00000


===================================================================================
```

12.1.2   Live Overview Report

The Live Overview Report shows the overview data for the prove, as each run is completed. When the prove cycle finishes, the information on the page is finalized and becomes the source of information for the relevant Master Meter Overview Report.

```
MASTER METER INFERRED MASS OVERVIEW REPORT # 0                          App Version:      1v2r8

Generated: Invalid date / time

Owner/Operator:  Newflow                        Location:        Malton. UK
Site Reference:  Office                         MM Micro ID:     Coriolis Master Meter

MASTER METER DATA
Manufacturer:    Endress+Hauser                 Model #:         Promass O
Meter Type:      Coriolis                       Serial #:        NF-123 OB
Meter Size:      4"                             Meter NKF:       1000                pulses/kg
Pressure Compensation: No                       Temperature Compensation: No
Totalizer:       61411.14                       Pulse Mode:      MASS

DUTY METER DATA
Manufacturer:    A.N.Other                      Model #:         XYZ
Meter Type:      Coriolis                       Serial #:        ABC123
Meter Size:      4 Inch                         Meter NKF:       1000                pulses/m3
Pressure Compensation:      No                  Temperature Compensation:      No
Cubic Pressure Coefficient: 6e-06       /bar    Cubic Temperature Coefficient: 4.12e-05      /°F
                                                Pulse Mode:      VOLUME
FLUID DATA
Product Name:    Crude
LVC Tables:      2007 API Ch11.1 (Crude Oil)
Base Density:    0                              Observed Density:  0
Measured Density: 0

PROVE CRITERIA
Report Method:        Average Meter Factor Method
Run Criteria:         Repeatability                 Requirement:  3 of 00 completed runs - (Max 10)
Repeatability Limit: 0.025      %                   Calculated Repeatability: 0.000000  %

DATA FROM PROVE RUNS
Run  Run  Master Meter   Master Meter    Duty Meter     Duty Meter   Master Meter    Test      IMF
 #   Ack  Pulse Count    Indicated         Volume       Indicated     Flow Rate     Time
                            Mass         Pulse Count       Mass         kg/hr        secs
                            kg                             kg
01   No        0         0.000000          0           0.000000        0.00         0      0.00000
02   No        0         0.000000          0           0.000000        0.00         0      0.00000
03   No        0         0.000000          0           0.000000        0.00         0      0.00000
04   No        0         0.000000          0           0.000000        0.00         0      0.00000
05   No        0         0.000000          0           0.000000        0.00         0      0.00000
06   No        0         0.000000          0           0.000000        0.00         0      0.00000
07   No        0         0.000000          0           0.000000        0.00         0      0.00000
08   No        0         0.000000          0           0.000000        0.00         0      0.00000
09   No        0         0.000000          0           0.000000        0.00         0      0.00000
10   No        0         0.000000          0           0.000000        0.00         0      0.00000

Aves      ------        ------         ------        ------           0.00      ------     0.00000

========================================================================================

Previous Meter Factor:   0.0000             Average Meter Factor:    0.0000

Prove Status: Complete

========================================================================================

Remarks, Repairs, Adjustments, Etc.,_____


_____


     Signature              Date                      Company Represented


_____     _____     _____



_____     _____     _____


END OF MASTER METER INFERRED MASS OVERVIEW REPORT
```

12.1.3 CTL_CPL Values

This menu shows the CTL and CPL values calculated on each of the prove runs.

12.1.4 Meter Factor Deviation

All settings in this menu are shown For Indication Only and can be set under Operational Setup.

Home ► Logs & Info ► Live Reports & Diagnostics ► Meter Factor Deviation	
Meter Factor Deviation Check	Enabled
Average MF	0
Allowable Meter Factor Deviation	0.25 %
Status	OK

Meter Factor Deviation Check	Used to Enable or Disable the deviation check on the Proved Meter Factor.
Average MF	Shows the Proved Meter Factor from the last prove.
Allowable Meter Factor Deviation	If the Meter Factor Deviation Check is Enabled, enter the maximum deviation that is allowed.
Status	Shows the status of whether the current MF is inside the allowable deviation.

12.1.5 Prover Calculation Error

A value of zero indicates no errors.

12.1.6 Meter Under Test Calculation Error

A value of zero indicates no errors.

12.1.7 XML Specific Datapoints

This menu shows datapoints that are used specifically in the XML comms link but were not needed for the remainder of the displays.

12.2   System Information

System Uptime	11 days, 04:10:14
System ID	247D4D0018D1
System Firmware	4v7r8951-B
I/O Firmware	HW 3.03 SW 2.11
Metrology Firmware	1v1
System O/S	5.7.7 [RevB]
Expansion Board Date	14/01/19 12:26:49
Expansion Board Ident	5WT1
Application Name	Master Meter Application
Application Version	0v4r22
Dataset	Base*
Application Checksum	34BEF893AA4A6861
Metrology Checksum	0000000000000000
Constants Checksum	7A582D947B758A9A

‣ Software Checksums

Profile (mSec) [Min/Last/Avg/Max]	36 / 38 / 38 / 67
Digital Inputs [1..9]	000000000
Digital Outputs [1..6]	000000
Pulse Outputs Buckets [1..2]	0 / 0

System Uptime	This shows how long the unit has been running since the last restart.
System ID	The System ID is a unique hardware number for every device.
System Firmware	This is the runtime firmware version and represents the firmware held in the CPU card.
I/O Firmware	This information refers to the Logic design and the CPU firmware within the I/O Processor.
Metrology Firmware	This is the firmware version of any metrology specific functionality in the System Firmware.
System O/S	This shows the version of the Linux Operating System in use.
Expansion Board Date	This is the date the expansion board was calibrated. The expansion board type fitted to the NÅNO controller is the 6+2 Channel Analog I/O board.
Expansion Board Ident	This factory information contains the expansion board serial number and calibration information.
Application Name	This is the name of the application current running.
Application Version	This is the version number of the application current running.
Dataset	This shows which Dataset was selected when the application was downloaded by NÅNOConf. The dataset contains a consistent set of constants, so a pipe diameter may be defaulted to 12 inches in USC but 300 mm in Metric for example. The Master Meter application contains a single 'Base' dataset.
Application Checksum	This is the checksum value of the application current running, including the cold start constants.
Metrology Checksum	Any code or constants designated as a metrology field will be included in this checksum but data such as a Tag Name, or a site address field would not be. The Master Meter application does not have any metrology designated data.
Constants Checksum	This is the checksum of all constants, both metrology and constants that can be changed by an Administrator or Technician level user.
Software Checksums - **see Software Checksums** below.	
Profile (mSec) [Min/Last/Avg/ Maximum]	These four numbers indicate the performance of the C‖Cure runtime engine. Clicking the line opens a dialog that allows the maximum recorded profile information to be reset.
Digital Inputs [1..9]	This shows the current status of the Digital Inputs in a very compact manner. A "0" represents the OFF state and a "1" represents the ON state. The left most digit is Digital Input 1.
Digital Outputs [1..6]	This shows the current status of the Digital Outputs in a very compact manner. A "0" represents the OFF state and a "1" represents the ON state. The left most digit is Digital Output 1.

Pulse Outputs Buckets [1..2]	This is a status only display and shows the number of pulses generated by the application that are still waiting to be output. The value to the left of the "/" is associated with Pulse Output 1 and the value on the right is associated with Pulse Output 2. In normal operation, these should show 0 or occasionally 1, but any other value indicates a mismatch in the Sampler Pulse setup, and pulse are being generated faster than they can be delivered.

Clicking the Software Checksums link will open a menu which lists the checksum for the C||Cure® library blocks in the application that are configured to publish their checksum.

12.2.1   Software Checksums

For any calculation block defined as a metrology block, a high integrity hash code is generated as a checksum for the software, and this can be compared to the checksum on third-party metrological approval certificates.
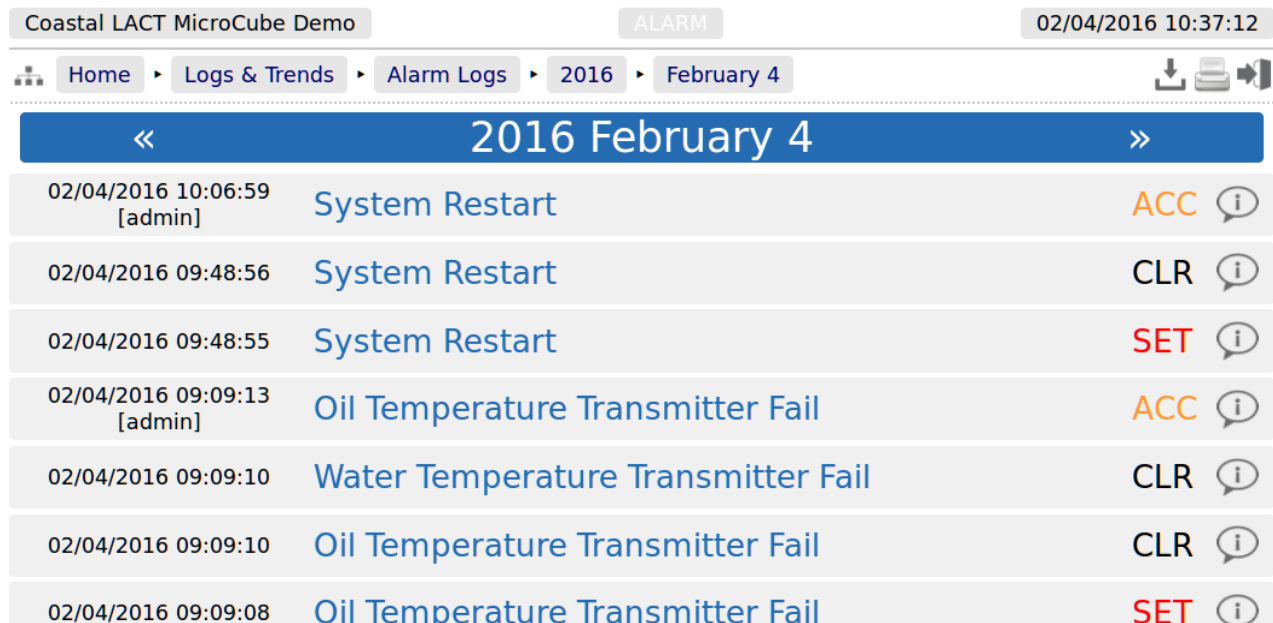
12.3 Alarm Logs

Clicking on Alarm Logs will show calendar view for the Alarm logs. The calendar view operates in the same manner as the Reports Calendar view, see Reports Calendar View for more details. Drilling down to each day shows all of the Alarms stored in sequential time order. The controller stores 1000 Alarms and they can all be downloaded from the website or via XML communications.

Each Alarm is time and date stamped, has a description of the Alarm, states if the Alarm is being set, accepted or cleared.

At the end of the line is an information bubble, known as the Additional Log Values (ALVs).

Hovering the mouse pointer over the information bubble results in a small pop-up window that shows the configured pins and their associated values at the time the Alarm was recorded.

If the entire Alarm history is needed, it can be retrieved using the XML communications for routine and regular use, but for immediate access, the data can be downloaded from the NÅNO controller website, simply by clicking on the Download Icon, at the top of the screen. The data will be downloaded as a single file in Tab Separated Value (.TSV) format and can be opened and manipulated in LibreOffice, Excel or other spreadsheet programs.

12.4   Event Logs

▸ System Event log

▸ Operator Event log

▸ Metrology Event log

▸ Security Event log

▸ Application Event log

▸ Combined Event Log

There are 5 categories of events. The Operator Event Log stores 2500 events, and all the others store 1000 events each (6500 events in total). Each event also has the ALVs logged, to aid forensic analysis.

System Event Log	Events that change the Time / Date settings, Network Settings, User Information, SD Card state, Power Cycles and Communications (including Printers, XML and Modbus ports, Local Panel) as well as remote events using the NÅNOConf configuration tool.
Operator Event Log	This log records all the input from the Local Panel, from the driver or the Metering Technician, as well as changes to the Application settings made from the website.
Metrology Event Log	Any item changed that is declared as a metrology point is logged here. Field calibration events are stored in this log.
Security Event Log	This log is used to record who logged in and out, the type of login, web or XML and the IP address of the user.
Application Event Log	This is used to insert custom entries into the event log on a particular application. In the Master Meter Prover Application, no Application Events are configured.
Combined Event Log	This shows the last 32 events of any type in reverse time order.

As an example, clicking on System Event Log will show all events for the selected day, in sequential time order. The screenshot below is part of the log.

NOTE: An example of the ALVs is shown in the smaller black text within the yellow box.

The Event log is similar to the Alarm log, in that only a single day's events are displayed at a time on the website, but all the data can be collected using the XML communications, or downloaded from the website as a Tab Separated Value document.

The Event Log fields are slightly different. The 1st Column shows the time the event was logged and the source of the event. The second column is a description of the event. The last column shows the ALVs information bubble, containing the values for the configured pins.

12.5   Constants Log

Clicking on the Constants Log generates a log file with all the editable data points. This file can be printed or downloaded via XML or from the website.

NOTE: The screenshot below is just the first few lines of the Constant Log, the whole document is too long to display in this manual

12.6   Trending

The NÅNO controller has a powerful data logging facility combined with an easy to use web-based visualization tool which gives unrivaled trending information.

There are three separate historical data zones, each of which can store 20,000 records. Each record is comprised of up to 13 data points and the time-stamp for when the selected data points were snapshot by the trigger. Each historical data zone can have a separate trigger, and the collection of data points in each zone can be different. In the Master Meter Application zones 1 and 2 are configured and are for Continuous Trending (Zone 1) and Trending When Proving (Zone 2).

Ten data slots are used in this application. The screenshot below shows the contents of each slot. Clicking on a particular line will generate a chart showing just the data points in that particular slot, and the last line, *All active slots*, will show a chart with all 10 slots overlaid.

Home ▸ Logs & Info ▸ Trending ▸ Continous Trending

Slot 1 : Meter Under Test Pulse Frequency

Slot 2 : Master Meter Frequency

Slot 3 : Master Meter Temperature In Use

Slot 4 : Master Meter Pressure In Use

Slot 5 : Meter Under Test Temperature In Use

Slot 6 : Meter Under Test Pressure In Use

Slot 7 : Run Master Meter Mass Total

Slot 8 : Run Meter Under Test Mass Total

Slot 9 : Run Meter Under Test Volume Total

Slot 10 : Not in use

Slot 11 : Not in use

Slot 12 : Not in use

Slot 13 : Current Run #

All active slots

NOTE: As well as being able to display the Historical Data in a zoom-able chart, the Historical Data can be downloaded and saved on a PC and displayed in a spreadsheet. To accomplished this, simply click on the download icon.

	Date	Oil Pressure In Use (psig)	Oil Temperature In Use (°F)	S&W In Use (%)	Oil Indicated Volume Flow Rate (bbls/hr)	Water Indicated Volume Flow Rate (bbls/hr)	Auxiliary Input 1 - In Use (%)	Auxiliary Input 2 - In Use (%)	Auxiliary Input 3 - In Use (%)	Auxiliary Input 4 - In Use (%)	Current Water Day Total [IV] (bbls)	Water Temperature In Use (°F)	Oil Local Totalizer [IV] (bbls)	Oil Non-Resettable Total [IV] (bbls)
2	05/01/16 03:10	50.6	90	0.463	0	3600	100.8274	-22.7144	5.7813	29.3803	11400	60	10	490405.12
3	05/01/16 03:05	50.6	90	0.463	0	3600	100.8254	-22.7148	5.7814	29.3805	11100	60	10	490405.12
4	05/01/16 03:00	50.59	90	0.462	0	3600	100.8251	-22.7138	5.779	29.3798	10800	60	10	490405.12
5	05/01/16 02:55	50.59	90	0.462	0	3600	100.8264	-22.7133	5.7785	29.3796	10500	60	10	490405.12
6	05/01/16 02:50	50.59	90	0.462	0	3600	100.8258	-22.7137	5.7802	29.3795	10200	60	10	490405.12
7	05/01/16 02:45	50.59	90	0.462	0	3600	100.8249	-22.7153	5.78	29.3809	9900	60	10	490405.12
8	05/01/16 02:40	50.58	90	0.462	0	3600	100.8253	-22.715	5.7771	29.3806	9600	60	10	490405.12
9	05/01/16 02:35	50.58	90	0.462	0	3600	100.8248	-22.7138	5.7771	29.3803	9300	60	10	490405.12
10	05/01/16 02:30	50.58	90	0.462	0	3600	100.8242	-22.7141	5.777	29.3804	9000	60	10	490405.12
11	05/01/16 02:25	50.58	90	0.462	0	3600	100.8245	-22.7138	5.7767	29.38	8700	60	10	490405.12
12	05/01/16 02:20	50.58	90	0.462	0	3600	100.8233	-22.7145	5.7772	29.3806	8400	60	10	490405.12
13	05/01/16 02:15	50.58	90	0.462	0	3600	100.8231	-22.7152	5.7771	29.38	8100	60	10	490405.12
14	05/01/16 02:10	50.58	90	0.462	0	3600	100.8239	-22.7143	5.7752	29.3797	7800	60	10	490405.12
15	05/01/16 02:05	50.58	90	0.462	0	3600	100.8222	-22.7126	5.7768	29.3798	7500	60	10	490405.12
16	05/01/16 02:00	50.58	90	0.462	0	3600	100.8219	-22.7142	5.7775	29.3804	7200	60	10	490405.12
17	05/01/16 01:55	50.58	90	0.462	0	3600	100.821	-22.714	5.7766	29.38	6900	60	10	490405.12

The example above only shows 16 of the possible 20,000 records.

If *All active slots* was selected then a chart showing a composite of all the data points is generated, in a time line (x-axis) against a single y-axis which indicates the value. In the example shown below, the chart is dominated by two data slots with large values.

Under the **Show Series** title, there is a list of each data slot with an associated tick box. If the larger value item, in this example "Oil Non-Resettable Total [IV] (bbls)", checkbox is clicked to toggle the tick to "off", then this slot will no longer be displayed and the display will re-scale.

You can also scale the time line by using the slider bars between the graph and the list of slots in use. The example below has the left-hand slider moved inwards by about a third.

If the cursor is placed over the graph, a dot will appear on each slot at the same instance in time and a readout of the value for each slot and the time the record was made is shown. In the example below, the cursor is highlighting 26/12/2015 at 18:20:00 and the **Oil Pressure In Use (psig)** is showing 51.

Show Series:

☑ Oil Pressure In Use (psig)	26/12/2015, 18:20:00:
☑ Oil Temperature In Use (°F)	**Oil Pressure In Use (psig)**: 51
☑ S&W In Use (%)	**Oil Temperature In Use (°F)**: 90
☑ Oil Indicated Volume Flow Rate (bbls/hr)	**S&W In Use (%)**: 0.471
☑ Water Indicated Volume Flow Rate (bbls/hr)	**Oil Indicated Volume Flow Rate (bbls/hr)**: 0
☑ Auxiliary Input 1 - In Use (%)	**Water Indicated Volume Flow Rate (bbls/hr)**: 3600
☑ Auxiliary Input 2 - In Use (%)	**Auxiliary Input 1 - In Use (%)**: 100.723
☑ Auxiliary Input 3 - In Use (%)	**Auxiliary Input 2 - In Use (%)**: -22.7127
☑ Auxiliary Input 4 - In Use (%)	**Auxiliary Input 3 - In Use (%)**: 5.8891
☑ Current Water Day Total [IV] (bbls)	**Auxiliary Input 4 - In Use (%)**: 29.3789
☑ Water Temperature In Use (°F)	**Current Water Day Total [IV] (bbls)**: 66000.04
☑ Oil Local Totalizer [IV] (bbls)	**Water Temperature In Use (°F)**: 60
☑ Oil Non-Resettable Total [IV] (bbls)	**Oil Local Totalizer [IV] (bbls)**: 10
	Oil Non-Resettable Total [IV] (bbls): 490395.12

13   Diagnostic Information

The Master Meter Application has been designed for ease of use as well as simplifying installation & commissioning and gives a remarkable amount of information to help diagnose process problems. The primary diagnostic information is grouped under *Logs & Info*:

Live Run & Overview reports	Home ▸ Logs & Info ▸ Live Reports & Diagnostics The Live Data gives a page of live information of the application data, allowing an engineer to instantly see the effects of any changes made to the system.
System Information	Home ▸ Logs & Info ▸ System Information This shows the System Information for the NÅNO controller. See System Information for more details.
Calculation Diagnostics	Home ▸ Logs & Info Home ▸ Logs & Info ▸ CTL_CPL Values These pages show the correction factors from the Liquid Volume Correction calculation running in the Master Meter Prover application.
Trending	Home ▸ Logs & Info ▸ Trending The historical data logging and trending displays are a powerful tool for investigating process issues.

14   Liquid Volume Correction Calculations

The Master Meter Application has a range of hydrocarbon calculations. However only the later calculations are made accessible on the general release version of the application:

- API Ch11.1, 2007 for commodities Crude and Refined for both USC with a 60°F reference temperature and Metric Units at 15°C or 20°C reference temperatures.

- TP15 or an entered Vapor Pressure (Pe) can be used with API Ch11.1 for higher density NGLs.

- GPA TP27, 2007 together with API Ch11.2.2 (0.35 to 0.637 SG) and an option with a wider density range. They are available for both USC and Metric units. Again TP15 or an entered Vapor Pressure (Pe) can be selected.

- The API rounding can be disabled for higher resolution calculations.

- Density can be entered as a reference density, taken from a Densitometer or entered from a sample.

15   Glossary

Icon	Description
	If a line contains the blue "gear" icon, this indicates that the line can be edited. Click the line to open the edit dialog.
	If a line contains a gray colored "gear" icon, this indicates that the line has editable data, but the current user does NOT have the necessary user level privileges.
	Sitemap Icon. Clicking this icon opens the sitemap allowing rapid navigation around the website.
	Logout Icon. Clicking this icon will logout the current user of the session, and takes you back to the login screen.
	Download Icon. This icon is visible when information is available for downloading from the NÅNO. Clicking this icon allows the information to be viewed or downloaded depending upon browser preferences.
	Print Icon. Clicking this item causes the current viewed screen to be printed to the designated Web printer.
	Accept/Apply Icon. This is used when several pieces of information are preset and then actioned as a group, for example setting networking parameters.

Term	Description
ADC	Analog to Digital Converter
ALVs	Additional Log Values - data that is snapshot when an Alarm or Event occurs.
AO	BLM Authorized Officer
App	A configuration file for the NÅNO where all hard coded calculation routing has been finalized. Field settings may or may not have been entered.
BLM	Bureau of Land Management
CONSTANTS	Numbers which are only infrequently changed.
ConstED	An off-line configuration program for NÅNO applications.
CPU	Central Processor Unit
CSV	Comma Separated Variables (a spreadsheet format)
DCS	Distributed Control System
DEFAULT VALUE	A fallback value that the input 'defaults' to if measurement is not possible due to the input from the transmitter being determined BAD.

FIELD SETTINGS	Constants, Limits, Scalings for a specific Meter Run. This does not relate to specific calculations as these will be defined in the Application.
FWA	Flow Weighted Average
HMI	Human Machine Interface
LACT	Lease Automated Custody Transfer
mA	milliAmp
METER RUN	The pipework and associated instrumentation for a single device to measure flow. Typically a turbine meter, orifice meter, Coriolis meter, ultrasonic meter, etc.
OVERRIDE VALUE	A fixed manual entry to 'override' any transmitter values.
PLC	Programmable Logic Controller
PROVER	The pipework and associated instrumentation for a single device to verify the data produced by a meter run flow device. Typically a Ball or Piston type Prover.
RTD	Resistance Temperature Detector
RX	Received information
SECURITY CODE	Security Codes are used to limit access by operators to parameters retained in NON VOLATILE memory.
STATION	Possibly pipework and associated instrumentation or just an application to collate data (and possibly disseminate header data) from a number of meter runs (and possibly a Prover) into a single source for display and/or passing to a Supervisory Computer.
TAGNAME	Alphanumeric string used to represent an item held within the computer database.
TSV	Tab Separated Values (a variant of CSV)
TX	Transmitted information
VARIABLES	Changeable values

Digital & Serial

Usage/Tag — TB1

24V DC IN A	+ −	1 2
24V DC IN B	+ −	3 4

Usage/Tag — TB5

Dig In 1	+ −	1 2
Dig In 2	+ −	3 4
Dig In 3	+ −	5 6
Dig In 4	+ −	7 8
Dig In 5	+ −	24 25
Dig In 6	+ −	26 27
Dig In 7	+ −	28 29
Dig In 8	+ −	30 31
Dig In 9	+ −	32 33

Prover Detector Switch

Usage/Tag — TB5

Meter Pulse Ch A	+ −	15 16
Meter Pulse Ch B	+ −	17 18
Meter Pulse Ch C	+ −	19 20
Meter Pulse Ch D	+ −	21 22

Usage/Tag — TB5

Chassis	23

Multiple Isolated Internal Power Rails

Power-on Reset, Watchdog & Alarm Monitor

Closed = No Alarms

Open = No Alarms

COM1 RS232

COM3 RS422

COM2 RS485

COM4 RS422

4mm Chassis Stud

TB4 — Usage/Tag

1	N/O 1	
2	N/O 2	
3	N/C 1	
4	N/C 2	

TB2 — Usage/Tag

1	TxOUT	
2	RxIN	
3	SIG-GND	
4	CTSIN	
5	RTSOUT	

TB2 — Usage/Tag

7	TxOUT+	
8	TxOUT −	
9	RxIN+	
10	RxIN −	
6	SIG-GND	

TB2 — Usage/Tag

11	TxRx+	
12	TxRx −	
6	SIG-GND	

TB6 — Usage/Tag

5	TxOUT+	
6	TxOUT −	
7	RxIN+	
8	RxIN −	
3	SIG-GND	
4	Chassis	

TB5 — Usage/Tag

9 10	+ −	Dig Out 1	
11 12	+ −	Dig Out 2	
13 14	+ −	Dig Out 3	
34 35	+ −	Dig Out 4	
36 37	+ −	Dig Out 5	
38 39	+ −	Dig Out 6	

TB5 — Usage/Tag

| 40 41 | + − | Pulse Out 1 | |
| 42 43 | + − | Pulse Out 2 | |

TB5 — Usage/Tag

| 44 45 | + − | Raw Pulse Bus | |

TB5 — Usage/Tag

| 46 | Chassis | |

Analog Expansion

Usage/Tag   TB3

	AnIn 1 **+** **−**	TB3-1 TB3-2
	AnIn 2 **+** **−**	TB3-3 TB3-4
	AnIn 3 **+** **−**	TB3-5 TB3-6
	AnIn 4 **+** **−**	TB3-7 TB3-8

Usage/Tag

TB3 & TB6

	AnIn 5 or RTD 2 I **+** V **+** V **−** I **−**	TB6-1 TB3-9 TB3-10 TB6-2

1mA

Usage/Tag   TB3

	RTD 1 or AnIn 6 I **+** V **+** V **−** I **−**	TB3 - 15 TB3 - 16 TB3 - 17 TB3 - 18

1mA

TB3   Usage/Tag

TB3-11 TB3-12	V **+** I **−** AnOut 1	
TB3-13 TB3-14	V **+** I **−** AnOut 2	

TB3

TB3-19 TB3-20	Chassis	

Newflow *Gear*

NÅNO 300

SERIAL NUMBER

UK CA CE 2021

TB1
PSU B: 3 (+24V), 4 (0V)
PSU A: 1 (+24V), 2 (0V)

TB4
Watchdog N/C: 3 4
Watchdog N/O: 1 2

TB5
RAW PULSE: + − | 44 45 46
PULSE OUT 2: + − | 42 43
PULSE OUT 1: + − | 40 41
DIGOUT 6: + − | 38 39
DIGOUT 5: + − | 36 37
PULSE IN: + − | 21 22 23
PULSE IN: + − | 19 20
PULSE IN: + − | 17 18
PULSE IN: + − | 15 16
DIGOUT 3: + − | 13 14

DIGOUT 4: + − | 34 35
DIGOUT 2: + − | 11 12
DIGIN 9: + − | 32 33
DIGOUT 1: + − | 9 10
DIGIN 8: + − | 30 31
DIGIN 4: + − | 7 8
DIGIN 7: + − | 28 29
DIGIN 3: + − | 5 6
DIGIN 2: + − | 26 27
DIGIN 6: + − | 3 4
DIGIN 1: + − | 1 2
DIGIN 5: + − | 24 25

TB2
COM3 RS422 TX: + − | 7 8
COM3 RS422 RX: + − | 9 10
COM2 RS485: + − | 11 12
COM1 RS232: TX RX GND CTS RTS SCN | 1 2 3 4 5 6

TB3
ANOUT 1: + − | 11 12
ANOUT 2: + − | 13 14
ANIN 1: + − | 1 2
ANIN 2: + − | 3 4
ANIN 3: + − | 5 6
ANIN 4: + − | 7 8
ANIN 5: V+ V− | 9 10
RTD1: I+ ANIN 6, V+, V− I− | 15 16 17 18 19 20
RTD2: I+ I− | 1 2

TB6
COM4 RS422 Rx: + − | 7 8
COM4 RS422 Tx: + − | 5 6
SCN: 3 4
RTD2: I+ I−, V+ V− | 1 2