METRIX

DATAWATCH IX

Installation Manual

Doc#100910 • REV A (Aug 2016)

List of Sections

Software effectivity
This manual refers to instruments fitted with software version 5.5.
Software versions 2.20 onwards are ‘backwards compatible’ so that it can be used on all hardware versions of the unit.
Previous software versions are not compatible with instruments with hardware status greater than 2.
The status level may be found on the instrument label and consists of a letter indicating software status followed by a numeral indicating the hardware status (e.g. ‘B2’)

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Safety Notes

Warning: Any interruption of the protective conductor inside or outside the apparatus, or disconnection of the protective earth terminal is likely to make the apparatus dangerous under some fault conditions. Intentional interruption is prohibited.

Warning: Live sensors: The unit is designed to operate if the temperature sensor is connected directly to an electrical heating element. It must be ensured that service personnel do not touch connections to such inputs whilst the inputs are live. With live sensors, all cables, connections and switches for connecting the sensor must be mains rated for use in 240V Cat II.

Warning: Grounding the temperature sensor shield: Where it is common practice to replace the temperature sensor whilst the instrument is live, it is recommended that the shield of the temperature sensor be grounded to safety earth, as an additional protection against electric shock.

Warning: The instrument must not be wired to a three-phase supply with an unearthed star connection, because, under fault conditions, such a supply could rise above 240V RMS with respect to ground, thus rendering the instrument unsafe.

Note: Safety requirements for permanently connected equipment state:
a. A switch or circuit breaker shall be included in the building installation
b. It shall be in close proximity to the equipment and within easy reach of the operator.
c. It shall be marked as the disconnecting device for the equipment.

Note: Recommended external fuse ratings are: 2A Type T 250V.

1. This instrument is intended for industrial vibration monitoring applications within the requirements of safety and EMC directives.

2. Installation may be carried out only by qualified personnel.

3. To prevent hands or metal tools coming into contact with parts that are electrically live the instrument must be installed in an enclosure.

4. Where conductive pollution (e.g. condensation, carbon dust) is likely, adequate air conditioning/filtering/sealing etc. must be installed in the enclosure.

5. The mains supply fuse within the power supply is not replaceable. If it is suspected that the fuse is faulty, the manufacturer's local service centre should be contacted for advice.

6. Whenever it is likely that protection has been impaired, the unit shall be made inoperative, and secured against accidental operation. The manufacturer's nearest service centre should be contacted for advice.

7. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment might be impaired.

8. The unit must be wired according to the instructions in this manual.

9. Before any other connection is made, the protective earth terminal shall be connected to a protective conductor. The mains (supply voltage) wiring must be terminated in such a way that, should it slip, the Earth wire would be the last wire to become disconnected. The protective earth terminal must remain connected (even if the equipment is isolated from the mains supply), if any of the I/O circuits are connected to hazardous voltages*.

The protective earth connection must always be the first to be connected and the last to be disconnected. Wiring must comply with all local wiring regulations, e.g. in the UK, the latest IEEE wiring regulations (BS7671) and in the USA, NEC class 1 wiring methods.

10. Signal and supply voltage wiring should be kept separate from one another. Where this is impractical, shielded cables should be used for the signal wiring.

11. The maximum continuous voltage applied between any of the following terminals must not exceed 240Vac.

a. Relay output to logic, dc or sensor input connections
b. Any connection to ground.
The ac supply must not be connected to sensor input or low-level inputs or outputs.

12. Over temperature protection: A separate over-temperature protection unit (with an independent temperature sensor) should be fitted to isolate the process heating circuit should a fault condition arise. Alarm relays within the recorder/controller do not give protection under all fault conditions.

13. In order to allow the power supply capacitors to discharge to a safe voltage, the supply must be disconnected at least two minutes before the instrument is removed from its sleeve. The touching of the exposed electronics of an instrument which has been removed from its sleeve should be avoided.

14. Instrument labels may be cleaned using iso-propyl alcohol, or water or water-based products. A mild soap solution may be used to clean other exterior surfaces.

USB Device Precautions

Note: Use of U3 USB Flash drives is not recommended.

1. Precautions against electrostatic discharge should be taken when the instrument terminals are being accessed. The USB and Ethernet connections are particularly vulnerable.

2. Ideally, the USB device should be plugged directly into the instrument, as the use of extension leads may compromise the instrument's ESD compliance. Where the instrument is being used in an electrically 'noisy' environment, it is recommended that the user brings the USB socket to the front of the panel using a short extension lead. This is because the USB may 'lock up' or reset in noisy environments and the only means of recovery is to remove the device, then re-insert it. For memory sticks, EMC-related failure during a write operation might cause corruption of the data held on the stick. For this reason, the data on the memory stick should be backed up before insertion and checked after removal.

3. When using a USB extension cable, a high quality screened cable must be used. The total length of USB cable between the device and the USB port must not exceed 3 metres (10 ft.)

4. Most barcode readers and keyboards are not designed for use in industrial EMC environments, and their operation in such environments may result in impaired performance of the recorder/controller.

32-BIT RESOLUTION

Floating point values are stored in IEEE 32-bit single precision format. Values which require greater resolution than is available in this format are rounded up or down.

SYMBOLS USED ON THE RECORDER LABELLING

One or more of the symbols below may appear as a part of the recorder labelling.

Symbol	Meaning		
	Refer to User Manual for instructions.		Risk of electric shock.
CE	This unit is CE approved.		Precautions against static electrical discharge must be taken when handling this unit.
	C-Tick mark for Australia (ACA) and New Zealand (RSM).		Ethernet connector.
c UL US LISTED	Underwriters laboratories listed mark for Canada and the U.S.		USB connector.
40	For environmental reasons, this unit must be recycled before its age exceeds the number of years shown in the circle.		Protective-conductor terminal (Earth)

1. INTRODUCTION

This document describes the installation, operation and configuration of a paperless graphic recorder/controller. The instrument comes, as standard with four input channels and is equipped, for secure archiving via FTP transfer and/or to USB memory stick.

1.1 UNPACKING THE INSTRUMENT

The instrument is despatched in a special pack, designed to give adequate protection during transit. Should the outer box show signs of damage, it should be opened immediately, and the contents examined. If there is evidence of damage, the instrument should not be operated and the local representative contacted for instructions. After the instrument has been removed from its packing, the packing should be examined to ensure that all accessories and documentation have been removed. The packing should then be stored against future transport requirements.

Caution: Before installation, ensure that the specified instrument supply voltage matches the facility supply

2. INSTALLATION

2.1 MECHANICAL INSTALLATION

Figure 2.1.1 gives installation details.

2.1.1 Installation Procedure

1. If it is not already in place, fit the IP65 sealing gasket behind the front bezel of the instrument.
2. Insert the instrument through the panel cutout, from the front of the panel.
3. Spring the retaining clips into place, and secure the instrument by holding it firmly in place whilst pushing both clips towards the rear face of the panel.
4. The protective membrane can now be removed from the display.

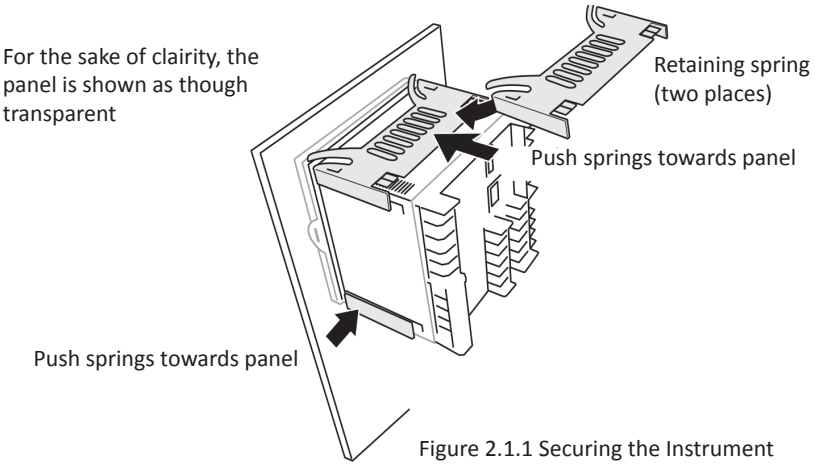


Figure 2.1.1 Securing the Instrument

2.1.2 Demounting

Warning: Before removing the supply voltage wiring, isolate the supply voltage and secure it against unintended operation.

1. Isolate the mains supply and secure it against accidental operation. Remove all wiring and the USB device and Ethernet cable (if any).

2. Remove the retaining springs by unhooking them from the sides using a small flat-blade screwdriver.

3. Pull the instrument forwards out of the panel.

2.1.3 Removing the Instrument from its sleeve

The instrument is designed to be removed from its sleeve from the front panel. However, if a USB memory stick or the Ethernet cable is fitted then this must be removed first.

When the instrument is shipped from the factory it is fitted with two small red clips, one in the top side of the sleeve and the other below. These are intended as a safeguard against removal of the instrument from its sleeve when an Ethernet cable is fitted. These clips must also be removed, using a small screwdriver, before the instrument can be taken out of its sleeve.

Ease the latching ears (Figure 2.1) outwards and pull the controller forward.
When plugging back in ensure that the latching ears click into place to maintain the panel sealing.

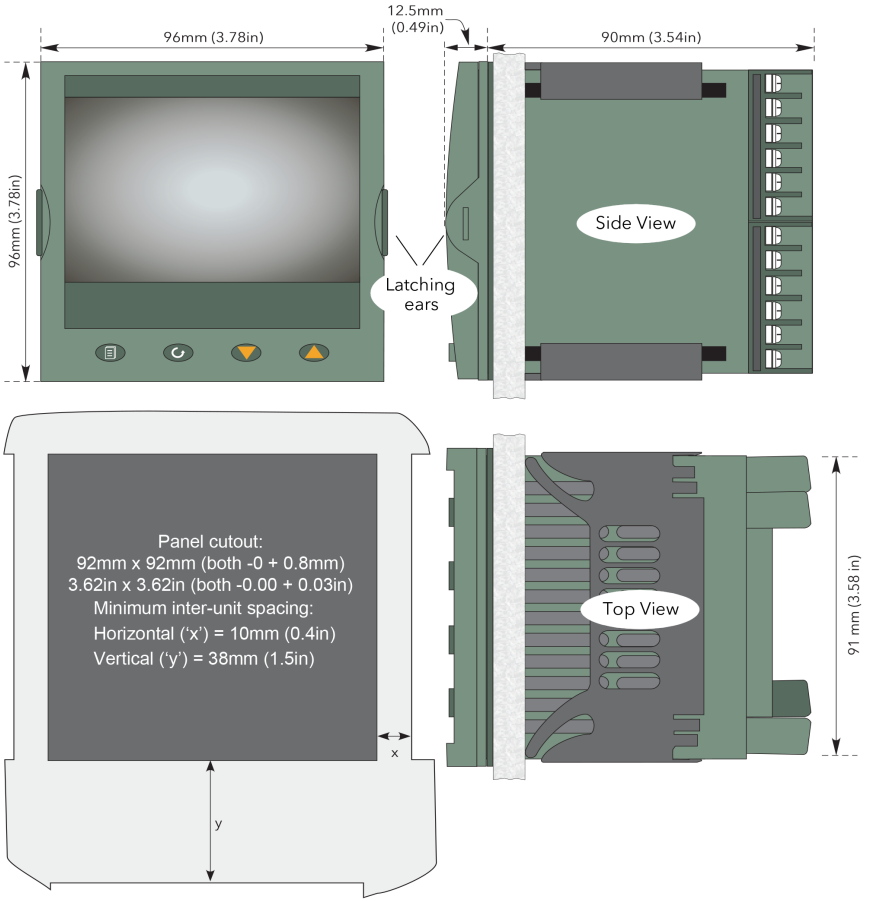


Figure 2.1a Mechanical installation details (standard case)

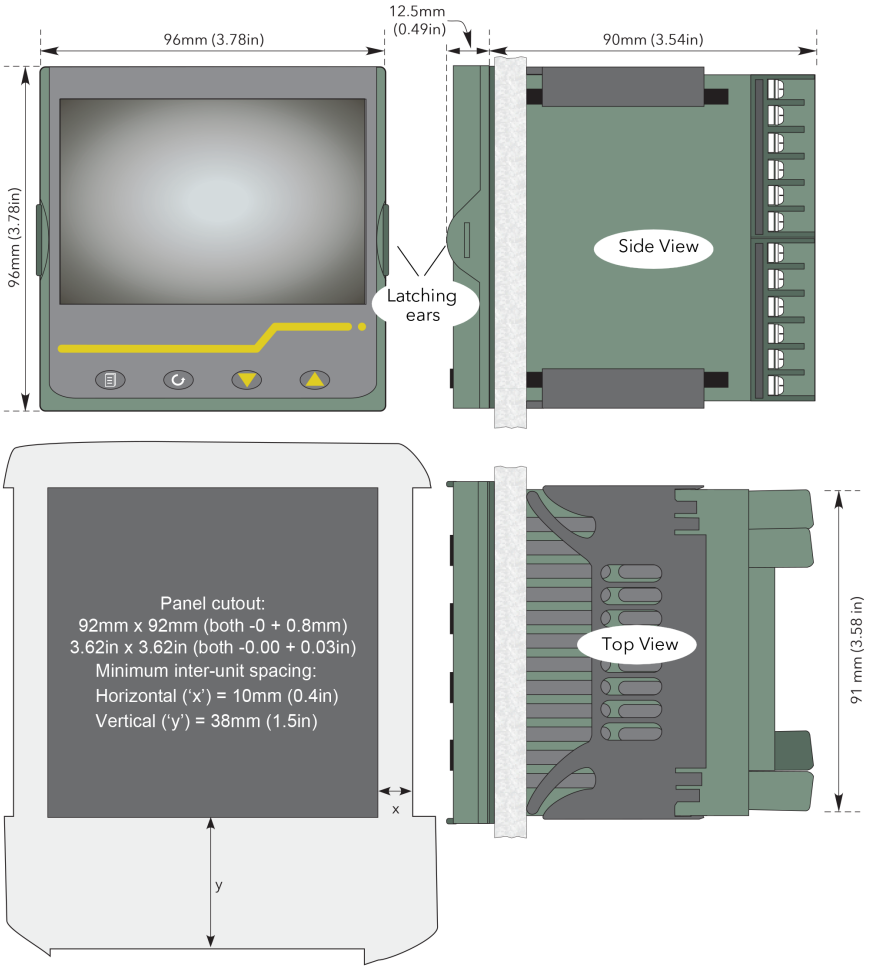


Figure 2.1a Mechanical installation details

2.2 ELECTRICAL INSTALLATION

Figure 2.2 shows the locations of the various user terminations along with signal and supply wiring pinouts.

2.2.1 Termination details

The screw terminals accept single wires in the range 0.21 to 2.08 mm² (24 to 14 AWG) inclusive, or two wires each in the range 0.21 to 1.31 mm² (24 to 16 AWG) inclusive.
Screw terminals should be tightened to a torque not exceeding 0.4Nm (3.54 lb in)

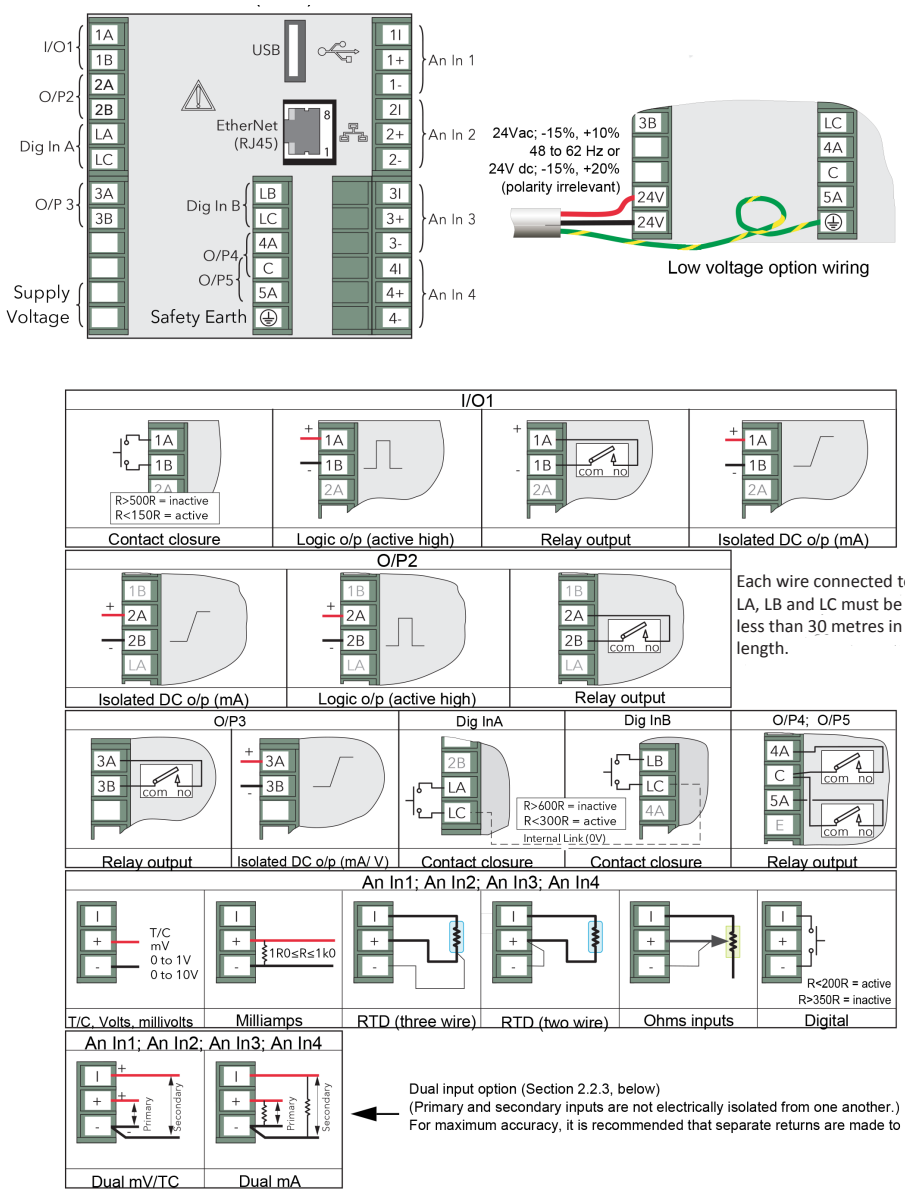


Figure 2.2 Connector locations and pinouts (rear panel)

2.2.2 Voltage Options
This option allows the use of a 240 or 120VAC supply. The specification in Appendix A gives full details.

2.2.3 Dual Input Option
This is a cost option, enabled on a channel-by-channel basis by means of entering the relevant password in the 'Feature3 Pass' field in Instrument.Security menu described in Section 4.1.6.

For each enabled channel, a pair of thermocouple, mV or mA inputs can be connected to the instrument. These inputs are called 'primary' and 'secondary', and are terminated at the analogue input terminals (An In1 to An In 4) as shown in 'figure 2.2, above. The primary inputs 1 to 4 are assigned to channels 1 to 4, as normal. Each secondary input must be soft wired to a maths channel configured as Operation = 'Copy' if it is to be recorded/
displayed/alarmed etc.

Note: Due to the nature of the input circuit, a large offset may appear for secondary thermocouple inputs. This offset can be removed only by using the input adjust feature described in Section 4.1.9 Because of this offset, the dual thermocouple input option is not suitable for AMS2750D applications

Soft wiring is described in Section 7
Maths channels are described in Section 4.5.1
Channel configuration is described in Section 4.4.1
Input adjust is carried out as described in Section 4.1.9

SAMPLE RATE
For dual input channels, both primary and secondary sample rate is reduced to 4 Hz (250ms) from the normal 8Hz (125ms).

SENSOR BREAK DETECTION
Input sensor break detection is not supported for secondary inputs. The internal circuit acts as a 'pull up' on the secondary input which therefore saturates high in the event of a sensor break.

DUAL MILLIAMP OFFSET CORRECTION
If 'Dual mA' is selected as input type, then an automatic offset correction will be made, according to the shunt value entered in channel configuration.

INPUT RANGE LIMITATION
There is no 10V range associated with the secondary input. Any input greater than +2V or less than -2V is deemed to be 'bad range'.

2.2.4 Modbus Master communications
The master instrument can be connected directly to up to two slaves using standard ethernet network cable either directly (single slave only) or via a hub or switch (one or two slaves). In either case, 'straight through' or crossover' cable may be used. The cable is terminated at the RJ45 socket at the rear of the unit.

3. OPERATION

On power up a default or custom splash screen appears and remains visible whilst the unit is initialising. If during this process a network broadcast storm is detected, the unit stops, displaying a network failure icon until the broadcast storm has cleared, after which the initialisation process resumes.

3.1 INTRODUCTION

The operator interface consists of a display screen and four push buttons.

3.1.1 Display Screen

The display screen is used both to display channel information (in one of a number of display modes), and to display the various configuration screens which allow the user to setup the recorder to display the required channels, to set up alarms and so on. Display modes are described in Section 3.4 below; configuration is described in Section 4. In display mode, the screen is split horizontally into three areas (figure 3.1.1)

1. a faceplate giving channel details.
2. the main display screen showing channel traces etc.
3. the status area, displaying instrument name, the current time and date and any system icons.

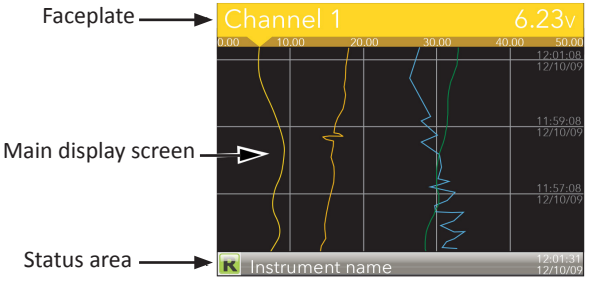


Figure 3.1.1 Display mode screen (vertical trend)

In configuration mode, the entire display screen is devoted to the selected configuration menu.

3.1.2 Navigation Pushbuttons

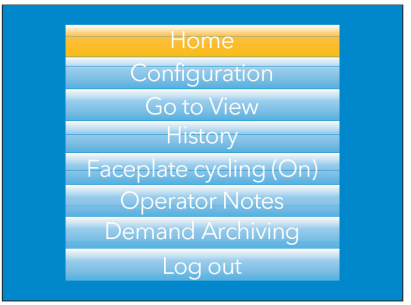


Figure 3.1.2 Top level menu (Engineer level access)

There are four navigation buttons, called ‘Page’, ‘Scroll’, ‘Lower’ and ‘Raise’ located below the screen. The general properties of these buttons are described in the remainder of this section, but some have additional, context sensitive functions, which, for the sake of clarity are not described here but in the relevant sections (e.g. ‘Message summary’) of the manual.

Navigation Pushbuttons (Cont.)

PAGE BUTTON 

From any non-configuration page, pressing this push button causes the top level menu (figure 3.1.2) to appear. The figure shows the menu for a user logged in with 'Engineer' level access. Other access levels may have fewer menu items.

Within configuration pages, the Scroll button can be used as an enter key to select lower menu levels. In such cases the page button is used to reverse this action, moving the user up one menu level per operation.

SCROLL BUTTON 

From trending pages, operation of the scroll push-button scrolls through the channels enabled in the group. The Faceplate cycling 'Off' selection can be used to keep a particular channel permanently displayed, and the scroll pushbuttons can then be used to select channels manually. In configuration pages, the scroll key operates as an 'enter' key to enter the next menu level associated with the highlighted item. Once the lowest menu level is reached, operation of the scroll key allows the value of the selected item to be edited by the relevant means (for example, the raise/lower keys, or a keyboard entry). The 'Page' key is used to move the user back up the menu structure, until the top level menu is reached, when the scroll key can be used again to return to the Home page. The scroll button is also used to initiate user wiring as described in Section 7.

RAISE/LOWER BUTTONS 

Within trending displays, the Raise and Lower keys can be used to scroll through the enabled display modes in the sequence: vertical trend, horizontal trend, vertical bargraph, horizontal bargraph, numeric, vertical trend...and so on. Within configuration pages, these pushbuttons act as cursor keys, allowing, for example, the user to highlight menu items for selection using the scroll button, and in many cases allowing the user to select one from a number of alternative values within menu items. These keys are also used to navigate through the virtual keyboards (Section 3.6) and number pads used to enter text or numeric strings.

3.1.3 On Screen Help

The top level configuration menu includes contextual help text on the right-hand half of the screen. Mostly this text fits within on screen height. Where this is not the case, the text can be moved up or down the screen by holding the Page button operated whilst using the up and down arrows to move the text. The down arrow moves the text upwards on the screen; the up arrow moves it downwards.

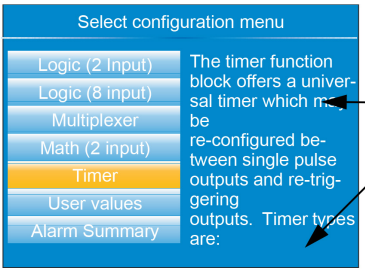


Figure 3.1.3
On-screen help
(typical)

3.2 VIBRATION OR PROCESS VARIABLE DISPLAY

As discussed above, the operator interface consists of a display screen and associated push buttons. The display screen shows process variables in one of a number of formats, or operational details (notes or alarm history for example), or configuration details for use in setting up the recorder to produce the required displays and history formats. The remainder of section three discusses the process variable displays, alarm displays and so on; configuration details are to be found in Section 4.

Note: Some of the items below can be selected for use only by users with a suitable permission level as set up in the 'Instrument' 'Security' menu described in Section 4.1.6.

Figure 3.2 below, depicts a typical trend display and gives details of the various areas of the display page.

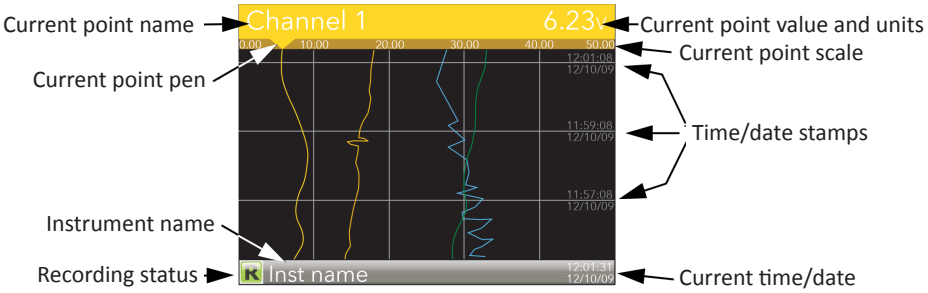


Figure 3.2 Typical display screen (Vertical trend)

Figure 3.2 shows a vertical trend page. Operating the Raise/Lower push-buttons allows the user to scroll through the other display modes: Horizontal trend, Vertical bargraph, horizontal bargraph, numeric, vertical trend... and so on. All these display modes are described in Section 3.4, below. A display mode can also be selected from the Top level menu 'Go To View' item which appears when the 'Page' key is operated. The scroll button can be used to scroll through the points in the group, overriding the 'Faceplate Cycling' on or off selection.

3.2.1 Alarm Icons

Note 1: A full discussion of alarms is given in the Channel Configuration section of this manual, Section 4.4.3.
Note 2: Trigger alarms do not display threshold marks or bars, or faceplate symbols

The alarm icons shown below appear in some display modes. The icons on a channel faceplate show the status of that channel's alarm(s), as follows:

Icon is flashing	alarm is active but unacknowledged or it is an Auto alarm which is no longer active but which has not been acknowledged
Icon steadily illuminated	the alarm is active and has been acknowledged.

Alarm thresholds and deviation alarm bars appear for horizontal and vertical trend modes. For deviation bars, the bar stretches from (Reference - Deviation) to (Reference + Deviation). Vertical and Horizontal bargraph modes display only absolute alarm symbols.

Alarm Icons (Cont.)

▲	Absolute High
▼	Absolute Low
▲	Deviation High
▼	Deviation Low
▲▼	Deviation Band
◢	Rising Rate of change
◣	Falling Rate of change
▲	Digital High
▼	Digital Low

Table 3.2.1 Alarm icons

3.2.2 Status Bar Icons

The following items can appear in a dedicated window immediately to the left of the time and date, at the bottom right-hand corner of the display. The width of this window expands as the number of icons increases, and the instrument name is truncated, as necessary, to make room.

SYSTEM ALARMS 

This indicator appears, flashing, if any one or more of the alarms listed below is active. The System Alarms summary page (accessed from 'Go to View in the top level menu) allows the user to view such system alarms as are active. It is not possible to 'acknowledge' system alarms

Archive Disabled An	Unattended archiving strategy has temporarily been disabled.
Archiving Failed	An unattended archiving strategy has failed to complete.
Archiving Timeout	A configured archiving strategy has timed out.
Battery failure	Indicates that the battery is approaching the end of its useful life, or that it is missing or is completely exhausted. Immediate battery replacement is recommended (Appendix C; section C1).
Broadcast Storm detected	Networking is limited until the storm has passed.
Clock failure	The internal clock was found to be corrupt at power up, or that the time has never been set. Time is forced to 00:00 1/1/1900. Can be caused by battery failure, in which case a battery failure message appears. The error is cleared by setting the time and date.
Channel error	Indicates a hardware failure in the channel circuit or in the internal cold junction temperature measurement.
Database failure	Corrupted EEPROM or flash memory.
DHCP Server failure	For units with 'IP Type' set to 'DHCP' (Network.Interface configuration) this alarm occurs if the instrument is unable to obtain an IP address from the server.
FTP Archiving file lost	A file has been deleted that had not yet been archived. Possible causes: Communications with the server could not be established,; archive is disabled; archive rate too slow.
FTP Archiving to slow	The archive rate is too slow to prevent the internal memory from overflowing. The recorder effectively switches to 'Auto matic' (Section 4.2.2) to ensure that data is not lost.

Status Bar Icons (Cont.)

FTP Primary Server Failure	This error occurs if the recorder fails to establish connection with the primary server, after two attempts. After the second attempt fails, the recorder attempts to establish connection with the secondary server instead. Primary and secondary server details are entered in the Network. Archiving area of configuration (Section 4.2.2).
FTP Secondary Server Failure	This error occurs if the recorder fails to establish connection with the secondary server, after two attempts. Primary and secondary server details are entered in the Network.Archiving area of configuration (Section 4.2.2).
Maths channel failure	Appears if, for example, the divisor of a divide function is zero.
Media archiving file lost	A file has been deleted that had not yet been archived. Possible causes: Memory stick missing, full or write protected; archiving has been disabled; archiving rate too slow.
Media archiving to slow	The archive rate is too slow to prevent the internal memory from overflowing. The recorder effectively switches to 'Automatic' (Sec tion 4.2.2) to ensure that data is not lost.
Media full	Archive storage device is full. The alarm becomes active only when an archive is in progress.
Media missing	No archive storage device present when archive attempted.
Non-volatile memory failure	RAM copy of non-volatile parameters is corrupted.
Non-volatile Write Frequency	Warning one or more parameters are being written frequently to non-volatile memory. If this continues, it may lead to 'memory depletion' (i.e. the memory will no longer be able to store values correctly). A common cause of this problem is frequent writes over Modbus comms.
Recording failure (message)	Message explains reason for failure.
SNTP failure	Invalid data received from SNTP server, for example, the year received from the server is <2001 or >2035, or the server cannot be accessed. Time synchronisation failure Instrument time has failed to syn chronise with SNTP server. If more than 5 'Time change events' occur within 24 hours a 'Time synchronisation failure' alarm is set. The alarm occurs 24 hours after the first event. Once syn chronisation is re-established, the alarm selfclears within 24 hours. A 'Time change event' occurs whenever the recorder time is found to be more than 2 seconds different from the server time. If the instrument time differs from the SNTP time by less than 2 seconds, the instrument time is updated gradually (1 ms 8 times a second) to prevent time changes being recorded. SNTP time is based on elapsed seconds since 00:00 hours on 1st January 1900. The time is not affected by time zones or daylight saving adjustments.
USB overcurrent	USB power fault - too much current (i.e. >100mA) is being drawn by a USB device.
Wiring failure	The user wiring has failed to verify, i.e. one or more wires has been detected that does not have both a source and a destina tion defined. This may be the result, for example, of power loss during a download from iTools.

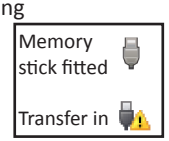
CHANNEL ALARM

This indicator appears if any channel (including channels not in the display group) is in an alarm state. The symbol is illuminated continuously if all alarms are acknowledged or flashes if any one or more alarms is unacknowledged. Alarms are acknowledged from the Root menu 'Alarm summary' item as described in Section 3.3.3 or in the Channel configuration area (Section 4.4.3) if the user's access permission is appropriate.

USB

This icon appears whenever a memory stick (max. capacity 8GB) or other supported USB device (Section 8) is plugged into the USB port at the rear of the recorder. When data transfer is in progress between the instrument and the memory stick, the icon changes to a 'busy'version.

Caution: The Memory stick must not be removed while archiving (demand or automatic) is in progress, as to do so may irreparably damage the file system of the memory stick, rendering it unusable. It is recommended that all archiving be suspended before the memory stick is removed.



FTP ICON

The FTP icon appears whenever transfer activity is taking place.

RECORD ICON

One of four icons appears at the bottom left corner of the display to indicate recording status.

Record

This indicates that the recorder is recording the items selected in the Group Recording area of configuration (Section 4.3).

Stopped

This means that 'Enable' has been set to 'no' in the Group Recording area of configuration (Section 4.3). Trending is not affected.

Paused (Suspended)

This means that recording has been paused by a wire to the Suspend parameter (Group Recording area of configuration (Section 4.3) going true (high). Trending is not affected.

In Configuration

The recorder has been placed in configuration mode either at the user interface, or via iTools. Recording is stopped until the recorder is no longer in configuration mode. For each non-recording state (Stopped, Paused or In Configuration). A new history file is created when the unit comes out of configuration mode.

Note: For recording to be enabled, configuration status must be 'logged out' both at the instrument and at iTools. Relays will not operate while the unit is in configuration mode, locally through the display as well as when connected to the configuration software.

MESSAGE ICON

This 'envelope' icon appears when a message is generated and it remains on display until the Message Summary is accessed, when it is removed from the display until the next new message is generated.

3.2.3 Breaks in recording

Breaks in recording can be caused by the unit being powered down, by the user entering configuration mode or when the recorder time is changed manually. In vertical and horizontal trend modes, a line is drawn across the width/height of the chart to indicate that recording has been interrupted. On power up, a red line is drawn across the chart. In 'History', if messages are enabled the message: Date Time System power up is printed on the chart, together with the configuration and security revisions.

On exiting configuration mode, a blue line is drawn on the chart and in 'History', if messages are enabled, the messages:
Date Time Logged out.
Date Time Config Revision: N was N-1 (assuming a configuration change was made)
Date Time Logged in as: Engineer
appear on the chart.

When the instrument time is changed (manually - not through daylight saving action) a green line is drawn on the chart and in 'History', if messages are enabled, the message:
Date Time Time/Date changed
appears on the chart.

3.3 TOP LEVEL MENU

This menu appears when the page key is operated from any non-configuration page. The menu items displayed depend on the access permission of the user. One of the menu items is highlighted, and if the scroll key is operated, then it is the highlighted item that is 'entered'. Figure 3.3 shows the top level menu for Engineer level access.

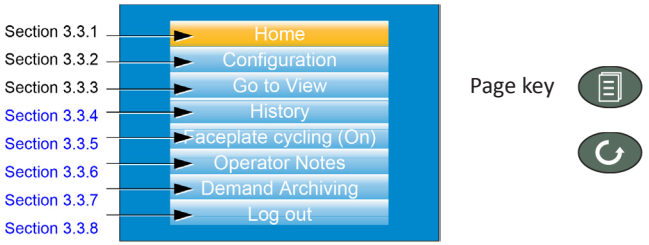


Figure 3.3 Top level menu

3.3.1 Home

Operating the scroll key whilst 'Home' is highlighted causes a return to the 'Home' page. By default, this is the vertical trend mode, but the mode can be changed in 'Instrument. Display' configuration (Section 4.1.3)

3.3.2 Configuration

Operating the down arrow key highlights the 'Configuration' item. Operating the Scroll key enters the configuration submenu described in Section 4 of this manual.

Note: 'Configuration' appears only if the user has an appropriate access level.

3.3.3 Go to View

Operating the scroll key while the 'Go to view' item is highlighted, calls the 'Go to view' sub-menu (figure 3.3.3a). This allows the user to view channel alarms, system alarms, messages or to select a different display mode.

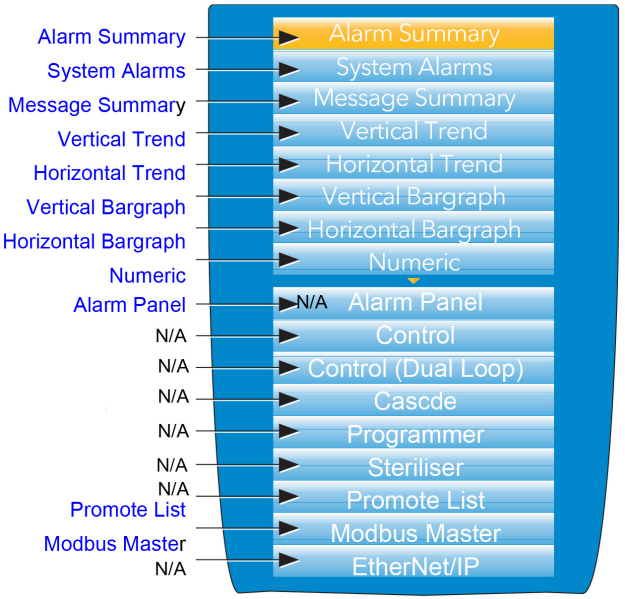


Figure 3.3.3a Go to view submenu

Note 1: If an option (e.g. 'Steriliser') is not fitted, its display mode does not appear in the list.
Note 2: Some display modes must be enabled in Instrument. View configuration (Section 4.1.3) before they become available.

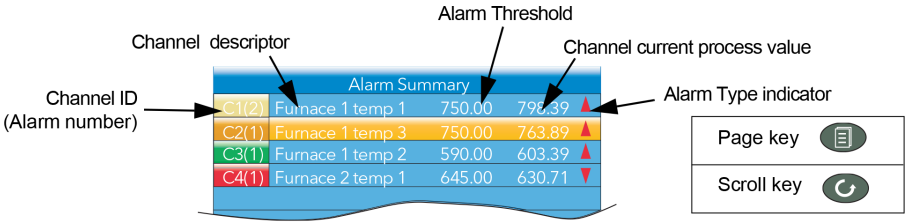
Go To View (Cont.)

ALARM SUMMARY

For each active alarm, this page displays the channel identifier with alarm number (e.g. C1(2) = channel 1; alarm 2), the channel descriptor, the alarm threshold the current vibration or process value and an alarm type symbol. To return to the top level menu, operate the Page key.

Note 1: The background color to the channel ID is the same as that chosen for the channel

Note 2: A prefix 'C' in the channel ID means that this is a measuring channel; A prefix 'V' means that this is a virtual channel (i.e. a totaliser, counter or maths channel



ALARM ACKNOWLEDGEMENT

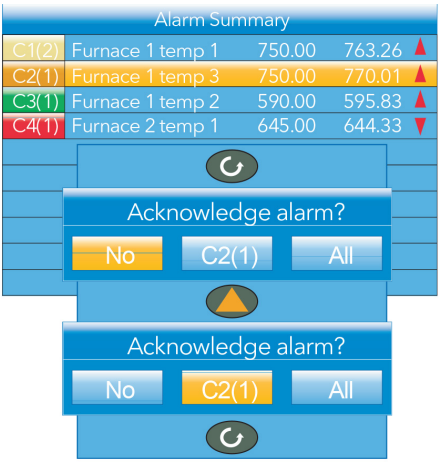
To acknowledge an alarm from this view:

1. Use the up and down arrows to highlight the required alarm

2. Operate the scroll button. The 'Acknowledge alarm' window appears.

3. Use the up arrow to highlight the relevant field (C2(1) in this example), or 'All' if all alarms are to be acknowledged.

4. Operate the scroll key to confirm. If the alarm fails to respond, this may be due to the fact that it has been configured as a 'Manual' alarm, and the trigger has not yet returned to a 'safe' (non-alarm) state, or it could be that the instrument is in a logged out state.



SYSTEM ALARMS

Operating the scroll button whilst the 'System Alarms' field is highlighted displays a list of all currently active system alarms. Section 3.2.2 contains a list of system alarms and their interpretations. To return to the top level menu, operate the Page key. A further operation of the scroll button displays a 'Help Information' page, giving the reason for the highlighted alarm. Operate the scroll button again to return to the system alarm display.

Go To View (Cont.)

MESSAGE SUMMARY

Operating the scroll key while the 'Message summary' field is highlighted displays the 10 most recent messages.

Operating the scroll key while a message is highlighted shows the selected message in more detail (and using the up/down keys allows the other messages to be scrolled through). While in this mode, operating the scroll key again, allows the user to choose to jump to the message's location in trend history mode (Section 3.5) or to return to the summary page.

By default, the interface is set up such that:

1. all message types are included
2. the up and down arrow keys cause the highlighted selection to move up or down by one message at a time.

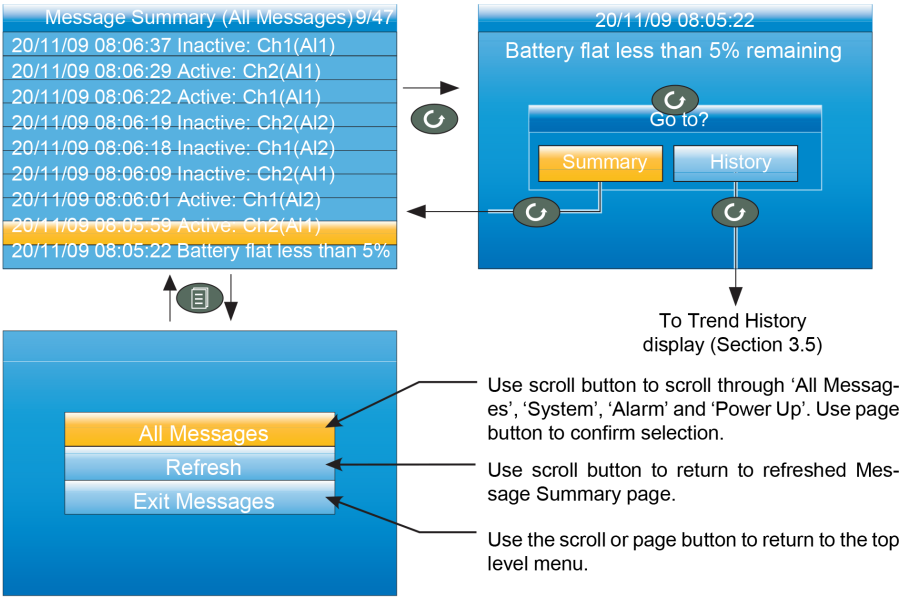


Figure 3.3.3c Message summary features

MESSAGE FILTERS

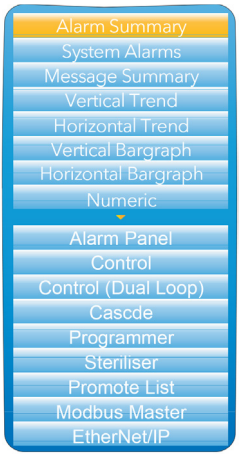
All Messages	Causes all messages to be displayed on the screen.
System	Shows only system alarms
Alarm	Shows only channel alarms
Power up	Shows only power up messages
Login/out	Limits the display to Log in and Log out events.

Go To View (Cont.)

DISPLAY MODE SELECTION

Use the up/down arrow buttons to highlight the required display mode. Once the required display mode is highlighted, operation of the scroll button causes the recorder to leave the 'Go to View' menu and to display channel values in the selected mode. See Section 3.4 for a description of the various display modes.

Alternatively the up and down arrow buttons can be used from any of the display modes to cycle through the available modes in the order listed in the figure.



Note 1: If an option (e.g. 'Steriliser') is not fitted, its display mode is not available for selection.
Note 2: Some display modes must be enabled in Instrument. Display configuration (Section 4.1.3) before they become available.

3.3.4 History

This top level menu item allows the user to switch from real-time trending to review mode, where channel values, messages, alarm triggers etc. can be viewed back as far as the last significant configuration change. History mode is fully discussed in Section 3.5.

3.3.5 Faceplate Cycling on/off

For the purposes of this document the channel whose faceplate is currently displayed and whose 'pen' symbol is visible is called the 'Active' channel. By default, the recorder scrolls through all the channels in the display group, with each channel becoming the active channel in turn. This top level menu 'Faceplate Cycling' item allows the user to inhibit this scrolling action such that the currently active channel remains active permanently, or until a manual scroll is performed using the scroll button (or until Faceplate Cycling is re-enabled). 'Faceplate Cycling' is highlighted by using the up/down arrow buttons. Once highlighted, the status can be changed from 'On' to 'Off' or vice-versa using the scroll button. Operation of the 'Page' button returns the user to the trend display.

3.3.6 Operator Notes

This area allows up to 10 notes to be created when logged in as Engineer, using either the text entry techniques described in Section 3.6, or 'iTools' described in Section 6. Once logged out, operating the scroll button whilst a note is highlighted calls a selection box allowing the user either to send that note to the chart, or to write a Custom Note.

CUSTOM NOTE

The Custom Note is written using the text entry techniques described in Section 3.6. Once the note is complete, operation of the page button calls a confirmation display. The down arrow is used to highlight 'Yes', and when the scroll key is then operated, the message is sent to the chart. This custom message is not retained for further use, so if it is required on a regular basis, it is suggested that one of the Operator Notes 1 to 10 be configured (Engineer access level required) so that it may be used instead.

Note: Each note can contain up to 100 characters

3.3.7 Demand Archiving

This allows a user, with a high enough access level, to archive a selected portion of the recorder history, either to a 'memory stick' plugged into the USB port at the rear of the recorder (Local Archiving), or to a pc, by means of the FTP protocol (Remote Archiving). The archived data remains in the flash memory of the instrument. When the flash memory is full, new data causes the oldest file(s) to be discarded. The up and down arrow keys are used to navigate to the required field.

ARCHIEVE MENU

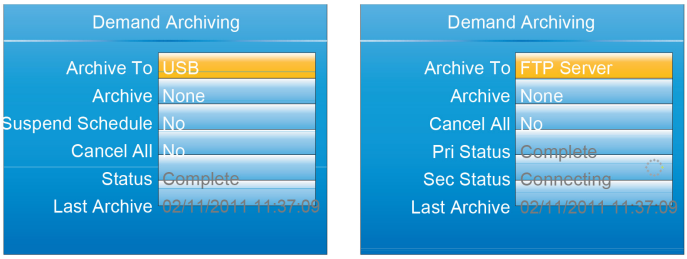


Figure 3.3.7 Demand Archiving menu (Local Archiving on left; Remote Archiving on right)

Archive To	With this item highlighted, the scroll button and the up/down arrows can be used to select 'USB' or 'FTP Server'. For 'USB', the archive will be made to the rear USB memory stick. For 'FTP Server' the archive will be made to the Primary or Secondary server (configured in the Network.Archive area of configuration described in Section 4.2.2. For more details about remote archiving, see 'Remote archiving', below.
Archive	In a similar way, select the archive period: None: No archiving to take place. (Not editable when logged out) Last Hour: Archives all files created within the last 60 minutes. Last Day: Archive all files created in the last 24 hours. Last Week: Archives all files created in the past seven days. Last Month: Archives all files created in the past 31 days. Archive All: Archives all the files in the recorder's history. Bring To Date: Archives all files created or updated since the 'Last Ar chive' date and time.
Suspend Schedule	When set to 'Yes', automatic (scheduled) archiving is stopped, once the transfer of the current file is complete. Suspend Schedule must be set to 'No' again, to re start the suspended archive. Suspend can be used to allow the memory stick to be removed and refitted safely.
Cancel All	When set to 'Yes', this cancels USB archiving activity immediately, or cancels FTP archiving once transfer of the current file (if any) is complete.
Last Archive	Shows the date and time at which the last archive (demand or automatic) was attempted. If a demand archive is requested, or is in operation when an auto matic archive is triggered, the automatic archive takes precedence.
Status	For Archive to USB only 'Complete' means that no archiving is currently taking place. 'Transferring' indicates that an archiving is in progress. Accompanied by an ani mated circular display. 'Suspended' means that archiving has been suspended as requested.
PriStatus	For Archive to FTP Server only, this shows the transfer status between the instru ment and the primary host computer.
SecStatus	For Archive to FTP Server only, this shows the transfer status between the instru ment and the secondary host computer.

Demand Archiving (Cont.)
FTP SERVER ARCHIVING

This allows the archiving of recorder files to a remote computer via the RJ45 type connector at the rear of the recorder, either directly or via a network.

In order to carry out a successful transfer:
1. Details of the remote host must be entered in the Network.Archive area of configuration (Section 4.2.2).

2. The remote computer must be set up as an FTP server. Help from the user's IT department may be necessary in order to achieve this.

3. The remote computer must also be set up to respond to 'pings'. This is because the instrument pings the host whilst establishing connection, and if it does not receive a response the archive attempt fails.

When accessing files using Microsoft® Internet Explorer, the address (URL) field can be in one of two formats:

1. ftp://<instrument IP address>. This allows a user to log in as the anonymous user (if the recorder has any account with the user name set to 'anonymous' with a blank password.

2. ftp://<user name>:<password>@<instrument IP address> to log in as a specific user.

For IE5 users, Microsoft® Internet Explorer displays, by default, history files only. To quit the history folder, either uncheck the Tools/Internet Options/Advanced/Browsing/'Enable folder view for FTP sites' option, or check the Tools/Internet Options/Advanced/Browsing/'Use Web based FTP' option.

REVIEW SOFTWARE

'Review' is a proprietary software package which allows the user to extract 'archive' data from one or more suitable instruments* and to present this data on a host computer, as if on a chart, or as a spreadsheet. The host computer must be set up as an ftp server. As described in the Review help system, 'Review' allows the user to set up a regular transfer of data (using ftp) from connected instruments into a database on the pc, and then from this database to the chart or spreadsheet. The chart/spreadsheet can be configured to include one or more 'points' from one or all connected instruments (where a 'point' is an umbrella term for channel, totaliser, counter etc.). It is also possible to archive instrument history files to a memory stick, Compact Flash card etc. (depending on instrument type) and to use this to transfer the data to the pc.
Each type of instrument has its own remote user name and password configuration - for this instrument, the user name and password are both 'history.

*Suitable instruments are connected instruments, the archive files of which have the suffix '.uhh'.

3.3.8 Login

Login allows the user to enter a password in order to gain access to areas of the unit's configuration which are not available when the user is logged out.

LOGGED OUT ACCESS LEVEL

Logged out mode allows the user to select viewing mode, to view history, to view alarms, to toggle faceplate cycling on and off, to send notes, to suspend/resume USB archiving and to access the login process.

OPERATOR ACCESS LEVEL

In addition to the logged out features, Operator access level allows the user to acknowledge alarms, to edit notes and to perform demand archive operations.
By default, no password is required in order to enter Operator level, but a password can be set either at Supervisor level or at Engineer level.

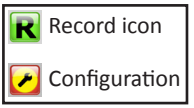
SUPERVISOR ACCESS LEVEL

In addition to the logged out level function, this access level allows the user to view the recorder's configuration, and to edit some values (such as alarm thresholds). By default, there is no password required to enter Supervisor level, but a password can be set in the Instrument area of configuration, either at Supervisor level or at Engineer level.

ENGINEER ACCESS LEVEL

This allows full access to all areas of the recorder configuration. The default password is 100, but this can be edited in the Instrument area of configuration (Section 4.1.5).

Note: Recording is stopped for as long as the user is logged in at Engineer level, even if the recorder is not being configured. This is indicated by the Record icon at the bottom left corner of the process value display screen being replaced by the Configuration (wrench) icon.



LOGIN PROCEDURE

From the top level menu, use the up or down arrow keys as often as necessary in order to highlight 'Login', and then operate the Scroll key to produce the 'Access Logged out' display.

Note: This procedure describes how to login to an access level with a password associated with it. For non-password protected logins, the user needs only to select the required access level, and press the scroll key.

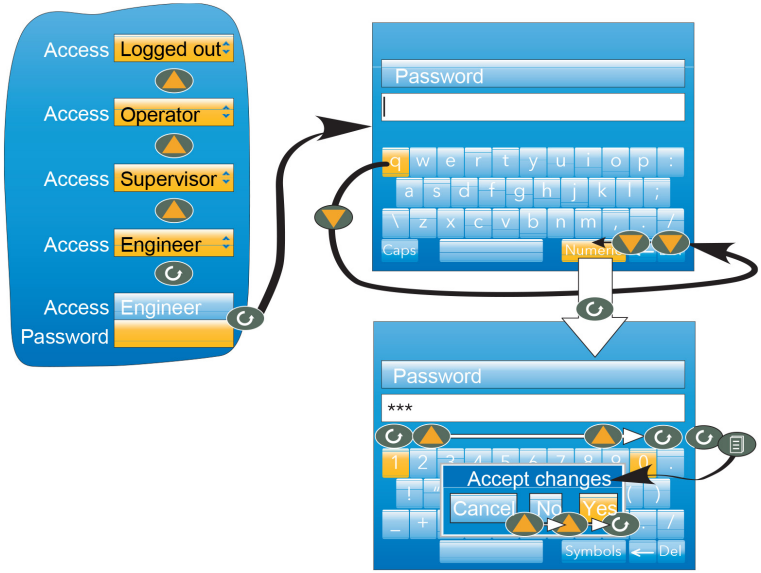


Figure 3.3.8. Log in Menu

To log in as Engineer (password = 100):

1. Operate the up arrow key three times, to display 'Engineer'.

2. Press the scroll key to call the 'alpha' keyboard, with the letter 'q' highlighted.

3. Use the down arrow key three times to highlight 'Numeric'.

4. Operate the scroll key to display the numeric keyboard (numeral '1' highlighted.)

5. Operate the scroll key to enter '1', then use the up arrow key nine times to high light numeral '0' and use the scroll key twice to enter '0' 0', completing the password of 100.

6. Use the Page key to call the confirmation display.

7. If the password entry is as required, use the up arrow twice (or the down arrow once) to highlight the word 'Yes' and operate the scroll key to confirm. The top level configuration menu appears. Otherwise, 'Cancel' can be used to clear the entry in order to start again, or 'No' can be used to quit login.

3.4 DISPLAY MODES

The following subsections describe the various display modes available to the user. By default, the 'Home' display mode is 'Vertical Trend', but this can be edited as a part of 'Instrument Display' configuration. This configuration area also allows the user to disable one or more display modes should they not be required. The current display mode can be chosen either by using the top level menu 'Go to View' item or, from any display mode, by scrolling through the enabled modes using the up or down arrow button.
Details of the various display modes are to be found in the following subsections:

3.4.1 Vertical Trend

In this mode, channel values are traced as though on a chart rolling downwards (i.e with the latest data at the top). The chart speed, and the number of major divisions are configured in the 'Group.Trend' area of configuration (Section 4.3.1). By default, the chart background is black, but this can be changed to white or grey in the 'Instrument' 'Display' area of configuration (Section 4.1.3).

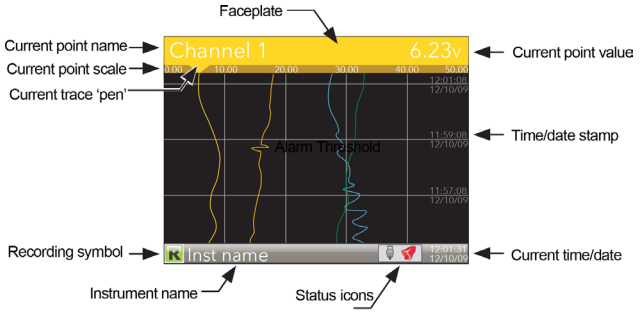


Figure 3.4 Vertical trend mode display elements

One of the channels is said to be the 'current' or 'scale' channel. This channel is identified by its pen icon being displayed, and by the channel descriptor, dynamic value and its scale being displayed on a 'faceplate' across the width of the display, above the chart.
Each channel in the Group becomes the 'current' channel in turn, for approximately five seconds -i.e. the channels are cycled through, starting with the lowest numbered channel. Once the final channel in the Group has ben displayed for five seconds, the first channel is returned-to and the process repeats. This scrolling behaviour can be enabled/disabled from the top level menu 'Faceplate Cycling (Off)' item described in Section 3.3.5. The scroll button can be used to cycle through the channels manually in both Faceplate cycle on and off modes. Use of the up arrow button causes the next enabled display mode to be entered (default = horizontal trend). The page key calls the top level menu.

3.4.2 Horizontal Trend mode

This view is similar to the vertical trend mode described in section 3.4.1 above, except that the traces are produced horizontally rather than vertically. Initially, as each channel appears, its scale appears at the left edge of the display (as shown below), but in order to show the maximum amount of trend data, the scale is overwritten after a few seconds.

By default, after a few seconds, the 'chart' expands leftwards to hide the scale. This feature can be disabled in the Instrument.Display area of configuration (Section 4.1.3, H.Trend scaling) so that the scale is per-

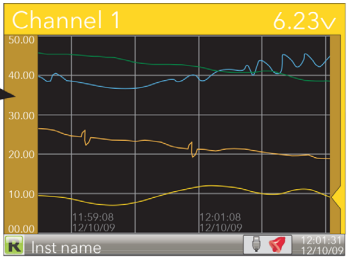


Figure 3.4.2 Horizontal trend display mode

Note: Time stamps appear to the right of the gridline to which they relate

Use of the up arrow button causes the next enabled display mode to be entered (default = vertical bargraph). Use of the page key calls the top level menu.

3.4.3 Vertical Bargraph mode

This display mode shows the channel values as a histogram. Absolute alarm threshold values appear as lines across the bars, grey if the alarm is not triggered; red if the alarm is triggered. Alarm symbols appear for active alarms.

Bargraph widths for four to six channels divide the width of the display screen equally between them. For one and two channels, the width is fixed, and the bars are centred on the screen. Figure 3.4.3 shows some examples (not to the same scale).

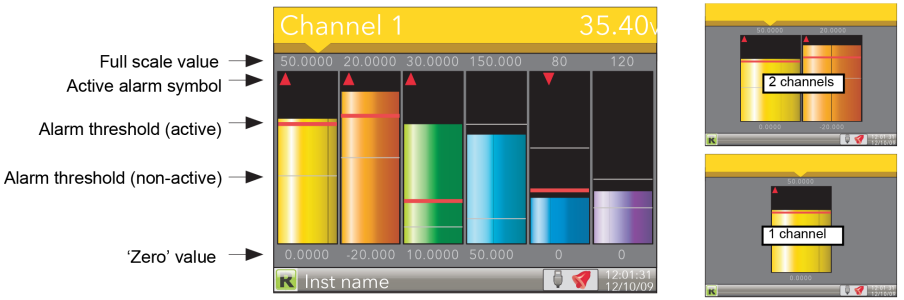


Figure 3.4.3 Vertical bargraph display mode

Use of the up arrow button causes the next enabled display mode to be entered (default = horizontal bargraph). Use of the page key calls the top level menu.

3.4.4 Horizontal Bargraph mode

Similar to the Vertical bargraph mode described in Section 3.4.3, above, but includes channel descriptors.

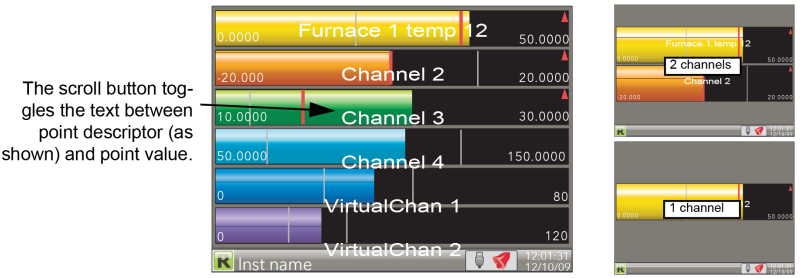


Figure 3.4.4 Horizontal bargraph mode

Use of the up arrow button causes the next enabled display mode to be entered (default = numeric). Use of the page key calls the top level menu.

3.4.5 Numeric mode

Shows the enabled channels' values along with their descriptors and with indications of the type(s) of alarm configured for each channel.

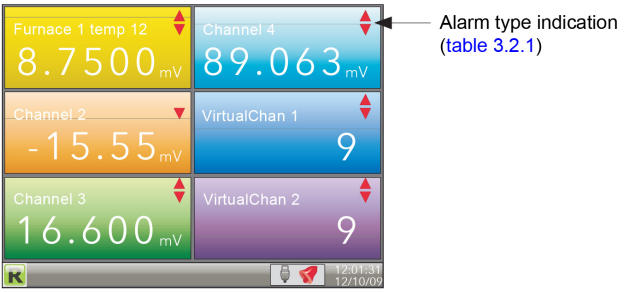


Figure 3.4.5a Numeric display mode (six enabled channels)

The figure above shows an example where the Trend group contains six channels. Figure 3.4.5b shows how the display appears for trend groups with fewer than six channels configured.

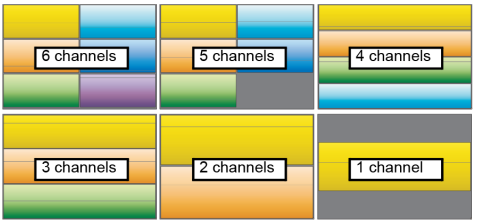


Figure 3.4.5b Display layout for different numbers of channels

The up arrow button returns to the vertical trend display mode; the page key calls the top level menu.

3.4.6 Alarm panel

This display appears only if enabled in the Instrument Display configuration (Section 4.1.3) Alarm panel mode shows current value and alarm status for each channel enabled in the Trend Group. The status is shown in two ways, by the colour of the relevant bar, and by the alarm status indicators.

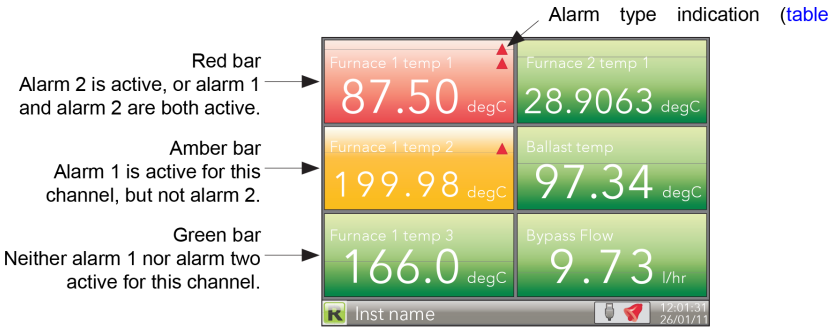


Figure 3.4.6a Alarm panel display (six channels)

The figure above shows an example where the Trend group contains six channels. Figure 3.4.6b shows how the display appears for trend groups with fewer than six channels configured.

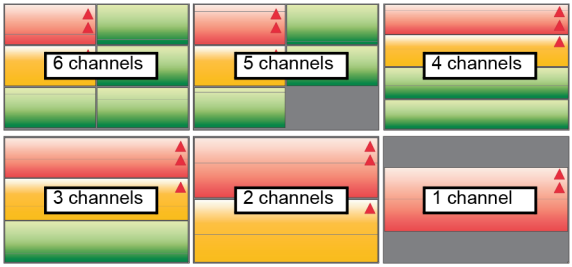


Figure 3.4.6b Alarm panel display layouts for trend groups with fewer than six channels

3.5 TREND HISTORY

Entered from the top level menu (Section 3.1), this allows vertical and horizontal traces to be reviewed for Trend group channels. The amount of data displayed in one screen depends on the 'Zoom In/Out' setting in the History menu (Section 3.5.2) and on the recording interval selected in Group Recording configuration (Section 4.3.2). It is also possible to enter a time and date to which the history then jumps. The history display is identical in appearance with the trend display except:

1. History displays can include messages if so configured in the History menu.
2. For horizontal trends, the scale is displayed permanently at the left edge of the display.

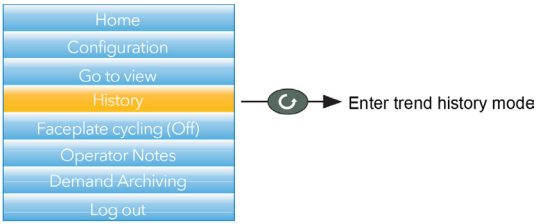


Figure 3.5a Top level menu

3.5.1 Navigation

The down arrow button moves the display backwards in time by 1/3 screen-full per operation (assuming that the current display is not the earliest). See also 'SEARCH FOR', below.

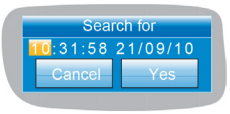
The up arrow button moves the display forwards in time by 1/3 screen-full per operation (assuming that the current display is not the latest). See also 'SEARCH FOR', below

The scroll key scrolls through the trend group channels, emphasizing each channel (and displaying its faceplate) as it is selected.

The page key calls the History Menu, described in Section 3.5.2, below.

SEARCH FOR

In the history display, holding the up or down arrow key operated for approximately two seconds produces a 'Search for' display which allows the user to enter a time and date. Once a time and date have been entered, 'Yes' then causes the history display to jump to that time and date (if such history exists).



To enter a time and date:

1. Use the up/down arrows to highlight the item to be edited.
2. When highlighted (orange background), operate the scroll button. The highlighted text turns black.
3. Use the up and down arrow keys to scroll to the required value for the field, then operate the scroll button again. The text goes white.
4. Repeat the above editing process for all the remaining items which are to be edited.
5. Use the up/down keys to select 'Yes'. The 'Search for' window closes, and the history display jumps to the selected time and date.

Note 1: If no history exists for the selected time and/or date 'No History Available' is displayed.
Note 2: The time and date format and Daylight Savings Time (DST) effects are as set in the 'Locale' area of Instrument configuration. See Section 4.1.2 for further details.

3.5.2 History Options Menu

Operating the page key from within a history display, causes the History Options menu to appear.

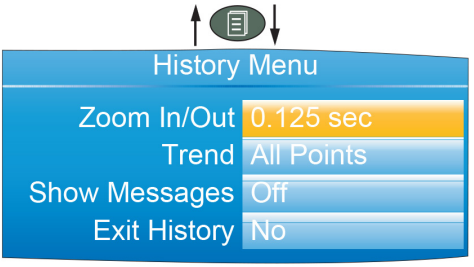


Figure 3.5.2 History Options menu

PARAMETERS

Zoom In/out	Allows the user to select the amount of history displayed on the screen.
Trend	Select either 'All Points' or 'Each Point'. 'All points' displays all channels in the trend group, with the first channel emphasized on the screen and its faceplate displayed. The Scroll button is used to select the next channel in the group. 'Each Point' initially displays only the first point in the trace group. The scroll key is used to cycle through individual group channels in turn.
Show Messages	'Off' disable the inclusion of messages in history display. 'On' causes messages to appear, superimposed upon the point traces (vertical trend mode only).
Exit History	Selecting 'Yes' for this item causes a return to the top level menu or to the message summary page.

Note: Operating the page key from the History menu causes a return to the history display.

3.6 TEXT ENTRY

The user is often required to enter text characters or numbers (when editing operator notes, for example). This is done using the pop-up keyboards which are displayed when required. When only numerals are required a special keyboard is presented which contains only numerals.

Figure 3.6 shows the three standard keyboards, along with a 'scan' direction for operations of both up arrow and down arrow keys. To change keyboards, use the arrow pushbuttons to highlight the keyboard name ('Numeric', 'Symbols' or 'Alpha'), and then operate the scroll button. Generally, to enter text, the required character is highlighted using the up and down arrows and the scroll button is used as an 'Enter' key. Once text entry is complete, the Page button is used to confirm the edit (use the down arrow to select 'Yes' then operate the scroll button).

Pressing and holding the scroll button and then immediately operating the up or down arrow, causes the character insertion point to move to the left (down arrow) or to the right (up arrow). The user can press and hold the scroll key to display variations on certain characters (the letter 'e' in the figure). Once displayed, the up and down arrows can again be used to scroll through auxiliary list, allowing capital letters,

and characters with diacriticals (e.g. accents, umlauts, tildes, cedillas) to be selected and entered using the scroll button.

The backarrow key is used as a back space key - i.e. it deletes the character to the left of the cursor position. The 'Del' key deletes the character to the right of the cursor.

Note: Leading and trailing space characters are automatically removed from text strings

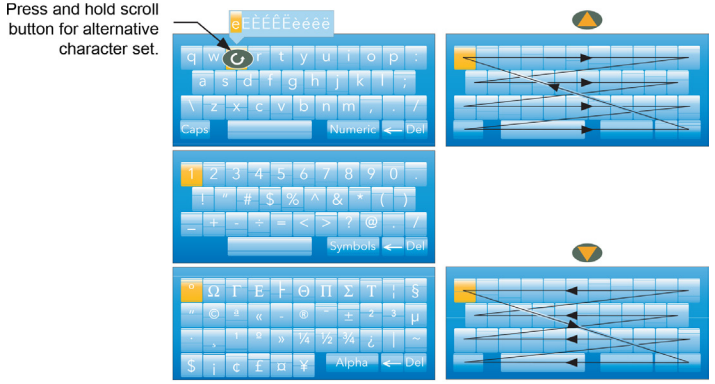


Figure 3.6 Standard Keyboards

3.6.1 Numeric keyboard

As mentioned previously, for functions which can take only numerals, a special numeric keyboard appears, as depicted in figure 3.6.1.

Figure 3.6.1 Numeric keyboard

4. CONFIGURATION

Entered from the top level menu (Section 3.1) this allows the recorder configuration to be accessed and edited ('Engineer' access level required for full editing).

Caution: Recording is stopped for as long as the recorder login is at Engineer level. This means that Input/output circuits are switched off during configuration.

As shown in figure 4, below, the recorder configuration is arranged in a number of 'areas', each of which is allocated its own sub-section within section 4.

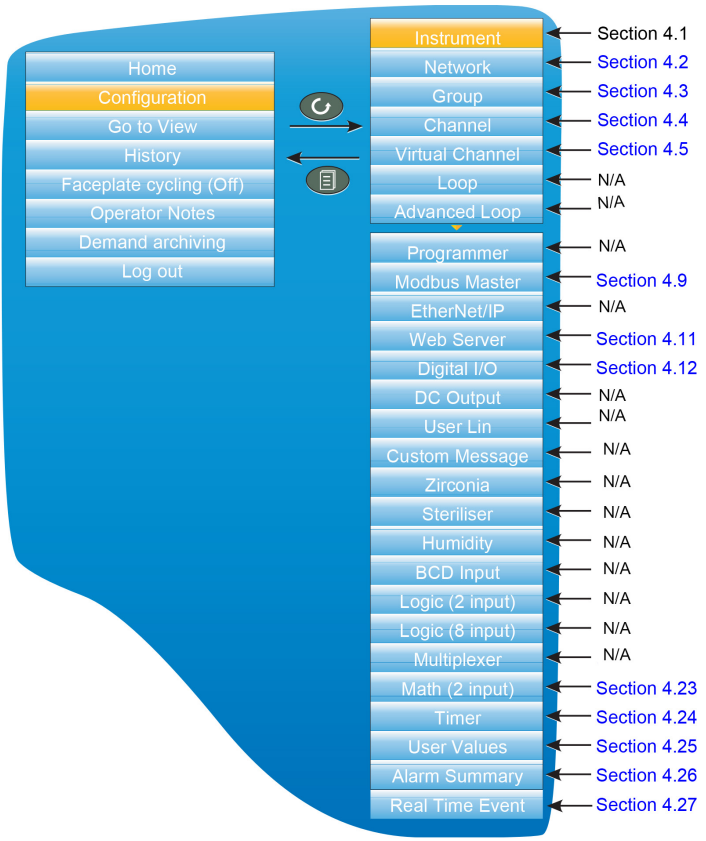
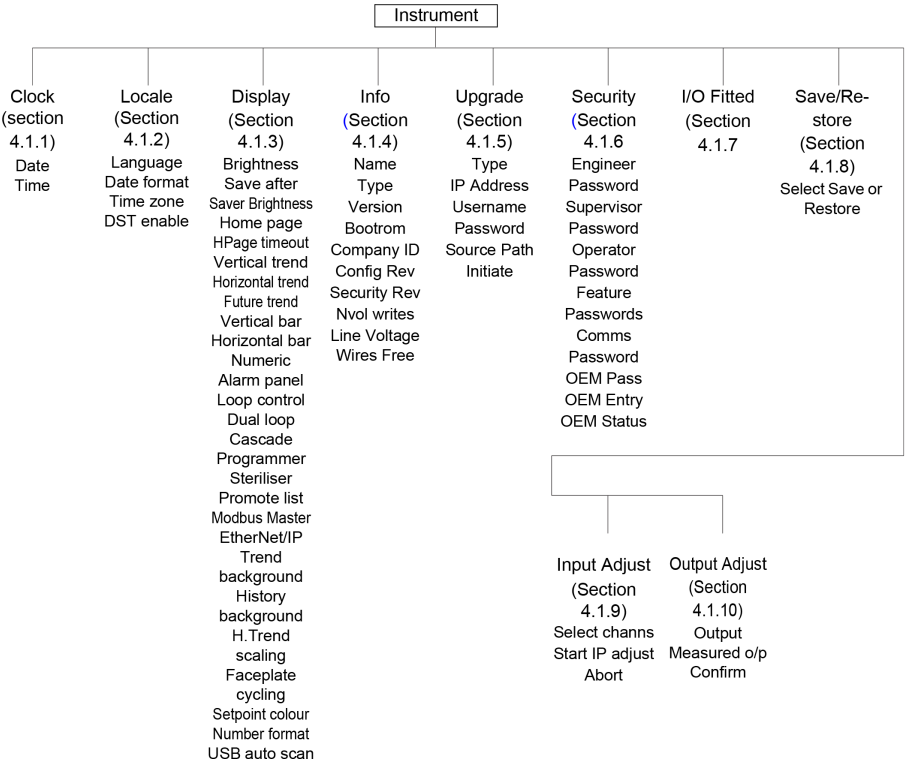


Figure 4 Top level configuration menu

The factory default configuration can be returned-to, if required, by entering a special Engineer password, as described in Section 4.1.6.

4.1 INSTRUMENT MENU



* CNOMO = Comité de normalisation des moyens de production.

4.1.1 Clock

The up and down arrows are used to highlight 'Date' (default) or 'Time'.
To set the date, the scroll button is used to display the numeric keyboard described in Section 3.6.1. The up and down arrows are used to highlight the relevant numeral or separator ('/' or ':') and the scroll key used to enter it into the display window.

To set the time, the scroll button is operated to enter edit mode, then the up and down buttons are used to scroll to display a time, say 15 seconds later than the current time. Once the current time matches the display, the scroll button is pressed to confirm the time and to start the clock.

Figure 4.1.1 Clock menu

The 'DST' field appears only If 'DST Enable' is selected 'Yes', in 'Locale' (Section 4.1.2). If the 'box' contains a cross (as shown) then Daylight Saving Time (DST) is not currently active. A 'tick' means that the time shown has been advanced by an hour because DST is active.

4.1.2 Locale

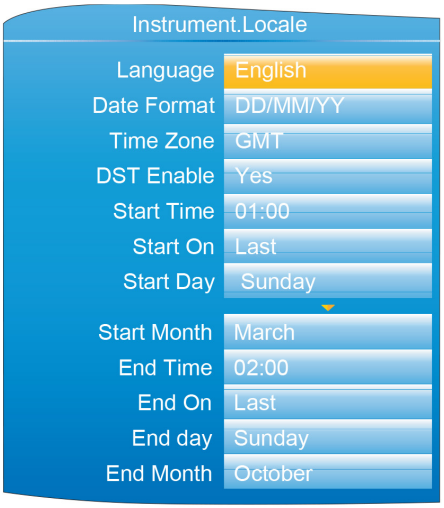


Figure 4.1.2 Typical Instrument configuration menu (expanded to show all fields)

Language	Select the language to be used for displays etc.
Date format	Select MM/DD/YY, YY/MM/DD as the required format.
Time Zone	Select the required offset from GMT (UTC). This setting affects only the displayed time. Archiving, recording etc. times remain in GMT.
DST Enable	Daylight Saving Time enable. Once the selection is enabled, the follow ing (previously hidden) fields appear, allowing the start and end dates for Daylight Saving Time (DST) to be configured. DST affects only the displayed time. Archiving, recording etc. times remain in GMT.
Start Time	Appears only when 'DST Enable' (above) is set to 'Yes'. Use the up/down keys to scroll to the required start time.
Start On	Select 'Last', 'First', 'Second', 'Third' or 'Fourth' as the required week. Used in conjunction with the 'Start Day' and 'Start Month' entries fol lowing.
Start Day	Select the day of the week on which DST is to commence.
Start Month	Select the month in which DST is to commence.
End Time, End On, End Day, End Month	As for 'Start Time' etc. above, but specifies the end time and date for daylight savings.

4.1.3 Display configuration

This allows the user to set display brightnesses and screen saver details, to select a display mode as the 'Home' page, and to enable/ disable the various display modes. The normal 'Select, Scroll, Enter' editing technique is used as has been previously described.

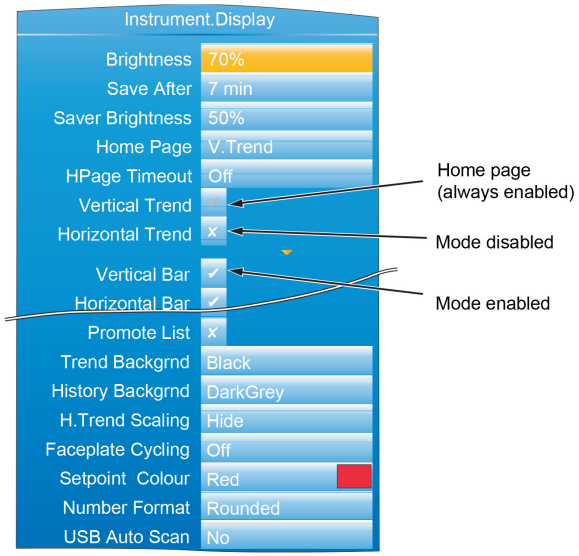


Figure 4.1.3 Display menu (expanded to show all fields)

Brightness	Allows the user to select a normal operating brightness for the screen from 10% to 100%, in 10% steps.
Save After	The elapsed time (since last button press) before the screen switches from 'Brightness' to 'Saver Brightness'. (Off = saver function disabled)
Saver Brightness	The screen saver brightness. Valid entries are 10% to 100% inclusive, in 10% steps. Using a lower power when not 'in use' not only saves power, but also increases display life. Typical screen power consumption is 0.5W at 100%, falling in a linear fashion to 0.05W at10%.
Home page	Allows any display mode to be chosen as the 'Home' page. This is the page that the recorder displays at power up, and also the page displayed when the 'Home' key is selected from the top level menu (Section 3.3. The selected display mode (vertical trend in figure 4.1.3) is always en abled in the following display mode enable fields (its 'tick' is greyed out and cannot be edited). See Section 3.4 for a description of the available modes.
HPage Timeout	The elapsed time (since last button press) before the display returns to the home screen. (Off = disabled)
Vertical Trend	This is the default home page, and its tick is greyed. If this is not the home page, the tick can be changed to a cross, by highlighting it and operating the scroll button.

Display Configuration (Cont.)

Horizontal Trend, Vertical Bar, Horizontal bar, Numeric, Alarm Panel, Loop control, Dual Loop, Cascade, Programmer, Steriliser, Promote List, Modbus Master, EtherNet/IP.

As for Vertical Trend, above. By default some display modes are disabled (grey cross). In order to enable such display modes the relevant cross is highlighted using the up/down arrow buttons, and the scroll button then used to change the grey cross to a white tick. The tick associated with the selected home page is always grey.

Note: Some display modes are available only if the relevant option is fitted.

Future Trend	This and the associated colour selections appear only if the Programmer option is fitted. See Section 3.4.9 for more details.
Trend Background	Allows the user to select black (default), white dark grey or light gray as the 'chart' colour.
History Background	As above for 'Trend background', but for history displays.
H.Trend Scaling	As described in Section 3.4.2, by default, the scale for horizontal trends appears at the left edge of the chart for a few seconds before the chart expands leftwards to occupy the scale area. Setting 'H.Trend Scaling' to 'Permanent', ensures that the scale remains permanently on display.
Faceplate cycling	Allows the default faceplate cycling state to be defined as 'On' or 'Off' (Section 3.3.5)
Setpoint colour	The colour for the setpoint in Control Loop display pages (Section 3.4.7).
Number Format	Rounded: Truncated:
USB Auto Scan	If set to 'Yes', bar code data messages are automatically generated and appear on the display and in the Message list without operator interven tion. If set to 'No', the Message appears on the screen for editing and/ or confirmation, before being displayed etc. Section 8.2 provides further details.

There is a new paramter been added to the Instrument. Display list - Number format.

The options are to "Round" or "Truncate" values. On the previous firmware releases of the nanodac, numbers were truncated (in the same way as the 6000).

From firmware versions V3.01 and above there is an option to allow numbers to be rounded. The reason for this is driven primarily from a control point-of-view. With truncation, it is quite likely that the PV will look as though it never settles onto setpoint. The rounding/truncation affects the UI display and MODBUS scaled integers, the underlying numbers are not affected, nor the values saved in the history files. Over MODBUS comms, all floating point parameters that are read via scaled integer comms will take note of the configured setting for rounding or truncating and reflect this. On the UI, ALL floating point values rendered will adhere to the configured setting of rounding or truncating.

4.1.4 Info menu

Gives information about the recorder hardware and software, and allows the user to enter a descriptor for the instrument. The normal 'Select, Scroll, Enter' editing technique, previously described) is used to edit those fields that are not read only.

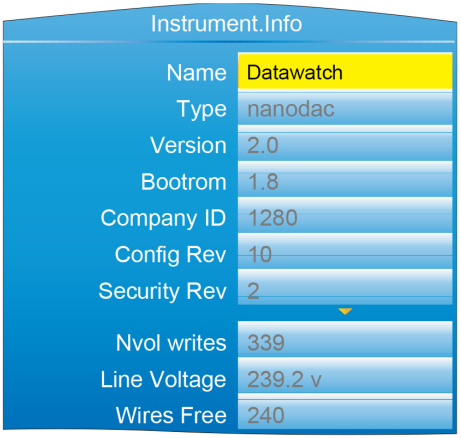


Figure 4.1.4 Info menu (expanded to show all fields)

Name	Allows the user to enter a descriptor of up to 20 characters, using the text entry techniques described in Section 3.6. The number of characters visible in the display mode pages varies according to the number of alarm symbols on display.
Type	Read only display of the instrument model (used by 'iTools').
Version	Read only. The software version of the instrument.
Bootrom	Read only. Instrument software Boot ROM version
Company ID	Read only. For CNOMO* purposes over Modbus (1280 decimal; 0500 hex).
Config Rev	Read only. This value is updated, and a message including this value generated, every time configuration is quit, if any one or more configura tion parameter has been changed.
Security Rev	Read only. This number is incremented every time configuration is quit, if any one or more passwords has been changed, or if the FTP Server username has been changed, or if the omms Enable field has been edited.
Nvol writes	Number of non volatile write operations for diagnostic purposes.
Line voltage	The instantaneous value of the supply voltage applied to the instrument. Used in some control loop operations.
Wires Free	This shows the number of wires free to be used. The value takes into account all user wiring whether carried out at the instrument or down loaded from the iTools graphical wiring editor.

4.1.5 Upgrade

Caution: 1. Power must not be removed from the unit while upgrade is in progress, as to do so will cause permanent damage to the unit.
2. For USB upgrades, the memory stick must not be removed whilst upgrade is in progress or the instrument will be perma nently damaged.

This item allows the user to update the instrument firmware, either from a memory stick in the USB socket at the rear of the unit, or via FTP transfer from a host computer. Firmware upgrade files are downloaded from the recorder manufacturer and transferred to the instrument by memory stick or by FTP transfer. Splash screens are prepared by the user and transferred using a memory stick. The unit restarts automatically after an upgrade or splash screen replacement.

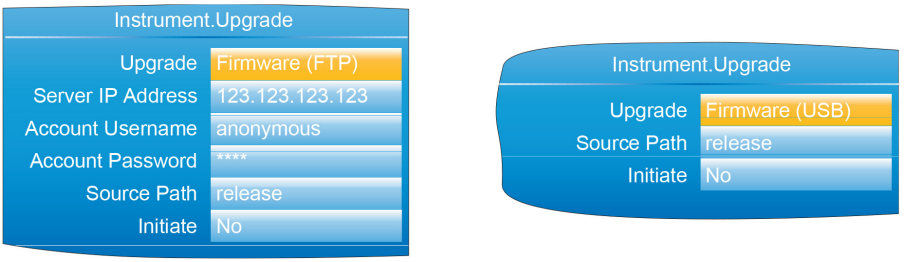


Figure 4.1.5 Typical Upgrade menus

Upgrade	Select 'Firmware (USB)', 'Firmware (FTP)', 'Bootrom (USB)' or 'Splash (USB)' as the source of the upgrade.
Server IP Address	For 'Upgrade' = 'Firmware (FTP)' only, this field must contain the IP ad dress of the pc which is to supply the upgrade file.
Account Username	For 'Type' = 'Firmware (FTP)' only, the username set up in the host ftp server
Account Password	For 'Type' = 'Firmware (FTP)' only, the password set up in the host ftp server
Source Path	The name of the directory from which the upgrade file is to be read. This is only the name of the directory without any path elements (e.g. '/') included unless the path is 'release/upgrade/files'.
Initiate	Select 'Yes' to initiate the upgrade.

CUSTOMISING THE SPLASH SCREEN

'Splash (USB)' allows the user to select a new image for the splash screen (i.e. the screen that appears at power up or restart). When 'Initiate' is set to 'Yes', the instrument searches the USB device for a file called 'splash.bmp' located in the 'release' folder. If such a file is found, it is loaded, and the instrument re-starts with the new image as the 'splash' screen. If no file is found, the request is ignored. If the image is not of the correct type or size, the instrument re-starts with the default splash screen. The original splash screen is included on the 'tools' DVD, so that it can be restored if required.

Rules:

1. This feature is available only with Bootrom versions 2.0 and above.
2. The file must be located in a folder called 'release' and the file name must be 'splash.bmp'.
3. The image must be 320 x 240; 24-bit resolution.
4. The image must be in bitmap (suffix.bmp) format.
5. The image may not exceed 256kB.

4.1.6 Security menu

This allows the user to enter passwords for all security levels (except logged out), and to enable/disable serial communications security.

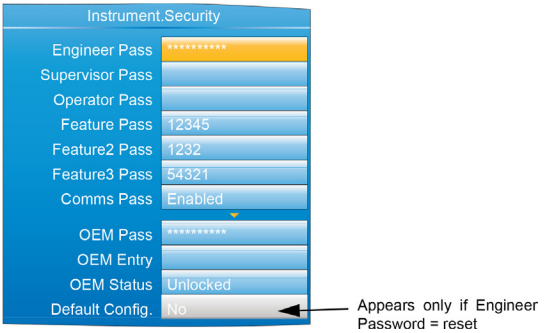


Figure 4.1.6 Security menu

Engineer Pass	Gives access to configuration menus. Set to 100 when despatched, but can be edited here, if required, by entering an alternative of up to 20 characters (note 1). If 'reset' (case sensitive) is entered as the Engineer Password, the 'Default Config.' field appears allowing the instrument default configuration to be restored (note 2).
Supervisor Pass	A password (none by default) of up to 20 characters can be entered here to protect Supervisor level access.
Operator Pass	A password (none by default) of up to 20 characters can be entered here to protect Operator level access.
Feature Pass	This is a password supplied by the manufacturer to enable the software options (e.g. Loop, Zirconia block, Toolkit blocks etc.). When applying for this code, the manufacturer will require the instrument's MAC address (Network.Interface menu Section 4.2.1) and the instrument's firmware Version (Instrument.info menu - Section 4.1.4). The password is MAC address dependent so that it cannot be used on any other instrument.
Feature2/3	Pass Similar to 'Feature Pass' above, but for additional features.
Comms Pass	Enables/disables password security for external communications (includ ing via iTools). If set to 'Enabled', the Engineer level password will be required if an attempt is made to enter the configuration menus from a remote pc. If set to 'Disabled', then access to configuration can be gained over a communications link, without a password. If enabled, then entry to configuration mode via the Instrument Mode (IM) parameter must be completed within 5 seconds of entering the password, or the attempt will fail.

Note 1: It is recommended that only such characters as appear on the user's pc keyboard be used in the Engineer password. The use of other characters makes it necessary to use 'Escape' codes (e.g. Alt 0247 for the '÷' sign) when trying to enter configuration mode from iTools, for example.
Note 2: The time and date format and Daylight Savings Time (DST) effects are as set in the 'Locale' area of Instrument configuration. See Section 4.1.2 for further details.

Security Menu (Cont.)

OEM Pass	The configured pass phrase used to enable / disable the OEM security option. This field is editable whilst the OEM Status is 'Unlocked' and the user has 'Engineer' access.
OEM entry	To lock or unlock the OEM security feature, the user must enter the pass phrase entered in 'OEM Pass' above. The default passcode is OEM (in capitals).
OEM Status	Read only 'Locked' or 'Unlocked' status display.
Default Config	This field appears only if 'reset' has been entered as the Engineer Pass word. Selecting 'Yes' Causes the instrument to restart with default con figuration (i.e. the instrument 'cold starts'). See note 2 above.

OEM SECURITY

In products that incorporate user wiring, the value of an application may lie more in the user wiring (connecting the function blocks together) than in the configuration of the instrument's parameters. OEM Security allows the user to prevent the application from being copied either via comms (by iTools or a third party comms package) or via the instrument's user interface. When OEM security is enabled, users are prevented from accessing wiring (for reading or writing) from any source (comms or user interface), and it is not possible to Load or Save the configuration of the instrument via iTools or by using the Save/Restore facility (Section 4.1.8). From firmware version V5.00 onwards OEM Security is enhanced by providing an option, enabled by a new parameter 'Instrument.Security.OEMParamLists. This parameter is available only through iTools and allows the OEM to:

1. Make all parameters that are read/write in Engineer access level only, read only when the instrument is OEM locked AND it is in Engineer access level. It is possible for the OEM to select up to 100 parameters which are to remain read/write in Engineer access level.

2. Make up to 100 parameters that are read/write in Supervisor access level, read only when the instrument is OEM locked. Examples of how to set up OEM security are given in the iTools Section 6.6.10.

4.1.7 I/O fitted

This provides a read only display showing what type of input or output circuit is associated with each set of rear
terminals.

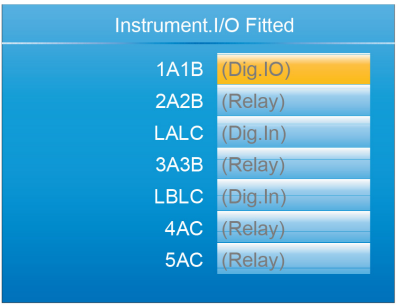


Figure 4.1.7 I/O fitted display

I/O TYPES

Dig.IO	Digital input/output
Relay	Relay output
Dig.In	Digital input
Dig.Out	Digital output
DC.Op	DC output

Note: The I/O types fitted in locations LALC, LBLC, 4AC and 5AC are always as shown above. The types of I/O fitted in locations 1A1B, 2A2B and 3A3B depends on the options specified at time of order.

4.1.8 Save/Restore

This allows the user to save and/or restore instrument clone configurations to a memory stick inserted into the USB connector at the rear of the unit. The format of the saved/restored files is iTools clone files (*.uic)

Selecting 'Restore' presents a list of clone files in the configured directory on the USB device. (In the example below, the file is located in the basic usb0 directory - it has not been saved to a particular configuration directory.)
When 'Save' is selected, the virtual keyboard must be used to enter the filename. If the file already exists on the USB device, a warning appears offering 'Cancel' or 'Overwrite' alternatives.

Note: 1. The ability to save and restore is disabled if OEM security is enabled.
Note: 2. Configuration save/restore is available only when the unit is logged into at 'Engineer' access level.
Note: 3. During USB cloning (USB save/restore), the priority of modbus slave comms is lowered. This allows the save/restore process to complete in a minimal time (around 60 seconds). During this period, modbus slave comms response times will be extended and may result in the master device timing-out.

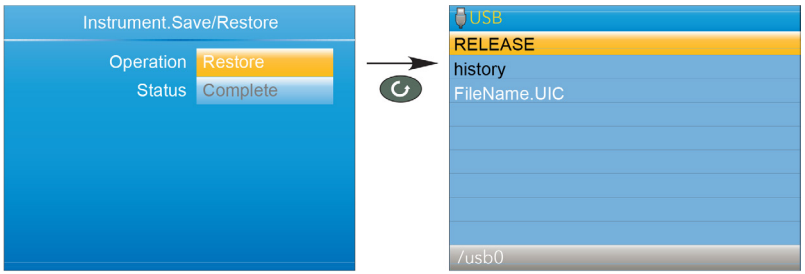


Figure 4.1.8 Save/Restore display

Operation	Select 'Save' or 'Restore'. Use the up/down arrow keys to highlight the required .UIC file, then use the scroll key to initiate the operation.
Status	Shows the status of the operation, as follows: Inactive: Neither saving or restoring a clone file has occurred since the last time the instrument was power cycled. Complete: Indicates that the cloning process has completed. Restoring: Restore operation is currently in progress. Saving: A clone file is currently being saved. Cold started: A power-cycle of the product occurred whilst a Restore operation was in progress. The product configuration is unreliable and has been reset to factory default.

The 'Restoring' and 'Saving' status text is accompanied by an animated display (circling green 'flash') to indicate that the operation is in progress.

4.1.9 Input adjust

Note: 1. Input adjust cannot be applied to input channels with input type of 'Digital', 'Test' or 'Off'.
Note: 2. Input adjustments can be carried out only by users logged in as 'Engineer' (see Section 3.3.8).
Note: 3. The instrument must be powered for a sufficient time (e.g. 30 minutes) for it to reach thermal equilibrium before an input adjust is performed.

This facility allows the user to compensate for tolerance errors etc. The technique used is to select those channels to which adjust is to be applied, then for each channel to:

a. apply a known low level signal (at or close to the low input range value) to the relevant input. When the recorder reading is steady, press 'Apply'.

b. apply a known high level signal (at, or close to, the high input range value) to the relevant input. When the recorder reading is steady, press 'Apply'.

Figure 4.1.9a shows a typical display when 'Input adjust' is selected from the Instrument menu, and Apply adjust has been selected. As can be seen, channel 3 has previously been adjusted.

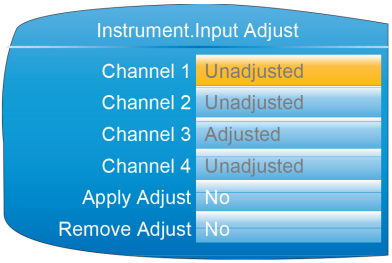


Figure 4.1.9a Input adjust top level display

Channel 1 to 4	Shows the adjust status of each channel
Apply Adjust	Selecting 'Yes' initiates the adjustment procedure described below.
Remove Adjust	Selecting 'Yes' initiates the adjustment removal procedure described below.
Abort	Allows the user to abandon input adjustment at any point in the proce dure.

ADJUSTMENT PROCEDURE

1. As shown in figure 4.1.9b, highlight the 'Apply Adjust' field, and operate the scroll key to enter edit mode. Use the up or down arrow key to select 'Yes'. Use the scroll button to change Channel 1 'cross' to a 'tick' (check mark). Similarly select any other channels which require adjustment.

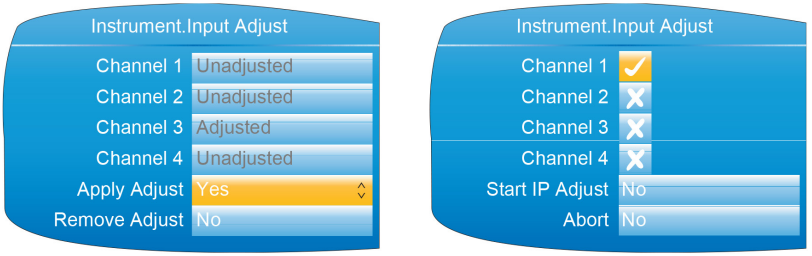


Figure 4.1.9b Channel adjustment procedure (1)

Input Adjust (Cont.)

ADJUSTMENT PROCEDURE (Cont.)

2. Highlight the 'Start IP 'Adjust' field and use the scroll and up/down arrow to select 'Yes'. Use the scroll key again to enter the low value adjust page.

3. Apply the known low value and wait for the value to stabilise. Enter the 'Low Target Value' (the value that the recorder is to read for the applied input). When all is steady, use the scroll and up/down arrow to set the 'Confirm Low' field to 'Yes', then operate the scroll button again.

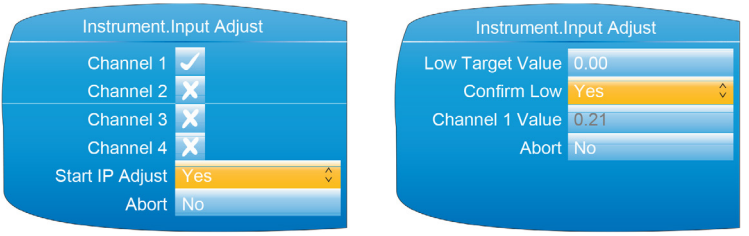


Figure 4.1.9c Channel adjustment procedure (2)

4. The display changes to the high value adjust page.

5. Apply the known high value and wait for the value to stabilise. Enter the High Target Value (the value that the recorder is to read for the applied input). When all is steady, set 'Confirm High' to 'Yes'.

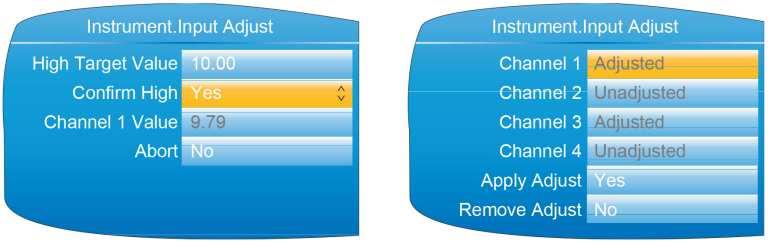


Figure 4.1.9d Channel adjustment procedure (3)

REMOVAL PROCEDURE

1. Set 'Remove Adjust' to 'Yes' and operate the scroll button.

2. Use the scroll and up/down arrow buttons to change the required channel icons from crosses to ticks.

3. Select Remove IP Adjust to 'Yes' and operate the scroll key. The adjustment is removed from all selected channels without further confirmation.

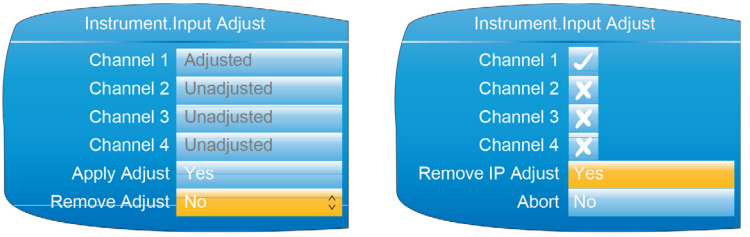


Figure 4.1.9e Channel adjustment removal

Input Adjust (Cont.)

DUAL INPUT CHANNELS

For the dual input channel option, input adjust is carried out as described above, except that for any channel where dual inputs are configured, the user must initiate adjustment to primary and secondary inputs separately. As shown in figure 4.1.9f, a new field 'Input on Channel' is introduced for this purpose.

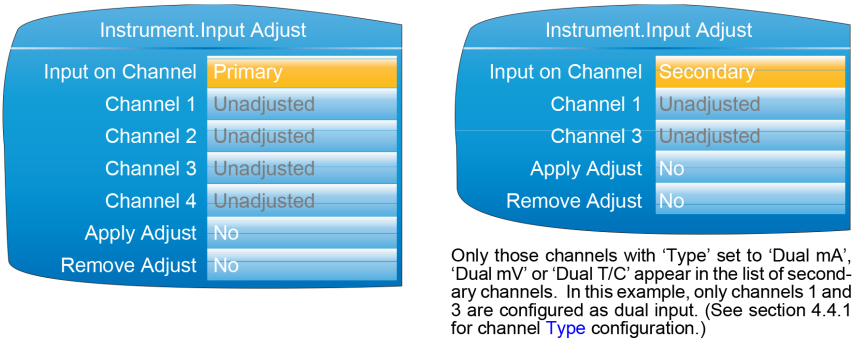
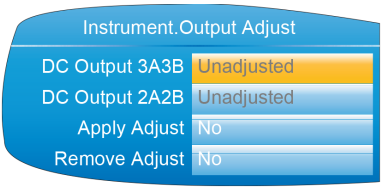


Figure 4.1.9f Input adjust top level display (dual input channels)

For primary inputs, all four channels are included in the list and can therefore be selected for adjustment. For secondary inputs, only those channels which have been configured as dual input are included.

4.1.10 Output adjust

This item appears only if one or more of I/O type DC Output is fitted and allows the user to compensate fortolerance errors etc. in connected equipment.

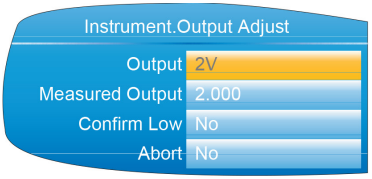


1A1B and 2A2B can be configured only as mA outputs.
3A3B can be configured as mA or Volts.
See Section 4.13 for configuration details.

Figure 4.1.10a Output adjust initial display

ADJUST PROCEDURE

1. Highlight the 'Apply Adjust' field, and operate the scroll key to enter edit mode. Use the up or down arrow key to select the required output and confirm with the scroll key. The output adjust page appears for the low point.
2. Measure the output at the required point, and enter this value in the 'Measured Output' field using the text entry techniques described in Section 3.6. To skip this stage go to step 3.
3. Set 'Confirm Low' to 'Yes'. The output adjust page appears for the high point.
4. Measure the output at the required point, and enter this value in the 'Measured Output' field as described for the low point. To skip this stage go to step 5.
5. Set 'Confirm High' to 'Yes'. The output adjust initial display reappears, with the word 'Adjusted' in the relevant DC Output field.



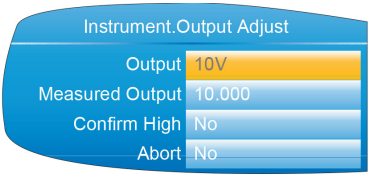


Figure 4.1.10b Low and High adjust point displays

Note 1: The figures above show the displays when the DC output is set to 'Volts' (Section 4.13) (3A3B only). The mA displays are similar, but the fixed low and high values are 4mA and 20mA respectively
Note 2: 'Abort' cancels operations so far and returns to the output adjust initial display (figure 4.1.10a).

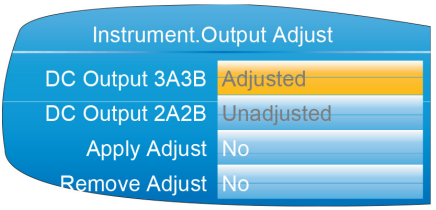
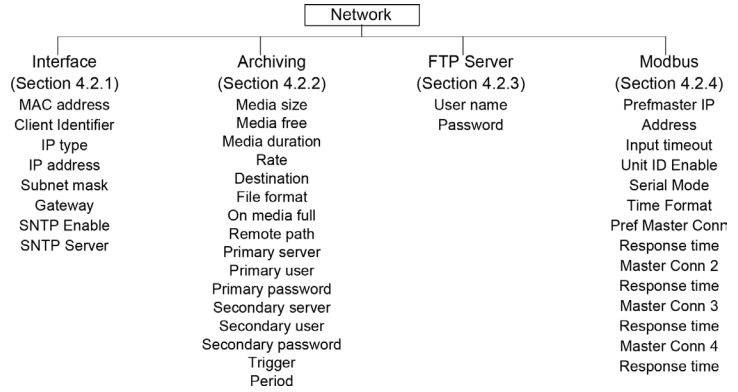


Figure 4.1.10c Adjusted display

ADJUST REMOVAL

In the output adjust initial display (figure 4.1.10c) highlight the 'Remove Adjust' field, and operate the scroll key to enter edit mode. Use the up or down arrow key to select the required output and confirm with the scroll key. The output adjustment is removed, without confirmation. The initial display returns to 'Unadjusted' as in figure 4.1.10a.

4.2 NETWORK MENU



4.2.1 Interface

This area of configuration allows the user to set up an IP address for the instrument, either by typing one in (Fixed), or automatically (DHCP), assuming a DHCP server is running

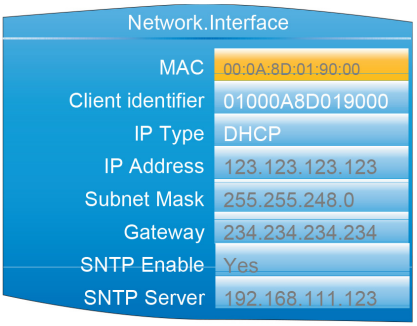


Figure 4.2.1 Network Interface menu

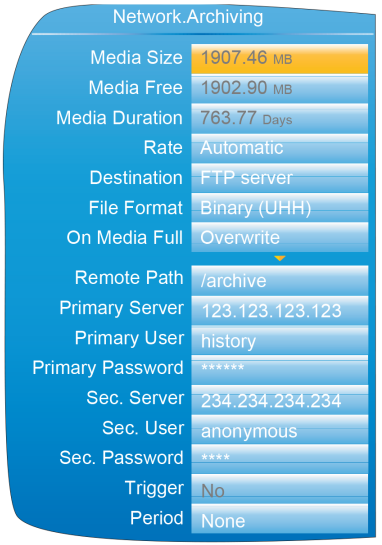
MAC	Read only. Media Access Control. A unique address for each instrument, entered at the factory.
Client Identifier	The client identifier is a unique id used by DHCP servers that implement option 61. Each nano product will have a unique ID built up from its MAC address. If the DHCP server is configured to use option 61, then it will use this id instead of the MAC address to assign a dynamic IP address.
IP Type	If 'Fixed', the user needs to enter an IP address and Subnet Mask in the following fields, and a Gateway address if required. If 'DHCP' the subse quent fields become read only, with the entries automatically generated by the DHCP server. When set to DHCP, it takes several seconds before the IP address is obtained from the DHCP server.
IP Address	Read only if 'IP Type' = 'DHCP'. If 'IP Type' = 'Fixed', the user may enter an IP address (IPV4 dot nota tion). This would normally be supplied by the user's IT department, or from the Network supervisor.
Subnet Mask	Read only if 'IP Type' = 'DHCP'. If 'IP Type' = 'Fixed', this sets a range of IP addresses that can be ac cessed. Normally supplied by the user's IT department, or from the Network supervisor.

Gateway	Read only if 'IP Type' = 'DHCP'. If 'IP Type' = 'Fixed' this allows the user to enter a gateway address for use when the unit is to communicate outside the local network. Nor mally supplied by the user's IT department, or from the Network super visor.
SNTP Enable	Select 'Yes' to allow time synchronisation from a Simple Network Time Protocol (SNTP) server to be enabled. When enabled the instrument time is updated every 15 minutes. SNTP always works using UTC/GMT. Time zones are handled separately. SNTP is a protocol that allows clients on a TCP/IP network to synchronise the instrument clock with that of a server - port number 123. nanodac can act only as a client. Servers such as Microsoft 'TimeServ' cannot be used with the nanodac because they are not SNTP servers.
SNTP Server	The IP address of the SNTP Server. This only appears if the SNTP server is enabled. If 'IP Type' is set to 'DHCP', the SNTP Server address is automatically assigned. Although this address can be altered it will be overwritten once the instrument is power cycled. The SNTP address should only be entered manually if 'IP Type' is set to 'Fixed'. For a description of SNTP alarms see Section 3.2.2.

4.2.2 Archiving

This area of configuration is used to set up the parameters for use during unattended archiving. Some of the fields appear only if other fields are set to a particular value. For example, the CSV fields appear only if 'File Format' is set to 'CSV' or to 'Both'.
The archived data is not removed from the flash memory of the instrument. When the flash memory is full, new data causes the oldest file(s) to be discarded.

> **Note:** For remote archiving, the host computer must be set up to respond to 'pings'. This is because the nano pings the host whilst establishing connection, and if it does not receive a response the archive attempt fails.



Remote with Binary file format

Local with CSV files included

Figure 4.2.2a Unattended Archive configuration (typical settings)

Media Size	Appears only for File Format = 'Binary (UHH)'. A read only value showing the capacity of the memory stick inserted in the USB port at the rear of the unit. Shows zero if no memory stick is present.
Media Free	Appears only for File Format = 'Binary (UHH)'. A read only value showing the space remaining in the memory stick inserted in the USB port at the rear of the unit. Shows zero if no memory stick is present.
Media Duration	Appears only for File Format = 'Binary (UHH)'. A read only value showing the time it will take to fill the Memory stick if the recorder configuration remains unchanged.

Rate — Allows the user to specify the frequency at which the contents of the Flash memory are archived to the USB port or, via FTP, to a pc. Scrollable settings are:
None: Automatic archiving is disabled. Any archiving must be initiated by the user using Demand Archiving, as described in Section 3.3.7.
Hourly: Archive occurs on the hour, every hour.
Daily: Archive initiated at 00:00* each day
Weekly: Archive is initiated at midnight* every Sunday
Monthly: Archive is initiated at 00:00* on the 1st of every month.
Automatic: The recorder selects the least frequent of the above archive periods which is guaranteed not to lose data as a result of the internal flash memory's running out of space.

Note: * Archive times are not adjusted for daylight saving time (DST). Thus, if the archive is set to 'Daily', 'Weekly' or 'Monthly', then during summer time, the archive will be triggered an hour late (i.e at 01:00 hours instead of midnight).

Destination — Select 'FTP Server' for archive to a remote pc, or 'USB' to archive to the USB port device.

File format — Select 'Binary (UHH)' 'CSV' or 'Both'.
Binary (UHH): A proprietary format used by the instrument that needs other software (e.g. Review', to interpret the data before it can be presented in spreadsheets etc. Binary files have the extension '.uhh'.
CSV: This format is a standard open-file format for numeric data. A simple ASCII-based format, it is readable by a wide range of pc applications as well as being suitable for direct import into many commercial databases. CSV files have the extension .csv'.
Both: Archiving includes both .uhh and .csv files.

Note: .CSV is ASCII based and cannot interpret Unicode characters. For this reason, some characters available to the user will not be displayed correctly in .csv files.

CSV Values — Appears only if 'File Format' is set to 'CSV' or 'Both'. If 'Yes' is selected, then process values are included in the file (see figure 4.2.2b for details).

CSV Messages — Appears only if 'File Format' is set to 'CSV' or 'Both'. If 'Yes' is selected, then messages are included in the file (see figure 4.2.2b for details).

CSV Headers — Appears only if 'File Format' is set to 'CSV' or 'Both'. If 'Yes' is selected, then Header details are included in the file (see figure 4.2.2b for details).

CSV Headings — Appears only if 'File Format' is set to 'CSV' or 'Both'. If 'Yes' is selected, then column headers are included in the file (see figure 4.2.2b for de tails).

CSV Date Format — Appears only if 'File Format' is set to 'CSV' or 'Both'. Allows 'Text' or 'Spreadsheet' to be selected. Text causes a time/date to ap pear in the spreadsheet. 'Spreadsheet Nu' displays the number of days since December 30th 1899. The decimal part of the number represents the latest six hours. For example: DDD--- --DD.25 represents 06:00 hours and DDD--- --DD.5 represents 12:00 hours. Spreadsheet

Numeric format is more easily interpreted than 'Text' by some spreadsheet applications.

CSV Tab Del — Appears only if 'File Format' is set to 'CSV' or 'Both'.
CSV (Comma Separated Variables) does not always use commas as sepa rators. For example, in some countries the decimal point is represented by a full stop (period), whilst in others a comma is used. In order to avoid confusion between a comma as a decimal point and a comma as a sepa rator, a different separator can be used. This field allows the 'tab' charac ter (^t) to be used instead of a comma.

On Media Full — For 'Destination' = 'USB' only, this allows the user to select 'Overwrite' or 'Stop' as the action to be taken when the memory stick is full. 'Overwrite' causes the oldest data to be discarded from the memory stick to make room for newer data. 'Stop' inhibits archiving activity.

Remote Path — Left blank if the archive destination is the home folder. If the destination is to a subfolder within the home folder, then the name of the subfolder is entered here, preceded by a '/' character (e.g. '/history').

Primary Server — Allows the user to enter the IP address for the pc to be used as the pri mary FTP server.

Primary User/Password
These are the Login name and password of the remote host account, assigned either by the Network administrator, or set up in the 'Guest' account of the remote host's 'FTP server' or 'User Manager' configura tion.

Sec. Server/user/password
As Primary server details above, but for the secondary FTP server used when the primary is not available for any reason. Trigger This parameter can be 'wired' to, say, an alarm going active, or a digital input, to allow an archive to be triggered remotely. Can also be set to 'yes' manually.

Period — Appears only if 'Trigger' is wired (Section 7). Allows a period of history to be selected for archiving when 'Trigger' goes 'true. Selections are: None, Last Hour, Last Day, Last Week, Last Month, All, Bring to Date. ('Last Month' archives the last 31 days of history.)

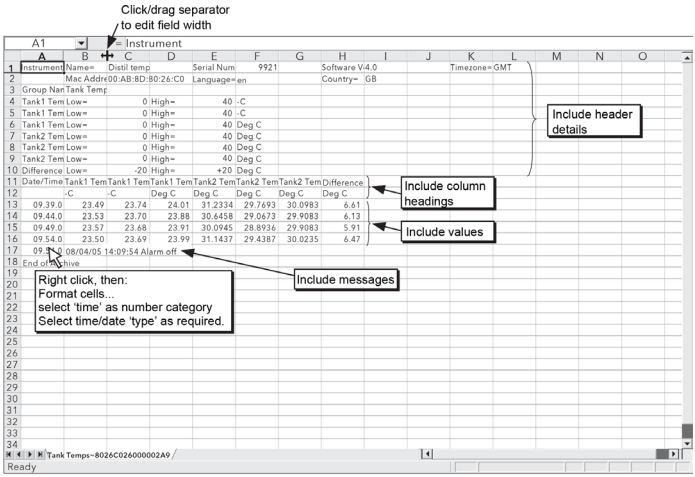


Figure 4.2.2b CSV data example

4.2.3 FTP Server

This area of configuration allows the user to enter the Username and Password used to access the instrument from a remote FTP client.

4.2.4 Modbus TCP

This allows the user to configure the recorder so as to allow it to communicate using Modbus Transmission Control Protocol.

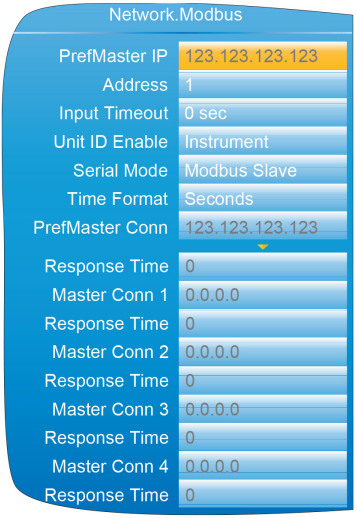


Figure 4.2.4 Modbus TCP configuration menu

PrefMaster IP The IP address of the relevant Modbus master. The Preferred master is guaranteed to be able to connect, even if all slave connections (max. = 4 for TCP) are in use.

Address The Modbus address for this slave. This address must be unique for the network to which it is attached. The recorder will respond to this address and to Address 255.

Input Timeout Allows a value of between 0 and 3600 seconds to be entered to set the timeout period for modbus input channels. If a modbus input is not writ ten to within this period the value of the channel is set to -9999.0 with a 'No Data' status. A value of 0 disables the comms inactivity timeout feature.

Unit ID Enable Enables/Disables the checking of the Modbus TCP unit identity field. StrictThe Modbus TCP Unit Identity Field (UIF) does not have to match the instrument address. The instrument responds only to Hex value FF in the UIF. iTools finds this instrument only at location 255, and then stops scanning. LooseThe Modbus TCP Unit Identity Field (UIF) does not have to match the instrument address. The instrument responds to any value in the UIF InstrumentThe Modbus TCP Unit Identity Field (UIF) must match the instrument address or no response will be made to messages.

Serial Mode Slave communications via the side mounted configuration port interface (CPI) clip (for iTools use.) Parameters: Baud rate 19,200; Parity = none; Number of data bits = 8; Number of stop bits = 1; no flow control. Can be set to 'Modbus Slave' or 'Off'. The unit must be restarted before any change takes effect.

Time Format	Allows the user to choose milliseconds, seconds, minutes or hours as the time format. Sets the resolution for the reading and writing of time format parameters.
PrefMaster Conn	Read only. Shows the IP address of the preferred master, when connect ed.
Response Time	Read only. Shows the response time for a single communications request to the relevant master.
Master Conn 1 to 4	Read only. Shows the IP addresses of any other masters connected to this recorder.

4.3 GROUP CONFIGURATION

Group configuration is separated into two areas, one which defines trending characteristics (for display channels) the other defining the recording characteristics for saving data to the Flash memory ready for archiving.

4.3.1 Group Trend configuration

This allows the user to define which points are to be traced on the display and at what interval, and also allows the number of chart divisions to be set up. Figure 4.3.1 shows a typical configuration page.

Note: .The background chart colour is set up as a part of Instrument Display configuration (Section 4.1.3)

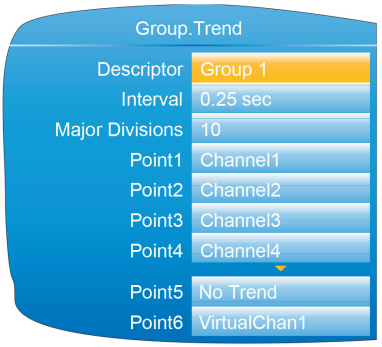


Figure 4.3.1 Group Trend Configuration

Descriptor	Allows the user to enter a descriptor (20 characters max.) for the group.
Interval	The trending interval which defines how much data appears on one screen height or width. A number of discrete intervals can be chosen between 0.125 seconds to 1 hour. The selection should be made accord ing to how much detail is required, and how much data is to be visible on the screen.
Major Divisions	Allows the user to select the number of divisions into which the scale is divided and how many gridlines are displayed. Setting the value to 1 results in just the zero and full scale values appearing. Setting the value to 10 (the maximum) results in a scale with zero, full scale and nine intermediate values appearing, with associated grid lines.
Point1 to Point6	Allows the user to select which channels and virtual channels are to be traced. The maximum number of traces is six.

4.3.2 Group Recording configuration

Similar to Trend configuration, above, but for saving the data to Flash memory history files. Each point can individually be enabled or disabled for recording, or recording can be disabled for the whole group. Figure 4.3.2 shows a typical page.

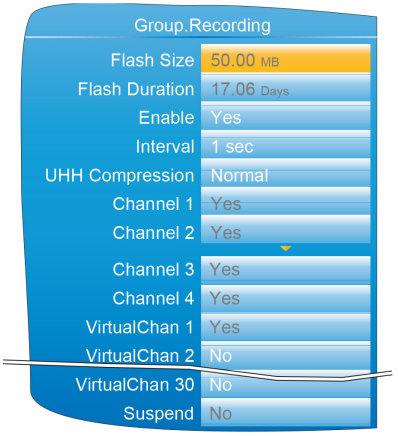


Figure 4.3.2 Group trend recording configuration

Flash Size	Read only. Shows the size of the Flash memory fitted in MB.
Flash Duration	Read only. Shows the time it will take to fill the Flash memory if the recorder configuration remains unchanged.
Enable	'Yes' enables group recording so that all points set to 'Yes' are stored in the recorder's flash memory. 'No' disables group recording.
Interval	Defines the rate at which data is saved to the recorder's Flash memory. The value affects how much trace history appears on the screen in trend history mode.
UHH Compression	Select 'Normal' or 'High'. 'Normal' compresses the data, but still provides an exact copy. 'High' compresses more, but values are saved only to 1 part in 108 resolution. See also note 1, below.
Channel 1 to VirtualChan 30 (see note 2, below)	Read only (greyed 'yes') for points being trended, (these are automati cally recorded). For non-trending points the user may enable or disable each point individually.
Suspend	Ignored unless the user has wired to this field. If wired then when set to 'No' recording is active, when set to 'Yes' recording is paused.

Note 1: Where very high values are involved, such as in some totaliser values, 'High' compression may cause the value displayed at the recorder, and held in the history file, to be incorrect. The problem may be resolved by changing to 'Normal' compression, or, in the case of a totaliser, by re-scaling it (for example from MegaWatt hours to TeraWatt hours).

Note 2: Virtual channels 1 to 15 are included in the standard build. Channels 16 to 30 are included only if the Modbus Master and / or EtherNet/IP option is fitted.

4.4 INPUT CHANNEL CONFIGURATION

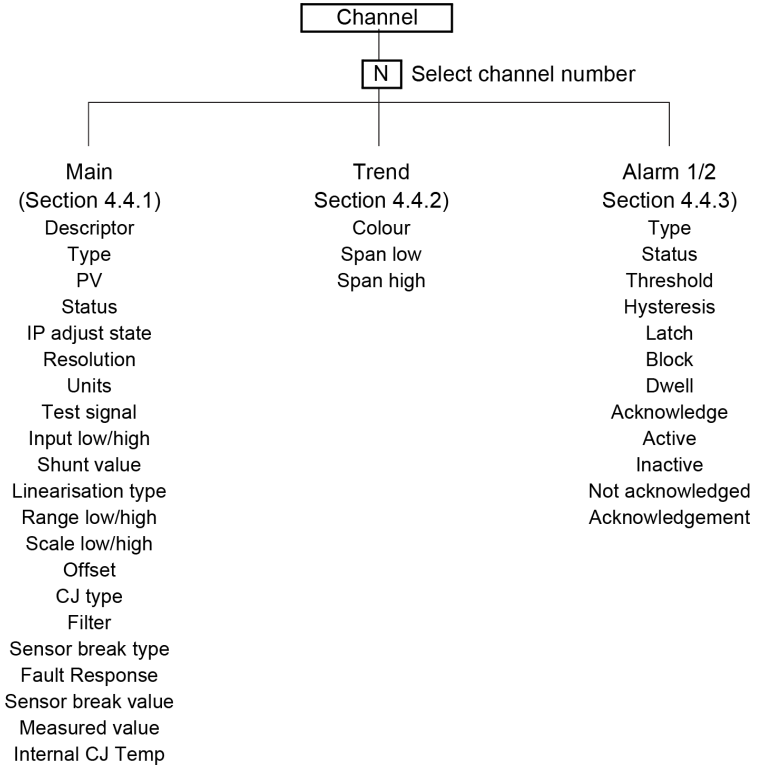


Figure 4.4 Channel configuration menu

4.4.1 Channel Main

This section describes all possible menu items, but it should be noted that some items are context dependent (e.g. Cold Junction settings appear only for Type = 'Thermocouple'). Channels one to four in the configuration relate to An In 1 (terminals 1I, 1+ and 1-) to An In 4 (terminals 4I, 4+ and 4-) respectively - see figure 2.2.

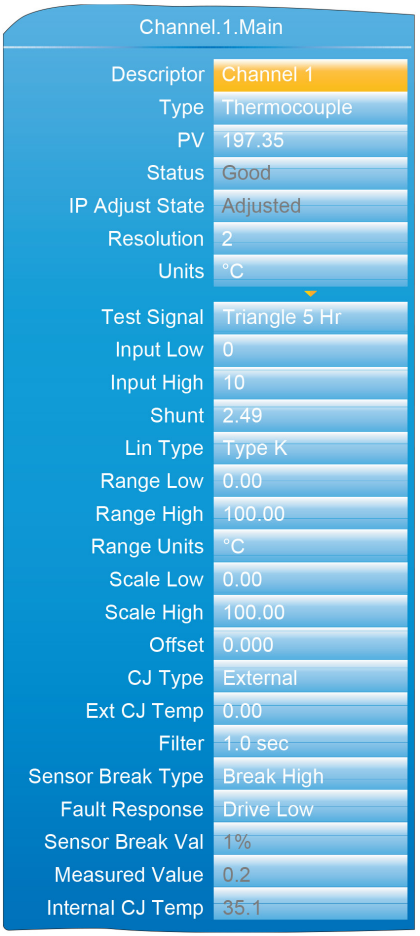


Figure 4.4.1a Channel main menu (expanded)

Note: For the sake of completeness, the figure above shows all possible fields, even though many are mutually exclusive. For example, 'Test signal' appears only when 'Test' is selected as Type. It would never appear when Type = thermocouple (as shown). Similarly, 'Shunt' would appear only for Type = mA.

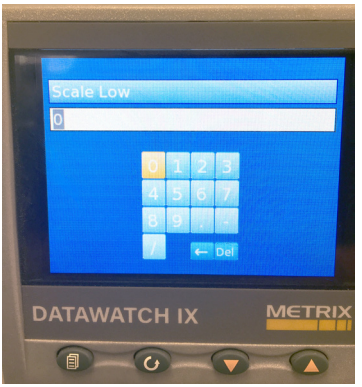
Channel Main (Cont.)

Descriptor	Allows a (20 character max.) descriptor to be entered for the channel. Some thought should be given to ensure that the descriptor is meaning ful because in some display screens it is truncated. For example, 'Fur nace 1 area 1' and 'Furnace 1 area 2' might both appear as 'Furnace 1 a' and thus be indistinguishable from one another, except in background colour.
PV	Read only. Displays the current value of the channel.
Status	Read only. Shows the channel status as one of: 'Good', 'Channel Off', 'Over range', 'Under range', 'HW error', 'Ranging', 'HW (capability) ex-ceeded'.
PV2	Read only. For dual inputs only, displays the current value of the second ary input.
Status2	Read only. For dual inputs only, shows the secondary input status (as 'Status' above).
IP Adjust State	Appears only for channels which have been included in the 'Adjust Input' procedure described in Section 4.1.9.
IP Adjust State2	As 'IP Adjust State', above but for secondary channels.
Resolution	Allows the number of decimal places to be defined for the channel. Valid entries are zero to six.
Units	Allows a units string of up to five characters to be entered.
Type	Allows the user to select an input type for the channel. Available selec tions are: 'Off', 'Thermocouple', 'mV', 'V', 'mA', 'RTD', 'Digital', 'Test' or 'Ohms'. If the Dual Input option is fitted, Dual mV, Dual mA, Dual T/C (if enabled) are also available.

Note: If Dual T/C is selected then it is essential that the secondary T/C input is field calibrated using the Input Adjust procedure (Section 4.1.9)

Test signal	Appears only if 'Test' is selected as 'Type'. Allows either a sinusoidal or a triangular waveform to be selected at one of a number of cycle times between 40 seconds and five hours.
Input Low*	For Type = mV, Dual mV, V, mA, Dual mA or Ohms, the lowest value of the applied signal in electrical units.
Input High*	As 'Input Low', but the highest value of the applied signal in electrical units.
Shunt value	For mA and Dual mA input types only, this allows the value of the shunt resistor (in Ohms) to be entered. The recorder does not validate this value - it is up to the user to ensure that the value entered here matches that of the shunt resistor(s) fitted. For Dual mA input type, both primary and secondary inputs must have independent shunts each of the same value.
Lin type	Linear, Square root, x3/2, x5/2, User Lin. Thermocouple types (alphabetical order): B, C, D, E, G2, J, K, L, N, R, S, T, U, NiMo/NiCo, Platinel, Ni/MiMo, Pt20%Rh/Pt40%Rh. User 1 to User 4 Resistance thermometer types: Cu10, Pt100, Pt100A, JPT100, Ni100, Ni120, Cu53. See Appendix A for input ranges, accuracies etc. associated with the above thermocouple and RTD types. See Section 4.14 for details of user linearisations.

Range Low*	For thermocouples, RTDs, User linearisations and retransmitted signals only, the lowest value of the required linearisation range.
Range High*	For thermocouples, RTDs, User linearisations and retransmitted signals only, the highest value of the required linearisation range.
Range Units	For thermocouples only and RTDs, Select °C, °F or K.
Scale Low/High	Maps the process value to (Scale High - Scale Low). For example, an input of 4 to 20mA may be scaled as 0 to 100% by setting Scale low to 0 and Scale High to 100.
Scale Low2/High2	As 'Scale Low/High but for the secondary input (PV2).



Offset	Allows a fixed value to be added to or subtracted from the process variable.

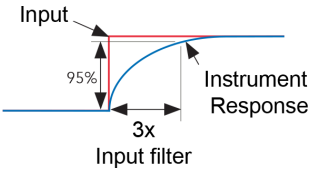
Note: * See Section 4.14 for details of the configuration of Range High/Low and Input High/Low when 'Type' = User 1 to User 4

Offset2

The nature of the secondary input results in an offset being introduced into the process variable value. For mA inputs this offset is removed automatically, without user intervention. For mV inputs the offset depends on the value of the voltage source impedance and is equal to 199.9µV/Ω. This offset can be compensated for either by using this Offset2 parameter, or by carrying out the 'Input Adjust' procedure (Section 4.1.9). For Dual T/C inputs, it is recommended that the 'Input Adjust' procedure be used instead of Offset2 as the use of Offset2 results in an offset which is non-linear over the thermocouple range.

Input filter

Damping can be used to filter out noise from slowly changing signals so that the underlying trend can be seen more clearly. Valid input values are between 0 and 60 sec.



Note: Applying a filter to an input channel can affect the operation of any Rate-of-change alarms configured to act on that channel.

CJC Type

For thermocouple input types only, this allows the user to select 'None', 'Internal', 'External' or 'Remote 1' to 'Remote 4'. For Dual T/C inputs, both primary and secondary inputs use the same cold junction.
None: No Cold junction compensation applied.
'Internal' uses the recorder's internal cold junction temperature mea surement.
'External' means that the cold junction is to be maintained by the user, at a fixed, known temperature. This temperature is entered in the 'Exter nal CJ Temp' field which appears when 'External' is selected.
Remote 1 (2) (3) (4) means that the cold junction temperature is being measured by input channel 1 (2) (3) (4) respectively. (This must be a dif ferent channel from that currently being configured).

Ext. CJ Temp — Appears only if CJC type is set to 'External', and allows the user to enter the temperature at which the external cold junction is being maintained.

Sensor Break Type — Defines whether the sensor break becomes active for circuit impedances greater than expected.
'Off' disables Sensor Break detection.
Break Low: Sensor break active if measured impedance is greater than the 'Break Low impedance' value given in table 4.4.1.
Break High: Sensor break active if measured impedance is greater than the 'Break High Impedance' value given in table 4.4.1. For mA inputs, limits are applied, such that if the process value lies outside these limits, a sensor break is assumed to have occurred. These limits are (Input lo - 4% Span) and (Input high + 6% Span). For example, for a 4 to 20mA signal, an input below 3.36mA or above 20.96mA will trigger a sensor break event

Range	Break Low impedance	Break High impedance
40mV	~5k Ω	~20k Ω
80mV	~5k Ω	~20k Ω
2V	~12.5k Ω	~70k Ω
10V	~12.5k Ω	~120k Ω

Table 4.4.1 Minimum impedances for sensor break detection

Note: Break High impedance values would be used typically for sensors which have a high nominal impedance when working normally

Sensor Break type (Cont.)
Input sensor break detection is not supported for secondary inputs. The internal circuit acts as a 'pull up' on the secondary input which therefore saturates high in the event of a sensor break.

Fault Response — Specifies the behaviour of the recorder if a sensor break is detected or if the input is over driven (saturated high or low). 'None' means that the input drifts, with the wiring acting as an aerial. 'Drive High' means that the trace moves to (Scale High +10%). 'Drive Low' means that the trace moves to (Scale Low -10%), where the 10% values represent 10% of (Scale High - Scale Low).

Sensor Break Val — A diagnostic representation of how close the sensor break detection circuitry is to tripping. Measured ValueThe (read only) input channel measured value before any scaling or linearisation is applied.

Measured Value2 — As 'Measured Value', above but for the secondary input.

Internal CJ temp — The (read only) temperature of the internal cold junction associated with this channel.

4.4.2 Channel Trend configuration

This area allows the configuration of channel colour and span.

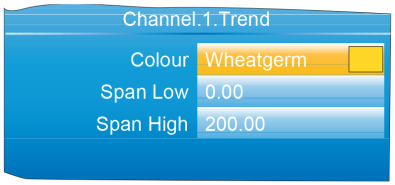


Figure 4.4.2a Channel Trend menu

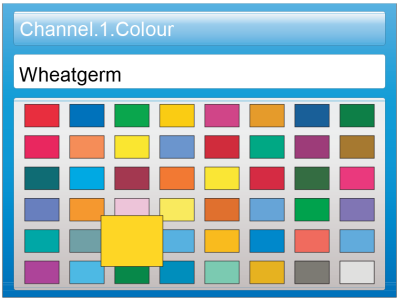


Figure 4.4.2b Colour selection

Colour — Allows a colour to be specified for the channel. The Scroll key is used to enter the colour swatch page. The up and down arrows are used to scroll through the available colours, with each colour being enlarged for as long as it is 'selected'. Once the required colour, is reached, the scroll key is used again to return to the Trend Configuration.

Span Low/High — Span low and high values.

Note: Trend colours and alarm settings for secondary inputs are configured in the maths channels to which they are wired.

SPAN EXAMPLE

In an input range of 0 to 600 degrees C, the temperature range between 500 and 600 degrees is of most interest. In such a case, Span Low is set to 500 and Span High to 600 so that the recorder trends only the required part of the temperature range, effectively magnifying the area of interest.

Note: Trending is restricted to the PV range (Span High - Span Low), but the instrument can display values outside this range

CHANNEL CONFIGURATION EXAMPLE

A type J thermocouple is used to measure a temperature range of 100 to 200 degrees Celsius. This thermocouple output is transmitted to the recorder by a 4 to 20mA transmitter, for display as a value between 0 and 100%.

In Channel.Main, set the following for the relevant channel:

Type = mA
Units = %
Input Low = 4.00
Input high = 20.00
Shunt = 250 Ohms
Lin Type = Type J
Range Low = 100.00
Range High = 200.00
Range Units = °C
Scale Low = 0
Scale High = 100
Other items may be left at their defaults.

4.4.3 Alarm 1 menu

Allows the alarm characteristics for Alarm 1 to be configured. The figure below shows a typical configuration page (expanded for clarity). Actual configuration parameters are context sensitive.

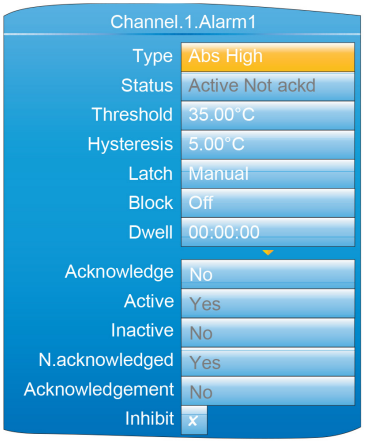


Figure 4.4.3 Typical alarm 1 configuration menu

Type	Select an alarm type from: 'Off', 'Abs. High' (absolute high). 'Abs. Low' (absolute low), 'Dev. High' (deviation high), 'Dev. Low' (deviation low), 'Dev. Band' (deviation band), 'Rise ROC' (rate-of-change: rising), 'Fall ROC' (rate-of-change: falling), 'Digital High', 'Digital Low'. See 'Alarm types', below, for definitions.
Status	Read only. This shows that the alarm is Off, Active, SafeNotAcked or ActiveNotAcked. For 'Auto' and 'Manual' alarms only, 'SafeNotAcked' means that the alarm trigger source has returned to a non-alarm state, but the alarm is still active because it has not been acknowledged. Similarly, 'ActiveNotAcked' means that the source is still active and the alarm has not been acknowledged. Always shows 'Off' when the alarm is inhibited (see below).
Threshold	For absolute alarms only, this is the trip point for the alarm. For absolute high alarms, if the threshold value is exceeded by the process value (PV) of this channel, then the alarm becomes active, and remains active until the PV falls below the value (threshold - hysteresis). For absolute low alarms, if the PV of this channel falls below the threshold value, then the alarm becomes active and remains active until the PV rises above (Threshold + Hysteresis).
Reference	For deviation alarms only, this provides a 'centre point' for the deviation band. For 'deviation high' alarms, the alarm becomes active if the process value (PV) rises above the value (Reference + Deviation) and remains active until the PV falls below (Reference + Deviation - Hyster esis). For 'deviation low' alarms, the alarm becomes active if the process value (PV) falls below the value (Reference - Deviation) and remains ac tive until the PV rises above (Reference - Deviation + Hysteresis). For 'deviation band' alarms, the alarm is active whenever the process value (PV) lies outside the value (Reference ± Deviation) and remains active until the PV returns to within the band, minus or plus Hysteresis as appropriate.

Alarm 1 Menu (Cont.)

Deviation	For deviation alarms only, 'Deviation' defines the width of the deviation band, each side of the Reference value, as described immediately above.
Hysteresis	For absolute and deviation alarms, this provides a means of preventing multiple alarm triggering, if the process value is drifting close to the trig ger value.
Amount	For rate-of-change alarms only. The alarm becomes active if the process value rises (Rise ROC) or falls (Fall ROC) by more than the specified 'Amount' within the time period defined in 'Change Time', below. The alarm remains active until the rate of change falls below the value (Amount/Change Time) in the relevant sense.
Change Time	Settable to 1 second, 1 minute or 1 hour. See 'Amount' (above).
Average Time	For rate-of-change alarms only. This allows an averaging period (for the process value) to be entered to reduce nuisance trips due to signal noise, or if the rate of change is hovering around the trip value.
Latch	None: the alarm remains active until the monitored value has returned to a non alarm state, when it becomes inactive. Auto: The alarm remains active until the monitored value has returned to a non alarm state and the alarm has been acknowledged. Acknowl edgement can take place either before or after the value has returned a non alarm state. Manual: The alarm remains active until the monitored value has re turned to a non alarm state and the alarm has been acknowledged. Acknowledgement is permitted only after the value has returned a non alarm state. Trigger: Not enunciated, this mode is used only to initiate an action defined by user wiring either using iTools or using the user interface.
Block	Alarms with 'Block' set to 'On' are inhibited until the monitored value has entered the 'safe' condition after a start-up. This prevents such alarms from becoming active whilst the process is brought into control. If a latching alarm is not acknowledged then the alarm is reasserted (not blocked), unless the alarm's threshold or reference value is changed, in which case the alarm is blocked again.
Dwell	Initiates a delay between the trigger source becoming active, and the alarm becoming active. If the trigger source returns to a non alarm state before the dwell time has elapsed, then the alarm is not triggered and the dwell timer is reset.
Acknowledge	Select 'yes' to acknowledge the alarm. Display returns to 'No'.
	Active Read only. Shows the status of the alarm as 'Yes' if it is active, or No, if inactive. The active/inactive state depends on the Latch type (above) and acknowledgment status of the alarm. Always shows 'No' if the alarm is inbited (below).
Inactive	As for 'Active' above, but shows 'Yes' if the alarm in inactive and 'No' if the alarm is active. Always shows 'Yes' if the alarm is inbited (below).
N.acknowledged	As for 'Active' above but shows 'Yes' for as long as the alarm is unac knowledged, and 'No' as soon as it is acknowledged. Always shows 'No' if the alarm is inbited (below).
Acknowledgement	Fleetingly goes 'Yes' on alarm acknowledgement, and then returns to 'No'.

Alarm 1 Menu (Cont.)

Inhibit — When 'Inhibit' is enabled, (tick symbol), the alarm is inhibited. Status is set to 'Off'; 'Active' and 'N.acknowledged' are set to 'No', and 'Inactive' is set to 'Yes'. If the alarm is active when inhibit is enabled, then it becomes inactive until inhibit is disabled, when its status depends on its configura tion. Similarly if the alarm trigger becomes active when the alarm is inhibited, the alarm remains 'off' until inhibit is disabled, when its status depends on its configuration.

4.4.4 Alarm 2 menu

As above for Alarm 1 menu.

Note: The parameters 'Acknowledge', 'Active', 'Inactive', 'N(ot) Acknowledged' and, 'Acknowledgement' can all be 'wired' to other parameters, so, for example, a relay can be made to operate whilst the alarm is inactive or whilst it is active or on acknowledgement etc. by wiring the relevant parameter to the relay's 'PV' input. See Section 7 for details of user wiring.

4.4.5 Alarm types

The following figures attempt to show graphically the meanings of the alarm parameters which can be set for the various alarm types available.

ABSOLUTE ALARMS

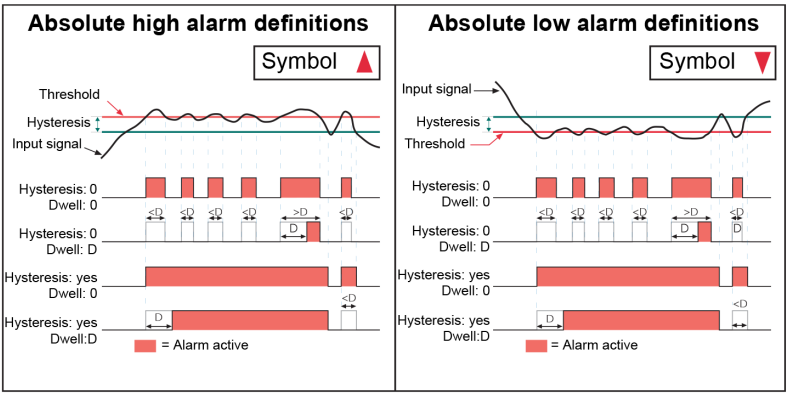
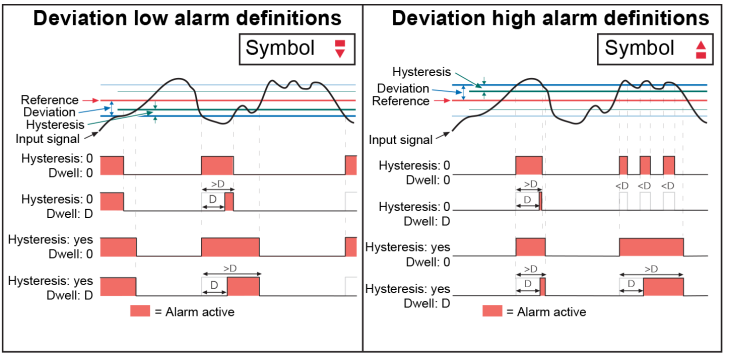


Figure 4.4.5a Absolute alarm parameters



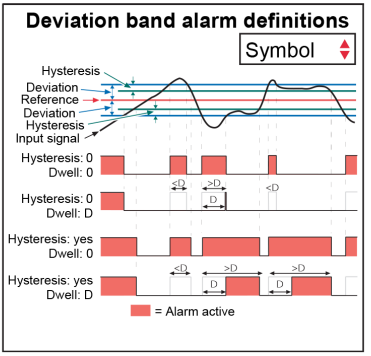


Figure 4.4.5b Deviation alarm parameters

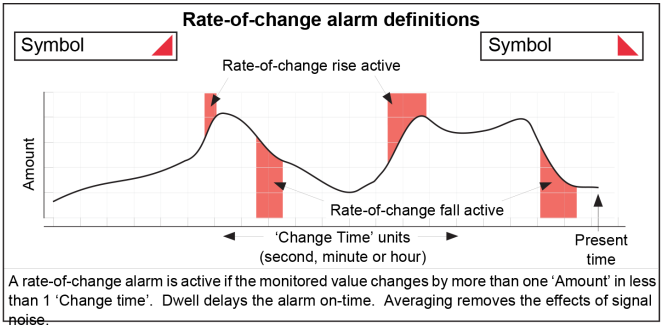


Figure 4.4.5c Rate-of-change alarm parameters

Note: Operation of rate-of-change alarms may be affected if an input filter (Section 4.4.1) is applied to the input signal.

4.5 VIRTUAL CHANNEL CONFIGURATION

This allows the configuration of maths channels, totalisers and counters. The configuration is divided into the following areas: 'Main', 'Trend', 'Alarm 1*' and 'Alarm 2*'. Items appearing in the 'Trend', Alarm 1' and 'Alarm 2' areas are identical with the equivalent items described in Section 4.4 (Input channels), above.

Note: * Virtual channels 16 to 30 (supplied with Modbus Master and EtherNet/IP options only) come without alarms

4.5.1 Maths channel configuration

The following maths functions are available (listed in up-arrow scroll order)
Off, Add, Subtract, Multiply, Divide, Group Average, Group minimum, Group maximum, Modbus input, Copy, Group minimum (latch), Group maximum (latch), Channel maximum, Channel minimum, Channel Average, Configuration revision, Off.
Figure 4.5.1 shows a typical maths channel configuration

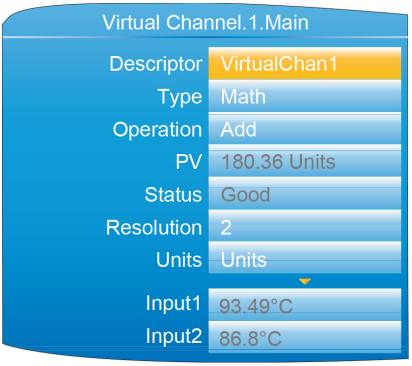


Figure 4.5.1 Maths channel configuration (typical)

Descriptor	Allows the user to enter a descriptor (20 characters max.) for the maths channel Type Math selected for this example. (See Section 4.5.2 and Sec tion 4.5.4 for totalisers and counters respectively.)
Operation	Allows the user to select the required maths function. See 'Maths Func tions', below.
PV	Read only. Shows the dynamic value of this channel in the units entered in 'Units' below.
Status	Read only. Shows the status of this channel, reflecting the status of the input sources.
Resolution	Enter the number of decimal places required
Units	Allows a five character string to be entered to be used as the channel units.
Input1	The value of input 1. May be entered manually, or it may be wired from another parameter (Section 7). Uses the resolution of the source.
Input 2	As for 'Input 1', Appears only when the operation requires two inputs.
Reset	Allows the user to reset latching functions (e.g. Channel Max) or averag ing functions (e.g. Channel Avg). Reset is carried out by setting the field to 'Yes', then operating the scroll key. The display returns to 'No'. Alterna tively the function can be reset by another parameter wired to 'Reset'.

Maths Channel Configuration (Cont.)

Time Remaining	The period of time remaining before the virtual channel performs its operation. For example, the time remaining for the maths channel aver age operation to sample the input before performing the calculation.
Period	For averaging functions, this allows a period to be entered, over which the value is to be averaged. Selectable periods are: 0.125, 0.25, 0.5, 1, 2, 5, 10, 20, 30 seconds, 1, 2, 5, 10, 20, 30 minutes, 1, 2, 6, 12, 24 hours

MATHS FUNCTIONS

Off	Out = -9999; status = Off
Add	Out = Input1 + Input2
Subtract	Out = Input1 - Input2
Multiply	Out = Input1 x Input2
Divide	Out = Input1 ¸ Input2. If Input2 = 0, Out = -9999; Status = 'Bad'.
Group Avg*	Out = Instantaneous sum of all points in the recording group (except this one and any channel that has been configured with operation = group average, group minimum, group maximum, group minimum (latched), group maximum (latched), channel maximum or channel minimum), divided by the number of points in the group (excluding this one). Any point that has a status other than 'Good' is excluded from the calcu lation. If the group contains no channels, Out = -9999; Status = 'No data'.
Group Min*	Out = Instantaneous value of whichever point (except this one) in the recording group has the lowest value. Any point that has a status other than 'Good' is excluded from the calculation. If the group contains no channels, Out = -9999; Status = 'No data'.
Group Max*	Out = Instantaneous value of whichever point (except this one) in the recording group has the highest value. Any point that has a status other than 'Good' is excluded from the calculation. If the group contains no channels, Out = -9999; Status = 'No data'.
Modbus Input	Out = value written to this channel's modbus input. If the comms time out expires, Out = -9999; status = 'No data'.
Copy	Allows an input or other derived channel to be copied.
Grp Min Latch*	Out = Lowest value reached by any point in the recording group (except this one) since last reset. Any point that has a status other than 'Good' is excluded from the calculation. If the group contains no channels, Out = -9999; Status = 'No data'.
Grp Max Latch*	Out = Highest value reached by any point in the recording group (except this one) since last reset. Any point that has a status other than 'Good' is excluded from the calcu lation. If the group contains no channels, Out = -9999; Status = 'No data'.
Channel Max	Out = Highest value reached by Input1 since last reset. If Input1 has a status other than 'Good', then Out = -9999 and 'Status' depends on the status of Input1.
Channel Min	Out = Lowest value reached by Input1 since last reset. Input1 has a status other than 'Good', then Out = -9999 and 'Status' depends on the status of Input1.
Channel Avg	Out = the average value of Input1 over the time specified in 'Period'. If Input1 has a status other than 'Good', then Out = -9999 and 'Status' depends on the status of Input1.
Config Revision	Out = current Configuration Revision value.

Note: * All 'Group' functions operate on the 'Recording' group, not on the 'Trend' group.

4.5.2 Totaliser configuration

Totalisers allow the user to maintain a running total of any input channel, or of any maths channel. Using maths channels, it is possible to totalise combinations of input channels so that, for example, the sum of two channels or the difference between them could be totalised if required. A totaliser is configured using Virtual Channels. This is in essence a way to convert an input signal representing a rate of change of some parameter, such as a fuel flow being measured, for example, in litres/minute into a cumulative flow. If the fuel flow is constant then, of course, the conversion would be simple, just multiply the flow rate by time and the answer comes out directly in litres. Provided, of course, that the time units of the flow rate and the time measurement are in the same units. Both need to be in Seconds, Minutes, Hours, etc. in order to get the correct answer.

If the flow rate is variable, the calculation has to be done repeatedly over the time period required and the results of the individual calculations must then be added together (Totalised). In order to get reasonable accuracy it is important that the flow should be reasonably constant during each measurement period. This means that the sampling time for the measurements should be sufficiently frequent that significant changes in flow rate are not missed. If the sampling frequency is high enough, the totalisation process is approximately equivalent to mathematical integration of the input signal.

The totaliser block in the Nanodac is intended to automate this process. It uses the built-in sampling rate of the nanodac (125mSec) as the sampling period for the totalisation process. In addition, it provides two separate parameters which can be used to adjust the results of the totalisation process so that the output from the block is scaled in the correct units. Figure 4.5.2. shows the Main configuration parameter list when the Virtual Channel block is being configured as a totaliser.

Wiring is carried out, either at the operator interface (Section 7), or in iTools (Section 6).

The totaliser equation is:

$$tot_t = tot_{t-1} + \frac{ma_t}{PSF \times USF}$$

where,

tott = totaliser value this sample
tott-1 = totaliser value last sample
mat = process value this sample
PSF = Period Scaling Factor (Period)
USF = Units Scaling Factor (Units scaler)

Note: The time between samples is 125ms

Figure 4.5.2 shows a typical totaliser configuration page.

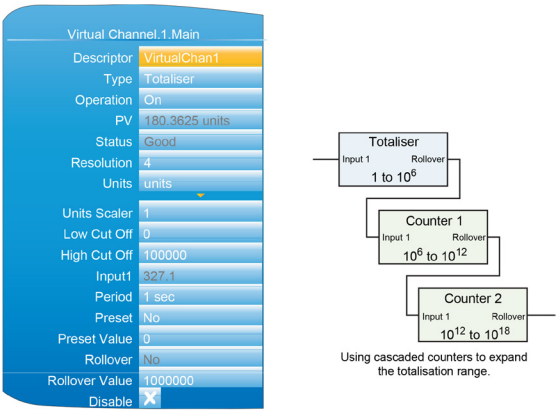


Figure 4.5.2 Typical totaliser configuration menu

Descriptor	Allows the user to enter a descriptor (20 characters max.) for the to taliser.
Type	Select: Math, Counter or Totaliser.
Operation	Allows the user to enable ('On') or disable ('Off') the totaliser.
PV	Read only. This is the dynamic output value of the totaliser.
Status	Read only. Shows the status of the totaliser.
Resolution	The Resolution parameter allows the number of decimal places (up to 6) to be set for the totalised value as displayed on the instrument panel. It does not affect the resolution of the totalisation process. Up to 6 decimal places may be set for the totalised value.
Units	Allows a units string of up to five characters to be entered for the to talised value.
Units Scaler	Allows a units scaler to be selected. Typically this will be used to scale between unit types rather than to influence time period. One example of this would be when an input is measured in Litres/Min ute, and Period has been set to 1Minute. If UnitsScaler is set to 1 then the total volume will be measured in Litres. If the volume is required in Cubic Metres then conversion of the total will be needed. There are 1000 Litres in a Cubic Metre so the UnitsScaler should be set to 1000. This produces an additional division of 1000 and results in a total output in Cubic Metres. Another example would be a requirement for the out put in Gallons rather than litres, still with an input being measured in Litres/Minute. There are 4.54609 litres in an imperial gallon so the UnitsScaler would be set to 4.54609. (For a US Gallon the figure would be 3.78541.)
Low Cut Off	Used to restrict the input operating range of the totaliser. Minimum value = -100 000
High Cut Off	Used to restrict the input operating range of the totaliser. Maximum value = 100 000 Low Cut Off and High Cut Off are particularly important as they directly affect the totalisation process. Together these two parameters define the range of valid inputs to the totalisation process. If Input1 value lies between them, then the input is considered valid and

	it contributes to the total for any period during which it remains valid. Negative input values are allowed and will cause the totaliser to de crease in value for negative values. The total increases with positive values. If the input lies outside the region defined by these CutOff parameters then it will be ignored and not contribute to the total. Many applications do not wish to use negative values and so LowCutOff would then normally be set to 0. Occasionally though, calibration errors at the low scale end could cause unacceptable errors in the total. In these circumstances, it may be necessary to consider setting LowCutOff to a small positive value. An example where this may be needed is when a process has a very low input value for long periods of time interspersed with short periods of high input values. The cumulative effect of slightly inaccurate low input values for long periods could then reduce the accuracy of the overall total recored Thoughtful use may produce an increase in the overall accuracy of the total; inappropriate use could introduce significant inaccuracy.
Input1	The value of the source. May be entered manually, or this parameter can be wired from an external channel PV. Input1 is the input signal repre senting an external measurement which is in the form of Units/Time-Unit, i.e. a rate. The sampling rate internal to the block is fixed at the instrument tick rate of 8 times/second, taking one sample every 125mSec.
Period	The Period parameter divides the signal being applied to Input1 by the number which is needed to generate a Total PV which is scaled in appro priate time units. There is a selection of preset values available for the Period parameter. These are listed in Table 1 below. The totaliser equa tion works in seconds. If the totalised channel units are other than 'per second', a period scaler different from the default (1 sec) must be used. The 'Period' field presents a number of fixed periods from 0.125 seconds to 24 hours for selection.
Preset	Setting this to 'Yes' causes the totaliser to adopt the Preset Value. The field returns immediately to 'No'. The totaliser can also be preset by an external source 'wired' to this parameter.
Preset Value	Allows the entry of a value, from which the totaliser is to start incre menting or decrementing. The direction of the count is set by the sign of the units scaler: positive = increment; negative = decrement.
Rollover	This is the rollover output which will be set for one execution cycle when the totaliser rolls over. This output can be used to expand the range of the totaliser by wiring it to the Trigger input of a counter.
Rollover Value	This is the value at which the totaliser will rollover to 0. It is configurable (default 1,000,000). When the totaliser rolls over the difference between the rollover value and the calculated output will be added to 0. Example 1: with a rollover value of 1000, a current output of 999 and an input of 5, then the output will become 4. Example 2: with a rollover value of -1000, a current output of -999 and an input of -5, then the output will become -4. In both examples, the Rollover output will be set for 1 execution cycle. Many applications do not require very large values to be totalised and can be scaled so that the Rollover Value will never be reached. The instrument default value of 10^6 is

generally satisfactory for these. If, however, higher values are expected, a larger Rollover value than this will have to be used. When configuring very large values the number stored on the instrument display may be slightly larger or slightly smaller. This happens because the numbers are stored in the instrument in IEEE representation as used by all computing systems to save space. The trade-off is that very large values are stored with a small inaccuracy, which increases as the value being stored in creases. As an example, if a value of 9,999,999,999,999 is entered into the instrument screen as the Rollover value, it is read back on the instru ment panel as 9,999,999,827,968. The inaccuracy caused by the com pression amounts to 0.02 parts per million, considerably smaller than the inaccuracy associated with the input channel which is being used to generate the input to the totaliser.

Disable

Allows the user temporarily to suspend totalising action. The totaliser is toggled between being enabled (cross symbol) and disabled (tick symbol) by means of the scroll key. The output retains the pre-disabled value until the totaliser is re-enabled, when it resumes from that value, or until the value is changed using the Preset parameter men tioned above. In the latter event, it will still be necessary to enable the totalisation by setting the Disable parameter to the cross symbo again.

Table 1 : Period

Sec	Divider	Sec	Divider	Min	Divider	Hour	Divider
0.125	1	1	8	1	480	1	2880
0.25	2	2	16	2	960	2	5760
0.5	4	5	40	5	2400	6	17280
		10	80	10	480	12	34560
		20	160	20	960	24	69120
		30	240	30	1440		

The selections in Bold Italic font are those which set the calculation into common time units, Second, Minute, Hour and Day(24Hours), and are probably going to be the most commonly selected. The other selections may be useful for more unusual applications.

Note: The formula linking Input1 and PV is:
PV Increment each 0.125Sec = Input1/(8*Period(Sec) * UnitsScaler).
There is no reason why the Period and UnitsScaler parameters have to be used only in the way described above, one reflecting the units used by the input channel and the other linked directly to the output units required. There may be application where they may be used in other ways. Use Table 1 showing the divisor associated with a particular selection for Period in combination with a custom value as the UnitsScaler to generate a custom overall divisor.

4.9 MODBUS MASTER CONFIGURATION

Modbus master configuration is divided into two areas: a) setting up the slave(s), including diagnostics, and b) defining the locations of the parameters to be read. Figure 4.9 shows an overview. Section 3.4.12 shows the Modbus Master display page, and describes the configuration options available there.

Note: Versions 2.40 to 2.50 of the Mini8 Controller, and versions 2.70 to 3.20 of the Model 3550 controller are supported. It is not guaranteed that later software versions of these instruments will be fully compatible.

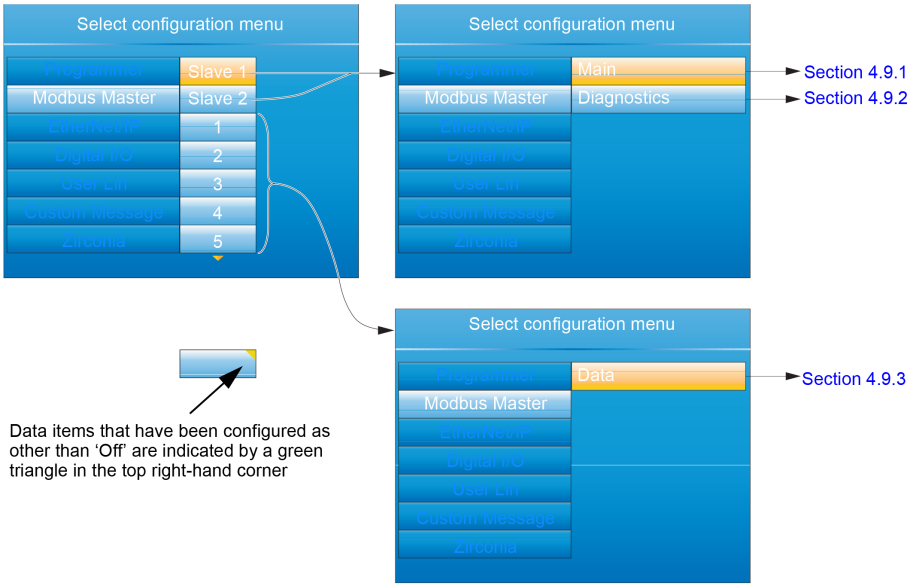


Figure 4.9 Modbus Master configuration top level menus

4.9.1 Slave Main menu

This allows the IP address, Unit ID and other communications parameters to be entered for Slaves 1 and 2.

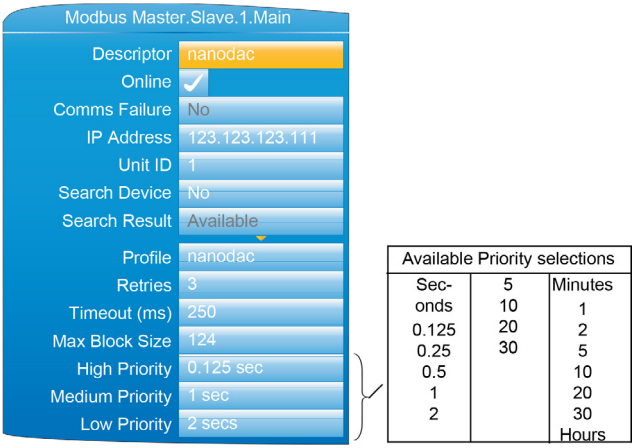


Figure 4.9.1 Modbus Master Slave 1 configuration (Slave 2 similar)

Descriptor	A descriptor for this instrument. For use in Modbus communications, this is not the same as the 'Name' which appears in the Instrument Info configuration (Section 4.15).
Online	Disabled by default (Cross symbol). Must be enabled (highlighted using the down arrow, then edited by the scroll button) to allow the remain ing configuration items to appear and to allow data transactions be processed. Setting the slave offline temporarily disables data transactions - it does not reconfigure them.
Comms Failure	Active (yes) if a data item has failed to respond after all retries.
IP Address	The IP address of the Slave device
Unit ID	The Unit Id or Modbus address to use in each data transaction with the slave device. Limits are 1 to 255
Search Device	Setting this to 'Yes' searches the network to see if the device with the specified IP address and Unit ID is available. If so, the descriptor will be overwritten to indicate what type of device has been found.
Search Result	The status of the selected 'Search Device' request (Searching, Available, Unreachable). Search activity is indicated by a rotating animated display in the 'Searching' field.
Profile	A number of profiles are held within the instrument that match a selec tion of known devices. If the device is 'known', its type, model number etc. is displayed. If the device is unknown, '3rd Party' appears instead. Retries The number of times (0 to 3) to re-send a data transaction to the device if no response is received within the configured timeout period (below).
Timeout	The timeout period for each Modbus transaction in ms
Max Block Size	The maximum number of registers (16bit words) that a single data trans action is permitted to contain
High Priority	The interval rate between each high priority data transaction. Default = 0.125 second.

Slave Main Menu (Cont.)

Medium Priority	The interval rate between each medium priority data transaction. De fault = 1 second.
Low Priority	The interval rate between each low priority data transaction. Default = 2 seconds.

PRIORITY LEVELS

Three levels of update rate can be entered for use in data configuration (Section 4.9.3), to define how often a value is read or written. In order to optimise performance, it is recommended that the slowest rate consistent with requirements be selected. The intervals are selected from a scroll list see figure 4.9.1 above.

4.9.2 Slave Diagnostics menu

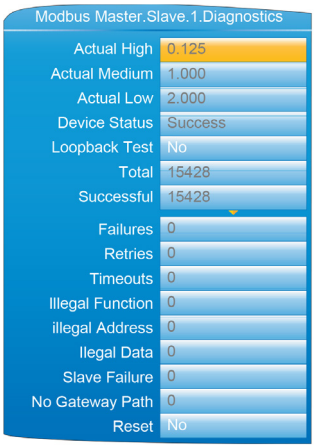


Figure 4.9.2 Diagnostics menu

Note: Diagnostic values are reset on power up

Actual High	The high priority rate that this slave is actually running at. This can never be faster than the high priority rate that was configured for this device (Slave Main menu, above), but if the master is heavily loaded the rate may be lower than that specified.
Actual Medium	The medium priority rate that this slave is running at. This can never be faster than the medium priority rate that was configured for this device (Slave Main menu, above), but if the master is heavily loaded the rate may be lower than that specified.
Actual Low	The actual low priority rate that this slave is running at. This can never be faster than the low priority rate that was configured for this device (Slave Main menu, above), but if the master is heavily loaded the rate may be lower than that specified.
Device Status	The status of the last transaction to this slave Success: The transaction was successfully actioned by the slave device Timeout: There was no response from the slave device to a given request within the configured time
Illegal Address:	The request to the slave device contained an invalid modbus address.

Slave Diagnostics Menu (Cont.)

	The address may be for a read only parameter
Illegal Value:	The request to the slave device contained invalid data for the specified parameter
Bad Sub:	The sub function code in the request was invalid Idle: This data item is currently idle and not communicating with the slave device
Illegal Code:	The slave does not support the function code transmitted by the master.
Pending:	The request is waiting to be sent, the most likely cause being that the slave device has not been set to online
Loopback Test	If set to 'Yes', Sends a function code 8 transaction to the slave, and waits for a response.
Total	A count of all the transactions sent to the slave including reads, writes both good and failed transactions.
Successful	A count of all the successful transactions sent to the slave.
Failures	A count of all the unsuccessful (failed) transactions sent to the slave. May be caused by Illegal Function, Illegal Address etc. failures, as detailed below
Retries	The number of transactions that were re-sent because of timed out responses from the slave devices.
Timeouts	A count of all the transactions sent to the slave for which no response was received within the configured timeout period.
Illegal Function	A count of all the transactions sent to the slave that the slave claimed contained an invalid function code. Exception code (1).
Illegal Address	A count of all the transactions sent to the slave that the slave claimed contained an invalid Modbus register address. Exception code (2).
Illegal Data	A count of all the transactions sent to the slave that the slave claimed contained an invalid value. Exception code (3)
Slave Failure	A count of all the times this slave device has failed to communicate. Exception code (4)
No Gateway Path	A count of all the times it has not been possible to access the slave de vice as it is on another network that requires a gateway for access
Master Rejects	A count of all the transactions that the Modbus Master has refused to send to the slave due to invalid configuration data
Reset	A one shot action that immediately resets all diagnostics counts.

4.9.3 Modbus master data configuration

This is the area of configuration in which the individual data items are selected for transmission across the Modbus master communications link. The configuration fields that appear depends on the parameter selected, so the examples given here will probably not match those that appear to the user. The parameters that appear in the 'parameter List' scroll menu depends on the slave model.

Modbus Master Data Configuration (Cont.)

EXAMPLE 1: TARGET SP1 WITH DATAWATCH SLAVE

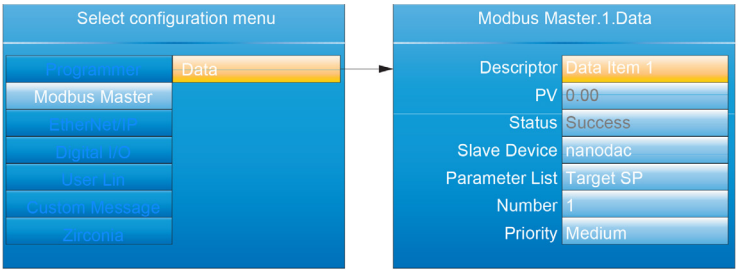


Figure 4.9.3a Target Setpoint

EXAMPLE 2 USER DEFINED PARAMETER

This allows the user to enter a Modbus address (decimal) and a data type in order to read the value of a parameter from or write a parameter value to the slave. Modbus address and data types must be obtained from the documentation supplied with the slave device. For convenience, this example uses a nanodac as the slave; table 5.3 of this document providing the required data.

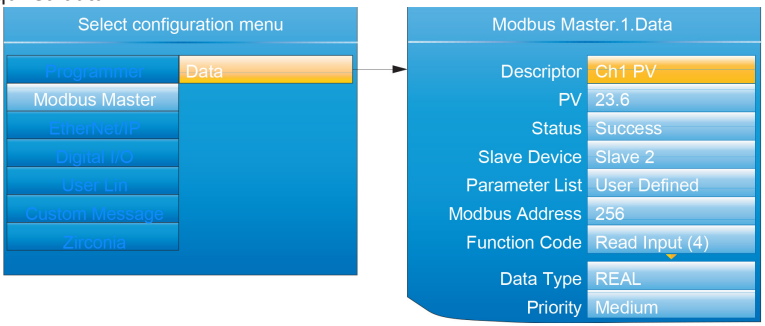


Figure 4.9.3b User defined parameters

DATA PARAMETERS

This lists all possible configuration fields that might appear, not just those shown in the examples above.

Descriptor	Up to 20 characters used to describe the current data item (used in the Modbus Master user page (Section 3.4.12)).
PV	The process value currently being read from the selected slave. Visible only if data item is not an alarm type. The value must be wired to a virtual channel with 'Operation' = 'Copy' if it is to be trended and/or recorded.
Sys Alm Status	The status (e.g. None, Active) of the data item. Visible only for specific read profiles. The value must be wired to a virtual channel with 'Opera tion' = 'Copy' if it is to be trended and/or recorded.
Chan. Alm Status	The status of the data item. Visible only for specific read profiles. The value must be wired to a virtual channel with 'Operation' = 'Copy' if it is to be trended and/or recorded.
Set	Allows the user to set an on/off value. Visible only for specific write profiles.

Modbus Master Data Configuration (Cont.)

Mode	Allows the user to set an auto/manual value. Visible only for specific write profiles. Value Configured or wired value to be sent to the selected slave. This parameter is available only with function codes 6 & 16
Fall Back Value	The value to be sent to the selected slave if the 'Value' parameter is wired and has a status other than GOOD_PV. This parameter is available only with function codes 6 & 16 It is not possible to wire Fall Back Value from another parameter and it can be configured only manually
Send	A one shot action that sends the data in the 'Value' parameter or the 'Fall Back Value' parameter (depending upon the status of 'Value') to the selected slave. This is classed as an acyclic write and so is available only for function codes 6 & 16. The 'Priority' parameter must be set to 'Acyclic'
Status	The status of the last transaction sent to the selected slave Success: The transaction was successfully actioned by the slave device Timeout: There was no response from the slave device to a given request within the configured time Illegal Address: The request to the slave device contained an invalid modbus address. The address may be for a read only parameter Illegal Value: The request to the slave device contained invalid data for the specified parameter Bad Sub: The sub function code in the request was invalid Idle: This data item is currently idle and not communicating with the slave device Illegal Code: The slave does not support the function code transmitted by the master. Pending: The request is waiting to be sent, the most likely cause being that the slave device has not been set to online.
Slave Device	A list of available slaves that this data is to communicate with.
Parameter List	List of parameters available for the selected slave devices profile. These parameters require no user configuration.
Number	The channel, loop or group etc. instance.
Modbus Address	The Modbus register address that this data is to be read or written to. Limits are 0 - 65535
Function Code	The function code to use, this determines if the data is going to be read or written to the selected slave. Supported function codes are:

Code	Description	Code	Description
1	Read contiguous colis	5	Write a single coil on or off
2	Read contiguous discrete inputs	6	Write to a single register
3	Read contiguous holding registers	8	Loopback test
4	Read contiguous input registers	16	Write to contiguous registers

Modbus Master Data Configuration (Cont.)

Data Type	The data type that defines how this data is going to be represented. The data types listed below are supported. 8-bit signed byte (BYTE) 8-bit unsigned byte (UBYTE) 16-bit signed integer (INT) 16-bit unsigned integer (UINT) 32-bit signed long (DINT) 32-bit unsigned long (UDINT) 32-bit floating point IEEE (REAL) 32-bit signed long (little Endian, word swapped) (DINT (Swap)) 32-bit unsigned long (little Endian, word swapped) (UDINT (Swap)) 32-bit floating point IEEE (little Endian, word swapped) (REAL (swap)) Bit from register (BIT) By default all 16 & 32 bit data types (unless specified) will be transmitted in Big Endian format, where the most significant byte in the value is sent first. Byte Ordering: (for big Endian) (0x12 sent first) 16-bit 0x1234 0x12, 0x34 32-bit 0x12345678 0x12, 0x34, 0x56, 0x78
Bit Position	The bit in the register to be extracted, this is only available if the 'Data Type' selected is 'BIT In Register'
Scaling	The decimal placing for scaled 16 bit data types. Visible depending on the 'Data Type' selected.
Priority	The frequency with which this data will be managed. See 'Priority Levels', in Section 4.9.1, above.

* Temperature units are those configured for the channel to which the temperature measuring transducer is connected

4.11 WEB SERVER

The Web Server has been added from firmware versions V5.00 onwards and provides the following features:

- Up to four unique client connections
- PC, Tablet and mobile phone client support (using appropriate browsers)
- Full URL translation support
- Runtime data
- Historical data
- Target information
- Alarm information
- Message log
- Promote page
- Full cookie support
- Safari, IE9 or greater and Google chrome browser support

The web server provides visualisation only.

4.11.1 Configuration Display

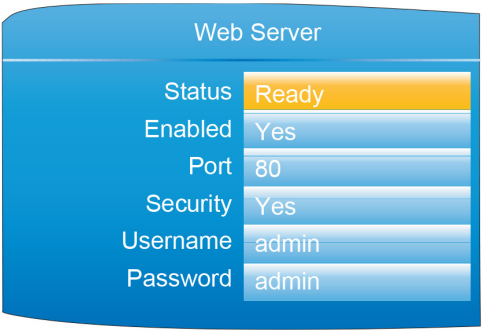


Figure 4.11.1 Web server configuration page

Status	Read only. Ready - the web server is running. Inactive - the web server is not ready Connected - the web server is connected. It is possible that Status will flip between Ready and Connected during operation.
Enabled	Yes/No
Port	80 or 8080
Security	Yes/No. Yes is the default.
Username	Enter a customised user name. This will be required when logging in to the webserver. Default is 'admin'. Username is only shown when 'Secu rity' is set to 'Yes'.
Password	Enter a customised pass word. This will be required when logging in to the webserver. Default is 'admin'. Password is only shown when 'Secu rity' is set to 'Yes'

Web Server pages are shown in Appendix E.

4.12 DIGITAL I/O

This area of configuration allows the digital I/O types to be selected.

Note 1.: If 2A2B is set to 'Valve Raise', then 3A3B is set to 'Valve Lower'. Similarly, if relay 4AC is set to 'Valve Raise', then relay 5AC is set to 'Valve Lower'. When the loop channel output is wired to the PV input of a Valve Raise function, then the PV input of the associated Valve Lower function becomes unavailable for wiring, and both outputs are controlled by the loop as a pair, using only the single wire.

Note 2.: See section B2.6.11 for a description of time proportioning.

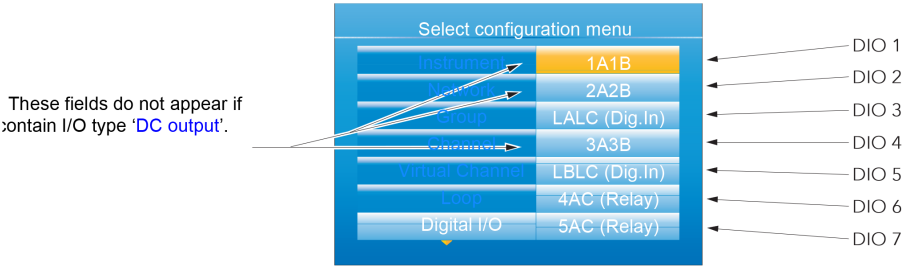


Figure 4.12 Digital I/O top level menu

4.12.1 Digital input/output

This applies to signals at terminals 1A/1B (figure 2.2). Highlight '1A1B', then operate the scroll key to reveal the configuration menu.

Module Ident	Dig IO
Type	On Off O/P, Time Prop O/P or Contact I/P (default)
PV	For inputs, 0 = contact is open; 1 = contact is closed. For On Off O/P, a value ≥ 0.5 drives the output high, otherwise, the output is driven low. For Time Prop O/P, the value is the demanded output %.
Min On Time	For Type = Time Prop O/P only, this allows a minimum on time to be specified. Configurable range = 0.1 to 150 seconds
Invert	Inverts the output sense for digital outputs; or the input signal for digital inputs.
Output	Off = output being driven low; On = output being driven high. Does not appear for Type = Contact I/P

4.12.2 Relay outputs

This may apply to terminal pairs 1A1B, 2A2B, 3A3B, 4AC, 5AC (figure 2.2). Highlight the relevant terminal pair, then operate the scroll key to reveal the configuration menu.

Module Ident	Relay
Type (2A2B, 4AC)	On Off O/P (default), Time Prop O/P, Valve Raise (not if DC output I/O fitted).
Type (3A3B, 5AC)	'On Off O/P' (default), 'Time Prop O/P'. The 3A3B relay is not fitted if 'DC Output' I/O is fitted.
PV	For On Off O/P, a value ≥ 0.5 closes the relay contacts, otherwise, the contacts are open.

For Time Prop O/P, the value is the demanded output %.

Min On Time	For Type = Time Prop O/P only, this allows a minimum on time to be specified to reduce relay wear. Configurable range = 0.1 to 150 seconds
Invert	Inverts the output sense for the relays (not applicable if Type = Valve Raise).
Inertia	For Type = Valve Raise only, this allows a value to be entered (in seconds) to take into account valve run-on.
Backlash	For Type = Valve Raise only, this allows a value to be entered (in seconds) in order to compensate for backlash in the valve linkage.
Standby action	For Type = Valve Raise only, this specifies the valve action when the instrument is in standby mode.

Continue: Output continues at the demanded level
Freeze: The valve stops being driven.
Output Off = relay contacts open; On = relay contacts closed

4.12.3 Digital inputs

This applies to terminals pairs LALC, LBLC (figure 2.2). Highlight the relevant terminal pair, then operate the scroll key to reveal the configuration menu.

Module Ident	Dig.In
Type	Contact I/P
PV	0 = contact is open; 1 = contact is closed.
Invert	Inverts the sense of the input.

4.12.4 Digital outputs

This applies to terminal pair 2A2B (figure 2.2). Highlight 2A2B, then operate the scroll key to reveal the
configuration menu.

Module	Ident Dig.Out
Type	On Off O/P, Time Prop O/P or Valve Raise
PV	For On Off O/P, a value ≥ 0.5 drives the output high, otherwise, the out put is driven low. For Time Prop O/P, the value is the demanded output %.
Min On Time	For Type = Time Prop O/P only, this allows a minimum on time to be specified. Configurable range = 0.1 to 150 seconds
Invert	Inverts the output sense for digital outputs; or the input signal for digital inputs.
Inertia	For Type = Valve Raise only, this allows a value to be entered (in seconds) to take into account valve run-on.
Backlash	For Type = Valve Raise only, this allows a value to be entered (in seconds) in order to compensate for backlash in the valve linkage.
Standby action	For Type = Valve Raise only, this specifies the valve action when the instrument is in standby mode. Continue: Output continues at the demanded level Freeze: The valve stops being driven.
Output	Off = output being driven low; On = output being driven high.

4.23 MATH (2 INPUT)

This 'Toolkit' option block allows one of a number of operations to be carried out using two input values which
may be analogue or digital in nature. Either or both of the inputs can be scaled, using a 'Multiplier'.

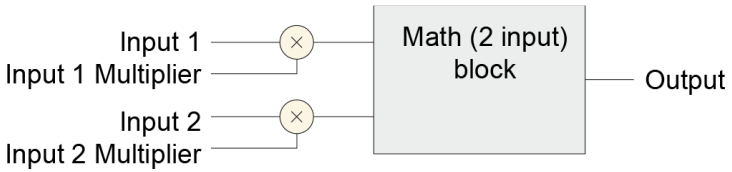


Figure 4.23a Block schematic

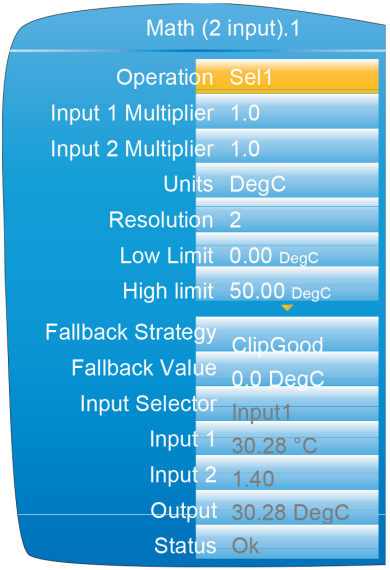


Figure 4.23b Block configuration (typical)

4.23.1 Parameters

Operation

Add Output = Input 1 + Input 2
Subtract Output = Input 1 - Input 2
Multiply Output = Input 1 x Input 2
DivideOutput = Input 1 ÷ Input 2
Abs Diff Output = the difference between Input 1 and Input 2, ignoring sign
Select Max Output = whichever is the larger of Input 1 or Input 2
Select Min Output = whichever is the smaller of Input 1 or Input 2
Hot Swap Output = Input 2 if Input 1 is 'Bad'; otherwise Output = Input 1
Sample/Hold Output tracks Input 1 whilst Input 2 = 1. Output value is held whilst Input 2 = 0 (See Section 4.23.2, below, for more details)
Power*Output = Input 1 to the power of Input 2. (Output = Input $1^{Input\ 2)}$
Square RootOutput = ÖInput 1 (Input 2 ignored)
Log Base 10Output = Log10 Input 1 (Input 2 ignored)
Log Base e Output = Ln Input 1 (Input 2 ignored)
Exponential Output = eInput1 (Input 2 ignored)
10 to the XOutput = 10Input 1 (Input 2 ignored)
Sel1Output = Input 1 if Input Selector = Input1
Output = Input 2 if Input Selector = Input2

Note 1: * For this implementation:
0 to the power 0 = 1.
Negative values raised to any power result in bad status.
0 raised to a negative power results in bad status.

Parameters (Cont.)

Input 1(2) Multiplier	The scaling factor for input 1(2). This multiplying factor is ap plied to the input of the function, but does not affect the dis played values of Input1 and Input 2 (below).
Units	Allows a five-character string to be entered for the function
Resolution	Sets the number of decimal places for the Output value. Input resolution (if applicable) is that of the relevant input.
High Limit	The high limit for input, output and fallback values. Minimum value is Low Limit.
Low Limit	The low limit for input and fallback values. Maximum value is High Limit.
Fallback Strategy	Clip Bad: If the input value is above 'High Limit' or below 'Low Limit', then the output value is set to the appropriate limit, and the status is set to 'Bad'. If the input signal is within the limits, but its status is bad, the output is set to the Fall Back value. Clip Good: If the input value is above 'High Limit' or below 'Low Limit', then the output value is set to the appropriate limit, and the status is set to 'Good'. If the input signal is within the limits, but its status is bad, the output is set to the Fall Back value. Fall Bad: If the input value is above 'High Limit' or below 'Low Limit', then the output value is set to the Fall Back value, and the status is set to 'Bad' Fall Good: If the input value is above 'High Limit' or below 'Low Limit', then the output value is set to the Fall Back value, and the status is set to 'Good' Upscale: If the input status is bad, or if the input signal is above 'High Limit' or below 'Low Limit', the output value is set to the High limit. Downscale: If the input status is bad, or if the input signal is above 'High Limit' or below 'Low Limit', the output value is set to the Low limit.
Fallback Value	The value to be adopted by the output, under error conditions, if 'Fallback Status' is set to 'Fall Good' or 'Fall Bad'.
Input Selector	For 'Select' operation only. When wired to a suitable param eter, Input Select becomes read only. Input 1 is selected if 'Input Select' = 1; Input 2 is selected if 'Input Select' = 2. Input Select values greater than 2 are ignored. If not wired, the user may select the required input using the scroll keys.
Input 1(2)	Wired to suitable input parameters. Displayed values ignore any input multiplier effects.
Output	Gives the output value for the operation.
Status	Shows the status of the output value, as 'Ok' or 'Error'

4.23.2 Sample and Hold details

As described above, Output follows Input1 as long as Input 2 is 'High'. When Input 2 goes Low, the output adopts the instantaneous value of Input 1 until Input 2 goes High again. When Input 2 goes high the output jumps to the current value of Input 1 and tracks it until Input 2 goes low.

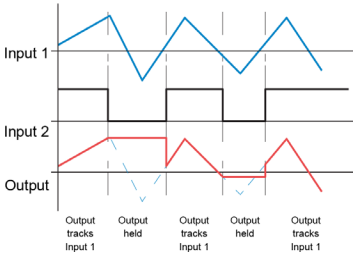


Figure 4.23.2 Sample and Hold example

4.24 TIMER

This 'Toolkit' option allows the user to configure up to four timers as: 'On Pulse', 'On Delay', 'One Shot' or 'Min On' types. The different types are described in Section 4.24.2, below.

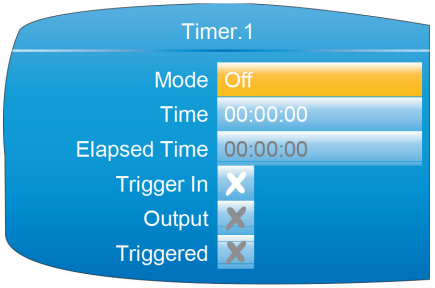


Figure 4.24 Timer configuration

4.24.1 Parameters

Mode	Select 'On pulse', 'On delay', 'One shot' or 'Min On'
Time	Allows the user to enter a period for the timer.
Elapsed time	This read-only parameter shows timing progress
Trigger in	Shows if the trigger source is active (tick) or inactive (cross)
Output	Shows if the output is on (tick) or off (cross)
Triggered	Shows if the timer is currently triggered (can remain triggered even after the trigger source has returned to off).

4.24.2 Timer modes

ON PULSE

Output goes 'on' as soon as the trigger input goes active, and remains on until the time period has elapsed. Ifthe timer is re-triggered during the timing period, the timer restarts.

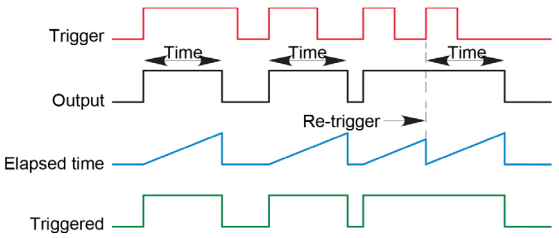


Figure 4.24.2a 'On Pulse' definitions

Timer Modes (Cont.)

ON DELAY

Provides a delay between the trigger point and the timer output becoming active.

Rules

1. After the trigger goes active, the output switches on after the delay time has elapsed, and stays on until the trigger goes inactive.
2. If the trigger goes inactive before the delay time has elapsed, the output does not switch on.

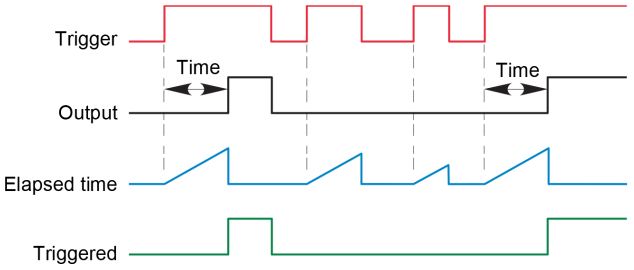


Figure 4.24.2b 'On Delay' definitions

ONE SHOT

If the trigger input is active, countdown timing is initiated as soon as the entered time value is confirmed (scroll key). The entered time decrements to zero, and must be re-entered by the user before any further timer function can be initiated.

Rules

1. The time value decrements only when the trigger input is active.
2. The output is On only when the trigger value is active (and the entered time value has not elapsed).
3. The entered time value can be edited at any time to increase or decrease the remaining time period

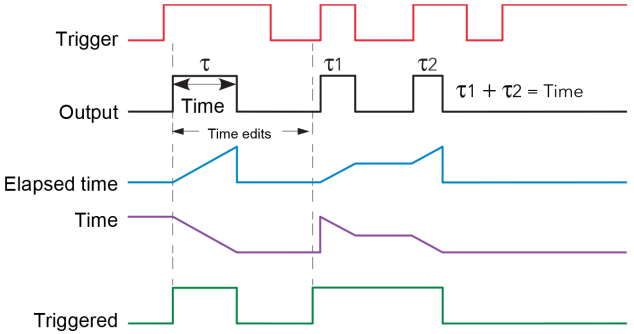


Figure 4.24.2c 'One Shot' timer definitions

Note: For ease of comparison the two time edits in the figure above were both to the same value. This is not a necessary condition.

Timer Modes (Cont.)

MIN ON

This 'Off delay' function provides an output signal that goes 'on' when the trigger goes active and remains on for a specified period after the trigger goes inactive.
If the trigger goes inactive, then active again before the time period has elapsed, then the elapsed time is reset to zero and the output remains on.
The 'Triggered' parameter is on whenever the elapsed time is counting down.

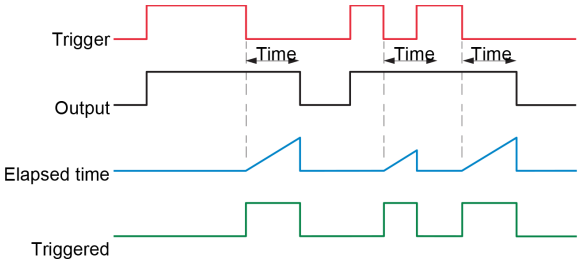


Figure 4.24.2d 'Min On' timer definitions

4.25 USER VALUES

This 'Toolkit' option block allows up to 12 values to be configured for use as inputs to other parameters.

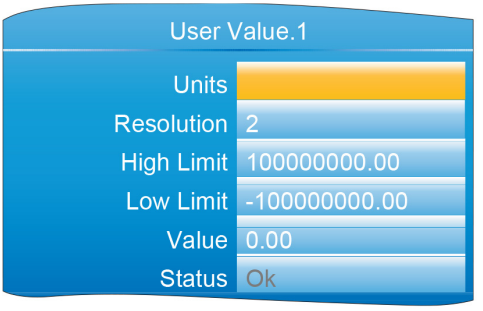


Figure 4.25 User value configuration

4.25.1 Parameters

Units	Allows a five-character string to be entered for the user value units
Resolution	The number of decimal places for the user value (max. = 6)
High/Low Limit	Sets maximum and minimum values that the User value can be set to
Value	The user value, either entered manually, or wired to another appropriate parameter
Status	The output status for the User Value.

4.26 ALARM SUMMARY

Allows the user to view the overall status of the unit's alarms, and to carry out a global acknowledgement of active alarms if required.

Global Ack	Allows the user to acknowledge all applicable alarms simultaneously. 'Manual' alarms must be non-active before they can be acknowledged.
Any Channel alarm	Indicates if there are any channel alarms active, acknowledged etc.
Any Sys Alarm	Indicates if there are any active system alarms.
Any Alarm	Indicates if there are any channel or system alarms active.

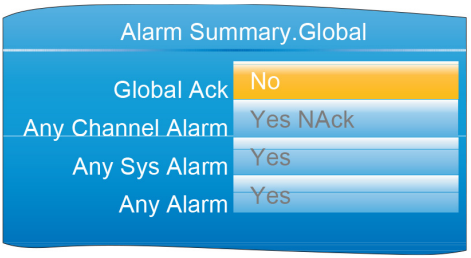


Figure 4.26 Alarm summary display

4.27 REAL TIME EVENT CONFIGURATION

This allows the user to configure up to two events to trigger at a specific time and date, or on a particular day, and to remain active for a configurable time, either measured as a duration, or as a specific 'Off' time. Typical applications would be to start and/or stop a programmer at a particular time, or to act as an input to a 'Wait' segment.

Figure 4.27 shows the two types of timer: 'Time and Date', and 'Time and Day', for Event 1.

Figure 4.27 Real Time Events (typical)

REAL TIME EVENT CONFIGURATION (Cont.)

Type	Selects the type of the real time event (Off, Time and Day, Time and Date.
On Month	For 'Time and Date' only, this is the month that the event is to switch on (January, ...December or Every Month). (Every Month was added in soft ware version 5.5).
On Date	For 'Time and Date' only, this is the date in the month that the event is to switch on.
On Day	For 'Time and Day' only, this is the day(s) of the week that the event output is to switch on (Mon, Tue, Wed, Thu, Fri, Sat, Sun, Mon-Fri, Sat-Sun, Everyday).
On Time	The time of day that the event output is to switch on (00:00:00 to 23:59:59)
Off Type	Selects the action that will switch the event off (Duration, Time)
Off Month	For 'Time and Date' only and with 'Off Type' set to 'Time', this is the month that the event is to switch off. (January, ... December or Every Month). (Every Month was added in software version 5.5).
Off Date	For 'Time and Date' only and with 'Off Type' set to 'Time', this is the day number in the month that the event is to switch off.
Off Day	For 'Time and Day' only and with 'Off Type' set to 'Time', this is the day of the week that the event output is to switch off (Mon, Tue, Wed, Thu, Fri, Sat, Sun, Mon-Fri, Sat-Sun, Everyday).
Off Time	The time at which the event output is to switch off (00:00:00 - 23:59:59)
Duration	For 'Off type' set to 'Duration', this specifies the duration for which the event output is to remain on (00:00:01 to 23:59:59 for Time and Day, or 00:00:01 to 500:00:00 for Time and Date)
Output	The output for the real time event (Cross symbol = Off, Tick = On) (Read only)

5. MODBUS TCP SLAVE COMMS

5.1 INSTALLATION

The installation of the Modbus link consists of connecting a standard Ethernet cable between the RJ45 connector at the rear of the unit to a host computer either directly or via a network. A 'straight-through' cable can be used in either case (i.e. a cross-over cable is not required).

5.2 INTRODUCTION

MODBUS TCP allows the instrument to act as a 'slave' device to one or more host computers connected via the RJ45 connector at the rear of the recorder. Each recorder must have a unique Internet Protocol (IP) address, set up as described in Section 4.2.1 (Network. Interface). MODBUS TCP (Transmission Control Protocol) is a variant of the MODBUS family of communications protocols intended for supervision and control of automated equipment specifically covering the use of MODBUS messaging in an intranet or internet environment, using TCP/IP protocols. Much of the MODBUS detail in this manual is derived from the document openmbus.doc, available at http://www.modbus.org/default.htm The above mentioned document also includes implementation guidelines for users.

Note: The Modbus protocol allows a maximum of 255 data bytes to be read from or written to in one transaction. For this reason, the maximum number of standard (16 bit) registers that can be accessed in one transaction is 255/2 = 127 and the maximum number of IEEE (32-bit) registers is 127/2 = 63.

5.2.1 Function Codes

MODBUS function codes 3, 4, 6, 8 and 16, defined in table 8.2.1a below, are supported and are fully described in section 5.5, below.

Code	Modbus definition	Description
03	Read holding registers	Reads the binary contents if holding registers. In this implementation codes 3 and 4 are identical in operation.
04	Read input registers	Reads the binary contents if holding registers. In this implementation codes 3 and 4 are identical in operation.
06	Preset single register	Writes a single value to a single register.
08	Diagnostics	Performs a simple loop back test.
16	Preset multiple registers	Writes values to multiple holding registers.

Table 5.2.1a MODBUS Function code definition

DIAGNOSTIC CODES

Function code 08, subfunction 00 (Return query data) echoes the query (Loop back).

EXCEPTION CODES

MODBUS TCP provides reserved codes used for exceptions. These codes provide error information relating to failed requests. Exceptions are signalled by hex 80 being added to the function code of the request, followed by one of the codes listed in table 8.2.1b, below.

Code Dec	Code Hex	Modbus definition	Description (seeModbus specification for full details)
01	01	Illegal function	An invalid function code was received
02	02	Illegal Data Address	An invalid data address was received
03	03	Illegal Data Value	An invalid data value was received
04	04	Slave Device Failure	An unrecoverable error occurred in the instrument
09	09	Illegal Sub Function	An invalid sub function was received
10	0A	Gateway path unavailable	Gateway misconfigured or overloaded
11	0B	Gateway target device failed to respond	Device not present on the network

Table 5.2.1b Exception codes

5.2.2 Data types

The following data types are supported:

1. 2's complement signed 16-bit analogue values with implied decimal point. The decimal point position must be configured in both the recorder and the host com puter.
2. 16, 32 and 64 bit signed integers.
3. 16-bit unsigned integer values.
4. 32 bit IEEE Floating point values.
5. Strings of limited size, can be transferred across Modbus TCP in Unicode format using a single non-multiplexed set of consecutive registers.

DATA ENCODING

MODBUS uses what is called a 'Big endian' representation for addresses and data items. This means that when a numerical quantity larger than a single byte is transmitted, the most significant byte is sent first. For example a 32-bit hex value of 12345678 would be transmitted as 12, followed by 34, followed by 56 and finally 78.

5.2.3 Invalid multiple register writes

When a recorder receives a multi-register write request, it is possible that one or more requests will be rejected. Under such a circumstance, the recorder accepts all valid write requests and ignores any invalid writes. No error response is produced.

5.2.4 Master communications timeout

Whilst the instrument is archiving, it is possible that communications responses slow sufficiently to cause communications timouts. The Modbus master device should be configured with a timout value large enough to ensure against nuisance timeouts during archiving.

5.2.5 Non-volatile parameters in EEPROM

Caution: The parameters in the following list must not be written-to on a continuous basis as to do so will damage the EEPROM, greatly shortening its useful life.

5.3 PARAMETER LIST

This list is arranged in alphabetical block order and gives the memory address for each parameter in both hex and decimal.

The Modbus addresses, in the range 0x0001 - 0x3FFF, listed in the table below give access to the parameter values in a scaled integer format. It is possible to gain access to the parameter values in native format by using the following formula:

Native address = (scaled integer address x 2) + 0x8000

PARAMETER LIST (Cont.)

The blocks are ordered as follows:

Advanced Loop	Loop 2	Virtual chan 1	Virtual chan 18
Alarm summary	Math (2 input)	Virtual chan 2	Virtual chan 19
BCD Input	Modbus Master	Virtual chan 3	Virtual chan 20
Channel 1	Multiplexer	Virtual chan 4	Virtual chan 21
Channel 2	Network	Virtual chan 5	Virtual chan 22
Channel 3	OR block	Virtual chan 6	Virtual chan 23
Channel 4	Program	Virtual chan 7	Virtual chan 24
Custom messages	Programmer	Virtual chan 8	Virtual chan 25
DC Output	Real Time Events	Virtual chan 9	Virtual chan 26
Digital I/O	Segments	Virtual chan 10	Virtual chan 27
Ether|Net/!P	Steriliser	Virtual chan 11	Virtual chan 28
Group	Timer	Virtual chan 12	Virtual chan 29
Humidity	User Lin 1	Virtual chan 13	Virtual chan 30
Instrument	User Lin 2	Virtual chan 14	Zirconia
Logic (2 Input)	User Lin 3	Virtual chan 15	
Logic (8 input)	User Lin 4	Virtual chan 16	
Loop 1	User values	Virtual chan 17	

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