invensys
Eurotherm

versadac™

User Guide

Data recorder
Version 2

HA031352/1
July 2013

invensys
Eurotherm

Restriction of Hazardous Substances (RoHS)

Product group Versadac

Table listing restricted substances

Chinese

限制使用材料一览表

产品	有毒有害物质或元素					
Versadac	铅（Pb）	汞（Hg）	镉（Cd）	六价铬(Cr(VI))	多溴联苯(PBB)	多溴二苯醚(PBDE)
IOC	X	O	X	O	O	O
IO 模块	X	O	X	O	O	O
端子模件	X	O	X	O	O	O
基座	X	O	O	O	O	O
O	表示该有毒有害物质在该部件所有均质材料中的含量均在SJ/T11363-2006 标准规定的限量要求以下。					
X	表示该有毒有害物质至少在该部件的某一均质材料中的含量超出SJ/T11363-2006 标准规定的限量要求。					

English

Restricted Materials Table

Product	Toxic and hazardous substances and elements					
Versadac	Pb	Hg	Cd	Cr(VI)	PBB	PBDE
IOC	X	O	X	O	O	O
IO Module	X	O	X	O	O	O
Terminal Unit	X	O	X	O	O	O
Base	X	O	O	O	O	O
O	Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in SJ/T11363-2006.					
X	Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement in SJ/T11363-2006.					

Approval

Name:	Position:	Signature:	Date:
Martin Greenhalgh	Quality Manager	Martin Greenhalgh	16 APR 2013

IA029470U805 Issue 1 Apr 13 (CN29949)

versadac data recorder

User Guide

List of sections

Associated documents

HA028838 Printable version of iTools Help
HA025464 EMC installation guidelines
HA027962 Printable version of 'Review' Help
IA249986U805 Declaration of conformity

Software effectivity

This manual refers to instruments fitted with software version 2.x.

versadac data recorder

User Guide

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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.

Note: in order to comply with the requirements of safety standard BS EN61010, the instrument shall have one of the following as a disconnecting device, fitted within easy reach of the operator, and labelled as the disconnecting device.

a. A switch or circuit breaker which complies with the requirements of IEC947-1 and IEC947-3
b. A separable coupler which can be disconnected without the use of a tool
c. A separable plug, without a locking device, to mate with a socket outlet in the building.

Note: Under extreme shock along the axis of the backplane, the versadac IOC is liable to reset and restart. During this restart, recording is temporarily suspended. Segment 1 of the setup switch on the terminal unit must be set to off, to prevent the versadac entering debug mode upon restart.

1. Before any other connection is made, the protective earth terminal shall be connected to a protective conductor. The mains (supply voltage) wiring to the PSU must be terminated in such a way that, should it slip, the Earth wire would be the last wire to become disconnected.
2. 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*.
3. Fuses are not user replaceable. If it is suspected that the fuse is faulty, the manufacturer's local service centre should be contacted for advice.
4. 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.
5. Any adjustment, maintenance and repair of the opened apparatus under voltage, should be avoided as far as possible and, if inevitable, shall be carried out only by a skilled person who is aware of the hazard involved.
6. Where conductive pollution (e.g. condensation, carbon dust) is likely, adequate air conditioning/filtering/sealing etc. must be installed in the recorder enclosure.
7. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment might be impaired.
8. In order to comply with the requirements of BS EN61010 the voltage applied across I/O terminals may not exceed the isolation voltage for those terminals. For terminals specified as having 'no isolation', the maximum permissible voltage is 30V ac or 60V dc.

* A full definition of 'Hazardous' voltages appears under 'Hazardous live' in BS EN61010. Briefly, under normal operating conditions, hazardous voltages are defined as being >42.2V peak ac (30V RMS) or > 60V dc.

I/O ISOLATION STRATEGY

Isolation is implemented in the form of a double insulation (300V) barrier separating all the I/O channels in a module from the rest of the system.

This prevents hazardous voltages on any one I/O channel from introducing hazards on wiring associated with any other I/O module, or from putting the rest of the system at risk.

Modules which provide channel-to-channel isolation further ensure safety and good signal quality on all channels within such modules. Refer to the relevant section of Appendix A for more details.

EMC

This instrument conforms with the essential protection requirements of the EMC Directive 89/336/EEC, amended by 93/68/EEC. It also satisfies the emissions and immunity standards for industrial environments.

To ensure compliance with the European EMC directive certain installation precautions are necessary:

General guidance	For general guidance refer to the EMC Installation Guide (Part no. HA025464).
Relay outputs	When using relay outputs it may be necessary to fit a filter suitable for suppressing conducted emissions. The filter requirements will depend on the type of load.
Routing of wires	To minimise the pick-up of electrical noise, low voltage DC connections and sensor input wiring should be routed away from high-current power cables. Where it is impractical to do this, shielded cables should be used.
Power supply	The instrument must be powered from a local power supply and must not be connected to a DC distribution network. The power supply must be earthed according to manufacturers instructions in order to give best EMC performance for the system.

SYMBOLS USED ON THE INSTRUMENT LABELLING

One or more of the symbols below may appear either as a part of the labelling of the items comprising this instrument. In some cases, symbols may be incorporated in the moulding or stamped on the metalwork.

	Refer to the user guide for instruction
	Protective conductor terminal (safety earth)
	Precautions against electrostatic discharge must be taken before handling this item or any electronic component of it.
	Complies with the RoHS2 (2011/65/EU) directive.
	For environmental reasons, this item must be recycled before its age exceeds the number of years shown in the circle.
	Underwriters Laboratories listed mark for the United States and Canada
	This item is CE compliant
	This item is ACMA compliant
	Risk of electric shock

1 INTRODUCTION

This document describes the installation, operation and configuration of a versadac data recorder. The instrument supports up to 16 I/O modules (according to base unit size) and is equipped for secure archiving via FTP transfer and/or to USB memory stick.

1.1 PHYSICAL STRUCTURE

The unit consists of an Input/Output Controller (IOC) module and a number of Input/Output (I/O) Modules each of which clips into its own individual terminal unit which provides termination for user wiring. The terminal units themselves are located in a base unit which is mounted on a DIN rail or on a panel, as required. Base units are available in different sizes to accommodate different numbers of I/O Modules (maximum 16).

The lower front of the unit is covered by a removable flap which protects the wiring, but leaves the status Led open to view.

Live replacement of a failed control module can be carried out, without wiring disconnections. Full hardware and software status indication allows rapid verification and diagnostics.

Automatic health checks, self-testing, and initialisation are carried out at power-up. I/O status and external communications are checked continuously and LEDs are provided on all modules to indicate communications and module I/O status.

1.2 MODULES AVAILABLE

AI2	Two universal analogue input channels
AI3	Three analogue input channels used for current loops, either self powered or externally powered
AI4	Four analogue input channels suitable for use with thermocouples, mA or mV inputs
AO2	Two analogue output channels supplying 0 to 20mA or 0 to 10V signals
DI16	16 digital input channels (universal inputs)
RLY8	Eight relays (normally open)

1.3 POWER SUPPLY

Power is applied to terminals mounted on the IOC module, as shown in section 2.3.1. The system monitors the supply voltage allowing an alarms to be triggered should the supply voltage drop below an acceptable value.

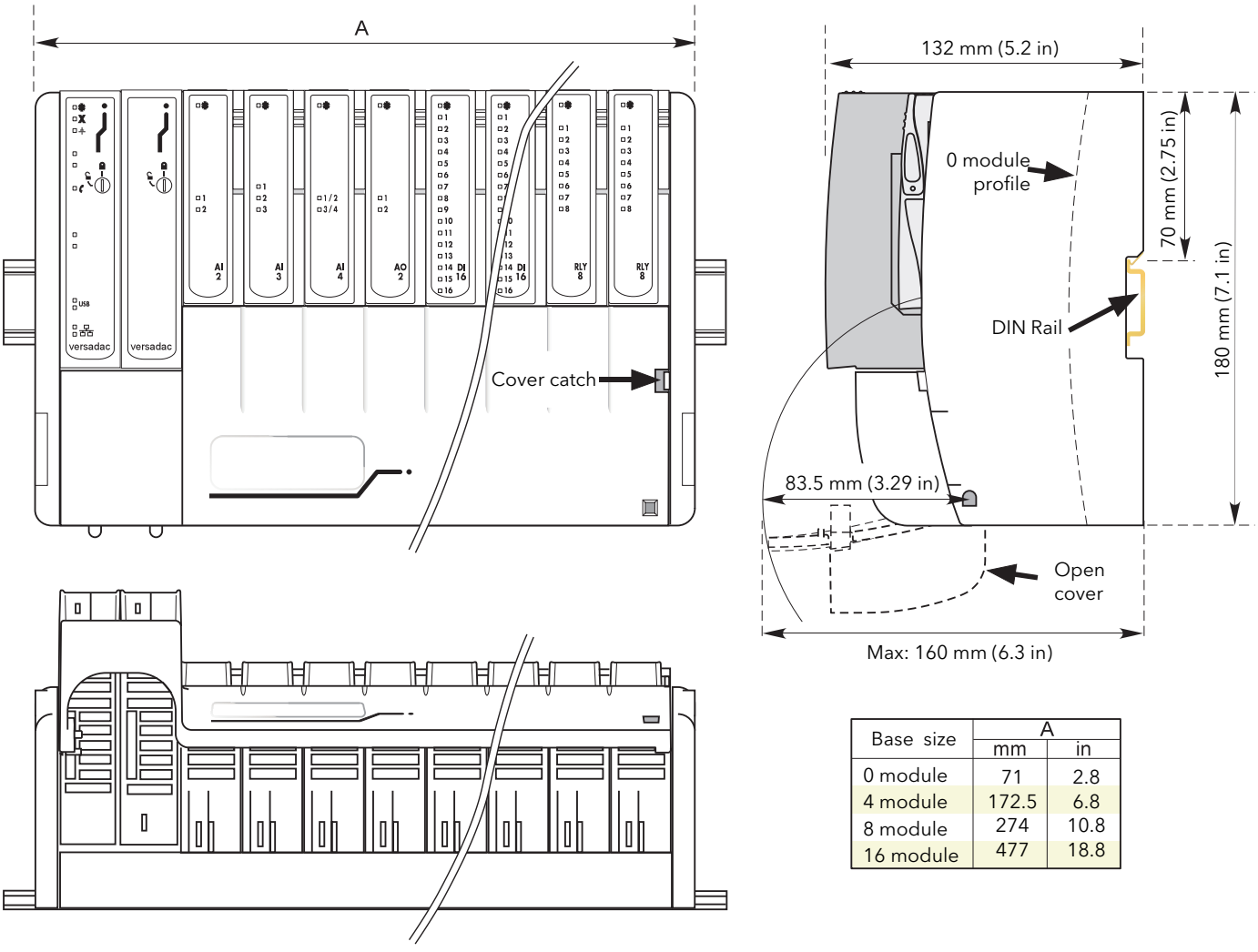
2 INSTALLATION

2.1 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.

2.2 MECHANICAL INSTALLATION

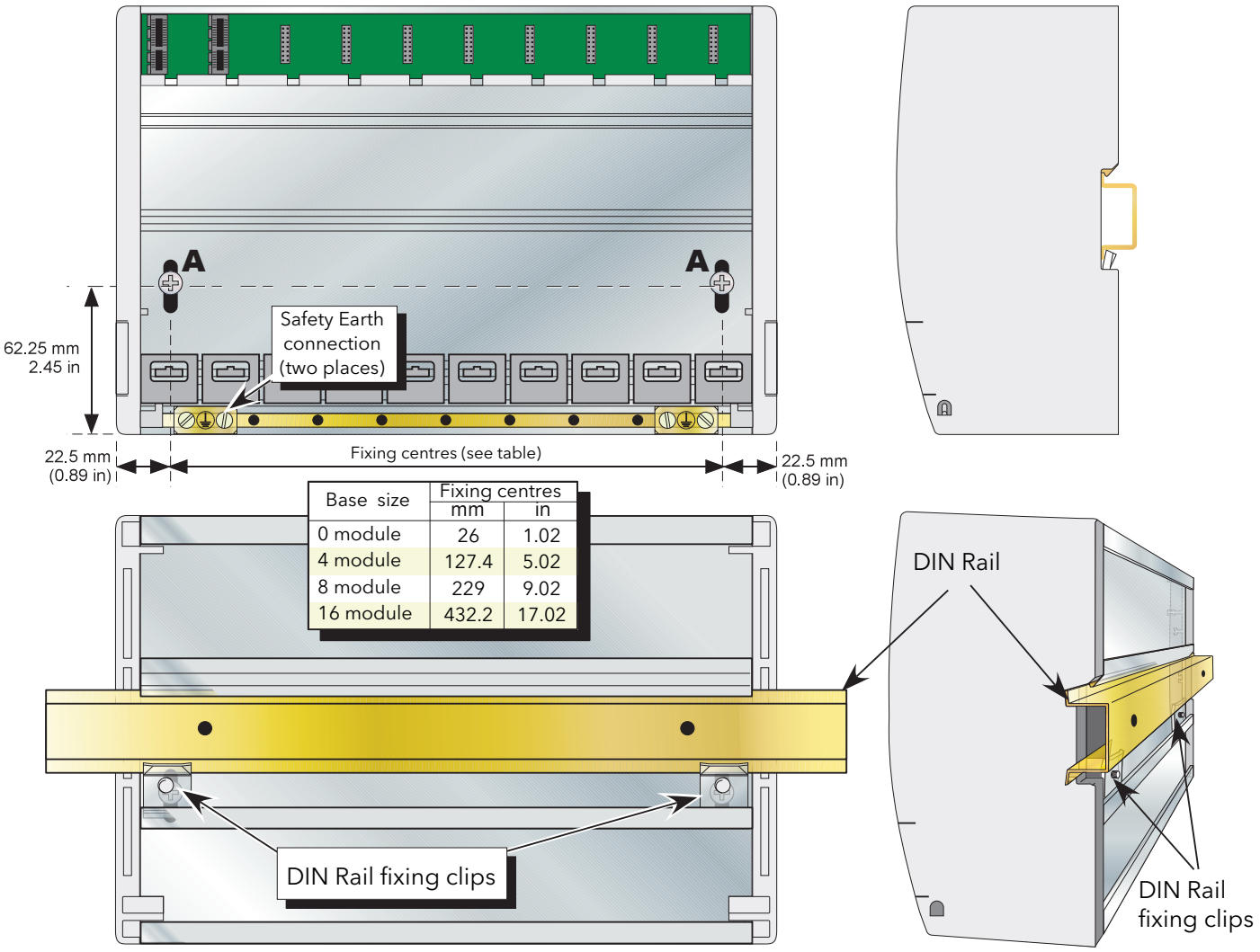
Figure 2.2a gives dimensional details; figure 2.2b gives fixing details.



Base size	A	
	mm	in
0 module	71	2.8
4 module	172.5	6.8
8 module	274	10.8
16 module	477	18.8

Figure 2.2a Overall dimensions

2 MECHANICAL INSTALLATION (Cont.)



Base size	Fixing centres	
	mm	in
0 module	26	1.02
4 module	127.4	5.02
8 module	229	9.02
16 module	432.2	17.02

Figure 2.2b Fixing details

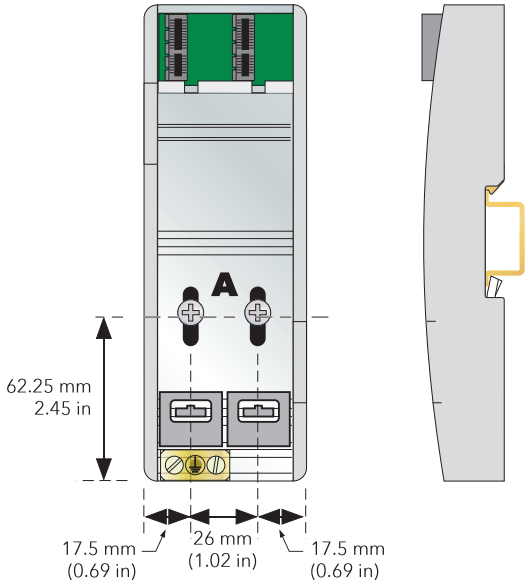


Figure 2.2c No-module base details

2.2.1 Base unit mounting

This Base Unit is intended for DIN rail or bulkhead mounting within an enclosure.

WARNING

The equipment should not be operated without a protective earth conductor connected to one of the earth terminals on the Base Unit. The earth cable should have at least the current rating of the largest power cable used to connect to the instrument.

The protective earth cable should be terminated with a suitable tinned copper eyelet, retained by one of the screw and washer supplied with the base unit, tightened to a torque of 1.2Nm (10.5lbin).

This connection also provides a ground for EMC purposes.

DIN RAIL MOUNTING

For DIN rail mounting, symmetrical, horizontally-mounted 35×7.5 or 35× 15 DIN rail to BS EN50022 should be used.

1. Mount the DIN rail, using suitable bolts, ensuring that it makes good electrical contact with the enclosure metal work either *via* the bolts or by means of a suitable earthing cable.
2. Loosen the screws ('A' in figure 2.2b/c) in the Base Unit, two or three turns, and allow them, and the associated fixing clips to slide to the bottom of the screw slot.
3. Lower the base unit on to the DIN rail such that the top edge of the rail fits into the slot on the underside of the support bar (see figure 2.2b/c).
4. Slide the screws (A) and associated clips as far as they will go towards the top of the screw slots, ensuring that the top of each fixing clip locates behind the bottom edge of the DIN rail.
5. Tighten the screws, and check that the base unit is fully secure on the rail.

PANEL MOUNTING

WARNING

Bolt heads must not exceed 5mm in height, or there will be insufficient isolation clearance between the bolt head and the relevant terminal unit(s).

1. Remove the screws (A in figure 2.2b/c) and associated fixing clips.
2. Holding the base unit horizontally on the panel, mark the position of the two holes on the panel.
3. Drill two suitable holes in the panel, and use two suitable bolts (M5 recommended) to secure the base unit to the panel, ensuring that good electrical contact with the enclosure metal work is made either *via* the bolts or by means of a suitable earthing cable.

2.2.2 Terminal unit installation

1. Insert the tag at the top of the terminal unit printed circuit board into the relevant slot in Base Unit (action 'B' in figure 2.2.2).
2. Press on the bottom of the terminal unit until a 'click' confirms that the retention clip has sprung back into position to secure the terminal unit (action 'C').

Note: If the base unit is not fully populated a blank Terminal Unit (supplied) must be fitted immediately to the right of the final module position in order to maintain IP20 rating

TERMINAL UNIT REMOVAL

1. Remove the terminal unit's I/O module, if fitted (section 2.2.3, below).
2. If necessary, remove all wiring from the terminal Unit.
3. Press the retention clip at the bottom of the terminal Unit and lift the terminal unit out (action 'D').

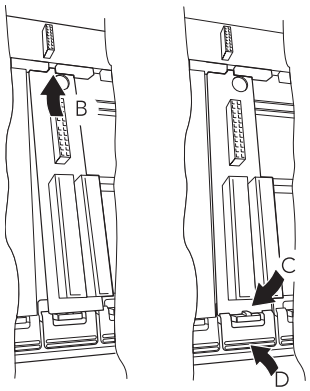


Figure 2.2.2 Terminal unit installation/removal

2.2.3 Module Installation

IOC MODULES

The working Input/Output controller (IOC) module (figure 2.2.3a) is installed in the left-most slot; a blank case being fitted in the adjacent slot.

To install an IOC:

1. Use a 3mm flat-blade screwdriver to ensure that the securing bolt is rotated anti-clockwise (counter clockwise) to the unlocked position.
2. Offer the module up to the terminal unit and the backplane, and push home.
3. Use a 3mm flat-blade screwdriver to rotate the securing bolt 90 degrees clockwise to the locked position.

To remove an IOC:

1. Use a 3mm flat-blade screwdriver to rotate the securing bolt 90 degrees anti-clockwise (counter clockwise) to the unlocked position.
2. Disengage the module and lift it out of the base unit.

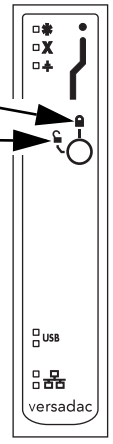


Figure 2.2.3a
IOC installation

Note... Whilst the I/O cover flap (4/8/16-way units) may be removed to ease access to terminal units, the side pieces must be left in place to provide support and to guide insertion.

2.2.3 MODULE INSTALLATION (Cont.)

IO MODULES

1. Pull the module retaining lever forwards into the unlocked position as shown in figure 2.2.3b.
2. Offer the module up to the terminal unit and the backplane, and push home.
3. Return the retaining lever to the locked position.

MODULE REMOVAL

1. Pull the module retaining lever forwards into the unlocked position as shown in figure 2.2.3
2. Disengage the module from the backplane connector and lift the module out of the base unit.

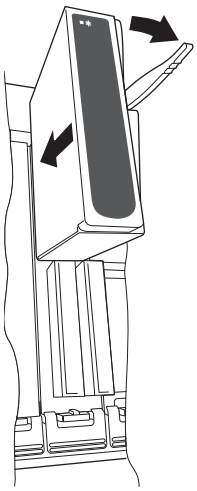


Figure 2.2.3b
IO Module installation

CAUTION

It must be ensured that the correct terminal unit is used for the type of IO Module being fitted. In particular, fitting an AI2 module to an AI4 terminal unit, or vice-versa, causes unexpected behaviour which may damage the process being controlled.

2.2.4 Module identification

The inside of the cover contains locations ('slots') for labels which can be used to identify the module fitted 'above' each slot.

A document template is supplied on the DVD which allows the user to print onto a precut adhesive sheet (GA030486, supplied with the instrument). Once printed, the relevant labels can be peeled-off the backing sheet and attached to the relevant slots.

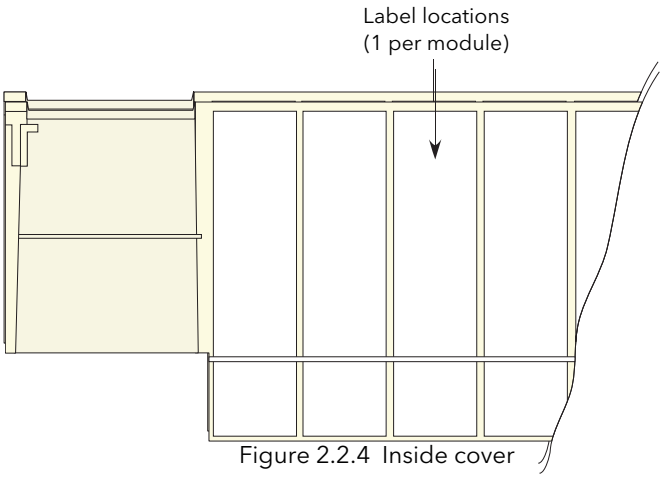


Figure 2.2.4 Inside cover

2.3 ELECTRICAL INSTALLATION

2.3.1 Controller module (IOC) terminal unit

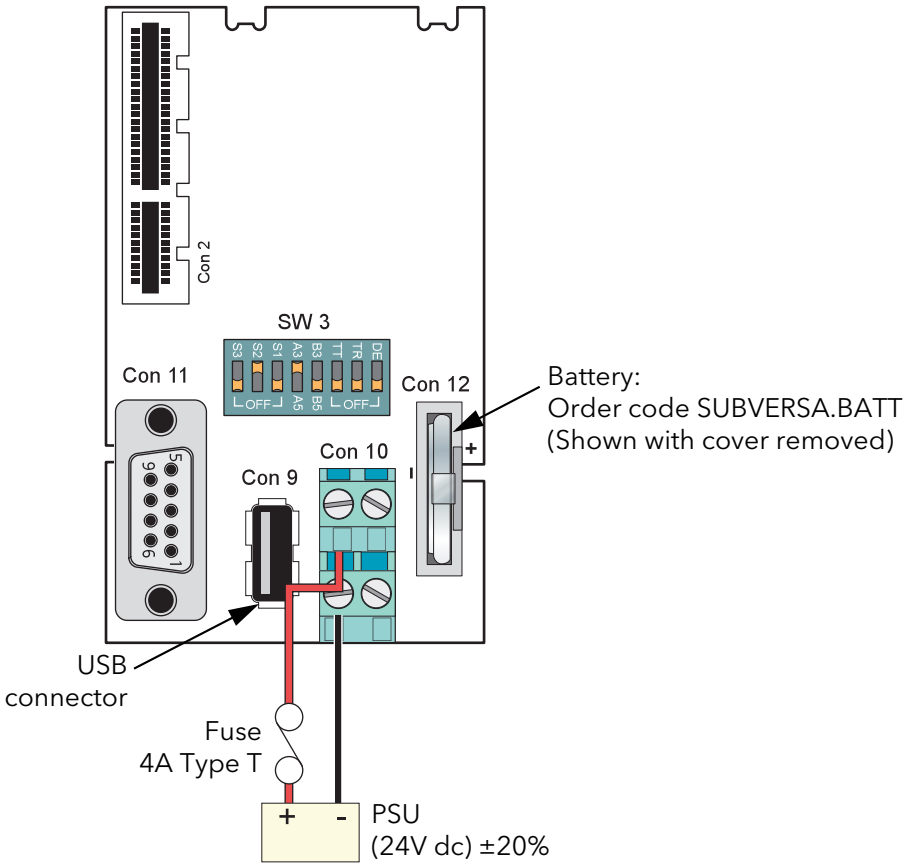


Figure 2.3.1a IOC terminal unit wiring

SUPPLY WIRING

Figure 2.3.1a shows the control module terminal unit with wiring details for the supply and for the battery.

Caution

The supply line must not be allowed to rise above 30 Volts with respect to safety earth.

Note: should the supply voltage fall below 19.2V during startup, the instrument will not start successfully and will attempt repeatedly to restart.

The instrument supply voltage is 24Vdc ± 20%.

Typical power requirement is 150mA (3.6W) for the control module (IOC), plus 0.5A (12W) for a four-module unit, 1 Amp (24W) for an eight-module unit or 2 Amps (48W) for a 16-module unit.

FUSES

The positive supply line must incorporate a fuse. A suitable type is a 4Amp Type T.

2.3.1 CONTROLLER MODULE TERMINAL UNIT (Cont.)

WIRE SIZES

Supply wiring: 0.25mm^2 to 2.5mm^2 (20 AWG to 14 AWG)

Note...The above diameters relate to the total cross sectional area of the conductor(s) inserted into the terminal.

TERMINAL DETAILS

Recommended screwdriver type for supply power connector: 3 mm flat blade.

Maximum tightening torque: 0.6Nm.

Maximum current carrying capability: 5A per pin.

Caution

The maximum current carrying capacity should be considered when 'daisy chaining'.

SAFETY EARTH

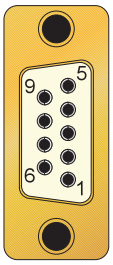
Figure 2.2b above, and associated text gives safety earth details.

COMMUNICATIONS CONNECTOR

A 9-way D-Type connector socket, located as shown in figure 2.3.1a, above, is used for EIA485 serial communications. Figure 2.3.1b gives the pinout and the pin layout for the matching 9-way plug.

See section 4.31 for configuration details.

View on solder bucket face of male connector (plug)



Pin	3-wire	5-wire
1	NC	NC
2	B	TxB
3	Reserved	RxA
4	Ground	Ground
5	Ground	Ground
6	Ground	Ground
7	A	TxA
8	Reserved	RxB
9	Ground	Ground

Figure 2.3.1b RJ45 pinout (EIA485)

Notes...

1. Best RFI performance is achieved if the screen is also earthed at its other end, but see 'warning' below.
2. 3-wire/5-wire working is selected using the eight-element slider switch (SW3) located on the IOC terminal board. The Tx and Rx lines can also be terminated (with 150Ω resistors) using other elements of this switch. See figure 2.3.1c for details.

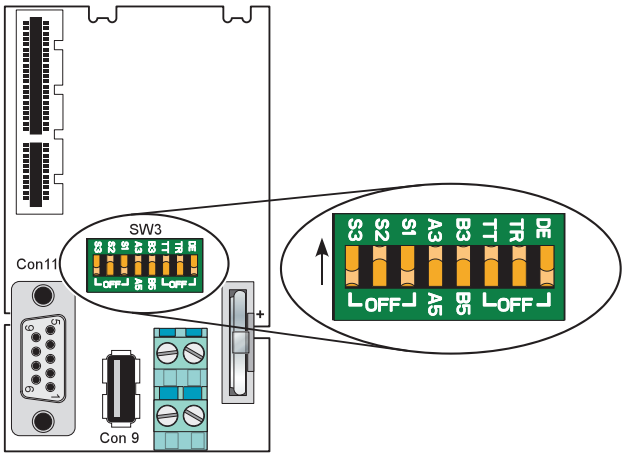
WARNING

If the screen is earthed at both ends, it must be ensured that the earth potentials at the ends of the cable are equal. If such is not the case, very large currents can flow through the screen, causing the cable to become hot enough to harm personnel who come into contact with it, and/or to cause fire.

2.3.1 CONTROLLER MODULE TERMINAL UNIT (Cont.)

COMMUNICATIONS HARDWARE CONFIGUATION

Communications setup is carried out using SW2 on the IOC terminal unit, as shown below:



1	Set to 'DE' to enable serial debug (section 3.1.1); set to 'OFF' to disable.
2	Set to 'TR' to terminate Rx line; set to 'OFF' to leave Rx unterminated.
3	Set to 'TT' to terminate Tx line; set to 'OFF' to leave Tx unterminated.
4	Set to 'B3' for 3-wire serial communications; set to 'B5' for 5-wire.
5	Set to 'A3' for 3-wire serial communications; set to 'A5' for 5-wire.
6	Reserved
7	Reserved
8	Reserved

Figure 2.3.1c Communications hardware configuration details

USB CONNECTOR

A single Type-A USB connector, for USB2.0 host communications, is located on the IOC terminal unit as shown in figure 2.3.1a.

The connector is intended for use with USB memory sticks, and can supply up to 500mA. Any attempt to draw more than 500mA will cause the current limiting circuitry to shut the USB power down.

The IOC module contains a USB fuse which prevents the entire supply power system from being affected in the unlikely event of a catastrophic failure in the USB electronics. The fuse is not user replaceable, so if it fails, the module must be returned to the supplier for service.

2.3.1 CONTROLLER MODULE TERMINAL UNIT (Cont.)

IOC STATUS INDICATORS

Figure 2.3.1d,shows the IOC front panel LEDs. Other modules' LEDs are described in the relevant sections, below.

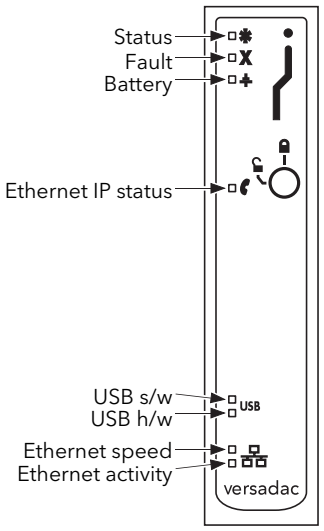


Figure 2.3.1d IOC LEDs

2.3.1 LED interpretation

LED	Function
Status (green)	On: Main power input valid Off: Main power input failed
Fault (red)	On: Module missing or faulty Flashing: Watchdog failure Off: No hardware faults detected
Battery (green)	On: Battery OK Flashing: battery failed or not fitted
Ethernet IP status (green)	On: versadac online with at least one CIP connection Flashing: versadac online but with no CIP connections Off: versadac is initialising communications or a connection has timed out
USB s/w (green)	On: USB device powered. Flashing: USB device being accessed. The USB device must not be removed. Off: USB device not powered and may be removed.
USB h/w (yellow)	On: an attempt is being made to draw too much current (>500mA) from the USB socket. USB activity suspended. Off: No hardware failure reported.
Ethernet speed (green)	On: 100MB Off: 10MB
Ethernet activity (yellow)	On: Connected to a live Ethernet network Flickering; Network traffic detected Off: Ethernet connection invalid

2.3.2 Two-channel analogue input (AI2)

This module can be ordered as one of a number of variants to measure thermocouple inputs, resistance thermometer inputs, Volts/mV or mA. Figure 2.3.2a gives pinout details.

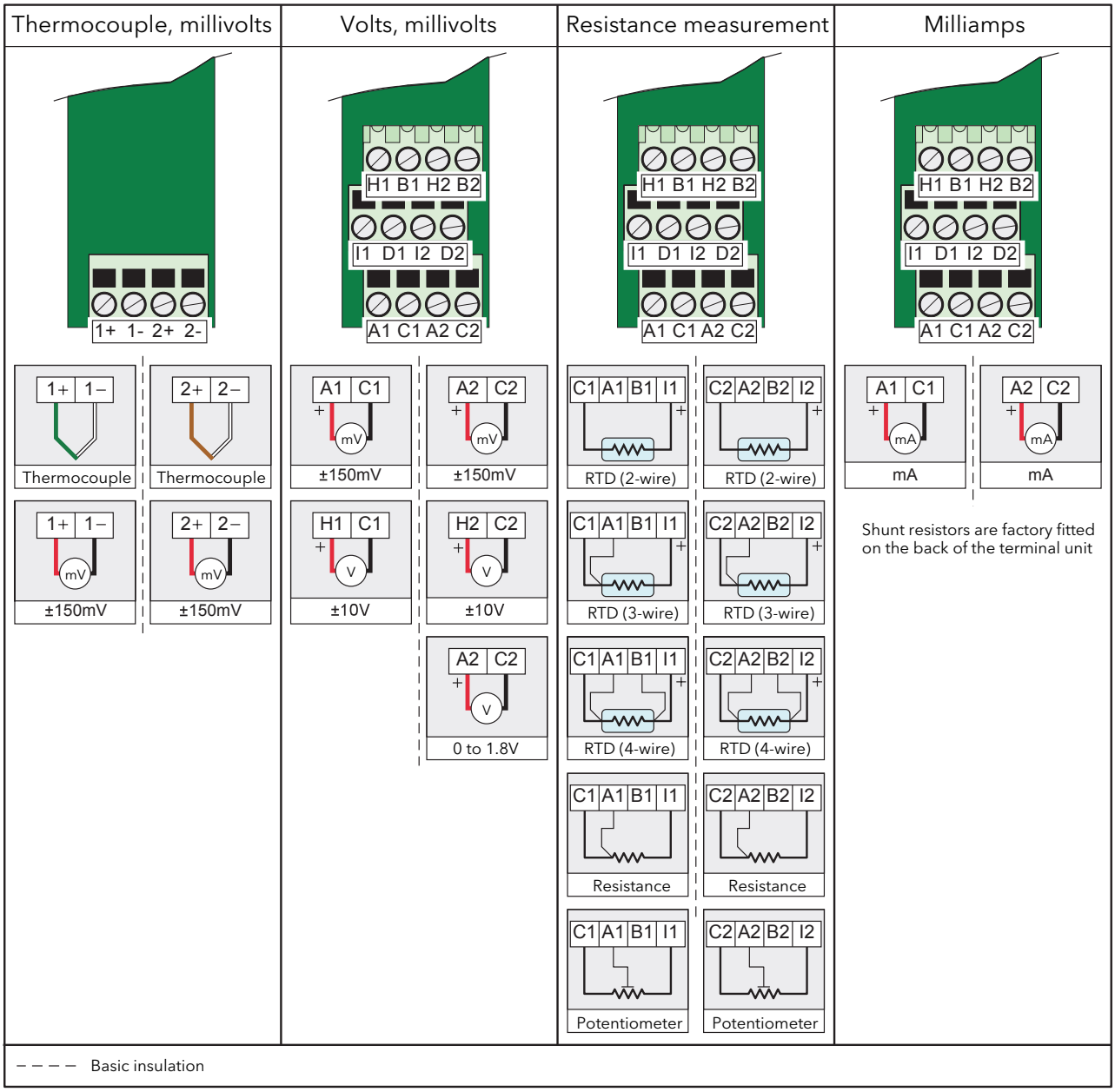


Figure 2.3.2a AI2 module pinout

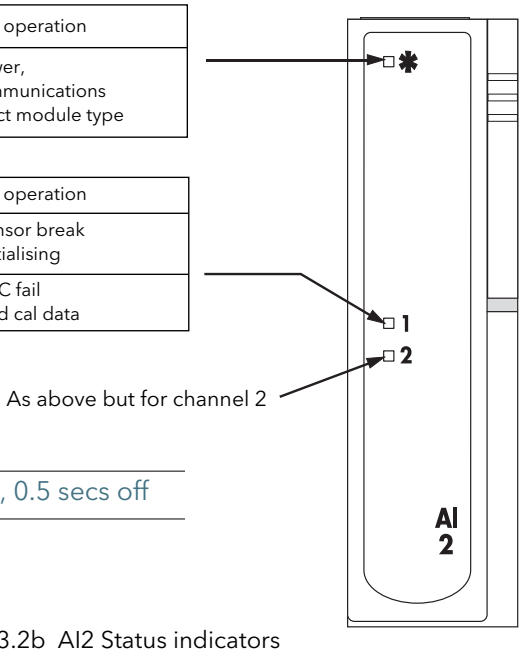
Note: The module terminals accept wire sizes from 0.20 to 2.5mm2 (14 to 24AWG).
The screws should be tightened to 0.4Nm (5.3lb in) using a 3.5mm flat blade screwdriver.

2.3.2 TWO-CHANNEL ANALOGUE INPUT (AI2) (Cont.)

STATUS INDICATORS

On green	Normal operation
Off	No power, No communications Incorrect module type

Off	Normal operation
On red	Ch1 sensor break Ch1 initialising
Flashing red/off	Ch1 CJC fail Ch1 bad cal data



Note: Flashing = 0.5 secs on, 0.5 secs off

Figure 2.3.2b AI2 Status indicators

2.3.3 Three-channel analogue input (AI3)

This module provides three isolated mA input channels. An isolated 24V (nom) supply is available across the 'P' and 'C' terminals for powering the current loop. If the current loop is self powered, the 'C' and 'I' terminals should be used. Figure 2.3.3a shows the pinout.

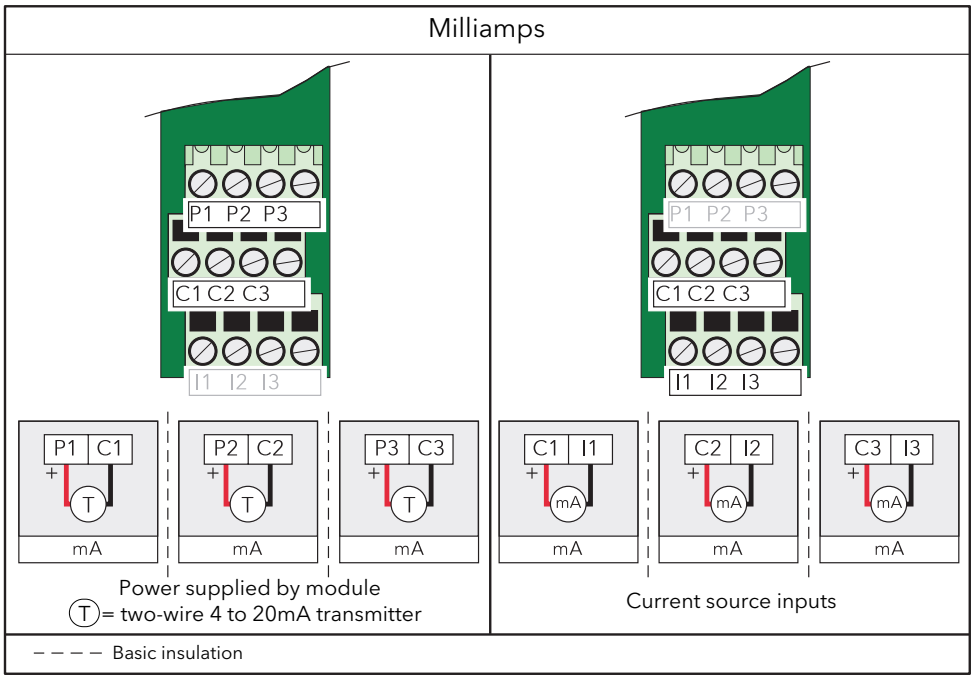
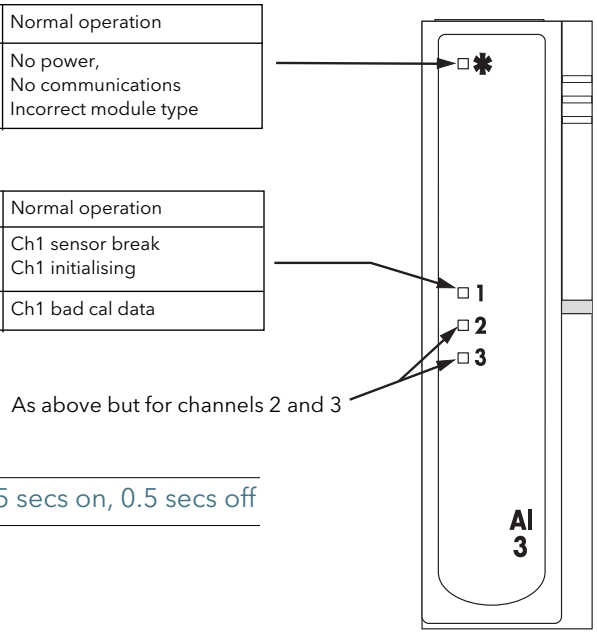


Figure 2.3.3a AI3 module pinout

STATUS INDICATORS

On green	Normal operation
Off	No power, No communications Incorrect module type

Off	Normal operation
On red	Ch1 sensor break Ch1 initialising
Flashing red/off	Ch1 bad cal data



Note: Flashing = 0.5 secs on, 0.5 secs off

Figure 2.3.3b AI3 Status indicators

Note: The module terminals accept wire sizes from 0.20 to 2.5mm2 (14 to 24AWG).
The screws should be tightened to 0.4Nm (5.3lb in) using a 3.5mm flat blade screwdriver.

2.3.3 THREE CHANNEL ANALOGUE INPUT MODULE (Cont.)

HART COMPATIBILITY

For each channel a 195 Ohm resistor is fitted in the input circuitry to the amplifier. Normally, these resistors are by-passed by printed circuit links on the underside of the terminal unit. In order to make the module Hart compatible, these links can be cut, placing the resistors in series with the amplifier inputs.

Figure 2.3.3c shows the module equivalent circuit, and figure 2.3.3d shows the location of the links on the underside of the terminal unit.

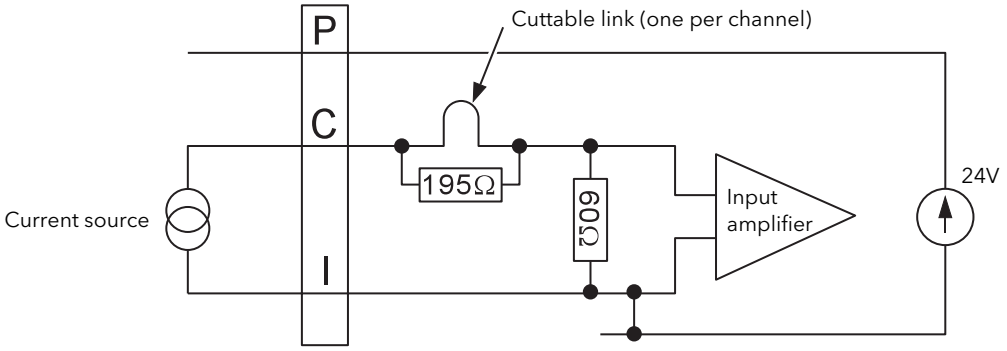


Figure 2.3.3c AI3 module equivalent circuit

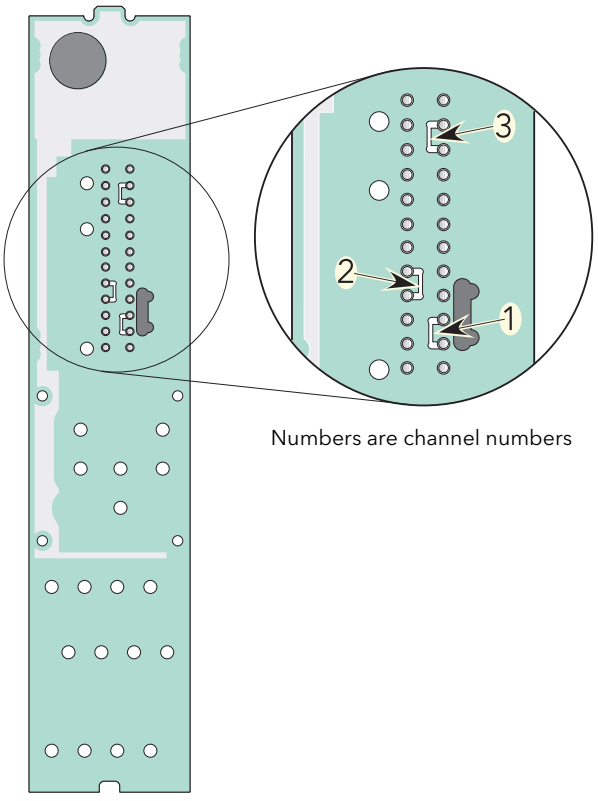


Figure 2.3.3d Link locations on underside of terminal unit

2.3.4 Four-channel analogue input (AI4)

This module can be ordered as one of a number of variants to measure thermocouple inputs, mV or mA. Figure 2.3.4a gives pinout details.

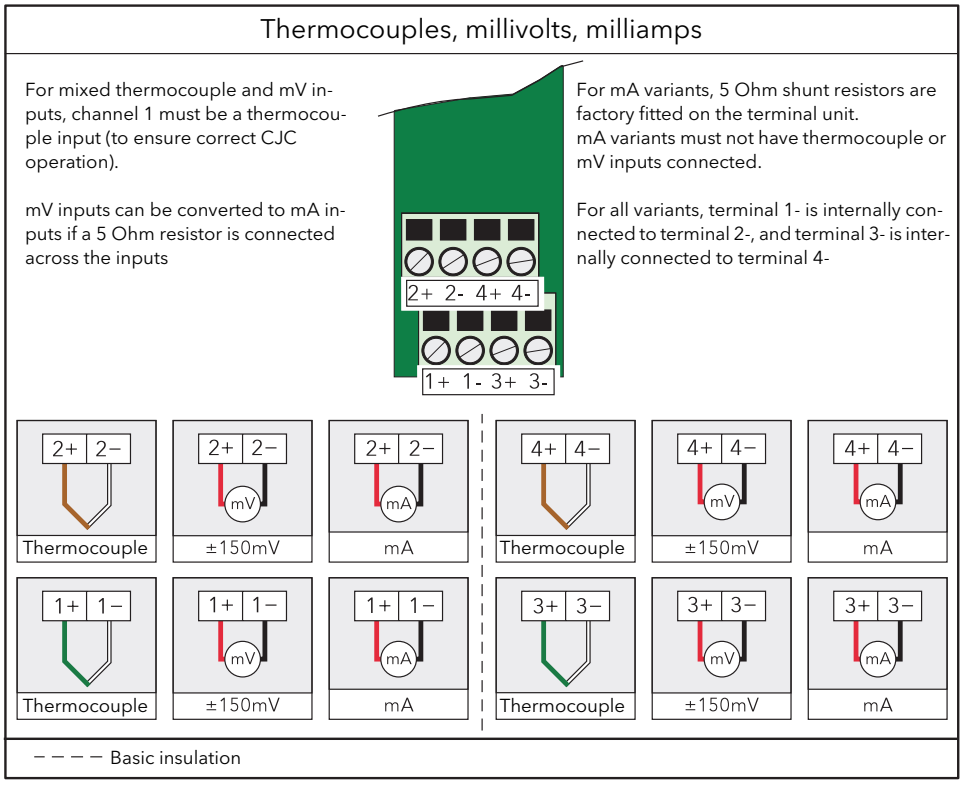


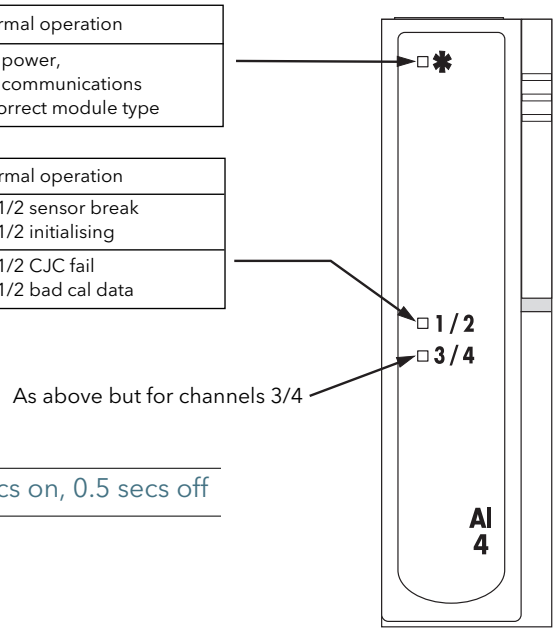
Figure 2.3.4a AI4 module pinout

Note: The module terminals accept wire sizes from 0.20 to 2.5mm2 (14 to 24AWG).
The screws should be tightened to 0.4Nm (5.3lb in) using a 3.5mm flat blade screwdriver.

STATUS INDICATORS

On green	Normal operation
Off	No power, No communications Incorrect module type

Off	Normal operation
On red	Ch1/2 sensor break Ch1/2 initialising
Flashing red/off	Ch1/2 CJC fail Ch1/2 bad cal data



Note: Flashing = 0.5 secs on, 0.5 secs off

Figure 2.3.4b AI4 status indicators

2.3.5 Two-channel analogue output (AO2)

This module provides two isolated output channels which can be configured independently (in software) as voltage or current source outputs. The specified voltage output range (0 to 10V) can be expanded slightly (-0.3V to +10.3V) by limiting the load to a minimum value of 1500 Ohms. Figure 2.3.5a gives the module pinout.

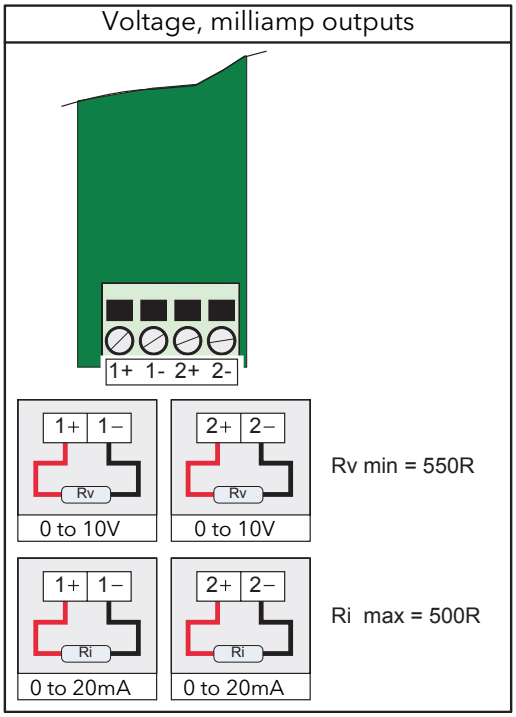


Figure 2.3.5a AO2 module pinout

Note: The module terminals accept wire sizes from 0.20 to 2.5mm2 (14 to 24AWG).
The screws should be tightened to 0.4Nm (5.3lb in) using a 3.5mm flat blade screwdriver.

STATUS INDICATORS

On green	Normal operation
Off	No power, No communications Incorrect module type

Off	Normal operation
On red	Ch1 saturated Ch1 initialising
Flashing red/off	Ch1 bad cal data

As above but for channel 2

Note: Flashing = 0.5 secs on, 0.5 secs off

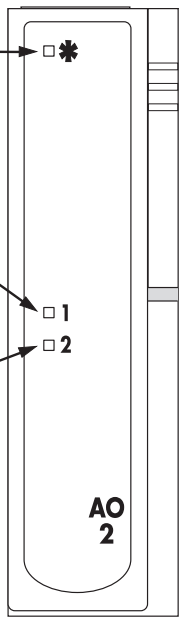


Figure 2.3.5b AO2 module status indicators

2.3.6 16-Channel digital input module (DI16)

This module provides 16 digital inputs which support either logic inputs or contact closure inputs. Both input types may be freely mixed on each DI16 module.

Note: The 'P' terminals are internally connected together and the 'C' terminals are internally connected together.

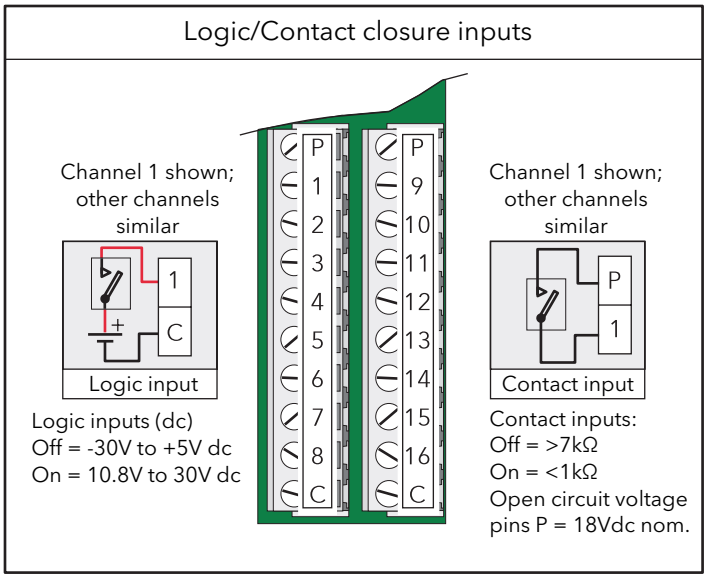


Figure 2.3.6a DI16 module pinout

Note: The module terminals accept wire sizes from 0.20 to 2.5mm2 (14 to 24AWG).
The screws should be tightened to 0.4Nm (5.3lb in) using a 3.5mm flat blade screwdriver.

STATUS INDICATORS

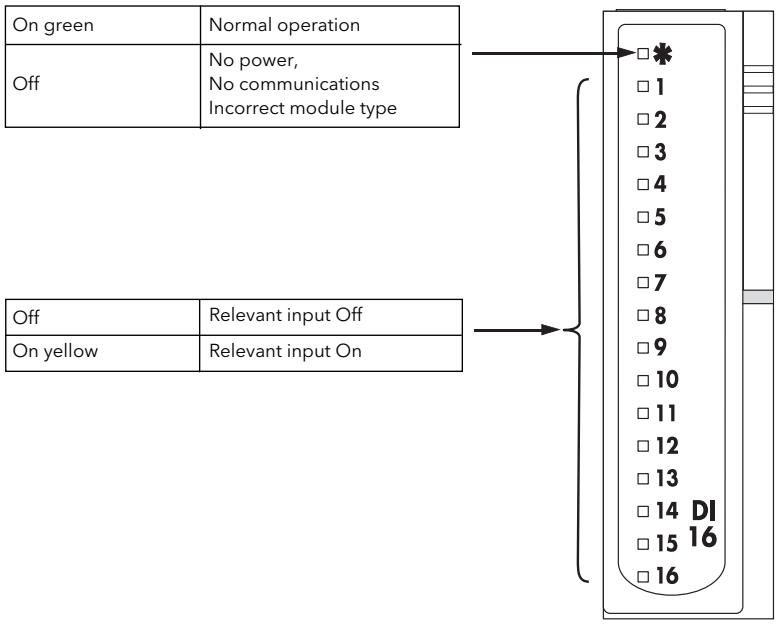


Figure 2.3.6b DI16 module status indicators

2.3.7 Eight output relay module (RLY8)

This module provides eight relay outputs with common/normally open contacts. No snubber circuitry is built into this module so it is the responsibility of the user to incorporate such circuit elements as are necessary to protect the relay contacts from undue wear, and to maintain CE compliance for the system.

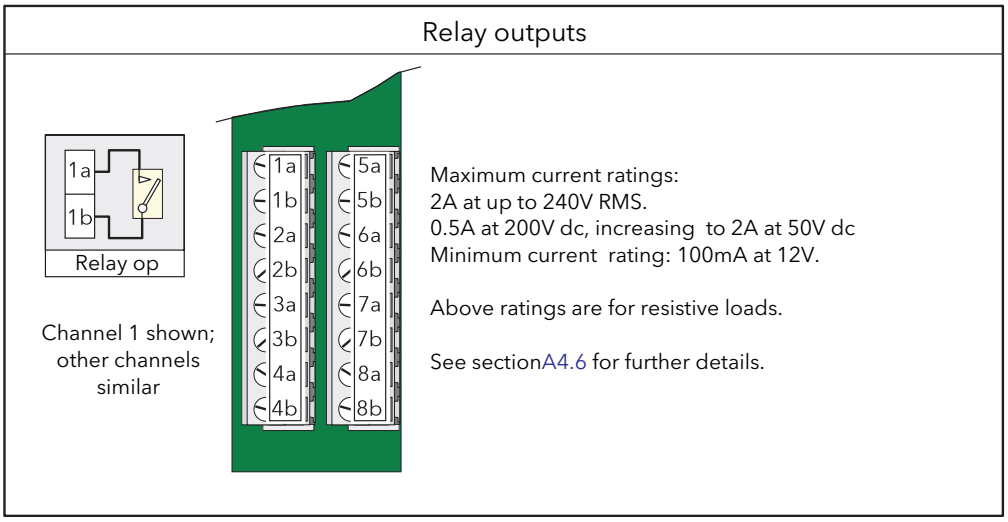


Figure 2.3.7a RLY8 module pinout

Note: The module terminals accept wire sizes from 0.20 to 2.5mm2 (14 to 24AWG).
The screws should be tightened to 0.4Nm (5.3lb in) using a 3.5mm flat blade screwdriver.

STATUS INDICATORS

On green	Normal operation
Off	No power, No communications Incorrect module type

Off	Relevant output Off (de-energised)
On yellow	Relevant output On (energised)

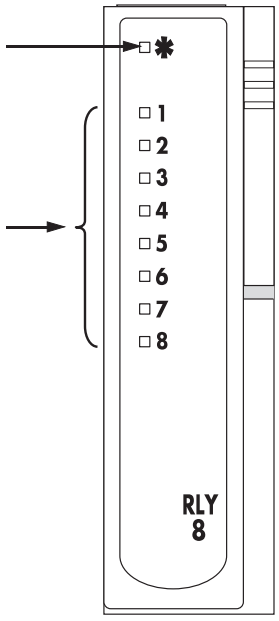


Figure 2.3.7b RLY8 status indicators

3 iTools

The unit is configured and parameter values are monitored using proprietary software called 'iTools', running on a pc (Windows XP, Windows 7). iTools allows quick and easy access to the configuration of the unit and gives the user the ability to create software wiring between function blocks using the Graphical Wiring Editor feature.

iTools can be used to assign individual input and maths channels to one or more recording groups. The content of these groups can subsequently be downloaded to 'Review' software (section 3.7) which allows channels to be presented on a 'chart' or in spreadsheet format.

In addition to the guidance given in the remainder of section 3, there are two on-line Help systems available within iTools: Parameter help and iTools help. Parameter help is accessed by clicking on 'Help' in the toolbar (opens the complete parameter help system), by right-clicking on a parameter and selecting 'Parameter Help' from the resulting context menu, or by clicking on the Help menu and selecting 'Device Help'. iTools help is accessed by clicking on the Help menu, and selecting 'Contents'. iTools help is also available in manual format under part number HA028838, either as a physical manual or as a pdf file.

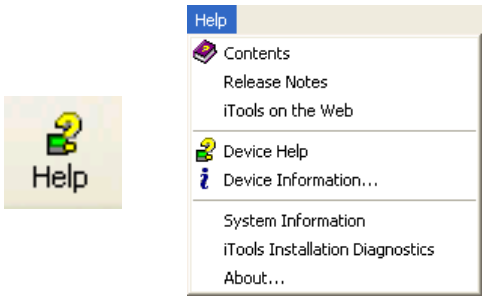


Figure 3 iTools help access

3.1 iTools CONNECTION

The following descriptions assume that iTools software has been correctly installed on the pc.

3.1.1 Ethernet (Modbus TCP) communications

Note: the following description is based on Windows XP. Windows 7 is similar.

It is first necessary to determine the IP address of the unit, as described under 'Network.Interface' in section 4.2.1.

Once the Ethernet link has been correctly installed, carry out the following actions at the pc:

1. Click on 'Start'
2. Click on 'Control Panel'. (If Control Panel opens in 'Category View' select 'Classic View' instead.)
3. Double-click on 'iTools'.
4. Click on the TCP/IP tab in the Registry settings configuration.
5. Click on 'Add...'. The 'New TCP/IP Port' display opens.
6. Type-in a name for the port, then click 'Add...' again
7. Type the IP address of the unit in the 'Host Name/Address:' field. Click OK.
8. Check the details in the 'New TCP/IP Port' box, then click on 'OK'.
9. Click on 'OK' in the 'Registry settings' box to confirm the new port.

(Continued)

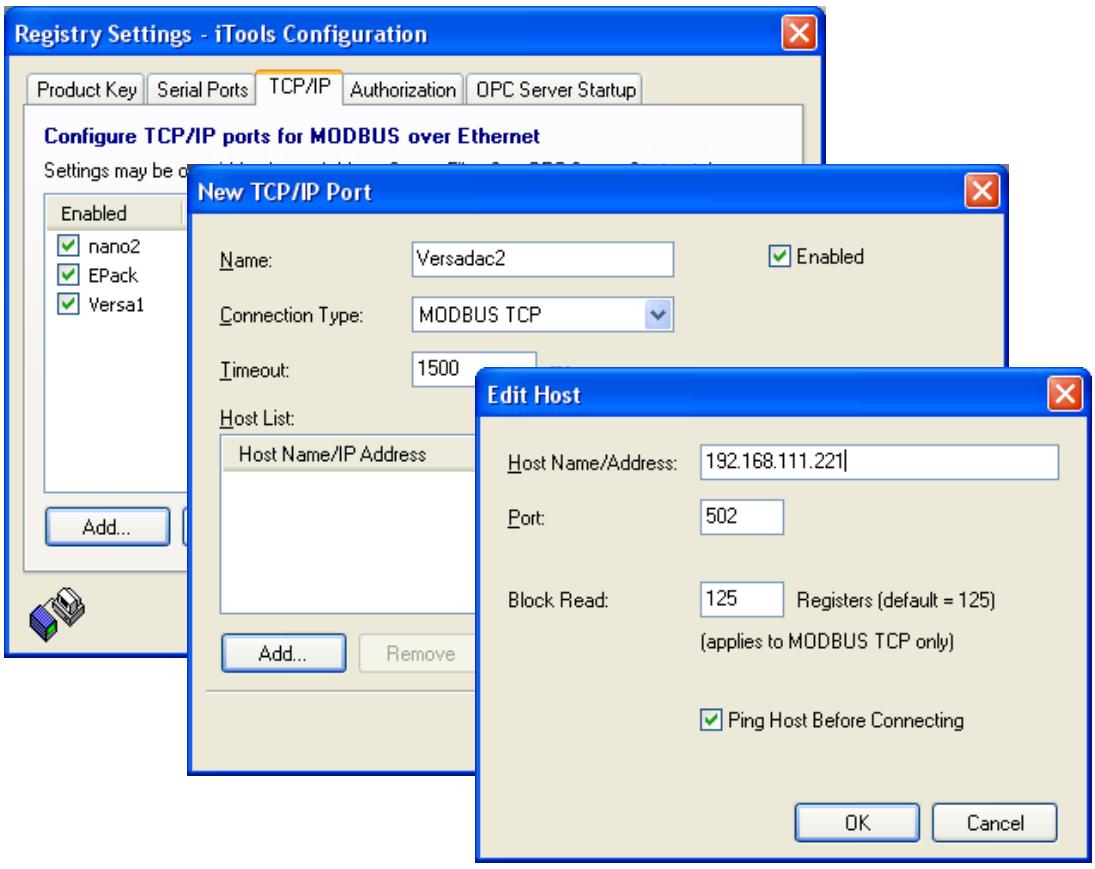


Figure 3.1.1a Adding a new Ethernet port

3.1.1 ETHERNET (TCP/IP) COMMUNICATIONS (Cont.)

To check that the pc can now communicate with the instrument, Click 'Start'. 'All Programs', 'Accessories', 'Command Prompt'.

When the Command Prompt box appears, type in: Ping<Space>IP1.IP2.IP3.IP4<Enter> (where IP1 to IP4 are the IP address of the instrument). The default address is 192.168.111.222.

If the Ethernet link to the instrument is operating correctly, the 'successful' reply arrives. Otherwise, the 'failed' reply arrives, in which case the Ethernet link, IP address and pc port details should be verified.

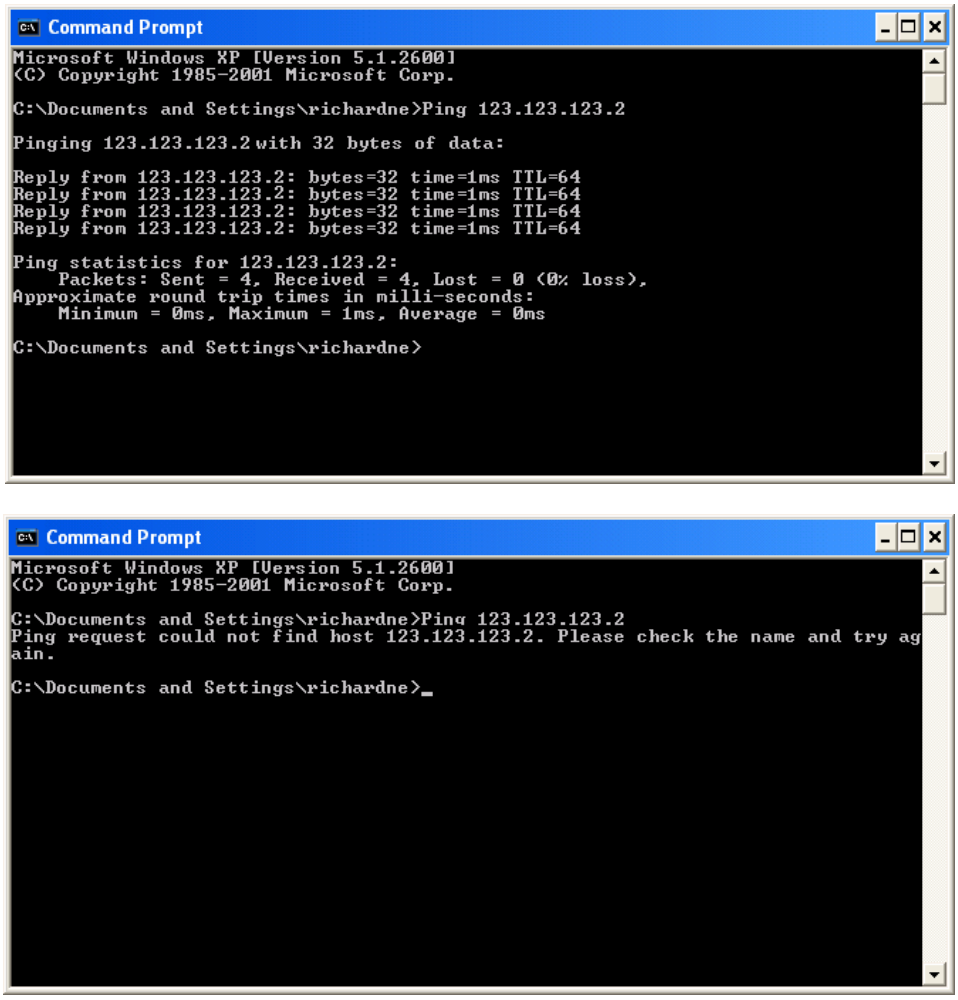


Figure 3.1.1b Command prompt 'Ping' screens (typical)

Once the Ethernet link to the instrument has been verified, iTools can be started (or shut down and restarted), and the Scan toolbar icon used to locate the instrument. The scan can be stopped at any time by clicking on the Scan icon a second time.

See section 3.2 for more details of the scan procedure.

RECOVERY FROM UNKNOWN IP ADDRESS CONFIGURED

If the DE (debug enable) switch (section 2.3.1) on the terminal unit is set to on and the instrument is power cycled the serial comms port on the terminal board becomes a debug port (38400 Baud, one stop, no parity)*. This presents a simple menu on a terminal emulator allowing the network settings to be viewed.

Once finished with the debug port the DE switch should be set to off and the instrument power cycled for normal operation to resume.

*Note: The protocol used is EIA-485. A suitable converter for communicating with a PC is available (order code SUBVERSA.DEBUGCABLE)

3.1.2 Direct Connection

This section describes how to connect a pc directly to the instrument.

Connection is made from the instrument's Ethernet connector to an Ethernet RJ45 connector, usually located at the rear of the pc. The cable can be either a 'cross-over' or 'straight through' type.

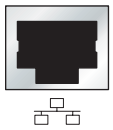


Fig 3.1.2a PC Ethernet connector.

Once connected correctly, and powered up, it is necessary to enter a suitable IP address and sub-net mask into the versadac Comms configuration. This information can be found as follows:

1. At the pc, click 'Start'. 'All Programs', 'Accessories', 'Command Prompt'
2. When the Command Prompt box appears, type IPConfig<Enter>

   The response is a display, such as that shown below, giving the IP address and Subnet mask of the pc. Choose an address in the range covered by these two values.

   A subnet mask element of 255 means that the equivalent element of the IP address must be used unchanged. A subnet mask element of 0 means that the equivalent element of the IP address may take any value between 1 and 255 (0 is not allowed). In the example below, the range of IP addresses which may be chosen is 123.123.123.2 to 123.123.123.255. (123.123.123.0 is not allowed and 123.123.123.1 is the same as the pc's address, and may therefore not be used.)

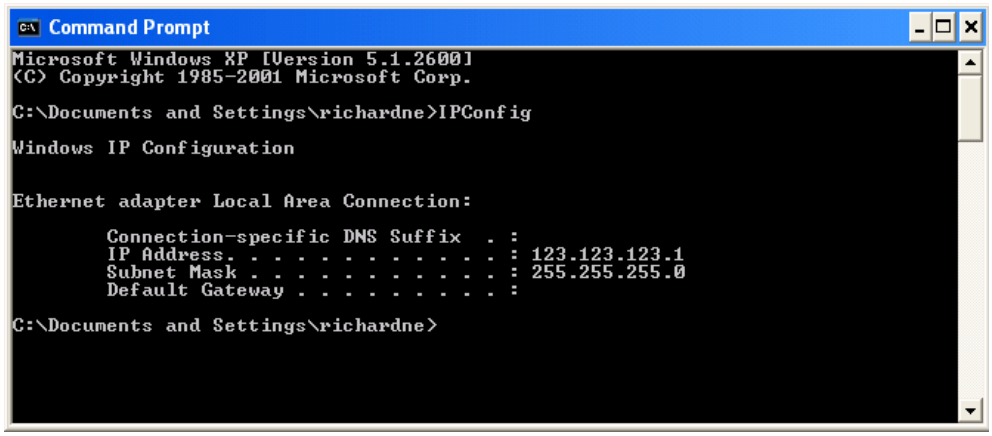


Figure 3.1.2b IP Config command

3. In Network.Interface configuration (section 4.2.1) enter the selected IP address and the subnet mask (as it appears in the command prompt window) in the relevant parameter field.
4. Check communications by 'pinging' as described in section 6.1.1, above.

Once the link to the instrument has been verified, iTools can be started (or shut down and re-started), and the Scan toolbar icon used, to 'find' the instrument. The scan can be stopped at any time by clicking on the Scan icon a second time.

See section 3.2 for more details of the scan procedure.

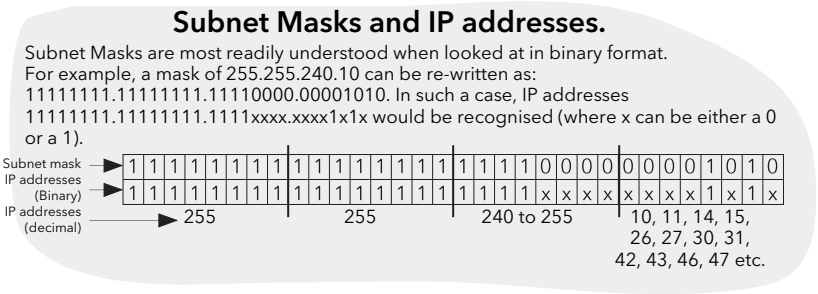


Figure 3.1.2c Subnet mask and recognised IP address range

3.2 SCANNING FOR INSTRUMENTS

Clicking on the 'Scan' toolbar icon causes 'Enable Background Scan' to appear, allowing the user to define a search range of addresses.

Notes:

1. The relevant instrument address is that entered in the Network.Modbus configuration item (section 4.2.3, and it can take any value between 1 and 254 inclusive, as long as it is unique to the comms link.
2. The default selection (Scan all device addresses...) will detect any instrument on the network, which has a valid address.

As the search progresses, any instruments detected by the scan appear as thumbnails (faceplates) in the 'Panel Views' area, normally located at the bottom of the iTools screen, and in the device list near the top left corner of the window. If only one device is to be scanned for, click on the 'Terminate Scan when first device found' tick box.

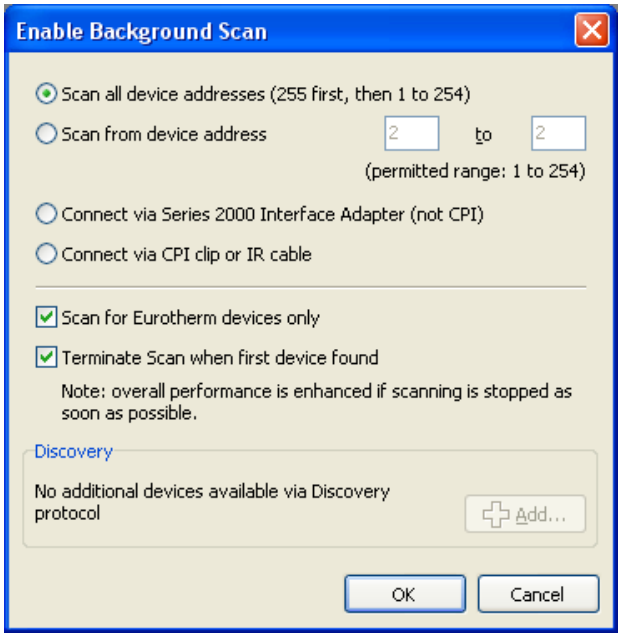


Figure 3.2a Scan range enable

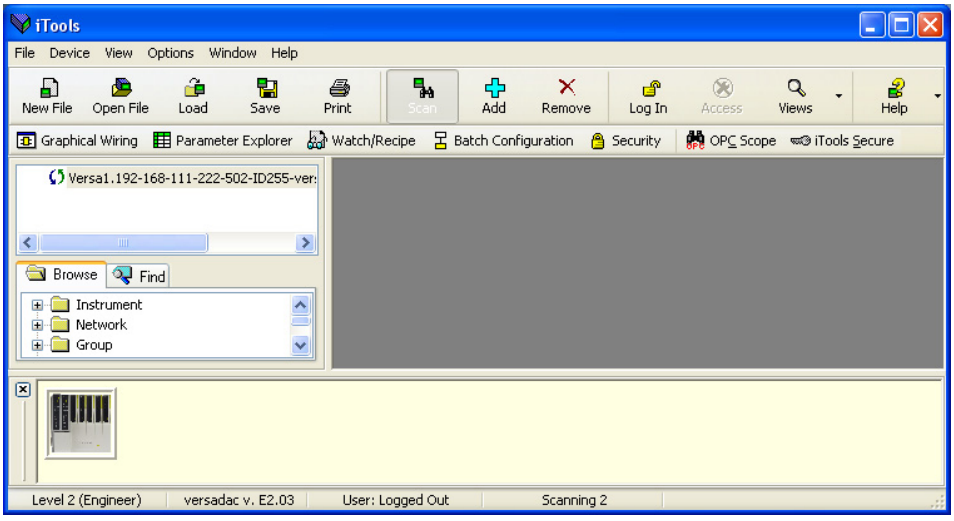
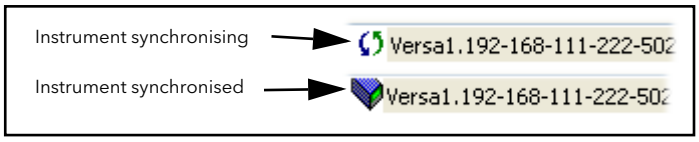
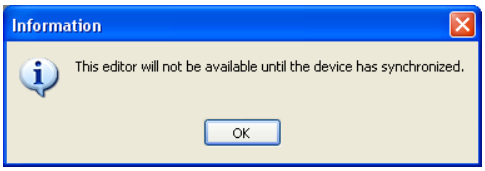


Figure 3.2b iTools initial window with one instrument detected

3.2 SCANNING FOR INSTRUMENTS (Cont.)

Once the instrument has been detected stop the scan (if necessary) and wait for the instrument to synchronise. (see below). Any attempt to access the instrument configuration before synchronisation is complete results in an error message.





3.2.1 Logging in 

Click on the 'Login' button and enter the relevant (case-sensitive) User name and Password. The button legend 'Log In' changes to 'Log Out'.
Attempts to access the instrument before login usually result in a request to log in.

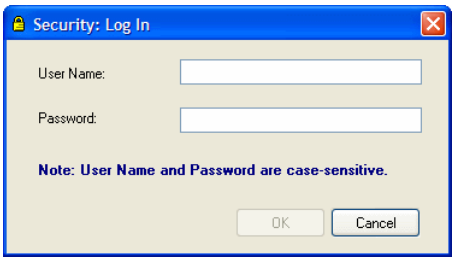


Figure 3.2.1a Log In window

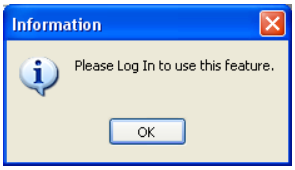


Figure 3.2.1b Log in request

To Log out, click on the Log out button.

Note: The default User Name is 'Engineer' and the default Password is '100' The password can be edited in the Security area of configuration (section 3.7)

LOGIN FAILURE

For Active directory users, if Login fails, check that the Active Directory Server system alarm is not active, and that the Active Directory security level (section 4.2.1) is correct for the server. At the Active Directory Server, check that the password has not expired and that 'Change Password at next login' has not been enabled. (It is usually necessary to ask the Active Directory Server Administrators to make these checks.)

3.2.2 Access to configuration 

Click on the Access button to enter configuration mode. Once the editing session is complete, click on the Access button again to quit configuration mode.

3.3 GRAPHICAL WIRING EDITOR Graphical Wiring

Clicking on the Graphical Wwiring Editor toolbutton causes the Graphical wiring window for the current instrument configuration to open. The toolbutton appears in read-only mode if the signed-in user does not have permission to edit configuration.

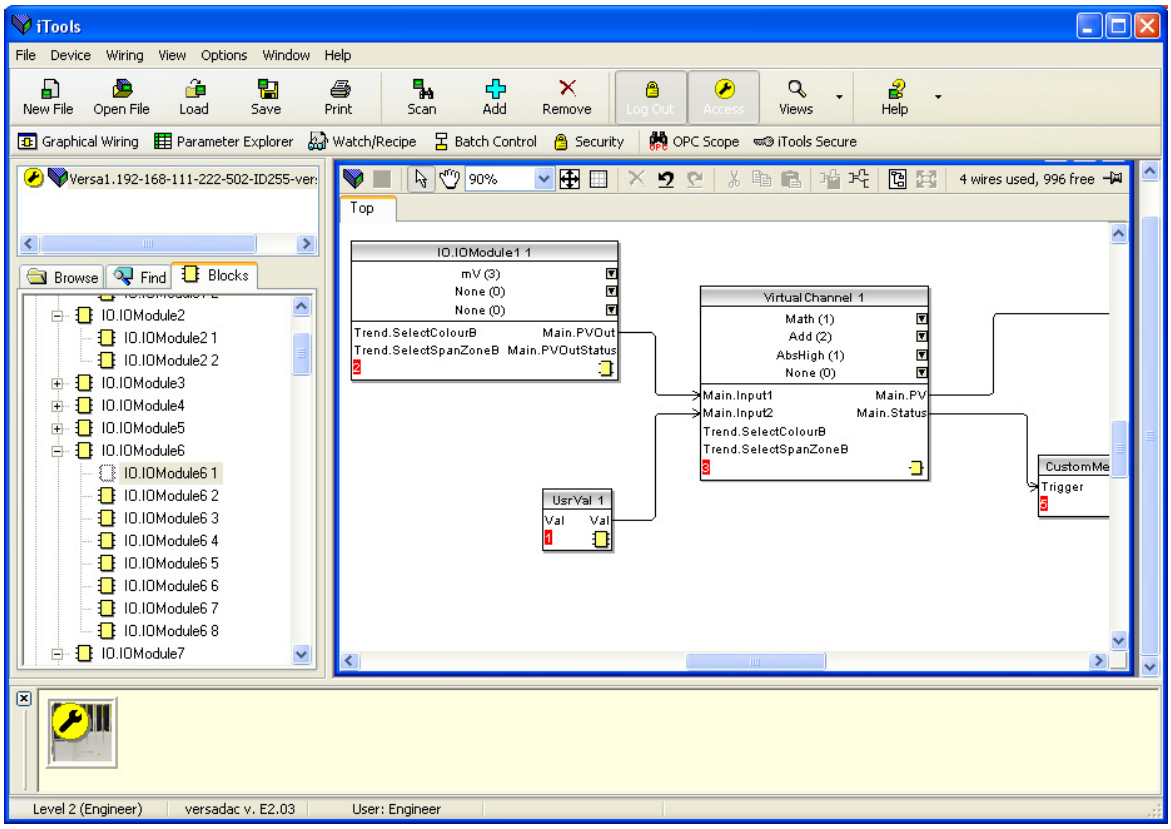


Figure 3.3 Graphical Wiring Editor

The Graphical Wiring Editor allows:

1. Function blocks, notes, comments etc. to be 'drag and dropped' into the wiring diagram from the Blocks tab tree (left pane).
2. Parameters to be wired to one another by clicking on the output, the clicking on the required input (but see note below).
3. Viewing and/or editing of parameter values either by right-clicking on a function block and selecting 'Function Block View' or double clicking on the block.
4. The user to select parameter lists and to switch between parameter and wiring editors.
5. Completed wiring to be downloaded to the instrument. Function blocks and wiring items with dashed outlines are new, or have been edited since the last download.

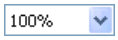
Note: Only one self clearing edge type input parameter (e.g. a Message Trigger parameter) can be wired to any one output parameter.

3.3.1 Toolbar

Download wiring to instrument

Mouse select. Select normal mouse operation. Mutually exclusive with 'Mouse Pan' below.

Mouse Pan. When active, this causes the mouse cursor to change to a hand-shaped icon. Allows the graphical wiring diagram to be click-dragged within the GWE window aperture.



Zoom. Allows the magnification factor of the wiring diagram to be selected

Pan tool. Whilst left clicked, the cursor appears as a rectangle showing which part of the wiring diagram is currently displayed. Click dragging allows the rectangle to be moved freely about the diagram. The size of the rectangle depends on the zoom setting.

Show/Hide grid. This toggles an alignment grid on and off.

Undo, redo.Allows the user to undo the last action, or, once an undo action has taken place, to undo the undo. Short cuts are <Ctrl>+<Z>. for undo; <Ctrl>+<R>, for redo

Cut, Copy, Paste. Normal Cut (copy and delete), Copy (copy without delete) and Paste (insert into) functions. Shortcuts are: <Ctrl> + <X> for 'Cut'; <Ctrl> + <C> for copy and <Ctrl> + <V> for Paste.

Copy diagram fragment; Paste diagram fragment. Allows a part of the wiring diagram to be selected, named and be saved to file. The fragment may then be pasted into any wiring diagram, including the source diagram

Create compound; Flatten compound. These two icons allow compounds to be created and 'flattened' (i.e.re-integrated into the parent diagram).

3.3.2 Graphical Wiring Editor operating details

A Function Block is enabled by dragging the block onto the diagram, wiring it, and finally downloading it to the instrument. Initially blocks and associated wires are drawn with dashed lines, and when in this state the parameter list for the block is enabled but the block is not executed by the instrument.

The block is added to the instrument function block execution list when the 'Download' icon is operated after which the items are redrawn using solid lines.

If a block which has been downloaded is deleted, it is shown on the diagram in a ghosted form until the download button is pressed. (This is because it and any wires to/from it are still being executed in the instrument. On download it will be removed from the instrument execution list and the diagram.) A ghosted block can be 'undeleted' as described in 'Function Block Context menu', below.

When a dashed block is deleted it is removed immediately.

COMPONENT SELECTION

Single wires are shown with boxes at 'corners' when selected. When more than one wire is selected, as part of a group, the wire colour changes to magenta. All other items have a dashed line drawn round them when selected.

Clicking on a single item selects it. An item can be added to the selection by holding down the control key (Ctrl) whilst clicking on the item. (A selected item can be deselected in the same way.) If a block is selected, then all its associated wires are also selected.

Alternatively, the mouse can be click-dragged on the background to create a 'rubber band' round the relevant area; anything within this area being selected when the mouse is released.

<Ctrl>+<A> selects all items on the active diagram.

BLOCK EXECUTION ORDER

The order in which the blocks are executed by the instrument depends on the way in which they are wired. Each block displays its place in its sequence in a coloured block in the bottom left-hand corner (figure 3.3.2a).

3.3.2 WIRING EDITOR OPERATING DETAILS (Cont.)

FUNCTION BLOCKS

A Function Block is an algorithm which may be wired to and from other function blocks to make a control strategy. Each function block has inputs and outputs. Any parameter may be wired from, but only parameters that are alterable in Operator Mode may we wired to. A function block includes any parameters that are needed to configure or operate the algorithm. The inputs and outputs which are considered to be of most use are always shown. In most cases all of these need to be wired before the block can perform a useful task.

If a function block is not faded in the Block tab tree it can be dragged onto the diagram. The block can be dragged around the diagram using the mouse.

An IO Module channel is shown below as an example. When block type information is alterable (as in this case) clicking on the box with the down arrow in it displays an edit box allowing the value to be altered.

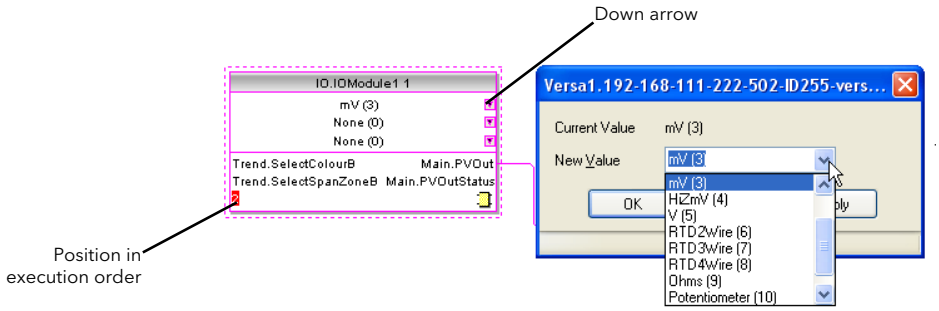


Figure 3.3.2a Function block example

If it is required to wire from a parameter, which is not shown as a recommended output, click on the 'Click to Select Output' icon in the bottom right hand corner to display a full list of parameters in the block (figure 3.3.2c, below). Click on one of these to start a wire.

FUNCTION BLOCK CONTEXT MENU

Right click in the function block to display the context menu.

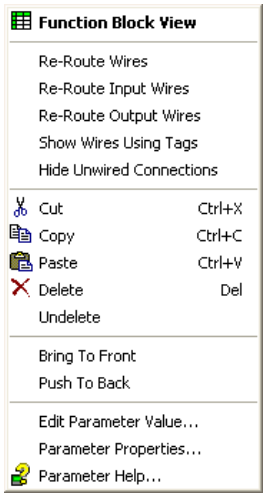


Figure 3.3.2b Function Block View context menu

Function Block View — Displays a list of parameters associated with the function block. 'Hidden' parameters can be displayed by de-selecting 'Hide Parameters and Lists when not Relevant' in the options menu 'Parameter availability setting...' item.
Function Block View displays the same items as a Parameter Explorer View but is dedicated to the function block for which it was launched. More than one View can be launched and can be brought to the front by clicking on the Function Block toolbutton which appears next to Graphical Wiring on the iTools Views toolbar.

3.3.2 WIRING EDITOR OPERATING DETAILS (Cont.)

FUNCTION BLOCK CONTEXT MENU (Cont.)

Re-Route Wires — Redraws all wiring associated with the function block.

Re-route Input Wires — Redraws all input wiring associated with the function block

Re-route Output Wires — Redraws all output wiring associated with the function block.

Show Wiring using tags

Wires are not drawn, but their start and end destinations are indicated by tags instead. Reduces wire clutter in diagrams where source and destination are widely separated.

Hovering the cursor over the tag shows both its source and destination parameters and their values.

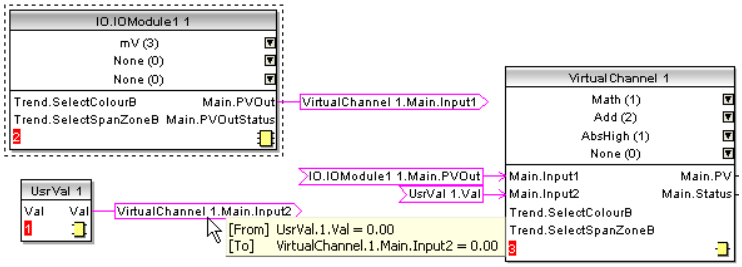


Figure 3.3.2c Tagged wires example

Hide unwanted connections

Causes the display to include only wired items.

Cut — Allows one or more selected items to be moved to the Clipboard ready for pasting into another diagram or compound. The original items are greyed out, and function blocks and wires are shown dashed until next download, after which they are removed from the diagram. Short cut = <Ctrl>+<X>. Cut operations carried out since the last download can be 'undone' by using the 'Undo' tool bar icon, by selecting 'Undelete' or by using the short cut <Ctrl>+<Z>.

Copy — Allows one or more selected items to be copied to the Clipboard ready for pasting into another diagram or compound, or for use in a Watch window, or OPC scope. The original items remain in the current wiring diagram. Short cut = <Ctrl>+<C>. If items are pasted to the same diagram from which they were copied, the items will be replicated with different block instances. Should this result in more instances of a block than are available, an error display appears showing details of which items couldn't be copied.

Paste — Copies items from the Clipboard to the current wiring diagram. Short cut = <Ctrl>+<V>. If items are pasted to the same diagram from which they were copied, the items will be replicated with different block instances. Should this result in more instances of a block than are available, a Paste error display appears showing details of those items which could not be copied.

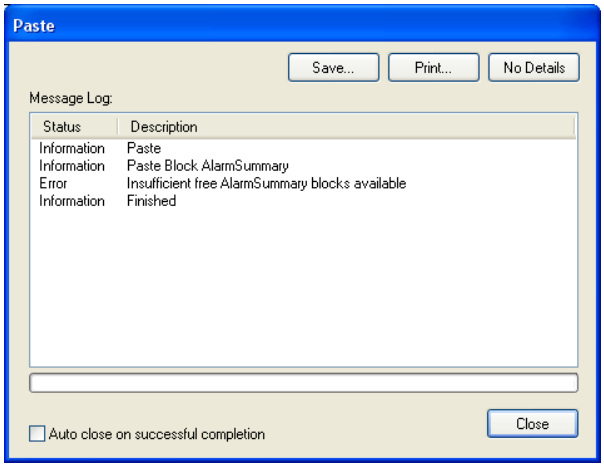
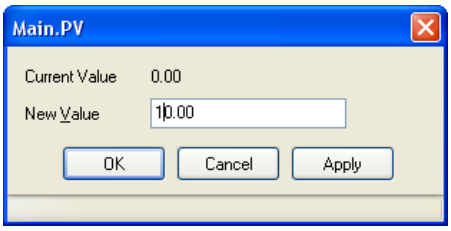


Figure 3.3.2d Paste error

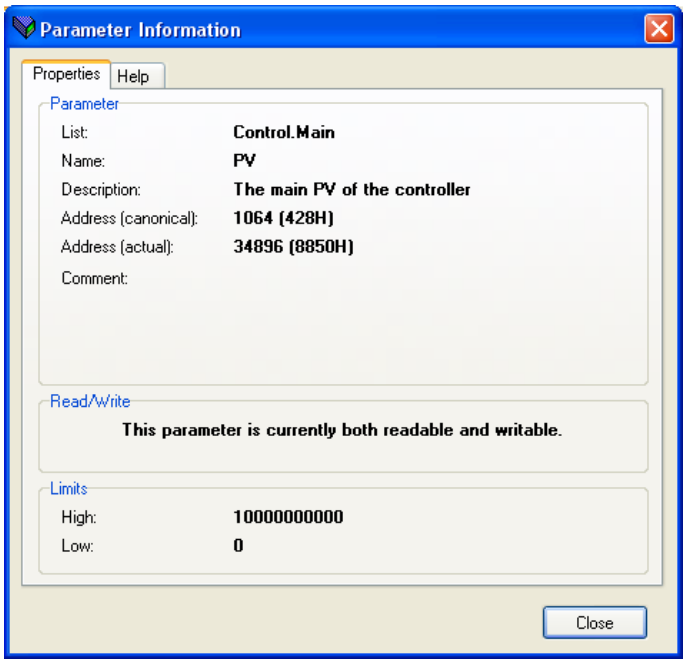
3.3.2 WIRING EDITOR OPERATING DETAILS (Cont.)

FUNCTION BLOCK CONTEXT MENU (Cont.)

Delete	Marks all selected items for deletion. Such items are shown dashed until next download, after which they are removed from the diagram. Short cut = <Del>.
Undelete	Reverses 'Delete' and 'Cut' operations carried out on selected item(s) since the last download.
Bring to Front	Brings selected items to the front of the diagram.
Push to Back	Sends the selected items to the back of the diagram.
Edit Parameter Value...	This menu item is active if the cursor is hovering over a parameter. Selecting this menu item causes a Parameter Value window to appear allowing the user to edit the parameter value (providing it is not read-only.)



Parameter Properties	This menu item is active if the cursor is hovering over a parameter. Selecting this menu item causes the Parameter Information window to appear, which allows the user to view the parameter properties, and also, to view the parameter Help (by clicking on the 'Help' tab).



Parameter Help	Produces Parameter Properties and Help information for the selected function block or parameter, depending on the hover position of the cursor, when the right-click occurs.

3.3.2 WIRING EDITOR OPERATING DETAILS (Cont.)

WIRES

To make a wire

1. Drag two (or more) blocks onto the diagram from the function block tree.
2. Start a wire by either clicking on a recommended output or clicking on the 'Click to Select output' icon at the bottom right corner of the block to display the available connections, and clicking on the required parameter. Recommended connections are shown with a green plug symbol; other parameters which are available being shown in yellow. Clicking on the red button causes all parameters to be shown. To dismiss the connection list either press the escape key on the keyboard, or click the cross at the bottom left of the box.
3. Once the wire has started a dashed wire is drawn from the output to the current mouse position. To complete the wire click on the required destination parameter.
4. Wires remain dashed until they are downloaded

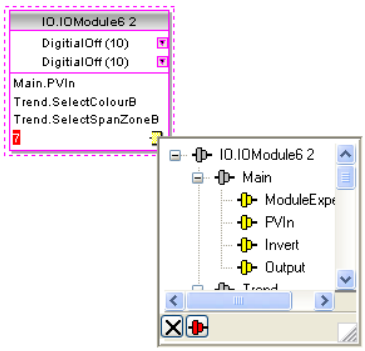


Figure 3.3.2e
Output connection parameter list.

Routing wires

When a wire is placed it is auto-routed. The auto routing algorithm searches for a clear path between the two blocks. A wire can be auto-routed again using the context menus or by double clicking the wire. A wire segment can be edited manually by click-dragging. If the block to which it is connected is moved, the end of the wire moves with it, retaining as much of the path as possible.

If a wire is selected by clicking on it, it is drawn with small boxes on its corners.

Wire Context Menu

Right click on a wire to display the wire block context menu:

Force Exec Break	When wires form a loop, a break point must be introduced, where the value written to the block comes from a source which was last executed during the previous cycle. A break is automatically placed by iTools, and appears in red. Force Exec Break allows the user to define where a break must be placed. Surplus breaks appear in black.
Re-Route wire	Replaces the current wire route with a new route generated from scratch.
Use Tags	Toggles between wire and tag mode between parameters. Tag mode is useful for sources and destinations which are widely separated.
Find Start	Goes to the source of the wire.
Find End	Goes to the destination of the wire.
Cut, Copy, Paste	Not used in this context.
Delete	Marks the wire for deletion. The wire is redrawn as a dashed line (or dashed tags) until next download. Operation can be reversed until after next download.
Undelete	Reverses the effect of the Delete operation up until the next download, after which, Undelete is disabled.
Bring to Front	Brings the wire to the front of the diagram.
Push to Back	Sends the wire to the back of the diagram.

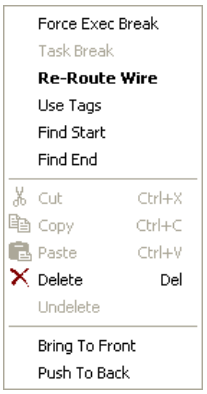


Figure 3.3.2f
Wire context menu

3.3.2 WIRING EDITOR OPERATING DETAILS (Cont.)

Wire Colours

Black	Normal functioning wire
Red	The wire is connected to a non-changeable parameter. Values are rejected by the destination block.
Magenta	A wire is coloured magenta if it is connected to a selected block, or if it is being hovered-over by the mouse cursor.
Purple	A red wire is being hovered-over by the mouse cursor.
Green	New Wire (dashed green wire changes to solid black after being downloaded.)

See also 'Item Colours' below.

COMMENTS

Comments are added to a wiring diagram by click-dragging them from the Function Block tree onto the diagram. As soon as the mouse is released, a text entry box opens to allow the comment text to be typed in.

Because comment text does not wrap around, new lines must be created manually using Carriage returns. Once text entry is complete, 'OK' causes the comment to appear on the diagram. There are no restrictions on the size of a comment. Comments are saved to the instrument along with the diagram layout information.

Comments can be linked to function blocks and wires by clicking on the chain icon at the bottom right-hand corner of the comment box and then clicking again on the required block or wire. A dashed line is drawn to the top of the block or to the selected wire segment (figure 3.3.2h).

Note: Once the comment has been linked, the Chain icon disappears. It re-appears when the mouse cursor is hovered over the bottom right-hand corner of the comment box.

Comment Context Menu

Edit	Opens the Comment text entry box to allow the comment text to be edited.
Unlink	Deletes the current link from the comment.
Cut	Moves the comment to the Clipboard, ready to be pasted elsewhere. Short cut = <Ctrl>+<X>.
Copy	Copies the comment from the wiring diagram to the Clipboard, ready to be pasted elsewhere. Short cut = <Ctrl>+<C>.
Paste	Copies a comment from the Clipboard to the wiring diagram. Short cut = <Ctrl>+<V>.
Delete	Marks the comment for deletion at next download.
Undelete	Undoes the Delete command if download has not taken place since.

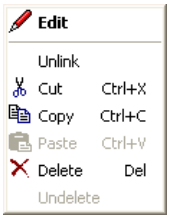


Figure 3.3.2g
Comment context menu

3.3.2 WIRING EDITOR OPERATING DETAILS (Cont.)

MONITORS

Monitor points are added to a wiring diagram by click-dragging them from the Function Block tree onto the diagram. A monitor shows the current value (updated at the iTools parameter list update rate) of the parameter to which it is linked. By default the name of the parameter is shown. To hide the parameter name either double click on the monitor box or 'Show Names' in the context (right-click) menu can be used to toggle the parameter name on and off.

Monitors are linked to function blocks and wires by clicking on the chain icon at the bottom right-hand corner of the box and then clicking again on the required parameter. A dashed line is drawn to the top of the block or the selected wire segment.

> Note: Once the monitor has been linked, the Chain icon disappears. It re-appears when the mouse cursor is hovered over the bottom right-hand corner of the monitor box.

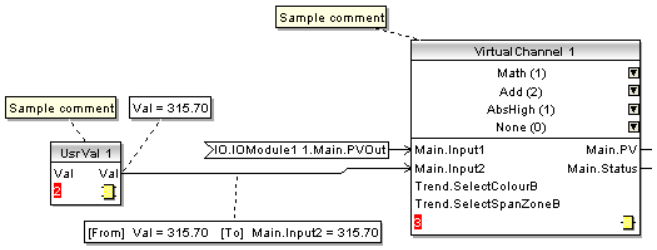


Figure 3.3.2h Comment and Monitor appearance

Monitor Context Menu

Show names	Toggles parameter names on and off in the monitor box.
Unlink	Deletes the current link from the monitor.
Cut	Moves the monitor to the Clipboard, ready to be pasted elsewhere. Short cut = <Ctrl>+<X>.
Copy	Copies the monitor from the wiring diagram to the Clipboard, ready to be pasted elsewhere. Short cut = <Ctrl>+<C>.
Paste	Copies a monitor from the Clipboard to the wiring diagram. Short cut = <Ctrl>+<V>.
Delete	Marks the monitor for deletion at next download.
Undelete	Undoes the Delete command if download has not taken place since.
Bring to Front	Moves the item to the 'top' layer of the diagram.
Push to Back	Moves the item to the 'bottom' layer of the diagram.
Parameter Help	Shows parameter help for the item.

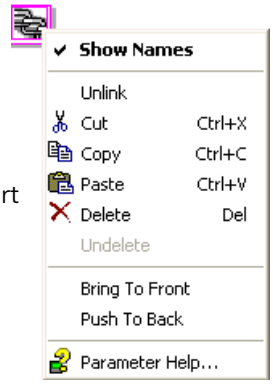


Figure 3.3.2i
Monitor context menu

DOWNLOADING

When the wiring editor is opened the current wiring and diagram layout is read from the instrument. No changes are made to the instrument function block execution or wiring until the download button is pressed. When a block is dropped onto the diagram, instrument parameters are changed to make the parameters for that block available. If changes are made and the editor is closed without saving them there is a delay while the editor clears these parameters.

During download, the wiring is written to the instrument which then calculates the block execution order and starts executing the blocks. The diagram layout including comments and monitors is then written into instrument flash memory along with the current editor settings. When the editor is reopened, the diagram is shown positioned as it was when it was last downloaded.

3.3.2 WIRING EDITOR OPERATING DETAILS (Cont.)

ITEM COLOURS

Items on the diagram are coloured as follows (see also 'Wire colours', above):

Red	Items which totally or partially obscure other items and items which are totally or partially obscured by other items. Wires that are connected to unalterable or non-available parameters. Execution breaks.
Blue	Non-available parameters in function blocks.
Green	Items added to the diagram since last download are shown as green dashed lines.
Magenta	All selected items, or any item over which the cursor is hovering.
Purple	Red wires when being hovered over by the mouse cursor.
Black	All items added to the diagram before the last download. Redundant execution breaks. Monitor and comment text.

DIAGRAM CONTEXT MENU

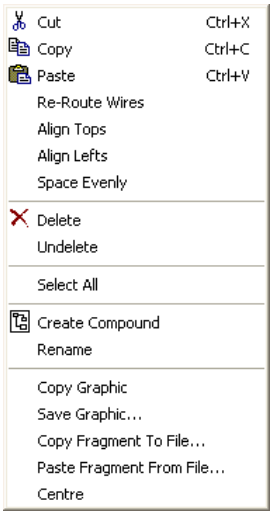


Figure 3.3.2j
Diagram context menu

Cut	Active only when the right click occurs within the bounding rectangle which appears when more than one item is selected. Moves the selection off the diagram to the Clipboard. Short cut = <Ctrl>+<X>.
Copy	As for 'Cut', but the selection is copied, leaving the original on the diagram. Short cut = <Ctrl>+<C>.
Paste	Copies the contents of the Clipboard to the diagram. Short cut = <Ctrl>+<V>.
Re-Route Wires	Reroutes all selected wires. If no wires are selected, all wires are re-routed.
Align Tops	Aligns the tops of all blocks in the selected area.
Align Lefts	Aligns the left edges of all blocks in the selected area.
Space Evenly	Spaces selected items such that their top left corners are spaced evenly across the width of the diagram. Click on the item which is to be the left-most item, then <Ctrl>+<left click> the remaining items in the order in which they are to appear.
Delete	Marks the item for deletion at next download time. Can be 'Undeleted' up until download occurs.
Undelete	Reverses the action of 'Delete' on the selected item.
Select All	Selects all items on the current diagram.
Create Compound	Active only when the right click occurs, in the top level diagram, within the bounding rectangle which appears when more than one item is selected. Creates a new wiring diagram as described in 'Compound', below.
Rename	Allows a new name to entered for the current wiring diagram. This name appears in the relevant tab.
Copy Graphic	Copies the selected items (or the whole diagram if no items are selected) to the clipboard as a Windows metafile, suitable for pasting into a documentation application. Wiring entering/leaving the selection (if any) are drawn in tag mode.
Save Graphic...	As for 'Copy Graphic' above, but saves to a user-specified file location instead of the clipboard.
Copy Fragment To File...	Copies selected items to a user-named file in folder 'My iTools Wiring Fragments' located in 'My Documents'.
Paste Fragment From File	Allows the user to select a stored fragment for inclusion in the wiring diagram.
Centre	Places the display window at the centre of the selected items. If 'Select All' has previously been clicked-on, then the display widow is placed over the centre of the diagram.

3.3.2 WIRING EDITOR OPERATING DETAILS (Cont.)

COMPOUNDS

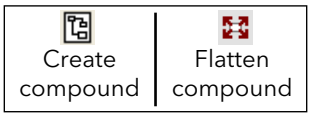
Compounds are used to simplify the top level wiring diagram, by allowing the placing of any number of function blocks within one 'box', the inputs and outputs of which operate in the same way as those of a normal function block.

Each time a compound is created, a new tab appears at the top of the wiring diagram. Initially compounds and their tabs are named 'Compound 1', 'Compound 2', etc. but they can be renamed by right clicking either on the compound in the top level diagram, or anywhere within an open Compound, selecting 'Rename' and typing in the required text string (16 characters max.).

Compounds cannot contain other compounds (i.e. they can be created only in the top level diagram).

Compound creation

1. Empty compounds are created within the top level diagram by clicking on the 'Create Compound' tool bar icon.
2. Compounds can also be created by highlighting one or more function blocks in the top level diagram and then clicking on the 'Create Compound' tool bar icon. The highlighted items are moved from the top level diagram into a new compound.



3. Compounds are 'uncreated' (flattened), by highlighting the relevant item in the top level menu and then clicking on the 'Flatten Compound' tool bar icon. All the items previously contained within the compound appear on the top level diagram.
4. Wiring between top level and compound parameters is carried out by clicking on the source parameter, then clicking on the compound (or the compound tab) and then clicking on the destination parameter. Wiring from a compound parameter to a top level parameter or from compound to compound is carried out in similar manner.
5. Unused function blocks can be moved into compounds by dragging from the tree view. Existing blocks can be dragged from the top level diagram, or from another compound, onto the tab associated with the destination compound. Blocks are moved out of compounds to the top level diagram or to another compound in a similar way. Function blocks can also be 'cut and pasted'.
6. Default compound names (e.g. 'Compound 2') are used only once, so that if, for example, Compounds 1 and 2 have been created, and Compound 2 is subsequently deleted, then the next compound to be created will be named 'Compound 3'.
7. Top level elements can be click-dragged into compounds.

TOOLTIPS

Hovering the cursor over the block displays 'tooltips' describing that part of the block beneath the cursor. For function block parameters the tooltip shows the parameter description, its OPC name, and, if downloaded, its value. Similar tooltips are shown when hovering over inputs, outputs and over many other items on the iTools screen.

3.4 PARAMETER EXPLORER Parameter Explorer

This view can be displayed:

1. by clicking on the 'Parameter Explorer' toolbar icon,
2. by double clicking on the relevant block in the tree pane or in the graphical wiring editor
3. by selecting 'Parameter Explorer from the 'View' menu
4. by using the short cut <Alt>+<Enter>

In each case the function block parameters appear in the iTools window in tabular form, such as the example in figure 3.4a, below.

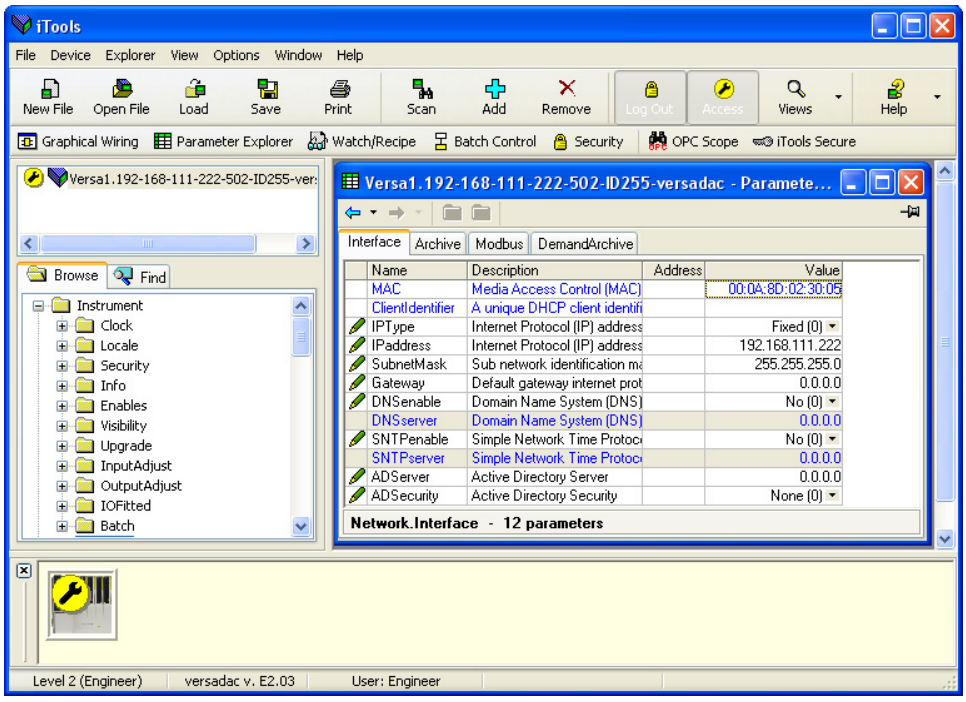
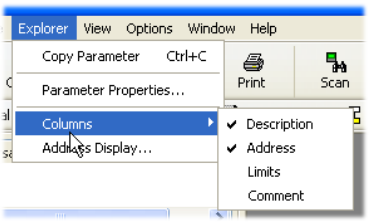


Figure 3.4a Parameter table example

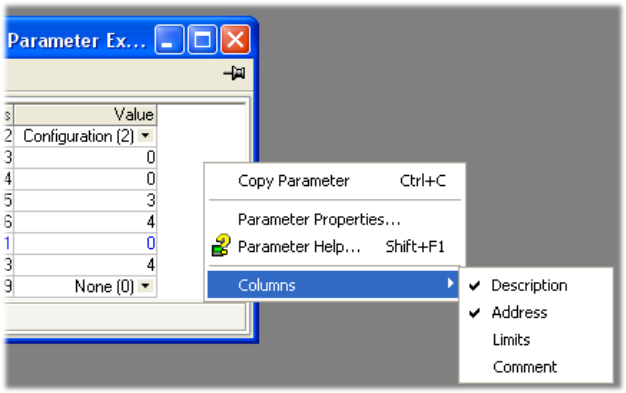
The figure above shows the default table layout. Columns can be added/deleted from the view using the 'Columns' item of the Explorer or context menus (figure 3.4b).

Note... The Explorer menu appears in Parameter Explorer view. It is replaced by the Wiring menu if Graphical Wiring Editor is the active view.

3.4 PARAMETER EXPLORER (Cont.)



From Explorer menu



From Context menu

Figure 3.4b Column enable/disable

3.4.1 Parameter Explorer detail

Figure 3.4.1a shows a typical parameter table. This particular configuration item has a number of subfolders associated with it, and each of these is represented by a 'tab' across the top of the table.

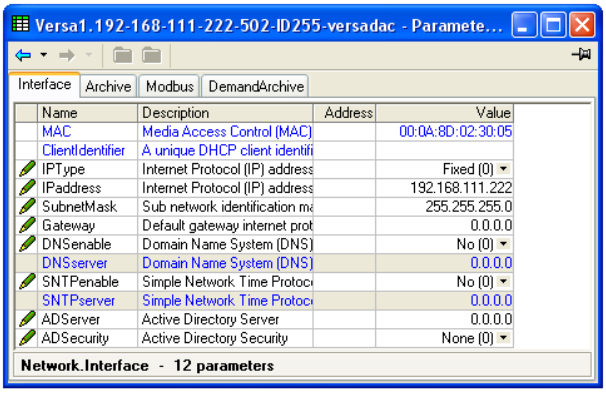


Figure 3.4.1a Typical parameter table

Notes:

1. Parameters in blue are non-editable (Read only). Read/write parameters are in black and have a 'pencil' symbol in the 'Read/Write access column at the left edge of the table. Read/Write status for many parameters depends on the access level of the logged-in user, and whether or not the instrument is in configuration mode.
2. Columns. The default explorer window (figure 3.4a) contains the columns 'Name', 'Description', 'Address' and 'Value'. As can be seen from figure 3.4b, the columns to be displayed can be selected, to a certain extent, using either the 'Explorer' menu or the context menu. 'Limits' have been enabled for the example above.
3. Hidden Parameters. By default, iTools hides parameters which are considered irrelevant in the current context. Such hidden parameters can be shown in the table using the 'Parameter availability' settings item of the options menu (figure 3.4.1b). Such items are displayed with a shaded background.
4. The full pathname for the displayed parameter list is shown at the bottom left hand corner of the window, along with the total number of parameters and the number of hidden parameters (if any).

3.4.1 PARAMETER EXPLORER DETAIL (Cont.)

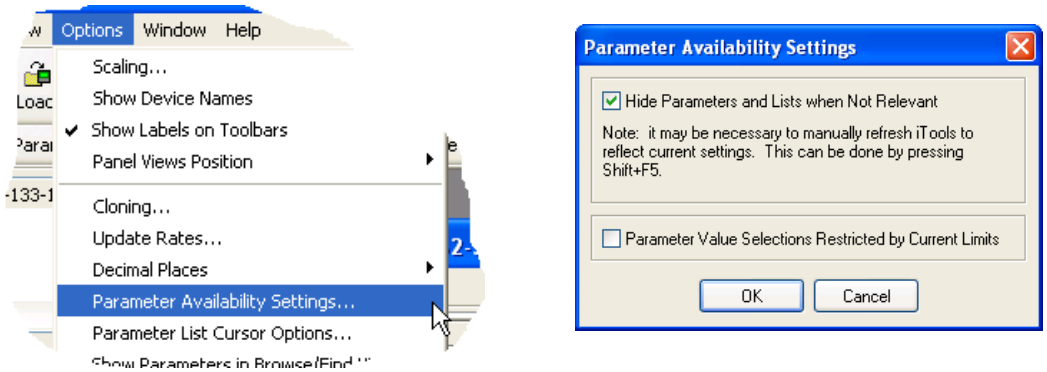


Figure 3.4.1b Show/Hide parameters

3.4.2 Explorer tools

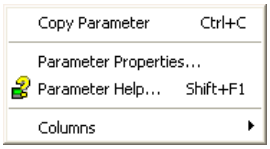
A number of toolbuttons appear above the parameter list:

Back to: and Forward to:. Parameter Explorer contains a history buffer of up to 10 lists that have been browsed in the current instance of the window. The 'Back to: (list name)' and 'Forward to: (list name)' icons allow easy retracing or repeating of the parameter list view sequence.
If the mouse cursor is hovered over the tool icon, the name of the parameter list which will appear if the icon is clicked-on appears. Clicking on the arrow head displays a pick list of up to 10 previously visited lists which the user can select. Short cut = <Ctrl>+<B> for 'Back to' or <Ctrl>+<F> for 'Forward to'.

Go Up a Level, Go Down a Level. For nested parameter lists, these buttons allow the user to navigate 'vertically' between levels. Short cut = <Ctrl>+<U> for 'Go Up a Level' or <Ctrl>+<D> for 'Go Down a Level'.

Push pin to give the window global scope. Clicking on this icon causes the current parameter list to be permanently displayed, even if another instrument becomes the 'current device'.

3.4.3 Context Menu



Copy Parameter	Copies the clicked-on parameter to the clipboard
Parameter properties	Displays parameter properties for the clicked-on parameter
Parameter Help...	Displays help information for the clicked-on parameter
Columns	Allows the user to enable/disable a number of parameter table columns (figure 6.1.4b).

3.5 WATCH/RECIPE EDITOR Watch/Recipe

The Watch/Recipe editor is opened by clicking on the Watch/Recipe tool icon, by selecting 'Watch/Recipe' in the 'Views' menu or by using the short cut <Ctrl>+<A>. The window is in two parts: the left part containing the watch list; the right-hand part containing one or more data sets, initially empty and unnamed.

The Watch/Recipe window is used:

1. To monitor a list of parameters. This list can contain parameters from many different, and otherwise unrelated parameter lists within the same device. It cannot contain parameters from different devices.
2. To create 'data sets' of parameter values which can be selected and downloaded to the device in the sequence defined in the recipe. The same parameter may be used more than once in a recipe.

Figure 3.5 Watch/Recipe Editor window (with context menu)

3.5.1 Creating a Watch List

After opening the window, parameters can be added to it as described below. The values of the parameters update in real-time, allowing the user to monitor a number of values simultaneously.

ADDING PARAMETERS TO THE WATCH LIST

1. Parameters can be click-dragged into the watch list from another area of the iTools window (for example, the Parameter Explorer window, the Graphical Wiring Editor, the browse tree). The parameter is placed either in an empty row at the bottom of the list, or if it is dragged on top of an already existing parameter, it is inserted above this parameter, with the remaining parameters being moved down one place.
2. Parameters can be dragged from one position in the list to another. In such a case, a copy of the parameter is produced, the source parameter remaining in its original position.
3. Parameters can be copied <Ctrl>+<C> and pasted <Ctrl>+<V> either within the list, or from a source external to it, for example the parameter browse window or the graphical wiring editor.
4. The 'Insert item...' tool button the 'Insert Parameter' item in the main iTools Recipe menu, or in the context menu or the short cut <Insert> can be used to open a browse window from which a parameter can be selected for insertion above the currently selected parameter.

DATA SET CREATION

Once all the required parameters have been added to the list, select the empty data set by clicking on the column header. Fill the data set with current values using one of the following methods:

1. Clicking on the 'Capture current values into a data set' toolbutton (also known as the 'Snapshot Values' tool).
2. Selecting 'Snapshot Values' from the Recipe or Context (right-click) menu.
3. Using the short cut <Ctrl>+<A>.

3.5.1 CREATING A WATCH LIST (Cont.)

DATA SET CREATION (Cont.)

Individual data values can now be edited by typing directly into the grid cells. Data values can be left blank or cleared, in which case, no values will be written for those parameters at download. Data values are cleared by deleting all the characters in the cell then either moving to a different cell or typing <Enter>.

The set is called 'Set 1' by default, but it can be renamed by either by using the 'Rename data set...' item in the Recipe or context menus, or by using the short cut <Ctrl>+<R>.

New, empty data sets can be added using one of the following:

1. Clicking on the 'Create a new empty data set' toolbar icon.
2. Selecting 'New Data Set' in the Recipe or context menus
3. Using the short cut <Ctrl>+<W>

Once created, the data sets are edited as described above.

Finally, once all the required data sets have been created, edited and saved, they can be downloaded the instrument, one at a time, using the Download tool, the 'Download Values' item in the Recipe or context menus, or the short cut <Ctrl>+<D>.

3.5.2 Watch Recipe toolbar icons

Create a new watch/recipe list. Creates a new list by clearing out all parameters and data sets from an open window. If the current list has not been saved, confirmation is requested. Short cut <ctrl>+<N>

Open an existing watch/recipe file. If the current list or data set has not been saved, confirmation is requested. A file selection box then opens allowing the user to choose a file to be opened. Short cut <ctrl>+<O>

Save the current watch/recipe list. Allows the current set to be saved to a user specified location. Short cut <ctrl>+<S>.

Download the selected data set to the device. Short cut <ctrl>+<D>

Insert item ahead of selected item. Short cut <Insert>.

Remove recipe parameter. Short cut <ctrl>+<Delete>.

Move selected item. Up arrow moves selected parameter up the list; down arrow move the selected parameter down the list.

Create a new empty data set. Short cut <ctrl>+<w>.

Delete an empty data set. Short cut <ctrl>+<Delete>

Capture current values into a data set. Fills the selected data set with values. Short cut <ctrl>+<A>.

Clear the selected data set. Removes values from the selected data set. Short cut <Shift>+<Delete>.

Open OPC Scope. Opens a separate utility that allows trending, data logging and Dynamic Data Exchange (DDE). OPC Scope is an OPC explorer program that can connect to any OPC server that is in the windows registry.
(OPC is an acronym for 'OLE for Process Control, where OLE stands for 'Object Linking and Embedding'.)

3.5.3 Watch/Recipe Context Menu

The Watch/Recipe Context menu items have the same functions as described above for toolbar items.

3.6 BATCH CONFIGURATION Batch Configuration

Batch records form a part of recording history and are included in the normal archiving process.

Batches can be initiated directly by the operator (if access permission is granted), or automatically whenever a specified PV changes value, by job or remotely via MODBUS/TCP.

Batch operation mode can be configured as start/stop, continuous or Steriliser cycle and can incorporate all channels, or just those associated with a specified Group. For start/stop batches, the batch record starts when the batch is started, and continues until it is stopped. For continuous batches, the batch record starts when the batch is started and continues until the next batch is started, or until batch recording is disabled.

> Note: See section 4.28 for Batch configuration details, section 4.3 for Group configuration and section 4.11 for Steriliser configuration.

When using 'PC Review' (section 3.8) software the 'Go to Batch' feature can be used to select a particular batch record.

If 'Name files by Batch' is enabled (section 4.28), a separate history file is created for each batch.

For each batch start, a start message is generated:

```
DD/MM/YY HH:MM:SS Batch start (User Full Name)
```

Where DD/MM/YY is the date, HH:MM:SS is the time, and User Full name is either the current user name, the security level (e.g. Engineer) or 'PV' if the batch has been initiated by using 'use PV start'. A similar message is printed at Batch Stop. (There are no stop messages associated with continuous batch selection).

In addition to the above start/stop messages, up to 10 named data field values can, if required, be included in the history file at the start of a batch and, if required, at the end of a batch. The number of fields can be set using the Batch Fields drop-down list. The names of each field can be customised using this editor and the data values themselves are entered in the Batch Configuration page described in section 4.28. The first field is typically either a manually entered batch number or an automatically generated value.

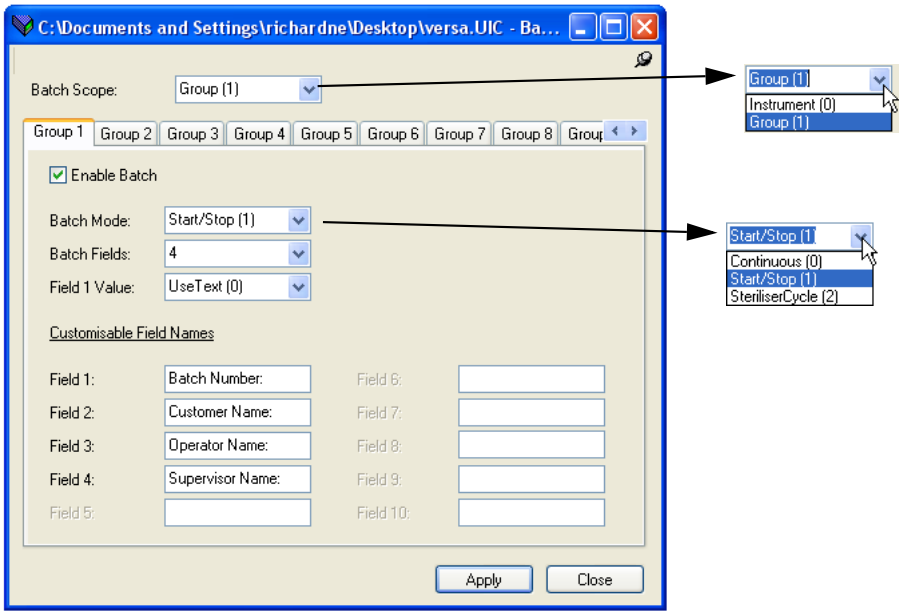


Figure 3.6 Batch control editor

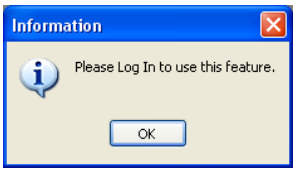
Batch Scope	0 = Instrument; 1 = Group
Enable Batch	Clicking on this tick box enables Batch Control
Batch Mode	0 = Continuous; 1 = Start/Stop; 2 = Steriliser Cycle
Batch Fields	Specifies the number of text lines to be made available.
Field 1 Value	Field 1 will use either Field 1 text, as entered below, or the value of the triggering PV.
Field 1 to 10	Enter the required text lines here.

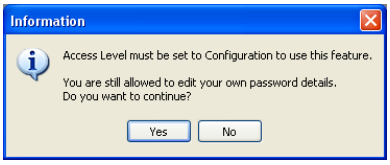
3.7 SECURITY EDITOR Security

This Editor allows passwords to be set up for general logins (e.g. 'Engineer'), specific users to be added, access permissions granted, and signing/authorising strategies to be set up. In addition, login and password security can be enabled so that (for example) passwords can be set to expire after a configurable period.

Before the security functions can be accessed, the user must log on, and set the access level to 'Configuration' as described in section 3.2.1. Failure to do either causes the relevant error message to appear (below).

Note: If Security Manager is enabled (see Instrument.Info) then the security button allows the user solely to change password.





3.7.1 Initial screen

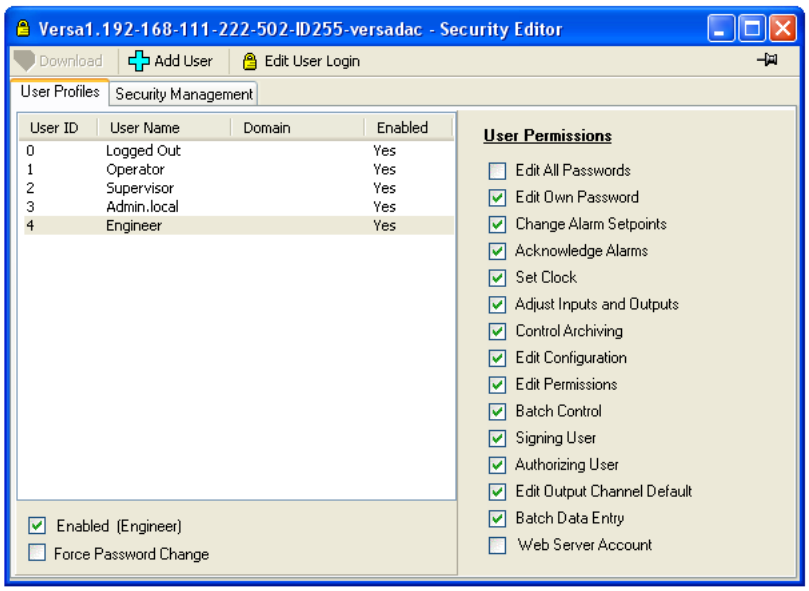


Figure 3.7.1 Security Initial screen

Once logged in and with configuration mode set to Configuration, clicking on the Security button calls the initial security screen. As can be seen from the figure above, there are three toolbuttons (Download, Add User and Edit User Login), two tabs (User Profiles and Security Management) and numerous enable selections.

If the 21cfr11 option is not enabled there is also a Remove User toolbutton.

Note: 'Admin.local' is s special user (default login:100) that cannot be disabled and never uses active directory. The Engineer default user can be deleted, disabled and have passwords expiry set as per Added users described below.

3.7.2 User Profiles tab

The initial screen (figure 3.7.1) allows the logged in user to edit those User Permissions which are enabled (green ticks) for each User ID. Enables which are 'greyed' cannot be edited by the currently logged-in user.

Most permissions are self evident, but the following may be helpful:

Signing User	Allows this user to sign configuration changes (see section 3.7.3, below).
Authorising User	Allows this user to authorise configuration changes (see section 3.7.3, below).
Force Password Change	Forces a user to change password at first login.

ENABLED (USER NAME)

This tick box allows individual log-ins to be enabled and disabled.

WEB SERVER ACCOUNT

This must be ticked for any user who is to access the instrument via the Web Server. It is not possible to enable Web Server Account for default users (i.e. Admin.local, Supervisor, Operator or Logged out).

See Section 7 for more details of the Web Server.

DOWNLOAD BUTTON 

Initially greyed out, this button becomes active whenever any changes have been made to the security settings. In order for changes to become permanent, 'Download' must be clicked on before quitting Security setup. A warning message appears if an attempt is made to leave security setup without 'Download' having previously been clicked on.

3.7.2 USER PROFILES TAB (Cont.)

ADD USER Add User

Clicking on this button calls the add new user screen as shown in figure 3.7.2b, below.

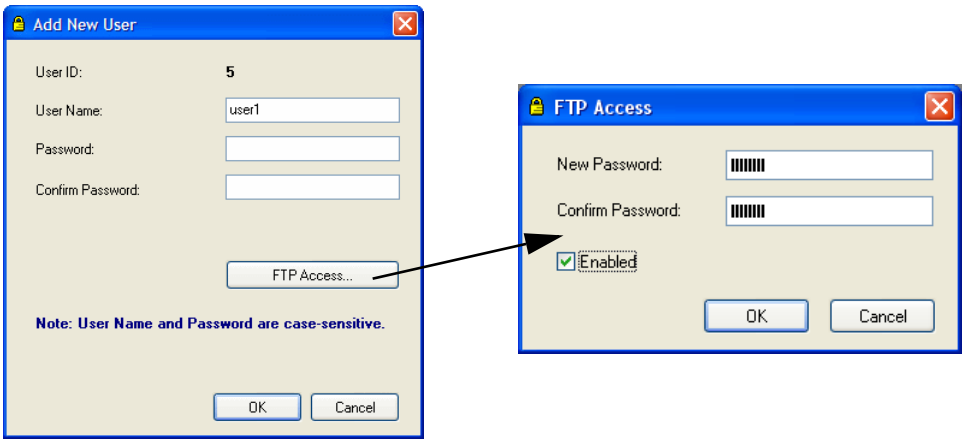


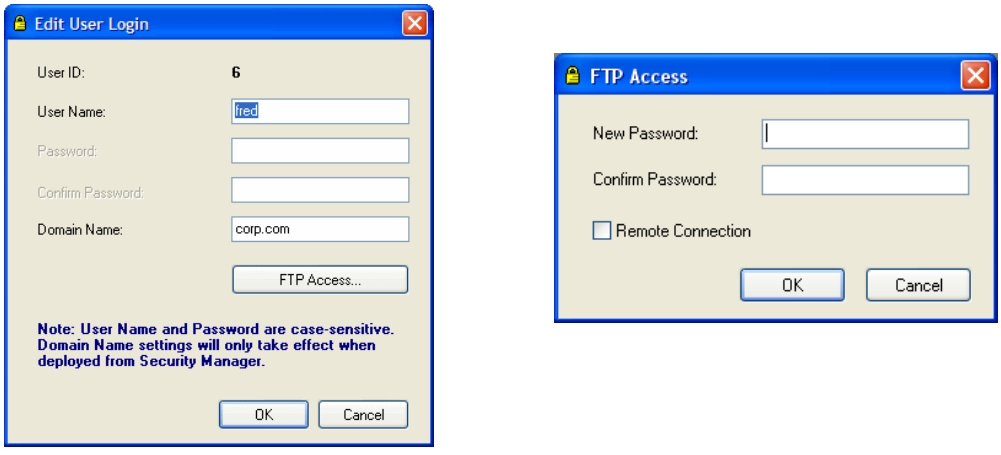
Figure 3.7.2b Add New User/ FTP access screens

User ID	The number of this user, automatically incremented and non-editable.
User Name	Enter a user name in this (initially blank) field. User name is case sensitive.
Domain Name	Appears only if the domain is set with security manager and then the instrument has security manager disabled. This is so the user can be reconfigured to be a non domain user. If a Domain Name is entered here, both the Password and Confirm Password fields are greyed out (i.e. they become non-editable as shown below).
Password	Enter a (case-sensitive) password. The password must have a minimum number of characters, as specified in 'Security Management', described below. Greyed out if a Domain Name is entered.
Confirm Password	Re-enter the password to ensure that no errors have been made. If the 'Confirm Password' does not match the 'Password' an error message appears. Greyed out if a Domain Name is entered.
FTP Access	FTP Access allows a user to be set up to access the instrument via FTP with the instrument acting as an FTP server, for example Review - Instrument File Services.

When the new user configuration is complete, click on the 'Download' button to confirm the changes.

EDIT USER LOGIN BUTTON Edit User Login

Clicking on this button allows the user to edit the Login details of the highlighted user or of the Remote User. When the edit is complete, click on the 'Download' button to confirm the changes.



3.7.3 Security management tab

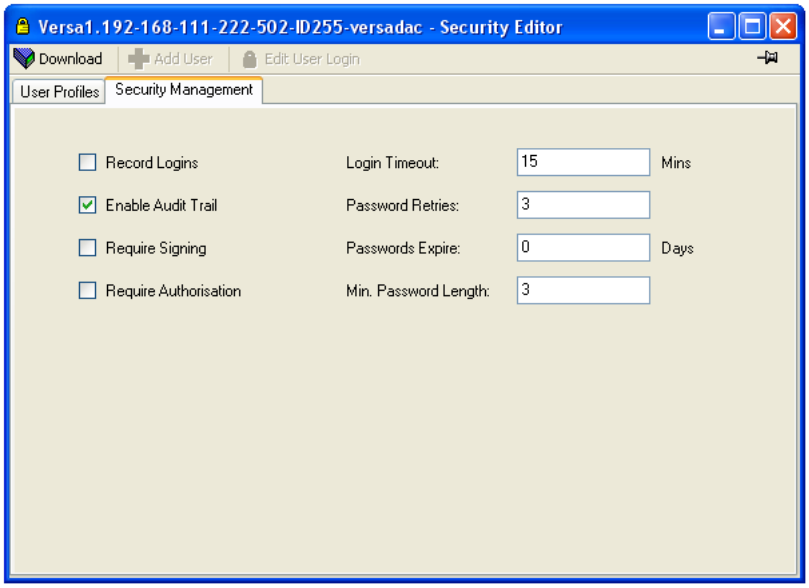


Figure 3.7.3 Security management page

This page allows a number of security management parameters to be configured.

Record Logins	When enabled, all logins are recorded in the history file, giving time, date, and User.
Enable Audit Trail	Records all configuration changes.
Require Signing	If this is enabled, any configuration change must be confirmed by a user with Signing User permission enabled.
Require Authorisation	If this is enabled, any configuration change must be confirmed by a user with Authorising User permission enabled.
Login Timeout	If the time since the last user operation exceeds this value, the user is required to log in again. If set to zero, the login never times out.
Password Retries	Sets the number of times an attempt to login can be made with an incorrect password. If this number is exceeded, the user's login is disabled.
Passwords Expire	Sets a number of days, after which all passwords expire and new ones must be entered. Setting the value to zero means that the passwords do not expire.
Min. Password Length	Sets a minimum length for passwords.

When all changes have been made, click on the Download button to confirm.

3.7.4 Cloning security data

The security data tab in Cloning Options allows the user to define whether or not to include security file data when cloning. A further option causes iTools to ask whether or not to include security data before the cloning operation is initiated.

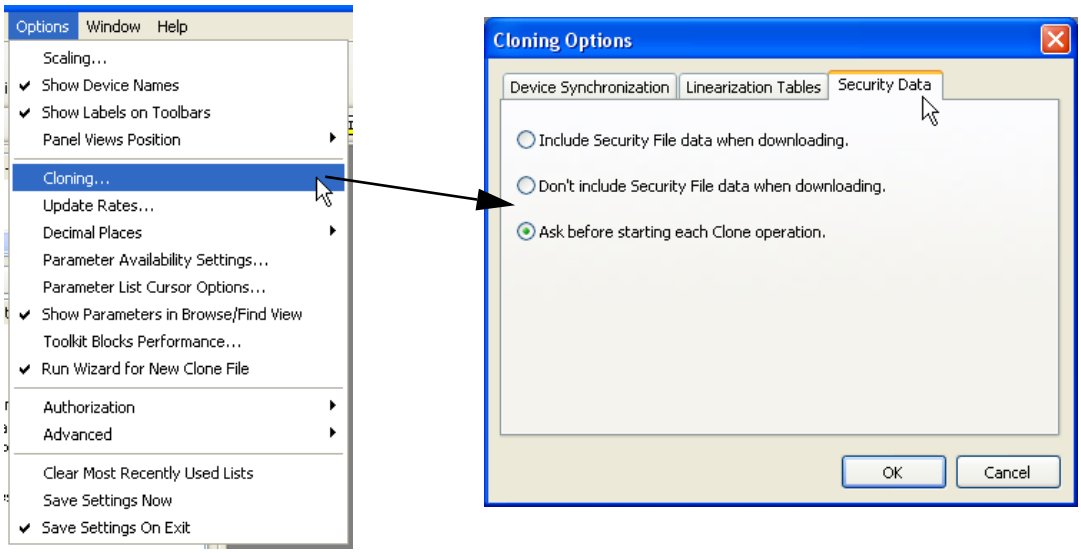


Figure 3.7.4 Cloning security tab

3.8 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 (see Appendix B section B2 for a description of one way of doing this).

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 and they are not editable.

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

4 CONFIGURATION

The configuration process allows the data recorder configuration to be accessed and edited using iTools. The user needs to log in and click on the Access button, as described in section 3.2.1.

Toggle Configuration access level

When in configuration mode, the instrument icon in the 'Panel Views' pane at the bottom of the iTools window has a spanner symbol superimposed on it.

CAUTION

Outputs are turned off during configuration; therefore the unit will not control.

Note...Changes to the configuration are applied when Configuration mode is exited.

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, as shown in the table. The factory default configuration can be returned-to, if required, by entering a special Engineer password, as described in section 4.1.3.

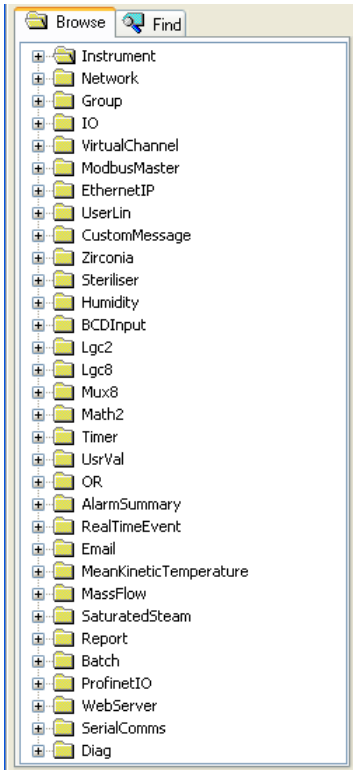
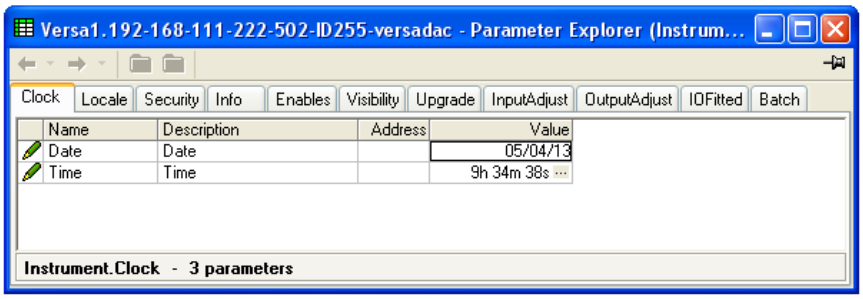
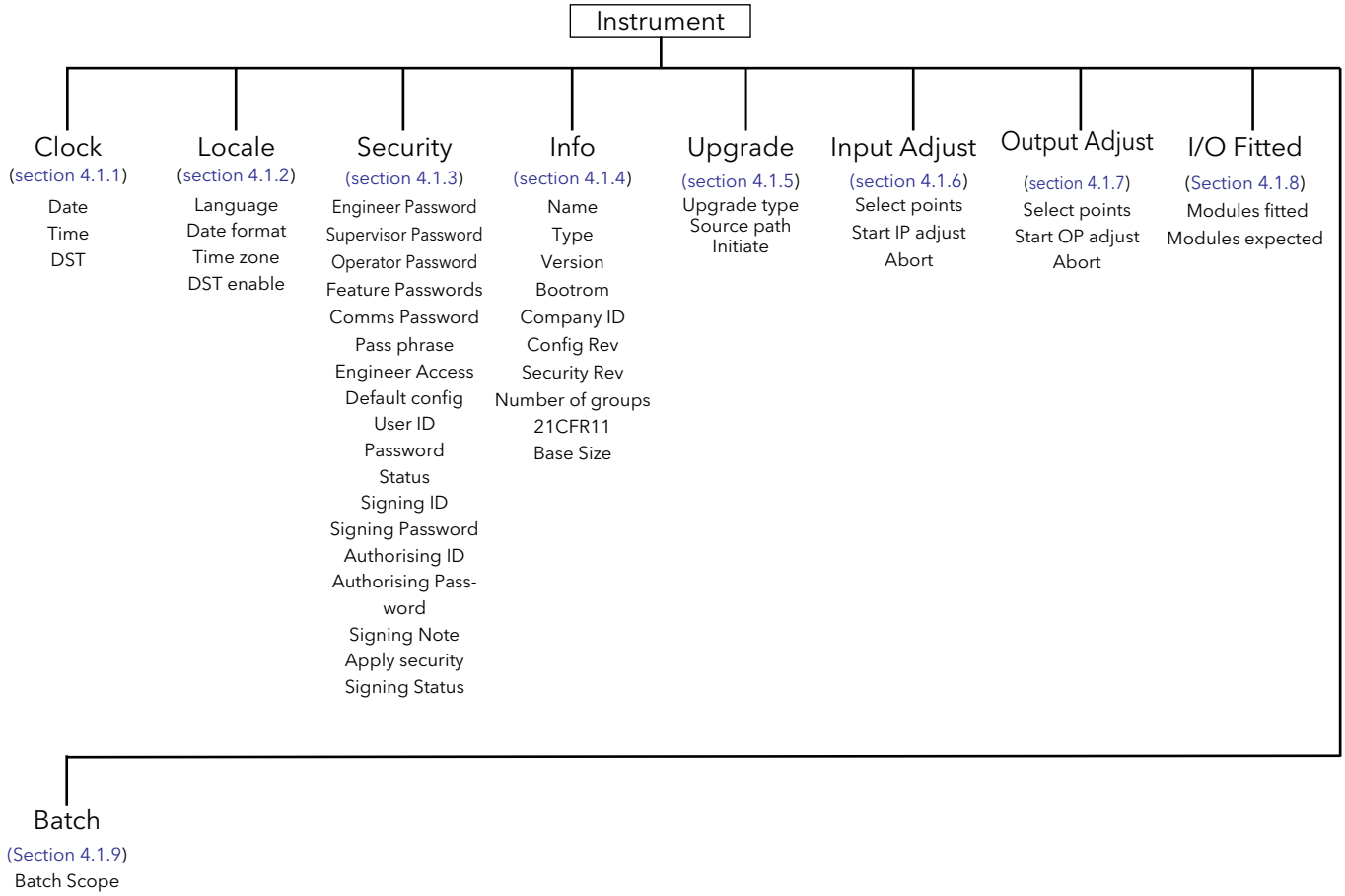


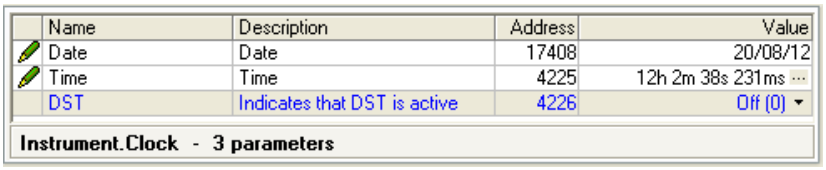
Figure 4 Top level configuration menu

4.1 INSTRUMENT PARAMETERS





4.1.1 Clock



	Name	Description	Address	Value
	Date	Date	17408	20/08/12
	Time	Time	4225	12h 2m 38s 231ms
	DST	Indicates that DST is active	4226	Off (0)

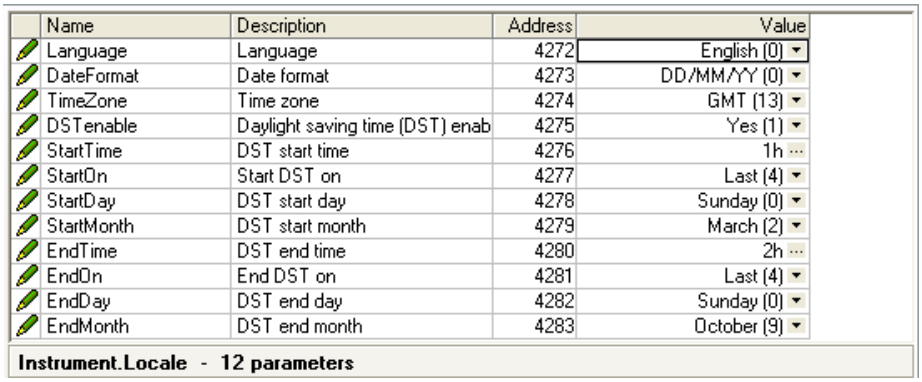
Instrument.Clock - 3 parameters

Figure 4.1.1 Clock menu

The date is set by typing in the relevant values, in the format displayed. (The format can be changed in 'Locale' configuration (section 4.1.2), below.)

The 'DST' value is 'On' only if 'DST Enable' is selected 'Yes', in 'Locale' (section 4.1.2) and if daylight saving time is in operation. 'On' means that the displayed time is advanced by one hour.

4.1.2 Locale



	Name	Description	Address	Value
	Language	Language	4272	English (0)
	DateFormat	Date format	4273	DD/MM/YY (0)
	TimeZone	Time zone	4274	GMT (13)
	DSTenable	Daylight saving time (DST) enab	4275	Yes (1)
	StartTime	DST start time	4276	1h
	StartOn	Start DST on	4277	Last (4)
	StartDay	DST start day	4278	Sunday (0)
	StartMonth	DST start month	4279	March (2)
	EndTime	DST end time	4280	2h
	EndOn	End DST on	4281	Last (4)
	EndDay	DST end day	4282	Sunday (0)
	EndMonth	DST end month	4283	October (9)

Instrument.Locale - 12 parameters

Figure 4.1.2 Locale configuration menu

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 following previously read-only (blue) fields become editable, 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'. Enter 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 following.
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 Security menu

This allows the user to change the installed features and to return individually the configuration, the security settings and the SSL to factory defaults.

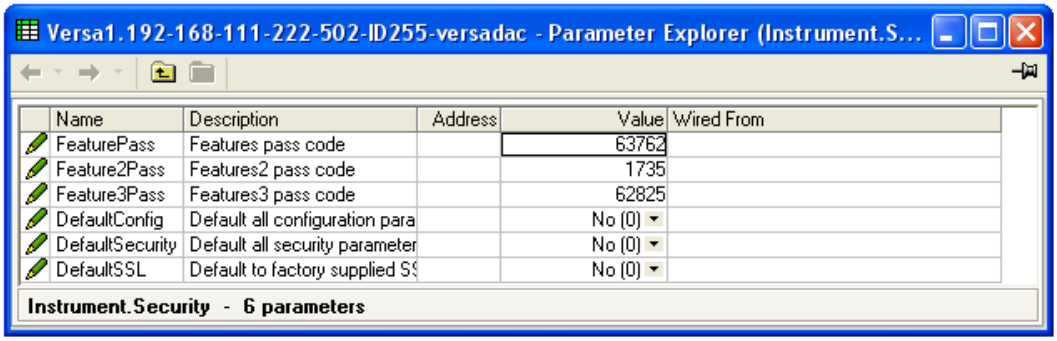


Figure 4.1.3 Security menu

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.
Default Config	Selecting 'Yes (1)' causes the instrument to restart with default configuration (i.e. the instrument 'cold starts'). A confirmation is required before this action is taken.
Default Security	Resets the security parameters to their factory default values.
Default SSL	Selects the factory supplied SSL for use with the Web Server.

4.1.4 Info menu

Gives information about hardware and software, and allows the user to enter a descriptor for the instrument.

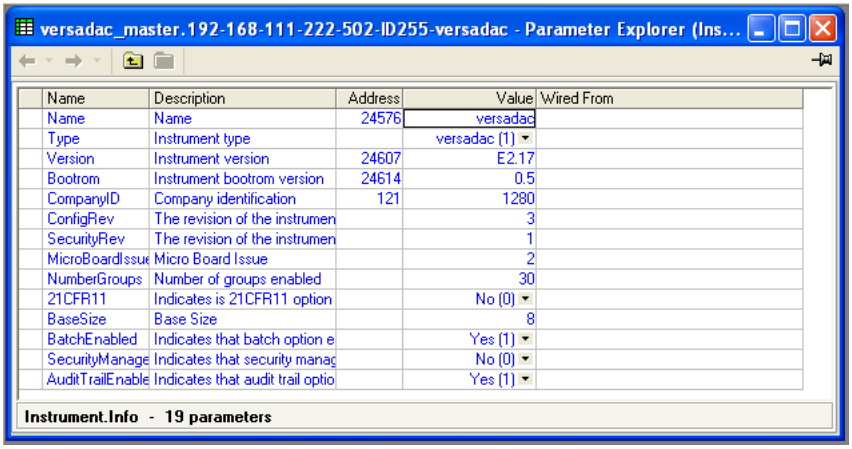


Figure 4.1.4 Info menu

The following parameters are Read Only unless otherwise stated.

Name	Read/Write. Allows the user to enter a descriptor of up to 20 characters.
Type	Displays the instrument model.
Version	Displays the software version of the instrument.
Bootrom	Displays the instrument software Boot ROM version
Company ID	For CNOMO* purposes over Modbus (1280 decimal; 0500 hex).
Config Rev	This value is updated every time configuration is quit, if any one or more configuration parameter has been changed.
Security Rev	This number is incremented every time security configuration is downloaded.
Micro Board Issue	The revision level of the microprocessor board
Number Groups	Read/Write. Allows the user to select the number of recording groups enabled.
21CFR11	Shows whether 21CFR11 option has been enabled.
Base Size	Shows the maximum number of modules that can be fitted in this base.
Batch Enabled	Shows whether the Batch option has been enabled.
Security Manager Enabled	Shows whether Security Manager option has been enabled.
Audit Trail Enabled	Shows whether Audit Trail has been enabled.

* CNOMO = Comité de normalisation des moyens de production.

4.1.5 Upgrade

This feature allows the user to upgrade the instrument from an upgrade file supplied by the manufacturer (downloadable from the support web site).

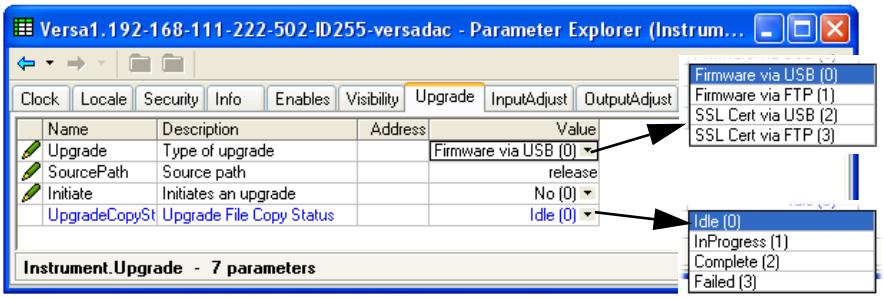


Figure 4.1.5 Upgrade menu

Upgrade	Select the type of upgrade required, as Firmware from USB or via an FTP server or SSL certificate from USB or via an FTP server. The versadac uses SSL certificates supplied in PEM format. (SSL = Secure Socket Layer, this being the method used to encrypt web server access to the recorder.) Refer to technical support for details on installing customers own SSL certificates (section 7.12.1).
Source path	Defines the full source path where the required upgrade data files are stored on the memory stick or FTP server.
Initiate	Set to 'yes' to initiate the upgrade.
Upgrade Copy status	Shows the status of the upgrade process as Idle, In progress, Complete or Failed.

UPGRADE PROCEDURE

Note: It is recommended that the instrument configuration should be saved to a clone file using iTools before upgrading the versadac firmware. After the firmware has been upgraded the configuration can be restored by downloading the clone file. This procedure is recommended because it is likely that the versadac will be cold started and the existing configuration lost on upgrading the firmware.

1 Upgrade iTools to the latest version. If this is not done, some features might not be supported, and the representation of the instrument in the Panel View pane may not appear correctly.
2. Copy the upgrade.tgz file obtained from buildFiles.zip to a USB Memory stick or an FTP server.
3. Initiate the upgrade by setting 'Initiate' to 'Yes'.

The versadac copies the upgrade file to its internal memory and automatically restarts. When the versadac restarts the IOC LED's 'light chase' while the upgrade is progressing.

4.1.6 Input adjust

Notes

1. Input adjust cannot be applied to input channels with input type of 'Digital', 'Test' or 'Off'.
2. Input adjustments can be carried out only by users with 'Adjust Inputs and Outputs' permission enabled (section 3.7.2).
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.
4. It is recommended that 'Hide parameters and lists when not relevant' be selected from the iTools Options>Parameter availability settings... menu item (section 3.4.1). Otherwise the list of parameters will contain many that are not relevant.

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 such 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'.

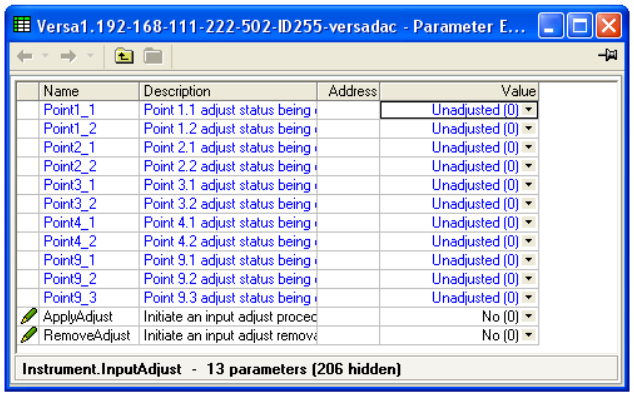


Figure 4.1.6a Input adjust menu

PointM_C	Shows the adjust status of point module M channel C
Apply Adjust	Selecting 'Yes' calls the Select Point page, described below.
Remove Adjust	Selecting 'Yes' initiates the adjustment removal procedure described below.

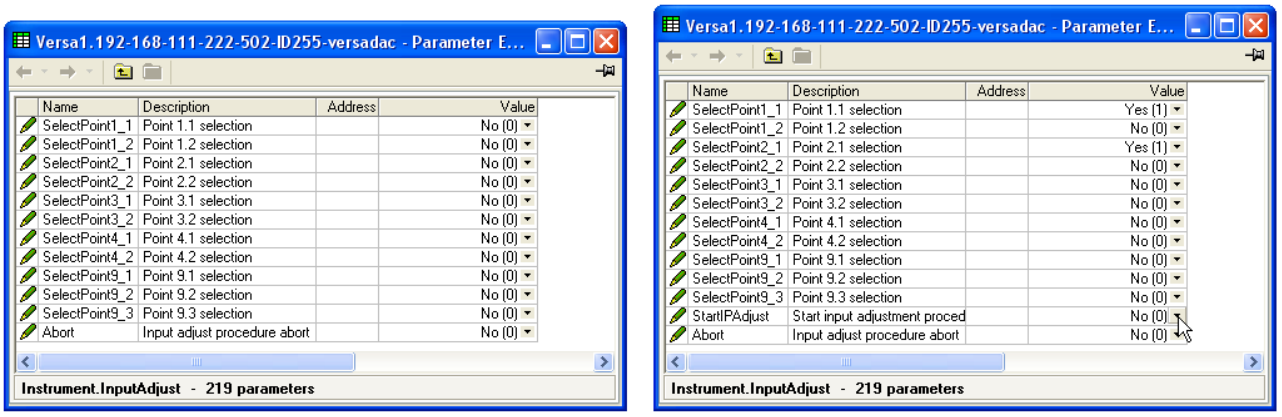


Figure 4.1.6b Select points for adjustment

SelectPointM_C	Includes module M, channel C in the adjust or remove adjust procedure. As soon as one point has been selected, the 'Start IP Adjust' field appears.

4.1.6 INPUT ADJUST (Cont.)

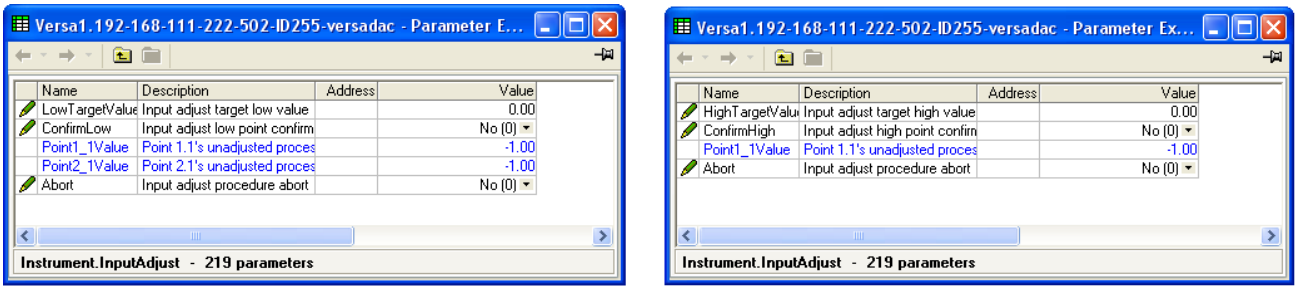


Figure 4.1.6c Input adjust High and Low targets

StartIPadjust	Applies the low target value to the selected points (see 'Adjustment procedure below)
LowTargetValue	The value that the instrument is required to read for the applied low input.
ConfirmLow	Confirms that the values are stable, and moves to the high target.
HighTargetValue	The value that the instrument is required to read for the applied high input.
ConfirmHigh	Completes the adjustment procedure.
RemoveIPAdjust	Allows points which have been adjusted to have their adjustment removed.
Abort	Allows the user to abandon input adjustment at any point in the procedure.

INPUT ADJUSTMENT PROCEDURE

1. Set 'ApplyAdjust' to 'Yes'
2. Set those points to be adjusted to 'Yes' (e.g. set 'SelectPoint1_1' to 'Yes'.)
3. Apply a known low value and wait for the value to stabilise. Enter the 'Low Target Value' (the value that the recorder is required to read for the known low value). When the values of the selected points (e.g. Point1_1Value) have stabilised set 'ConfirmLow' to 'Yes'.
4 Apply a known high value and wait for the value to stabilise. Enter the 'High Target Value' (the value that the recorder is required to read for the known high value). When the values of the selected points (e.g. Point1_1Value) have stabilised, set 'ConfirmHigh' to 'Yes'.

REMOVE ADJUSTMENT PROCEDURE

1. Set 'RemoveAdjust' to 'Yes'
2. Set the relevant points, the adjustment of which is to be removed to 'Yes' (e.g. set 'SelectPoint1_1' to 'Yes'.)
3. Set 'RemoveIPAdjust' to 'Yes'.

4.1.7 Output adjust

This item can be used only if one or more of Output modules is fitted, and allows the user to compensate for tolerance errors etc. in connected equipment.

Notes

1. Input adjustments can be carried out only by users with 'Adjust Inputs and Outputs' permission enabled (section 3.7.2).
2. 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.
3. It is recommended that 'Hide parameters and lists when not relevant' be selected from the iTools Options>Parameter availability settings... menu item (section 3.4.1). Otherwise the list of parameters will contain many that are not relevant.

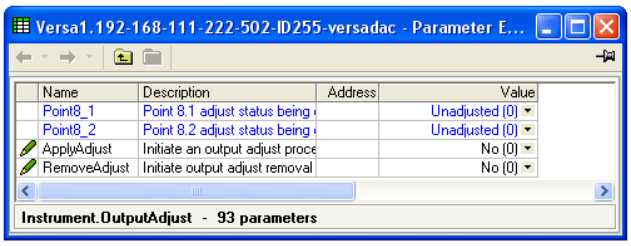
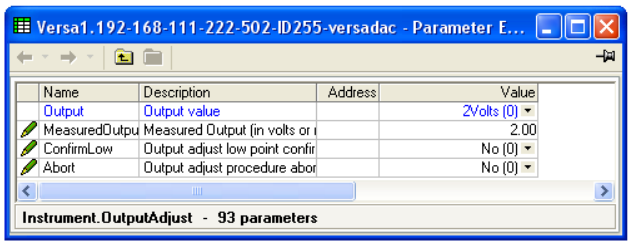


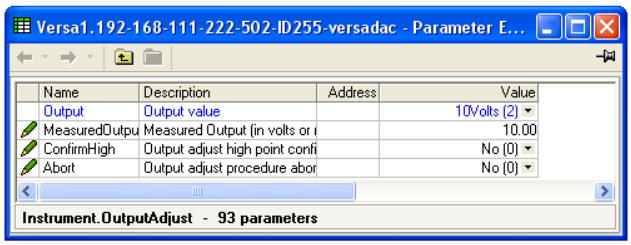
Figure 4.1.7a Output adjust initial display

ADJUST PROCEDURE

1. Set 'Apply Adjust' to 'Yes'.

2. Set the relevant 'SelectPoint' parameter(s) to 'Yes'.
3. Set 'StartOPAdjust' to 'Yes'.





4. Measure the output at the required point, and enter this value in the 'Measured Output' field. To skip this stage go to step 5.
5. Set 'Confirm Low' to 'Yes'.
6. 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 7.
7. Set 'Confirm High' to 'Yes'. The output adjust initial display reappears, with the word 'Adjusted' in the relevant point's field.

The 'Output' parameter indicates the nominal output value that is being delivered to the DC output. Possible values are 2V, 10V, 4mA, 20mA.

'Abort' cancels operations so far and returns to the output adjust initial display (figure 4.1.7a).

4.1.7 OUTPUT ADJUST (Cont.)

ADJUST REMOVAL

1. Set 'Remove Adjust' to 'Yes' and operate the scroll key to enter edit mode.
2. Set the required output to 'Yes'. The output adjustment is removed, without confirmation. The point description returns to 'Unadjusted'.

4.1.8 I/O fitted

This provides a display showing what type of input or output module is fitted in each slot. When configuring an instrument, it is possible to enter the types of modules that it is expected will be located in each slot, so that the remainder of the configuration can be completed ready for downloading to a real instrument.

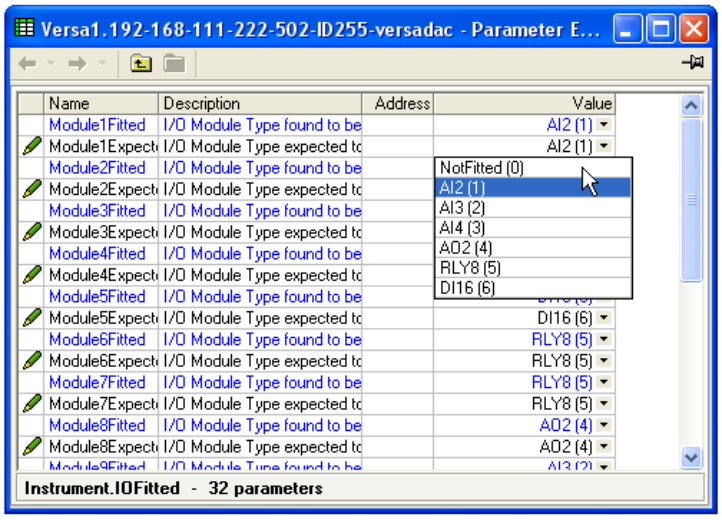


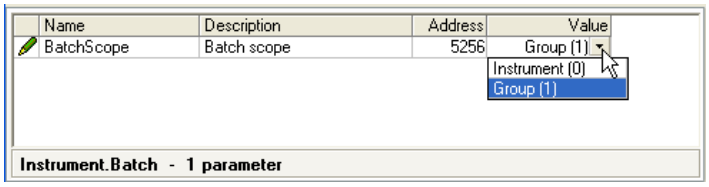
Figure 4.1.8 I/O fitted display

Module N Fitted The module detected by the instrument in slot N. Read only

Module N Expected Allows the user to enter the type of module expected to be fitted in slot N.

4.1.9 Batch

This part of the configuration allows the user to select 'Instrument' or 'Group' as the Batch scope.The remaining batch configuration is described in 'Batch Configuration' in section 4.28



4.1.9 Batch scope configuration

Note: Scope is forced to 'Group', and made read only if the Steriliser option is fitted.

4.2 NETWORK MENU

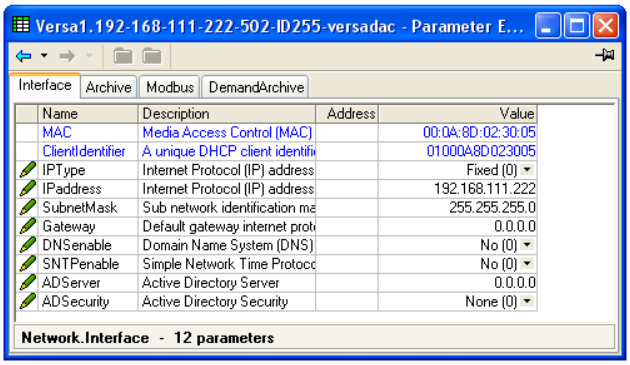
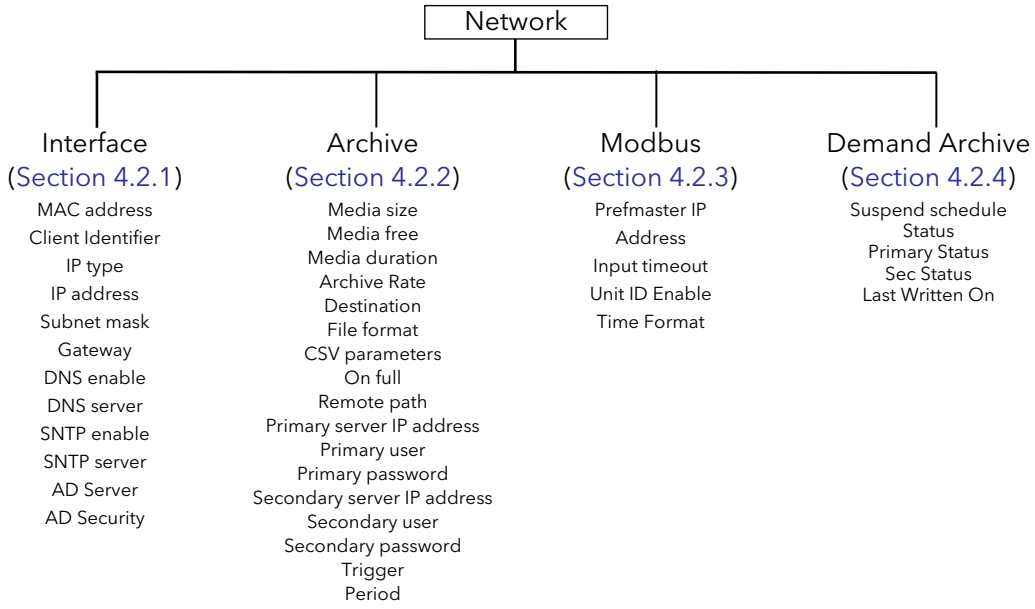


Figure 4.2 Top level Network menu



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.

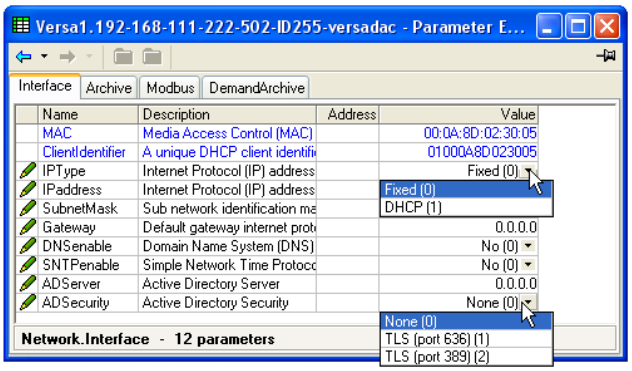


Figure 4.2.1 Network Interface menu

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 instrument has a unique ID built up from its MAC address. If the DHCP server is configured to use option 61, then it uses 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 subsequent 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 notation). 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 accessed. 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. Normally supplied by the user's IT department, or from the Network supervisor.
DNS Enable	Enables Domain Name system. Enables the mapping of host names to IP addresses and vice-versa.
DNS Server	IP address supplied by IT department or the Domain Manager or Supervisor.
SNTP Enable	Enables SNTP
SNTP Server	The IP address of the SNTP Server.
AD Server	This item appears only if the Security Manager option is enabled. It allows an Active Directory server IP address to be entered for use with this application. The IP address would normally be obtained from the user's IT department or Network administrator. Once entered, assuming the instrument is connected to the same network as the server, users with a domain configured will be able to login using their normal network log-in password.

4.2.1 NETWORK INTERFACE (Cont.)

AD Security — This item appears only if the Security Manager option is enabled. I When TLS (port 636) is selected all access to the server is secured using TLS on port 636 using the LDAP_SERVER_START_TLS_OID method. TLS (port 389) is similar but uses TLS on port 389.

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 instrument pings the host whilst establishing connection, and if it does not receive a response the archive attempt fails.

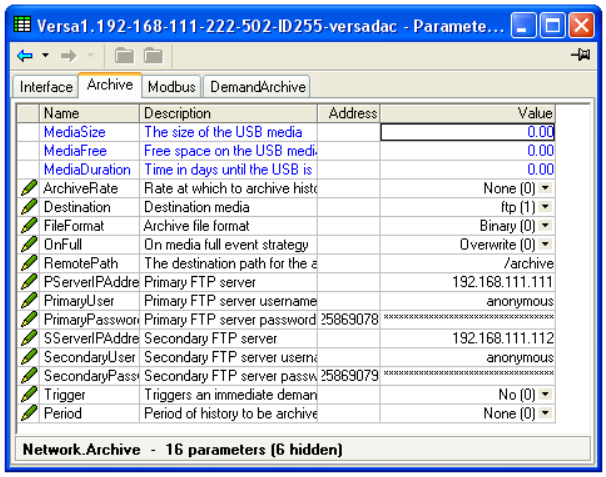


Figure 4.2.2a Unattended Archive configuration menu

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. Shows zero if no memory stick is present.

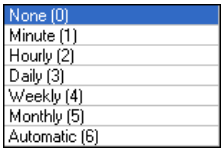
Media Free — Appears only for File Format = 'Binary (UHH)'. A read only value showing the space remaining in the memory stick inserted in the USB port. Shows zero if no memory stick is present.

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.

Archive 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.
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.



*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).

4.2.1 NETWORK ARCHIVE (Cont.)

ARCHIVE RATE (Cont.)

Automatic The instrument 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.

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 details).

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 appear 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 separators. 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 separator, a different separator can be used. This field allows the 'tab' character (^t) to be used instead of a comma.

On 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 primary 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' configuration.

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.

4.2.2 ARCHIVING (Cont.)

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 — 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.)

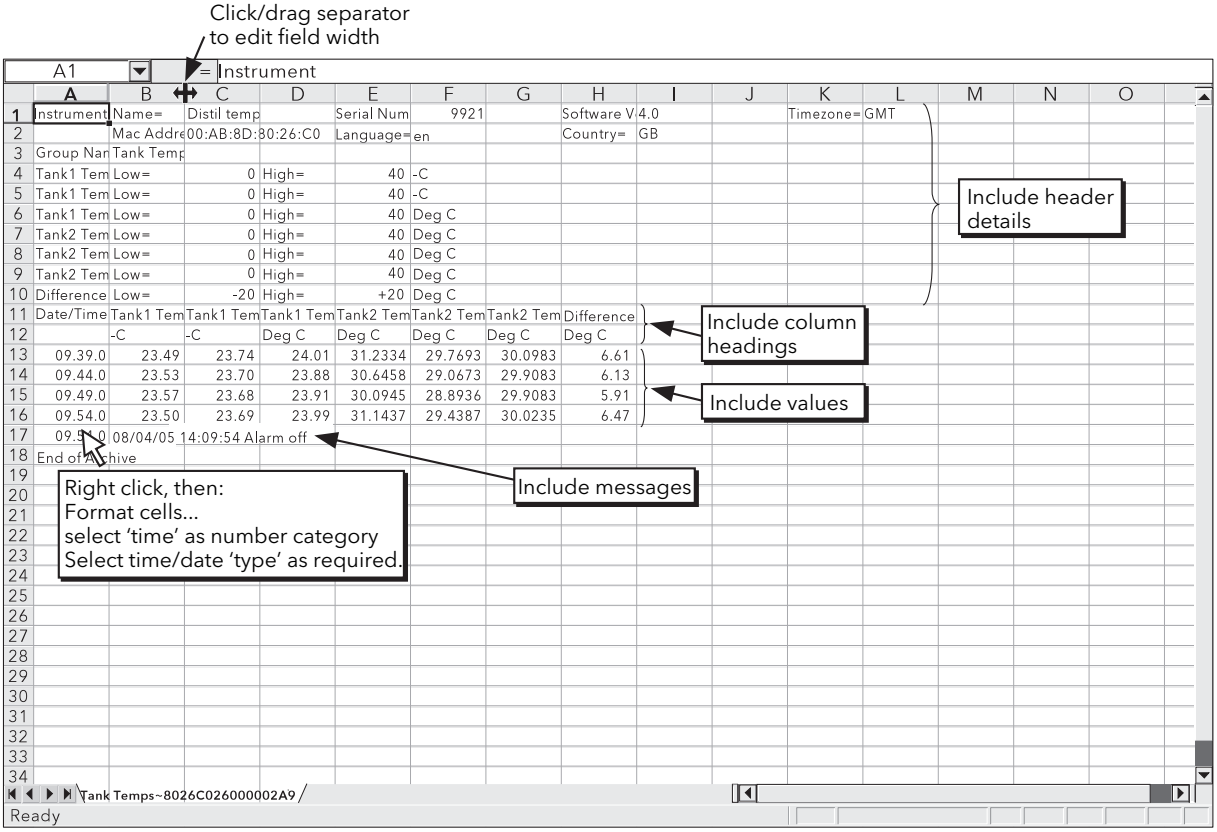


Figure 4.2.2b CSV data example

4.2.3 Modbus TCP

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

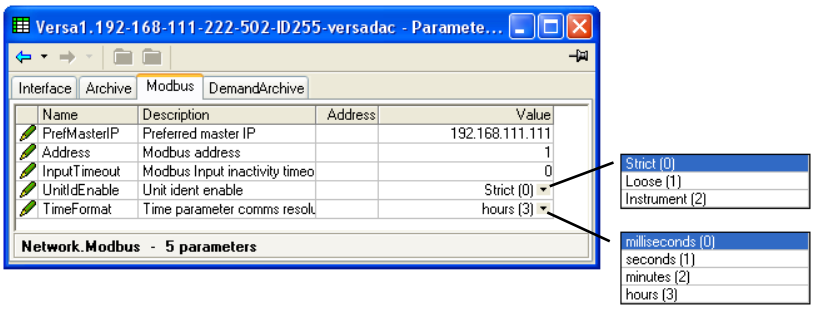


Figure 4.2.3 Modbus TCP configuration menu

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 written 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.

- Strict — The 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.
- Loose — The Modbus TCP Unit Identity Field (UIF) does not have to match the instrument address. The instrument responds to any value in the UIF
- Instrument — The Modbus TCP Unit Identity Field (UIF) must match the instrument address or no response will be made to messages.

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.

*Note...Unit ID Enable must be set to 'Instrument' for Modbus Serial talk through. Also, the Serial Port protocol must be set to 'Modbus Master' (Section 4.31).

4.2.4 Demand archive

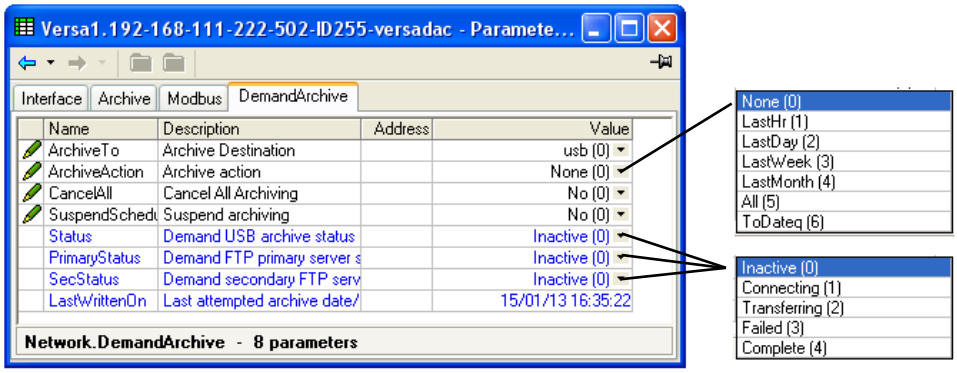


Figure 4.2.4 Demand archive menu

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 (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.

Archive To	Select 'USB' or 'FTP Server'. For 'USB', the archive will be made to the 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).
Archive Action	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 Archive' 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 restart the suspended archive. Suspend can be used to allow the memory stick to be removed and re-fitted safely.
Status	Active 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 animated 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 instrument and the primary host computer.
SecStatus	For Archive to FTP Server only, this shows the transfer status between the instrument and the secondary host computer.
Last Written On	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 automatic archive is triggered, the automatic archive takes precedence.

4.3 GROUP CONFIGURATION

Group configuration is separated into three areas: trending characteristics, recording characteristics and alarm status and acknowledgement.

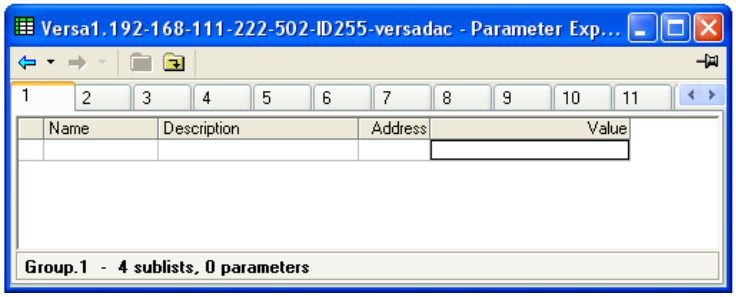


Figure 4.3a Top level group configuration

To access the lower level menus for a group, click on the required group's tab, then on the down-arrow folder.

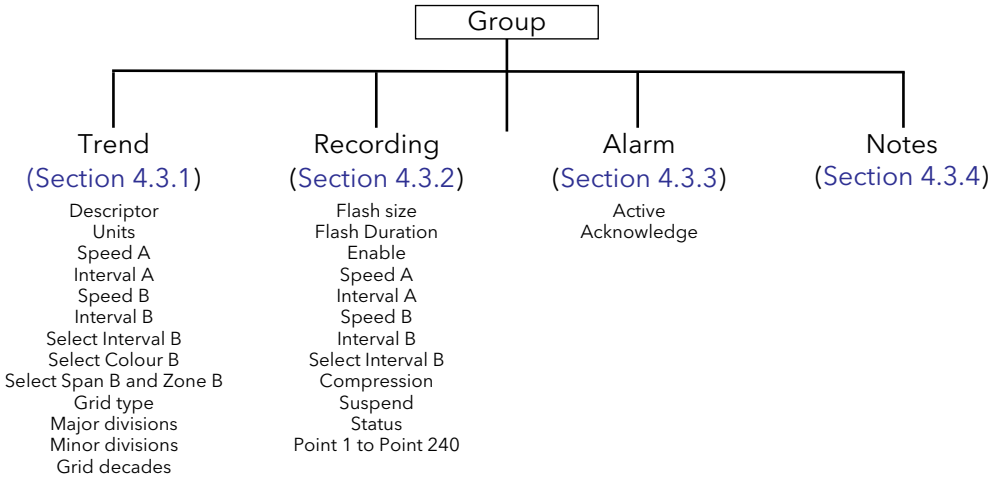


Figure 4.4b Group configuration menu

4.3.1 Group Trend configuration

This allows the user to define trend interval, to select Trend interval B, Colour B and Span and Zone B, and also allows the number of chart divisions to be set up. Figure 4.3.1 shows a typical configuration page.

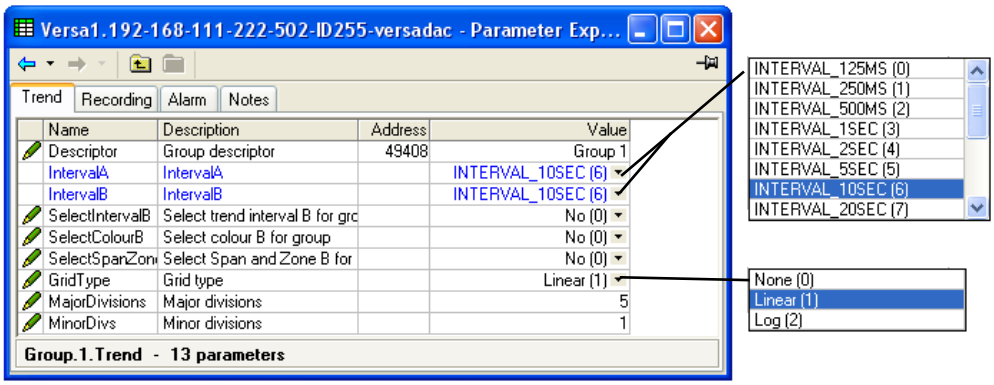


Figure 4.3.1 Group Trend Configuration

Descriptor	Allows the user to enter a descriptor (20 characters max.) for the group. More characters can be typed-in, but only the first 20 are accepted.
Interval A (B)	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 according to how much detail is required, and how much data is to be visible on the screen.
Select Interval/Colour/Span/Zone B	If 'Yes' is selected, Set B parameters become active, otherwise Set A parameters are used.
Grid Type	Select 'None', 'Linear' or 'Log'
Major Divisions	For 'Linear' grid type, this 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.
Minor Divs	For 'Linear' grid type, this allows the user to select the number of divisions into which the major divisions are divided.
Grid decades	For 'Log' grid type, this allows the user to select the number of decades to be included in the grid.

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.

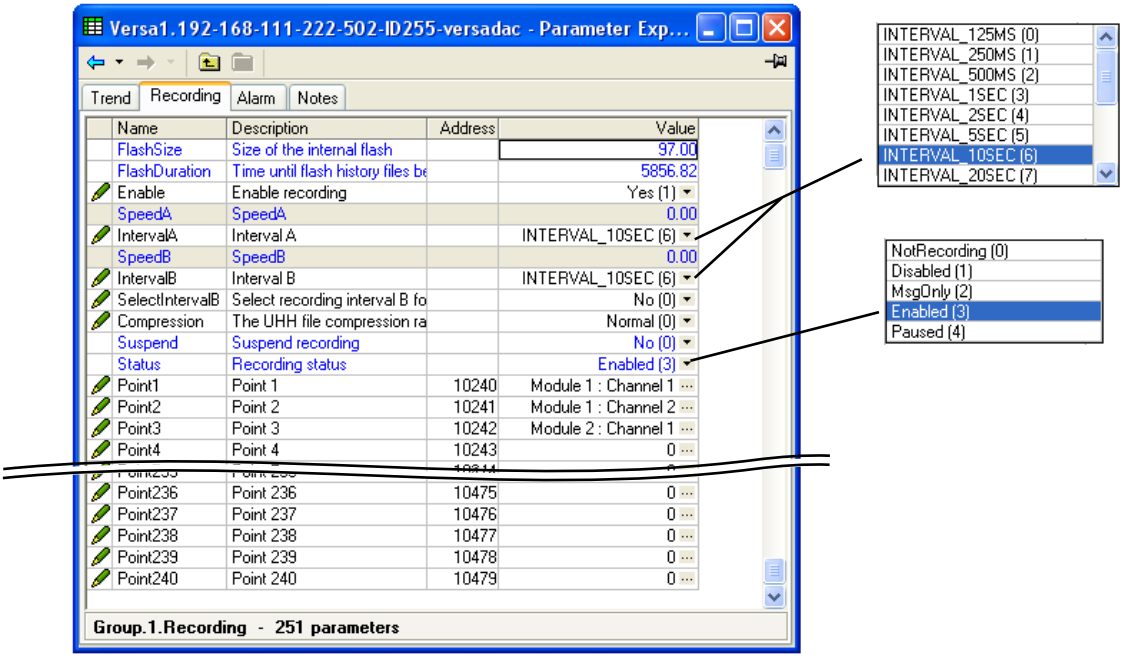


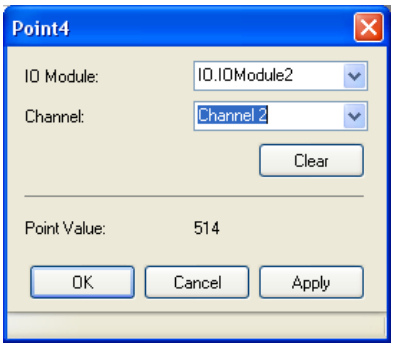
Figure 4.3.2 Group recording configuration

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.
Speed A (B)	Enter a number of mm/hour or inches/hour to define trend speed.
Interval A (B)	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. A number of discrete intervals can be chosen between 0.125 seconds to 1 hour.
Select IntervalB	If 'Yes' is selected, Set B parameters become active, otherwise Set A parameters are used.
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 10^8 resolution.

Note... 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).

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.
Status	The current status of recording. 0: Not Recording (The instrument has not been configured to record any data.) 1: Recording Disabled (The instrument has not been configured to record any data.) 2: Messages Only (The instrument is configured to record message data only.) 3: Recording Enabled (The instrument is configured to record all data.) 4: Recording Paused (The instrument is currently paused from recording any data

4.3.2 GROUP RECORDING CONFIGURATION (Cont.)



Point1 to Point240 Allows the user to select which points are to be recorded, by clicking on the ellipsis (...) button and then selecting an IO module and associated channel from the dialogue box which appears.

Note... A maximum of 500 points can be configured across all groups

4.3.3 Group alarm

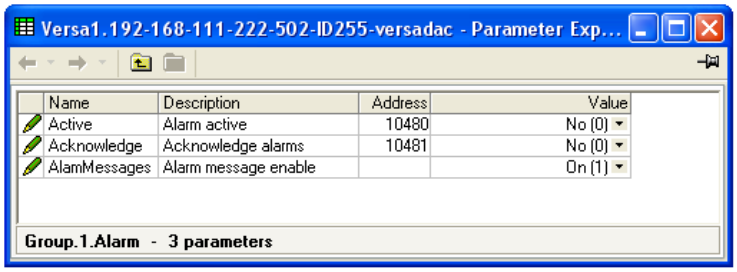


Figure 4.3.3 Group alarm menu page

This display shows if there is one or more alarm active in the group and allows the user to acknowledge them. Alarm message enable causes alarm messages to be included in the group's history

4.3.4 Notes

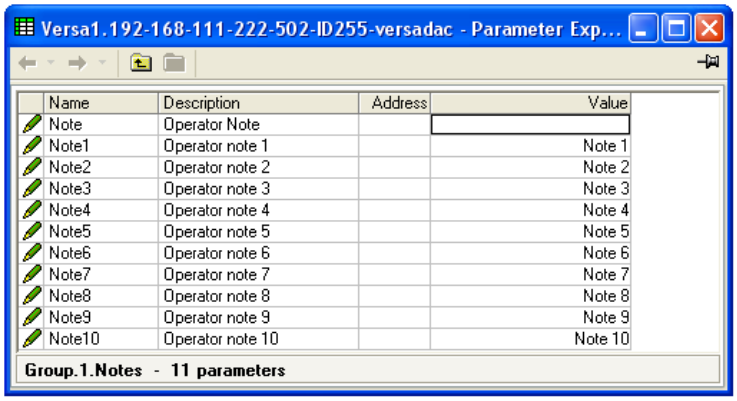


Figure 4.3.4 Group notes configuration page

'Note' can be entered at any time by the operator. Of up to 100 characters, this not becomes associated with the current group's history.

Notes 1 to 10 are pre-set notes which can be included in messages etc.

4.4 IO (INPUT/OUTPUT) CONFIGURATION

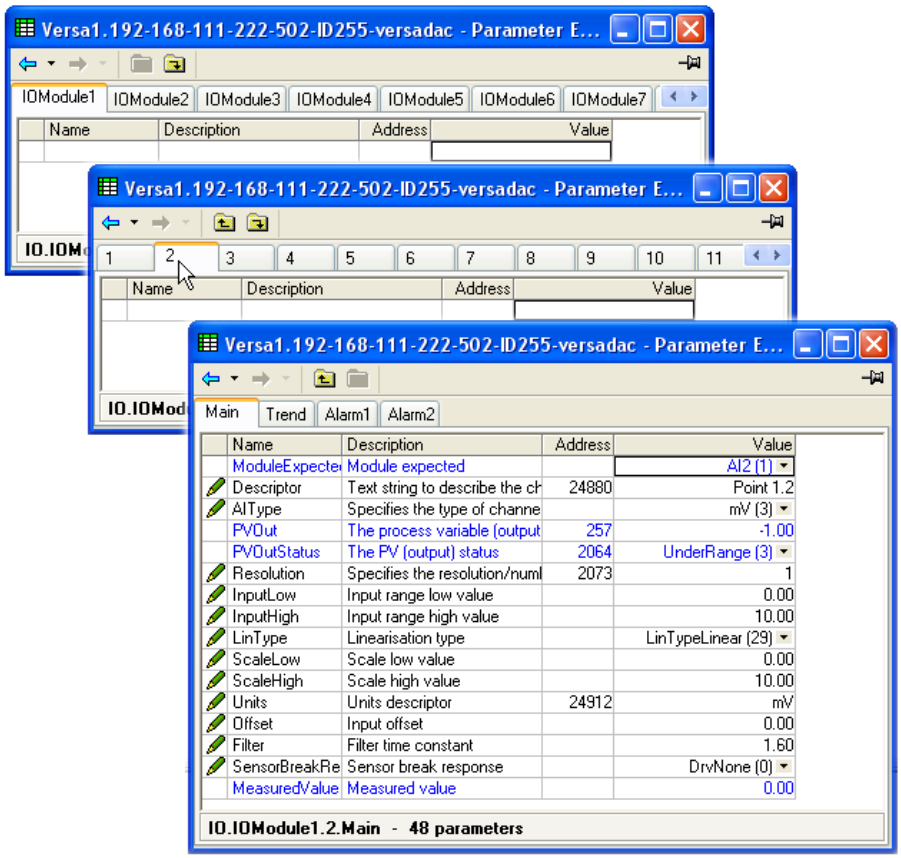


Figure 4.4a Channel configuration menu

Click on the down arrow folder to access lower menu levels for the selected module and channel.

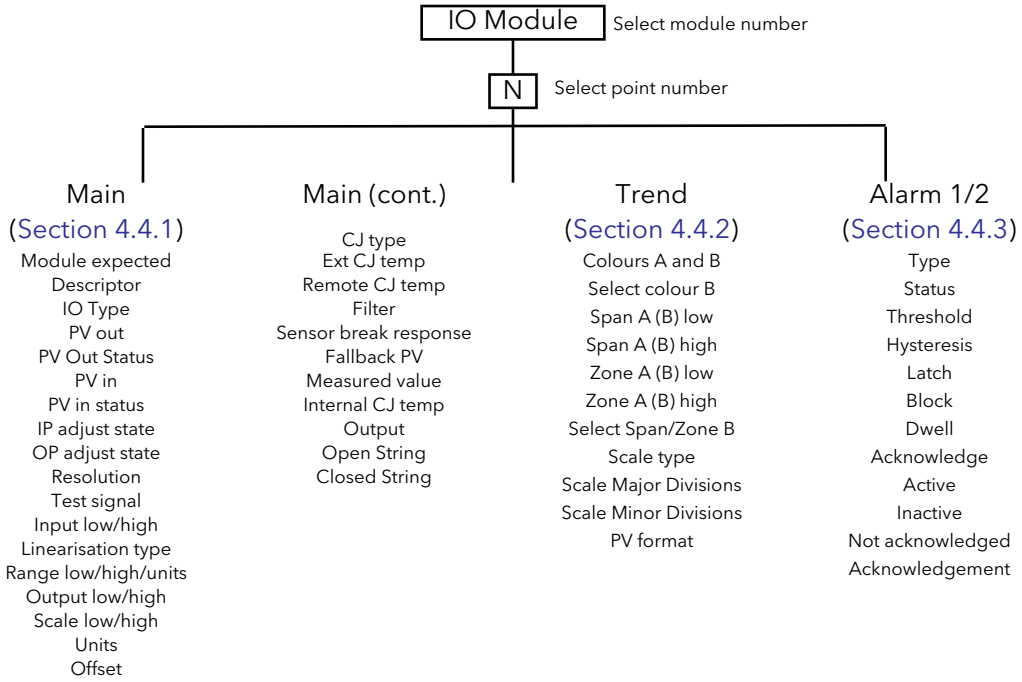


Figure 4.4b I/O Configuration Menu structure

4.4.1 IO Main

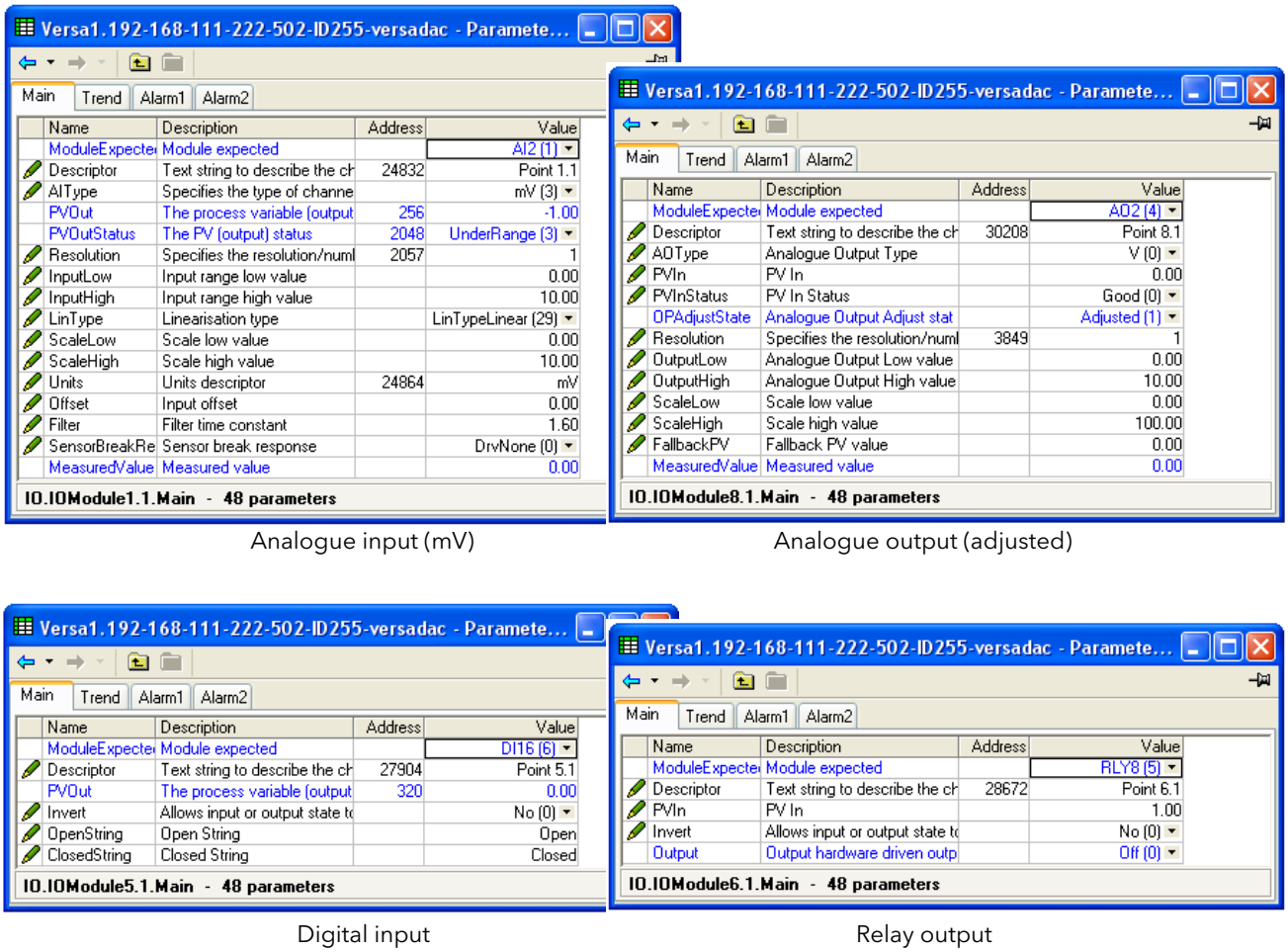


Figure 4.4.1a Channel main menu

PARAMETERS

Only the parameters relevant to the current I/O module appear (if Options>Parameter availability settings...>'Hide parameters and lists when not relevant' is enabled).

Module expected — The module which is supposed to be in this module slot

Descriptor — Allows a (20 character max.) descriptor to be entered for the channel.

AI Type — Select Input type (choices vary according to Module type (AI2, AI3, AI4))

0: Off	All module types
1: mA.	Required input range is specified, in units of mA, by the Input Low and Input High parameters. (Hardware range for all module types is ±30mA)
2: Thermocouple	Not AI3 modules. Thermocouple type is selected in 'Lin Type' (below).
3: mV.	Not AI3 modules. Required input range is specified, in units of mV, by the Input Low and Input High parameters. Hardware range for AI2 and AI4 module types is ±150mV)
4: HiZmV	(High Impedance millivolt inputs - channel 2 of AI2 modules only). Required input range is specified, in units of mV, by the Input Low and Input High parameters. Hardware range is ±1800 mV.

4.4.1 CHANNEL MAIN (Cont.)

AI Type (Cont.)

	5: V	AI2 Modules only. Required input range is specified, in units of volts, by the Input Low and Input High parameters. Hardware range is ±10V).
	6: RTD 2 Wire	Not AI3 modules. RTD type is selected in 'Lin Type' (below).
	7: RTD 3 Wire	Not AI3 modules. RTD type is selected in 'Lin Type' (below).
	8: RTD 4 Wire	Not AI3 modules. RTD type is selected in 'Lin Type' (below).
	9: Ohms	AI2 modules only. Required input range is specified, in units of ohms, by the Input Low and Input High parameters. Two hardware ranges (0 to 464Ω, and 0 to 7000Ω) are available, the appropriate range being selected automatically.
	10: Potentiometer	AI2 modules only
	11: Test	AI2 modules only. The required test waveform is selected in 'Test Signal', below.
AO Type	0: Voltage Output Type allowing an output range of 0 to 10 V 1: Current Output type allowing an output range of 0 to 20 mA	
PV out	Read only. Displays the current value of the IO point.	
PV Out Status	Status of the output PV	
	0: Good.	The process variable is ok.
	1: Off	Channel is configured to be off.
	2: Over range	Input signal is greater than the selected hardware range upper limit.
	3: Under range	Input signal is less than the selected hardware range lower limit.
	4: Hardware error	Input hardware failure.
	5: Ranging	Input hardware is being ranged i.e. being set-up as required by the range configuration.
	6: Overflow	Process variable overflow, possibly due to calculation attempting to divide a large number by a very small number.
	7: Bad	The process variable is not ok and should not be used.
	8: Hardware exceeded	The hardware capabilities have been exceeded at the point of configuration, for example configuration set to 0 to 40V when input hardware is capable of a maximum of 10V.
	9: No data	Insufficient input samples to perform calculation
PV In	Process value to be used to drive an output.	
PV In Status	Status of the signal providing PV In. Values as above for PV Out Status	
IP Adjust State	Appears only if this input has been adjusted. 1 = Adjusted. For details, see the 'Adjust Input' procedure described in section 4.1.6.	
OP Adjust state	Appears only if this output has been adjusted. 1 = Adjusted. For details, see the 'Adjust Output' procedure described in section 4.1.7.	
Resolution	Specifies the resolution (number of decimal places). This determines the resolution of the process variable (output) when read from the scaled integer comms region. In addition, it specifies the maximum number of decimal places that are to be displayed.	
Test signal	For use when 'Test' is selected as 'AI 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 as follows:	
	0: Triangle 5 Hours	1: Triangle 40 Minutes 2: Triangle 4 Minutes
	3: Triangle 40 Seconds	4: Sine 5 Hours 5: Sine 40 Minutes
	6: Sine 4 Minutes	7: Sine 40 Seconds

4.4.1 CHANNEL MAIN (Cont.)

Input Low* — For Input types other than T/C, RTD or Test, 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.

Lin Type — When mV, V or mA inputs are configured with thermocouple linearisation, the input range is mapped directly to the linearisation table. For example if configured such that 0 to 20mA represents 0 to 1000 °C or 0 to 1000 °F or 10 to 1000K, 0 mA represents 0 °C, 0 °F or 10 K respectively and 20mA represents 1000°C, 1000°F or 1000K respectively.

0: Type B	9: Type R	18: User 2	27: Ni120
1: Type C	10: Type S	19: User 3	28: Cu53
2: Type D	11: Type T	20: User 4	29: Linear
3: Type E	12: Type U	21: Cu10	30: Sqrt
4: Type G2	13: NiMoNiCo	22: Pt100	31: x 3/2
5: Type J	14: Platinel	23: Pt100a	32: x 5/2
6: Type K	15: NiNiMo	24: JPT100	
7: Type L	16: Pt20RhPt40Rh	25: PT1000	
8: Type N	17: User 1	26: Ni100	

See Appendix A for input ranges, accuracies etc. associated with the above thermocouple and RTD types. See section 4.8 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 and RTDs. 0 = °C; 1 = °F; 2 = K.

Output Low — The lowest expected value for the analogue output.

Output High — The highest expected value for the analogue output.

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.

For analogue outputs, scale low and high are used to map the PVIn value onto the Output Low/High to produce the physical demanded output value. For example, an output channel configured as Output Low/High 0 to 10 V and Scale Low/High 0 to 100, a PVIn value of 50 would produce a 5 V output value.

Units — Allows a units string of up to five characters to be entered.

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

CJ Type — For use only with thermocouple input types, this allows the user to select 'None', 'Internal', 'External' or 'Remote.

0: None	No Cold junction compensation applied.
1: 'Internal'	Uses the instrument's internal cold junction temperature measurement.
2: 'External'	This means that the cold junction is to be maintained by the user at a fixed, known, temperature. This temperature is entered in the 'External CJ Temp' field (below).
3: Remote	This means that the cold junction temperature is being measured by another input channel which must be soft wired to the Remote CJ Temp parameter (below) in the graphical wiring editor.

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.

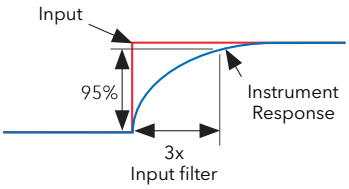
Remote CJ Temp — Soft wired (in the graphical wiring editor) to the input channel being used to measure the remote CJ temperature.

*Note: See section 4.8 for details of the configuration of Range High/Low and Input High/Low when 'Type' = User 1 to User 4.

4.4.1 CHANNEL MAIN (Cont.)

Input filter

Damping can be used to filter out noise from slowly changing signals so that the underlying trend can be seen more clearly. The entered value (between 0 and 60 seconds) is the filter time constant applied to the input measurement. The PV reaches 95% of an input step change in 3 times the filter time constant.



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

Sensor Break Response

0: None.	Disables Sensor Break detection.
1: Drive Low:	Value goes low if a sensor break is detected
2: Drive High:	Value goes low if a sensor break is detected

Fallback PV — The value to be output by an output channel if its PVIn status is anything other than 'Good'.

Measured Value — The (read only) input channel value before any scaling, linearisation or adjustment is applied.

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

Invert — For Relays and Digital Inputs, this allows the input or output to be inverted.

Output — Driven output state.

Open String — The text to be associated with the open status of a digital input.

Closed String — The text to be associated with the closed status of a digital input.

4.4.2 Trend configuration

This area allows the configuration of channel colour and span.

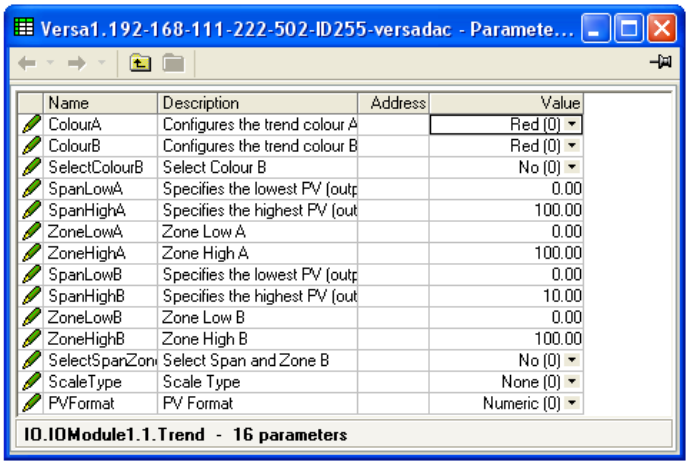


Figure 4.4.2a Trend configuration menu

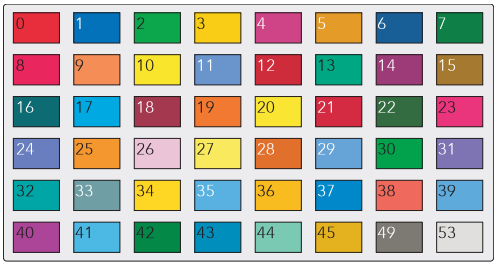


Figure 4.4.2b Trend colour swatch

Colour A (B)	Allows two alternative colours (A and B) to be specified for the channel. Figure 4.4.2b gives an approximate rendering.
Select Colour B	Setting this to 'Yes' (1) selects colour B, otherwise (0), the default colour (A) is used.
Span LowA/HighA	Set 'A' span low and high values.
Zone LowA/HighA	Set 'A' zone low and high values in %, to define the area of chart to be occupied.
Span LowB/HighB	Set 'B' span low and high values.
Zone LowB/HighB	Set 'B' zone low and high values in %, to define the area of chart to be occupied.
Select SpanZone B	Setting this to 'Yes' (1) selects span B and zone B, otherwise (0), the default values (A) are used.
Scale Type	0 = No Scale; 1 = Linear scale; 2 = Log scale.
Major Divisions	For linear scales, this 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.
Minor Divs	For linear scales, this allows the user to select the number of divisions into which the major divisions are divided.
Grid Decades	For Logarithmic scales (see 'Grid Type', above) this allows the user to select the number of decades to be included on the grid.

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.

4.4.3 Alarm 1 menu

Allows the alarm characteristics for Alarm 1 to be configured.

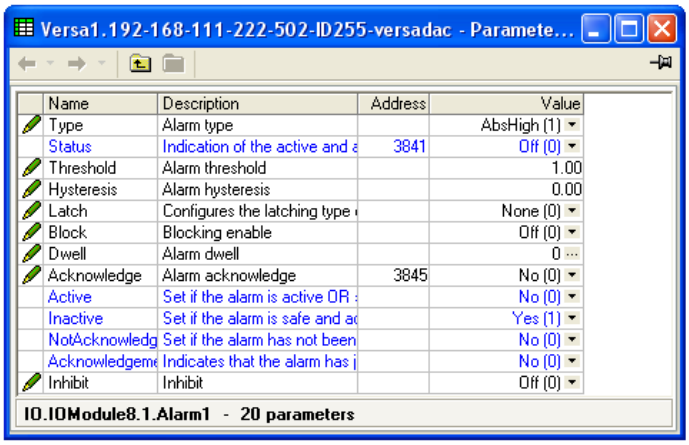


Figure 4.4.3 Typical alarm 1 configuration menu (Type = Absolute high)

Type

Select an alarm type from the following list: See 'Alarm types', below, for definitions.

0: Off
1: Abs.High (absolute high).
2: Abs. Low (absolute low),
3: Dev. High (deviation high)
4: Dev. Low (deviation low)
5: Dev. Band (deviation band)
6: Rise ROC (rate-of-change: rising)
7: Fall ROC (rate-of-change: falling)
10: Off (Digital alarms off)
11: Digital High
12: Digital Low

Status

Read only.

0: Off.	The monitored value is in the safe region and the alarm does not require acknowledgement. Always shows 'Off' when the alarm is inhibited (see below).
1: Active	The monitored value is in the active region but the alarm has been acknowledged (if appropriate).
2: SafeNack	The monitored value is now in the safe region but the alarm has not been acknowledged.
3: ActiveNack	The monitored value is in the active region and the alarm has not been acknowledged.

Threshold

For absolute alarms only, this is the trip point for the alarm. For absolute high alarms, if the process value of the point exceeds the threshold value, 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 - Hysteresis).
For deviation low alarms, the alarm becomes active if the process value (PV) falls below the value (Reference - Deviation) and remains active 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.

Deviation

For deviation alarms only, 'Deviation' defines the width of the deviation band, each side of the Reference value, as described immediately above.

4.4.3 ALARM 1 MENU (Cont.)

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.	
Hysteresis	For absolute and deviation alarms, this provides a means of preventing multiple alarm triggering, if the process value is drifting close to the trigger value.	
Latch	0: None.	The alarm remains active until the monitored value has returned to a non alarm state, when it becomes inactive.
	1: Auto.	The alarm remains active until the monitored value has returned to a non alarm state and the alarm has been acknowledged. Acknowledgement can take place either before or after the value has returned a non alarm state.
	2: Manual.	The alarm remains active until the monitored value has returned to a non alarm state and the alarm has been acknowledged. Acknowledgement is permitted only after the value has returned a non alarm state.
	3: 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	0 = Off; 1 = On. 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 re-asserted (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 inhibited (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 inhibited (below).	
N.acknowledged	As for 'Active' above but shows 'Yes' for as long as the alarm is unacknowledged, and 'No' as soon as it is acknowledged. Always shows 'No' if the alarm is inhibited (below).	
Acknowledgement	Fleetingly goes 'Yes' on alarm acknowledgement, and then returns to 'No'.	
Inhibit	0 = Off; 1 = On. When 'Inhibit' is enabled, 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 configuration. 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.

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

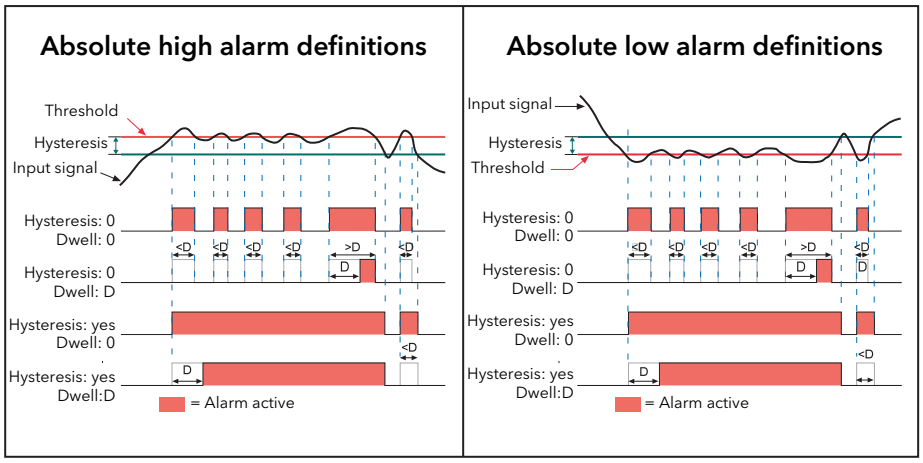


Figure 4.4.5a absolute alarm parameters

DEVIATION ALARMS

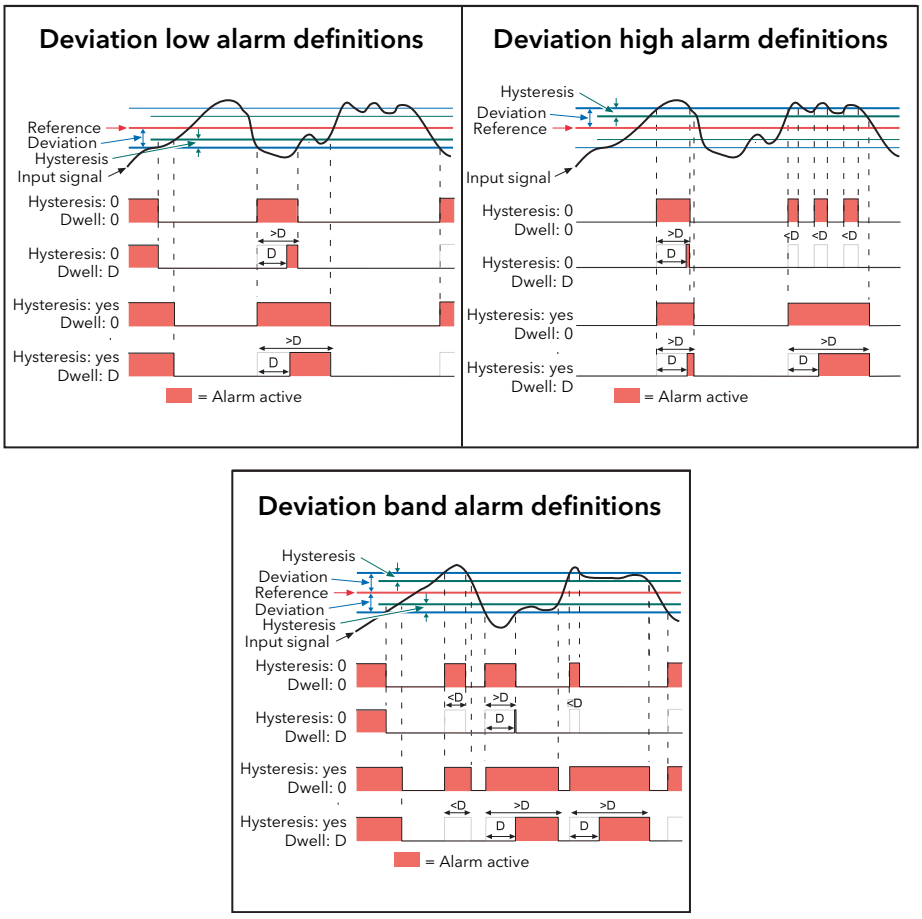


Figure 4.4.5b Deviation alarm parameters

4.4.5 ALARM TYPES (Cont.)

RATE-OF-CHANGE ALARMS

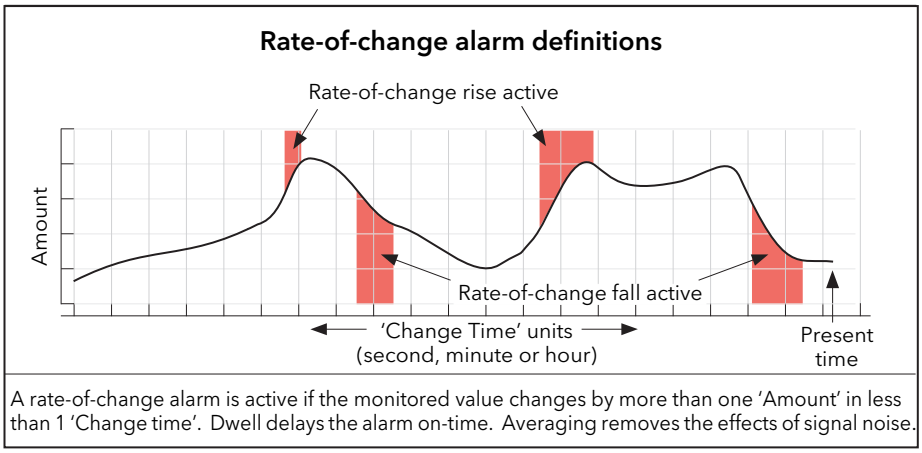


Figure 4.4.5c Rate-of-change alarm parameters

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

4.4.6 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	= 5 Ohms (fixed value - not editable)
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.

4.5 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 (IO channels), above.

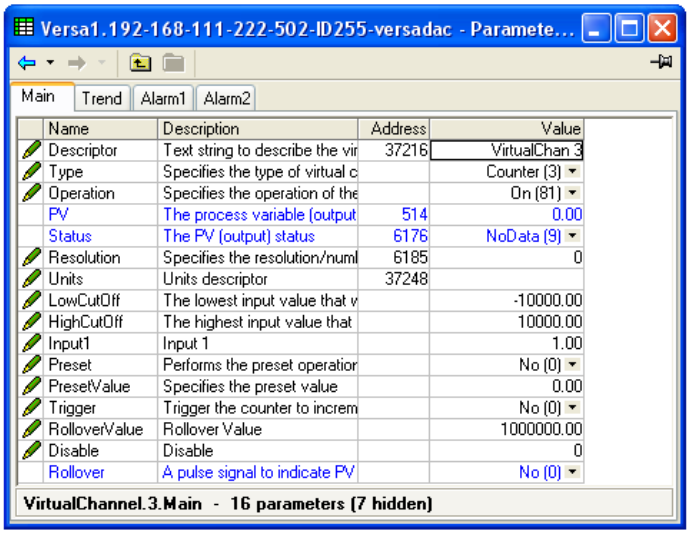


Figure 4.5 Virtual channel configuration (Counter; Main)

Descriptor — Allows the user to enter a descriptor (20 characters max.) for the maths channel

Type — 1 = Maths channel; 2 = Totaliser; 3 = Counter.

Totalisers allow the user to maintain a running total of any input or virtual 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 Rollover Value can be entered (default 1000000) and when the totaliser exceeds this value, the 'Rollover' output is set. This can be used to expand the range of the totaliser by wiring it to the Trigger input of a counter.

The totaliser equation is:

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

tot_t = totaliser value this sample

tot_{t-1} = totaliser value last sample

ma_t = process value this sample

PSF= Period Scaling Factor (Period)

USF= Units Scaling Factor (Units scaler)

Note: the time between samples is 125ms.

Operation — Allows the user to select the required maths function. See 'Maths operations', below.

Group — Select a group number for use with group related operations.

PV — Read only. Shows the dynamic value of this channel in the units entered in 'Units' below.

4.5 VIRTUAL CHANNEL CONFIGURATION (Cont.)

Status — Read only. Shows the status of this channel, reflecting the status of the input sources.

0: Good.	The process variable is ok.
1: Off	Channel is configured to be off.
2: Over range	Input signal is greater than the selected hardware range upper limit.
3: Under range	Input signal is less than the selected hardware range lower limit.
4: Hardware error	Input hardware failure.
5: Ranging	Input hardware is being ranged i.e. being set-up as required by the range configuration.
6: Overflow	Process variable overflow, possibly due to calculation attempting to divide a large number to a relatively small number.
7: Bad	The process variable is not ok and should not be used.
8: Hardware exceeded	The hardware capabilities have been exceeded at the point of configuration, for example configuration set to 0 to 40V when input hardware is capable of a maximum of 10V.
9: No data	Insufficient input samples to perform calculation

Resolution — This determines the resolution of the process variable when read from the scaled integer comms region. It also specifies the number of decimal places to be displayed

Units — Allows a five character string to be entered to be used as the channel units.

Units scaler — Allows a totaliser units scaler to be selected. If, for example, the input channel has units of litres per hour, then, if the Units Scaler is set to one, the totalised value will be in litres. If the Units Scaler is set to 1000, then the totalised value will be in thousands of litres. Setting the Units Scaler to a negative value, causes the totaliser to decrement rather than increment.

Low Cut Off — Used to restrict the input operating range of a totaliser. Minimum value = -100 000

High Cut Off — Used to restrict the input operating range of a totaliser. Maximum value = 100 000

Modbus Input — For a maths channel, this is the input value written to a maths channel via Modbus when the Maths channel operation value is set to 9 ('Modbus Input').
The value is displayed as the Maths Channel Process Variable (PV). If a comms inactivity timeout period has been configured (see 'Input Timeout' in section 4.2.4 (Network Modbus configuration)) then if this input is not written to within the timeout period the output (PV) is set to -9999.0 (NO DATA).

Input1 — The current value of input 1. Uses the resolution of the source.

Input 2 — As for 'Input 1', Appears only when the operation requires two inputs.

Time Remaining — The period of time remaining before the virtual channel performs its operation. For example, the time remaining for the maths channel average 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: Also used as a period scaler with a totaliser (e.g. per second, per minute, per hour etc

0: 0.125 second	5: 5 seconds	10: 2 minutes	15: 1 hour
1: 0.25 second	6: 10 seconds	11: 5 minutes	16: 2 hours
2: 0.5 second	7: 20 seconds	12: 10 minutes	17: 6 hours
3: 1 second	8: 30 seconds	13: 20 minutes	18: 12 hours
4: 2 seconds	9: 1 minute	14: 30 minutes	19: 24 hours

Reset — Allows the user to reset latching functions (e.g. Channel Max) or averaging functions (e.g. Channel Avg). 1 = Reset

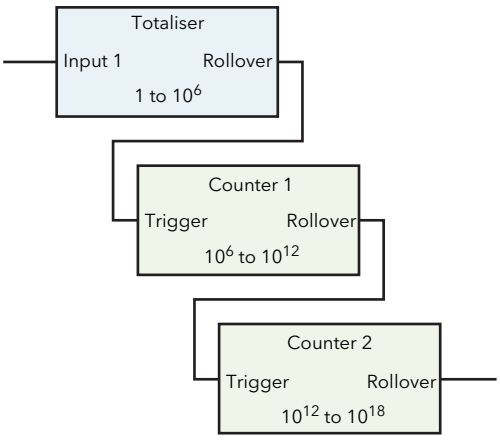
Preset — Setting this to 'Yes' (1) causes the totaliser to adopt the Preset Value.

Preset Value — Allows the entry of a value, from which the totaliser is to start incrementing or decrementing. The direction of the count is set by the sign of the units scaler: positive = increment; negative = decrement.

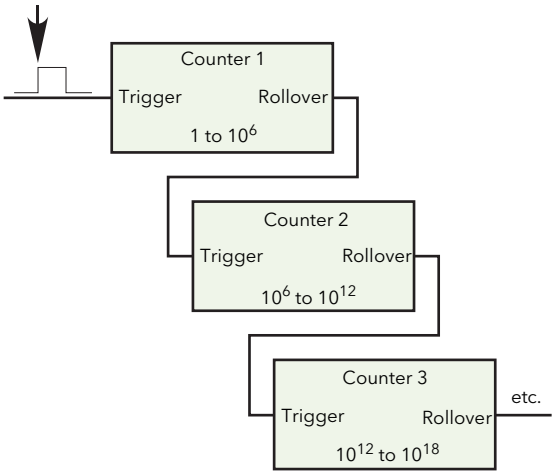
4.5 VIRTUAL CHANNEL CONFIGURATION (Cont.)

Trigger	Setting this to Yes (1), causes the current value of the input source to be added to the Counter value.
Rollover Value	When the value of the totaliser passes through this configurable value 'Rollover' (below) is set to 'Yes' for one iteration period. This can be used to increment a counter by wiring the totaliser 'Rollover' parameter to the 'Trigger' parameter of the counter. Counters can be cascaded in a similar way. See 'Cascading counters' below. If the rollover value is exceeded by more than one, then the remainder appears as the new instantaneous totaliser value. For example if the current totaliser value = 998; the rollover value = 1000 and the totaliser increments by five, then the Rollover output is set to 'Yes' and the new totaliser value = three. The feature works equally well for negative values.
Disable	Allows the user temporarily to suspend totalising action. The output retains the pre-disabled value until the totaliser is re-enabled, when it resumes from that value.
Rollover	This output is set to 'Yes' for one iteration period when the totaliser value passes through the Rollover Value (see above). This can be used to expand the range of the totaliser by wiring it to the input of a counter.

CASCADING COUNTERS



Using cascaded counters to expand the totalisation range (all rollover values set to 1000000).



Cascading counters (all Rollover Values set to 1000000)

4.5.1 Maths operations

0: Off	Out = -9999; status = Off
2: Add	Out = Input1 + Input2
3: Subtract	Out = Input1 - Input2
4: Multiply	Out = Input1 x Input2
5: Divide	Out = Input1 ÷ Input2. If Input2 = 0, Out = -9999; Status = 'Bad'.
6: Group Avg	Out = Instantaneous sum of all points in the specified 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 calculation. If the group contains no channels, Out = -9999; Status = 'No data'.
7: 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'.
8: 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'.
9: Modbus Input	Out = value written to this channel's modbus input. If the comms timeout expires, Out = -9999; status = 'No data'.
11: Copy	Allows an input or other derived channel to be copied.
20: 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'.
21: 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 calculation. If the group contains no channels, Out = -9999; Status = 'No data'.
34: 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.
35: Channel Min	Out = Lowest 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.
36: 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.
43: Config Revision	Out = current Configuration Revision value.
64: Off	Totaliser output is set to -9999.0 with a status of 'Channel Off'.
65: On	The output of the virtual channel is the totalised value of input 1.
80: Off	Counter output is set to -9999.0 with a status of 'Channel Off'.
81: On	Provides an incrementing/decrementing counter value.

4.6 MODBUS MASTER CONFIGURATION

Modbus master configuration is divided into three areas: a) setting up the slave(s) (Main), b) diagnostics, and c) defining the locations of the parameters to be read (Data).

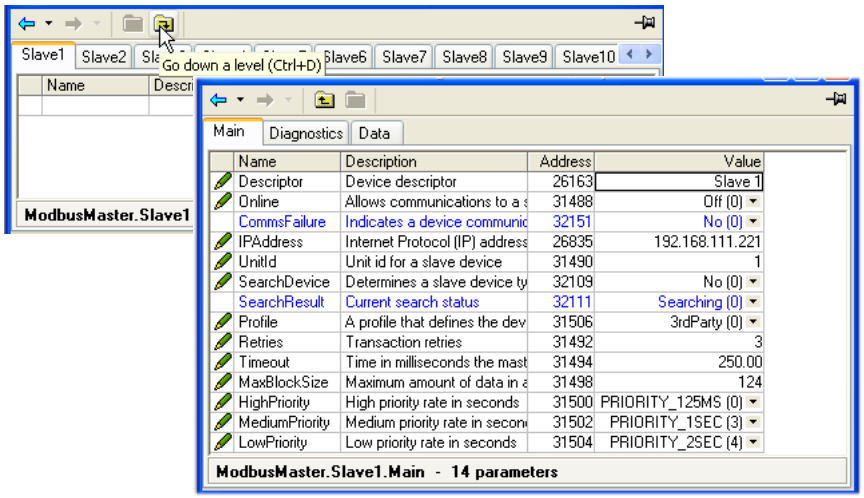
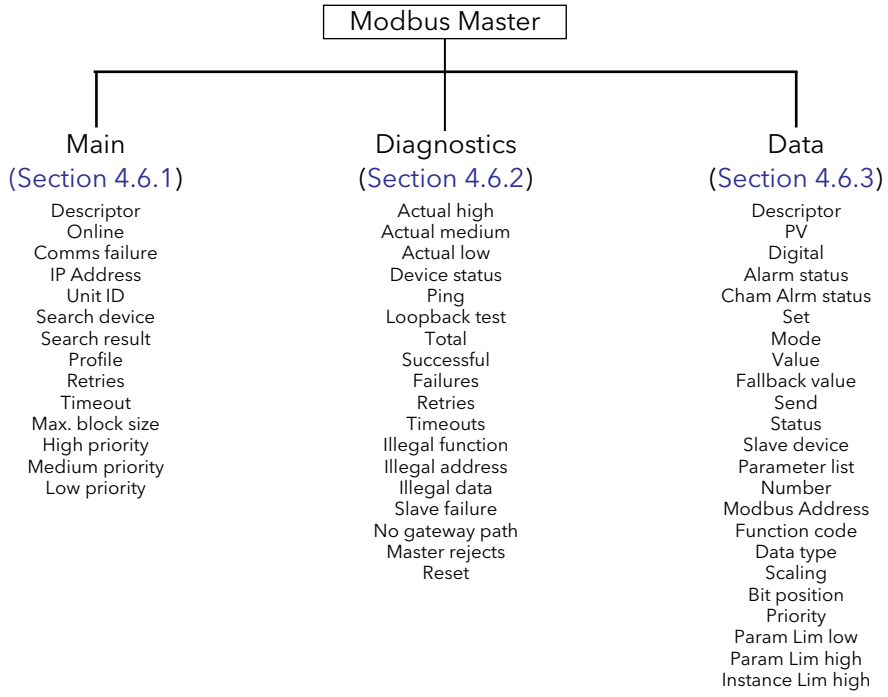


Figure 4.6 Modbus Master configuration top level menus



4.6.1 Slave Main menu

This allows the IP address, Unit ID and other communications parameters to be entered for Slaves 1 to 32.

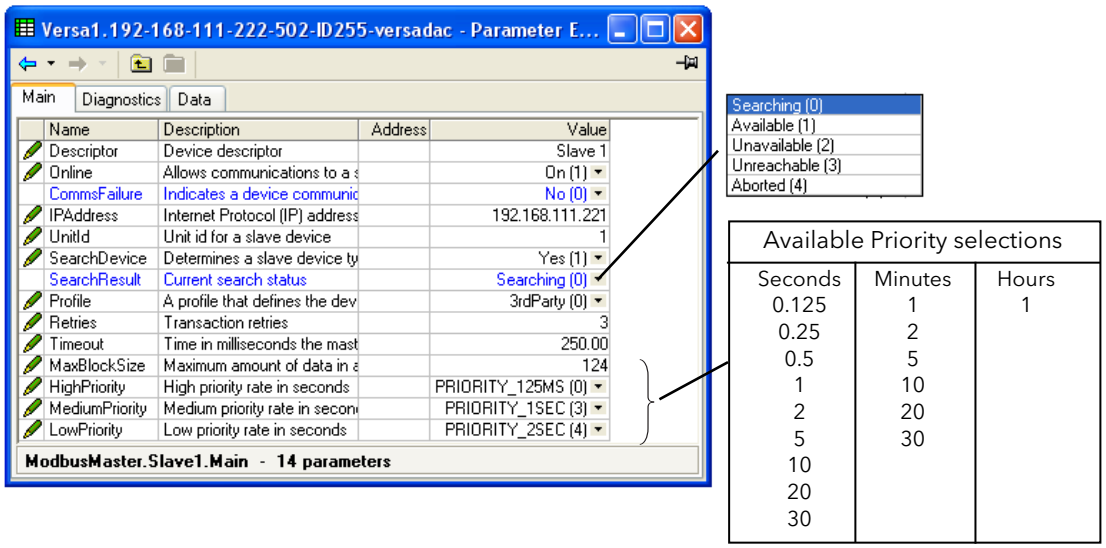


Figure 4.6.1 Modbus Master Slave 1 Main menu (other slaves similar)

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 4.1.4).
Online	The instrument always attempts to communicate with a slave device whilst online. When not online all communications with the slave device are suspended, and no transactions will be sent. Setting the slave offline temporarily disables data transactions - it does not reconfigure them. 0 = Offline; 1 = Online.
Comms Failure	1 (Yes) = Active. A data item has failed to respond after all retries.
IP Address	The IP address of the relevant slave device. If the IP address is set to 127.0.0.1, Modbus RTU is used instead (via the 9-way D-type - section 2.3.1) as long as the serial port is configured as Serial Master.
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	If set to '1' (Yes) the instrument attempts to determine the type of slave device at the configured IP address. If successful the device profile is selected for the recognised device.
Search Result	The status of the selected 'Search Device' request. 0: Searching. Looking for the selected device on the network 1: Available. The device is available for communicating 2: Unavailable. The device is not available for communicating 3: Unreachable. The device is unreachable on the network 4: Aborted. The user aborted the current search
Profile	A number of profiles are held within the instrument that match a selection 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 time in milliseconds the master waits for a response from a slave device before retrying
Max Block Size	The maximum number of registers (16bit words) that a single data transaction may contain
High Priority	The interval rate between each high priority data transaction. Default = 0.125 second.
Medium Priority	The interval rate between each medium priority data transaction. Default = 1 second.
Low Priority	The interval rate between each low priority data transaction. Default = 2 seconds.

4.6.1 SLAVE MAIN MENU (Cont.)

PRIORITY LEVELS

Three levels of update rate can be entered for use in data configuration (section 4.6.3), 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.

4.6.2 Slave Diagnostics menu

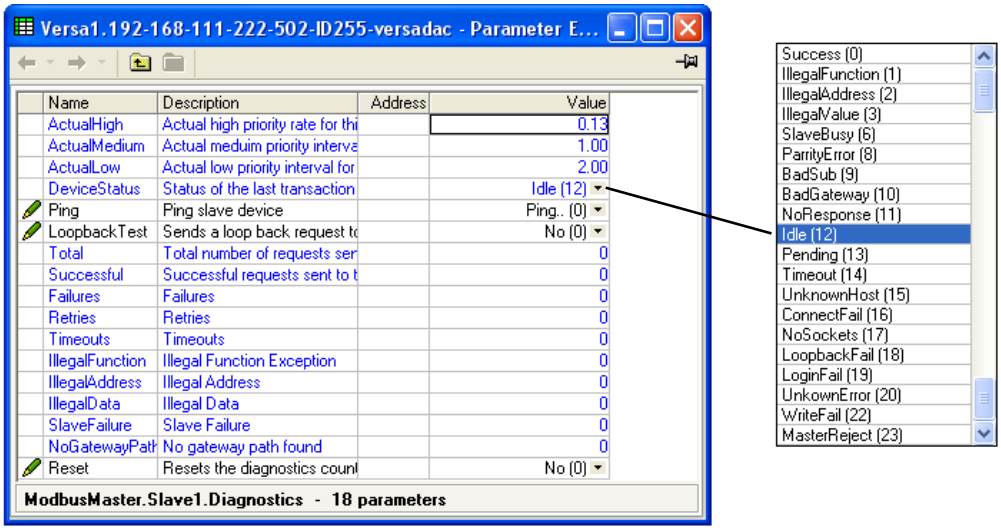


Figure 4.6.2 Diagnostics menu

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

0: Success	The transaction was successfully actioned by the slave device.
1: Illegal Function	The request to the slave device contained an invalid function code.
2: Illegal Address	The request to the slave device contained an invalid Modbus address. The address may be for a read only parameter. Exception code (2).
3: Illegal Value	The request to the slave device contained invalid data for the specified parameter.
6: Slave busy	The slave device is currently busy and therefore unable to action the request
8: Parity error	The request was not in the correct format.

4.6.2 SLAVE DIAGNOSTICS MENU (Cont.)

Device status (cont.)	9: Bad Sub	The sub-function code in the request was invalid
	10: Bad Gateway	There was no suitable gateway or route by which to send the request to the specified slave device.
	11: No Response	There was no response from the slave device to a given request
	12: Idle:	This data item is currently idle and not communicating with the slave device
	13: Pending	The request is waiting to be sent. A common cause is that the slave device is offline.
	14 Timeout	There was no response from the slave device to a given request within the configured time.
	15: Unknown Host	The slave device being used is not recognised.
	16: Connect Fail	The connection to the specified slave device was unsuccessful.
	17: No Sockets	There are no free sockets available to establish a connection to the slave device.
	18: Loopback Fail	The loopback request to the slave device failed.
	19: Login Fail	An attempt to login to the slave device was unsuccessful.
	20: Unknown Error	An error occurred, the cause of which could not be determined.
	22: Write Fail	The write request failed.
	23: Master Reject	The request was rejected by the master prior to sending to the slave device, due to a malformed request.

Loopback Test	If set to 'Yes', Sends a function code 8 transaction to the slave, and waits for a response. The response is added to the diagnostics count in one of the response types.
Total	A count of all read and write transactions (both good and bad) sent to the slave, including retries.
Successful	The number of transactions sent to the slave device that did not produce an exception response.
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	The number of illegal function exception responses from the slave device.
Illegal address	The number of illegal address exception responses from the slave device. 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 device 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. 0 = N0; 1 = Yes.

4.6.3 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.

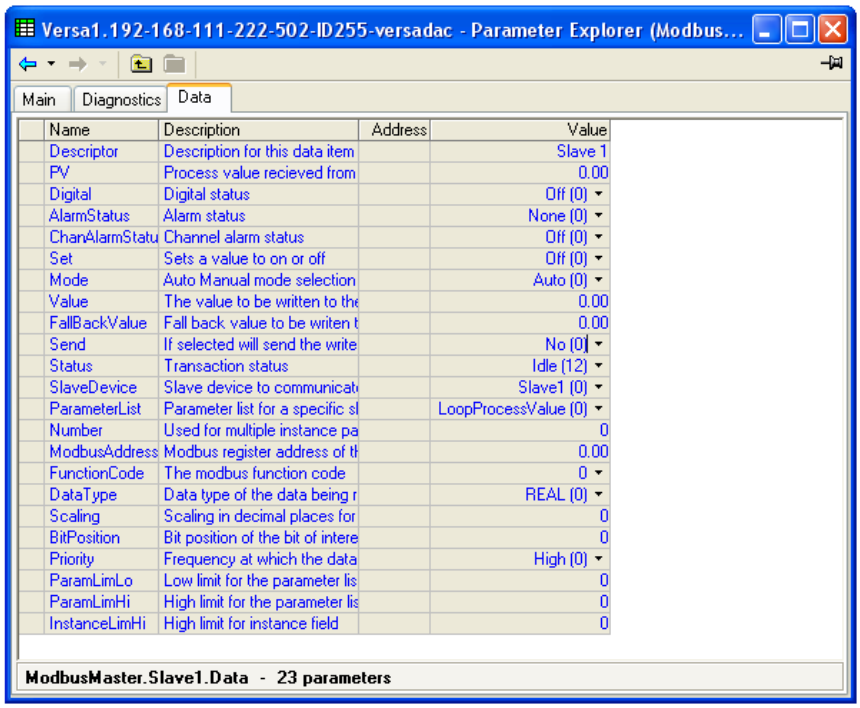


Figure 4.6.3 Modbus master data menu

Descriptor	Up to 20 characters used to describe the current data item.	
PV	The process value currently being read from the selected slave. Visible only if data item is not an alarm type.	
Digital	The status of the digital value being read from the slave device. 0 = Off; 1 = On	
Alarm status	Indicates if any one or more alarm is active. 0 = None 1 = At least one alarm is active	
Chan. Alm Status	0: Off	The monitored value is in the safe region and the alarm does not require acknowledgement
	1: Active	The monitored value is in the active region but the alarm has been acknowledged (if appropriate)
	2: Safe NAckd	The monitored value is now in the safe region but the alarm has not been acknowledged
	3: Active NAckd	The monitored value is in the active region and the alarm has not been acknowledged.
Set	Allows the user to set a digital value to On (1) or Off (0).	
Mode	Allows the user to set an auto/manual value to auto (0) or manual (1).	
Value	The value to be sent to the selected slave. This parameter is available only with function codes 6 & 16	
Fall Back Value	If configured as a write request and the parameter has a status other than OK, then the fallback value is written instead. It is not possible to wire from another parameter and 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'	

4.6.3 MODBUS MASTER DATA CONFIGURATION (Cont.)

Status	The status of the last transaction to this slave	
	0: Success	The transaction was successfully actioned by the slave device.
	1: Illegal Function	The request to the slave device contained an invalid function code.
	2: Illegal Address	The request to the slave device contained an invalid Modbus address. The address may be for a read only parameter. Exception code (2).
	3: Illegal Value	The request to the slave device contained invalid data for the specified parameter.
	6: Slave busy	The slave device is currently busy and therefore unable to action the request
	8: Parity error	The request was not in the correct format.
	9: Bad Sub	The sub-function code in the request was invalid
	10: Bad Gateway	There was no suitable gateway or route by which to send the request to the specified slave device.
	11: No Response	There was no response from the slave device to a given request
	12: Idle:	This data item is currently idle and not communicating with the slave device
	13: Pending	The request is waiting to be sent. A common cause is that the slave device is offline.
	14 Timeout	There was no response from the slave device to a given request within the configured time.
	15: Unknown Host	The slave device being used is not recognised.
	16: Connect Fail	The connection to the specified slave device was unsuccessful.
	17: No Sockets	There are no free sockets available to establish a connection to the slave device.
	18: Loopback Fail	The loopback request to the slave device failed.
	19: Login Fail	An attempt to login to the slave device was unsuccessful.
	20: Unknown Error	An error occurred, the cause of which could not be determined.
	22: Write Fail	The write request failed.
	23: Master Reject	The request was rejected by the master prior to sending to the slave device, due to a malformed request.
Slave Device	A list of available slaves that this data is to communicate with. 0 = Slave device 1; 1 = Slave device 2 and so on.	
Parameter List	List of parameters available for the selected slave devices profile. These parameters require no user configuration. See 'Parameter list', below.	
Number	The channel, loop or group etc. instance.	
Modbus Address	The Modbus register address that this data is to be read from or written to. Limits are 0 to 65535	

4.6.3 MODBUS MASTER DATA CONFIGURATION (Cont.)

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:

1: Read Coil. Read contiguous status coils
2: Read Discrete. Read contiguous discrete inputs
3: Read Holding. Read contiguous holding registers
4: Read Input. Read contiguous input registers
5: Write Coil. Write a single coil to on/off
6: Write Single. Write to a single register
16: Write Multiple. Write to contiguous registers

Data Type — The data type that defines how this data is going to be represented. The data types listed below are supported.

0: 32-bit floating point IEEE (REAL)
1: 32-bit signed long (DINT)
2: 16-bit signed integer (INT)
3: 8-bit signed byte (BYTE)
4: 32-bit unsigned long (UDINT)
5: 16-bit unsigned integer (UINT)
6: 8-bit unsigned byte (UBYTE)
8: 32-bit floating point IEEE (little Endian, word swapped) (REAL (swap))
9: 32-bit signed long (little Endian, word swapped) (DINT (Swap)
10: 32-bit unsigned long (little Endian, word swapped) (UDINT (Swap))
11: 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

Scaling — The decimal placing for scaled 16 bit data types. Visible depending on the 'Data Type' selected. 0 = No scaling

Bit Position — The bit in the register to be extracted, this is only available if the 'Data Type' selected is 'BIT In Register' Uses function code 03 for the read transaction.

Priority — The frequency with which this data will be managed. See 'Priority Levels', in section 4.6.1, above.

0: High. Adds the data item to the high priority queue
1: Medium. Adds the data item to the medium priority queue
2: Low. Adds the data item to the low priority queue
3: Acyclic. Does not add the data item to any queue, the request must be sent manually.

4.6.3 MODBUS MASTER DATA CONFIGURATION (Cont.)

PARAMETER LIST

Provides a list of parameters that the user can choose to read/write without having to know the Modbus address, data type etc.

0: Loop PV. Reads a process value from a loop in a 2500 controller
1: Target SP. Reads a target setpoint value from a loop in a 2500 controller
2: Target SP. (set) Writes a target setpoint value to a loop in a 2500 controller
3 Working SP. Reads a working setpoint value from a loop in a 2500 controller
4: Manual OP. Reads a manual output value from a loop in a 2500 controller
5: Manual OP. (set) Writes a manual output value to a loop in a 2500 controller
6: Working Output. Reads a working output value from a loop in a 2500 controller
7: Auto/Man (set). Sets a loop into auto or manual mode in a 2500 controller
8: User Defined. The user can specify all configuration data required to read any parameter from the 2500 controller
9: Off. No data to be exchanged
12: Loop PV. Reads a process value from a loop in a 2000 series controller
13: Target SP. Reads a target setpoint value from a loop in a 2000 series controller
14: Target SP (set). Writes a target setpoint value to a loop in a 2000 series controller
15: Working SP. Reads a working setpoint value from a loop in a 2000 series controller
16: Alarm 1 Status. Reads alarm status 1 from a loop in a 2000 series controller, not supported by the 26/2704 products.
17: Alarm 2 Status. Reads alarm status 2 from a loop in a 2000 series controller, not supported by the 26/2704 products.
18: Alarm 3 Status. Reads alarm status 3 from a loop in a 2000 series controller, not supported by the 26/2704 products.
19: Alarm 4 Status. Reads alarm status 4 from a loop in a 2000 series controller, not supported by the 26/2704 products.
20: Target Output. Reads a target output value from a loop in a 2000 series controller
21: Working Output. Reads a working output value from a loop in a 2000 series controller
22: Auto/Man (set). Sets a loop into auto or manual mode in a 2000 series controller
24: User Defined. The user can specify all configuration data required to read any parameter from a 2000 series controller
25: Off. No data to be exchanged
29: Loop PV. Reads a process value from a loop in a 3500 controller
30: Manual OP. Reads a manual output value from a loop in a 3500 controller
31: Manual OP (set). Writes a manual output value to a loop in a 3500 controller
32: Active Output. Reads an active output value from a loop in a 3500 controller
33: Target SP. Reads a target setpoint value from a loop in a 3500 controller
34: Target SP (set). Writes a target setpoint value to a loop in a 3500 controller
35: Working SP. Reads a working setpoint value from a loop in a 3500 controller
36: Alarm Output. Reads the alarm output value from a loop in a 3500 controller
37: Auto/Man (set). Sets a loop into auto or manual mode in a 3500 controller
38: User Defined. The user can specify all configuration data required to read any parameter from the 3500 controller
39: Off. No data to be exchanged
40: Loop PV. Reads a process value from a loop in a mini8 controller
41: Manual OP. Reads a manual output value from a loop in a mini8 controller
42: Manual OP (set). Writes a manual output value to a loop in a mini8 controller

4.6.3 MODBUS MASTER DATA CONFIGURATION (Cont.)

PARAMETER LIST (Cont.)

43: Active Output. Reads an active output value from a loop in a mini8 controller
44: Target SP. Reads a target setpoint value from a loop in a mini8 controller
45: Target SP (set). Writes a target setpoint value to a loop in a mini8 controller
46: Working SP. Reads a working setpoint value from a loop in a mini8 controller
47: Alarm Output. Reads the alarm output value from a loop in a mini8 controller
48: Auto/Man (set). Sets a loop into auto or manual mode in a mini8 controller
49: Fixed DI1 PV. Reads digital input 1 process value from a mini8 controller
50: Fixed DI2 PV. Reads digital input 2 process value from a mini8 controller
51: Relay A PV. Reads relay A process value from a mini8 controller
52: Relay B PV. Reads relay B process value from a mini8 controller
53: Module 1 PV. Reads a module process value from a mini8 controller
54: User Defined. The user can specify all configuration data required to read any parameter from the mini8 controller
55: Off. No data to be exchanged
61: Chan. PV. Reads the process value from an input channel on a 6000 recorder
62: Chan. PV (set). Writes a value to an input channel on a 6000 recorder
63: VChan. PV. Reads the value from a maths channel on a 6000 recorder
64: VChan. PV (set). Writes a value to a maths channel on a 6000 recorder
65: Chan. Alm SP1. Reads the value of alarm setpoint 1 from an input channel on a 6000 recorder
66: Chan. Alm SP2. Reads the value of alarm setpoint 2 from an input channel on a 6000 recorder
67: Math Alm SP1. Reads the value of alarm setpoint 1 from a maths channel on a 6000 recorder
68: Math Alm SP2. Reads the value of alarm setpoint 2 from a maths channel on a 6000 recorder
69: Batch Status. Reads the batch status of a group from a 6000 recorder
70: Batch Start. Starts a batch in a group in a 6000 recorder
71: Batch Stop. Stops a batch in a group in a 6000 recorder
72: Global Alm Ack. Acknowledges the global alarm indicator in a 6000 recorder
73: User Defined. The user can specify all configuration data required to read any parameter from a 6000 recorder
74: Off. No data to be exchanged
76: Loop PV. Reads a process value from a loop in a nanodac recorder/controller
77: Manual OP. Reads a manual output value from a loop in a nanodac recorder/controller
78: Manual OP (set). Writes a manual output value to a loop in a nanodac recorder/controller
79: Active Output. Reads an active output value from a loop in a nanodac recorder/controller
80: Target SP. Reads a target setpoint value from a loop in a nanodac recorder/controller
81: Target SP (set). Writes a target setpoint value to a loop in a nanodac recorder/controller
82: Working SP. Reads a working setpoint value from a loop in a nanodac recorder/controller
83: Loop Break AlmvReads the loop break alarm value from a nanodac recorder/controller
84: Auto/Man (set). Sets a loop into auto or manual mode in a nanodac recorder/controller
85: VChannel Input. Writes a value to a Modbus input virtual channel in the nanodac recorder/controller
86: Channel PV. Reads the process value of an input channel in the nanodac recorder/controller
87: VChannel PV. Reads the process value of a virtual channel in the nanodac recorder/controller
88: Chan Alarm 1. Reads the value of alarm setpoint 1 from an input channel in the nanodac recorder/controller
89 Chan Alarm 2. Reads the value of alarm setpoint 2 from an input channel in the nanodac recorder/controller

4.6.3 MODBUS MASTER DATA CONFIGURATION (Cont.)

PARAMETER LIST (Cont.)

90 VChan Alarm 1. Reads the value of alarm setpoint 1 from a virtual channel in the nanodac recorder/controller
91 VChan Alarm 2. Reads the value of alarm setpoint 2 from a virtual channel in the nanodac recorder/controller
92 Any Chan Alarm. Reads the status of any channel alarms from the nanodac recorder/controller
93 Any Sys Alarm. Reads the status of any system alarms from the nanodac recorder/controller
94 Any Alarm. Reads the status of any alarms from the nanodac recorder/controller
95 Start 121\xB0\x43. Starts a 121\xB0\x43 steriliser cycle in the recorder/controller
96 Start 134\xB0\x43. Starts a 134\xB0\x43 steriliser cycle in the recorder/controller
97 Running OP. Reads the status of the running output of a steriliser cycle in the nanodac recorder/controller
98 Passed OP. Reads the status of the passed output of a steriliser cycle in the nanodac recorder/controller
99 User Defined. The user can specify all configuration data required to read any parameter from the nanodac recorder/controller
100 Off. No data to be exchanged
110 Loop PV. Reads a process value from a loop in a 3000 series controller
111 Target SP. Reads a target setpoint value from a loop in a 3000 series controller
112 Target SP (set). Writes a target setpoint value to a loop in a 3000 series controller
113 Working SP. Reads a working setpoint value from a loop in a 3000 series controller
114 Auto/Man (set). Sets a loop into auto or manual mode in a 3000 series controller
115 Manual OP. Reads a manual output value from a loop in a 3000 series controller
116 Manual OP (set). Writes a manual output value to a loop in a 3000 series controller
117 Working Output. Reads a working output value from a loop in a 3000 series controller
118 User Defined. The user can specify all configuration data required to read any parameter from a 3000 series controller
119 Off. No data to be exchanged
127 Control PV. Reads a process value from a control network in an EPower
128 Control SP. Reads a set point value from a control network in an EPower
129 Control SP (set). Writes a set point value to a control network in an EPower
130 Voltage. Reads a voltage value from a power module in an EPower
131 Current. Reads a current value from a power module in an EPower
132 Power. Reads a power value from a power module in an EPower
133 User Defined. The user can specify all configuration data required to read any parameter from an Epower
134 Off. No data to be exchanged
145 User Defined. The user can specify all configuration data required to read any parameter from any 3rd party device
146 Off. No data to be exchanged

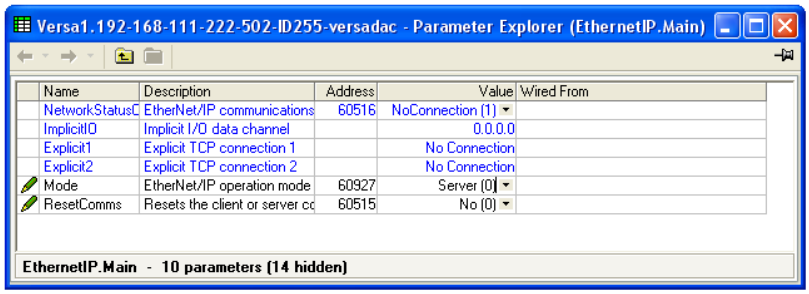
4.7 ETHERNET/IP CONFIGURATION

The versadac Ethernet/IP can be configured to be a "Server", an "IO Client" or a "Tag Client".

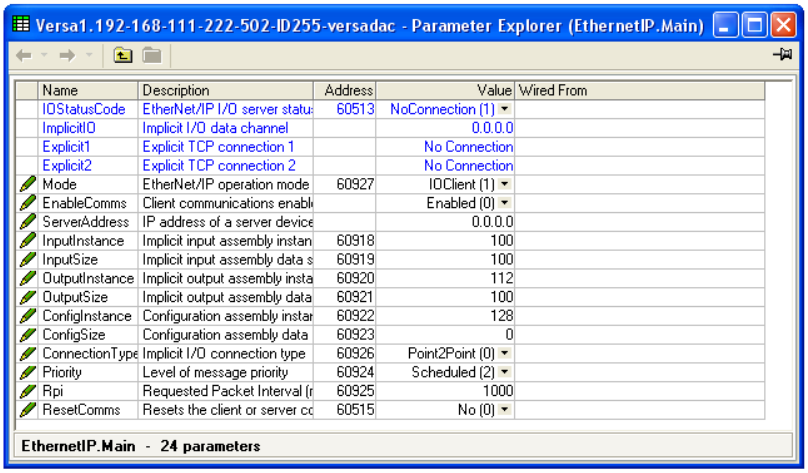
A versadac Ethernet/IP server can communicate with only one client using the Implicit IO tables but can accept two simultaneous Explicit TCP client connections.

When configured as an IO client, the versadac can communicate with only one Ethernet/IP server using the Implicit IO tables. Using iTools, it can also communicate with a single Ethernet/IP server using Explicit messaging at the same time.

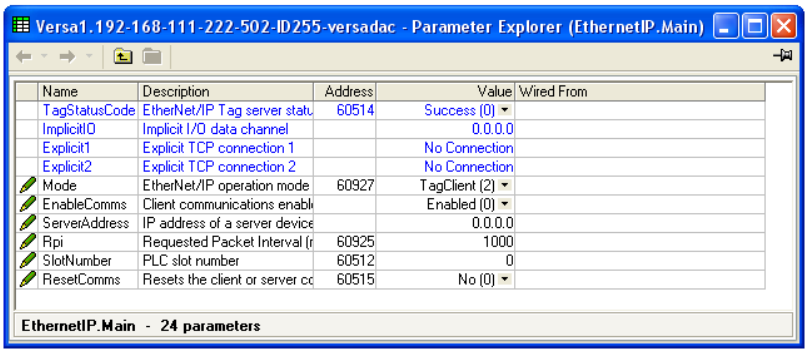
When configured as a Tag client, the versadac can communicate with a single PLC using tags by configuring the Input and Output tag tables. The PLC tags configured in the Input/Output tag tables will use the corresponding parameter values wired into the Implicit Input/Output tables



Mode = Server



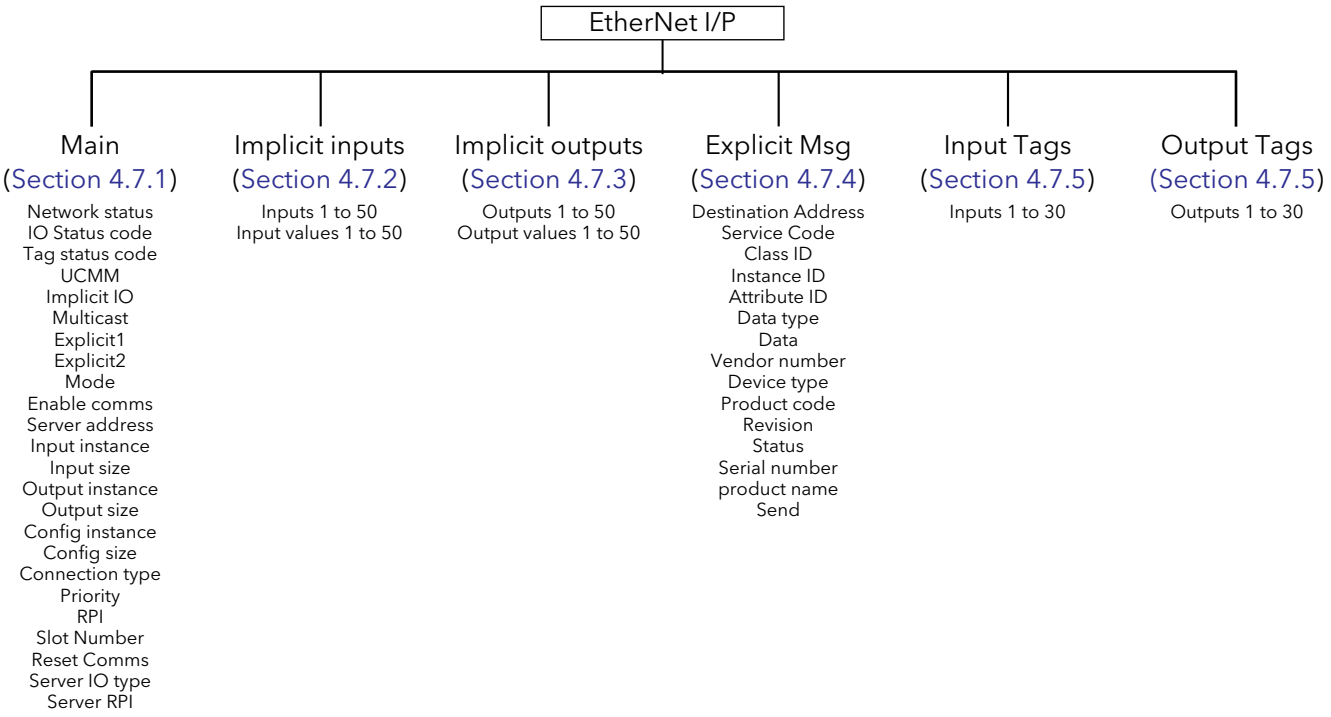
Mode = Client



Mode = Tag Client

Figure 4.7 EtherNet/IP Overview

4.7 ETHERNETI/P CONFIGURATION (Cont.)



4.7.1 Ethernet/IP Configuration Main menu

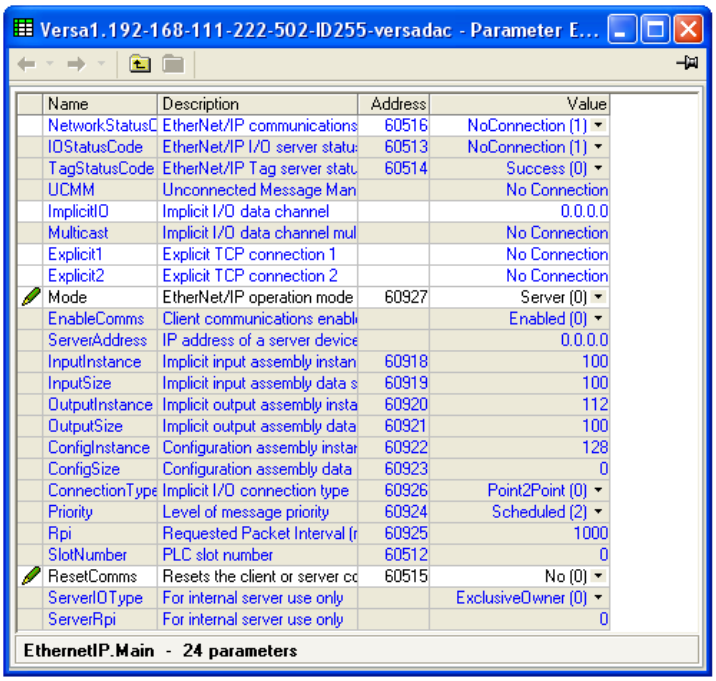


Figure 4.7.1 Ethernet/IP Main menu (all parameters)

Net Status Code — Network status (Server only)

0: Offline. The device is not communicating
1: No active CIP connections. Device is online but has no active CIP connections established
2: Online. Device is online and has at least one CIP connection established
3: Connection timeout. At least one CIP connection has timed out
4: Duplicate IP address. A duplicate IP address has been detected on the network
5: Server is initialising. The instrument is performing EtherNet/IP start up initialisation
10: Connection already in use. Connection already in use or duplicate forward open request
11: Not a supported combination. Transport class and trigger combination not supported
12: Ownership conflict. The connection could not be established as another client already has exclusive ownership
13: Target connection not found. The connection requested to be closed with a Forward Close request cannot be found
14: Invalid network connection parameter. The connection type, priority or owner was not recognised by the server device
15: Connection size mismatch. The size requested does not match the size required for a fixed size connection at the server device
16: Unsupported RPI. The requested O->T or T->O RPI cannot be supported by the server device
17: Manager out of connections. The connection manager cannot support any more connections, the limit has been reached
18: Vendor or id product code mismatch. The information specified in the electronic key logical segment does not match those of the device
19: Invalid produced or consumed application path. The produced or consumed application path specified in the connection path does not correspond to a valid application path within the server device
20: Invalid configuration application path. An application path specified for the configuration data does not correspond to a configuration application or is inconsistent with the consumed or produced application paths

4.7.1 ETHERNET I/P CONFIGURATION MAIN MENU (Cont.)

Net Status code (Cont.)

21: Non-listen only connection not opened. Connection request fails since there are no non-listen only connection types currently open

22: Server object out of connections. The maximum number of connections supported by this instance of the target object has been exceeded

23: Connection timed out. The current connection has timed out, the client must re-establish a new one to continue

24: Unconnected request timed out. The Unconnected Request Timed Out error occurs when the UCMM times out before a reply is received. This may happen for an Unconnected_Send, Forward_Open, or Forward_Close service. This normally means that the UCMM has tried a link a specific number of times, using a link specific retry timer, and has not received an acknowledgement or reply. This may be the result of congestion at the destination node or may be the result of a node not being powered up or present.

25: Unconnected parameter error. An invalid path parameter was found in the unconnected message

26: No buffer memory available. Insufficient connection buffer memory at the server device

27: Network bandwidth not available for data. This happens if any device that is a producer cannot allocate sufficient bandwidth for the connection on its link. This can only occur for scheduled priority connections.

28: No connection id filter available. This means that there is a device in the path, that contains a link consumer for the connection but does not have a consumed_connection _id filter available.

29: Not configured to send scheduled priority data. This error is returned if a device is asked to make a scheduled priority connection, but it is unable to send packets during the scheduled portion of the network update time interval.

30: Scheduled signature mismatch. The connection scheduling information in the originator device is not consistent with the connection scheduling information on the target network

31: Scheduled signature validation not possible. The connection scheduling information in the originator device can not be validated on the target network.

32: Port not available. A port specified in a port segment is not available or does not exist

33: Link address not valid. the link address specified in port segment is not valid

34: Invalid segment in connection path. The connection path cannot be decoded.

35: Forward close service connection path mismatch. The connection path in the Forward_Close service does not match the connection path in the connection being closed

36: Scheduling not specified. Either the Schedule Network Segment is not present or the Encoded Value in the Schedule Network Segment is invalid

37: Link address to self not valid. Under some conditions (depends on the device), a link address in the Port Segment which points to the same device (loopback to yourself) is invalid

38: Secondary resources not available. In a dual chassis redundant system, a connection request that is made to the primary system shall be duplicated on the secondary system. If the secondary system is unable to duplicate the connection request, then this extended status code is returned

39: Redundant connection mismatch. Failed to connect establish a redundant owner connection to the same target path, one or more paths were invalid

40: Unknown error. An error was returned from the server device that is not part of the CIP specification.

4.7.1 ETHERNET I/P CONFIGURATION MAIN MENU (Cont.)

Net status code (Cont.)	41: Unconfigured connection. A connection has been requested to the server device that has not been configured and the connection request does not contain a data segment for configuration. 42: Failed to establish a connection with the server. The client was unable to establish a connection with the server due to a network (not server) problem. 43: A fatal error has occurred. The EtherNet/IP may be running in an unpredictable manner.
IO Status Code	IO status (IO Client only). As above for Net status code.
Tag Status code	Tag status (Tag Client only). See table 4.7.1, below.
UCMM	Unconnected Message Manager. Displays the IP address of the device currently using this connection
Implicit I/O	Connected IO server IP address
Multicast	Connected IO server IP address (only if multicast selected)
Explicit 1	Connected client/server IP address
Explicit 2	Connected client/server IP address
Mode	Modes of operation 0: Server. The instrument is acting as an EtherNet/IP server device on the network 1: IO Client. The instrument is acting as an EtherNet/IP client device on the network, exchanging implicit IO data with a specified server device 2: Tag Client. The instrument is acting as an EtherNet/IP client device on the network, exchanging cyclic tag data with a specified server device
Enable comms	Enables or disables client communications to the configured server device. 0: Enabled. The client automatically attempts to establish a connection with the configured server device. 1: Disabled. The client never attempts to establish a connection with the configured server device.
Server Address	The instrument attempts to establish implicit I/O communications with this server device.
Input Instance	Input class instance number (client mode only)
Size (bytes)	The size in bytes of data that the client is expecting to read from the implicit input.
Output Instance	Output class instance number (client mode only)
Output Size	The size of data that the client is expecting to write to the server.
Connection Type	Connection type (client mode only). 0: Point To Point. The implicit I/O data is directly communicated between the client and server devices only. 1: Multicast. All implicit output data from the instrument is sent to a pre-defined multicast IP address where a number of clients can register their interest. This is supported for CIP transport classes 0 and 1 connections only.
Priority	CIP defines 4 levels of message priority, all levels are supported in both client and server modes. 0: Low. No CIP recommendations at present. 1: High. Typically used for I/O data 2: Scheduled. Typically used for Safety I/O data 3: Urgent. Typically used for CIP motion control data.
Rpi	IO connection speed. The RPI range for both server and client modes is 10 milliseconds to 10 seconds inclusive.
Slot Number	PLC slot number (zero indexed) when communicating using tags
Reset Comms	Applies all changes to the EtherNet/IP stack at the same time. Or can be used to reset communications using the current configuration.

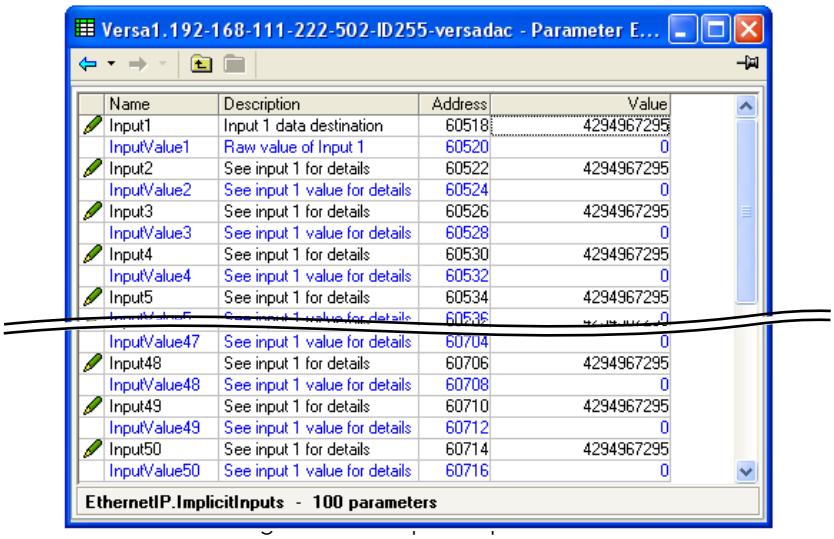
4.7 ETHERNET I/P CONFIGURATION MAIN MENU (Cont.)

0	Success. Service was successful
1	Connection Failed. A connection in the path failed
2	Invalid Parameter. A parameter associated with the request was invalid
3	Memory Unavailable. No available resources in the server to service the request
4	Path Segment Error. The syntax of all or some of the path was not understood
5	Path Dest. Error. The path references an unknown object, class or instance
6	Partial Transfer. Only part of the expected data was transferred
7	Connection Lost. The messaging connection was lost
8	Service Unsupported. Undefined service for requested object
9	Invalid Attribute. Invalid attribute data detected
10	Attribute Error. An attribute in the response has a non zero status
11	Already Requested. The object is already in the mode/state being requested
12	Object Conflict. The object cannot perform the requested service
13	Already Exists. The requested instance or object already exists
14	Attribute Error. Request to modify a non modifiable attribute received
15	No Privileges. Permission/Privilege check failed
16	State Conflict. The current state or mode prohibits the execution of the requested service
17	Reply To Large. Response buffer too small for response data
18	Fragmented Value. For example this service request will return only half a REAL data type
19	Not Enough Data. The service does not provide enough data to complete the request
20	Invalid Attribute. Requested attribute is not supported
21	Too Much Data. The service supplied more than was expected
22	Object Non-Exist. The object specified does not exist in the device
23	Seq. Fragmentation. The fragmentation sequence for this service is not active
24	No Attribute Data. The attribute data for this object was not saved at the server prior to this request service
25	Data Store Failure. The attribute data for this object was not saved due to a failure during the attempt
26	Routing Failed. The service request packet was too large for transmission on a network in the path to the destination. The routing device was forced to abort the service
27	Routing Failed. The service request packet was too large for transmission on a network in the path to the destination. The routing device was forced to abort the service
28	Missing Attribute. The service did not supply an attribute in a list of attributes that was needed by the service to perform the requested behaviour
29	Invalid Attribute. The service is returning the list of attributes supplied with status information for those attributes that were invalid
30	Embedded Tag Error. An embedded service resulted in an error. This is most commonly an incorrectly formatted tag name
31	Vendor Error. A vendor specific error has encountered
32	Invalid Parameter. A parameter associated with the request was invalid
33	Write Once Error. An attempt to write to a write once only parameter occurred
34	Invalid Reply. An invalid reply was received
35	Buffer Overflow. The message received is larger than the receiving buffer
36	Format Error. The format of the received message is not supported
37	Key Path Failure. The key segment in the path does not match destination key
38	Path Size Error. The size of the path in the request is too large
39	Unexpected Attribute. Unable to set the attribute at this time
40	Invalid Member Id. The requested member id does not match class object
41	Member Is R/O. A request to modify a R/O member was received
42	Group 2 Server. Group 2 DeviceNet server response
43	Translation Error. A CIP modbus translator request failed
44	Attribute Is R/O. A request to read a non readable attribute was received
64	No Tags Found. There were no tags configured in the input or output tables
65	Invalid Config. The total length in characters of all the tags in this table will cause the PLC to exceed its internal buffer of 500 bytes. To eliminate this problem, reduce the length of some or all tag names

Table 4.7.1 Tag Status code definition

4.7.2 Implicit inputs

This allows parameter names to be 'click-dragged' into the table to provide destinations for the incoming data.



4.7.3 Implicit outputs

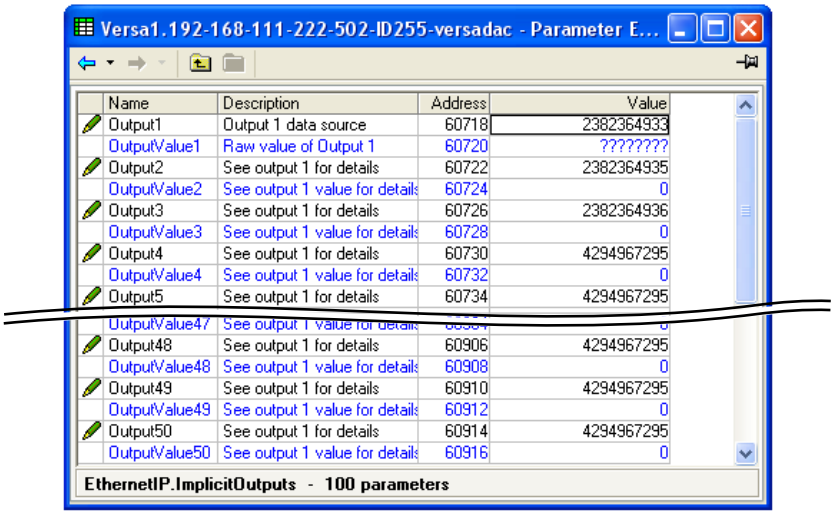


Figure 4.7.3 Implicit output menu

Output1 — Parameter names can be click-dragged into this table to act as sources for data to be sent to the EtherNet/IP device. Any necessary resolution formatting will be automatically applied using this wired parameter's configuration prior to being sent.

Output Value1 — This is implicit data being sent to the EtherNet/IP device. The value is displayed here in 'raw' format, and is updated only when Output 1 has a valid wired parameter.

Outputs 2 to 50 — As for Output1

Output Values 2 to 50 — As for OutputValue1

4.7.4 Explicit inputs/outputs

When configured as a server, versadac Ethernet/IP can accept two simultaneous Explicit TCP connections to its explicit application object, and that has the class ID= A2 (162 decimal). The instance ID is the Modbus address of the parameter and the Attribute is always = 1. Explicit service codes hex10 (decimal 16) and 0E (14) are both supported, for writing and reading single attributes respectively

Service code		Class ID		Instance ID	Attribute
Hex	Dec	Hex	Dec	Decimal	
0010	16	A2	162	1-65535	1
000E	14	A2	162	1-65535	1

Table 4.7.4 Explicit data specification

When configured as a client, two separate Explicit messaging connections are available but the iTools interface only allow one explicit read or write message to a single server device at any one time.

The instance ID and the data type are taken from the server manufacturer's data. Once all the information has been entered, the read is requested by setting 'Send' to 'Yes'. The Data field contains the response.

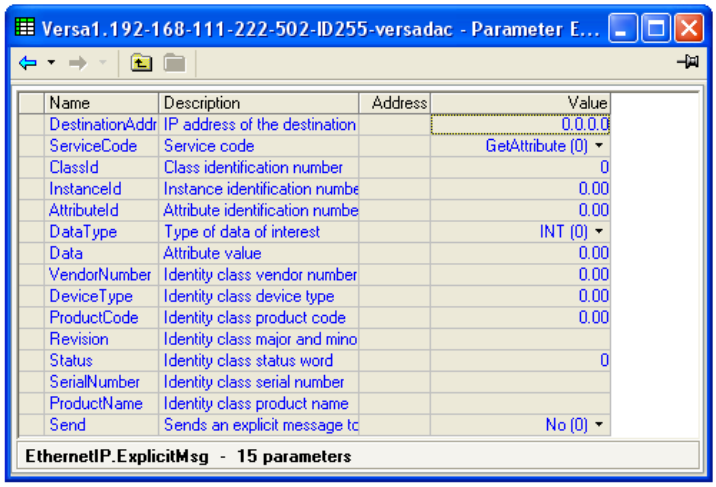


Figure 4.7.4 Explicit messaging menu

Destination Addr	The address to which the message is to be sent.
Service Code	The service code informs the server what action is to be taken.
	0: Get Attribute. Get a single attribute value from a class object.
	1: Set Attribute. Set a single attribute value from a class object.
	2: Get Identity. Get all attributes from the identity class object.
Class ID	The class identification number for the attribute.
Instance ID	The instance number of the class for the attribute.
Attribute ID	The attribute index for the data.
Data Type	The type of data being written or read.
	0: INT. 16 bit signed integer.
	1: UINT. 16 bit unsigned integer.
	2: SINT. 16 bit signed short integer.
	3: USINT. 16 bit unsigned short integer.
	4: BOOL. 8 bit boolean.
	5: DINT. 32 bit signed double integer.
	6: UDINT. 32 bit unsigned double integer.
	7: REAL. 32 bit floating point.

4.7.4 EXPLICIT INPUTS/OUTPUTS (Cont.)

Data	The value of the attribute.
Vendor Number	Identity class vendor number.
Device Type	Identity class device type.
Product Code	Identity class product code.RevisionIdentity class major and minor revision.
Status	See the server device manual for more details on how the status word is formatted
Serial Number	Identity class serial number (hex)
Product Name	Identity class product name
Send	1 (Yes) = send message to the configured server device.

4.7.5 Using tags

When acting as servers, many PLCs present their data in a tag format instead of implicit data format. For this reason, when the client is configured as Mode = 'Client (Tags)', (section 4.7.1), 30 input and 30 output tags become available to the user.

This allows tag names to be typed in, input tags 1 to 30 being associated with implicit inputs 1to 30 respectively and output tags 1 to 30 being associated with implicit outputs 1to 30 respectively.

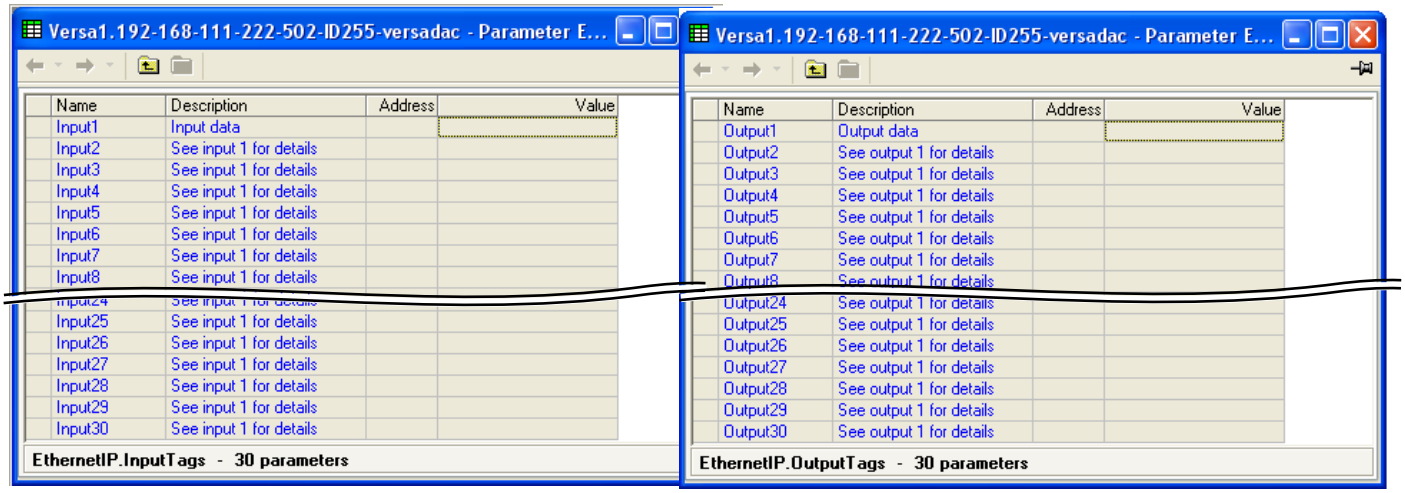


Figure 4.7.5 tag tables.

Notes:

1. Most PLCs have a data buffer limit of 500 Bytes. The total number of bytes being used is given by the equation: Total number of data bytes = (tag length + 10) × the number of requested tags.
2. Input data direction is always to the instrument:
   in server mode input data is written to the instrument from the client
   in client mode, input data is read by the instrument from the server device.
3. Output data direction is always from the instrument:
   in server mode output data is written to the client from the instrument
   in client mode, output data is read by the server from the instrument.

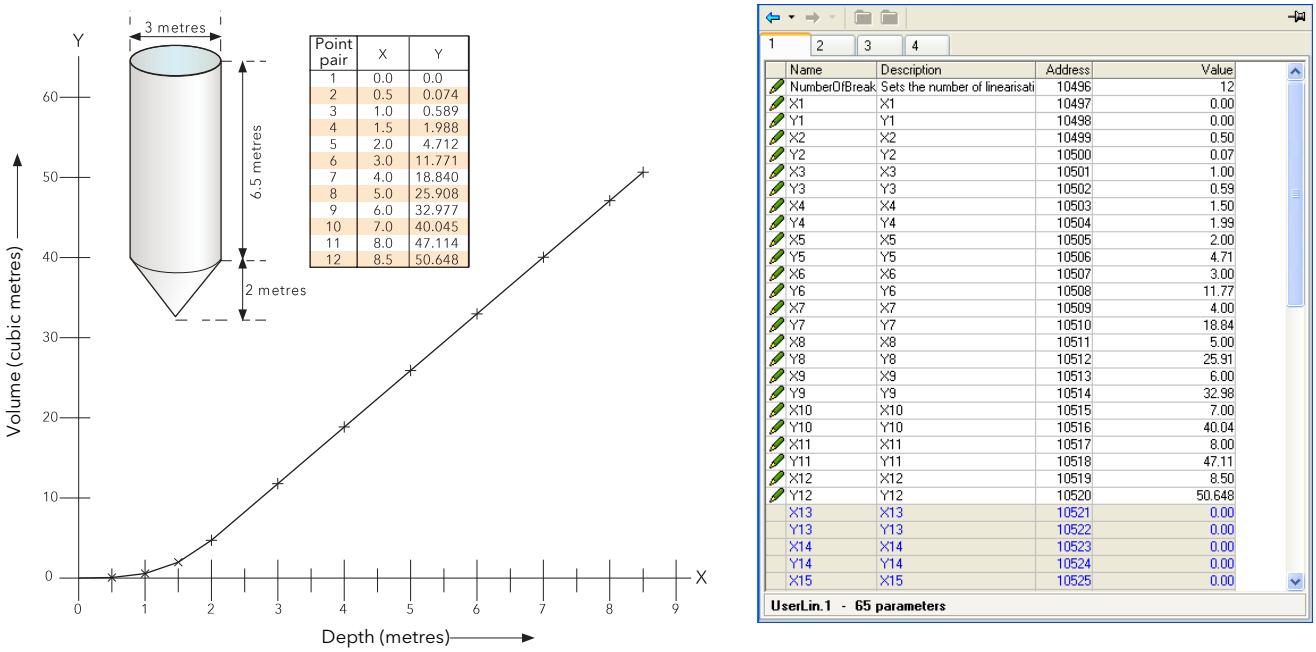
4.8 USER LIN

Allows the entry of up to four user linearisation tables, any one of which can be selected as 'Lin Type' in Channel configuration (section 4.4.1). Configuration consists of defining the number of points to be included (2 to 32) and then entering an X and a Y value for each point, where X values are the inputs and the Y values are the resulting outputs.

4.8.1 User linearisation table rules

1. Tables must be monotonic - i.e. there may not be more than one X value with the same Y value assigned to it.
2 Each X value must be greater than the preceding one.
3. Each Y value must be greater than the preceding one.
4. If units other than temperature units are to be displayed, the channel scale high and scale low values should be set to the same as the range high and low values, and the required scale units entered.

Figure 4.8.1 shows the configuration table for an imaginary cylinder example.



Point pair	X	Y
1	0.0	0.0
2	0.5	0.074
3	1.0	0.589
4	1.5	1.988
5	2.0	4.712
6	3.0	11.771
7	4.0	18.840
8	5.0	25.908
9	6.0	32.977
10	7.0	40.045
11	8.0	47.114
12	8.5	50.648

1 2 3 4

Name	Description	Address	Value
NumberOfBreak	Sets the number of linearisati	10496	12
X1	X1	10497	0.00
Y1	Y1	10498	0.00
X2	X2	10499	0.50
Y2	Y2	10500	0.07
X3	X3	10501	1.00
Y3	Y3	10502	0.59
X4	X4	10503	1.50
Y4	Y4	10504	1.99
X5	X5	10505	2.00
Y5	Y5	10506	4.71
X6	X6	10507	3.00
Y6	Y6	10508	11.77
X7	X7	10509	4.00
Y7	Y7	10510	18.84
X8	X8	10511	5.00
Y8	Y8	10512	25.91
X9	X9	10513	6.00
Y9	Y9	10514	32.98
X10	X10	10515	7.00
Y10	Y10	10516	40.04
X11	X11	10517	8.00
Y11	Y11	10518	47.11
X12	X12	10519	8.50
Y12	Y12	10520	50.648
X13	X13	10521	0.00
Y13	Y13	10522	0.00
X14	X14	10523	0.00
Y14	Y14	10524	0.00
X15	X15	10525	0.00

UserLin.1 - 65 parameters

Figure 4.8.1 User Linearisation table example

When configuring a channel (section 4.4.1) to use a User linearisation table:
If Type = Thermocouple or RTD, then Range High/Low must be set to the highest and lowest 'Y' values to be used, respectively. The instrument automatically looks up the associated 'X' mV or Ohms values.
If Type = mV, V or mA, then Range High/Low must be set to the highest and lowest 'Y' values to be used, respectively. Input High/Low should be set to the highest and lowest 'X' values in the table, respectively.

4.9 CUSTOM MESSAGES

This feature allows the entry of up to 50 messages for sending to the history file, when triggered by a wired source (e.g. an alarm going active).

Up to three parameter values may be embedded in messages in the format [*Address*], where 'Address' is the decimal Modbus address of the parameter.

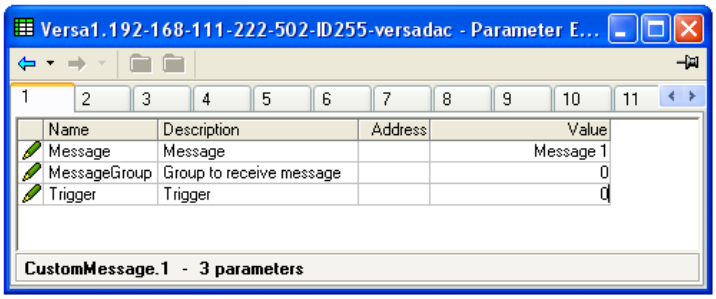


Figure 4.9 Message menu

4.10 ZIRCONIA BLOCK OPTION

Not available this software release.

4.11 STERILISER BLOCK OPTION

This (chargeable option) block provides a means of recording complete sterilisation cycles, including for example, venting and pumping as well as the actual sterilising period. Two instances are available, which use Batch block 1 and Batch block 2 respectively.

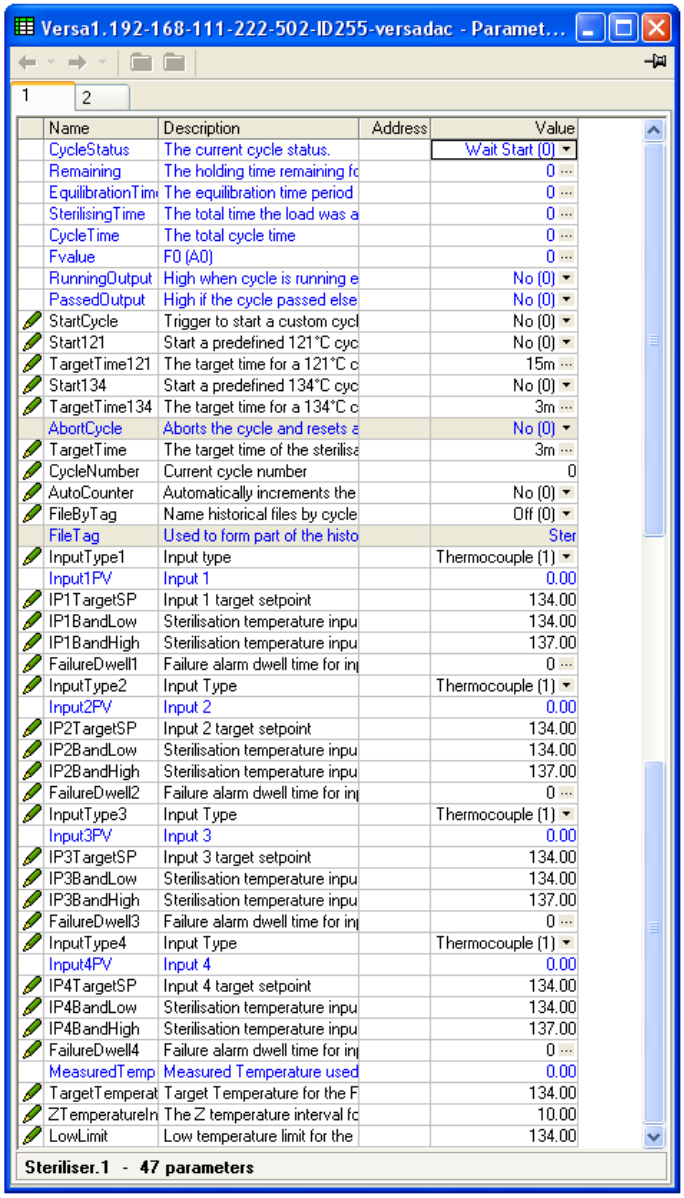
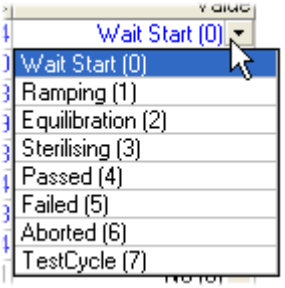
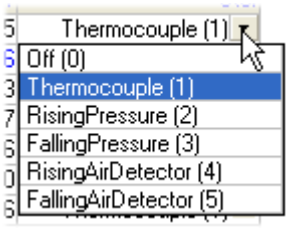


Figure 4.11 Steriliser block configuration menu

4.11 STERILISER BLOCK OPTION (Cont.)



Cycle Status	0: Wait start. The cycle is waiting to be started 1: Ramping. Waiting for input 1 to reach its target setpoint. 2: Equilibration. Currently in the equilibration period 3: Sterilising. Currently in the sterilising phase 4: Passed. The cycle has completed successfully 5: Failed. The cycle has failed 6: Aborted. The cycle has been aborted. 7: Test cycle. A test cycle is in progress
Remaining	The sterilising (holding) time remaining for the current cycle
Equilibration Time	The equilibration time period for the current cycle
Sterilising Time	The time for which the load has currently been at sterilisation conditions
Cycle Time	The total cycle time, from start to finish.
F value)	The current F_0, F_H or A_0 value
Running Output	1 (Yes) = Cycle running; 0 (No) = Cycle not running
Passed Output	1 (Yes) = Output passed; 0 (No) = Output did not pass
Start Cycle	Trigger to start a custom cycle (i.e. one for which High and Low band and / or Target setpoint have been changed from their default values.) 1 (Yes) = start.
Start 121	Trigger to start a pre-defined 121°C cycle (Setpoint, Band Low/Band High etc. values are set to their 121° defaults when the cycle is initiated). 1 (Yes) = start.
Target Time 121	Target time for a121°C cycle. Automatically copied to the 'Target Time' field when Start 121°C requested. Scrollable value in hh:mm:ss format.
Start 134	Trigger to start a pre-defined 134°C cycle (Setpoint, Band Low/Band High etc. values are set to their 134° defaults when the cycle is initiated)
134°C Time	Target time for a134°C cycle. Automatically copied to the 'Target Time' field when Start 134°C requested. Scrollable value in hh:mm:ss format.
Target Time 134	The time for which the input values must remain at their sterilisation values in order that the cycle shall pass. The cycle fails if any input moves outside its specified band limits during the Target Time. Scrollable value in hh:mm:ss format.
Target Time	All inputs must be within specification for this period of time, in order for the cycle to be completed successfully.
Cycle Number	Each execution of the Steriliser block uses a unique cycle number. This may be entered manually, or can be set to increment automatically by setting 'Auto Counter' (below) to 1 (Yes).
Auto Counter	1 (Yes) causes the Cycle Number (above) to increment automatically each time a new cycle is initiated. If Auto counter = 'Yes', the Cycle Number forms part of the historical data and can be used to help identify data during later review.
File By Tag*	'Tick' ensures that each cycle is recorded in its own unique history file identified by cycle number and 'File tag' (below). 0 = off; 1 = On.
File tag	This field allows a four-character identifier to be entered to be used with the Cycle Number (above) to identify the history file.
Input n Type	0: Off — This input is not included in steriliser monitoring calculations 1: Thermocouple — Degrees Celsius input 2: Rising pressure — A mBar pressure input with a rising pressure expected during the cycle. This pressure input would normally be synchronised with a temperature input, in the same chamber, when performing a 121°C or 134°C cycle.



* Note...To use this feature, the associated Batch must be set to steriliser mode. For steriliser 1, the associated batch is Batch 1; for steriliser 2, the associated batch is Batch 2

4.11 STERILISER BLOCK OPTION (Cont.)

Input Type (Cont.)	3: Falling pressure	As 'Rising Pressure' above, but with a falling pressure expected during the cycle
	4: Rise Air Detect	A mBar pressure input with a rising pressure expected during the cycle. This pressure input is not synchronised with a temperature input when performing a 121°C or 134°C cycle, as it is (typically) an outside chamber pressure.
	5: Fall Air Detect	As 'Rise Air Detect' above, but with a falling pressure expected during the cycle
Input n PV	Input 'n' value. See note 1 below.	
IP 'n' Target SP	Target setpoint for this input. See note 2 below.	
IP 'n' Band Low/High	The low and high steriliser temperature or pressure band for this input. See note 2 below. Values are effective only during Sterilisation mode.	
Failure Dwell n	A failure alarm is set if this input is out of band range for more than the Failure Dwell time. Scrollable value in hh:mm:ss format.	

Notes:

1. n = 1 to 4, where typically, inputs 1 to 3 are temperature inputs and input 4 is a pressure input.
2. Target SP and Band High/Low values are set to their relevant default values when a 121°C or 134°C cycle is initiated.

Measured Temp.	For F_0 or A_0 calculations, this value must be in °C. Typically wired to an input channel PV.
Target Temp.	For F_0 or A_0 calculations, the target temperature. This typically is the same value as the Target SP (above).
Z Temperature interval	For F_0 or A_0 calculations this is a temperature interval representing a factor-of-10 increase in killing efficiency. Z = 10°C for F_0 and A_0, and 20°C for F_H
Low Limit	The temperature below which F_0 or A_0 calculations are suspended.

4.12 HUMIDITY BLOCK OPTION

The (chargeable option) Humidity block uses wet and dry bulb temperatures, and atmospheric pressure inputs to derive values for relative humidity and dew point. Two blocks are available for use.

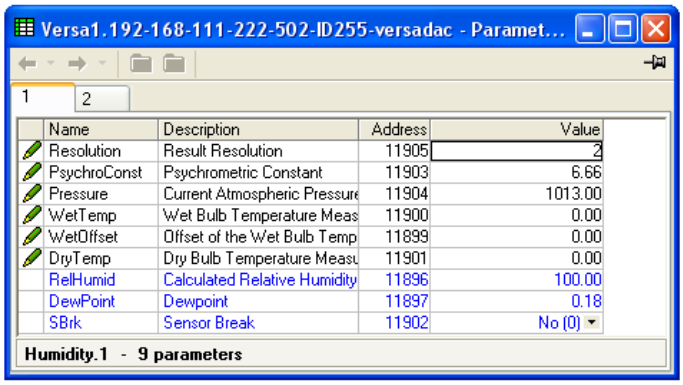


Figure 4.12 Humidity calculation configuration

Resolution	The number of decimal places for the Relative humidity and Dew point displays (0 to 4).
Psychro Const	The psychrometric constant (default = 6.66×10^{-4}) (See note below).
Pressure	The current atmospheric pressure in mBar.
Wet Temp	The wet bulb thermometer temperature.
Wet Offset	Offset for the wet bulb temperature.
Dry Temp	The dry bulb thermometer temperature.
Rel Humid	The relative humidity value calculated from the Wet temperature, the Dry temperature and the Pressure inputs. The number of decimal places depends on the Resolution setting.
Dew Point	The dew point value calculated from the Wet temperature, the Dry temperature and the Pressure inputs. The number of decimal places depends on the Resolution setting.
S Brk	1 (Yes) implies that a break has occurred between one (or more) of the temperature or pressure transducers and its input.

Note: The default value 6.66 may be edited, but the multiplier is always 10^{-4} (i.e. it cannot be edited).

4.13 BCD INPUT BLOCK

This block derives decimal and two-decade binary coded decimal (BCD) values from eight discrete inputs, where input 1 is the least significant input ($2^0 = 1$) and input 8 is the most significant ($2^7 = 128$). The example below shows that for inputs 2, 4, 6 and 8 high, the decimal input value is 170, but the BCD value is invalid. In any such case, the maximum BCD value for each decade is limited to 9.

Input number	8	7	6	5	4	3	2	1	
Input status	1	0	1	0	1	0	1	0	
Decimal input	128	0	32	0	8	0	2	0	(=170)
BCD output	1	0	1	0	1	0	1	0	(=10, 10)

Figure 4.13 BCD block example

4.13.1 Input rules

Valid BCD outputs are produced only with the following inputs set:

1. Any combination of inputs 1, 2, 3, 5, 6 and 7
2. Any combination of Inputs 1, 4, 5 and 8

4.13.2 Configuration

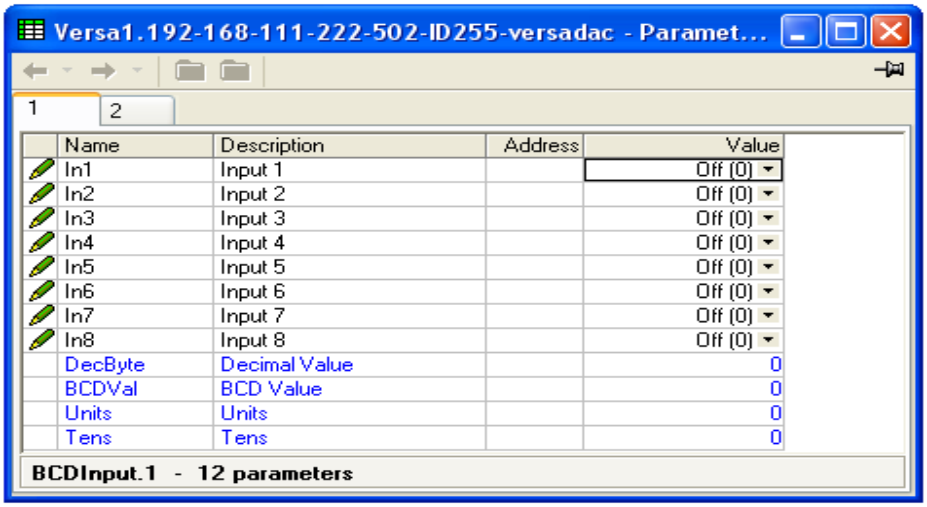


Figure 4.13.2 BCD input block configuration

PARAMETERS

In 'n'	Digital inputs 1 to 8. 0 = Off; 1 = On
Dec Byte	The value defined by the active inputs, where input 1 = 1, when active, input 2 = 2, input 3 = 4, input 4 = 8 and so on.
BCD Val	A two digit output being the binary coded decimal version of the input.
BCD Units	This least significant (right-most) digit represents the value of inputs 1 to 4, where input 1 = 1, input 2 = 2, input 3 = 4, input 4 = 8. Maximum value = 9, even if input is greater than 9.
BCD Tens	This most significant (left-most) digit represents the value of inputs 5 to 8, where input 5 = 1, input 6 = 2, input 7 = 4, input 8 = 8. Maximum value = 9, even if input is greater than 9.

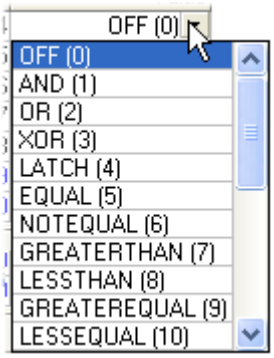
4.14 LGC (2 INPUT) BLOCK

This block allows a number of logic and comparison operations to be performed on a pair of inputs. For logic functions, the inputs can be inverted to allow, for example, a NOR function to be implemented by inverting the inputs to an AND function. 12 two-input logic blocks are available.

Figure 4.14 Two-input logic block configuration

Operation

0 = Off
1 = AND
2 = OR,
3 = XOR
4 = LATCH (boolean values only)
5 = Equal (Out is 1 (On) if In1 = In2)
6 = Not equal (Out is 1 (On) if In1 ≠ In2)
7 = Greater than (Out is 1 (On) if In1 > In2}
8 = Less than (Out is 1 (On) if In1 < In2)
9 = Greater than (Out is 1 (On) if In1 ≥ In2)
10 =Less than (Out is 1 (On) if In1 ≤ In2)

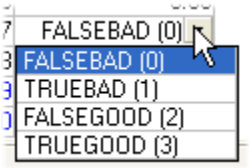


In1(2)

The inputs to the specified operation. For inverted inputs (below), this shows the 'real' (non-inverted) state.

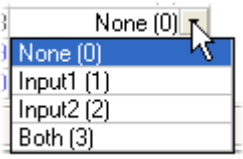
Fallback Type

Configures the output and status values to be used if either input has a status other than 'Good'.
0 = FalseBad: If Output = False then Status = Bad
1 = TrueBad: If Output = True then Status = Bad
2 = FalseGood: If Output = False then Status = Good
3 = TrueGood: If Output = True then Status = Good



Invert

For logic operators only allows neither, either or both inputs to be inverted. In1 and In2 show the non-inverted state.
0 = Invert neither; 1 = Invert In1; 2 = Invert In2;
3 = Invert In1 and In2



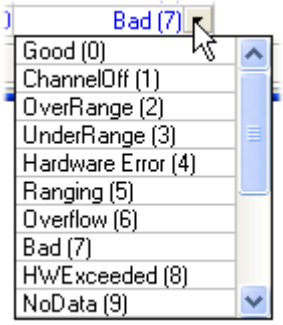
Out

1 (On) or 0 (Off) depending on input states etc.

Output Status

The status of the result ('Ok' or 'Error').

0: Good. The process variable is ok
1: Off. Channel is configured to be off
2: Over range. Input signal is greater than the selected hardware range upper limit
3: Under range. Input signal is less than the selected hardware range lower limit
4: Hardware error. Input hardware failure



4.14 LOGIC (2 INPUT) BLOCK (Cont.)

Output Status (Cont.)

5: Ranging. Input hardware is being ranged i.e. being set-up as required by the range configuration

6: Overflow. Process variable overflow, possibly due to calculation attempting to add a small number to a relatively large number

7: Bad. The process variable is not ok and should not be used

8: Hardware exceeded. The hardware capabilities have been exceeded at the point of configuration, for example configuration set to 0 to 40V when input hardware is capable of up to 12V

9: No data. Insufficient input samples to perform calculation

4.15 LOGIC (8 INPUT) BLOCK

This block allows AND, OR and cascading* XOR logic operations to be carried out on up to eight inputs.

*Cascading XOR example for inputs 1 to 4: (((Input1 ⊕ Input2) ⊕ Input3) ⊕ Input4). There are two Logic (8-input) blocks available for use.

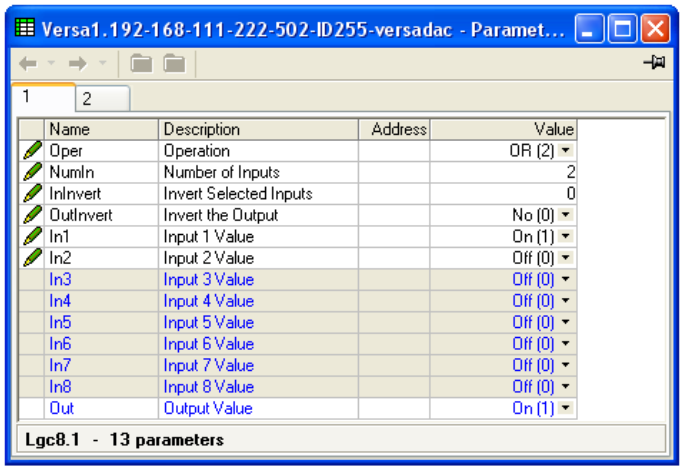


Figure 4.15 Eight input logic block configuration

4.15.1 Parameters

Operation	1 = AND; 2 = OR; 3 = XOR
Num In	The number of inputs to the logic operator
In Invert	Allows the user to invert individual inputs, as described below.
Out Invert	'Yes' inverts the output status
In1	The status of input 1, ignoring the Invert status. 0 = off; 1 = on.
In 2 to N	As for input 1, where N = the value of the 'Number of Inputs' parameter.
Output	On or Off. Includes the effect of 'Invert Output' status.

INPUT INVERSION

Use a binary value to enter the input(s) to be inverted. 1 = Invert In1; 2 = Invert In2; 3 = Invert In1 and In 2 and so on, as shown in table 4.15.3, below.

4.15.2 Schematic

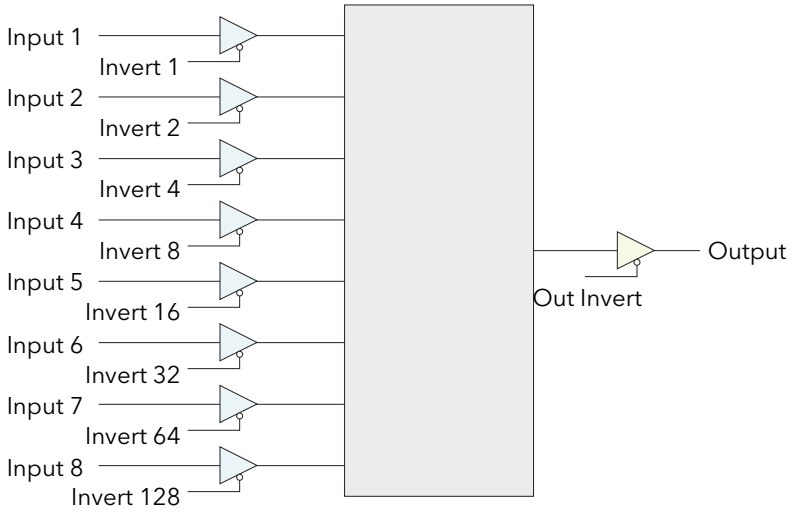


Figure 4.15.2 Logic (8 input) block schematic

4.15.3 Invert input table

Over a communications link, the inversion status is transmitted as a decimal value, which can be encoded/ decoded using the following table. ('N' = this input not inverted).

Input 8	7	6	5	4	3	2	1	Hex	Dec	Input 8	7	6	5	4	3	2	1	Hex	Dec	Input 8	7	6	5	4	3	2	1	Hex	Dec	Input 8	7	6	5	4	3	2	1	Hex	Dec
N	N	N	N	N	N	N	N	00	0	N	**7**	N	N	N	N	N	N	40	64	**8**	N	N	N	N	N	N	N	80	128	**8**	**7**	N	N	N	N	N	N	C0	192
N	N	N	N	N	N	N	**1**	01	1	N	**7**	N	N	N	N	N	**1**	41	65	**8**	N	N	N	N	N	N	**1**	81	129	**8**	**7**	N	N	N	N	N	**1**	C1	193
N	N	N	N	N	N	**2**	N	02	2	N	**7**	N	N	N	N	**2**	N	42	66	**8**	N	N	N	N	N	**2**	N	82	130	**8**	**7**	N	N	N	N	**2**	N	C2	194
N	N	N	N	N	N	**2**	**1**	03	3	N	**7**	N	N	N	N	**2**	**1**	43	67	**8**	N	N	N	N	N	**2**	**1**	83	131	**8**	**7**	N	N	N	N	**2**	**1**	C3	195
N	N	N	N	N	**3**	N	N	04	4	N	**7**	N	N	N	**3**	N	N	44	68	**8**	N	N	N	N	**3**	N	N	84	132	**8**	**7**	N	N	N	**3**	N	N	C4	196
N	N	N	N	N	**3**	N	**1**	05	5	N	**7**	N	N	N	**3**	N	**1**	45	69	**8**	N	N	N	N	**3**	N	**1**	85	133	**8**	**7**	N	N	N	**3**	N	**1**	C5	197
N	N	N	N	N	**3**	**2**	N	06	6	N	**7**	N	N	N	**3**	**2**	N	46	70	**8**	N	N	N	N	**3**	**2**	N	86	134	**8**	**7**	N	N	N	**3**	**2**	N	C6	198
N	N	N	N	N	**3**	**2**	**1**	07	7	N	**7**	N	N	N	**3**	**2**	**1**	47	71	**8**	N	N	N	N	**3**	**2**	**1**	87	135	**8**	**7**	N	N	N	**3**	**2**	**1**	C7	199
N	N	N	N	**4**	N	N	N	08	8	N	**7**	N	N	**4**	N	N	N	48	72	**8**	N	N	N	**4**	N	N	N	88	136	**8**	**7**	N	N	**4**	N	N	N	C8	200
N	N	N	N	**4**	N	N	**1**	09	9	N	**7**	N	N	**4**	N	N	**1**	49	73	**8**	N	N	N	**4**	N	N	**1**	89	137	**8**	**7**	N	N	**4**	N	N	**1**	C9	201
N	N	N	N	**4**	N	**2**	N	0A	10	N	**7**	N	N	**4**	N	**2**	N	4A	74	**8**	N	N	N	**4**	N	**2**	N	8A	138	**8**	**7**	N	N	**4**	N	**2**	N	CA	202
N	N	N	N	**4**	N	**2**	**1**	0B	11	N	**7**	N	N	**4**	N	**2**	**1**	4B	75	**8**	N	N	N	**4**	N	**2**	**1**	8B	139	**8**	**7**	N	N	**4**	N	**2**	**1**	CB	203
N	N	N	N	**4**	**3**	N	N	0C	12	N	**7**	N	N	**4**	**3**	N	N	4C	76	**8**	N	N	N	**4**	**3**	N	N	8C	140	**8**	**7**	N	N	**4**	**3**	N	N	CC	204
N	N	N	N	**4**	**3**	N	**1**	0D	13	N	**7**	N	N	**4**	**3**	N	**1**	4D	77	**8**	N	N	N	**4**	**3**	N	**1**	8D	141	**8**	**7**	N	N	**4**	**3**	N	**1**	CD	205
N	N	N	N	**4**	**3**	**2**	N	0E	14	N	**7**	N	N	**4**	**3**	**2**	N	4E	78	**8**	N	N	N	**4**	**3**	**2**	N	8E	142	**8**	**7**	N	N	**4**	**3**	**2**	N	CE	206
N	N	N	N	**4**	**3**	**2**	**1**	0F	15	N	**7**	N	N	**4**	**3**	**2**	**1**	4F	79	**8**	N	N	N	**4**	**3**	**2**	**1**	8F	143	**8**	**7**	N	N	**4**	**3**	**2**	**1**	CF	207
N	N	N	**5**	N	N	N	N	10	16	N	**7**	N	**5**	N	N	N	N	50	80	**8**	N	N	**5**	N	N	N	N	90	144	**8**	**7**	N	**5**	N	N	N	N	D0	208
N	N	N	**5**	N	N	N	**1**	11	17	N	**7**	N	**5**	N	N	N	**1**	51	81	**8**	N	N	**5**	N	N	N	**1**	91	145	**8**	**7**	N	**5**	N	N	N	**1**	D1	209
N	N	N	**5**	N	N	**2**	N	12	18	N	**7**	N	**5**	N	N	**2**	N	52	82	**8**	N	N	**5**	N	N	**2**	N	92	146	**8**	**7**	N	**5**	N	N	**2**	N	D2	210
N	N	N	**5**	N	N	**2**	**1**	13	19	N	**7**	N	**5**	N	N	**2**	**1**	53	83	**8**	N	N	**5**	N	N	**2**	**1**	93	147	**8**	**7**	N	**5**	N	N	**2**	**1**	D3	211
N	N	N	**5**	N	**3**	N	N	14	20	N	**7**	N	**5**	N	**3**	N	N	54	84	**8**	N	N	**5**	N	**3**	N	N	94	148	**8**	**7**	N	**5**	N	**3**	N	N	D4	212
N	N	N	**5**	N	**3**	N	**1**	15	21	N	**7**	N	**5**	N	**3**	N	**1**	55	85	**8**	N	N	**5**	N	**3**	N	**1**	95	149	**8**	**7**	N	**5**	N	**3**	N	**1**	D5	213
N	N	N	**5**	N	**3**	**2**	N	16	22	N	**7**	N	**5**	N	**3**	**2**	N	56	86	**8**	N	N	**5**	N	**3**	**2**	N	96	150	**8**	**7**	N	**5**	N	**3**	**2**	N	D6	214
N	N	N	**5**	N	**3**	**2**	**1**	17	23	N	**7**	N	**5**	N	**3**	**2**	**1**	57	87	**8**	N	N	**5**	N	**3**	**2**	**1**	97	151	**8**	**7**	N	**5**	N	**3**	**2**	**1**	D7	215
N	N	N	**5**	**4**	N	N	N	18	24	N	**7**	N	**5**	**4**	N	N	N	58	88	**8**	N	N	**5**	**4**	N	N	N	98	152	**8**	**7**	N	**5**	**4**	N	N	N	D8	216
N	N	N	**5**	**4**	N	N	**1**	19	25	N	**7**	N	**5**	**4**	N	N	**1**	59	89	**8**	N	N	**5**	**4**	N	N	**1**	99	153	**8**	**7**	N	**5**	**4**	N	N	**1**	D9	217
N	N	N	**5**	**4**	N	**2**	N	1A	26	N	**7**	N	**5**	**4**	N	**2**	N	5A	90	**8**	N	N	**5**	**4**	N	**2**	N	9A	154	**8**	**7**	N	**5**	**4**	N	**2**	N	DA	218
N	N	N	**5**	**4**	N	**2**	**1**	1B	27	N	**7**	N	**5**	**4**	N	**2**	**1**	5B	91	**8**	N	N	**5**	**4**	N	**2**	**1**	9B	155	**8**	**7**	N	**5**	**4**	N	**2**	**1**	DB	219
N	N	N	**5**	**4**	**3**	N	N	1C	28	N	**7**	N	**5**	**4**	**3**	N	N	5C	92	**8**	N	N	**5**	**4**	**3**	N	N	9C	156	**8**	**7**	N	**5**	**4**	**3**	N	N	DC	220
N	N	N	**5**	**4**	**3**	N	**1**	1D	29	N	**7**	N	**5**	**4**	**3**	N	**1**	5D	93	**8**	N	N	**5**	**4**	**3**	N	**1**	9D	157	**8**	**7**	N	**5**	**4**	**3**	N	**1**	DD	221
N	N	N	**5**	**4**	**3**	**2**	N	1E	30	N	**7**	N	**5**	**4**	**3**	**2**	N	5E	94	**8**	N	N	**5**	**4**	**3**	**2**	N	9E	158	**8**	**7**	N	**5**	**4**	**3**	**2**	N	DE	222
N	N	N	**5**	**4**	**3**	**2**	**1**	1F	31	N	**7**	N	**5**	**4**	**3**	**2**	**1**	5F	95	**8**	N	N	**5**	**4**	**3**	**2**	**1**	9F	159	**8**	**7**	N	**5**	**4**	**3**	**2**	**1**	DF	223
N	N	**6**	N	N	N	N	N	20	32	N	**7**	**6**	N	N	N	N	N	60	96	**8**	N	**6**	N	N	N	N	N	A0	160	**8**	**7**	**6**	N	N	N	N	N	E0	224
N	N	**6**	N	N	N	N	**1**	21	33	N	**7**	**6**	N	N	N	N	**1**	61	97	**8**	N	**6**	N	N	N	N	**1**	A1	161	**8**	**7**	**6**	N	N	N	N	**1**	E1	225
N	N	**6**	N	N	N	**2**	N	22	34	N	**7**	**6**	N	N	N	**2**	N	62	98	**8**	N	**6**	N	N	N	**2**	N	A2	162	**8**	**7**	**6**	N	N	N	**2**	N	E2	226
N	N	**6**	N	N	N	**2**	**1**	23	35	N	**7**	**6**	N	N	N	**2**	**1**	63	99	**8**	N	**6**	N	N	N	**2**	**1**	A3	163	**8**	**7**	**6**	N	N	N	**2**	**1**	E3	227
N	N	**6**	N	N	**3**	N	N	24	36	N	**7**	**6**	N	N	**3**	N	N	64	100	**8**	N	**6**	N	N	**3**	N	N	A4	164	**8**	**7**	**6**	N	N	**3**	N	N	E4	228
N	N	**6**	N	N	**3**	N	**1**	25	37	N	**7**	**6**	N	N	**3**	N	**1**	65	101	**8**	N	**6**	N	N	**3**	N	**1**	A5	165	**8**	**7**	**6**	N	N	**3**	N	**1**	E5	229
N	N	**6**	N	N	**3**	**2**	N	26	38	N	**7**	**6**	N	N	**3**	**2**	N	66	102	**8**	N	**6**	N	N	**3**	**2**	N	A6	166	**8**	**7**	**6**	N	N	**3**	**2**	N	E6	230
N	N	**6**	N	N	**3**	**2**	**1**	27	39	N	**7**	**6**	N	N	**3**	**2**	**1**	67	103	**8**	N	**6**	N	N	**3**	**2**	**1**	A7	167	**8**	**7**	**6**	N	N	**3**	**2**	**1**	E7	231
N	N	**6**	N	**4**	N	N	N	28	40	N	**7**	**6**	N	**4**	N	N	N	68	104	**8**	N	**6**	N	**4**	N	N	N	A8	168	**8**	**7**	**6**	N	**4**	N	N	N	E8	232
N	N	**6**	N	**4**	N	N	**1**	29	41	N	**7**	**6**	N	**4**	N	N	**1**	69	105	**8**	N	**6**	N	**4**	N	N	**1**	A9	169	**8**	**7**	**6**	N	**4**	N	N	**1**	E9	233
N	N	**6**	N	**4**	N	**2**	N	2A	42	N	**7**	**6**	N	**4**	N	**2**	N	6A	106	**8**	N	**6**	N	**4**	N	**2**	N	AA	170	**8**	**7**	**6**	N	**4**	N	**2**	N	EA	234
N	N	**6**	N	**4**	N	**2**	**1**	2B	43	N	**7**	**6**	N	**4**	N	**2**	**1**	6B	107	**8**	N	**6**	N	**4**	N	**2**	**1**	AB	171	**8**	**7**	**6**	N	**4**	N	**2**	**1**	EB	235
N	N	**6**	N	**4**	**3**	N	N	2C	44	N	**7**	**6**	N	**4**	**3**	N	N	6C	108	**8**	N	**6**	N	**4**	**3**	N	N	AC	172	**8**	**7**	**6**	N	**4**	**3**	N	N	EC	236
N	N	**6**	N	**4**	**3**	N	**1**	2D	45	N	**7**	**6**	N	**4**	**3**	N	**1**	6D	109	**8**	N	**6**	N	**4**	**3**	N	**1**	AD	173	**8**	**7**	**6**	N	**4**	**3**	N	**1**	ED	237
N	N	**6**	N	**4**	**3**	**2**	N	2E	46	N	**7**	**6**	N	**4**	**3**	**2**	N	6E	110	**8**	N	**6**	N	**4**	**3**	**2**	N	AE	174	**8**	**7**	**6**	N	**4**	**3**	**2**	N	EE	238
N	N	**6**	N	**4**	**3**	**2**	**1**	2F	47	N	**7**	**6**	N	**4**	**3**	**2**	**1**	6F	111	**8**	N	**6**	N	**4**	**3**	**2**	**1**	AF	175	**8**	**7**	**6**	N	**4**	**3**	**2**	**1**	EF	239
N	N	**6**	**5**	N	N	N	N	30	48	N	**7**	**6**	**5**	N	N	N	N	70	112	**8**	N	**6**	**5**	N	N	N	N	B0	176	**8**	**7**	**6**	**5**	N	N	N	N	F0	240
N	N	**6**	**5**	N	N	N	**1**	31	49	N	**7**	**6**	**5**	N	N	N	**1**	71	113	**8**	N	**6**	**5**	N	N	N	**1**	B1	177	**8**	**7**	**6**	**5**	N	N	N	**1**	F1	241
N	N	**6**	**5**	N	N	2	N	32	50	N	**7**	**6**	**5**	N	N	**2**	N	72	114	**8**	N	**6**	**5**	N	N	**2**	N	B2	178	**8**	**7**	**6**	**5**	N	N	**2**	N	F2	242
N	N	**6**	**5**	N	N	**2**	**1**	33	51	N	**7**	**6**	**5**	N	N	**2**	**1**	73	115	**8**	N	**6**	**5**	N	N	**2**	**1**	B3	179	**8**	**7**	**6**	**5**	N	N	**2**	**1**	F3	243
N	N	**6**	**5**	N	**3**	N	N	34	52	N	**7**	**6**	**5**	N	**3**	N	N	74	116	**8**	N	**6**	**5**	N	**3**	N	N	B4	180	**8**	**7**	**6**	**5**	N	**3**	N	N	F4	244
N	N	**6**	**5**	N	**3**	N	**1**	35	53	N	**7**	**6**	**5**	N	**3**	N	**1**	75	117	**8**	N	**6**	**5**	N	**3**	N	**1**	B5	181	**8**	**7**	**6**	**5**	N	**3**	N	**1**	F5	245
N	N	**6**	**5**	N	**3**	**2**	N	36	54	N	**7**	**6**	**5**	N	**3**	**2**	N	76	118	**8**	N	**6**	**5**	N	**3**	**2**	N	B6	182	**8**	**7**	**6**	**5**	N	**3**	**2**	N	F6	246
N	N	**6**	**5**	N	**3**	**2**	**1**	37	55	N	**7**	**6**	**5**	N	**3**	**2**	**1**	77	119	**8**	N	**6**	**5**	N	**3**	**2**	**1**	B7	183	**8**	**7**	**6**	**5**	N	**3**	**2**	**1**	F7	247
N	N	**6**	**5**	**4**	N	N	N	38	56	N	**7**	**6**	**5**	**4**	N	N	N	78	120	**8**	N	**6**	**5**	**4**	N	N	N	B8	184	**8**	**7**	**6**	**5**	**4**	N	N	N	F8	248
N	N	**6**	**5**	**4**	N	N	**1**	39	57	N	**7**	**6**	**5**	**4**	N	N	**1**	79	121	**8**	N	**6**	**5**	**4**	N	N	**1**	B9	185	**8**	**7**	**6**	**5**	**4**	N	N	**1**	F9	249
N	N	**6**	**5**	**4**	N	**2**	N	3A	58	N	**7**	**6**	**5**	**4**	N	**2**	N	7A	122	**8**	N	**6**	**5**	**4**	N	**2**	N	BA	186	**8**	**7**	**6**	**5**	**4**	N	**2**	N	FA	250
N	N	**6**	**5**	**4**	N	**2**	**1**	3B	59	N	**7**	**6**	**5**	**4**	N	**2**	**1**	7B	123	**8**	N	**6**	**5**	**4**	N	**2**	**1**	BB	187	**8**	**7**	**6**	**5**	**4**	N	**2**	**1**	FB	251
N	N	**6**	**5**	**4**	**3**	N	N	3C	60	N	**7**	**6**	**5**	**4**	**3**	N	N	7C	124	**8**	N	**6**	**5**	**4**	**3**	N	N	BC	188	**8**	**7**	**6**	**5**	**4**	**3**	N	N	FC	252
N	N	**6**	**5**	**4**	**3**	N	**1**	3D	61	N	**7**	**6**	**5**	**4**	**3**	N	**1**	7D	125	**8**	N	**6**	**5**	**4**	**3**	N	**1**	BD	189	**8**	**7**	**6**	**5**	**4**	**3**	N	**1**	FD	253
N	N	**6**	**5**	**4**	**3**	**2**	N	3E	62	N	**7**	**6**	**5**	**4**	**3**	**2**	N	7E	126	**8**	N	**6**	**5**	**4**	**3**	**2**	N	BE	190	**8**	**7**	**6**	**5**	**4**	**3**	**2**	N	FE	254
N	N	**6**	**5**	**4**	**3**	**2**	**1**	3F	63	N	**7**	**6**	**5**	**4**	**3**	**2**	**1**	7F	127	**8**	N	**6**	**5**	**4**	**3**	**2**	**1**	BF	191	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	FF	255

Table 4.15.3 Invert input values

Example: Decimal 146 means that inputs 8, 5 and 2 are inverted.

4.16 MULTIPLEXER BLOCK

This block selects one of eight analogue inputs to appear at its output. There are four multiplexer blocks available for use.

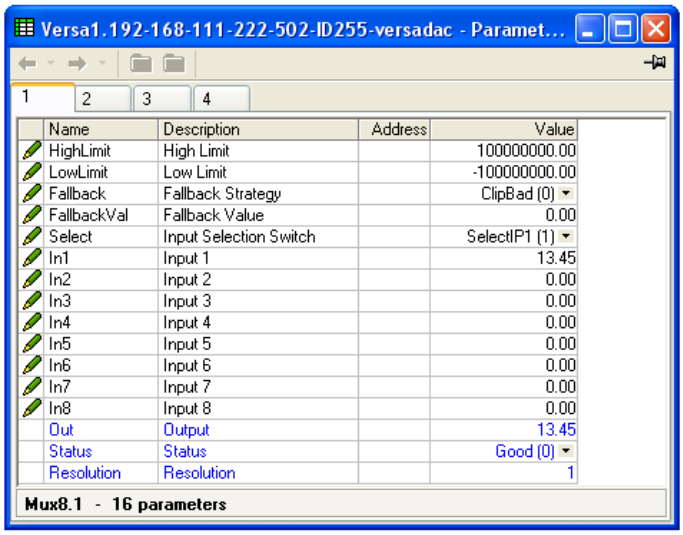
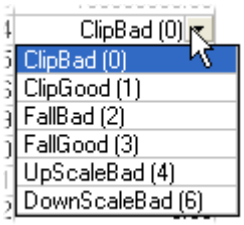
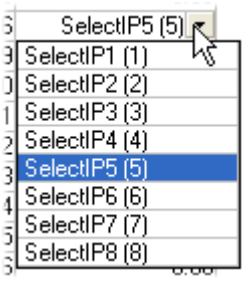


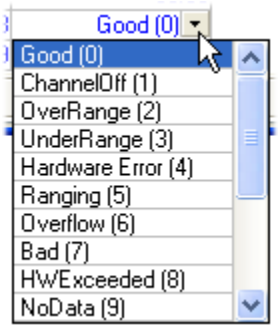
Figure 4.16 Multiplexer block configuration

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	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 Fallback 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 Fallback value. Fall Bad: If the input value is above 'High Limit' or below 'Low Limit', then the output value is set to the Fallback 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 Fallback value, and the status is set to 'Good' Upscale Bad: 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 Bad: 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	Selects which of the eight inputs is presented at the output.
Input 1 to 8	Wired to the relevant analogue inputs.
Out	The output from the multiplexer block.





4.16 MULTIPLEXER BLOCK (Cont.)



Status

Indicates the status of the operation

0: Good. The process variable is ok
1: Off. Channel is configured to be off
2: Over range. Input signal is greater than the selected hardware range upper limit
3: Under range. Input signal is less than the selected hardware range lower limit
4: Hardware error. Input hardware failure
5: Ranging. Input hardware is being ranged i.e. being set-up as required by the range configuration
6: Overflow. Process variable overflow, possibly due to calculation attempting to add a small number to a relatively large number
7: Bad. The process variable is not ok and should not be used
8: Hardware exceeded. The hardware capabilities have been exceeded at the point of configuration, for example configuration set to 0 to 40V when input hardware is capable of up to 12V
9: No data. Insufficient input samples to perform calculation

Resolution

The number of decimal places for the output value (maximum = 4). If the selected input is not wired, or if it's status is bad, or if the output value has been clipped to limits then the resolution will be set to 1 decimal place.

4.17 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'. There are as many two-input maths blocks available as there are virtual channels enabled.

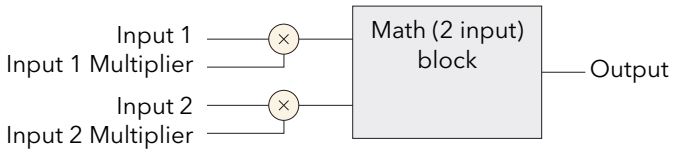


Figure 4.17a Block schematic

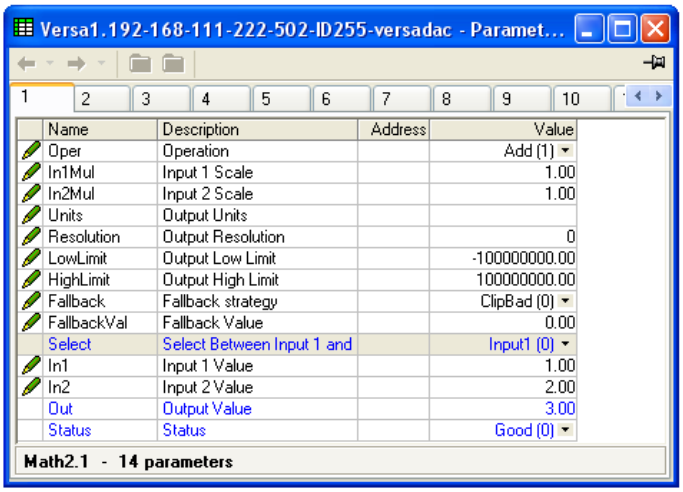
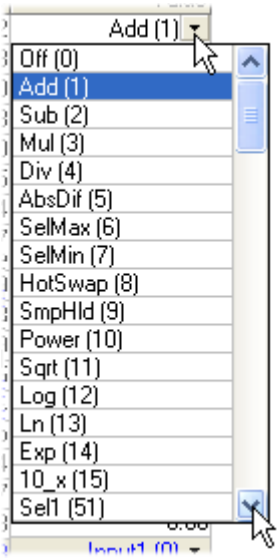


Figure 4.17b Block configuration (typical)

4.17.1 Parameters

Oper

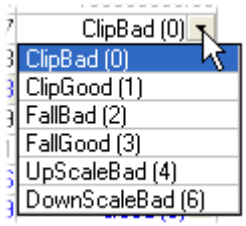
0: Off	
1: Add	Out = In1 + In2
2: Sub	Out = In1 - In2
3: Mul	Out = In1 x In2
4: Div	Out = In1 ÷ In2
5: Abs Dif	Out = the difference between In1 and In2, ignoring sign
6: Sel Max	Out = whichever is the larger of In or In2
7: Sel Min	Out = whichever is the smaller of In1 or In2
8: Hot Swap	Out = In 2 if In 1 is 'Bad'; otherwise Out = In1
9: Smp Hld	Out tracks In 1 whilst In 2 = 1. Out value is held whilst In 2 = 0 (See section 4.17.2, below, for more details)
10: Power*	Out = In1 to the power of In2. (Out = $In1^{In2}$)
11: Sqrt	Out = √In1 (In2 ignored)
12: Log	Out = Log_{10} In1 (In2 ignored)
13: Ln	Out = Ln In1 (In2 ignored)
14: Expn	Out = e^{In1} (In2 ignored)
15: 10_x	Out = 10^{In1} (In2 ignored)
51: Sel1	Out = In1 if Input Selector = Input1 Out = In2 if Input Selector = Input2

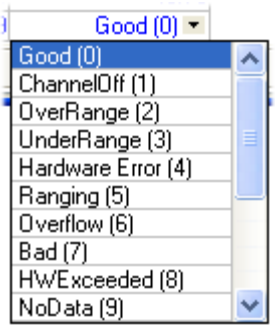


* Note... For this implementation:
0 to the power 0 = 1.
Negative values raised to any power result in 'Bad' status.
0 raised to a negative power results in 'Bad' status.

4.17.1 PARAMETERS (Cont.)

In1(2) Mul	The scaling factor for input 1(2). This multiplying factor is applied to the input of the function, but does not affect the displayed values of In1 and In2 (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	0: 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. 1: 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. 2: 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' 3: 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' 4: UpScaleBad. 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. 5: DownScaleBad. 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 Val	The value to be adopted by the output, under error conditions, if 'Fallback Status' is set to 'Fall Good' or 'Fall Bad'.
Select	For 'Select' operation only. When wired to a suitable parameter, Input Select becomes read only. In1 is selected if 'Input Select' = 1; In2 is selected if 'Input Select' = 2. Input Select values greater than 2 are ignored.
In1(2)	Wired to suitable input parameters. Displayed values ignore any input multiplier effects.
Out	Gives the output value for the operation.
Status	Shows the status of the output value. 0: Good.The process variable is ok 1: Off. Channel is configured to be off 2: Over range. Input signal is greater than the selected hardware range upper limit 3: Under range. Input signal is less than the selected hardware range lower limit 4: Hardware error. Input hardware failure 5: Ranging. Input hardware is being ranged i.e. being set-up as required by the range configuration 6: Overflow. Process variable overflow, possibly due to calculation attempting to add a small number to a relatively large number 7: Bad. The process variable is not ok and should not be used 8: Hardware exceeded. The hardware capabilities have been exceeded at the point of configuration, for example configuration set to 0 to 40V when input hardware is capable of up to 12V 9: No data. Insufficient input samples to perform calculation.





4.17.2 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.

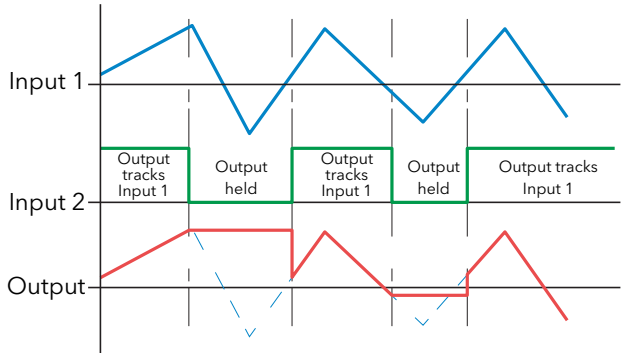


Figure 4.17.2 Sample and Hold example

4.18 TIMER

The timer function allows the user to configure up to 12 timers as: 'On Pulse', 'On Delay', 'One Shot' or 'Min On' types. The different types are described in section 4.18.2, below.

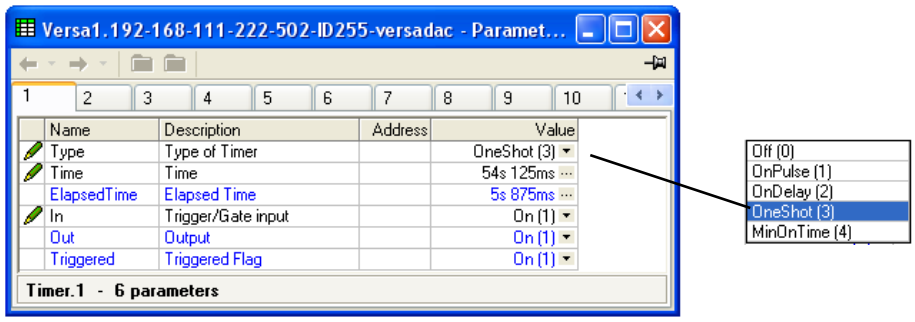


Figure 4.18 Timer configuration

4.18.1 Parameters

Mode	Select 0: Off; 1: On pulse; 2: On delay; 3: One shot or 4: Min On Time
Time	Allows the user to enter a period for the timer.
Elapsed time	This read-only parameter shows timing progress
In	Shows if the trigger source is active (1: On) or inactive (0 Off)
Out	Shows if the output is on (1) or off (0)
Triggered	Shows if the timer is currently triggered (can remain triggered even after the trigger source has returned to off). 1 = Triggered; 0 = not triggered.

4.18.2 Timer modes

ON PULSE

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

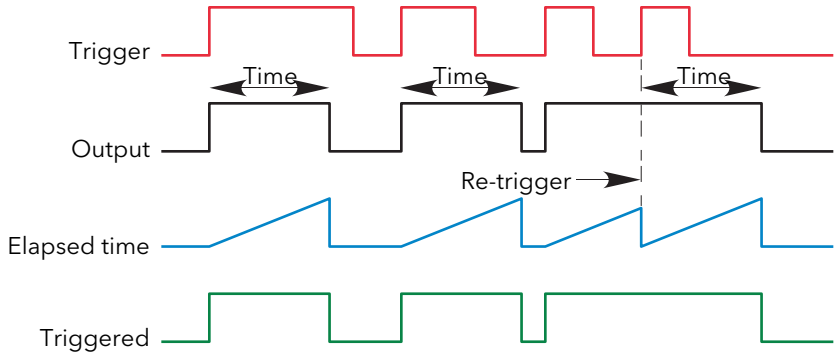


Figure 4.18.2a 'On Pulse' definitions

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.

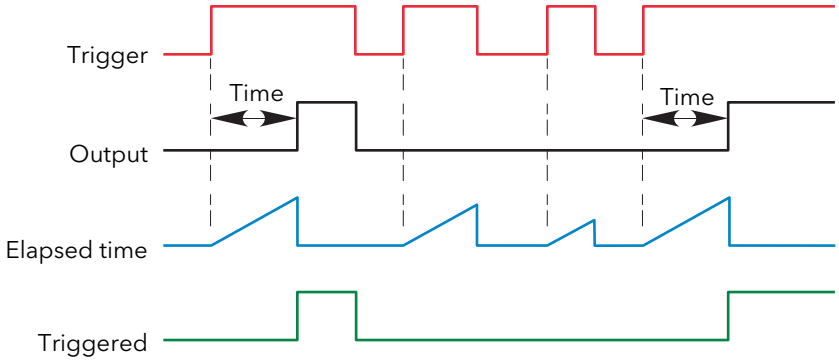


Figure 4.23.2b 'On Delay' definitions

4.18.2 TIMER MODES (Cont.)

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.

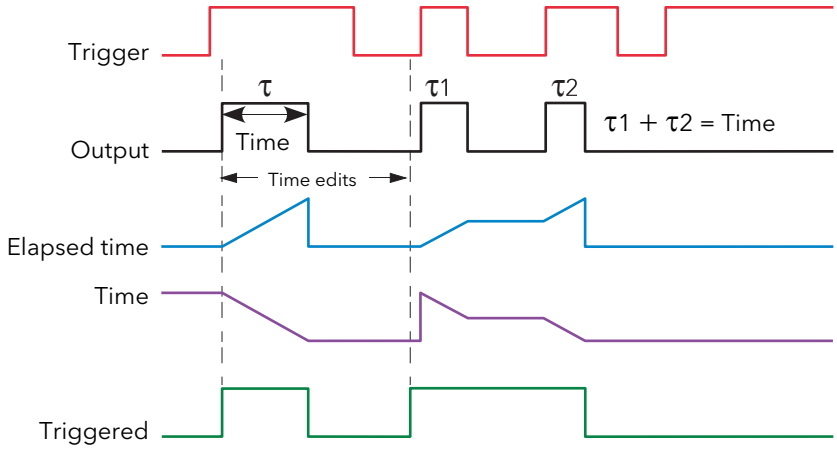


Figure 4.18.2c 'One Shot' timer definitions

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.

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.

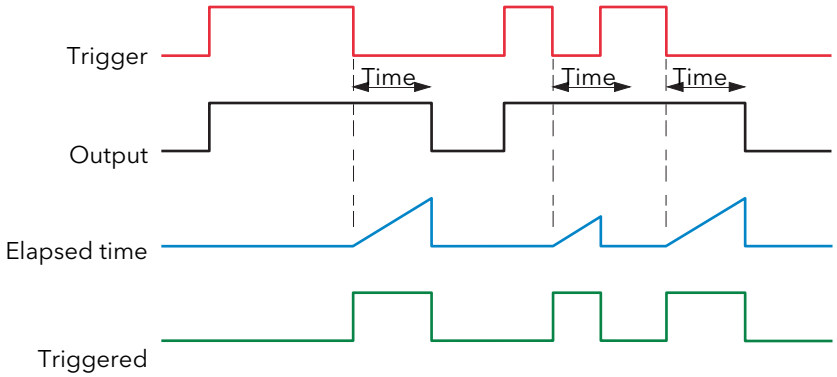


Figure 4.18.2d 'Min On' timer definitions

4.19 USER VAL

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

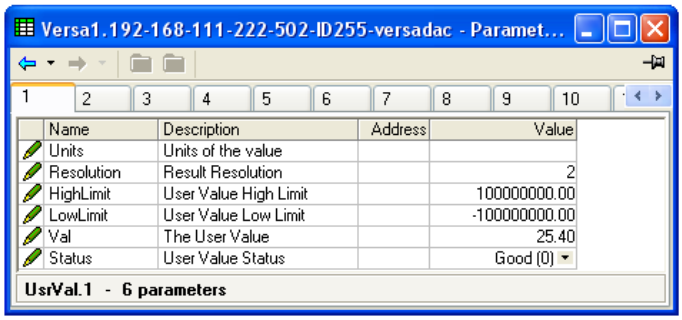


Figure 4.19 User value configuration

4.19.1 Parameters

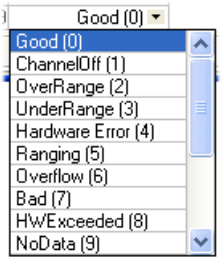
Units — Allows a five-character string to be entered for the user value units

Resolution — The number of decimal places for the user value (max. = 4)

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 — Shows the status of the output value.



0: Good.The process variable is ok

1: Off. Channel is configured to be off

2: Over range. Input signal is greater than the selected hardware range upper limit

3: Under range. Input signal is less than the selected hardware range lower limit

4: Hardware error. Input hardware failure

5: Ranging. Input hardware is being ranged i.e. being set-up as required by the range configuration

6: Overflow. Process variable overflow, possibly due to calculation attempting to add a small number to a relatively large number

7: Bad. The process variable is not ok and should not be used

8: Hardware exceeded. The hardware capabilities have been exceeded at the point of configuration, for example configuration set to 0 to 40V when input hardware is capable of up to 12V

9:No data. Insufficient input samples to perform calculation.

4.20 EIGHT INPUT OR BLOCK

An eight input logical OR block whose output is high (1, On) if any one or more inputs is high (1, On). If more than eight inputs are required, a second block is automatically introduced, as shown in figure C3.1a. The blocks in the figure are given the names 'A' and 'B', where 'A' and 'B' can be any of the 12 available instances.

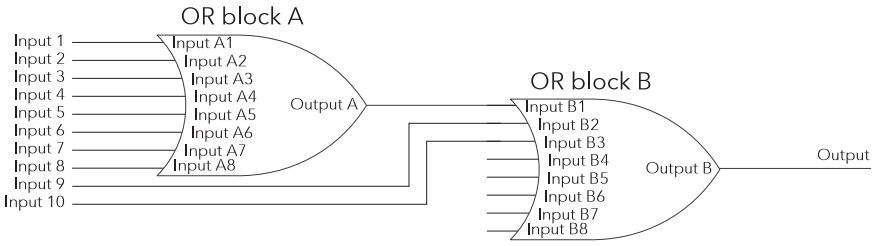


Figure 4.20a Eight input OR block

OR blocks are used automatically by the 'user wiring' when more than one source is wired to the same destination parameter. For example, it may be required that a Relay is to operate if channel 1 alarm 1 and/or channel 2 alarm 1 channels goes active. In such a case, the 'Active' parameter for the two channel alarms are wired to the same relay's 'Main.PVin' parameter. Figure 4.20b shows that this has been done by introducing an OR block to OR the two alarm outputs together.

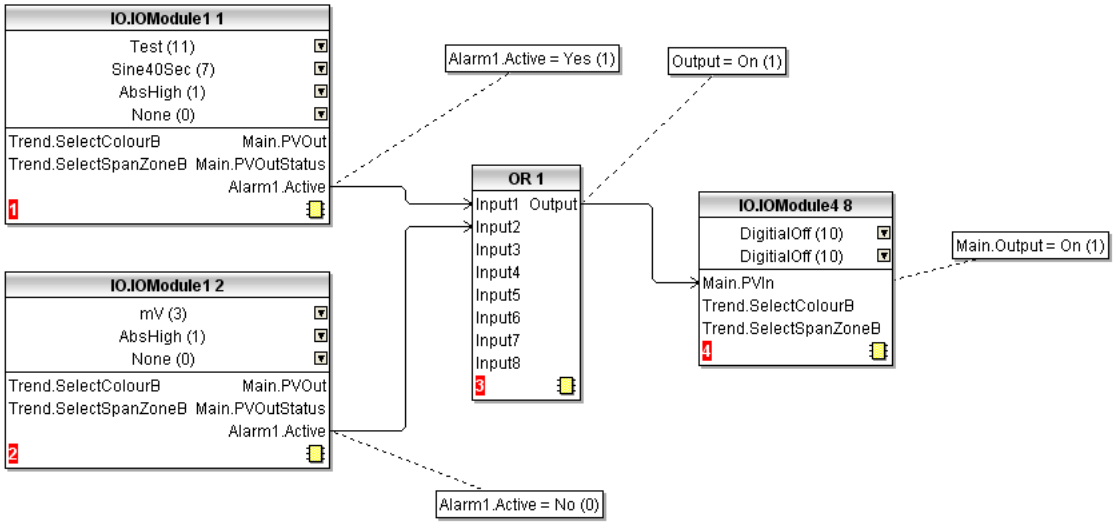


Figure 4.20b Graphical wiring representation of OR block usage

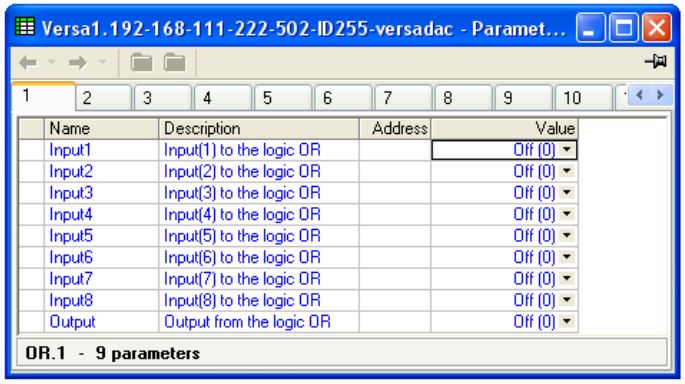


Figure 4.20c Parameter explorer representation of OR block

4.21 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.

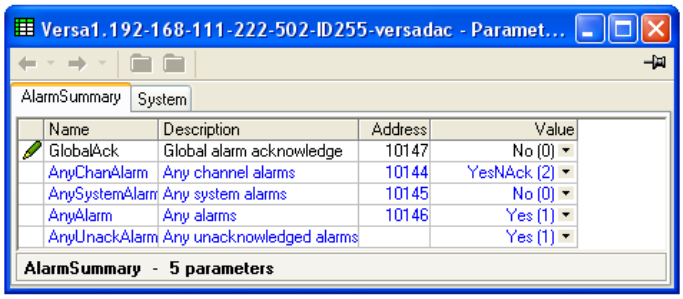


Figure 4.21 Alarm summary top level menu

4.21.1 Alarm Summary Tab

Global Ack	Allows the user to acknowledge all applicable alarms simultaneously. 'Manual' alarms must be non-active before they can be acknowledged. 1 = Acknowledge.
Any Channel alarm	0: None. no channel alarms are active 1: YesAckd. There is at least one alarm active but all alarms have been acknowledged. 2: YesNAck. There is at least one unacknowledged alarm
Any Sys Alarm	0: No. There are no active system alarms. 1: Yes. There is at least one active system alarm.
Any Alarm	0: No. There are no active channel or system alarms. 1: Yes. There is at least one active channel or system alarm.
AnyUnackAlarm	0: No. There are no unacknowledged alarms. 1: Yes. There is at least one unacknowledged alarm.
Alarm n Ack	1 = Acknowledge nth most recent alarm.

4.21.2 Alarm summary system tab

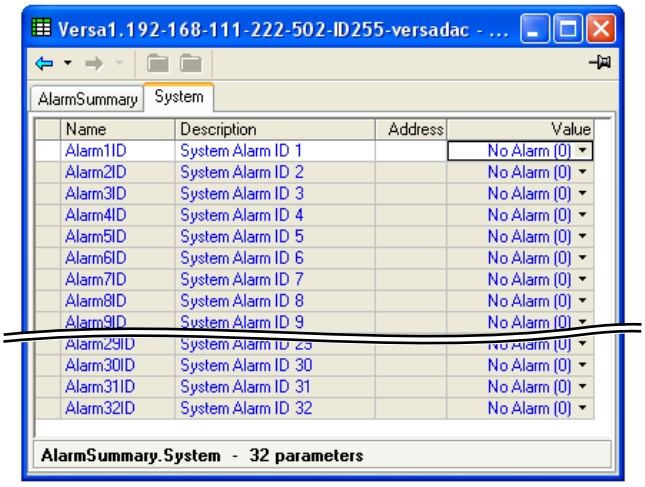


Figure 4.21.2 Alarm summary system tab

Alarm 1 ID	Most recent system alarm
Alarm 'n' ID	nth most recent system alarm.

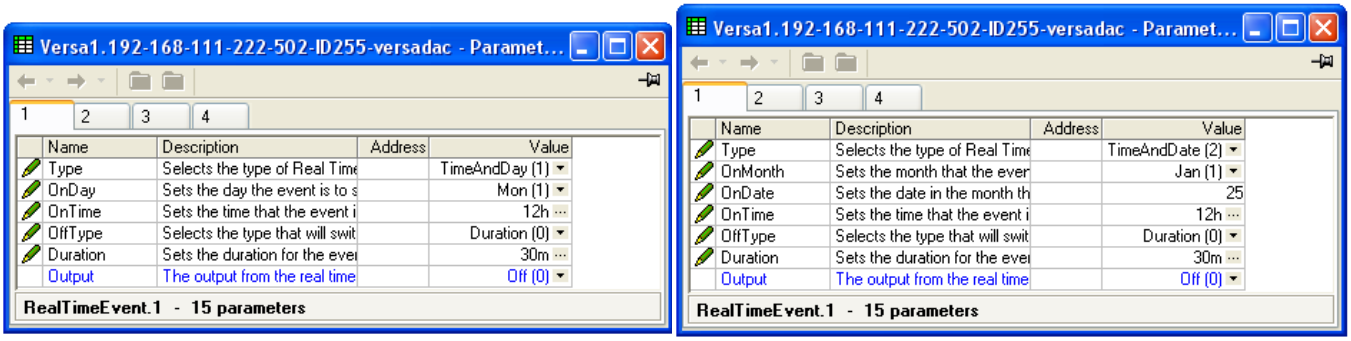
4.21.2 ALARM SUMMARY SYSTEM TAB (Cont.)

SYSTEM ALARMS

0: No alarm. Currently no active system alarms
1: Low battery warning. Less than 40% battery life remaining
2: Battery failure. Less than 10% battery life remaining, battery requires replacing immediately
3: System clock failure. Internal clock was corrupt at power-up, or the time and date has never been set. Can be cleared by setting the time and date
4: Channel error. Indicates a hardware failure in the channel circuit or the internal CJ temperature measurement
5: Channel failure. Indicates a hardware failure in the input channel circuit. This is not a self clearing alarm and the instrument must be power cycled
6: DHCP server failure. The instrument was not able to obtain network settings from the DHCP server. Probable cause, no DHCP servers connected to the current network
7: FTP Archive file lost. A file has been deleted that has not yet been archived. Probable causes, unable to establish communication with server, archiving rate disabled or too slow
8: FTP Archive slow. Possible loss of archive files, switching to automatic mode. Probable cause, unable to establish communication with the server
9: FTP primary server failure. Failed after two attempts to establish communications with the primary server. Attempting communications with the secondary server
10: FTP secondary server failure. Failed after two attempts to establish communications with the secondary server
11: Insufficient non-volatile memory.
12: Maths channel failure
13: Media archive file lost. A file has been deleted that has not yet been archived. Probable causes, media missing, full, write protected, archiving rate disabled or too slow
14: Media archive slow. Possible loss of archive files, switching to automatic mode. Possible cause, local archive strategy too slow
15: Network boot failure
16: DC Output Calibration Error
17: Recording failure. Recording has failed, probable cause, file error or internal overflow
18: Media failure. Failed to archive to removable media. Probable cause, corrupt or incompatible formatted media
19: Media full. Removable media is full
20: SNTP failure. Invalid data received from SNTP server, or server cannot be accessed
21: Time synchronisation failure. Instrument time has failed to synchronise with the SNTP server
22: Media missing. Removable media was not detected. To resume archiving insert a suitable media, media greater than 8GB are not supported.
23: Archive disabled. Archiving has been disabled from the 'Demand Archiving' page
24: Archiving failed. Archiving failed to current configured destination
25: Archiving timed out. Archiving timed out whilst attempting to archive to configured destination
26: USB Over Current. Too much current being drawn by the connected USB device (maximum of 100mA)
27: USB unsupported. Connected USB device is not supported
28: Invalid parameter database. The non-volatile parameter database has been corrupted
29: Invalid non-volatile datavRAM copy of the non-volatile parameter database has been corrupted
30: Flash write failure. The flash drivers failed to write data to flash, History is now potentially compromised. It is recommended that the history drive be reformatted.
31: Wiring failure. User wiring has failed to validate
32: Broadcast Storm. Broadcast Storm detected.
33: Non-volatile memory write frequency warning. One or more parameters is being written to non-volatile memory frequently which may lead to memory depletion if the same rate of writes is performed over the instrument's lifetime. Probable cause is frequent writes over comms.

4.22 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.



Time and day

Time and date

Figure 4.22 Real Time Events

Type	Selects the type of the real time event (0 = Off; 1 = Time and Day; 2 = Time and Date
On Month	For 'Time and Date' only, this is the month that the event is to switch on. 1 = January, 2 = February etc.
On Date	For 'Time and Date' only, this is the day number 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. 0 = Sunday; 1 = Monday; 2 = Tuesday; 3 = Wednesday; 4 = Thursday; 5 = Friday; 6 = Saturday; 7 = Every day, Monday to Friday inclusive; 8 = Saturday and Sunday; 9 = Every day.
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 (0 = Duration; 1 = Time)
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)
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 (as 'On Month').
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 (as 'On Day').
Off Time	The time at which the event output is to switch off (00:00:00 - 23:59:59)
Output	The output for the real time event (0 = Off; 1 = On) (Read only)

4.23 EMAIL

E-mails can be sent by the instrument to one or more recipients. The user can enter 10 recipient e-mail addresses in each of 24 email instances. A Recipient can appear in as many lists as required.

As well as a 'Subject', and the body text, each e-mail can include one of the messages set up in 'Custom Message Configuration', and can thus include embedded values, alarm status, batch status etc., as described in section 4.9.

E-MAIL CONFIGURATION

The figure below shows the e-mail configuration page

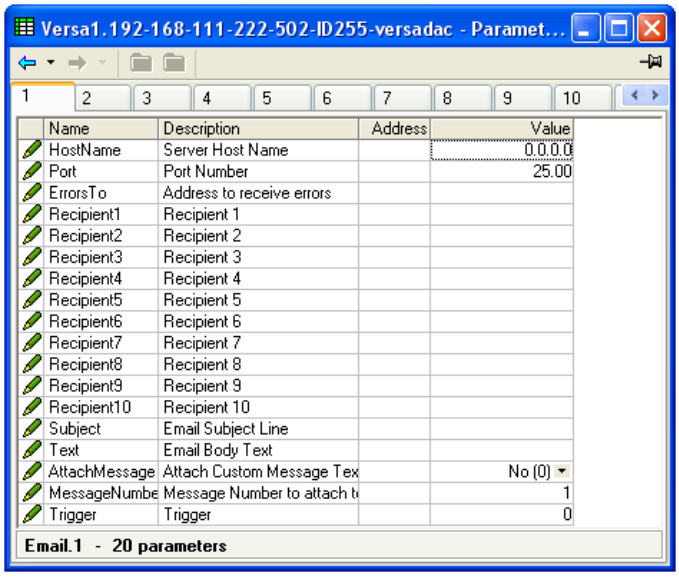


Figure 4.23 E-mail configuration

Host Name	The Host name or IP address of the email server
Port	This is the port number used for SMTP by the servers. Most servers use port 25 for this function, and this value should be changed from the default only by experienced personnel.
Errors To	An e-mail address to which any error messages can be sent for display etc. The instrument itself cannot receive e-mails and so is unable to display (for example 'undeliverable') messages itself. An entry in this field must be made. The same address may be used for any number of instruments.
Recipient 1 to 10	These fields allow 10 recipients' e-mail addresses to be entered for the selected list. The first valid address appears in the 'To:' part of the e-mail header; subsequent valid addresses appear in the 'Cc:' part of the e-mail header.
Subject	Allows the entry of up to 100 characters to appear in the 'Subject:' part of the e-mail header.
Text	Allows the entry of up to 100 characters to appear as the body of the e-mail. Also referred to as 'Body Text'.
Attach message	If this enabled (Yes (1)), one of the messages in the 'Message Configuration' (section 4.9) area can be selected to appear below the body text in the e-mail.
Message Number	The number of the message to be attached if 'Attach message' is enabled.
Trigger	The trigger input to cause the email to be sent. (1 = Send email.)

4.24 MEAN KINETIC TEMPERATURE (MKT)

MKT is defined as 'the isothermal temperature that corresponds to the kinetic effects of time-temperature distribution'.

	Name	Description	Address	Value
	MKTType	MKT calculated for either a s	12624	SingleInput (0)
	Enable	MKT enable	12625	Yes (1)
	Input	MKT Single Input value	12626	0.00
	Group	MKT Group	12627	1
	PV	MKT PV	12628	0.00
	Status	MKT PV Status	12629	Good (0)
	Resolution	MKT PV resolution/number c	12630	1
	NumOfSamples	MKT Number of Samples	12631	1
	SampleInterval	MKT Sample Interval	12632	1
	HeatOfActivation	MKT Heat of Activation	12633	83.14
	Reset	MKT Reset	12634	No (0)

MeanKineticTemperature.1 - 11 parameters

The recorder calculates MKT, using the equation below:

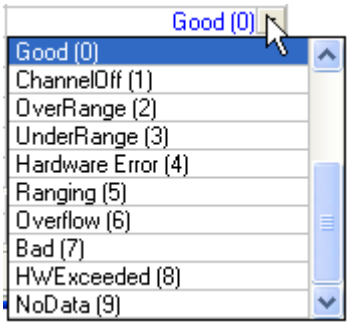
$$T_k = \frac{\frac{-\Delta H}{R}}{\ln\left(\frac{e^{\frac{-\Delta H}{RT_{1max}}} + e^{\frac{-\Delta H}{RT_{1min}}} + \ldots + e^{\frac{-\Delta H}{RT_{Nmin}}} + e^{\frac{-\Delta H}{RT_{Nmax}}}}{2N}\right)}$$

where:
- Tk = The required mean kinetic temperature in Kelvin
- DH = The heat of activation
- R = The universal gas constant
- T1max = The highest temperature reached during the first measurement period (in Kelvin)
- T1min = The lowest temperature reached during the first measurement period (in Kelvin)
- TNmax = The highest temperature reached during the Nth measurement period (in Kelvin)
- TNmin = The lowest temperature reached during the Nth measurement period (in Kelvin)
- N = The total number of measurement periods

Note: The input temperature must be in Kelvin. This can be achieved either by setting the relevant channel's units to Kelvin, or by using a virtual maths channel to convert the measuring units to Kelvin. (K = C + 273.15 or K = 0.555(F -32) + 273.15)

4.24.1 Configuration parameters

MKT Type	0 = Single input; 1 = Group input.
MKT enable	1 (Yes) enables the MKT function
Input	For MKT Type = 'Single', select the source from which MKT is to be derived. This may be an input channel, scaled in Kelvin, or it can be a maths channel used to convert a different temperature scale into Kelvin (see 'Note' above).
Group	For MKT Type = 'Group', select the source from which MKT is to be derived.
PV	The current MKT process value
Status	Shows the status of the output value. 0: Good.The process variable is ok 1: Off. Channel is configured to be off 2: Over range. Input signal is greater than the selected hardware range upper limit 3: Under range. Input signal is less than the selected hardware range lower limit 4: Hardware error. Input hardware failure 5: Ranging. Input hardware is being ranged i.e. being set-up as required by the range configuration 6: Overflow. Process variable overflow, possibly due to calculation attempting to add a small number to a relatively large number 7: Bad. The process variable is not ok and should not be used 8: Hardware exceeded. The hardware capabilities have been exceeded at the point of configuration, for example configuration set to 0 to 40V when input hardware is capable of up to 12V 9:No data. Insufficient input samples to perform calculation.
Resolution	Number of decimal places (0 to 6)
Num of Samples	Enter the number of samples over which the MKT is to be measured.
Sample Interval	Enter the time period, in seconds, between samples. At each sample interval, the maximum and minimum temperatures reached by the input source, since the last sample, are entered into the equation.
Heat of Activation	The default value is an average value based on many common organic reactions. Allows the user to enter an alternative value, if known.
Reset	Yes (1) resets the calculation.



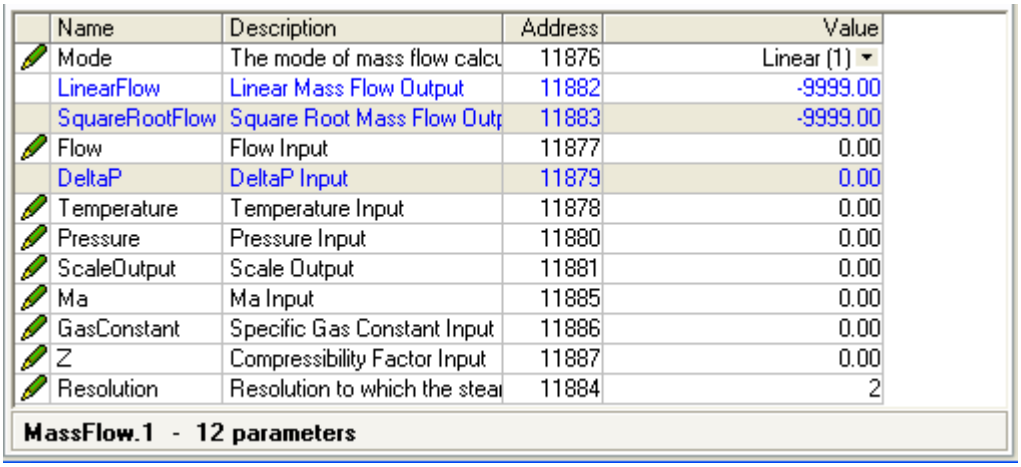
EXAMPLE 1: To Produce a 4-weekly value of MKT, taking samples every day.
Number of samples = 28
Sample interval = No. of seconds in a day = 24 x 60 x 60 = 86,400

EXAMPLE 2: To produce an annual value of MKT, taking samples every week.
Number of sample = 52
Sample interval = No. of seconds in a week = 7 x 24 x 60 x 60 = 604,800

Notes
1 This function produces a 'rolling' result. I.E. when the final (Nth) sample has been taken, the next sample (N + 1)th replaces Sample 1, the (N + 2th) sample replaces Sample 2, and so on.
2 During the first sample, the current minimum and maximum values of temperature are entered into the equation at the recorder iteration rate (i.e. 8Hz).

4.25 MASS FLOW

Note: The overall accuracy of a flow measurement installation depends on a number of factors outside the control of the data recorder manufacturer. For this reason, the data recorder manufacturer takes no responsibility for the accuracy of the results obtained using the mass flow equations implemented in the data recorder software.



	Name	Description	Address	Value
✎	Mode	The mode of mass flow calcu	11876	Linear (1)
	LinearFlow	Linear Mass Flow Output	11882	-9999.00
	SquareRootFlow	Square Root Mass Flow Outp	11883	-9999.00
✎	Flow	Flow Input	11877	0.00
	DeltaP	DeltaP Input	11879	0.00
✎	Temperature	Temperature Input	11878	0.00
✎	Pressure	Pressure Input	11880	0.00
✎	ScaleOutput	Scale Output	11881	0.00
✎	Ma	Ma Input	11885	0.00
✎	GasConstant	Specific Gas Constant Input	11886	0.00
✎	Z	Compressibility Factor Input	11887	0.00
✎	Resolution	Resolution to which the steal	11884	2

MassFlow.1 - 12 parameters

Figure 4.25 Mass flow menu

4.25.1 Configuration parameters

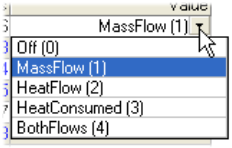
Mode	Select 0: Off; 1: Linear Mass Flow; 2: Square Root Mass Flow
Linear Flow	Calculated flow rate value for linear transducers
Square root Flow	Calculated flow rate value for square root type transducers
Flow	Input from flow meter
Delta P	The full scale value of the differential gas pressure
Temperature	Fluid temperature in Kelvin
Pressure	Absolute pressure of the gas in kPa(A)
Scale Output	Full scale output from the flow meter
Ma	The full scale mA input of the point reading the flow meter output
Gas Constant	The relevant gas constant in J/kg-K from published tables.
Z	Compressibility factor. This is a density-related measure of how far a particular gas deviates from a 'perfect' gas under any set of temperature and pressure conditions, and is given by the equation: $Z = \frac{P}{T} \times \frac{1}{\rho}$ where: Z=Compressibility factor P =Absolute pressure of the gas in kPa(A) T =Absolute temperature of the gas (Kelvin) ρ =gas density at pressure P and temperature T (from published tables)
Resolution	Number of decimal places for the Mass flow calculation (0 to 6).

4.26 SATURATED STEAM

	Name	Description	Address	Value
✎	Mode	The mode of steam calculatic	11826	MassFlow (1)
	HeatFlow	Heat flow output	11833	0.00
	MassFlow	Mass flow output	11834	0.00
	HeatConsumed	Heat combined output value	11835	0.00
✎	Flow	Flow Input	11827	0.00
	ReturnTemperatu	Return Temperature Input	11828	0.00
✎	Use	Use Temperature or Pressure	11829	Temperature (0)
✎	Fahrenheit	The type of temperature inpu	11837	No (0)
✎	Temperature	Temperature Input	11830	0.00
	Pressure	Pressure Input	11831	0.00
✎	Dryness	Dryness Constant	11832	0.00
✎	Resolution	Resolution to which the steal	11836	2

SaturatedSteam.1 - 12 parameters

Figure 4.26 Saturated steam menu.



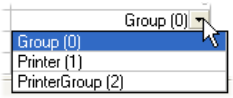
Mode	0 = Off; 1 = Mass flow; 2 = Heat flow; 3 = Heat Consumed; 4 = Both Flows
Heat flow	For Heat flow applications, this is the calculated heat flow output value.
Mass flow	For Mass flow applications, this is the calculated mass flow output value.
Heat consumed	For mode = 3, this is the calculated value of heat consumed.
Flow	Softwired (in the graphical wiring editor) to the channel supplying the measured flow rate.
Return Temperature	For Heat consumed calculations, the return temperature
Use	Allows the user to select 0 (Temperature) or 1 (Pressure in MPa) for the calculation.
Temperature	Appears only if Use = Temperature. Enter the number of the channel supplying the steam temperature.
Fahrenheit	No (0) = Use Celsius; Yes (1) = Use Fahrenheit.
Pressure	Appears only if Use = Pressure. Enter the number of the channel supplying the steam pressure.
Dryness	Enter a value between 0 and 100 to represent the dryness of the steam. 0 = no vapour; 100 = no liquid.
Resolution	The number of decimal places to be used for the output (0 to 6).

4.27 REPORT

Allows the setting up of up to 10 Reports for sending data to a printer.each report can contain up to 10 data items.

Figure 4.27 Report top-level menu

Report Desc	Allows the user to enter a descriptor for the report
Report Num Fields	Specifies the number of data items to appear in the report.
Report Destination	0 = Group: 1 = Printer; 2 = Printer Group.
Report Trigger	1 = Send report
Group Num	The destination group number for the report.



4.27.1 Report Field configuration

Figure 4.27.1a Field menu

Field 'n' Type	n = 1 to the number of fields entered in the top level menu.	
	0: Time date	Causes the time and date of report generation to be included in the report
	1: Raw Text	Allows the user to enter a text message of up to 60 characters.
	2: PV	Allows a specified point's process value (including descriptor and units) to be included in the report
	3: Batch Field	Batch field 1 can be included in the report.
	4: Cust Msg	A message can be selected for inclusion in the report. See section 4.3.8 for details of message configuration.
	5: Line Feed	Allows one or more blank lines to be left. This can be useful at the end of a report. Line feed applies only to printers and is ignored when sending reports to groups.

4.27.1 REPORT FIELD CONFIGURATION (Cont.)

Field 'n' Input	Allows a point to be chosen when 'PV' has been selected as Field Type. The point is selected from a pick-list containing all the input channels, derived channels, totalisers etc. in the instrument.
Field 'n' Cust Msg	Select a message number for inclusion, if Type = 'CustMsg'.
Field 'n' Batch Group	Batch group number
Field 'n' Text	A text string input for Field Type = RawText
Field 'n' Style	See figure 4.27.1b for examples of 'Normal', 'Bold', 'Emphasised' and 'Banner' print styles. For all styles, if the text is too long to fit on one line it 'wraps round' as shown (for normal style) in the figure.

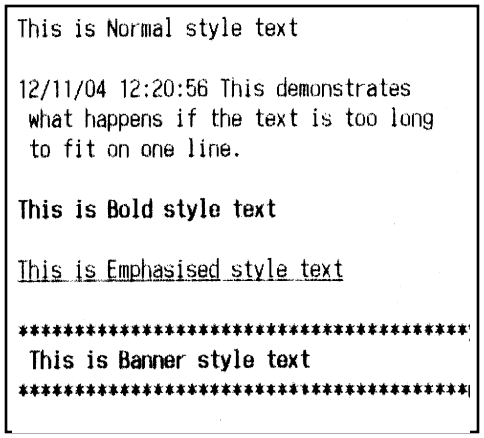


Figure 4.27.1b Field print styles

4.28 BATCH

This section allows the operator to initiate batches, as set up in Batch Control section3.6.

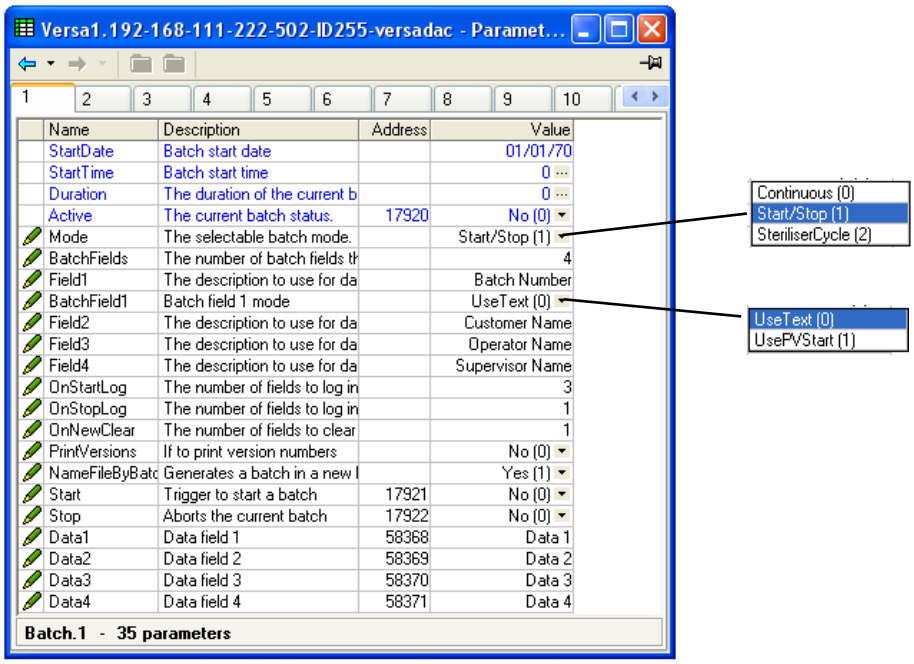


Figure 4.28 Batch menu

As shown in the figure above, some of the items (e.g. 'Batch fields', 'Fields 1 to 4'), reflect the settings made in Batch Control section 3.6. The remaining fields can now be filled in by the user prior to starting the batch. As usual, the fields available for editing are context sensitive.

Start Date	Displays the start date of the current batch.
Start Time	Displays the start time of the current batch.
Duration	Displays the duration (elapsed time) of the current batch.
Active	0 (No) = Not active; 1 (Yes) = Active
Mode	0 = Continuous; 1 = Start Stop; 2 = Steriliser cycle
Batch Fields	The number of batch fields currently active, and for which Data fields must be configured.
Batch Field 1	The text string to be used with 'Data1' if Batch Field 1' (below) is set to 'Text'. Otherwise, if Batch Field 1' is set to 'Use PV Start' the value of the triggering input is used instead.
Field 2 to 'N'	The text string to be used with Data 2 to Data N, where 'N' is the value of 'Batch Fields'.
On Start Log	Enter the number of Fields 1 to 10 to be included in the history file on Batch Start.
On Stop Log	Enter the number of Fields 1 to 10 to be included in the history file on Batch Stop.
On New Clear	For 'Use Text' Batches only, this allows the user to clear none or more of the batch entries at each batch start. In the example above, if the user enters a batch number of say 120825.001, with Customer Name: FishesRus, Operator name: Marvin, Supervisor: Fred, then setting 'On New Clear' to '1', causes the batch number to be cleared, and to have to be re-entered, each time a new batch is started. In a similar way, setting 'On New Clear' to '2' means that the batch number value and the Customer Name: value to be cleared. A new batch cannot be started without new values first being entered.

4.28 BATCH CONFIGURATION (Cont.)

Print Versions	Set to 1 (Yes) if version numbers are to be included in the printout.
Name Files by batch	If enabled, a new history file is generated for each new batch.
Start	Set to 1 (Yes) to initiate batch.
Stop	Set to 1 (Yes) if the current batch is to be stopped.
Data 1 to 10	The text strings to be associated with Fields 1 to 10 respectively.
PV Start	The PV value used to trigger a batch. This allows (for example) the incrementing of a counter to initiate a new batch.

4.29 PROFINET IO

Not available this release

4.30 WEB SERVER

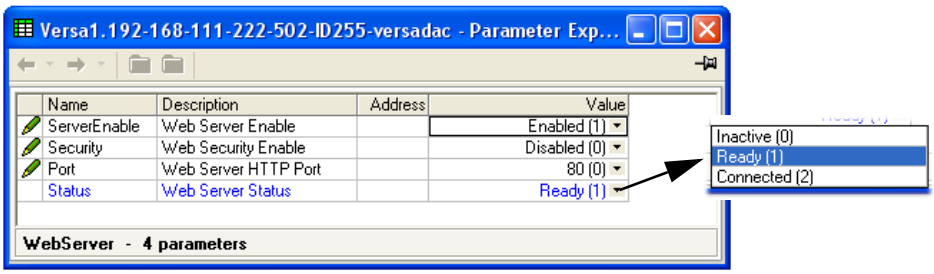


Fig 4.30 Web Server

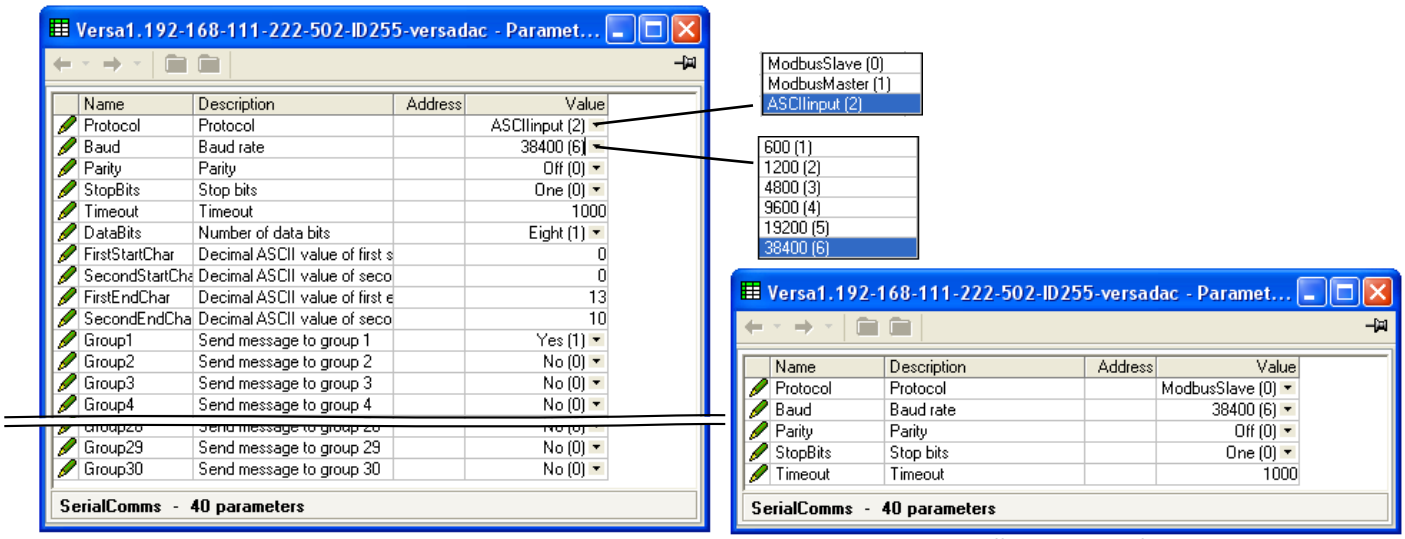
Server Enable	Allows access from the Web Server (section 7) to be enabled or disabled.
Security	If Enabled, the user must connect to the web server using an encrypted HTTPS connection. See note below. If Disabled, the connection is not encrypted, and access is allowed using an HTTP connection.
Port	The port number used by the Web Server
Status	Inactive. The Web Server is not active Ready. The Web Server is ready to be connected Connected. The Web Server is connected.

See section 7 for a full description of the Web Server option

Note: All common web browsers warn that the default SSL certificates supplied with the versadac are not from a recognised signing authority, and that the certificate doesn't match the domain on which the instrument is being accessed. It is possible to click through the browser warnings and continue to access the instrument using a secure connection.
To overcome this problem, a valid SSL certificate must be obtained from one of the many certificate authorities. The upgrade functionality (section 4.1.5) can be used to download the certificate to the instrument. Web browsers maintain an internal list of recognised certificate signing authorities and do not display a warning if the certificate is from one of these organisations and if it matches the current network domain of the instrument.

4.31 SERIAL COMMS

See section 2.3.1 for wiring details.



ASCII input Modbus master/slave

Figure 4.31 Serial communications configuration menu

Protocol*

0: Modbus Slave

1: Modbus Master. The EIA485 standard allows a master and up to 31 slave instruments to be connected (multi-dropped) using a three wire connection, with cable length of up to 1200m. EIA422/EIA485 is recommended for plant installation because its balanced differential signal transmission is less prone to interference a than EIA232 in noisy environments.
EIA485 may be used with half duplex protocols such as MODBUS RTU.

2: ASCII input

Baud

The baud rate of a communications network specifies the speed at which data is transferred between the instrument and the master. As a rule, the baud rate should be set as high as possible to allow maximum throughput. The instrument is capable of operating reliably at 38,400 baud under normal circumstances and assuming correct line termination. In noisy environments, it might be necessary to select a lower Baud rate

Although the baud rate is an important factor, when calculating the speed of communications in your system it is often the 'latency' between a message being sent and a reply being started that dominates the speed of the network. 'Latency' is the amount of time the instrument requires on receiving a request before being able to reply.

For example if a message consists of 10 characters (transmitted in 10msec at 9600 Baud) and the reply consists of 10 characters, then the transmission time is 10 + 10 = 20 msec. However, if the latency is 20msec, then the transmission time becomes 40msec. Latency is typically higher for commands that write to a parameter than those that read, and depends to some degree on what operation is being performed by the instrument at the time the request is received and the number of variables included in a block read or write. As a rule, latency for single value operations is between 5 and 20 msec, meaning a turnaround time of between 25 and 40msec.

If throughput rate is too slow, replacing single parameter transactions with Modbus block transactions, and increasing the baud rate to the maximum reliable value are steps that could be considered.

*Note...Protocol must be set to 'Modbus Master' for Modbus serial talk through. Also 'Unit ID Enable' must be set to 'Instrument' (Section 4.2.3).

4.31 SERIAL COMMUNICATIONS (Cont.)

Parity	Parity is a method of ensuring that the data transferred between devices has not been corrupted by ensuring that a single byte contains either an even or an odd number of ones or zeros in the data. In industrial protocols, there are usually layers of checking to ensure that first the byte transmitted is good and then that the message transmitted is good. Modbus applies a CRC (Cyclic Redundancy Check) to the data to ensure that the packet of data is not corrupted. Thus there is usually no benefit in using odd or even parity, and since this also increases the number of binary bits transmitted for any messages, it decreases throughput. 0 = No parity; 1 = Odd parity; 2 = Even parity
Stop Bits	0 = 1 stop bit; 1 = 2 stop bits
Timeout	This sets the slave timeout for modbus serial master or message timeout for ASCII input in milliseconds
Data Bits	0 = Seven Data Bits; 1 = Eight Data Bits
First Start Char	The decimal ASCII value for the first start character
Second Start Char	The decimal ASCII value for the second start character
First End Char	The decimal ASCII value for the first end character
Second End Char	The decimal ASCII value for the second end character
Group 1 to 30	1 = Send message to the relevant group.

4.31.1 ASCII protocol details

ASCII mode allows the unit to receive simple ASCII messages from, for example, barcode readers, Programmable Logic Controllers (PLCs), Global Positioning Systems (GPSs) (NMEA-0183 protocol) etc.

Messages are sent to as many groups as are set up to receive them, and become a part of these groups'

histories, and appear on vertical and horizontal trend displays in the following format:

23/01/2013 16:05:23 (Serial) Message

The message can be prefixed by 0, 1 or 2 specific characters and can be suffixed by 0, 1 or 2 specific characters. The First and Second Start and End characters are entered as decimal ASCII codes between 0 and 127 as required. 0 = no character, 10 = Line Feed; 13 = Carriage Return. See Annex B for a list of ASCII codes. If only one start or end character is required, the first character must be entered, and the second character be entered as zero.

GROUP SELECTION

For ASCII input protocol, this allows groups to be selected (Yes) or deselected (No) for receipt of the messages.

MESSAGING INFORMATION

Characters are read into a buffer, until the end of message characters are received, or until the time-since-last-character exceeds the entered Timeout value. Date, Time and '(Serial)' are then prefixed to the message, which is then sent to the selected group(s). The date and time relate to when the first buffered character was received. If Start-of-message characters are configured, characters will be read into the buffer only after these characters have been received.

The buffer holds up to 120 characters plus date/time etc. and start/end-of-message characters. Further characters are discarded until End-of-message is received, or timeout occurs.

Message characters below Hex 20 (decimal 32) are replaced by question marks (?).

Message characters above Hex 7F (decimal 127) are treated as Unicode.

4.31.1 ASCII PROTOCOL DETAILS (Cont.)

MESSAGING RULES

1. If no start-of-message characters are configured, but a timeout value other than 0 has been entered, the new message starts after the timeout period has elapsed.
2. If no end-of-message characters are configured, but a timeout value other than 0 has been entered, the new message ends after the timeout period has elapsed.
3. If start-of-message characters are configured, and a timeout value other than 0 has been entered, all characters prior to the Start-of-message characters are ignored.
4 If start-of-message characters are configured but neither end characters nor timeout have been configured, then this is an invalid configuration. Should this configuration be a requirement, if the same characters are entered as end-of-message characters instead, then each message will be sent to the groups when the next message is received.
5. If no start or end-of-message characters are entered and no timeout value is entered, all received characters are discarded
6. If a received message is deemed to be corrupt, it is discarded and the software will await a further message.
7. Start and End-of-message characters are removed before the messages are sent to the groups.

4.32 DIAGNOSTICS

This gives a read only display of a number of diagnostic items.

Figure 4.32 Diagnostic display

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 on the underside of the IOC unit to a host computer either directly or via a network. Either 'straight-through' or cross-over cable can be used.

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 5.2.1a 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).

5.2.1 FUNCTION CODES (Cont.)

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 5.2.1b, below.

Code		Modbus definition	Description (see Modbus specification for full details)
Dec	Hex		
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 computer.
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.

5.3 PARAMETER LIST

The list of parameters which are accessible via communications is to be found in the SCADA list included in the iTools Parameter Help file. This list includes both decimal and hexadecimal addresses. The enumerations (i.e what the values returned mean) are to be found both in the parameter help and in the various iTools configuration windows.

5.3.1 Addresses

Canonical addresses are generally the addresses published in communications handbooks, for users of 3rd-party communications drivers.

These are often not the addresses used by iTools because the same parameter also exists at a second address where it may be read with higher precision - as an IEEE 32-bit float or integer, rather than a scaled integer. Some 3rd-party communications drivers do not support this advanced functionality, thereby making it harder (or impossible) to configure when using these addresses.

6 USB DEVICES

The devices listed below can be plugged into the USB connector on the IOC terminal unit.

1. Memory Stick
2 Printer

Notes:

1. 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.
2. 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 1.5 metres (5 ft.)

6.1 MEMORY STICK

The use of the memory stick as an archiving device is well documented in the relevant sections of this manual.

6.2 PRINTER

Allows the printing of reports to a Star 700 TPS II ticket printer.

7 WEB SERVER

7.1 INTRODUCTION

The Web Server option allows the user to view a selectable recording group and to display the channels in this group as a graph, as a bar chart or as numerical values. The user can also acknowledge alarms, control batches, enter batch field data and control archiving if the relevant user permissions are set in the security editor (section 3.7.2).

Notes:

1. Up to four host computers can connect with the versadac instrument.
2. The host computer (pc, tablet mobile phone) must use one of the following browsers, or the Web Server might not work:
   Google Chrome V22.0 or higher
   Google Mobile Chrome (Android Mobile technology running 'Ice cream sandwich' or greater)
   Internet Explorer V9.0 or greater
   Mobile Safari (Apple Mobile technology running IOS 5.0 or greater).
3. Browsers should be configured to allow Cookies, and support for file caching should also be enabled.

7.1.1 Connecting

1. Ensure that the host computer and the versadac instrument are on the same network (section 4.2.1) and that the host is running one of the browsers in note 2, above.
2. Set 'Server Enable' to Enabled in Web Server configuration (section 4.30). In the same configuration area, ensure that 'Security' is Enabled or Disabled, as required.
3. Ensure 'Web Server Account' is ticked for the user (section 3.7.2), and that the relevant permissions are enabled. (See note below.)
4. Ensure that the versadac is not in configuration mode (section 3.2.2).
5. In the Web browser type in: http://IP1.IP2.IP3.IP4, or if security is enabled, https://IP1.IP2.IP3.IP4, where IP1.IP2.IP3.IP4 is the IP address of the versadac (section 4.2.1), and initiate the search.

Note: It is not possible to tick 'Web server Account' (the tick box is greyed out) for the default user IDs (Logged out, Operator, Supervisor or Engineer).

If all the above are satisfactory, the Web browser opens, displaying the login page. Once a successful login has been made, the home page appears, as described in section 7.2.

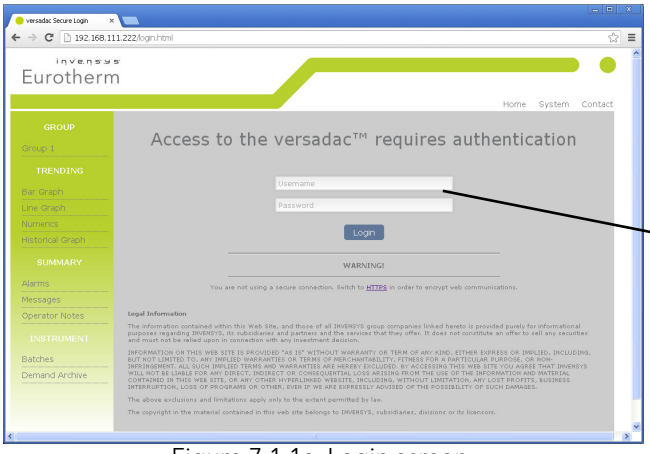


Figure 7.1.1a Login screen

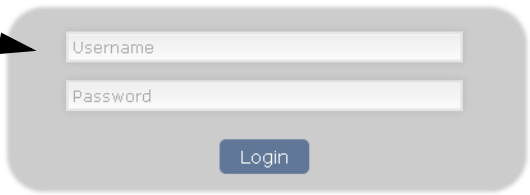


Figure 7.1.1b Login detail

7.2 HOME PAGE

Figure 7.2 shows a typical home page, with links to the different page items.

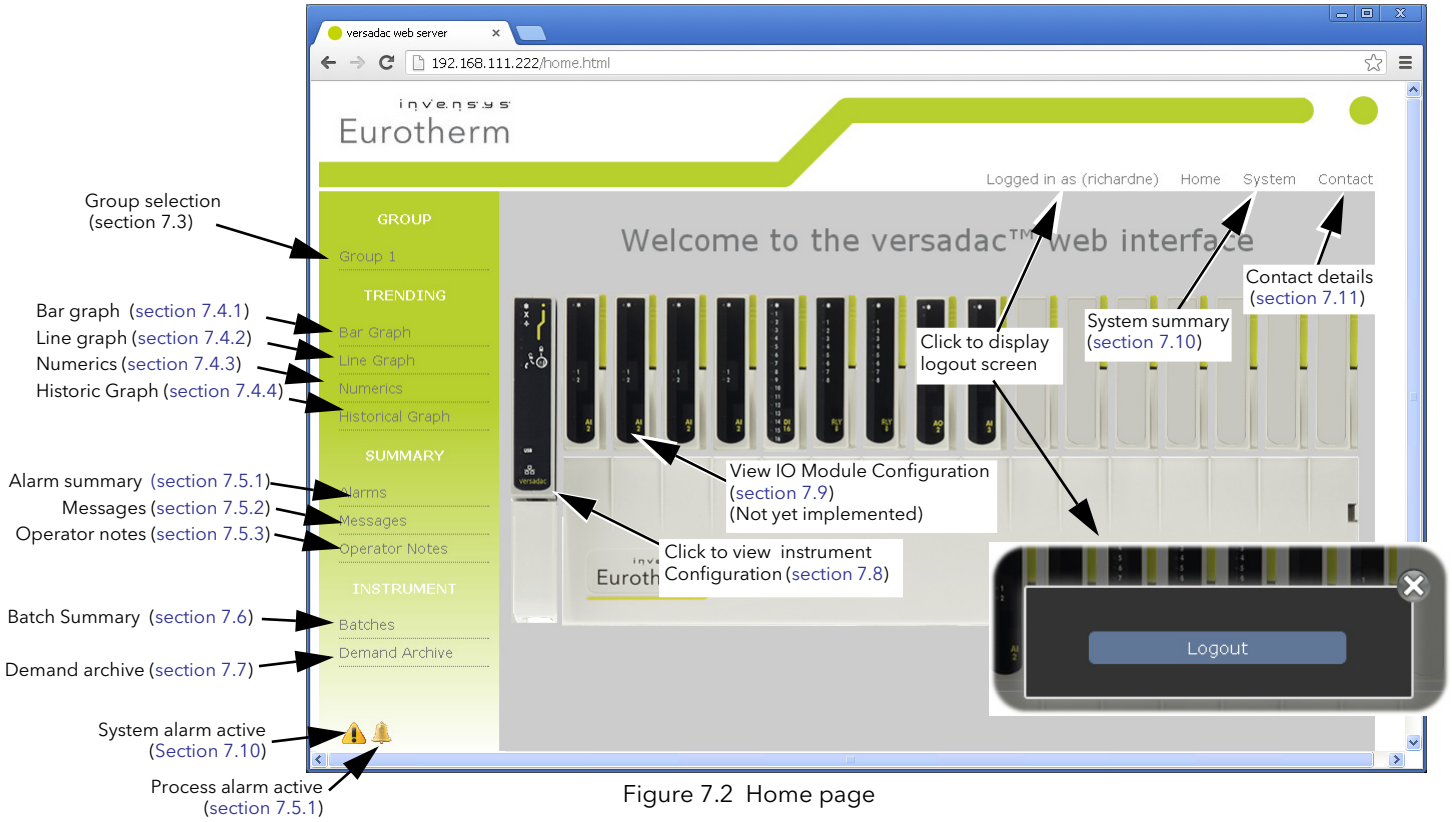


Figure 7.2 Home page

7.3 GROUP SELECTION

Clicking on this item produces a list of the available groups allowing the user to select a group for trending etc. If the group has been configured with a descriptor, then this descriptor appears instead of the default 'Group N'.

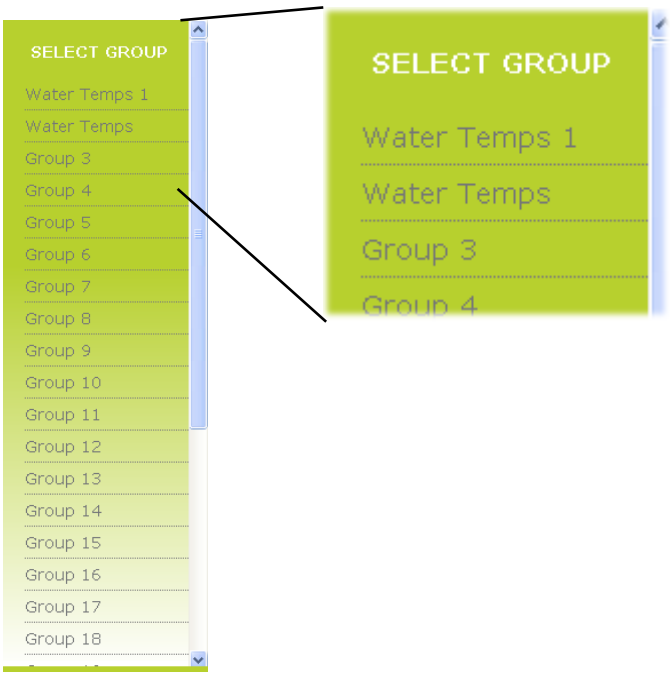


Figure 7.3 Group list

7.4 TRENDING

The type of trend selected affects all groups, not just the current group.

Note: The maximum number of points that can be displayed in any group is 20.

7.4.1 Bargraph

Clicking on 'Bargraph' calls the default bargraph display (figure 7.4.1a) for the selected group. In this example there are six points being recorded. If the user has selected an empty group, a warning message appears. See section 4.3 for details of Group configuration.

The vertical scale is set to match the highest and lowest values associated with all the points in the group

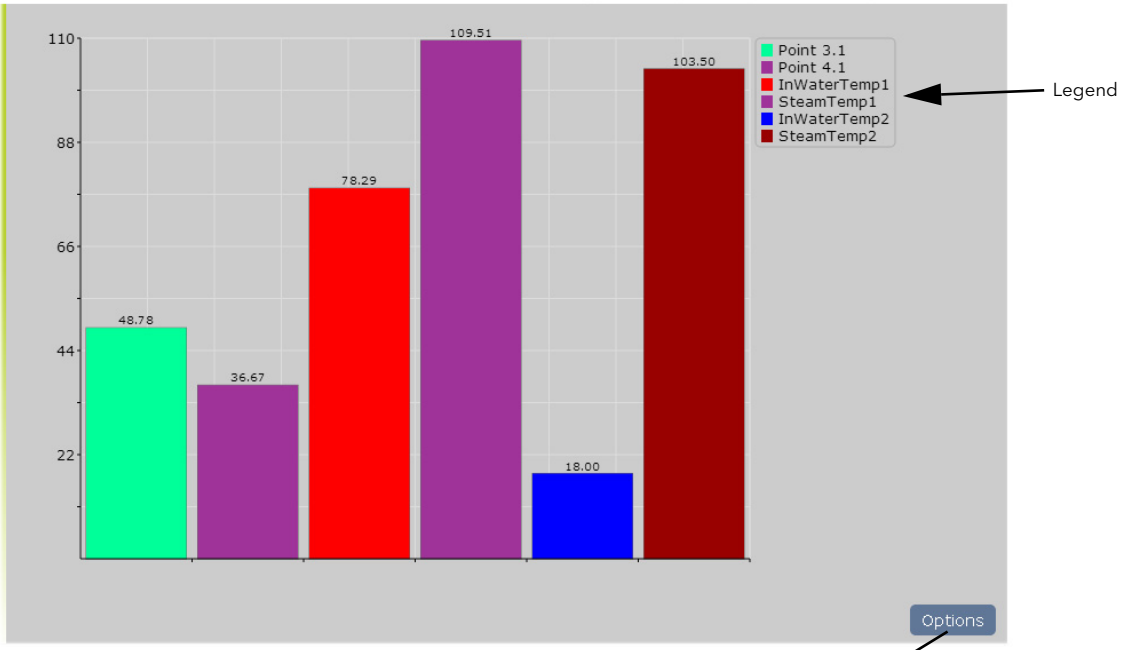


Figure 7.4.1a Default bargraph

Clicking on the Options button calls the bargraph options page, part of which is depicted below.

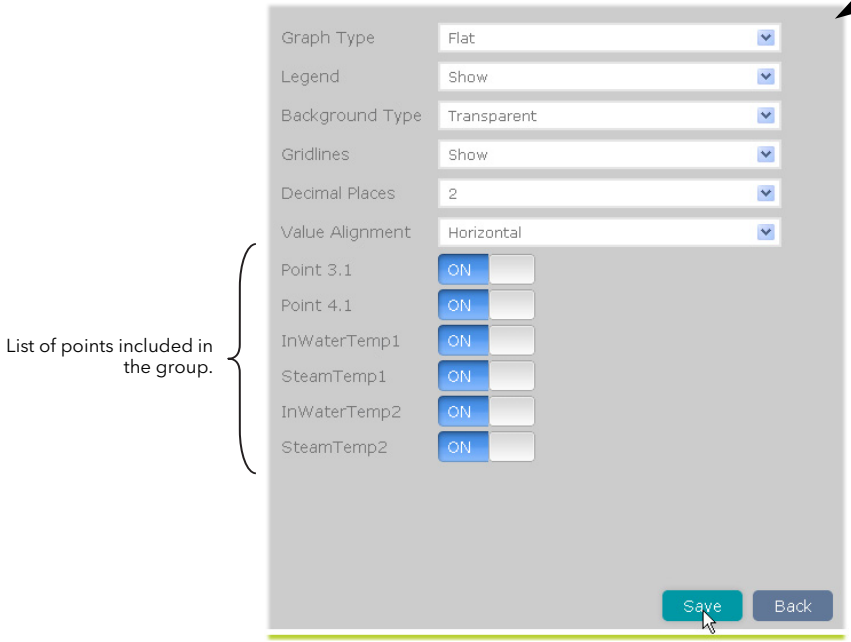


Figure 7.4.1b Bargraph options

7.4.1 BARGRAPH (Cont.)

OPTIONS

GRAPH TYPE

Three types of graphical representation are possible: Flat, Gradient and 3D. Figure 7.4.1c below, is a composite, showing the three types together for comparison. It is of course, not possible to mix graph types in this way in the Web Server.

Once any changes have been made, the 'Save' button must be clicked to confirm the changes, and the 'Back' button clicked on to return to the bargraph display. Clicking on the Back button before saving causes any changes made to be discarded.

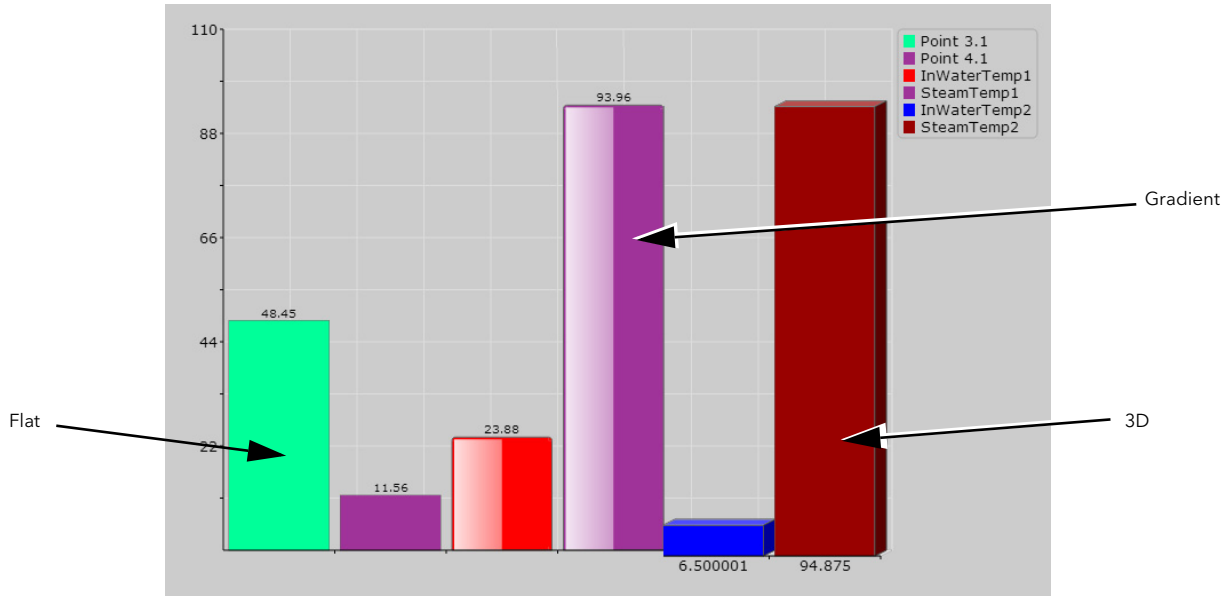
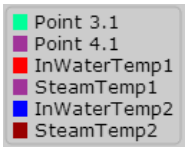


Figure 7.4.1c Bargraph type comparison.

LEGEND

This allows the Legend to be displayed or not, as required. The Legend lists each point in the group by name and by colour, in the order in which they are entered in the group configuration. This is an aid to determining which point is which on the display. If set to 'Hide', the trend display expands to fit the available width of the page.



BACKGROUND TYPE

This allows the user to select 'Transparent' (grey), White or Black as the background colour for the display. The gridlines (if shown) appear in a colour which contrasts with the selected background colour.

DECIMAL PLACES

The number of decimal places for the displayed values.

GRIDLINES

The gridlines can be switched on (Show) or off (Hide) as required.

VALUE ALIGNMENT

The values displayed for Flat or 3D bargraph types can be shown horizontal (as shown above) or vertical (figure 7.4.1d).

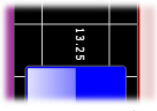


Figure 7.4.1d
vertical alignment

POINT LIST

This is a list of all the points in the selected group, together with an indication as to whether each one is being included in the display (ON) or not (OFF). To exclude a point, click on 'ON'. To include it, click on 'OFF'.

Figure 7.4.1e
Point display status

7.4.2 Line Graph

This type of display shows the group points as though being trended on a chart moving from right to left. Figure 7.4.2 shows the default display type. The amount of data displayed depends on the Sample Period selected in the options menu.

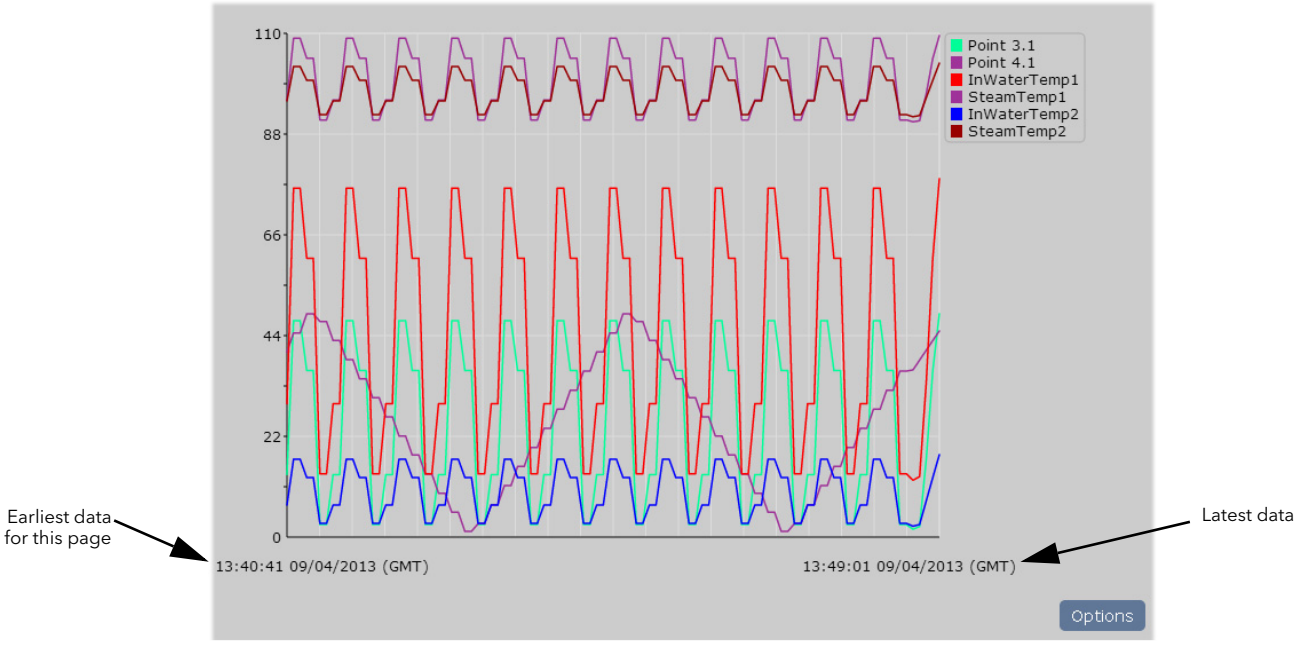


Figure 7.4.2a Line graph display

Clicking on the Options button calls the line graph options page, part of which is depicted below.

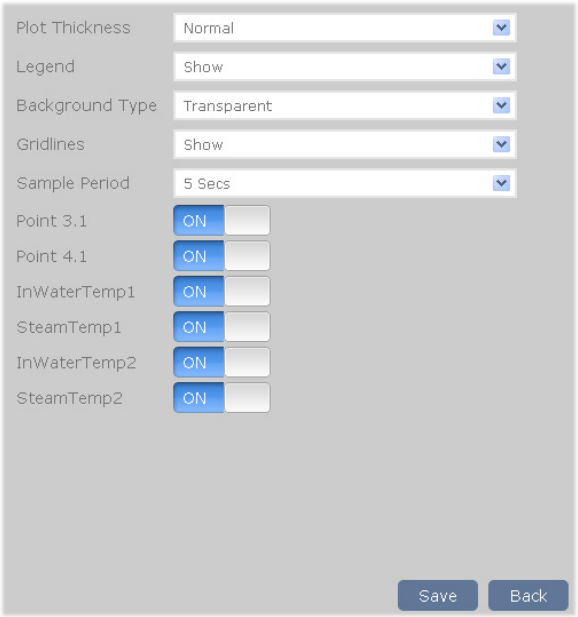


Figure 7.4.2b Line graph options

7.4.2 LINE GRAPH (Cont.)

OPTIONS

PLOT THICKNESS

This allows the choice of Narrow, Normal (default) or Wide as the trace thickness. Figure 7.4.2c is a composite figure showing the three thicknesses together for comparison. Clearly this could never happen on a real system, as only one thickness can be chosen at a time. The selected line thickness applies to all groups and historical displays.

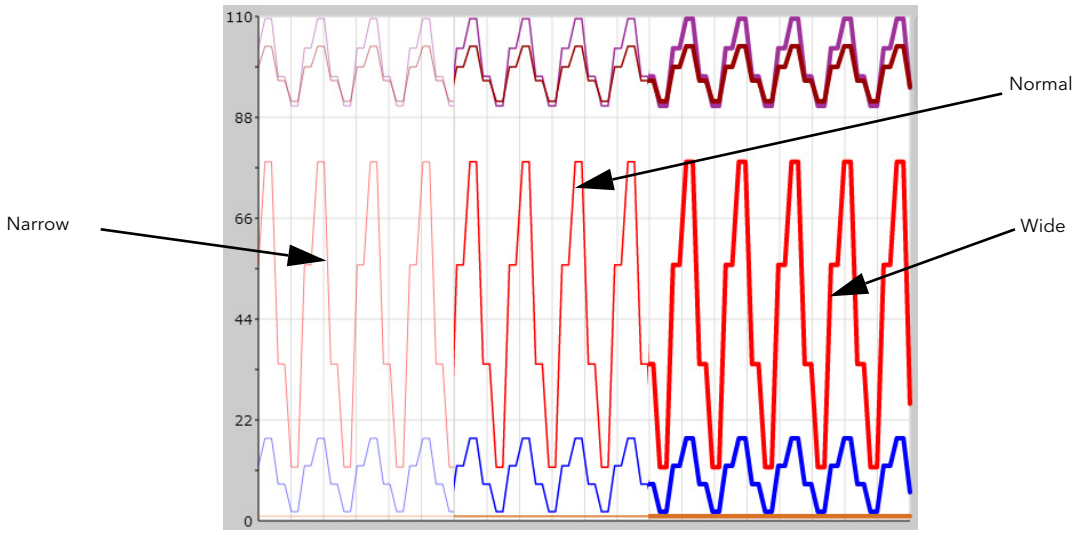


Figure 7.4.2c Plot thickness examples

Figure 7.4.2c shows the trend displays against a white background instead of the default transparent (grey). Background colour (Background Type) is selected as described for bargraphs in section 7.4.1, above

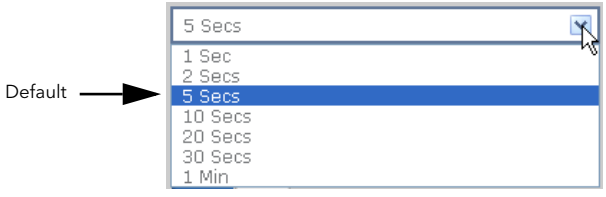
LEGEND, BACKGROUND TYPE AND GRIDLINES

As described for bargraphs in section 7.4.1, above.

SAMPLE PERIOD

Allows a sample period to be selected for the line graph display. The sample period can be set to one of a number of values as shown in figure 7.4.2d which also shows the amount of time displayed across the page for each selection. The selection applies to all groups and to historical data.

Note... The screen width contains 100 samples



Sample period	Amount of displayed data
1 sec	1 minute 40 seconds
2 secs	3 minutes 20 seconds
5 secs	8 minutes 20 seconds
10 secs	16 minutes 40 seconds
20 secs	33 minutes 20 seconds
30 secs	50 minutes
1 min	100 minutes

Figure 7.4.2d Sample period selection

POINT LIST

As described for bargraphs in section 7.4.1, above.

7.4.3 Numerics

This type of display shows the group points as numeric values against the points' background colours. Figure 7.4.3 shows a typical display.

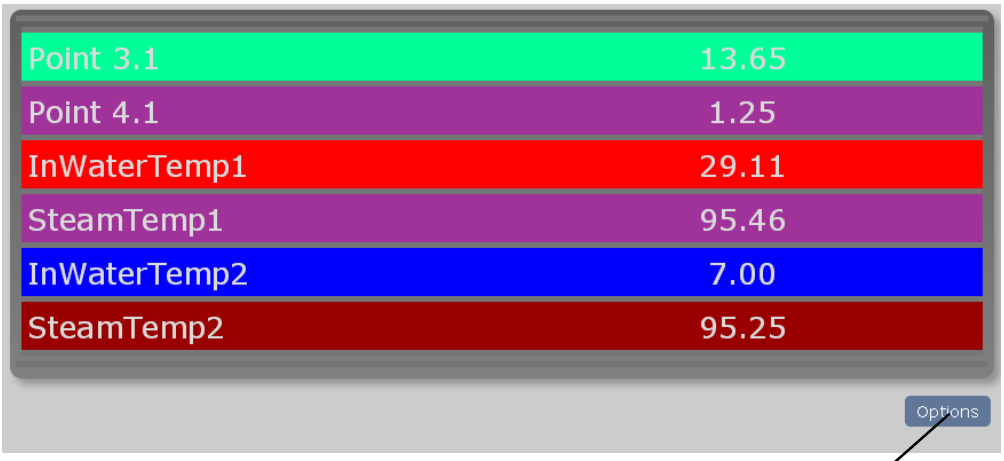


Figure 7.4.3a Numerics display

Clicking on the Options button calls the numerics options page, part of which is depicted below.

Figure 7.4.3b Numerics options

OPTIONS

CHANNEL/PV FONT SIZE

Allows Small, Normal or Large to be selected for either or both the point name and its associated value. Figure 7.4.3c, below, shows all three values for comparison, although it is not possible to display more than one size at a time.

DECIMAL PLACES

The number of decimal places for the displayed values.

7.4.3 NUMERICS (Cont.)

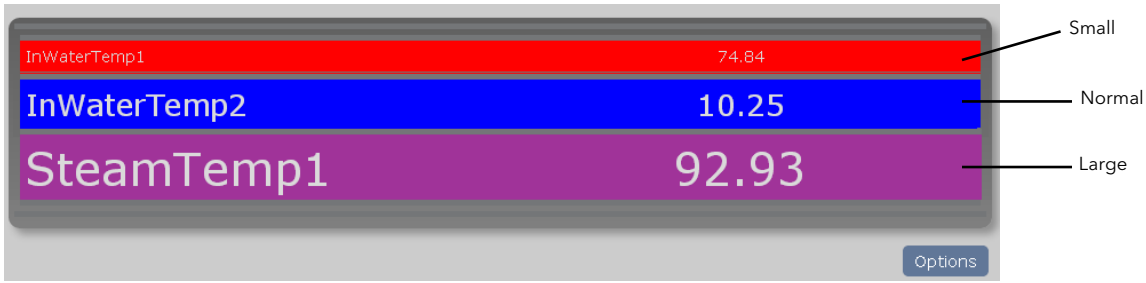


Figure 7.4.3c Comparative Font sizes

Note: The figure above shows the same font size used for both the point identifier (Channel Font Size) and the value (PV Font Size). It is also possible to use one font size for the channel and another for the PV.

7.4.4 Historical graph

The historical graph is a line graph display showing the trend history of the group, starting with the latest data, and allowing navigation back through the previous 6 screen widths of data. As with a normal line graph, the amount of data displayed is fixed at 100 points but as the time interval between points depends on the sample rate, the time period for the entire graph varies accordingly.

The times and dates of the beginning and end of each page of history are displayed, and 'Previous Data' and 'Next data' buttons allow for navigation.

Background colour, plot thickness etc. are as selected in the Options page (described in sections 7.4.1 and 7.4.2, above). Figure 7.4.4a shows a typical history page.

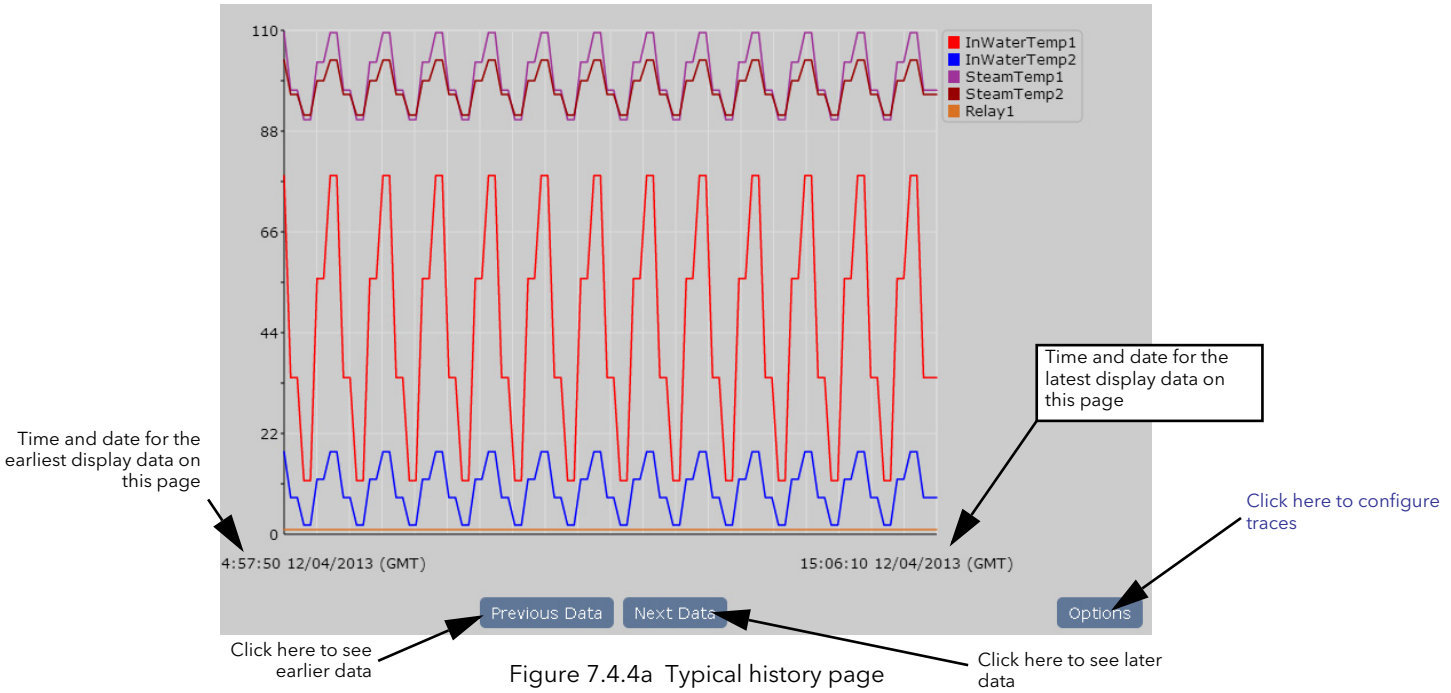


Figure 7.4.4a Typical history page

7.5 SUMMARY PAGES

7.5.1 Alarm summary

This page shows the current status of all the point alarms in the current group. Figure 7.5.1a shows the appearance of the different types of alarm, and the acknowledged and not acknowledged indicators.

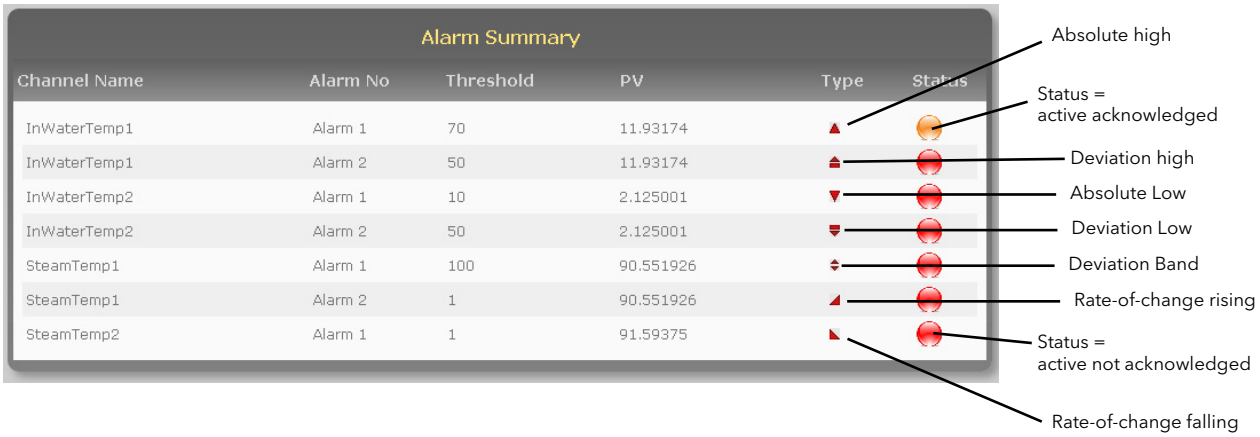


Figure 7.5.1a Alarm summary page

To acknowledge one or all alarms, click on the alarm to be acknowledged then click on either that alarm or 'All alarms in group' as required (figure 7.5.1b)

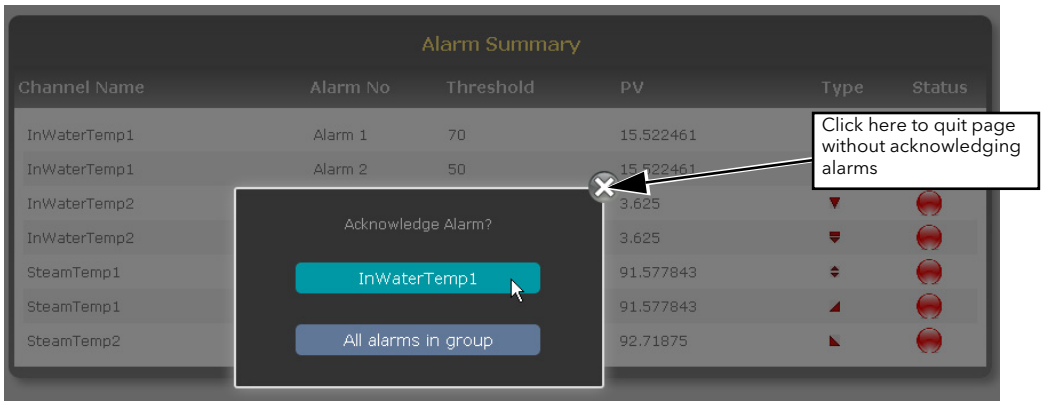


Figure 7.5.1b Acknowledge alarm

To quit the acknowledge page without acknowledging any alarms click on the 'X' button.

7.5.2 Messages

Clicking on Message calls the first message summary page, a typical example of which is shown in figure 7.5.2a, below. The complete list includes the last 30 messages for the current group, in chronological order.

Clicking on the Refresh icon towards the bottom of the page updates the list to show any messages which have arrived since the message summary page was opened, or since the last Refresh operation.

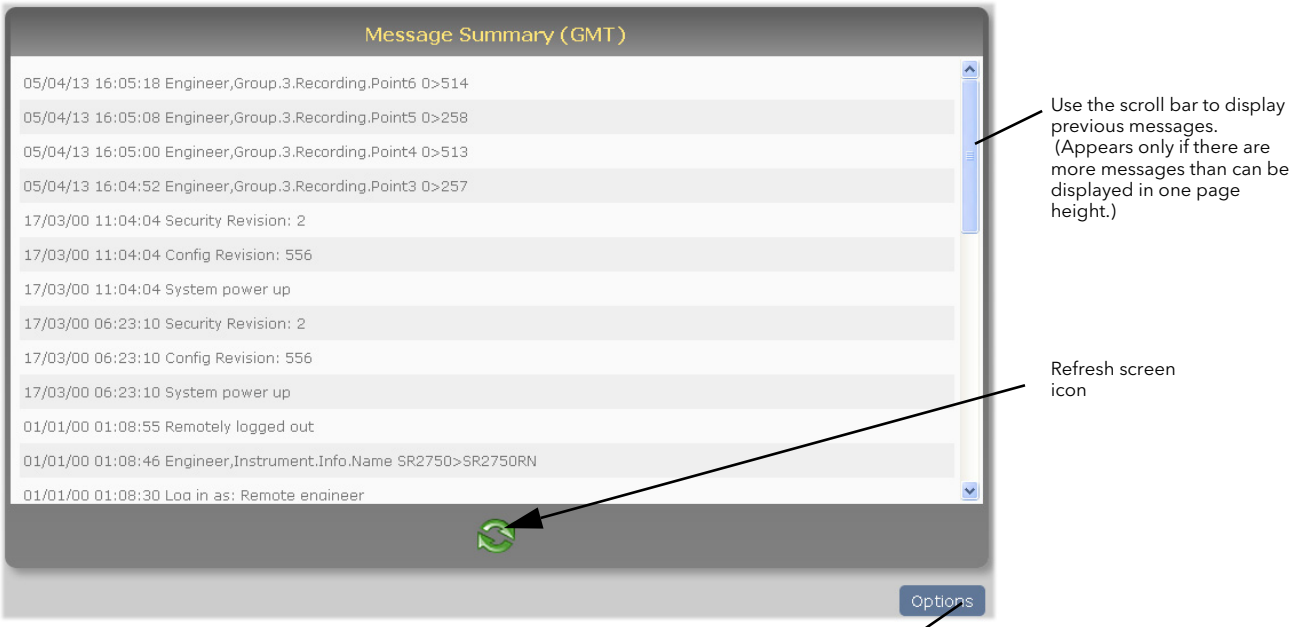


Figure 7.5.2a Message summary page

Clicking on the Options button allows the user to filter the messages (figure 7.5.2b) so that only messages of a certain category are listed.

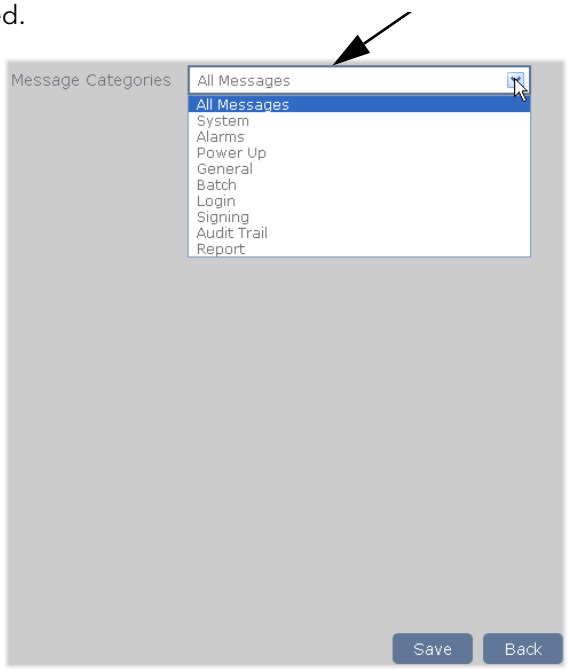


Figure 7.5.2b Message filters

7.5.3 Operator Notes

This page allows the user to type in and send a 'Custom Note', or to send one of ten notes as configured in Group configuration (Section 4.3.4) to the history file. Figure 7.5.3a shows the page, where Note 1 has been configured.

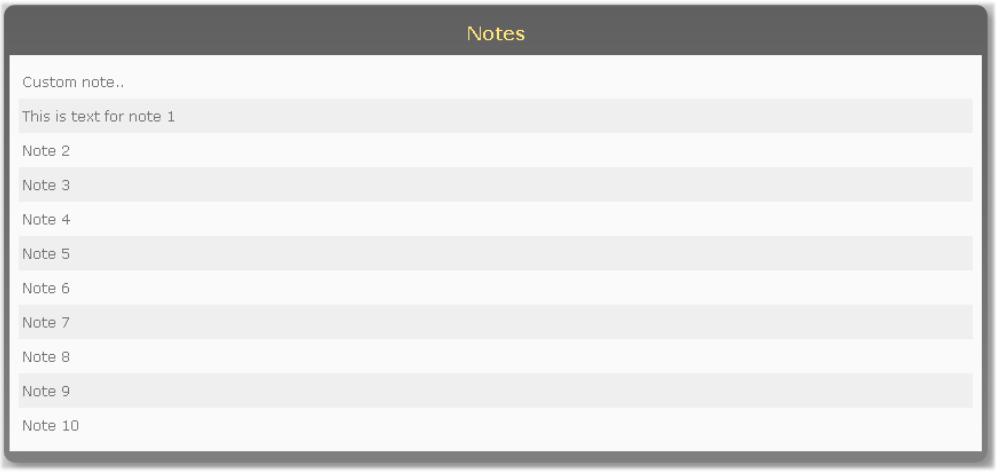


Figure 7.5.3a Operator notes summary page

To send notes 1 to 10, the user clicks on the required note, and then on 'Send' in the Confirmation pop-up shown (for Note 1) in figure 7.5.3b.

Figure 7.5.3b Confirm sending of note

The sending of the Custom Note is carried out in the same way except that the user can type in the required text (figure 7.5.3c) before clicking on 'Send'.

Figure 7.5.3c Custom note text entry

7.6 BATCH SUMMARY

See section 3.6 and section 4.28 for batch control and configuration details.

The Batch Summary page shows the Batch summary for each currently recording group (if Batch Scope is set to 'Group'), or for the whole instrument (if Batch Scope is set to 'Instrument').
Figure 7.6a, below shows a page with three group batches, the top two of which are running, the third of which is stopped.

Figure 7.6a Batch summary page

Clicking on any one of the fields, causes the batch control page for the selected group to appear. Figure 7.6b shows an example for a running 'Start/Stop' mode batch.

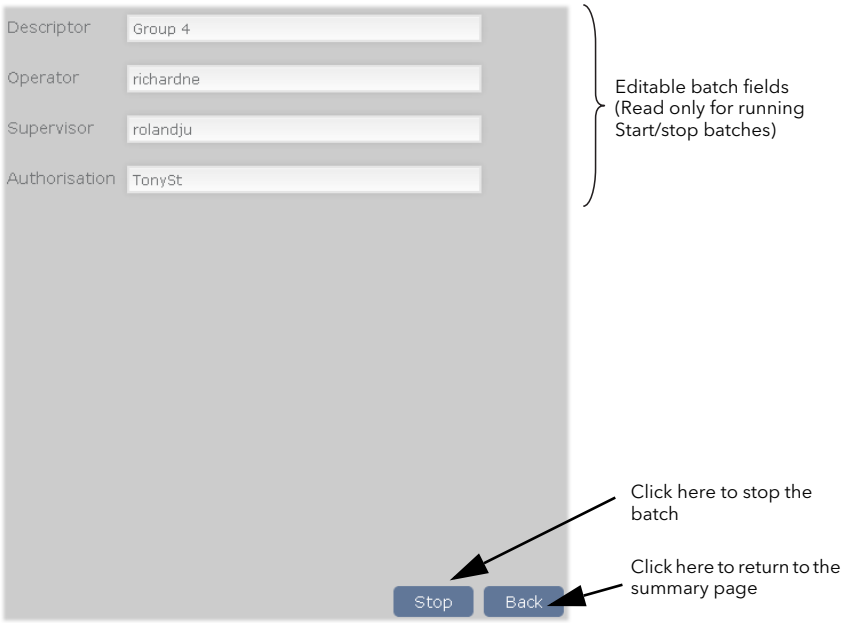


Figure 7.6b Batch Control page

The page for stopped batches or for continuous batches, is identical, except that the 'Stop' button is replaced by two buttons: 'Store' (allowing the changes to be saved for later batch initiation) and 'Start' to initiate the batch. (Figure 7.6c shows the three buttons.)

Figure 7.6c Save/Store/Back buttons

7.7 DEMAND ARCHIVE

This page allows the user to initiate a demand archive to a USB memory stick, or via FTP to a host computer.

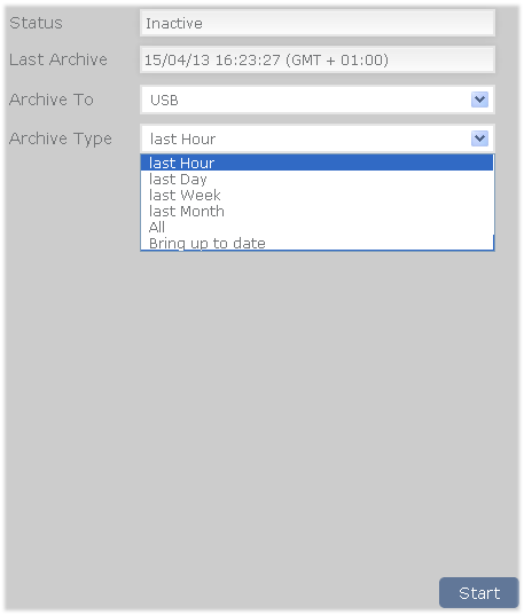


Figure 7.7 Demand archive page

7.7.1 Parameters

Status	Read only display of archive status as 'Active' or 'Inactive'.
Last Archive	The time and date of the last successful archive (including locale information)
Archive to	Select USB or FTP server. (See figure 2.3.1a for the location of the USB connector.)
Archive Type	Select the required amount of data to be archived from the drop-down list.

Click on 'Start' to initiate the archive.

7.8 IOC CONFIGURATION

Clicking on the image of the IOC in the home page calls the Instrument configuration page (figure 7.8) giving basic details of the instrument configuration. All the information is read-only.

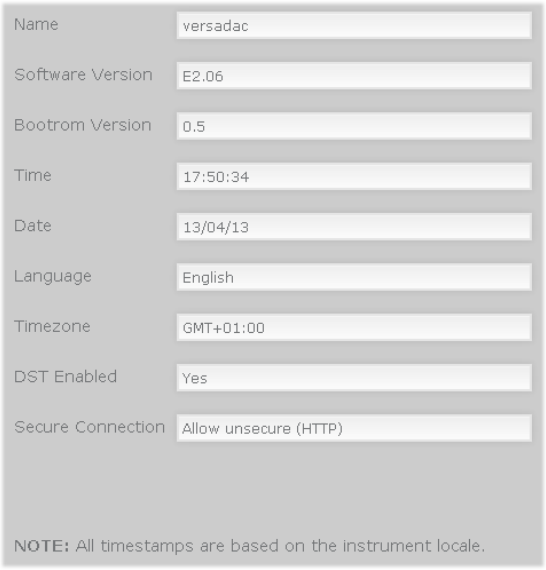


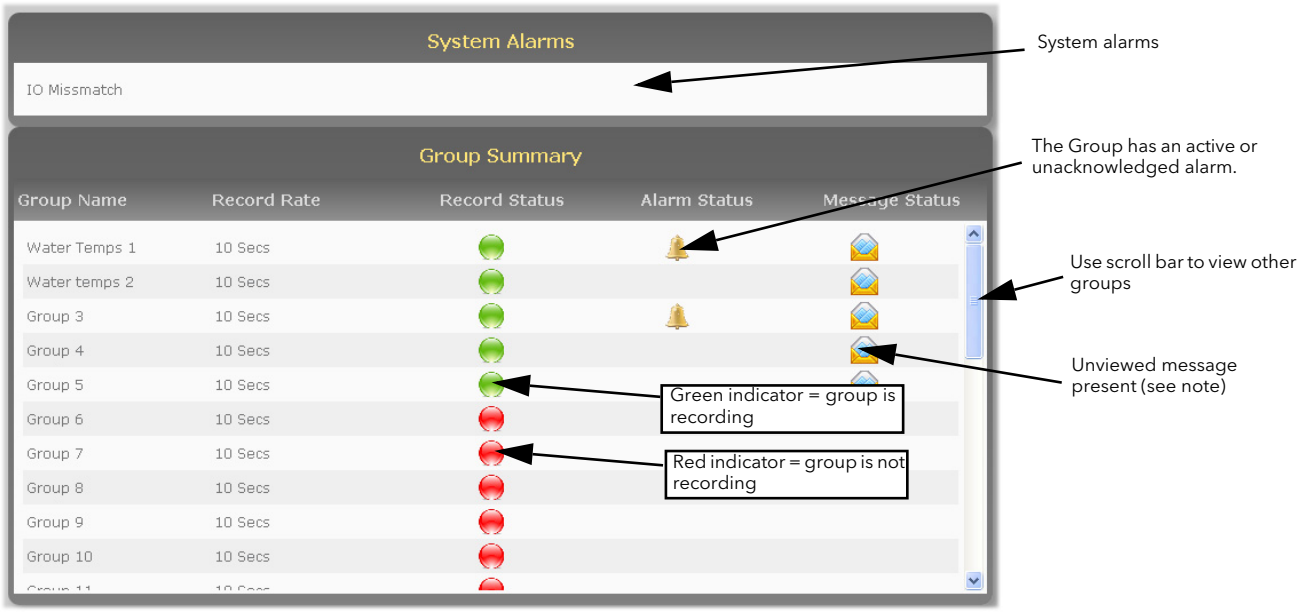
Figure 7.8 Instrument configuration

7.9 IO MODULE CONFIGURATION

Not implemented this release.

7.10 SYSTEM SUMMARY

This page lists all the active system alarms and contains a separate table showing the recording rate, recording status, alarm status and message status for every available group



Note: Once the Messages page for the Group has been visited from any of the four available connections to the Web Server, the Message Status icon for the Group will be cleared on all connections to the Web Server.

7.11 CONTACT DETAILS

This contains links to the following Eurotherm sites.

Accredited services: http://www.eurotherm.co.uk/services/accredited-services/

Customer first & technical support: http://www.getsatisfaction.com/eurotherm/

Installation and commissioning: http://www.eurotherm.co.uk/services/installation-and-commissioning/

Repair and support services: http://www.eurotherm.co.uk/services/service-and-repair/

Figure 7.11 Contact links page

7.12 ERROR MESSAGES

7.12.1 Cannot connect to error

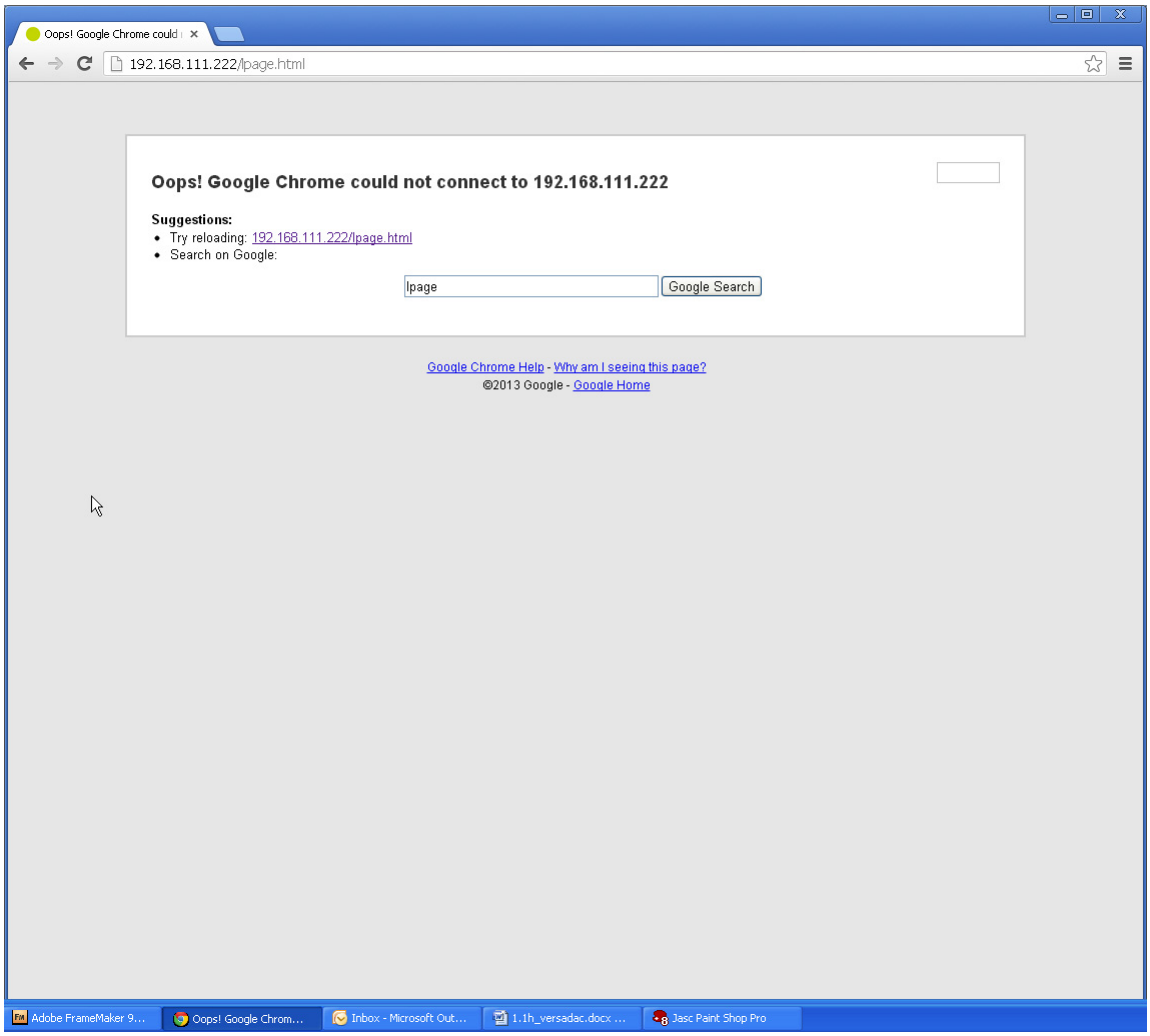


Figure 7.12.1 Cannot connect error

This message or one similar, according to the browser in use, appears when the instrument cannot be contacted, typically because it is not on the same network as the host, because it is powered down, because 'Server Enable' is Disabled in Web Server configuration (section 4.30).

Note: For secure (https) web access the versadac comes with some factory supplied self signed SSL certificates. It is possible to install custom SSL certificates if required. These must be in pem form and need to be put into an upgrade file ssl_cert.tgz. Details how to do this can be obtained from Eurotherm Technical Support. The SSL certificates are installed using Instrument/upgrade (section 4.1.5) by setting the type of upgrade to "SSl cert via USB" or "SSL cert via FTP".
It is possible to revert to the factory supplied certificates by using the 'DefaultSSL' parameter in 'Instrument/security (section 4.1.3).

7.12.2 Other error messages

The error messages that can be displayed are detailed below. Error messages appear in the format shown in figure 7.12.2, and are cleared from the screen by clicking on the white cross in the top right-hand corner.

Figure 7.12.2 Typical error message

ACCESS DENIED. INSTRUMENT IS IN CONFIG MODE

Occurs when an attempt is made to log in to the Web Server whilst the instrument is in configuration mode.

Open iTools and quit configuration mode.

CONFIG MODE ACTIVE, YOU HAVE BEEN LOGGED OUT!

The Web Server logs all users out when the instrument is switched into configuration mode. Log in again.

DEFAULT USERS CANNOT ACCESS WEB FUNCTIONALITY

Displayed if an attempt is made to log in using a default user (i.e. Engineer, Operator, etc).

FAILED TO CONNECT AFTER FIVE ATTEMPTS...

This message appears if connection with the instrument is lost, typically because the instrument loses power, the network cable is unplugged or some other communications problem (perhaps a timeout) arises between the host and the instrument.

The problem may be self correcting, in which case clicking on the 'Refresh now' button will return the user to the previously displayed page or to the login page. Otherwise communications must be restored manually before the Refresh now button has any effect.

HISTORICAL DATA NOT VALID FOR THIS CONFIGURATION

Displayed if an attempt is made to select historical trend mode for a Group which contains no points.

INVALID PASSWORD

Occurs if an attempt is made to log in, using a password not associated with the associated User ID.

NO MORE SESSIONS AVAILABLE

Appears when attempting to log in when four separate computers are already logged in.

NO POINTS CONFIGURED FOR THIS GROUP

Displayed if an attempt is made to select a trend mode for a Group which contains no points. Either select another Group, or configure the selected group such that it has at least one point in it (section 4.3.2).

USER ACCOUNT DOES NOT EXIST

Occurs when an attempt is made to log in using an unknown username.

USER ACCOUNT IS DISABLED

Appears if an attempt is made to log in using a disabled user account.

USER ACCOUNT IS EXPIRED

Appears if an attempt is made to log in using an expired user account.

USER DOES NOT HAVE WEB ACCESS PERMISSION

Appears if a user without web access permissions attempts to log in.

Note: Successive incorrect log in attempts add a cumulative 2 second delay to the log in time on the instrument. This is to prevent 'brute force' password attacks.

This page is deliberately left blank

Appendix A SPECIFICATION

A1 INSTALLATION CATEGORY AND POLLUTION DEGREE

This product has been designed to conform to BS EN61010 installation category II and pollution degree 2. These are defined as follows:

INSTALLATION CATEGORY II

The rated impulse voltage for equipment on nominal 230V ac mains is 2500V.

POLLUTION DEGREE 2

Normally, only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation shall be expected.

A2 GENERAL SPECIFICATION

Physical

Base unit dimensions	0 module:	61mm wide x 180 mm high x 132 mm deep (2.41in x 7.1in x 5.2in)
	4 module:	172.4mm wide x 180mm high x 132m deep (6.79in x 7.1in x 5.2in)
	8 module:	274mm wide x 180 mm high x 132 mm deep (10.8in x 7.1in x 5.2in)
	16 module:	477mm wide x 180 mm high x 132 mm deep (18.8in x 7.1in x 5.2in)
Base Unit fixing centres	0 module:	26mm (1.023in)
	4 module:	127.4mm (5.02 in)
	8 module:	229mm (9.016 in)
	16 module:	432.2mm (17.016 in)
Weight	0-module base unit:	0.7 kg (1.54 lb). Including IOC
	4-way:	No modules = 0.7 kg (1.54 lb). Including IOC and 4 x I/O modules = 1.65 kg (3.64 lb) max
	8-way:	No modules = 0.98 kg (2.16 lb). Including IOC and 8 x I/O modules = 3.1 kg (6.83 lb) max.
	16-way:	No modules = 1.6 kg (3.53 lb). Including IOC and 16 x I/O Modules = 5.24 kg (11.55 lb) max.

See figures 2.2a/b for dimensional details

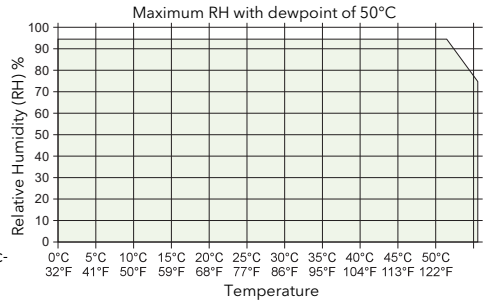
Electrical

Safety earth connections	Earth terminal strip at lower front flange of base unit
Supply voltage	24V dc (±20%)
Supply power (max.)	82 Watts (16 module base)
Surge current (max.)	8 Amps
Back-up supply	BR2032 Lithium coin cell fitted on the IOC terminal unit. (Figure 2.3.1a)

If the supply voltage falls below 19.2V dc during startup, the instrument can enter a continuous cycle of attempted re-starts.

Environmental

Temperature	Storage:	-20 to +85°C
	Operation:	0 to + 55°C
Humidity	Storage/Operation:	5 to 95% RH (dewpoint 50°C) (See graph)
Atmosphere		Non-corrosive, non-explosive.
Altitude (max.)		2000m
Environmental protection	Panel:	BS EN60529:IP20
RFI	EMC emissions:	BS EN61326-1:2006 Class A
	EMC immunity:	BS EN61326-1 :2006 Industrial locations
Electrical Safety Specification		BS EN61010-1: 2001 (see section 'A1', above); UL61010
Vibration		To BS EN61131-2 (9 to 150Hz @ 1g; 1 octave per minute).
Shock	Impact withstand	BS EN61010 (Corner drop test 100mm)
Packaging		BS EN61131-2 section 2.1.3.3
	Free fall:	BS EN60068-2-32, proc. 1 (five x 1 metre drops for each of six faces).
Flammability of plastic materials		UL746 UL V0
RoHS compliance		EU; China



Approvals

CE; cUL (UL61010); GOST

Ethernet Communications

Connectors:	RJ45 connector located on the IOC module.
Network medium:	Ethernet Category 5 cables.
Protocols:	Modbus-TCP RTU slave, FTP.
Speed:	10/100 Mbps.
Network Topology:	Star connection to a hub.
Line length (max):	100 metres, extendable by repeater.
Allocation of IP address:	Manual or DHCP.
Isolation:	50V dc; 30V ac. (IEEE 802.3)

Modbus Communications

Connector:	9-way D-type socket mounted on the Terminal unit.
Network medium:	EIA485, switch selectable as 3-wire or 5-wire.
Protocols:	MODBUS/JBUS RTU master and slave; ASCII input
Isolation:	None.

A3 IOC SPECIFICATION

A3.1 TERMINAL UNIT

Physical		
Dimensions (approx.)	50 mm wide x 110 mm high	
Weight (approx.)	0.1kg	
Setup Switch		
Segment 1:	Serial debug enable/disable	
Segment 2:	versadac Rx line terminated/not terminated	
Segment 3:	versadac Tx line terminated/not terminated	
Segment 4:	3-wire/5-wire select	Segments 4 and 5 must both be set to 3-wire or both be set to 5-wire.
Segment 5:	3-wire/5-wire select	
Segments 6 to 8:	Not used this version.	
User Connectors		
Supply power	Two x two-way terminal block for supply power.	
Modbus	9-way D-type connector	
USB	Type A connector.	
USB		
Connector type	Type A located on IOC terminal unit (figure 2.3.1a)	
USB standard	USB2.0 host communications	
Source current	500mA max (current limited)	
Fuse	Within primary IOC. Non-user replaceable.	

A3.2 IOC MODULE

A3.2.1 Hardware

General	
Dimensions	25 mm wide x 114.3 mm high x 110mm deep
Flash memory	128 MByte
LED Indicators	
	Status (24V dc nom - Main supply), Fault indicator, Battery, Communications, Ethernet (speed), Ethernet (activity), USB hardware and USB software
User Connections	
Ethernet Communications	RJ45 connector mounted on the underside of the IOC unit.

Note: Section 2.3.1 gives details of all IOC LEDs

A4 I/O MODULE SPECIFICATIONS

A4.1 AI2 MODULE

General specification, common to all variants

Power consumption		2W max.
Common mode rejection (47 to 63Hz)		>120dB
Series mode rejection (47 to 63Hz)		>60dB
Isolation	Channel to channel:	300V RMS or dc (basic insulation).
	to system:	300V RMS or dc (double insulation).
Max voltage across any channel		10.3V dc

A4.1.1Thermocouple input variant

mV inputs, Thermocouple inputs

Input range	-150mV to + 150mV
Input impedance	>100MΩ (sensor break detect circuit 'Off')
Input leakage current	<100nA (sensor break detect circuit 'Off')
Calibration accuracy	± 0.1% of measured value ± 10µV
Noise	<28µV p-p with filter off: <4µV p-p with 1.6s filter (better with longer time constants).
Resolution	Better than 2µV with 1.6 second filter
Linearity	Better than 5µV
Temperature coefficient	<40ppm of reading per °C
Sensor break protection	Switchable as 'High', 'low' or 'Off'. Sensor current: 125nA

Cold Junction

Temperature range:	-10° C to +70° C
CJ Rejection:	>30:1
CJ accuracy:	±0.5°C typical (±1.0°C max.)
Sensor type	Pt100 RTD, located beneath the input connector

High impedance input (channel two only)

Input range	0.0V to 1.8V
Input impedance	>100MΩ (sensor break detect circuit 'Off')
Input leakage current	<100nA (sensor break detect circuit 'Off')
Calibration accuracy	± 0.1% of measured value ± 20µV
Noise	<100µV p-p with filter off: <15µV p-p with 1.6s filter (better with longer time constants).
Resolution	Better than 7µV with 1.6 second filter
Linearity	Better than 50µV
Temperature coefficient	<40ppm of reading per °C

A4.1.2 DC input variant

mV inputs

Input range	-150mV to +150mV
Input impedance	>100MΩ (sensor break detect circuit 'Off')
Input leakage current	<100nA (sensor break detect circuit 'Off')
Calibration accuracy	± 0.1% of measured value ± 10µV
Noise	<28µV p-p with filter off: <4µV p-p with 1.6s filter (better with longer time constants).
Resolution	Better than 2µV with 1.6 second filter
Linearity	Better than 5µV
Temperature coefficient	<40ppm of reading per °C
Sensor break protection	Switchable as 'High', 'low' or 'Off'. Sensor current: 125nA

High impedance input (channel two only)

Input range	0.0V to 1.8V
Input impedance	>100MΩ (sensor break detect circuit 'Off')
Input leakage current	<100nA (sensor break detect circuit 'Off')
Calibration accuracy	± 0.1% of measured value ± 20µV
Noise	<100µV p-p with filter off: <15µV p-p with 1.6s filter (better with longer time constants).
Resolution	Better than 7µV with 1.6 second filter
Linearity	Better than 50µV
Temperature coefficient	<40ppm of reading per °C

Voltage inputs

Input range	-10.3V to + 10.3V
Input impedance	303kΩ
Calibration accuracy	± 0.1% of measured value ± 2mV
Noise	<2mV p-p with filter off: <0.4mV p-p with 1.6s filter (better with longer time constants).
Resolution	Better than 0.2mV with 1.6 second filter
Linearity	Better than 0.7mV
Temperature coefficient	<40ppm of reading per °C

A4.1 AI2 MODULE (Cont.)

A4.1.2 DC INPUTS (Cont.)

Resistance inputs	
Input range	0Ω to 640Ω (includes support for 2-, 3- or 4-wire RTD connection)
Calibration accuracy	± 0.1% of measured value
Noise	<0.05Ω p-p with 1.6s filter (better with longer time constants).
Resolution	Better than 0.02Ω with 1.6 second filter
Linearity	Better than 0.05Ω
Temperature coefficient	<30ppm of reading per °C

High Resistance input	
Input range	0 to 7kΩ
Calibration accuracy	± 0.1% of measured value
Noise	<0.5Ω p-p with 1.6s filter (better with longer time constants).
Resolution	Better than 0.2Ω with 1.6 second filter
Linearity	Better than 0.1Ω
Temperature coefficient	<30ppm of reading per °C

Potentiometer inputs	
Input range	0 to 100% rotation
End-to-end resistance	100Ω (min.) to 7kΩ (max.)
Calibration accuracy	± 0.1% of measured value
Noise	<0.01% p-p with 1.6s filter (5kΩ pot.); <0.3% p-p with 1.6s filter (100Ω pot.)
Resolution	Better than 0.001% with 1.6 second filter and 5kΩ pot.
Linearity	Better than 0.01%
Temperature coefficient	<20ppm of reading per °C

A4.1.4 mA input variant

4 to 20 mA loop inputs	
Input range	-25mA to + 25mA with 5Ω burden resistor in terminal unit.
Calibration accuracy	± 0.1% of measured value
Noise	<1µA p-p with 1.6s filter (better with longer time constants)
Resolution	Better than 0.5µA with 1.6 second filter
Linearity	Better than 1µA.
Temperature coefficient	<50ppm of reading per °C

A4.2 AI3 MODULE

General specification		
Power consumption	Current i/p:	2.2W
	Three powered loops:	1.5 W max.
Common mode rejection (47 to 63 Hz)		>120dB
Series mode rejection (47 to 63 Hz)		>60dB
Isolation	Channel to channel:	50V RMS or dc (basic insulation).
	to system:	300V RMS or dc (double insulation).

Hart Compliance	
	Cutting printed circuit links (one per channel) on the underside of the terminal unit places 195Ω resistors in the input circuits within the AI3 module (section 2.3.3).

Channel inputs		
Input range		-28mA to + 28mA
Calibration accuracy		± 0.1% of measured value
Noise		<1µA p-p with 1.6s filter (better with longer time constants)
Resolution		Better than 0.5µA with 1.6 second filter
Linearity		Better than 1µA
Temperature coefficient		<50ppm of reading per °C
Burden resistor		60Ω nominal; 50mA maximum current
Channel PSU		22V (min at 21mA) to 30V (max) at 4 mA
	PSU protection:	30mA (nom) current trip, auto resetting.

A4.3 AI4 MODULE

Note: Channels 1 and 3 support sensor break actions 'Hi', 'Lo' and 'None'; channels 2 and 4 support 'Hi' only.

General specification (applies to all AI4 variants)

Power consumption		2W max.
Common mode rejection (47 to 63 Hz)		>120dB
Series mode rejection (47 to 63 Hz)		>60dB
Isolation	Channel 1 to channel 2:	No isolation
	Channel 3 to channel 4:	No isolation
	Ch1 or Ch2 to Ch3 or Ch4:	300V RMS or dc (basic insulation).
	to system:	300V RMS or dc (double isolation).
Max. voltage across any channel		5V dc

A4.3.1 Thermocouple input variant

Thermocouple inputs

Input range	-150mV to + 150mV
Input impedance	>20MΩ (sensor break detect circuit 'Off')
Input leakage current	<125nA (sensor break detect circuit 'Off')
Calibration accuracy	± 0.1% of measured value ± 10µV
Noise	<4µV p-p with 1.6s filter (better with longer time constants).
Resolution	Better than 2µV with 1.6 second filter
Linearity	Better than 5µV
Temperature coefficient	<40ppm of reading per °C
Sensor break protection	Fixed pull-up. Sensor current: 125nA

Cold Junction

Temperature range:	-10°C to +70°C
CJ Rejection:	>30:1
CJ accuracy:	±0.5°C typical (±1°C maximum)
Sensor type	Pt100 RTD, located beneath the input connector

A4.3.2 mV input variant

Thermocouple inputs

Input range	-150mV to + 150mV
Input impedance	>20MΩ (sensor break detect circuit 'Off')
Input leakage current	<125nA (sensor break detect circuit 'Off')
Calibration accuracy	± 0.1% of measured value ± 10µV
Noise	<4µV p-p with 1.6s filter (better with longer time constants).
Resolution	Better than 2µV with 1.6 second filter
Linearity	Better than 5µV
Temperature coefficient	<40ppm of reading per °C

A4.3.3 mA input variant

Input range	-25mA to +25mA
Calibration accuracy	± 0.1% of measured value ± 2µA
Noise	<1µA p-p with 1.6s filter (better with longer time constants)
Resolution	Better than 0.5µA with 1.6 second filter
Linearity	Better than 1µA.
Temperature coefficient	<50ppm of reading per °C
Burden Resistor	5Ω ± 1% (fitted to terminal unit)

A4.4 AO2 MODULE

General specification

Power consumption		2.2W max.
Isolation	Channel to channel:	300V RMS or dc (basic insulation).
	to system:	300V RMS or dc (double insulation).

Current outputs

Output range	-0.1 to +20.5mA
Load limits	0 to 500Ω
Calibration accuracy	Better than ±0.1% of reading
Linearity	0.03% range (0.7µA)
Resolution	Better than 1 part in 10000 (1µA typical)

Voltage outputs

Output load limits	
-0.1 to 10.1V range:	550Ω min.
-0.3V to +10.3V range:	1500Ω min.
Calibration accuracy	Better than 0.1% of reading
Linearity	0.03% range (0.3mV)
Resolution	Better than 1 part in 10000 (0.5mV typical)

A4.5 DI 16 MODULE

General specification

Power consumption	Logic mode:	0.75 W max.
	Contact mode:	2.0 W max.
Isolation	Channel to channel:	Channels share 'common' ('C') connections.
	to system:	300V RMS or dc (Double insulation).
Minimum pulse width		78.125 ms
Max. voltage across any channel		30V dc

Logic inputs

Off (logic 0) voltage	-30V to +5V dc
On (logic 1) voltage	10.8V to 30V dc
Input current	3.8mA approx. at 12Vdc; 2.8mA approx. at 24Vdc.

Contact inputs

Off (0) resistance	>7kΩ
On (1) resistance	<1kΩ
Wetting current	4mA min.
Module internal isolated power supply (terminal P voltage)	16 to 18V dc
Wetting voltage (effective)	12V dc min.

A4.6 RLY8 MODULE

Note: Each input is fitted with a 100pF capacitor for EMC purposes. For each relay, this causes an earth leakage current of approximately 0.02mA at 240Vac 60Hz.

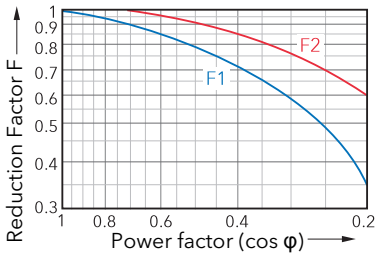
General specification

Power consumption		2.5W max.
Isolation	Channel to channel:	300V RMS or dc (Basic insulation).
	Channel to system:	300V RMS or dc (Double insulation).
Contact life (resistive load)	240Vac, 2A:	>$6x10^5$ operations
	240Vac, 1A:	>10^7 operations
Contact life (inductive load)		As per derating curves
Mechanical life		>$3x10^7$ operations

Relay specification

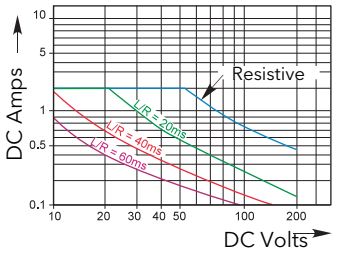
Contact material	AgCdO
Maximum current rating	2A at up to 240V ac; 0.5A at 200Vdc, increasing to 2A at 50V dc (resistive)
Minimum current rating	100mA at 12V
Contact format	Common and normally open contacts. (Open circuit with relay not energised)

AC inductive load derating curves



F1 = Measured results
F2 = Typical values
Life = Resistive life x reduction factor

DC inductive load breaking capacity derating curves



Appendix B: REFERENCE

B1 BATTERY REPLACEMENT

The battery is located in a plastic holder on the IOC terminal unit, as shown in the figures below.

WARNING

The battery must not be removed using metal pliars or tweezers, as these will cause a short circuit, possibly resulting in an explosion of the battery.

Remove the battery cover by:

1. Pressing in on the catch using a small screwdriver or similar
2. Pulling the cover away from the termianl unit to reveal the battery

To release the battery, gently bend the top of the retaining clip sideways. The battery can then be removed using plastic tweezers or similar.

Slide the replacement battery into the holder ensuring that the battery is orientated correctly.

Refit the battery cover

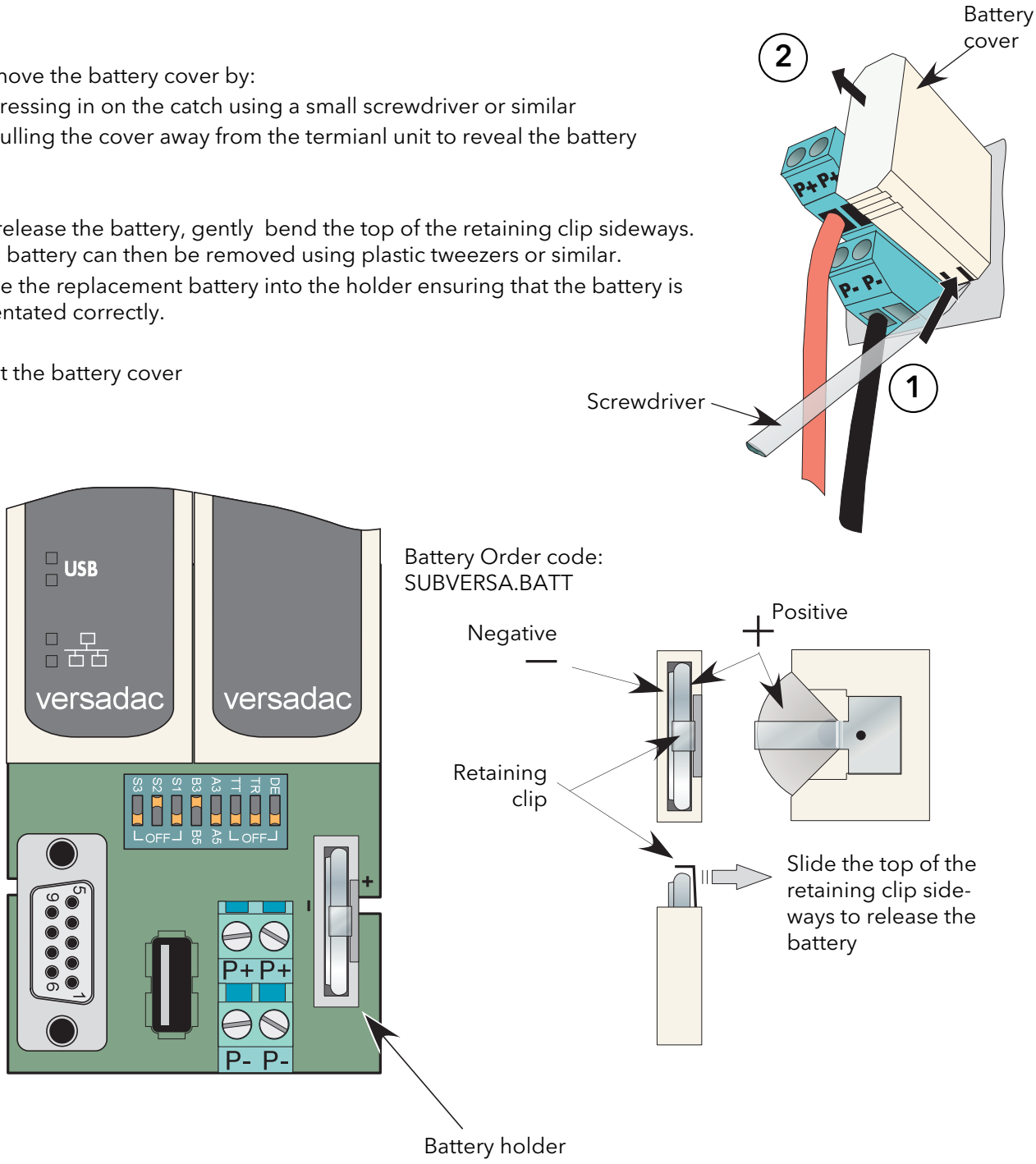


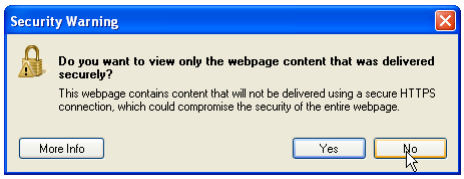
Figure B1 Battery replacement details

B2 SETTING UP AN FTP SERVER USING FILEZILLA

B2.1 DOWNLOADING

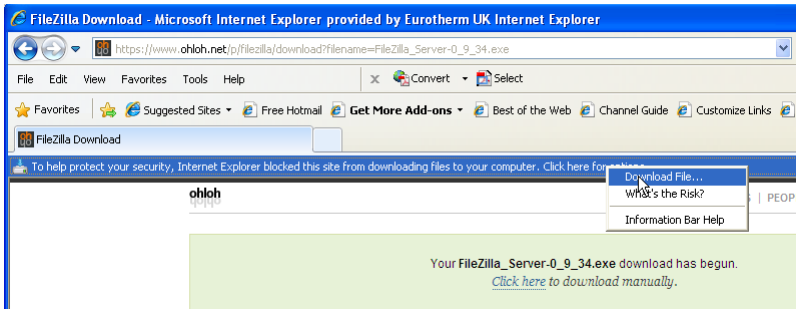
'FileZilla' is a free download from the internet (search for 'FileZilla server download').

1. Download the latest version, following the instructions on the screen.



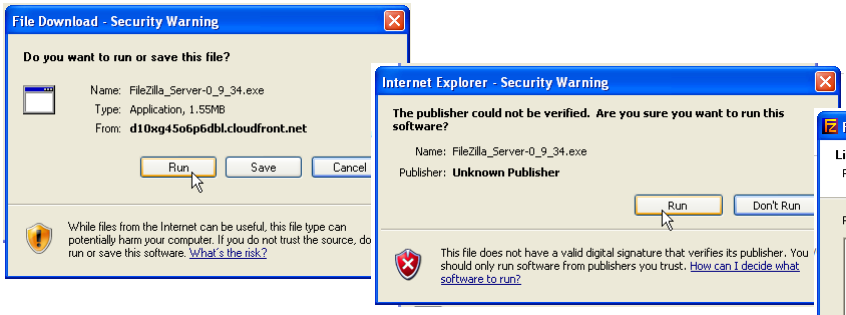
2. Answer 'No' to the question 'Do you want to view only the webpage content that was delivered securely'.

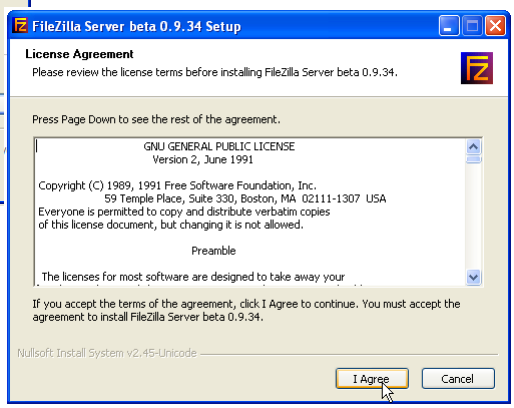
3. If necessary enable file download.



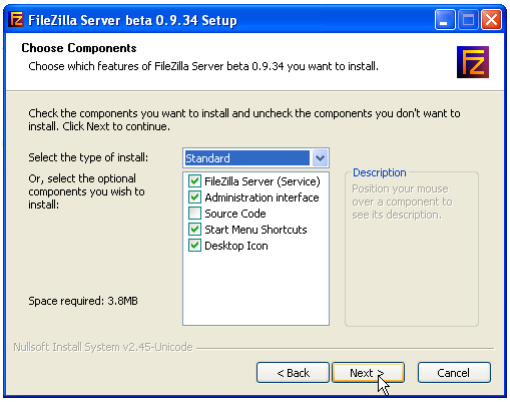
4. In the 'Do you want to run or save this file' Security Warning window- click on 'Run'

5. In the 'The Publisher could not be verified..., Security Warning window, click on 'Run'



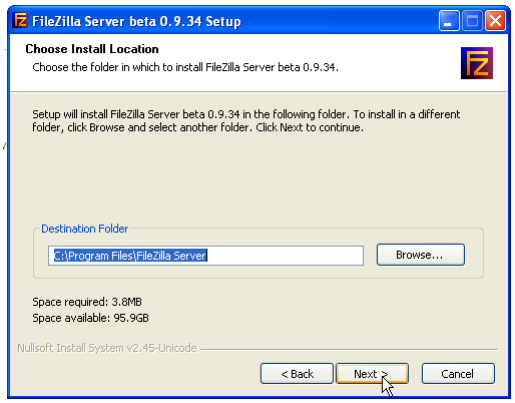


6. Agree or cancel the License agreement. If 'Agree', choose 'Standard' as the type of install.

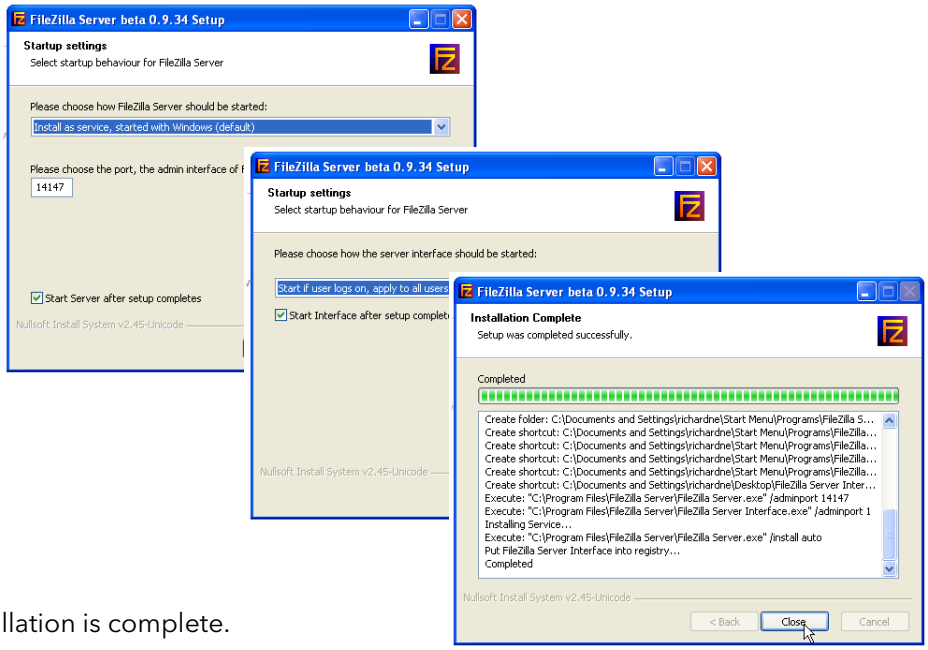


B2.1 DOWNLOADING (Cont.)

7. Choose the destination for the file

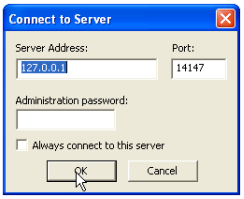


8. Select startup settings



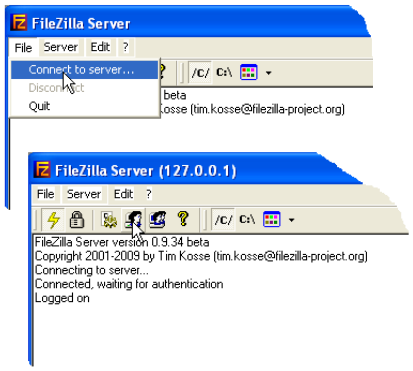
9. Click on Close when Installation is complete.

10. Click 'OK' in the 'Connect to Server' window.



B2.2 SERVER SETUP

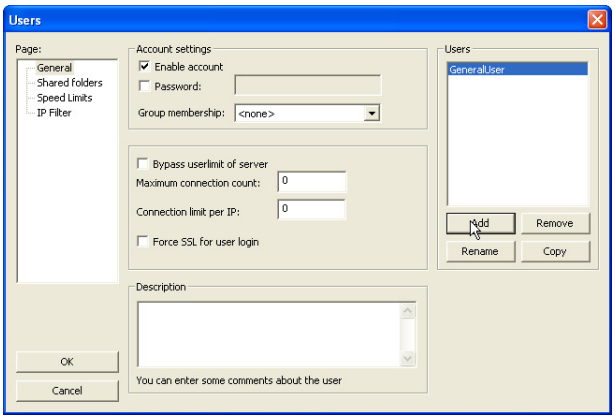
1. Create a new folder (directory) called, for this example, 'Archive' in a suitable location such as the C drive, or the desktop.



2. In the Filezilla server window, click on 'File' and select 'Connect to Server'.

   The 'Logged on' message appears

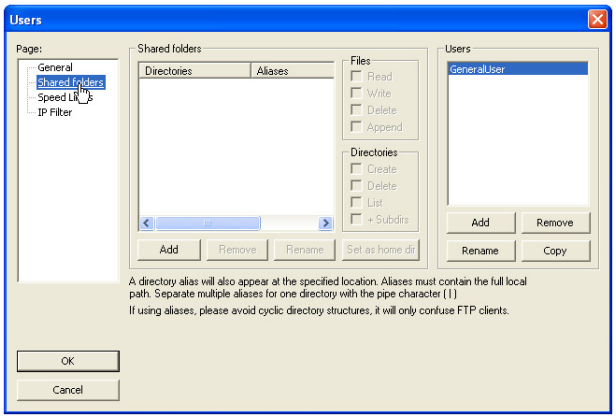
3 In the Edit menu, select 'Users' and in the 'General' page, click on 'Add' and enter a name for the user, then click 'OK'. For this example, 'GeneralUser' has been used, but it may be more advantageous to use 'Anonymous' because this is the default name in the recorder/controller. Click on 'OK'.



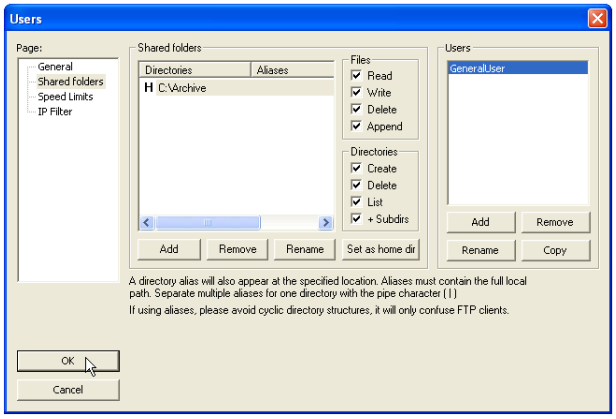
4 In the Edit menu, select 'Users' and in the 'Shared Folders' page, click on 'Add'

   A browse window opens allowing the user to select the new folder ('Archive') created in step 1, above.

   When OK has been clicked to confirm the selection, the new folder appears in the centre window (with an 'h' next to it to indicate that this is the home folder for this ftp user setup.

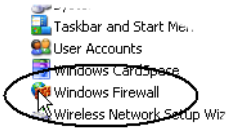


5. Click on the relevant folder to enable the tick boxes. Click on all the 'File' and 'Directory' enable tick boxes, then click OK

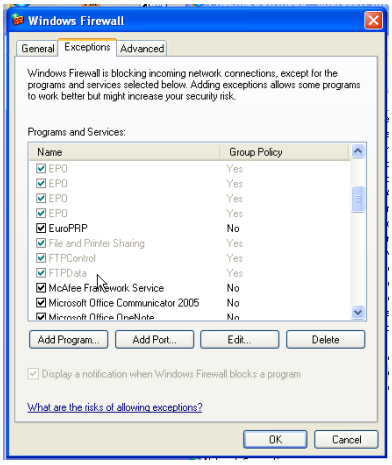


B2.3 PC SETUP

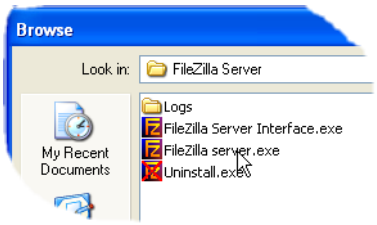
1. Operate the 'Start' button, and select 'Control Panel' from the window that appears. Double click on 'Windows Firewall'



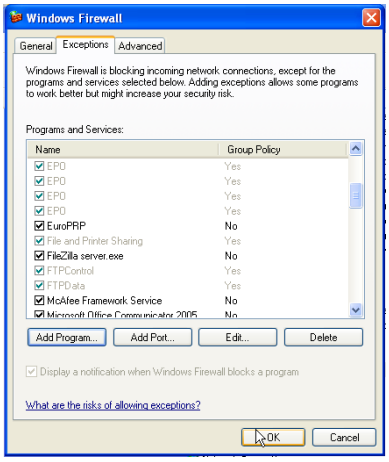
2. Click on the 'Exceptions' tab in the window that appears, and check that both 'FTPControl' and 'FTPData' are enabled (ticked). If not, the user's IT department should be contacted for advice.



3. Click on 'Add Program...' and browse to the Filezilla destination defined in step 7 of the download section (B2.1). Select 'FileZilla server.exe' and click on 'Open'



'FileZilla server.exe' appears in the Exceptions list.



Click on 'OK'

B2.4 RECORDER/CONTROLLER SET UP

In Network FTP Server (section 4.2.3):

1. Enter the IP address of the pc in which the FTP server has been enabled in the 'Primary Server' field.
2. Enter the Primary User name, as entered in step three of the Server setup procedure (section B2.2) above (GeneralUser in this example).
3. Enter the IP address of another suitable pc which has been configured as an ftp server in the 'Sec. Server' field, and enter the relevant 'Sec. User' name.
4. Configure the other unattended archive parameters as required (section 4.2.2).

Note: For the example above, 'Password' was not enabled in the User Accounts setup page (section B2.2), so for this example any Primary (Sec.) password entry is ignored. If a password had been entered in the User Accounts setup, then the Primary (Sec.) Password field would have to contain this password.

B2.5 ARCHIVE ACTIVITY

Once a demand or unattended archive is initiated, the FileZilla Server page shows the activity status as the archive progresses. Figure B2.5 shows a typical page. The top of the page shows the transaction details between the server and any clients to which it is connected. The bottom portion shows details of the files currently being transferred. These files are archived to the 'Archive' folder.

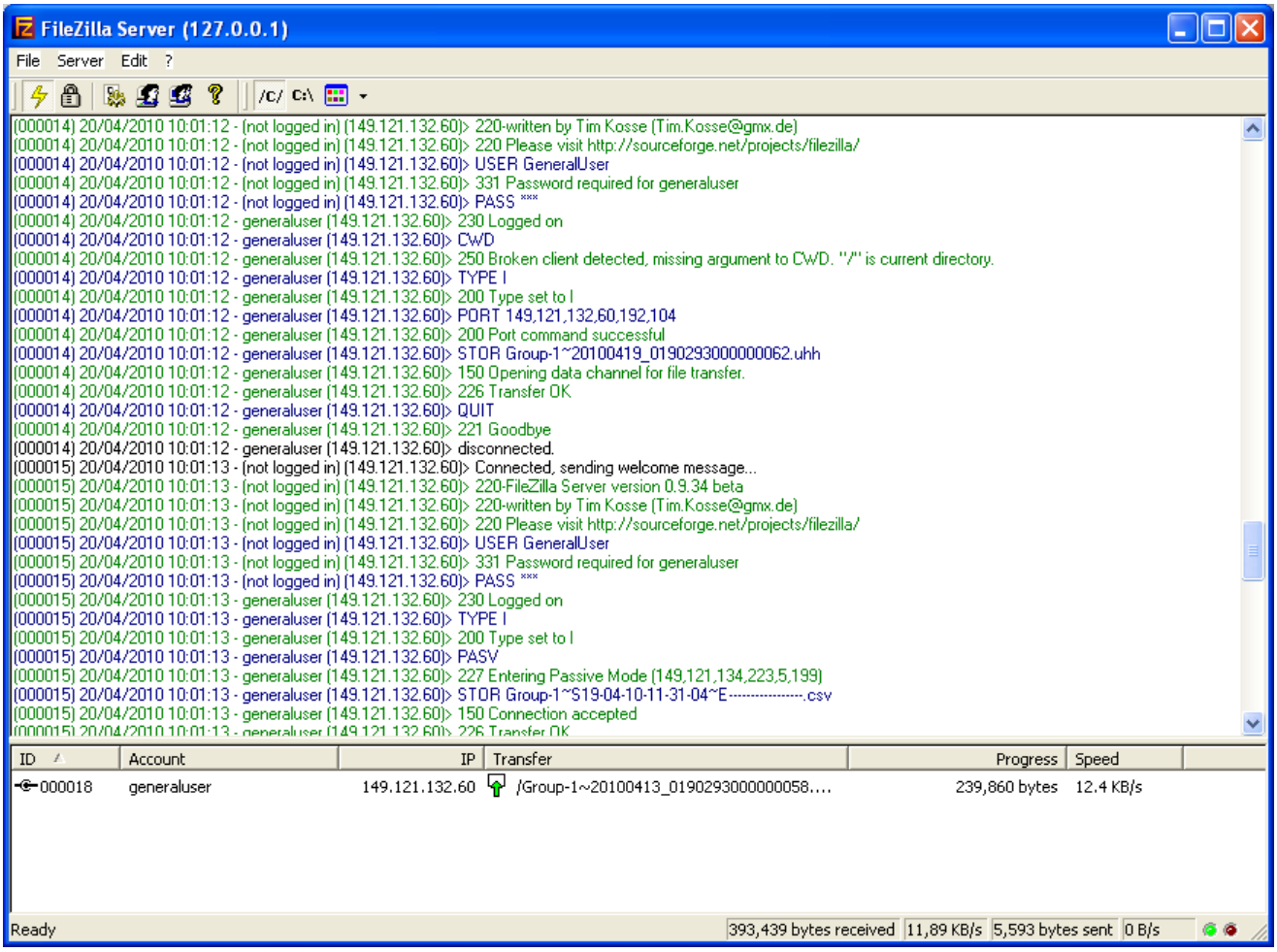


Figure B2.5 FileZilla Server archive activity page

B3 TCP PORT NUMBERS

The following TCP ports are made use of by the instrument.

Port	Usage
20	File Transfer protocol (FTP) data
21	FTP control
502	Modbus TCP communications

B4 ASCII CODES

This section contains details of the ASCII characters that may be used with the Serial Comms option. All the ASCII characters listed can be used as Start or End-of-message characters, but only characters with decimal codes 32 to 127 can be used in messages, as decimal codes 0 to 31 are replaced by Question marks in messages.

Character	Decimal	Hex	Character	Decimal	Hex	Character	Decimal	Hex	Character	Decimal	Hex
NUL	0	00	Space	32	20	@	64	40	‘	96	60
SOH	1	01	!	33	21	A	65	41	a	97	61
STX	2	02	"	34	22	B	66	42	b	98	62
ETX	3	03	#	35	23	C	67	43	c	99	63
EOT	4	04	$	36	24	D	68	44	d	100	64
ENQ	5	05	%	37	25	E	69	45	e	101	65
ACK	6	06	&	38	26	F	70	46	f	102	66
BEL	7	07	’	39	27	G	71	47	g	103	67
BS	8	08	(	40	28	H	72	48	h	104	68
HT	9	09	)	41	29	I	73	49	i	105	69
LF	10	0A	*	42	2A	J	74	4A	j	106	6A
VT	11	0B	+	43	2B	K	75	4B	k	107	6B
FF	12	0C	,	44	2C	L	76	4C	l	108	6C
CR	13	0D	-	45	2D	M	77	4D	m	109	6D
SO	14	0E	.	46	2E	N	78	4E	n	110	6E
SI	15	0F	/	47	2F	O	79	4F	o	111	6F
DLE	16	10	0	48	30	P	80	50	p	112	70
DC1	17	11	1	49	31	Q	81	51	q	113	71
DC2	18	12	2	50	32	R	82	52	r	114	72
DC3	19	13	3	51	33	S	83	53	s	115	73
DC4	20	14	4	52	34	T	84	54	t	116	74
NAK	21	15	5	53	35	U	85	55	u	117	75
SYN	22	16	6	54	36	V	86	56	v	118	76
ETB	23	17	7	55	37	W	87	57	w	119	77
CAN	24	18	8	56	38	X	88	58	x	120	78
EM	25	19	9	57	39	Y	89	59	y	121	79
SUB	26	1A	:	58	3A	Z	90	5A	z	122	7A
ESC	27	1B	;	59	3B	[	91	5B	{	123	7B
FS	28	1C	<	60	3C	\	92	5C	|	124	7C
GS	29	1D	=	61	3D	]	93	5D	}	125	7D
RS	30	1E	>	62	3E	^	94	5E	~	126	7E
US	31	1F	?	63	3F	_	95	5F	Not printed	127	7F

Notes:

1 All the above characters can be used as Start or End-of-message characters (entered in decimal)

2 If characters 0 to 31 (00 to 1F) are used as message characters, they will be replaced by question marks on the screen.

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