5000 Series

100 and 180 mm video-graphics recorders
Data acquisition and logging units

Options Manual

invensys
EUROTHERM

GRAPHICS RECORDER / DATA ACQUISITION UNIT

OPTIONS MANUAL

ALPHABETIC LIST OF SECTIONS

Effectivity

This manual refers to a number of different recorders and data acquisition units, not all of which support all the options described herein. If an option is not supported (or not fitted), it does not appear in the configuration menu.

Note that this manual deals with ‘stand alone’ options such as maths, totalisers etc. Those options which are extensions of basic configuration, such as Circular Charts, Auditor Pack and Log Scales are described in the User Guide supplied with the recorder.

For Remote Viewer and Communications option descriptions (including ASCII Printer Output), please refer to the Serial Communications and Remote Viewer User guide: HA028122

For recorders which are being operated under Remote Viewer software, any mention, in this manual, of ‘Push’, ‘Touch’ or ‘Operate’ should be read ‘Click-on’.

The User Guide, or Installation and Operation Manual supplied with the unit specifies the Software Version to which this (options) manual relates.

GRAPHICS RECORDER

OPTIONS MANUAL

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1 BATCH RECORDING OPTION

Note: This option is not available with all models.

1.1 INTRODUCTION

Batch records form a part of recording history and are included in the normal archiving process to ‘disk’ or to a remote PC (section 4.1 of the User Guide supplied with the unit). Batches can be initiated directly by the operator (if access permission is granted), automatically whenever a specified counter changes value, by job or remotely via MODBUS/TCP.

Batches can be defined as start/stop, or continuous and can incorporate all channels, or just those associated with a 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.

When using 'PC review' software the 'Go to Batch' feature can be used to select a particular batch record.

If ' Name files by Batch' is enabled (section 1.2.8), a separate history file is created for each batch.

For each batch start, a start message is printed:

```
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 or security level (e.g. Engineer). 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 six lines of text can, if required, be printed on the ‘chart’ at the start of a batch and, if required, at the end of a batch. The messages are in two parts, which for the sake of this document, are called ‘Headings’ and ‘Values’ The Headings are entered in Fields 1 to 6 in Batch Configuration (section 1.2). The Values associated with these headings are entered by the operator at initiation (section 1.3).

1.1.1 Auditor Pack messages

If the Auditor Pack option is fitted a Config/Security Revision message appears immediately after the Batch Start message:

```
DD/MM/YY HH:MM:SS Config Revision:NNNNNN Security Revision:SSSSSS
DD/MM/YY HH:MM:SS Batch start (User Full Name)
```

1.2 CONFIGURATION

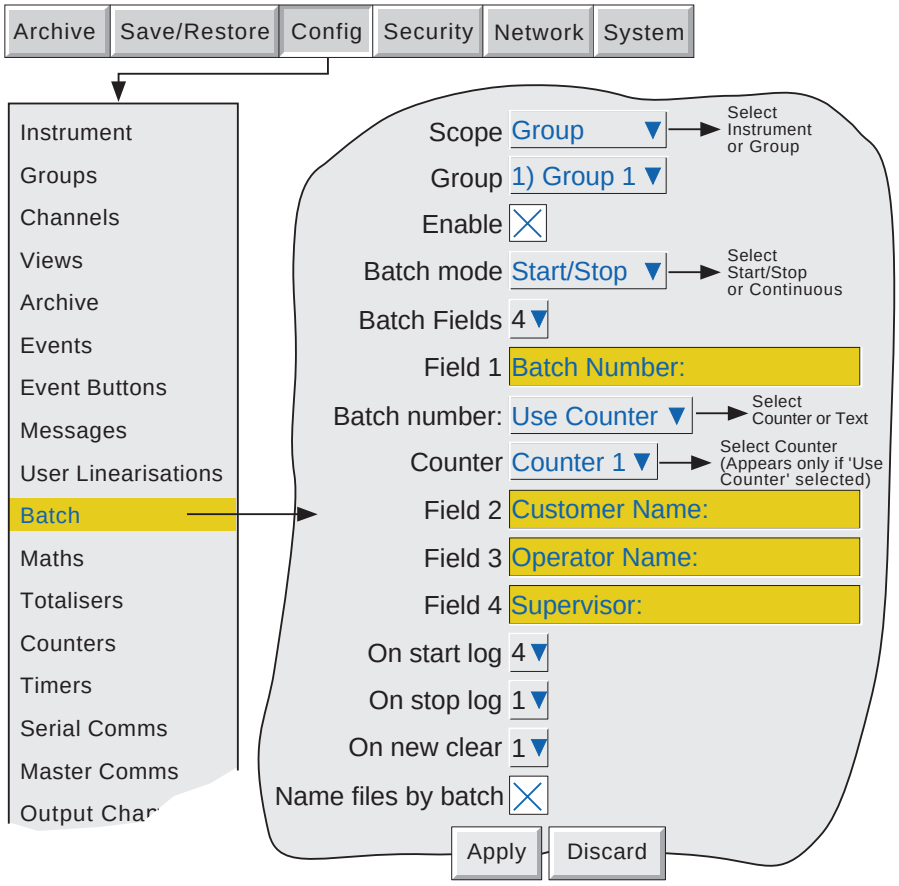


Figure 1.2 Batch configuration menu

As depicted in figure 1.2, the following configuration entries can be made:

SCOPE

Allows the user to define all configured channels (instrument) or just those in a particular group, for batch control. If 'Group' is selected, a further picklist appears allowing a specific group to be selected. If multiple groups are not available, this list contains only group 1.

ENABLE

Allows the batch function to be switched on or off.

BATCH MODE

Allows batch mode to be selected as Continuous or Start/Stop.

BATCH FIELDS

Allows the maximum number of messages to be printed at batch start/stop to be selected between one and six.

FIELD 1

This field is the first of up to six which can be used as headings for batch information. Headings can be up to 20 characters long (including spaces). In the example shown in Figure 1.2, Heading 1 has been entered as ‘Batch Number:’. When initiating the batch, the operator has to enter a value to be associated with this heading (see section 1.3 Operation, below), unless 'Use Counter' is selected in the following 'Batch Number' field.

1.2 BATCH CONFIGURATION (Cont.)

BATCH NUMBER

This allows the Value entered for Field 1's heading to be selected as 'Use Text' or 'Use Counter'.
USE TEXT. When Text is selected, the value for field 1 is entered by the operator on initiation of the batch.
USE COUNTER. When Counter is selected, a further field appears ('counter') allowing a specific counter to be selected from a picklist. The selected counter initiates a new batch whenever it changes value, and the counter value is appended to the text associated with Field 1.

FIELDS 2 TO 6

Fields 2 to 6 are also used as headings for batch information. Values for these headings must be entered by the operator prior to Batch initiation. See also 'On new clear', below. Headings can be up to 20 characters long (including spaces).

ON START LOG

This defines how many of the selected Fields are to be printed at batch start. An entry of '1' means that only Field 1 will be printed. An entry of '2' means that Fields 1 and 2 will be used, and so on. An entry of 0 means that only the 'Batch Start' message (section 1.1 above) will be printed. It is not possible to print only, say, Field 3. If Field 3 is required, it must be preceded by Fields 1 and 2.

ON STOP LOG

As for On start log, above, but for batch stop. This item appears only if Start/Stop is selected as batch mode.

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 001130.001, 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.

NAME FILES BY BATCH

As an aid to identification, if 'Name Files by Batch' is selected, the Batch Name, as entered by the operator (section 1.3.1), is inserted into the history file name.

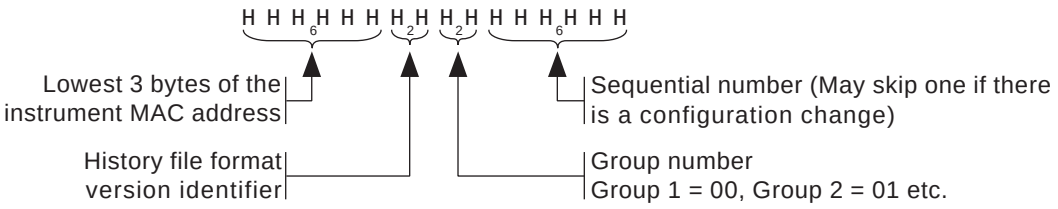
For example, if a batch name of 001130.001 is amongst the items archived to disk, then this file will appear in the form:

Group Name~001130.001~HHHHHHHHHHHHHHHH,

Where HH----HH is a 16 digit hex code* used by the recorder and by review software to identify the file. If name files by batch is not selected, the Batch name is not included, and the file will appear as:

Group Name~HHHHHHHHHHHHHHHH,

*The HHH--HHH code contains the following information:



1.3 OPERATION

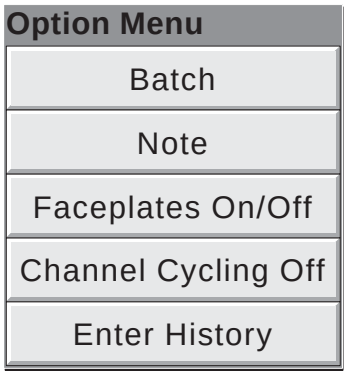
1.3.1 Operator initiation

This section describes how the operator initiates a new batch. Batches can be initiated from any of the trend, bar-graph or numeric display modes, but the start/stop and other messages appear only on the Trend Graph screen, and its associated trend history display. Batch information and status are retained whilst power is off.

To initiate a batch, either

a) Operate the Option key, then press 'Batch' in the Option menu* which appears, or

b) Touch the (dark green) message area at the top of the screen.

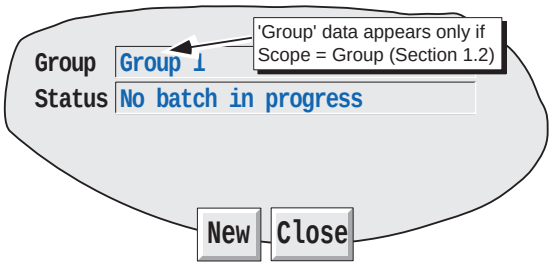


*Note: The option menu is context sensitive, so its appearance may differ from the example shown

The batch Status page appears - in this example - with no batch running.

Press new.

A new display page appears (figure 1.3.1a), showing all the headings entered in Field 1 to Field 6 during configuration. If the Batch Fields entry (Section 1.2.3) is less than 6, then only the selected number appear (in our example, 4).



'Values' can now be entered for these headings by entering strings of up to 60 characters (including spaces). This is done, as usual, by touching the empty field and using the resulting pop-up keyboard to type-in the entry. Once the entries are complete, operation of the Start button initiates batch recording. Operation of the Store button saves the configuration for later initiation by counter or via MODBUS/TCP, if either option is fitted.

The Values entry page is replaced by the batch status page (figure 1.3.1b), this time showing details of the batch in progress. This page allows the batch to be stopped or a new one triggered.

Figure 1.3.1a Batch values entry page

1.3.1 BATCH INITIATION (Cont.)

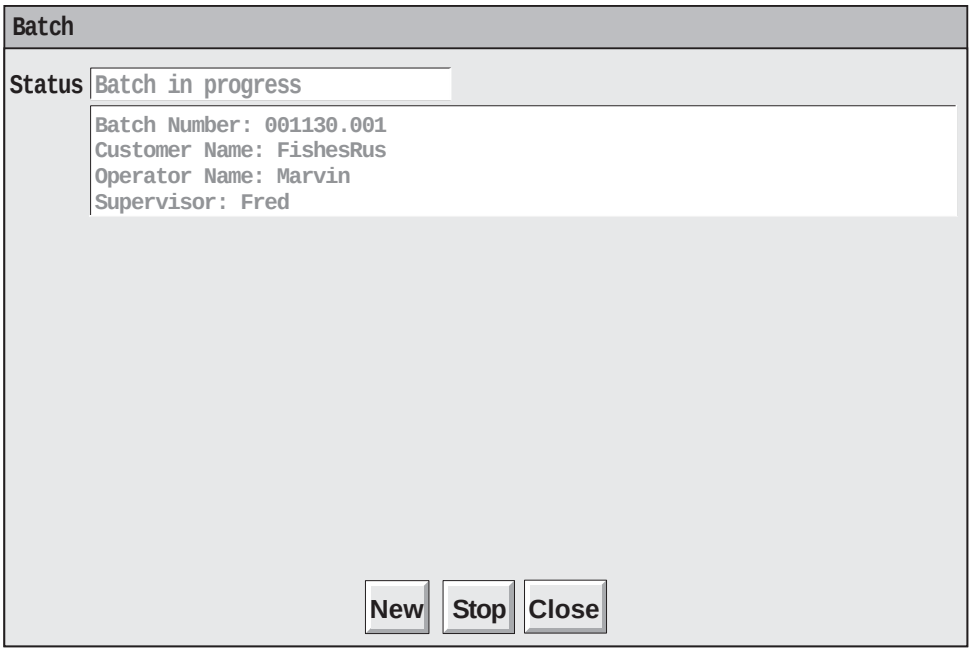


Figure 1.3.1b Status page (Batch running)

BATCH MESSAGE DISPLAY

The messages are displayed on the Graph Trend display as shown in figure 1.3.1c, below. This figure uses the example given in the previous sections, and uses only four messages. Further messages would appear above message 4. The figure also shows that time and date are added to the messages, and that the currently running batch number is given in the Group name area. Touching this area calls the Batch status page.

Note: for Modbus initiated messages, the Operator name or login level ('Engineer' in this example) is replaced by 'Modbus'.

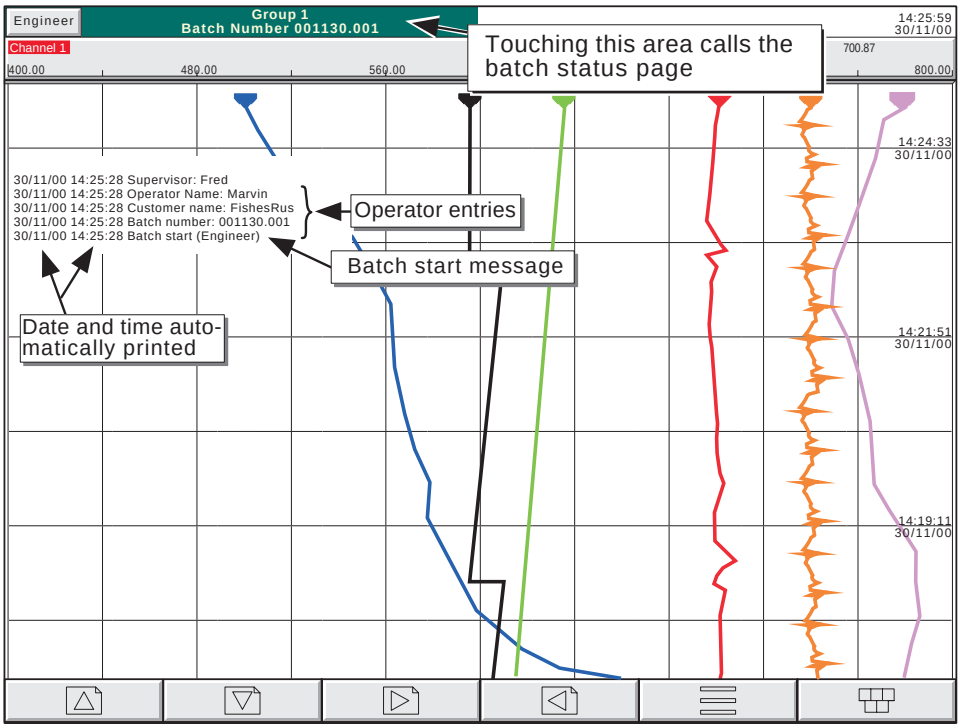


Figure 1.3.1c Typical Batch start messages

1.3.2 Non-operator initiation

Batch start/stop can be initiated by job, by counter or via MODBUS/TCP

JOB INITIATION

As described in section 4.7.9 of the User Guide supplied with the unit, a job can be set up to initiate a batch whenever the job source becomes active. If 'Scope' is set to 'Group' a specific group can be selected (default = Group 1) and the job will act only on the batch associated with this group.

COUNTER INITIATION

If Batch Number is selected as 'Use Counter', (section 1.2) then a new batch will automatically be started whenever the selected counter changes value (increment, decrement or preset). The new value of the counter is used as the value associated with Field 1.

For the other fields to have values printed on the chart, these must have been entered as described above for Operator initiation, then the 'Store' button touched.

The 'On new clear' setting (section 1.2) is ignored, the stored values being used each new batch.

Batch recording cannot be stopped by Counter action.

MODBUS INITIATION

In order to initiate batch recording via MODBUS/TCP, a Batch Start flag has to be set (value = 0001). For Scope = Group (section 1.2), the flag for the specified group must be set. For Scope = Instrument any group's Batch Start flag may be used.

The address of the flag for group 1 is decimal 42364; the address for group N is {42364 + 629(N-1)}

For further details of the Modbus option see section 2 of the Communications Manual.

If Batch mode = Start/Stop (section 1.2), batches can also be stopped via MODBUS. The address for group 1 is 42365; the address for group N is {42364 + 629(N-1)}. Again the value must be set to 0001.

Modbus start messages are of the form:

```
DD/MM/YY HH:MM:SS Batch start (Modbus)
```

Stop messages are similar.

1.3.3 Event sources

As described in section 4.3.6 of the User Guide (Event Configuration), ‘Batch Start’, ‘Batch Running’ and ‘Batch Stop’ can be selected as event sources. If 'Scope' = 'Group' in Batch configuration (described above), then the user can select which group's batch is to be used as the event source.

2 SCREEN BUILDER

Note: This option is not available with all models.

2.1 INTRODUCTION

This option allows the user to create screen layouts using recorder data, simple drawing tools, text and/or imported image files. The option comes in two variants, known as 'Lite' and 'Full'.

2.1.1 Versions

FULL

The Full version offers 24 user screens editable from the operator interface plus up to 100 extra screens which can be created only at the remote viewer. Once created, such screens (25 to 124) can be copied or moved to one or more of screens 1 to 24, thus becoming accessible at the instrument's operator interface. (For the data acquisition and logging unit, which has no operator interface other than Remote Viewer, there is no distinction between screens 1 to 24 and screens 25 to 124.)

When creating any of the screens at the remote viewer, a number of extra features are available to speed up the screen creation process. These 'Quick-build' features include the ability to edit the position and size of a screen component using familiar 'click and drag' mouse techniques, and the ability to 'clone' components. See section 2.5.1 for details.

LITE

The lite version is identical with the full version with the following exceptions:

1. There are only 6 user screens, all accessible from the user interface (if fitted).
2. The remote viewer does not include the 'Quick-build' features.

2.1.2 Display Access

As shown in figure 2.1, the user screens can be included in the display mode selection menus, described in section 3.4 of the User Guide supplied with the unit, and a User screen can be selected as the 'Home page'.

Note: Circular Trend option displays are not supported in User screens with this release of software.

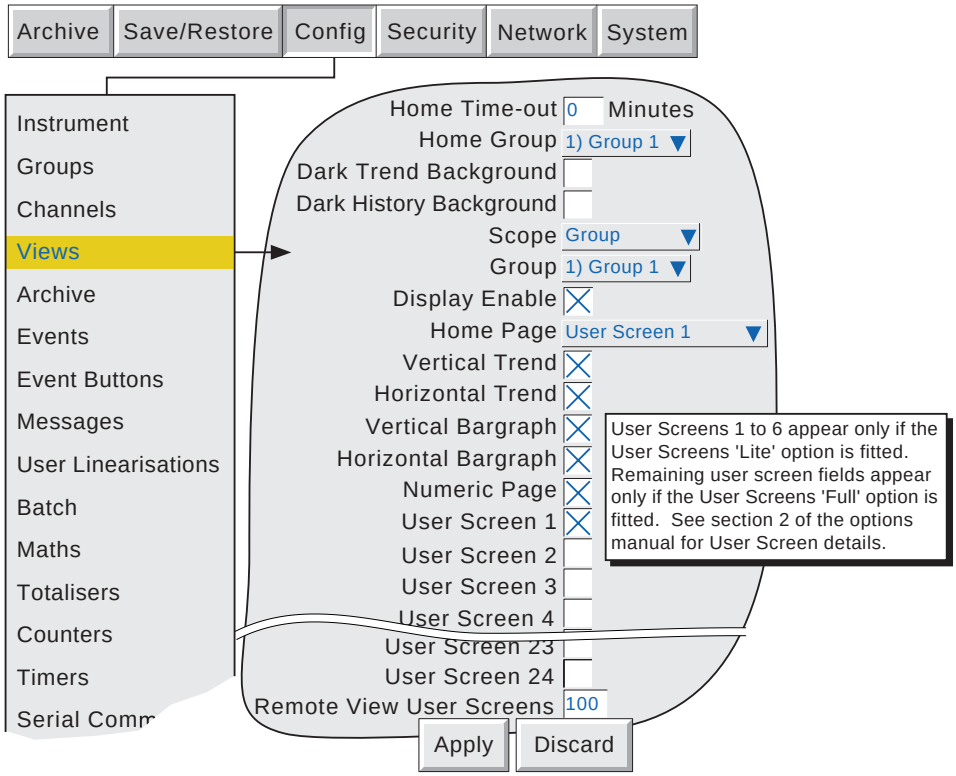


Figure 2.1 .2 Views configuration menu

2.1.3 Importing/Exporting screens

The Save/Restore screen (figure 2.1.3) includes the categories 'Import screen' and ‘Export screen’.

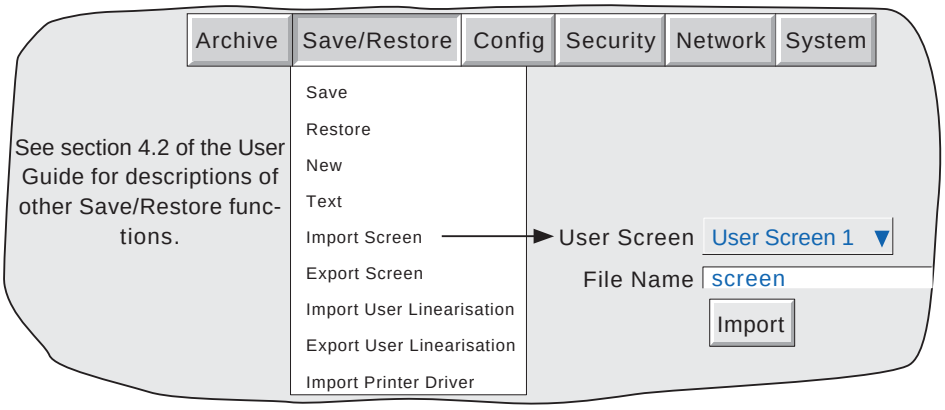


Figure 2.1.3 Save/Restore menu (Import screen)

IMPORTING/EXPORTING SCREENS (Cont.)

IMPORTING SCREENS

Touching the filename area, allows a previously created user screen to be selected either from the Flash memory or from disk to be imported. The User Screen picklist allows the user to define which User screen is to be 'replaced' by the imported file.

EXPORTING SCREENS

Allows user screens to be exported to Flash memory, or disk, The operator can assign a suitable filename before exporting.

2.2 DISPLAY CREATION

The following description is an attempt to show how to create a simple screen layout. The technique used is to define an object, then to specify its size, and where its top left corner is to be located on the screen.

The option offers two levels of sophistication - basic and advanced. The basic system defines size, position, fill colour etc. for components (section 2.3.1). Advanced parameters allow a more sophisticated fine-tuning of the appearance of the components

Note: X is horizontal, increasing rightwards. Y is vertical, increasing downwards.

As implied in figure 2.2.3a, screen component position and dimensions can be specified as percentage, absolute pixels or relative pixels. Percentage is ‘percentage of screen size'. Absolute pixels allow position and/or dimensions to be defined as an absolute number of pixels. Relative pixels are the same as absolute pixels, except that if the display is rescaled on, say, a pc screen, the absolute pixel object will remain unchanged, whereas the relative pixel object will scale appropriately. Similarly, for transfer from a VGA screen recorder to a 1/4VGA recorder or vice-versa.

2.2.1 Before starting

Before starting to lay the screen out:

1. The user must have ‘full configuration’ access permission.
2. One or more user screens must be enabled in Views Configuration (section 2.1)
3. A layout plan is produced, with all the required screen’s components listed with their top left corner co-ordinates, their widths and heights, and where appropriate background and foreground colours.

2.2.2 Screen components

Table 2.2.2 shows the selectable screen components, their default top-left corner positions, widths/heights and draw order. All these components are described in section 2.4 below.

Component	X	Y	Width	Height	Draw Order
Arc	0	0	10	10	10
Channel data	0	0	10	10	20
Channel horizontal bargraph	0	0	50	30	20
Channel numeric	0	0	50	20	20
Channel vertical bargraph	0	0	10	40	20
Dialogue action	0	0	10	10	10
Event Button	0	0	10	10	10
Group horizontal bargraph	0	0	50	50	30
Group horizontal trend	0	0	50	50	30
Group numeric	0	0	50	50	30
Group vertical bargraph	0	0	50	50	30
Group vertical trend	0	0	50	50	30
Image	0	0	10	10	10
Line	0	0	10	10	10
Main	0	0	100	100	1
Navigation action	0	0	10	10	10
Operator Button	0	0	10	10	10
Oval	0	0	10	10	10
Polygon	0	0	N/A	N/A	10
Polyline	0	0	N/A	N/A	10
Rectangle	0	0	10	10	10
Round rectangle	0	0	10	10	10
Text	0	0	0	0	20

Table 2.2.2 User screen selectable item default values

2.2.3 Example

To produce a new display screen with channels one to four inclusive each displayed as an independent bar graph across the width of the screen, with Group 1 vertical trend display below. To achieve the above, the following items will be required:

1. Bar1: Horizontal bargraph with X = 0, Y = 0, Width = 100, Height = 10, channel = Channel 1
2. Bar2: Horizontal bargraph with X = 0, Y = 12, Width = 100, Height = 10, channel = Channel 2
3. Bar3: Horizontal bargraph with X = 0, Y = 24, Width = 100, Height = 10, channel = Channel 3
4. Bar4: Horizontal bargraph with X = 0, Y = 36, Width = 100, Height = 10, channel = Channel 4
5. Group 1: Vertical trend group with X = 25, Y = 48, Width = 50, Height = 50. Group name to appear above display.

ACCESS TO THE PROPERTIES PAGE

1. Ensure that one or more user screens is enabled in views Configuration (section 2.1). If necessary, call the required User screen to the display using the Root menu 'Goto View' menu.

2. Press the Option key to call the Option Menu.

3. Press ‘Edit Screen’ to call the ‘Component Property Editor’ page to the display. This display contains the basic properties of the ‘Main’ (background) screen onto which the required components are to be overlaid.

   Note: This may take some seconds, according to the complexity of the configuration

4. A further press of the Option key calls the user screen Options display page.

   For this example, only the basic attributes will be required, so the basic/advanced pick list can be ignored.

   Component descriptions are not required for display, so the Component info on screen check box can be left un-selected.

   The final check box (Quick entry to edit) can be selected. When selected, the option key calls the component properties page directly from the user screen, without the option menu appearing.

5 Use the option key again to return to the Component Properties display

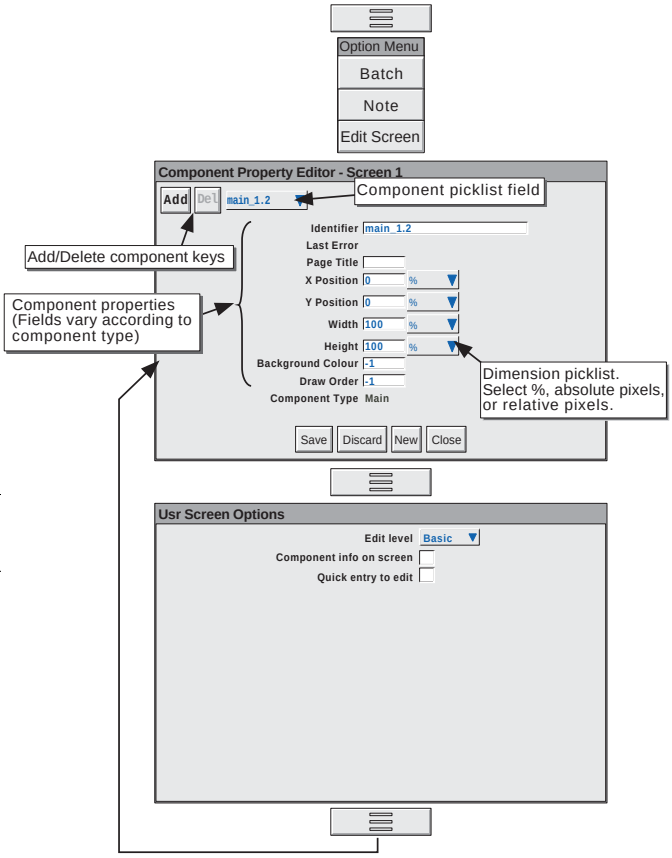


Figure 2.2.3a Component properties and User screen options pages

2.2.3 SCREEN CREATION PROCESS (Cont.)

KEY DESCRIPTIONS

Add Calls the Component selection list

Del Deletes (after confirmation) the component in the Identifier field (except the Main pane which cannot be deleted).

Save Causes all changes made since the last ‘Save’ to be applied to the screen.

Discard Causes all changes made since the last ‘Save’ to be discarded, after confirmation.

New Removes (after confirmation) all components from the current list and generates a new, empty background (main) page to be worked on. This change is permanent and cannot be 'Discarded'.

Close Closes the component properties page and displays the screen currently being edited. If this key is operated whilst there are still unapplied changes, a confirmation pop-up appears (Save Discard, Cancel).

Note: When working on the full version from remote viewer, further keys appear (e.g. Goto Canvas). These are fully explained in section 2.5.1.

OPTIONS PAGE ITEMS

Edit level

Allows Basic or Advanced edit level to be selected for further use.

Component info on screen

Enabling this box causes a component description to appear at the top left corner of each component. This description is in the form: Identifier(X,Y)+[∂X,∂Y], where X and Y defines the top left corner position in pixels, and ∂X and ∂Y are the width and height of the component in pixels. The identifier is the component name as appears in the Identifier field of the Component Property Editor page.

Quick entry to edit

If selected, this function allows direct entry from the user screen being edited to the Component Property editor page, without the options menu first appearing offering the choice of ‘Batch’ or ‘Edit Screen’.

If Quick entry is selected, the option menu does not appear when the option key is touched. The Batch status page can be called by touching the ‘Page Name’ (Dark Green) area at the top of the screen, as an alternative to the option menu.

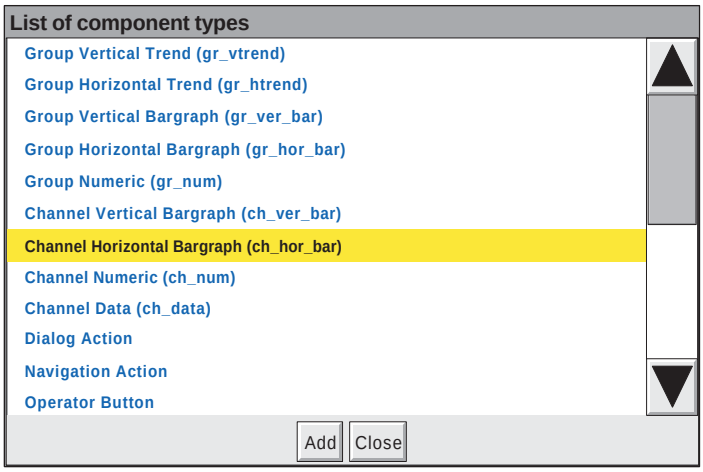
Quick entry has no effect on screens other than user screens.

Note: When working on the full version from remote viewer, further items appear (e.g. Use Last Properties). These are fully explained in section 2.5.2.

2.2.3 SCREEN CREATION PROCEDURE (Cont.)

PROCEDURE

1. Operate the ‘Add’ key to call the Component selection list.

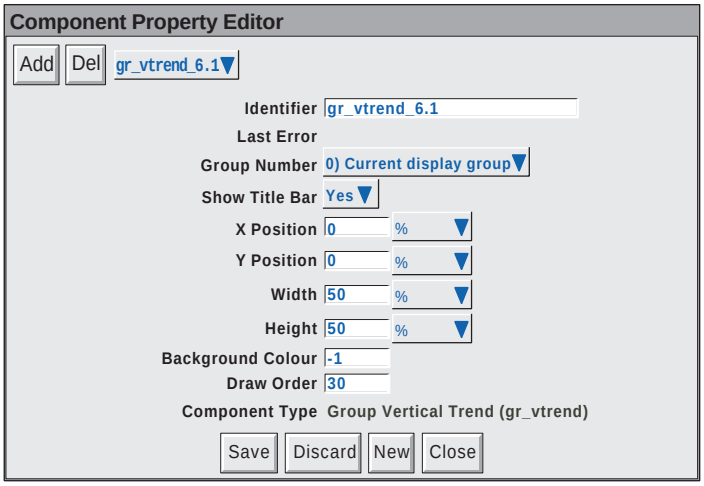


2. Touch Channel Horizontal Bargraph to highlight it, then press ‘Add’.

3. Repeat step 2 three times then

4. Touch ‘Group Vertical Trend’, then ‘Add’, then ‘Close’

5. The Component property editor page reappears with the default values for the most recently added component displayed.



6. Touch the Identifier field, then enter the name ‘Group 1’ ‘Ok’ using the pop-up keyboard which appears.

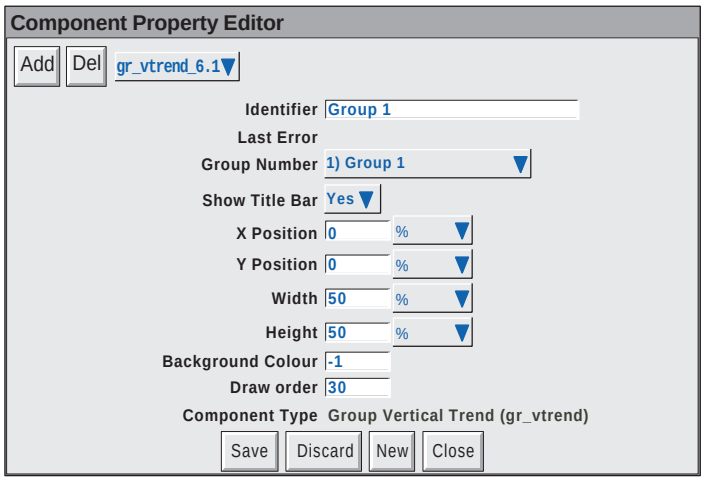
7. In Group Number, select: 1) Group 1

8. Title bar is selected on (yes), as required

9 Enter the X (25%) and Y (48%) co-ordinates, using the same technique as was used for the Identifier field in step 6. The default dimensions (50 x 50%) are as required.

10 The Draw order is as required.

11. Press ‘Save’



2.2.3 SCREEN CREATION PROCEDURE (Cont.)

12 Touch the component picklist field, and highlight the topmost ch_hor_bar... field.

13. In the Identifier field, enter the name ‘Bar 1’ using the pop-up keyboard. (To enter numbers, touch the 'Numeric' tab under the keyboard, then touch the required number.)

14. The channel number is as required

15. Touch the width field and enter a value of 100.

16. Touch the height field and enter ‘10’

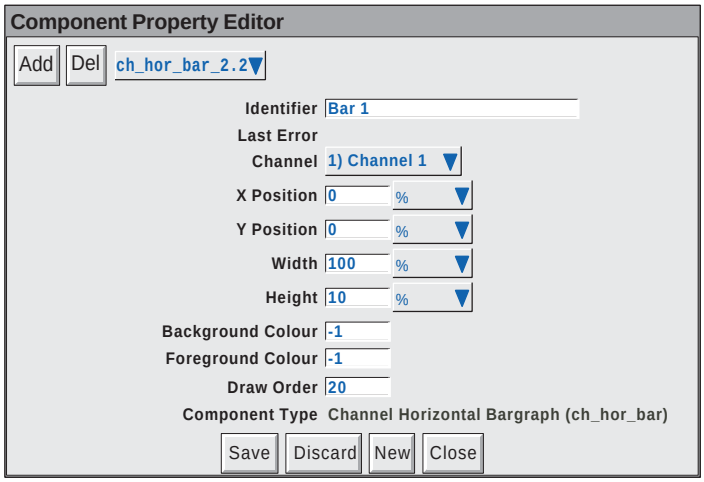
17. Press 'Save'

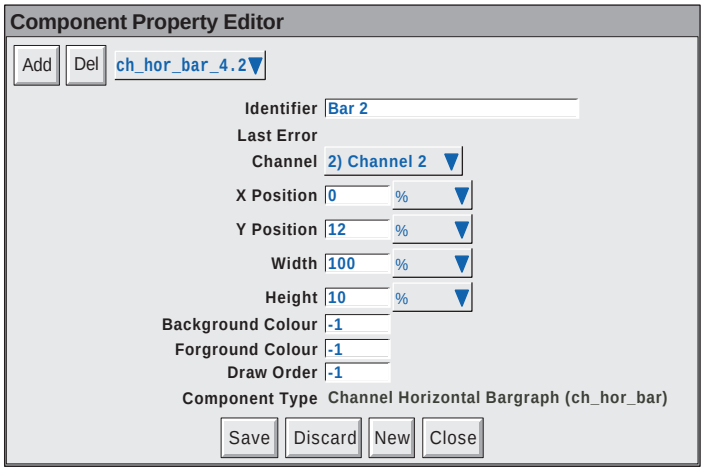
18. Touch the component picklist field and select another bargraph.

19. In a similar way to that described for Bar 1
    a) enter the identifier ‘Bar 2’
    b) select Channel 2 from the picklist
    c) enter a Y value of 12
    d) enter width = 100%; height = 10%.

20. Similarly configure Bar 3 and Bar 4, using the appropriate Y values (24 and 36) and Channel selection (3 and 4).

21 Finally, press 'Save', then ‘Close’, to reveal the display page.





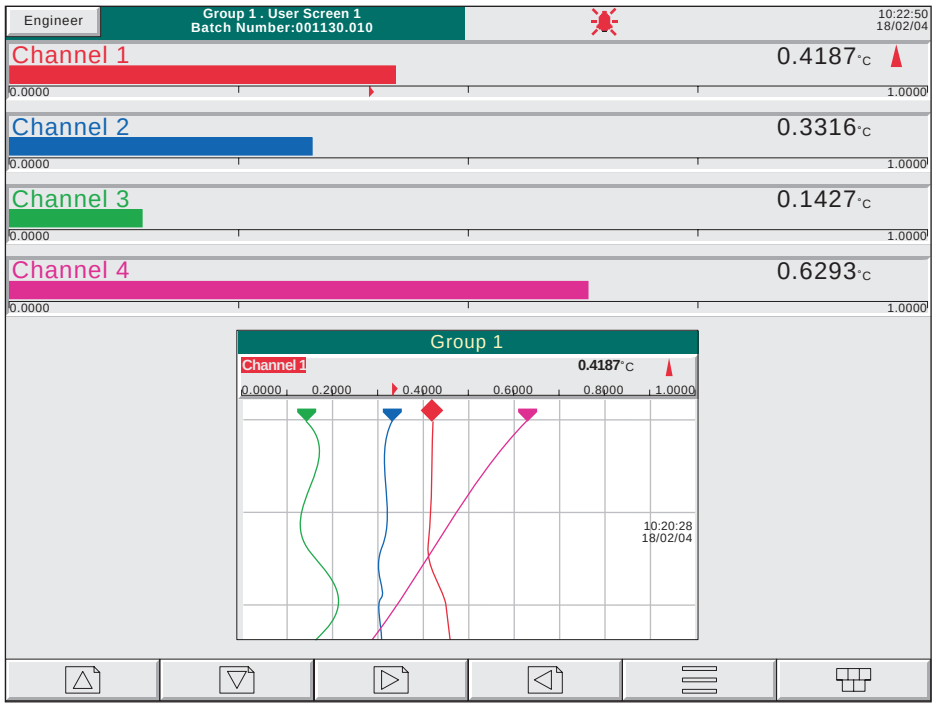


Figure 2.2.3b Complete user screen

2.2.3 SCREEN CREATION PROCEDURE (Cont.)

In order to provide a degree of contrast, the background colour of the 'Main' page can be changed to a darker colour as shown for colour 22 in figure 2.2.3c, below. Figure 2.2.3d on the next page, shows the relevant component property pages.

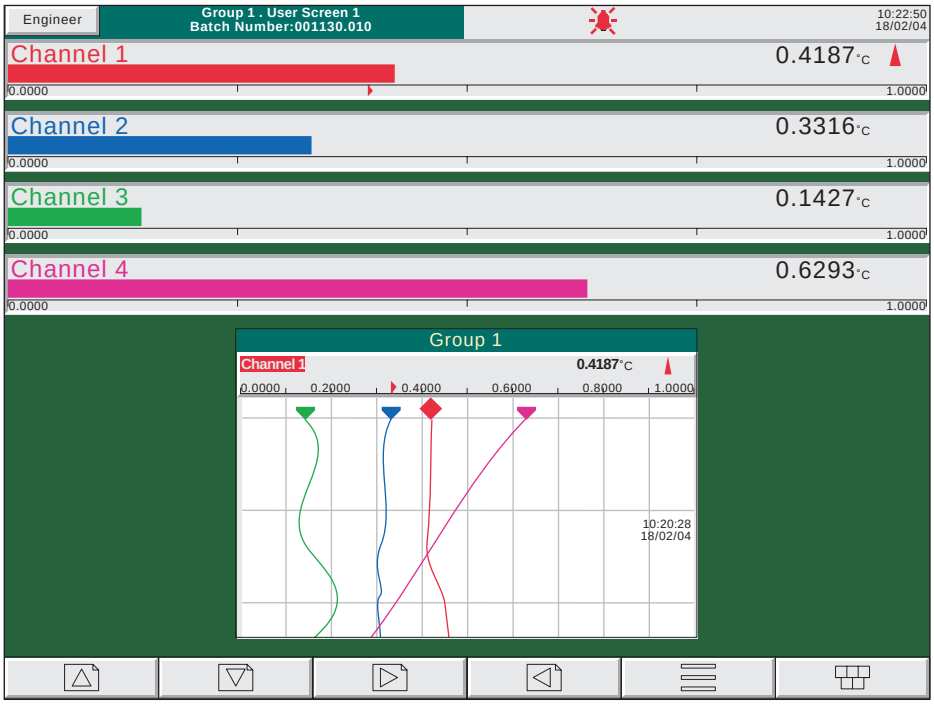


Figure 2.2.3 c User screen example with coloured background

2.2.3 SCREEN CREATION PROCEDURE (Cont.)

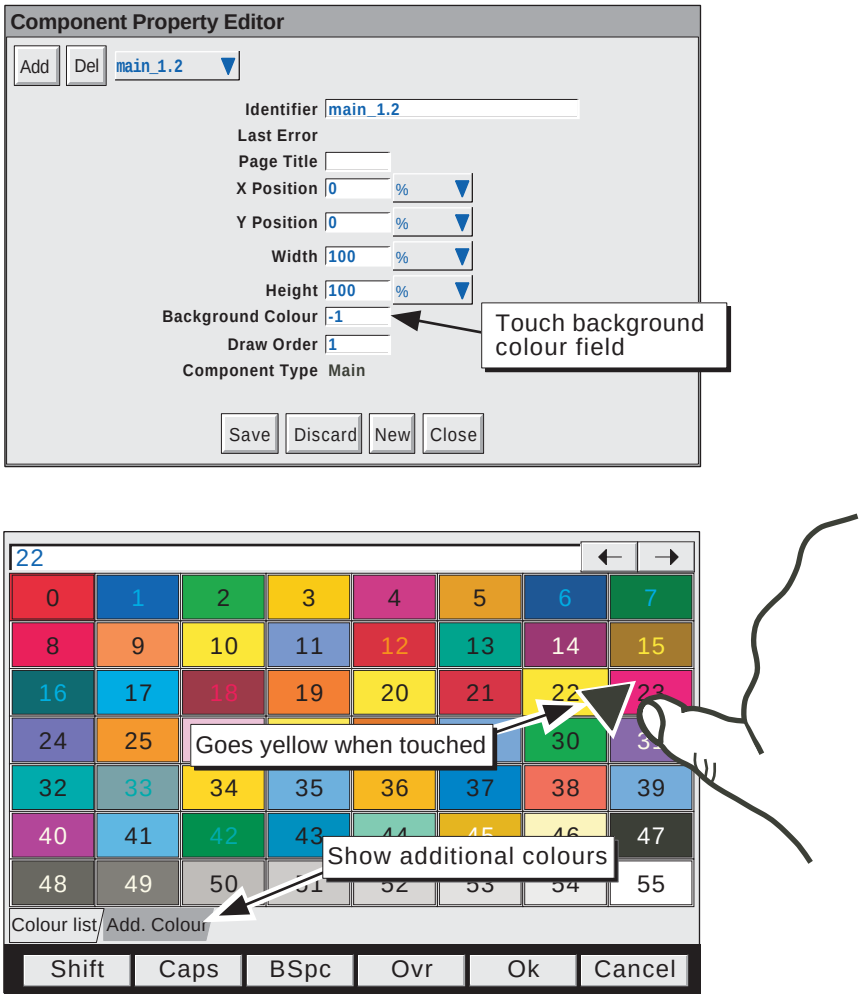


Figure 2.2.3d background colour selection pages

Note: The Add(itional) colours tab calls a supplementary palette to the display. This includes default colour (-1), flashing colours, and Windows® colours for use with user screens and Remote Viewer (Communications manual, section 1), to match recorder colours with Windows® colours.

2.3 PARAMETER DEFINITIONS

The following parameters are associated with the components listed in table 2.2.2, above. The list is divided into basic and advanced.

2.3.1 Basic parameters

Notes:

1 Not all components have all the following parameters associated with them. The component descriptions in section 2.4 define each component's parameters.

2 The generic term 'solid objects' as used in this description includes rectangles, lines, arcs, rounded rectangles, ovals, polygons and polylines. Lines and arcs do not have a background colour as they cannot be filled.

3. Default parameter units are in 'percentage of screen width/height'. The picklist next to each dimension field allows pixels to be used instead.

Parameter	Description
Arc Angle	For Arcs only, the number of degrees of arc drawn anti-clockwise (counter-clockwise) from the Start Angle. Negative angles draw clockwise.See figure2.4.20a for definitions.
Arc Height	For Rounded Rectangles only, this is double the vertical distance from the corner of the (unrounded) rectangle at which the curve is to start. To draw 'circular' corners, this value must be 3/2 times the Arc Width. The Arc height value must be less than half the Rectangle height. Percent units are relative to the rectangle height, not the screen height.
Arc Width	For Rounded Rectangles only, this is double the horizontal distance from the corner of the (unrounded) rectangle at which the curve is to start. To draw 'circular' corners, this value must be 2/3 the Arc Height. The Arc width value must be less than half the Rectangle width. Percent units are relative to the rectangle width, not the screen width.
Background colour	The fill colour of solid objects; the background colour for the main page, trend charts, text messages etc. For Bargraphs, the colour 'behind' the bar.
Button Text	For operator buttons, Dialogue Action and Navigation Action. Allows button text to be entered. Event button text is defined in Event Button Configuration, described in section 4.3.7 of the User Guide.
Channel	Allows a channel to be selected for bargraph, numeric, value etc. display.
Draw edge	If set to 'Yes', this causes the outline shape of a solid object to be drawn in the foreground colour. If set to 'No', the object's outline is not drawn.
Draw Order	Allows a layer scheme to be introduced. Item with higher draw order values are overlaid on components with lower draw order values. The Draw Order feature is included specifically to allow a dynamic element (such as a bargraph) to be placed 'on top of' a background, static image. A dynamic element is always drawn on top all other elements at update time. . When one or more dynamic elements are placed on top of one another, the results are unpredictable.
Edit Parameter	For operator buttons, allows the user to select the parameter type (e.g Channel N Alarm 1) to be edited when the button is operated. The parameter number (N) is entered in the 'N value' field.
Event Button	For Event buttons, this allows the user to assign an Event button to the User Screen Button to be displayed.
Feature	For 'Channel data' only, allows the type of data to be displayed (e.g. Current value), to be selected from a pick-list.
Fill Area	If set to 'Yes', this causes a solid object to be filled with the background colour. If set to 'No', the inside of the object is transparent. If 'draw edge' is also set to 'No', the object is invisible.
Foreground Colour	The line colour of solid objects. The bar colour of bargraphs (default = normal point colour). The colour of Text and of numeric values. Where applicable, this overrides channel colour.

Table 2.3.1 Basic level parameters (sheet 1 of 2)

2.3.1 BASIC PARAMETERS (Cont.)

Parameter	Description
Group number	Allows a group to be selected for group trend, bargraph and numeric displays, and for Dialogue action buttons. Select specific group, or '0' to follow current display group. If multiple groups are not fitted, this allows only group 1 to be selected.
Height	Height of a component, measured downwards from the component's 'Y position'. Negative values measure upwards.
Identifier	Component name. Initially as in the Add Component list, but editable by the user.
Image File	Allows a file name to be entered when importing GIF or JPG images.
Last error	A text message describing the last error to occur for this component. The component must be re-edited in order to clear the problem.
N Value	See 'Edit parameter' above.
Page Title	Allows a name for the current user screen to be entered in 'Main'. This name appears at the top of the screen, and in the Screen number picklist for navigation action buttons.
Screen Number	For navigation action buttons, allows a screen to be selected. When the button is operated, the instrument will switch to the selected display screen.
Show Title Bar	When set to 'Yes', group displays (e.g. Group Vertical Trend) display a title bar across the top of the component, giving the selected group's descriptor. Selecting 'Show Title Bar' to 'No', removes the title bar from the display
Start Angle	For Arcs only, defines a start point for 'Arc Angle' above. See figure2.4.20a for definitions.
Text	Allows a text string to be entered for display at the screen
Width	The width of a component measured rightwards from the component's "X osition'. Negative values measure leftwards.
X points	Defines the X co-ordinates for polylines and polygons. Must match the number of Y-points for correct interpretation
X position	Distance between the left edge of the screen and the left edge of the component.
Y points	Defines the Y co-ordinates for polylines and polygons. Must match the number of X-points for correct interpretation
Y position	Distance between the top edge of the screen and the top edge of the component.

Table 2.3.1 Basic level parameters (sheet 2 of 2)

2.3.2 Advanced parameters

The selection of the Advanced properties set, is carried out from the Properties Options page as described in section 2.3.1, above. Advanced properties are in addition to the basic properties described above, not a replacement for them.

Parameter	Pick list content	Description
3D effect	Enable/Disable	For Channel numeric display only, adds an embossed boxed surround to the display. Applies only if 'Custom' selected as Faceplate style.
Alarm marks colour	None	Allows a colour to be selected for alarm marks on trend scales. Default is colour 0 (red).
Bargraph style	Single Line...	For horizontal bargraphs only. 'Plain' produces a bargraph with descriptor to the left of the bar, digital value to the right of the bar, and alarm indication to the right of the decimal value. 'With units' adds units after the digital value. '3D' adds an embossed boxed surround. 'Scale' adds a scale below the bar, with end-point values and tick points. Scale style (described below) may be used to modify the appearance of the scale.
	Faceplate below bar	Produces coloured bar above channel descriptor, digital value and alarm indication. No scale is printed
	Just bar	Produces a colour bar with no textual information, or just the low and high scale values, according to component.
	Bar and scale	Produces a colour bar with a scale, but no digital value or alarm indication
	Default	Produces a colour bar with scale, with descriptor, digital value and alarm indication above.
	Default Vertical Bargraph	Produces a colour bar with a scale
	System Vertical Bargraph	Produces a colour bar with a scale
	Horizontal Bargraph	Produces a colour bar with scale, with descriptor, digital value and alarm indication above.
Best Fit Font	Enabled/Disabled	For Channel numeric only. Applies only if 'Custom' selected as Faceplate style. If enabled, the display fonts for descriptor, value and units are selected by the instrument to suit the screen scale. The fonts will thus vary in size according to the size of the Channel Numeric display. Overridden by any settings for Value Font, Descriptor Font or Units Font other than 'Default'.
Channel cycle time	10	For group trend displays, allows a time period, in seconds, to be entered for channel scroll rate. 0 = no scroll.
Colour Alarms	None	Used only when Colour style = 'Channel alarms'. A semicolon-separated list of (Colour channel) alarms, used to change the colour of the component being configured according to alarm status. Colours are defined in 'Colour Backgrounds' and 'Colour Foregrounds', described below.
Colour Backgrounds	None	Used only if Colour style = 'Channel Alarms' or 'Channel thresholds'. A semicolon-separated list of background colours for the component being configured. The number of colours entered must match the number of alarms or threshold values as appropriate. Overrides any entry in 'Background Colour'. Colours are entered by touching each required selection in turn. The semicolon separators are entered automatically, in front of each selection (apart from the first).
Colour channel	All channels	Allows a channel to be defined to be used in percentile or quartile filling or as a source of channel thresholds or channel alarms, as selected in 'Colour style', below.

Table 2.3.2 Advanced edit level parameters (sheet 1 of 6)

2.3.2 ADVANCED PARAMETERS (Cont.)

Parameter	Pick list content	Description
Colour foregrounds	None	Used only if Colour style = 'Channel Alarms' or 'Channel thresholds'. A semicolon-separated list of foreground colours for the component being configured. The number of colours entered must match the number of alarms or threshold values as appropriate. Overrides any entry in 'Foreground Colour'. Colours are entered by touching each required selection in turn. The semicolon separators are entered automatically, in front of each selection (apart from the first).
Colour style	Channel thresholds	Allows a number of semicolon-separated values to be entered, to act as colour change triggers for the component being configured. The values are those of the source channel selected in 'Colour Channel' described above. The number of threshold values entered must match the number of colour values entered in Colour Foregrounds and Colour Backgrounds.
	Channel Alarms	Allows a number of semicolon-separated values (1 to 4) to be entered, to act as colour change triggers for the component being configured. These values represent alarms 1 to 4 of the source channel selected in 'Colour Channel' described above. The number of alarms entered must match the number of colour values entered in Colour Foregrounds and Colour Backgrounds. Point is displayed in the colour of the latest active alarm. For example: Alarms configured 1,2. Foreground colours configured 3;0 (amber and red). When alarm 1 goes active, the component goes amber. When alarm 2 goes active the component goes red. When alarm two clears, component reverts to Amber and so on.
	Background quartile	Background colour represents the value of the colour channel. Colour 0 appears for values below 25%, colour 1 for values between 25 and 50 %, colour 3 for values between 50 and 75% and colour 4 for values above 75 %. Foreground colour is default (-1).
	Foreground quartile	As background quartile but for the foreground colour. Background colour is default (-1).
	Background decimal	Background colour represents the value of the colour channel. Colour 0 appears for values below 10%, colour 1 for values between 10 and 20 %, colour 2 for values between 20 and 30% and so on up to colour 9. Foreground colour is default (-1).
	Foreground decimal	As background decimal but for the foreground colour. Background colour is default (-1).
Colour Thresholds	None	Used only when Colour style = 'Channel thresholds'. A semicolon-separated list of (Colour channel) values, used to change the colour of the component being configured according to the process value of the point selected in 'Colour Channel' described above. The number of threshold values entered must match the number of colours defined in 'Colour Backgrounds' and 'Colour Foregrounds', described above.
Decimal places	Default	Number of decimal places in Channel data display.
Descriptor Font	Default	For Channel Numeric displays only, if Faceplate Style is set to 'Custom', then Descriptor Font allows the Channel Descriptor font to be selected from a picklist.
Display Alarms	Enable/Disable	For Channel Numeric displays only, if Faceplate Style is set to 'Custom', this selection determines whether or not alarm symbols are displayed in the top right hand corner of the display.

Table 2.3.2 Advanced edit level parameters (sheet 2)

2.3.2 ADVANCED PARAMETERS (Cont.)

Parameter	Pick list content	Description.
Display Bargraph	None	If selected, a vertical bargraph is drawn at the right hand edge of Horizontal Trend displays.
Display Descriptor	Enable/Disable	For Channel Numeric displays only, if Faceplate Style is set to 'Custom', this selection determines whether or not the channel descriptor appears at the top of the display.
Display messages	Enable/Disable	If selected, displays a message bar for Horizontal Trend displays.
Display Pens	Enable/Disable	If selected, pen representations appear at the top or right edge of a trend chart.
Display Units	Enable/Disable	For Channel Numeric displays only, if Faceplate Style is set to 'Custom', this selection determines whether or not the channel's units appear at the right edge of the display.
Faceplate Style	Default Just value No alarms Value and Units Single line Faceplate Custom	Produces a channel display with the descriptor and alarm indicators on the top line and with the digital value, and units on the bottom line. Shows only the channel value As default, but without alarm display Produces a larger digital display of the channel value, with units. As default, but all on a single line. The 'Display Descriptor', 'Display units' and 'Display Alarms' checkbox settings, and the font selections for Value, Units and Descriptor become active only if 'Custom' is selected as Faceplate style.
Faceplates Location	Dynamic, N, S, E, W	Allows the position of the faceplates to be 'dynamic' (appears at best position for the number of channels), or to be located above (North), below (South), to the right (East) or to the left (West) of the bargraphs. Also allows faceplates to be turned off altogether. For group trend displays, these faceplates are in addition to the current-channel faceplate, which always appears above the 'chart' across the full width of the display, unless turned off using Horizontal Faceplate disable.
Font style	List of fonts	Picklist holds a number of sizes, plain, bold and underlined bold.
Grid Line colour	Default	Allows a colour to be selected for trend chart gridlines
Horizontal Alignment	Left/centred/right	Allows text to be justified relative to its width setting
Horizontal Faceplate	Enable/Disable	For vertical trend displays, allows the current-channel faceplate to be selected on or off.
Horizontal Grid total	Default	Number of vertical divisions of a trend chart. If left at default uses the value entered in Group Configuration (section 4.3.2 of the User Guide). Any other setting overrides Group Configuration entry.
Horizontal Minor Divs	Default	Allows the user to enter a number of minor grid divisions. If left at default uses the value entered in Group Configuration (section 4.3.2 of the User Guide). Any other setting overrides Group Configuration entry
Line thickness	1	Allows a pixel value to be entered for the line thickness of some components. It should be noted that the nature of the screen and of the drawing method means that curved lines of multi-pixel thickness can suffer from Moiré fringe, or interference effects.

Table 2.3.2 Advanced edit level parameters (sheet 3)

2.3.2 ADVANCED PARAMETERS (Cont.)

Parameter	Pick list content	Description.
Message Colour	Default	Allows a colour to be selected for messages on a trend chart
Minimum Height	Default	For individual channels within a group horizontal bargraph display
Minimum Width	Default	For individual channels within a group vertical bargraph display
Minor grid line colour	Default	Allows a colour to be selected for trend chart minor gridlines
Nominal height	None	653 (503) = height of large frame (small frame) display area in pixels
Nominal width	None	1024 (934) = width of large frame (small frame) display area in pixels
Notes	None	Allows a note to be entered for the users convenience.
Number of Columns	None	Lays out group displays (other than trend) in the specified number of columns.
Number of Rows	None	Lays out group displays in the specified number of rows.
Numeric width	None	Number of characters in channel data display including decimal point.
On visibility change	Paint Background	Repaint the area of the component, including any text, in its background colour. If no background colour has been defined, the default (silver/ grey) colour is used.
	Paint All	Repaints the component area in the screen background colour thus rendering the component invisible.
PV Error Colour Background	Default	Allows a colour to be selected for background use when the relevant PV is in an error state. Overrides other selections.
PV Error Colour Foreground	Default	Allows a colour to be selected for foreground use when the relevant PV is in an error state. Overrides other selections
Reversed colour	None	Allows text to be displayed in the background colour against a back-ground of foreground colour.
Scale Digits	None	For Horizontal trend displays. Allows the chart area to be maximised, by reducing the width of the vertical bar to the right of the chart. Scales will be presented in scientific format, or in ‘N.?’, ‘N?’ format etc. depending on the number of digits specified. The number of digits is in addition to the decimal point.
Scale Divisions - Major	None	For channel bargraphs, allows the number of major scale divisions to be specified for the channel. Overwrites the Scale Divisions-Major setting in the Channel’s configuration.
Scale Divisions - Minor	None	For channel bargraphs, allows the number of minor scale divisions to be specified for the channel. Overwrites the Scale Divisions-Minor setting in the Channel’s configuration.

Table 2.3.2 Advanced edit level parameters (sheet 4)

2.3.2 ADVANCED PARAMETERS (Cont.)

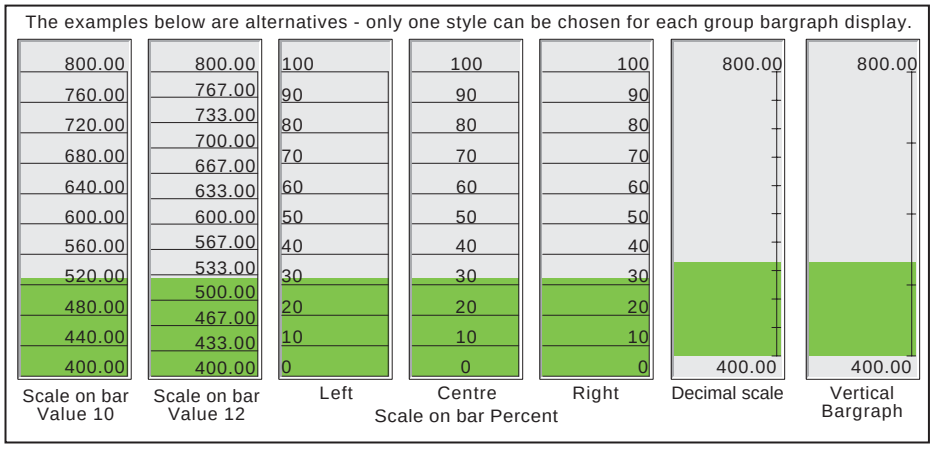
Parameter	Pick list content	Description.
Scale style	Scale on bar.---	See the figure below for clarification. For vertical bargraphs only.
	No Text	Produces scale tick marks, but without values
	Decimal scale	For bargraphs, produces scale with 9 divisions (0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100% of scale width). Zero and full scale values printed. For Horizontal bargraphs, each scale division has 4 minor divisions (0, 20, 40, 60, 80, 100 % of major division).
	Default	Uses scale information from each point's scale configuration
	Horizontal Bargraph	As default for horizontal bargraphs
	Horizontal Faceplate	Produces faceplate display with scale end points, descriptor, digital value and alarm indicator
	Vertical bargraph	As default for vertical bargraphs.
		
Show Alarm Marks	Yes/No	Allows channel scale alarm marks to be displayed (yes) or not (no). Alarm Marks Colour, described above, allows the user to select a colour for the alarm marks.
Time Marker colour	Default	Allows a colour to be selected for time/date printing on a trend chart
Time Marker interval	Default	Number of horizontal grid lines between successive time markers.
Trend Padding	Default	For group trend only. Normal trends are 1 pixel wide. Setting a padding value of N, adds N pixels on each side of the central pixel. For example, a padding value of 2 would produce traces 5 pixels wide. Applies to all channels in the group.
Units Font	List of fonts	For Channel Numeric displays only, if Faceplate Style is set to 'Custom', then Units Font allows the Channel Units font to be selected from a picklist.
Update when	Value changes	Action is taken when the value associated with the component changes
	Always	The component is redrawn, continuously, at the display update rate.
Vertical alignment	Centred/bottom/top	Allows text to be positioned relative to its height setting
Value Font	List of fonts	For Channel Numeric displays only, if Faceplate Style is set to 'Custom', then Value Font allows the Channel Value font to be selected from a picklist.

Table 2.3.2 Advanced edit level parameters (sheet 5)

2.3.2 ADVANCED PARAMETERS (Cont.)

Parameter	Pick list content	Description.
Vertical Grid Total	Default	Number of vertical divisions for trend chart. If left at default uses the value entered in Group Configuration (section 4.3.2 of the User Guide). Any other setting overrides Group Configuration entry
Vertical Minor Divs	Default	Allows the user to enter a number of minor grid divisions. If left at default uses the value entered in Group Configuration (section 4.3.2 of the User guide). Any other setting overrides Group Configuration entry
Visible Alarm	Default	For 'When Visible' (below) is selected as 'In alarm or error' or 'not in alarm or error'. 'Visible Alarm' allows an alarm number to be entered, for use in determining whether a component be visibile or invisible.
Visible Channel	All points	For use 'When Visible' (below) is selected as 'Channel Value', 'In alarm or error' or 'not in alarm or error'. 'Visible Channel' allows a point number to be selected from a pick list. See also Visible Operator, and Visible Value, below.
Visible Operator	List of operators	For 'When Visible' (below) is selected as 'Channel Value'. 'Visible Operator' allows a comparison operator to be selected from a picklist. The picklist contains the following items: Greater than, Less than, Greater than or equal to, Less than or equal to, Equal to, Not equal to. The comparison is made between the instantaneous value of the point selected in 'Visible Channel' and the value entered in 'Visible Value' (below). For example, when using the 'Greater than' operator, the component is visible whenever the Visible Channel's value is greater than the Visible Value.
Visible Value	Default	For 'When Visible' (below) is selected as 'Channel Value'. 'Visible Value' allows a value to be entered to be used in the 'Visible Operator' comparison described above.
When visible	Always Never Channel value In alarm or error Not in alarm or error	Component is always visible Component is never visible Component is visible or not, depending on the relationship between the current value of a selected channel and a specified constant value. See 'Visible channel', above, for details. Component is visible if a specified alarm on a specified point is active, or if the point is in an 'Error' state. See 'Visible Alarm', above, for details. Component is visible if a specified alarm on a specified point is not active, or the point is not in an 'Error' state. See 'Visible Alarm', above, for details.

Table 2.3.2 Advanced edit level parameters (sheet 6)

2.4 COMPONENT DEFINITIONS

This section defines all the available components listed in table 2.2.2 in terms of their parameters. The components occur in the order in which they appear in the list.

2.4.1 Group Vertical/Horizontal Trend

This produces a display which mimics a recorder chart, for a selected group. All the functions (e.g. trend history) described in, sections 3.4.1 and 3.4.2 of the User Guide, are available. The following unique parameters (fully described in table 2.3.2) are available for configuration:

Background colour	Allows the 'chart' to be drawn in the selected colour.
Message Colour	The colour of messages printed on the 'Chart'.
Time Marker Colour	The colour of time/date printed on the 'Chart'.
Grid Line Colour	The colour of the 'Chart' grid lines.
Faceplates location	Allows 'group' faceplates to be enabled/disabled, and when enabled allows the position of the faceplates to be defined. These 'group' faceplates are additional to the current-channel faceplate which always appears above the chart, unless it has been disabled under 'Horizontal faceplate' (below).
Time Marker Interval	Selects the number of horizontal chart lines between successive time markers
Vertical Grid Total	Total number of vertical chart divisions.
Horizontal Grid Total	Total number of horizontal chart divisions.
Trend Padding	Sets thickness of traces.
Channel cycle time	Allows a number to be entered for the scrolling period between channels. 0 = Channel hold.
Display Messages	Allows message printing to be enabled/disabled.
Display Bargraph	For Horizontal trending only, allows the vertical bargraph display to be switched on and off.
Display Pens	Allows the pen icons at the edge of the chart to be switched on and off.
Horizontal Faceplate	Allows the current-channel faceplate to be switched on and off.

2.4.2 Group vertical bargraph

Produces a vertical bargraph for a selected group in a format defined by 'Bargraph Style' and 'Scale style' described in table 2.3.2. The number of rows of bars can also be defined by the user, according to the overall size of the display, number of channels etc. The default value of zero means that the recorder will display what it 'believes' to be the most ergonomic number of rows.

The recorder attempts to fit as many channel bars as possible into the width of the display. The default minimum width of a column is 6 mm. If there are more channels than can be fitted into the display, a scroll bar device appears at the bottom edge to allow 'hidden' bars to be accessed.

The recorder attempts to fit as many faceplates as possible into the height of the display. If there are more faceplates than can be fitted into the display, a scroll bar device appears to allow 'hidden' faceplates to be accessed.

2.4.3 Group horizontal bargraph

Produces a group horizontal bargraph, for a selected group, in a format defined by 'Bargraph Style' and 'Scale style' described in table 2.3.2. The number of columns can also be defined by the user, according to the overall size of the display, minimum width, number of channels etc.

The recorder attempts to fit as many channels as possible into the height of the display, according to the specified minimum height (default = 12mm). If there are more channels than can be fitted into the display, a scroll bar appears at the right edge to allow 'hidden' channels to be accessed.

2.4.4 Group numeric display

This produces a display of a selected group's numeric values, in one of a number of formats, as described in 'Faceplate Style' in table 2.3.2 above. The number of columns can also be defined by the user, according to the overall size of the display, number of channels etc. The default value of zero means that the recorder will display what it 'believes' to be the most ergonomic number of columns.

The recorder attempts to fit as many channels as possible into the height of the display, according to the specified minimum height (default = 12mm.). If there are more channels than can be fitted into the display, a scroll bar appears at the right edge to allow 'hidden' channels to be accessed.

2.4.5 Channel vertical/horizontal bargraph

For a specified channel, this produces a dynamic horizontal or vertical bargraph display of channel value, in a format defined by 'Bargraph Style' and 'Scale style' described in table 2.3.2

2.4.6 Channel Numeric

For a specified channel, allows the channel faceplate to be displayed in one of a number of formats, as described in 'Faceplate Style' in table 2.3.2 above.

2.4.7 Channel data

For a specified channel, allows one of : Current value, Descriptor, Units, Span low or Span high to be selected for display.

2.4.8 Dialogue Action

This displays a pushbutton which can have one of three actions assigned to it:
1. Call the Login page.
2. Call the Batch Status page
3. Call the Operator Note dialogue box.

For Batch and Operator Note use, a Group number can be selected.

2.4.9 Navigation Action

This displays a pushbutton, the purpose of which is to call a different display screen. A Group and a screen can both be specified, so this button provides a shortcut version of the 'Goto group' and 'Goto View' keys of the root menu.

2.4.10 Operator button

This displays a user pushbutton. The legend on the pushbutton, and the task it is to carry out, are defined in the button configuration. If the text is too long for the width of the button, the text is truncated (e.g. Reset Ave...). Possible tasks are as follows (assuming that the relevant options are fitted):

1 Edit the threshold (setpoint) setting for alarms 1 to 4 for point N
2 Reset Maths channel N
3 Edit Maths constant N
4 Preset Totaliser N
5 Preset Counter N
6 Start/Stop Timer N
7 Initiate Demand Write N
8 Set output channel N to default values.

Figure 2.4.10
Typical Operator Button

In all the above, N represents any number between 1 and the maximum number available for the relevant type of point. (Point is an umbrella term for input channel, a maths channel, a totaliser, etc.)

When the button is operated a 'confirmation' page appears allowing, for example, the value of a constant to be edited before operating the 'Apply' button.

Notes:
1 If the point being accessed is not suitably configured, the 'confirmation' page is blank. For example, if the Operator button is configured to change, say, the threshold (SP) of Alarm 2 on Channel 6, and either Channel 6 is Configured 'Off', or alarm 2 is 'Off', then the Confirmation page will not have a configurable area allowing the user to enter the required new value.
2. Any signing or authorizing that normally applies to the item being edited, also applies when changes are being made by means of the Operator button.

2.4.11 Event Button

This displays a pushbutton, to be used as a source for an event. The button name, its action (latching or unlatching), and whether or not the operation of the button needs signing or authorizing are set up in Event Button configuration, described in section 4.3.7 of the User Guide. The actions taken when the button is operated are set up in Event configuration, described in section 4.3.6 of the User Guide. Signing and Authorizing are as described in section 4.4.2 (Management) of the User Guide.

Figure 2.4.11 Typical Event Button

2.4.12 Image

This allows a GIF or JPG image file to be loaded from (e.g.) the floppy disk drive. Once this has been done, the image size and shape can be edited to fill the screen area, and bargraphs, text messages etc. can be superimposed on the image.

Notes:
1 Only Gifs in Gif87a format are supported by the unit.
2. Because of memory constraints, only six of user screens 1 to 24 may have images embedded in them

2.4.13 Text

If width and height are left with the default values of zero, the text will start at the specified start point and fit in the space between there and the right edge of the screen, in a single line (left justified (ranged) as a default). If the text string is too long, it is truncated. The text appears in the specified foreground colour, superimposed on a 'box' of background colour which is the same width of the text string.

If width and height are defined, then the text will fill the defined width and any remaining text is truncated. The text appears in the foreground colour (default black), over a field of background colour (default grey).

Advanced properties allow the text to be set to range left, range right or be centred, at the top, bottom or centre of the field, and for the foreground and background colours to be swapped.

2.4.14 Round rectangle

Similar to a rectangle described in section 2.4.15, but offers the user the opportunity to draw rectangles with curved corners. The horizontal and vertical curve angles are specified separately, and the aspect ratio of the screen should be taken into account when working in percentage units.

Note: The rounded rectangle will draw incorrectly if either of the arc height /width settings are greater than half the rectangle height/width settings.

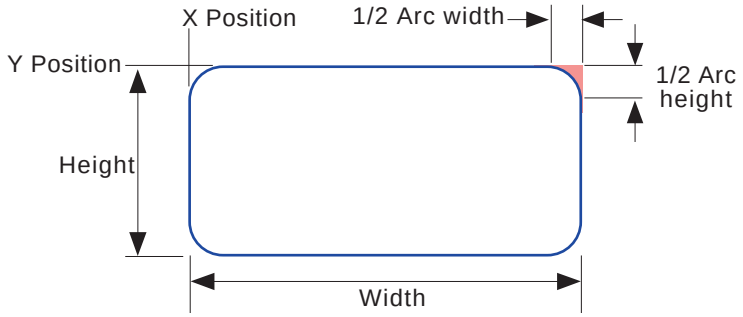


Figure 2.4.14 Round rectangle definitions

2.4.15 Rectangle

This draws a rectangle on the display page. If the height and width of the rectangle are defined in the default 'percentage units', then entering equal values for height and width will result in a rectangle with the same aspect ratio as that of the screen, not a square as might be expected. Because the screen height is approximately 2/3 the width, the rectangle height should be 3/2 the rectangle width to produce a square. (The actual height/width ratio is 535/800 = 0.669 for large frame units or 214/320 = 0.669 for small frame units).

Using pixels as the measuring units obviates this problem as pixels are square.

2.4.16 Polyline - series of points

Similar to closed polygons, described in section 2.4.17 below, but the first and last points are not automatically joined, and the drawn item cannot be filled and the line width cannot be specified - it is always one pixel.

> Note: When working in percentage units, it should be remembered that vertical percentage units are only 2/3 the size of horizontal percentage units - this affecting the appearance of the drawn item.

Example: To draw an (old fashioned) electronic resistor icon (Units = Absolute pixels)

X position = 400, Y position = 236,
Foreground colour = 0
X points = 0,10,15,25,35,45,55,65,75,85,90,100
Y points = 0,0,-10,10,-10,10,-10,10,-10,10,0,0

Press 'Apply', then 'Close' to produce a red ‘sawtooth’ outline, as depicted in figure 2.4.16 below.

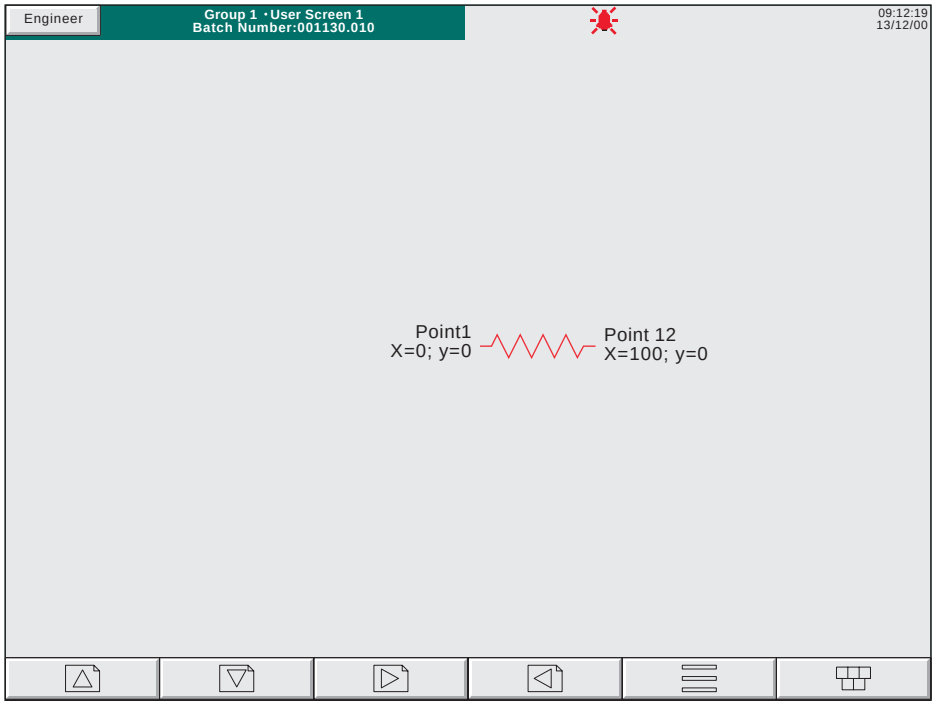


Figure 2.4.16 Polyline example

2.4.17 Polygon - closed area

This allows a number of pairs of points to be entered, which, if valid, will then be joined by straight lines. The first and last points are automatically joined, by the recorder. The shape, drawn in the specified foreground colour, with the specified line width, can be filled with the specified background colour.

Note: When working in percentage units, it should be remembered that vertical percentage units are only 2/3 the size of horizontal percentage units - this affecting the appearance of the drawn item

Example: To draw a left pointing solid arrow, positioned with its point at the centre of the screen.

Access the component page as described in section 2.2.3, select 'polygon - closed area' and press Ok. In the properties page, carry out the following configuration (units = %):

X position = 50, Y position = 50,
Background colour = 22, Foreground colour = 30
Draw edge = Yes, Fill area = Yes
X points = 0,10,10,30,30,10,10
Y points = 0, -15, -5, -5, 5, 5, 15

Press Apply, then Close to produce a dark green arrow, with pale green outline, as depicted in figure 2.4.17 below.

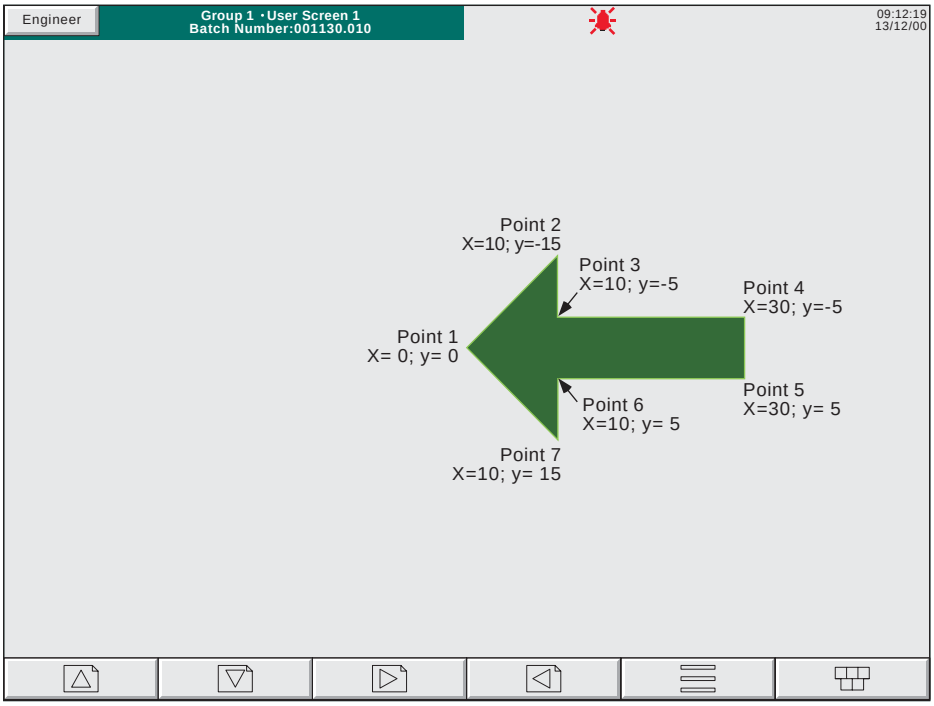


Figure 2.4.17 Polygon example

2.4.18 Oval

Similar to an arc with an arc angle of 360 degrees, but arcs cannot be filled,

If the height and width of the oval are defined in the default ‘percentage units’, then entering equal values for height and width will result in an oval with the same aspect ratio as that of the screen, not a circle as might be expected. Because the screen height is approximately 2/3 the width, the oval height should be 3/2 its width to produce a circle. (The actual height/width ratio = 0.669).

2.4.19 Line

This causes a straight line of user-definable thickness to be drawn between the points (X position; Y position) and (X position + width; Y position + height)

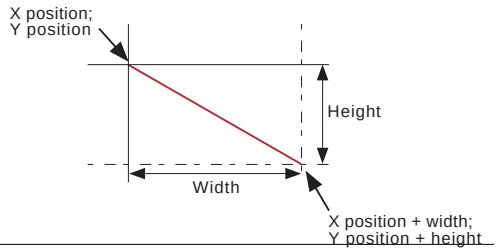
Notes:
1 Y increases downwards; X increases rightwards
2 Height = 2/3 width if measuring in percent

Example

To draw an approximation to a St.Andrew’s cross (saltire):

Access the component page as described in section 2.2.3, select ‘Line’ and press Add, then Ok.

In the properties page, carry out the following configuration:
Main - set background colour to 6
Line 1 - Set Height to 100, Width to 100. Set Foreground colour to 55 and Line thickness to 35
Line 2 - Set X to 100, Height to 100, Width to –100. Set Foreground colour to 55 and Line thickness to 35



Press 'Apply', then 'Close'.

Note: because of the thickness of the lines takes the corners beyond the display area, an error message may appear in the ‘Last error’ field for the lines : position maybe out of bounds. This should not prevent the screen being drawn correctly.

2.4.20 Arc

This causes a curved line of user-definable thickness to be drawn anti-clockwise between start angle and (start angle + arc angle). The origin ('centre') of the arc is (X position + 1/2 Width) ; (Y position + 1/2 Height). Arcs cannot be filled.

Notes:
1 Angle increases anticlockwise
2 Height = 2/3 width if measuring in percent
3 Arcs cannot be filled - the shading in the figure is included for clarity only

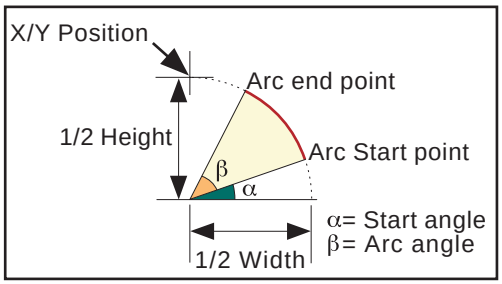


Figure 2.4.20a Arc dimension definitions

Example

An arc definition of:
X position = 50%, Y position = 50%, Width = 50%, Height = 50%, Start angle = 0; Arc angle 270 would produce the curve depicted in figure 2.4.20b, below.

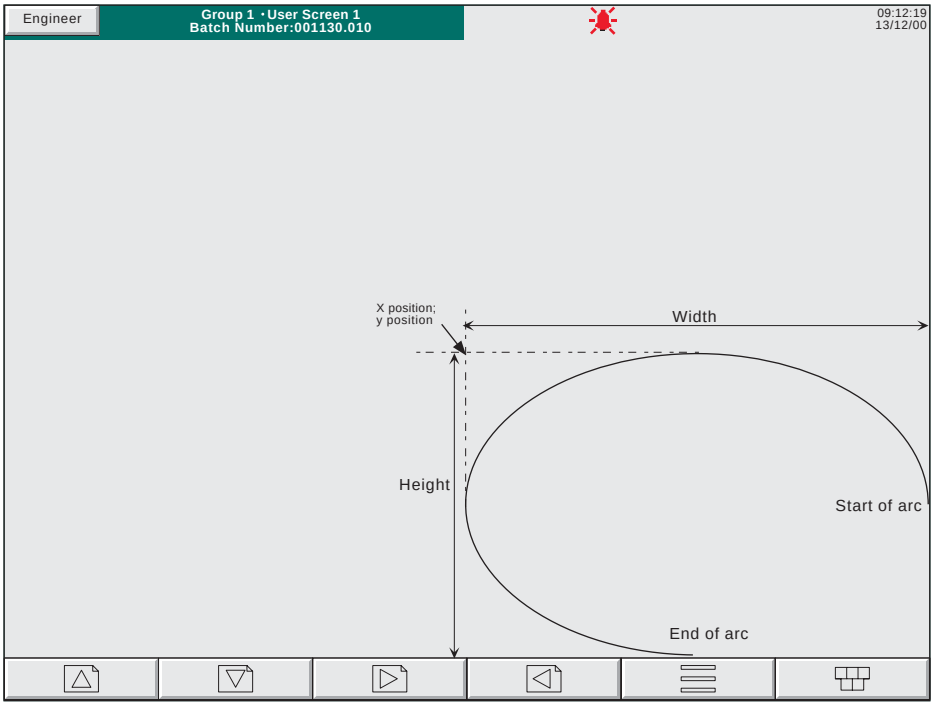


Figure 2.4.20b Sample arc

2.5 USER SCREENS WITH REMOTE VIEWER

Notes:
1 This description applies only to the Full version of Screen Builder. For the 'Lite' version, there is no difference between screen creation at a Remote Viewer, and screen creation at the Instrument's user interface.
2. See the Communications manual HA028122 for details of Remote viewer.

The major differences between creating User screens via Remote Viewer software, and creating User Screens at the instrument's user interface are as follows: (Clearly, these differences are not relevant to instruments whose only operator interface is the Remote Viewer.)

1. The number of User screens is increased by 100.
   Screens 25 to 124 are viewable only via the remote viewer.
   Figure 2.5 shows that the number of these extra screens available to the user must be set either globally, or on a group-by-group basis, in the 'Remote Viewer User Screens' part of 'Views' Configuration (section 4.3.4 of the User Guide). Once this number has been set, all the new screens appear in the Root menu 'GoTo view' display. It is recommended that the minimum convenient number of Remote Viewer User Screens be entered, in order to minimise the number of Goto View 'More...' screens.
2. The Component Property Editor page has 'Quick build' mode keys associated with it, allowing user screens to be created and edited more rapidly than otherwise. See section 2.5.1, for details.
3. The User Screens options page also has additional checkboxes. See section 2.5.2 for details

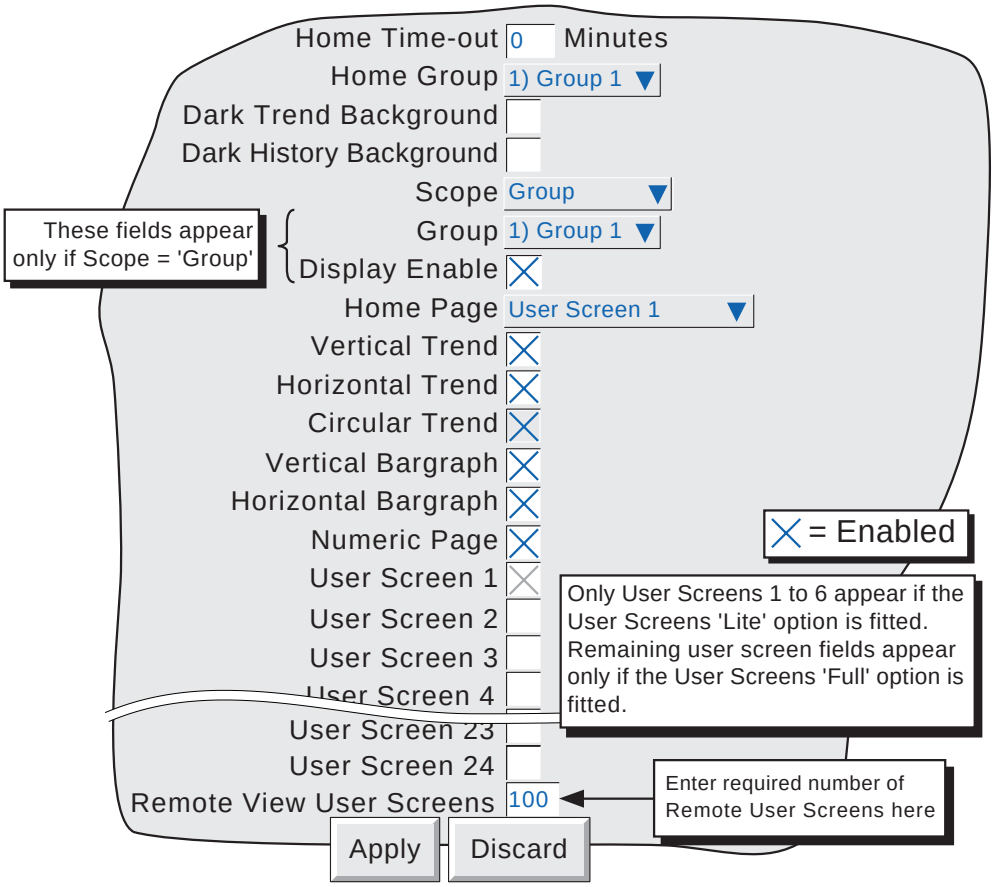


Figure 2.5 Views configuration page

2.5.1 Quick Build Features

When using Remote viewer and Screen Builder Full version, the Component Property Editor is as shown in figure 2.5.1.

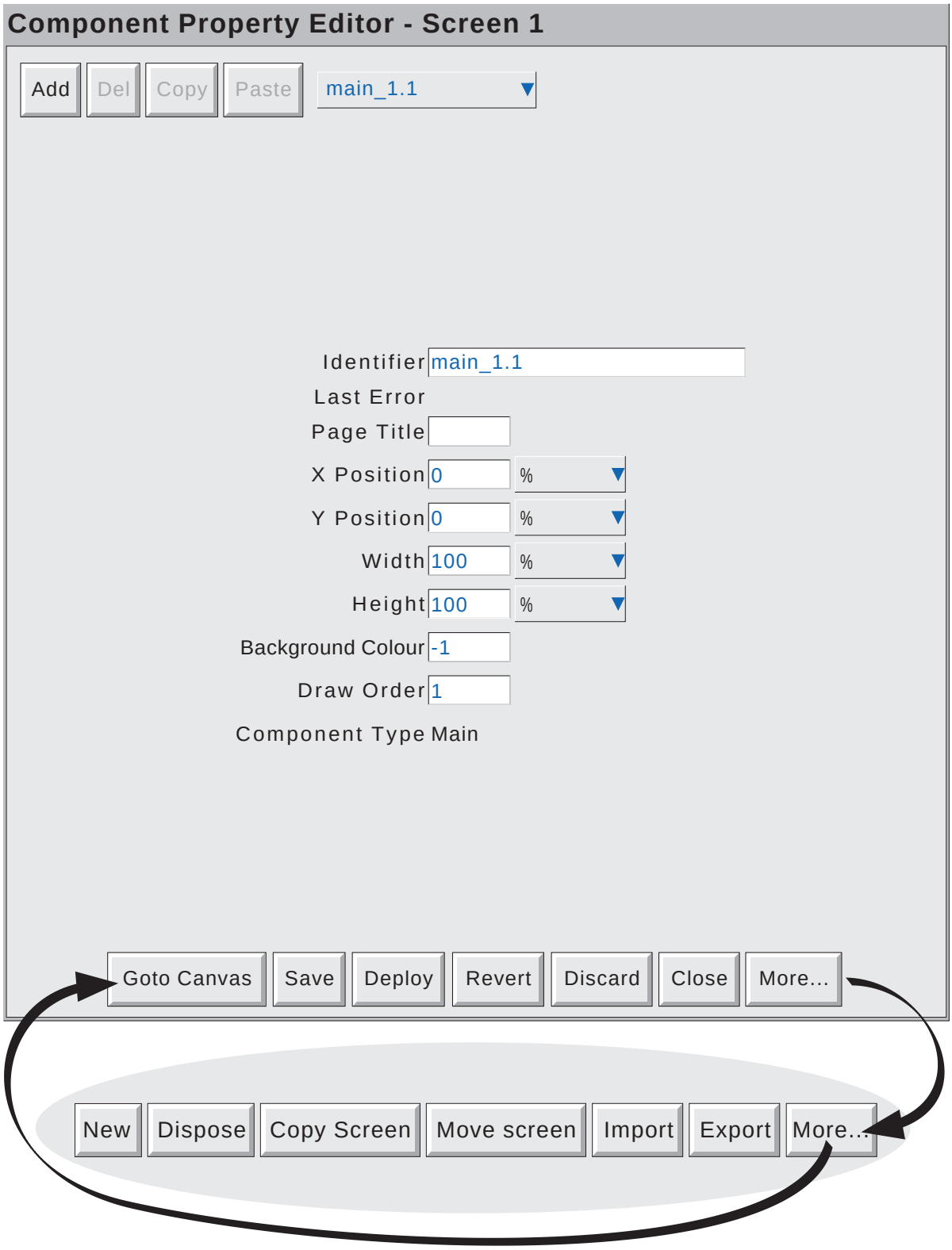


Figure 2.5.1 Component Property Editor Screen

2.5.1 QUICK BUILD (Cont.)

The key functions are as follows:

TOP OF SCREEN

Add	Used to call the list of component types
Del	Used to delete the current component. 'Greyed' for 'Main' as this cannot be deleted.
Copy	Used to copy the current component to the pasteboard. 'Greyed' for 'Main' as this cannot be Copied.
Paste	Used to 'paste' the copied component to the screen. The copied item is placed 1% to the right of, and 1% below, the source component. 'Greyed' until a component Copy action has taken place.

BOTTOM OF SCREEN - PRIMARY SET

Goto Canvas	The Component Property Editor page disappears, and the screen is shown with the current component highlighted. Click and Drag techniques on the highlight 'handles' allow the component to be resized and its aspect ratio to be edited. Clicking and dragging within the highlighted area allows the component to be moved to any position on the screen. See section 2.5.2 for details of helpful editing tools. Double clicking on any component re-opens the Component Property Editor with that component as the current component. Clicking on the Options key, calls the option menu. In this instance, this menu contains Copy, Paste and Revert keys, and a Goto Editor key. Copy, Paste and Revert are described elsewhere in this section. GoTo Editor returns the user to the Component Property Editor page.
Save	Causes the current screen to be saved to the PC database.
Deploy	Causes the screen to be saved to the PC database, and sent to the recorder or data acquisition unit.
Revert	Causes all changes made since the last 'Goto canvas' operation to be 'undone'.
Discard	Causes all changes made since the last 'Save' to be 'undone'
Close	Causes the screen to quit edit mode. If there are unsaved changes the user is asked for confirmation.
More...	Calls secondary keyset.

BOTTOM OF SCREEN - SECONDARY SET

New	Allows the creation of a new (blank) screen. Current screen components are deleted (after confirmation) leaving a blank screen. Items can be retrieved using the Revert key (above) prior to the next 'Save', 'Deploy' or 'Goto canvas'.
Dispose	Deletes the local version of the screen, so that the display reverts to the deployed version.
Copy Screen	Copies the contents of the current screen to another specified screen, leaving the current screen un-changed. If the destination screen is already in use, confirmation is required before the screen is overwritten, the user being given the opportunity to export the existing screen.
Move Screen	Moves the contents of the current screen to another specified screen, leaving the current screen empty. If the destination screen is already in use, confirmation is required before the screen is overwritten.
Import	Calls a browser screen, allowing the user to select a User Screen for import.
Export	Calls a browser screen, allowing the user to select a destination to which to Export the current screen.
More...	Returns to the Primary set of keys.

2.5.2 User Screens options page

Operation of the Options key whilst the Component Property Editor is on display, calls the User Screen options page.

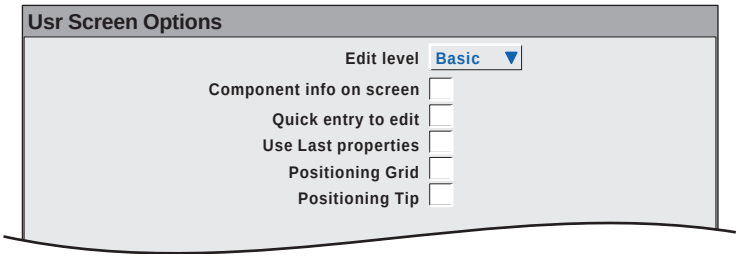


Figure 2.5.2 User Screen Options page

OPTIONS PAGE ITEMS

Edit level

Allows Basic or Advanced edit level to be selected for further use.

Component info on screen

Enabling this box causes a component description to appear at the top left corner of each component. This description is in the form: Identifier(X,Y)+[∂X,∂Y], where X and Y defines the top left corner position in pixels, and ∂X and ∂Y are the width and height of the component in pixels. The identifier is the component name as appears in the Identifier field of the Component Property Editor page.

Quick entry to edit

If selected, this function allows direct entry from the user screen being edited to the Component Property editor page, without the options menu first appearing offering the choice of ‘Batch’ or ‘Edit Screen’.

If Quick entry is selected, the option menu does not appear when the option key is touched. The Batch status page can be called by touching the ‘Page Name’ (Dark Green) area at the top of the screen, as an alternative to the option menu.

Quick entry has no effect on screens other than user screens.

Use Last properties

If selected, then all the common attributes (e.g. position, size, colours etc.) of the most recently edited object are applied to the next component to be added.

Positioning Grid

Causes a grid to appear on the ‘Goto canvas’ screen to help in component layout

Positioning tip

If enabled, then hovering over the highlighted item in a ‘goto Canvas’ screen causes the coordinates of the top left corner of the component to appear, in whatever units (%, pixels etc.) are selected for the component. The first number gives the ‘X’(left-right) co-ordinate; the second gives the ‘Y’ (up-down) position.

Clicking the left mouse key within a component causes the coordinates of the top left corner of the component to appear, in whatever units (%, pixels etc.) are selected for the component.

Clicking the left mouse key outside a component, shows the co-ordinates of the mouse cursor tip. To see these co-ordinates within a component, the mouse must be click-dragged from outside the component.

2.6 MEASURING UNIT COMPARISONS

Note: All the following figures are approximate

2.6.1 VGA screen

The physical display screen size is approximately 245 mm across and 164 mm high. For the purposes of the user screens option, this area can be divided into a 100 x 100 array for percentage measurement or into a pixel array, 800 across by 535 vertically.

Thus, horizontally, 10 mm = 4% = 32 pixels
or 1% = 2.45 mm = 8 pixels
or 10 pixels = 3 mm

and Vertically, 10 mm = 6% = 32 pixels
or 1% = 1.64 mm = 5.35 pixels
or 10 pixels = 3 mm

Centre of screen is given by X = 50%; Y = 50% or by X = 400 pixels; Y = 267 pixels

2.6.2 1/4VGA screen

The physical display screen size is approximately 100 mm across and 76 mm high. For the purposes of the user screens option, this area can be divided into a 100 x 100 array for percentage measurement or into a pixel array, 320 across by 214 vertically.

Thus, horizontally, 10 mm = 10% = 32 pixels
or 1% = 1 mm = 3 pixels
or 10 pixels = 3.2 mm

and Vertically, 10 mm = 13% = 28 pixels
or 1% = .76 mm = 2 pixels
or 10 pixels = 3.6 mm

Centre of screen is given by X = 50%; Y = 50% or by X = 160 pixels; Y = 107 pixels

2.7 ERROR CODES

Error codes 1 to F may appear at the top left corner of the screen. The following codes are currently implemented, and if more than one occurs at the same time, the code numbers are added. For example, Error code 6 would mean that codes 4 and 2 had both occurred.

1 Component error e.g. image does not exist.
2 Error loading the Property.uhr file
4 Error loading the Style.uhr file
8 Error loading the usrscrn.uhu file

3 MATHS

3.1 CONFIGURATION

This feature allows a range of mathematical functions to be performed. Group average, Group maximum and Group minimum, require Multiple Groups to be fitted for correct operation. Figure 3.1 shows a typical configuration page - the selected maths function determines which configuration fields actually appear.

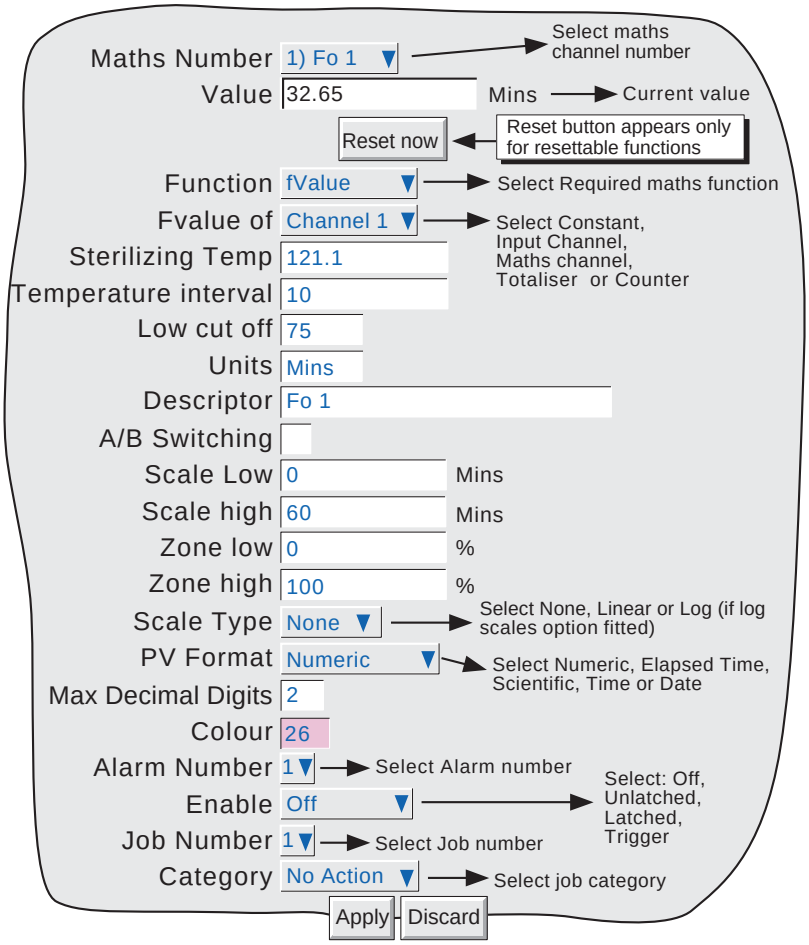


Figure 3.1 Maths configuration menu (typical - varies from function to function)

3.1.1 Maths number

Allows the user to select the required maths channel for configuration.

3.1.2 Value

This field shows the current value of the selected maths channel. If the channel has not yet been configured, the value reads 'Off'.

3.1.3 Reset Now

This button appears only after a resettable function has been selected. Operation of the button sets the maths value to zero.

3.1 MATHS CONFIGURATION (Cont.)

3.1.4 Function

This picklist allows the relevant maths function to be selected. In the following description, the word 'channel' is used as an umbrella term for input channels, maths channels, totalisers etc.

Off	Allows the function to be disabled. Once 'Apply' has been actioned, all configuration for this Maths number is lost.
Constant	Allows a maths channel to be set to a constant value.
Add	Allows any channel or a constant value to be added to any other.
Subtract	Allows any channel or a constant value to be subtracted from any other.
Multiply	Allows any channel or a constant value to be multiplied by any other.
Divide	Allows any channel or a constant value to be divided by any other. Should the value of the divisor pass through zero, 'Maths Channel N error' and 'Maths Channel Failure' messages appear.
Group average*	The instantaneous value of all the channels in the source group added together and divided by the number of channels in the group. For example, in a group of four channels whose instantaneous values are 4, 8, 2 and 6, the group maximum is (4 + 8 + 2 + 6) / 4 = 5. The relevant source group is selected by picklist. Should a channel return a non-valid value, it is excluded from the calculation, and the result of the function is the average of the remaining channels.
Group minimum*	The lowest value of any of the channels in the source group. For example, in a group of four channels whose instantaneous values are 4, 8, 2 and 6, the group minimum is 2. The required source group is selected by picklist. Should a channel return a non-valid value, it is excluded from the calculation, and the result of the function is the minimum of the remaining channels. See section 3.2.15, for more details.
Group maximum*	The highest value of any of the channels in the source group. For example, in a group of four channels whose instantaneous values are 4, 8, 2 and 6, the group maximum is 8. The required source group is selected by picklist. Should a channel return a non-valid value, it is excluded from the calculation, and the result of the function is the maximum of the remaining channels.

*Note: If a maths channel with a Group function is contained within its own source group, then it will act on itself as well as on the other group contents, thus changing the calculation.

For example, if Group 1 were to contain channel 1, channel 2 and maths channel 1, where maths channel 1 had the function 'Group Maximum' for Group 1, then the Group Maximum would become a latching function, showing the highest value ever reached by channel 1, channel 2 or maths channel 1 since the group was configured. In order to trace the instantaneous highest value, channel 1 and channel 2 would have to be contained in e.g. Group 1, and the group maximum channel contained in, say, Group 2, but with a source of 'Group 1'.

Comms	Allows a process value for the maths channel to be communicated over the Modbus link
Stopwatch	This causes the value of the maths channel to increment in milliseconds. The value can be displayed in milliseconds (PV format = numeric), or in HH:MM:SS (PV format = elapsed time). The value can be held, using a 'Disable' job or set to zero either using a 'reset' job or by the operation of the 'Reset now' button in the maths configuration page. See section 4.7 of the User Guide for a description of jobs. The function value is retained during power off.

Note: The scale low and high values are displayed in numeric format for both numeric and elapsed time display formats

3.1.4 FUNCTION (Cont.)

Copy	Copies the value of a selected point to the maths channel being configured. Allows extra alarms to be set up for the copied point.
Polynomial	Provides a polynomial curve fit for the specified point, using up to 8 orders, See section 3.2.1 below, for further details.
Fvalue	This function calculates 'equivalent time at sterilizing temperature' for temperatures above and below the sterilising temperature. FO (dry) and FH (steam) sterilizing calculations can be carried out, by entering the correct constant - see section 3.2.2 below, for further details. The value can be held, using a 'Disable' job or set to zero (prior to the next run) using a 'reset' job. See section 4.7 of the User Guide for a description of jobs. The function value is retained during power off.
Switch	Allows two channels ('A' and 'B') to be selected as alternative sources for the selected maths channel to copy. The maths channel copies source 'A', unless a 'Switch to B' job is active on the maths channel. See section 4.7 of the User Guide for Job descriptions.
Linear Mass Flow	This function calculates mass flow from linear-type transducer outputs. See section 3.2.3 below, for further details.
Root Mass Flow	This function calculates mass flow from square root-type transducer outputs. See section 3.2.4 below, for further details.
Rolling Average	This takes the average value of a single channel over a specified number of readings taken at a specified interval. See section 3.2.5 below, for further details. The function value is retained during power off.
MKT	Mean Kinetic Temperature. A single calculation to simulate non-isothermal effects of variations in storage temperature. See section 3.2.6, below for further details.
10 to the power	Output = 10 raised to the power of the selected input value.
Group Latched Minimum	Outputs the minimum value reached by any of the points in a selected source group since last reset. The function ignores points that are not producing valid PV. A disable job stops the function reading its input. A reset job sets the function to the current minimum value within the group. Note that for proper operation, the maths function must be in a group which is not the source group. If this is not the case, it will always see itself as the lowest valued point in the group, and Reset operations will have no useful effect.
Group Latched Maximum	As for Group Latched Minimum, above, but outputs the maximum value of the source group.
Sample and Hold	This function is initiated by a trigger job. At trigger time, the selected point value is sampled, and its value at trigger time is output continuously by this function. On reset, the PV becomes 'No data'.
Square Root	Outputs the square root of the value of the selected point.
High Select	Allows two points to be selected as inputs. The output of the function is the value of that input point which currently has the higher value.
Low Select	Allows two points to be selected as inputs. The output of the function is the value of that input point which currently has the lower value.
Saturated Steam Mass Flow	Calculates mass flow in kg/s for saturated steam, using either the steam temperature (Celsius) or pressure (MPa) as appropriate to the process. See section 3.2.7 for details.
Saturated Steam Heat Flow	Calculates the energy flow in kJ/s for saturated steam, using either the steam temperature (Celsius) or pressure (MPa) as appropriate to the process. See section 3.2.8 for details.
Saturated Steam Heat Consumed	Calculates the heat consumed in kJ/s for saturated steam, using the inlet steam temperature (Celsius) or pressure (MPa) (as appropriate to the process), and the return (condensate) temperature. See section 3.2.9 for details.
Group MKT	Calculates Mean Kinetic Temperature of a specified group of channels See section 3.2.10 for details.

3.1.4 FUNCTION (Cont.)

Log Base 10	Takes $\log_{10}$ of selected input. (For example: Input = 2 gives maths function value = 0.3010)
Log Base e	Takes $\log_e$ of selected input. (For example: Input = 2 gives maths function value = 0.6931)
e to the power	Takes natural antilog of input. (For example: Input = 0.6931 gives maths function value = 2)
Modulus	This function copies the magnitude of the input value, without the sign. For example, the modulus of value +100 = +100; the modulus of -100 = +100.
Channel Maximum	Maths function value is the maximum value the input point has reached since last reset. When reset, the value is reset to the current input value.
Channel Minimum	Maths function value is the maximum value the input point has reached since last reset. When reset, the value is reset to the current input value.
Channel Average	Takes the average value of the selected channel over a specified time period. The time period must be a multiple of 125 msecs. For example, a period of 0.2 seconds would be rejected, but a period of 0.25 seconds would be accepted.
Rate of change	Produces a value for the speed at which a signal changes over a specified period. See section 3.2.11 for further details.
O2 Correction	This function carries out O_2 correction of gas measurements for use in Continuous Emissions Monitoring applications. See section 3.2.12 for details.
Relative Humidity	This uses wet and dry bulb temeratures and atmospheric pressure inputs to produce a percentage Relative Humidity reading. See section 3.2.13 for details.
Zirconia probe	Allows oxygen concentration and oxygen potential to be determined by solving the Nernst oxygen equation. See section 3.2.14 for details.
Timestamp	When triggered by an event or alarm job, this causes the current number of milliseconds since 00:00 hrs on 1st January 1970 to appear as the function value (1.047×10^{12} at time of writing - 7th Mar 2003). If the selected PV format is date or time, the result is displayed as date or time, respectively.
Config Revision Number*	Allows the Configuration Revision number to be used as the input to a maths channel. When this maths channel is included in a group, the user can determine the Configuration Revision number obtaining at any time in the history record.
Security Revision Number*	Allows the Security Revision number to be used as the input to a maths channel. When this maths channel is included in a group, the user can determine the Security Revision number obtaining at any time in the history record.

*Note: See section 4.6.5 of the User Guide for a description of the Configuration and Security Revision numbers.

3.1.5 Scale Low / Scale High

The 'zero' and full scale values for the maths function, as displayed.

If A/B switching is enabled, a second set of scale low and scale high values can be entered. 'A' values are used during normal operation. 'B' values are switched to by job action, as described in section 4.7 of the User Guide.

3.1.6 PV Format

Numeric	Provides a decimal value for the maths channel.
Elapsed time	Shows the maths channel value in HH:MM:SS (hours minutes, seconds) format. Normally used only for time functions. For other functions, elapsed time counts in milliseconds e.g. a PV of 10000 would be displayed as 00:00:10; a PV of 60000 would be displayed as 00:01:00
Scientific	Values are displayed and entered as a decimal number between 1.0 and 10† (the mantissa), followed by a multiplier (the exponent). E.G. to enter a value of 1244.5678, the value entered would be 1.2445678E3, where 3 represents the number of places that the decimal point must be shifted to the left in order to convert the value to a number between 1 and 10†. To enter a value of 0.0004196, the entry would be 4.196E-4.
Time/date	For timestamp functions, displays the timestamp as time or date as selected, instead of a number of milliseconds, as would be displayed in numeric format.

† Notes
1. Strictly this is a number less than 10, as 10 would be 1.0E1.
2. There must be at least one number after the decimal point.

3.1.7 Remaining configuration items

The remaining configuration items are identical with the relevant items in Input Channel configuration (section 4.3.3 of the User Guide).

3.2 FUNCTION DETAILS

3.2.1 Polynomial fit.

A polynomial curve fit of up to eight orders:
$A0 + A1(X) + A2(X^2) + A3(X^3) + A4(X^4) + A5(X^5) + A6(X^6) + A7(X^7) + A8(X^8)$ where X is the value of the source channel and A0 to A8 are constants. Figure 3.2.1 shows the configuration items for a third order fit with channel 2 used as the source (X), and A0 = 1, A1 = 2, A2 = 3 and A3 = 4.

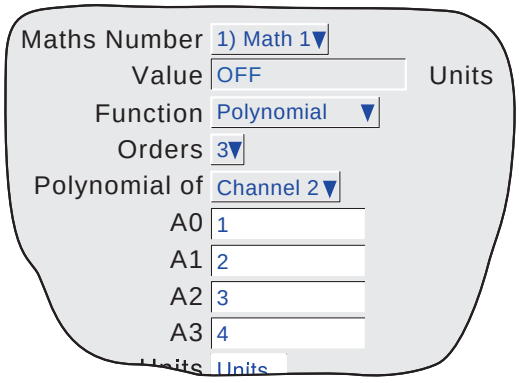


Figure 3.2.1 Polynomial configuration fields (3rd order)

3.2 FUNCTION DETAILS (Cont.)

3.2.2 Fvalue

To calculate the equivalent time at Sterilizing Temperature (for temperatures below, at and above Sterilizing Temperature) both in dry (F_H) and steam (F_O) sterilizing environments, using the following equation:

$$Fval_t = Fval_{t-1} + T \times 10^{\frac{ma_t - \text{Target temp}}{Z}}$$

Where $Fval_t$ = F value at time t (minutes)
$Fval_{t-1}$ = F value last iteration
T = Internal recorder iteration interval (minutes)
ma_t = Value of temperature measuring channel
Target temp = 121.1˚C for F_O; 170˚C for F_H
Z = Temperature interval representing a factor-of-10 reduction in killing efficiency
= 10˚C for F_O; = 20˚C for F_H

User configuration consists of entering the channel which is measuring temperature, the relevant sterilizing temperature and temperature interval (Z-value) and a low cut-off value, if required.

Figure 3.2.2 shows the configuration fields for measuring Fo, using channel 1 as the temperature input channel, Fo values for target temperature (121.1˚C) and z-value (10˚C), and 75˚C as the low cut-off value, below which killing credits are not to be counted.

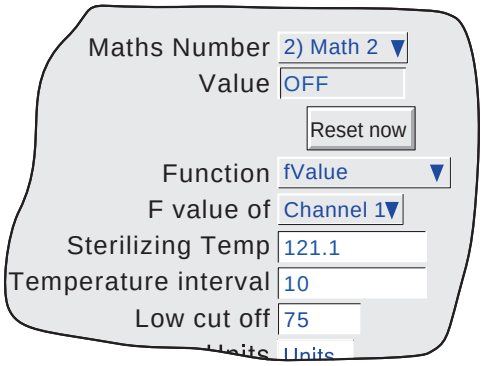


Figure 3.2.2 Fo setup example

Application Note

To ensure that sterilizer loads which contain materials with differing thermal inertias are thoroughly sterilized, a typical sterilizer has up to 12 different measuring points within the load. To ensure accuracy, the temperature sensors should be calibrated, and the channel adjustment facility used to compensate for any inaccuracies found.

If each of the inputs is used to compute an F value, each of these values can then be used as an input to a Group Minimum function, with a high absolute alarm set at the correct F value. The alarm output can be used to sound a warning, or an associated relay can be linked into the autoclave control system to signify the end of a sterilization cycle.

3.2.3 Linear Mass flow

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

The equations solved is:

$$QM_t = \frac{K}{Rg \times Z} \times \frac{Flow_t \times AbsP_t}{Temp}$$

where,
QM_t = Mass flow (in kg/sec), at time 't'
K = Scaling factor (see below)
Rg = Specific gas constant in J/kg-K (see below)
Z = Compressibility factor (see below)
$Flow_t$ = Measured value from the flow meter at time 't'
$AbsP_t$ = Absolute pressure of the fluid at time 't' in kPa(A)
Temp = Temperature of the fluid in Kelvins

SCALING FACTOR

This is determind from an assumed value of Qm at a known Flow, AbsP and Temp. The value is chosen to give an output within the range low scale to high scale.

SPECIFIC GAS CONSTANT

The specific gas constant for any gas is available from published tables. For convenience, the value for a number of common gases is given in table 3.2.3, below.

Gas	RG (J/kg-K)
Air	287.1
Ammonia	488.2
Carbon dioxide	188.9
Carbon monoxide	296.8
Ethylene	296.4
Hydrogen	4116.0
Methane	518.4
Nitrogen	296.8
Oxygen	259.8
Propane	188.5
Steam	461.4

Table 3.2.3 Common gas constants

3.2.3 LINEAR MASS FLOW (Cont.)

COMPRESSIBILITY FACTOR (Z-FACTOR)

Compressibility factor 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 give 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 (Kelvins)
- ρ = gas density at pressure P and temperature T (from published tables)

CONFIGURABLE PARAMETERS

Figure 3.2.3 shows the relevant part of the configuration menu for a maths channel with 'Linear Mass Flow' function selected.

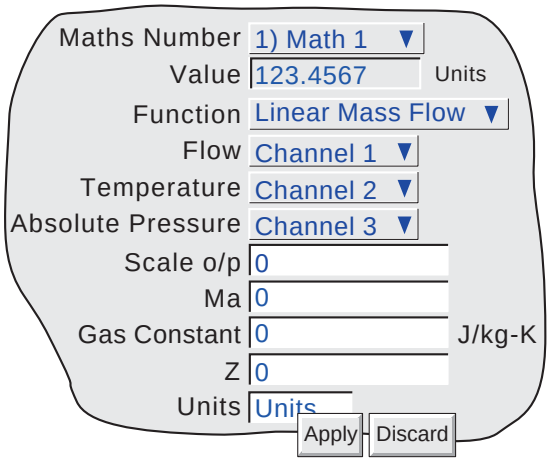


Figure 3.2.3 Linear mass flow menu

Flow	Allows the input channel measuring the flowmeter output to be entered
Temperature	Allows the input channel measuring the fluid temperature (Kelvins) to be entered
Absolute Pressure	Allows the input channel measuring the absolute gas pressure (kPa(A)) to be entered
Scale o/p	Full scale output from the flowmeter in flowmeter units (S)
Ma	Full scale input range set for 'Flow' channel in flowmeter units (ma_{max})
Gas Constant	the relevant gas constant in J/kg-K
Z	The compressibility factor described above.

3.2.4 Root Mass flow

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

The equations solved is:

$$QM_t = \sqrt{\frac{K^2}{Rg \times Z}} \times \sqrt{\frac{DeltaP_t \times AbsP_t}{Temp}}$$

where,
- QM_t = Mass flow (in kg/sec), at time 't'
- K = Scaling factor (see below)
- Rg = Specific gas constant in J/kg-K (see below)
- Z = Compressibility factor (see below)
- $DeltaP_t$ = Measured value across the orifice plate at time 't'
- $AbsP_t$ = Absolute pressure of the fluid at the up-stream tapping at time 't' in kPa(A)
- Temp = Temperature of the fluid at the up-stream tapping in Kelvins

SCALING FACTOR

This is determind from an assumed value of Qm at a known DeltaP, AbsP and Temp. The value is chosen to give an output within the range low scale to high scale.

SPECIFIC GAS CONSTANT

The specific gas constant for any gas is available from published tables. For convenience, the value for a number of common gases is given in table 3.2.3, above.

COMPRESSIBILITY FACTOR (Z-FACTOR)

Compressibility factor 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 give 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 (Kelvins)
- ρ = gas density at pressure P and temperature T (from published tables)

3.2.4 ROOT MASS FLOW (Cont.)

CONFIGURABLE PARAMETERS

Figure 3.2.4 shows the relevant part of the configuration menu for a maths channel with 'Root Mass Flow' function selected.

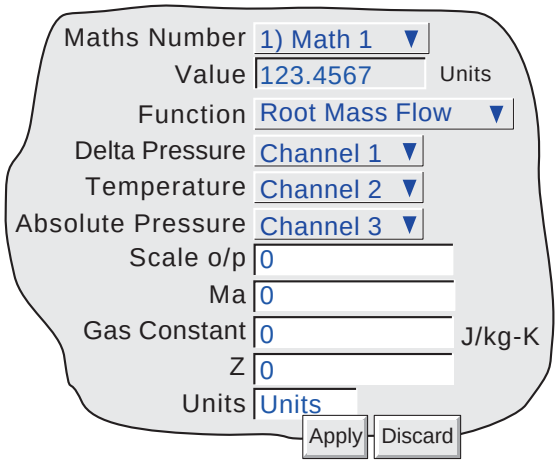


Figure 3.2.4 Root mass flow menu

Delta Pressure	Allows the input channel measuring the differential pressure output from the orifice plate to be entered
Temperature	Allows the input channel measuring the fluid temperature (Kelvins) at the upstream tapping to be entered
Absolute Pressure	Allows the input channel measuring the absolute gas pressure (kPa(A)) to be entered
Scale o/p	Full scale output from the flowmeter in flowmeter units (S)
Ma	Full scale input range set for 'Flow' channel in flowmeter units (ma_{max})
Gas Constant	The relevant gas constant in J/kg-K
Z	The compressibility factor described above.

3.2.5 Rolling Average

This calculates the average value of the last R samples of a channel, taken at N second intervals, where R and N can be defined by the user. At initiation, up to the time of the first sample reading, the displayed value is the average of the channel sampled every iteration (i.e at 8 Hz.).

The number of readings over which the average can be taken is limited by the amount of free RAM instantaneously available, and is thus dependent on the overall configuration of the recorder. An instrument alarm is generated if there is insufficient free RAM available - see section 3.1.3 for details.

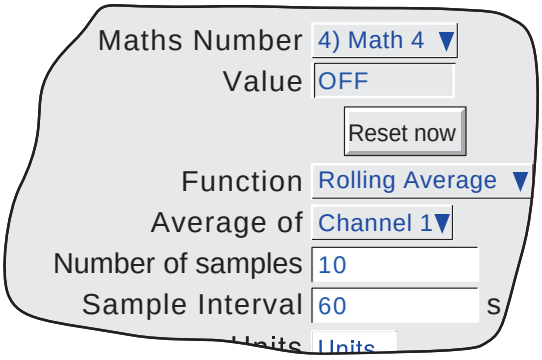


Figure 3.2.5 Rolling average menu

3.2.6 Mean Kinetic Temperature (MKT)

MKT is defined as 'the isothermal temperature that corresponds to the kinetic effects of time-temperature distribution'. The recorder calculates MKT, using the equation below:

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

where:

T_k = The required mean kinetic temperature in Kelvins
ΔH = The heat of activation
R = The universal gas constant
T_{1max} = The highest temperature reached during the first measurement period (in Kelvins)
T_{1min} = The lowest temperature reached during the first measurement period (in Kelvins)
T_{Nmax} = The highest temperature reached during the Nth measurement period (in Kelvins)
T_{Nmin} = The lowest temperature reached during the Nth measurement period (in Kelvins)
N = The total number of measurement periods

As described in 'Configurable items, below, this is simplified for the recorder user , to four entries *viz*:: The number of the channel measuring temperature, the number of samples to be used, the time between the samples and the relevant 'Heat of Activation'.

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

3.2.6 MEAN KINETIC TEMPERATURE (Cont.)

CONFIGURABLE ITEMS

Figure 3.2.6 shows the configurable items for the MKT function.

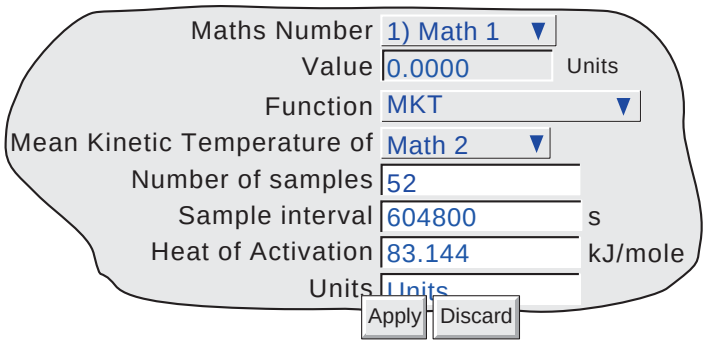


Figure 3.2.6 MKT function parameters

Mean Kinetic Temperature of
: Select the source from which MKT is to be derived. This may be an input channel, scaled in Kelvins, or it can be a maths channel used to convert a different temperature scale into Kelvins (see 'Note' on previous page).

Number 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.

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).
3. The number of readings over which the value can be taken is limited by the amount of free RAM instantaneously available, and is thus dependent on the overall configuration of the recorder. An instrument alarm is generated if there is insufficient free RAM available - see section 3.1.3 for details.

3.2.7 Saturated Steam Mass Flow

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

The equations solved is:

$$QM_t = \frac{Flow_t}{V_{LT} + \Delta V_T \left(\frac{d}{100}\right)}$$

where,
QM_t = Mass flow (in kg/sec), at time 't' (Note 1)
$Flow_t$ = Measured flow in m^3/sec. at time 't' (Note 1)
V_{LT} = Volume of liquid per kg of steam (m^3/kg) at temperature T ˚C
ΔV_T = $V_{VT} - V_{LT}$, where V_{VT} is the volume of vapour per kg of steam at temperature T ˚C
d = Dryness factor between 0 (no vapour) and 100 (no liquid)

V_{LT} and ΔV_T are available from published tables (note 2), but the recorder user need only enter 'values' for measured flow and either the temperature or the pressure of the steam. These 'values' can be constants, input channels or maths channels. Figure 3.2.7a and accompanying parameter descriptions give full details.

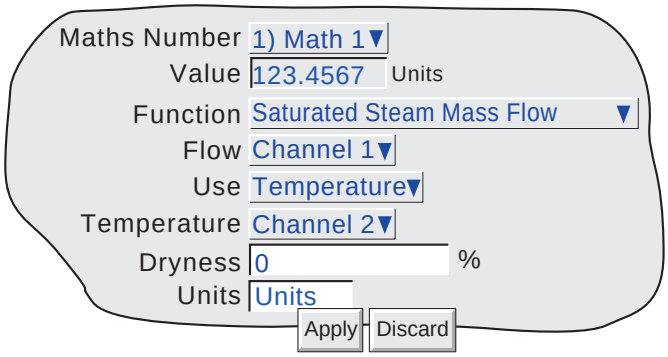


Figure 3.2.7a Typical Saturated Steam Mass Flow configuration page

PARAMETERS

Flow — Select 'Constant' or the number of the channel supplying the measured flow rate. If 'Constant' selected, a further 'box' allows the value for the constant to be entered.

Use — Allows the user to select Temperature (˚C) or Pressure (MPa) for the calculation.

Temperature — Appears only if Use = Temperature. Select 'Constant' or the number of the channel supplying the steam temperature. If 'Constant' is selected, a further 'box' allows a value for the constant to be entered.

Pressure — Appears only if Use = Pressure. Select 'Constant' or the number of the channel supplying the steam pressure. If 'Constant' is selected, a further 'box' allows a value for the constant to be entered.
Table 3.2.7 gives multipliers for converting some common pressure units to MPa. More details may be found at websites http://www.ex.ac.uk/cimt/dictunit/ccpress.htm and http://www.onlineconversion.com/pressure.htm, amongst others.

Dryness — Enter a value between 0 and 100 to represent the dryness of the steam. 0 = no vapour; 100 = no liquid.

Notes:
1 The units of kg/sec and m^3/sec are used above for simplicity. In fact any time unit can be used. For example if the measured flow is in m^3/hour, then the Mass flow will be in kg/hour.
2. ASME Steam tables 1999, from IAPWF IF97.

3.2.7 SATURATED STEAM MASS FLOW (Cont.)

PRESSURE UNITS CONVERSION

There is a wide range of pressure measuring units in use throughout the world. The following table gives a multiplication factor for converting some common units to MPa (MegaPascals), to four significant figures. Further conversion factors can be found at the websites given on the previous page. (Where the conversion is to Pascals, not to MegaPascals, the factors given have to be divided by 1,000,000.)

Pressure units	Multiplier for MPa
Atmospheres	0.1013
Bar	0.1
kg/cm^2	0.09 807
kNewton/m^2	0.001
kPa	0.001
mBar	0.0001
Lb/ft^2	0.00 004 788
Lb/in^2 (PSI)	0.006 895
Mercury (inches of)	0.003 386
Mercury (mm of)	0.0 001 333

Pressure units	Multiplier for MPa
Newtons/cm^2	0.01
Newtons/m^2	0.000 001
Pascals	0.000 001
Tonnes/m^2	0.009 807
Tons(UK)/ft^2	0.1 073
Tons(US)/ft^2	0.09 576
Water (feet of)	0.002 989
Water (inches of)	0.0 002 491
Water (mm of)	0.000 009 807

Table 3.2.7 Pressure unit conversion

The table above shows multiplying factors to convert common pressure units to MPa. This conversion is carried out as follows:

Example: A pressure transducer, connected to input channel 3 gives an output in the range10 to 100 PSI. The input to a steam equation in maths channel 1 requires the pressure units to be MPa. To convert, set up a further maths channel (e.g. No. 2) as shown below, then use maths channel 2 as the source channel for the pressure input to the steam equation.
The suggested scale low/high values are based on the resulting pressure range in MPa - i.e 0.06895 to 0.6895.

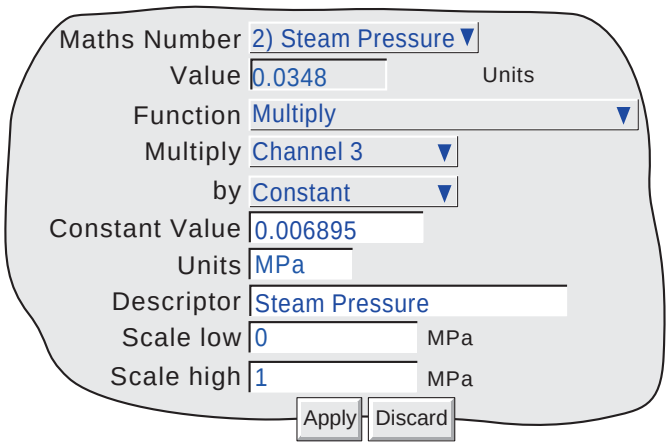


Figure 3.2.7b PSI to MPa conversion example

3.2.8 Saturated Steam Heat Flow

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

The equations solved is:

$$QE_t = \left(\frac{Flow_t}{V_{LT} + \Delta V_T \left(\frac{d}{100}\right)} \right) \left(h_{LT} + \Delta h_T \left(\frac{d}{100}\right) \right)$$

where,
QE_t = Heat energy flow (in kJ/sec), at time 't' (Note 1)
$Flow_t$ = Measured flow in m^3/sec (Note 1)
V_{LT} = Volume of liquid per kg of steam (m^3/kg) at temperature T ˚C
ΔV_T = $V_{VT} - V_{LT}$, where V_{VT} is the volume of vapour per kg of steam at temperature T ˚C
d = Dryness factor between 0 (no vapour) and 100 (no liquid)
h_{LT} = Enthalpy of the liquid in kJ/kg at temperature T ˚C
Δh_T = $h_{VT} - h_{LT}$, where h_{VT} is the enthalpy of vapour in kJ/kg vapour at temperature T ˚C

V_{LT} and ΔV_T; h_{LT} and Δh_T are available from published tables (note 2), but the recorder user needs only to enter 'values' for measured flow and either the temperature or the pressure of the steam. These 'values' can be constants, input channels or maths channels. Figure 3.2.8 and accompanying parameter descriptions give full details.

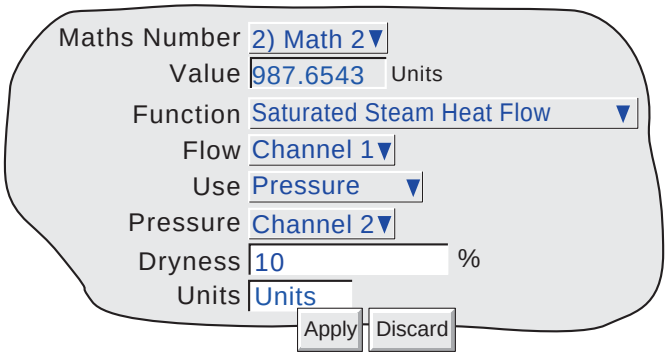


Figure 3.2.8 Typical Saturated Steam Heat Flow configuration page

PARAMETERS

Flow	Select 'Constant' or the number of the channel supplying the measured flow rate. If 'Constant' selected, a further 'box' allows the value for the constant to be entered.
Use	Allows the user to select Temperature (˚C) or Pressure (MPa) for the calculation.
Temperature	Appears only if Use = Temperature. Select 'Constant' or the number of the channel supplying the steam temperature. If 'Constant' is selected, a further 'box' allows a value for the constant to be entered.
Pressure (note 3)	Appears only if Use = Pressure. Select 'Constant' or the number of the channel supplying the steam pressure. If 'Constant' is selected, a further 'box' allows a value for the constant to be entered.
Dryness	Enter a value between 0 and 100 to represent the dryness of the steam. 0 = no vapour; 100 = no liquid.

Notes:
1 The units of kg/sec and m^3/sec are used above for simplicity. In fact any time unit can be used. For example if the measured flow is in m^3/hour, then the Mass flow will be in kg/hour.
2. ASME Steam tables 1999, from IAPWF IF97.
3. See section 3.2.7, above, for details of pressure unit conversion

3.2.9 Saturated Steam Heat Consumed

Note: The following assumtions are made with regard to this implementation:
1. The condensate return is 100% wet saturated water. No flash steam component is included.
2. The same mass leaves the system as enters it.

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

The equations solved is:

$$QE_t = \left(\frac{Flow_t}{V_{LT1} + \Delta V_{T1}\left(\frac{d}{100}\right)} \right) \left(h_{LT1} + \Delta h_{T1}\left(\frac{d}{100}\right) - h_{LT2} \right)$$

where,

QE_t = Heat energy consumed (in kJ/sec), at time 't' (Note 1)
$Flow_t$ = Measured flow in m^3/sec (Note 1)
V_{LT1} = Volume of liquid per kg of steam (m^3/kg) at temperature T1 ˚C
ΔV_{T1} = $V_{VT1} - V_{LT1}$, where V_{VT1} is the volume of vapour per kg of steam at temperature T1 ˚C
d = Dryness factor between 0 (no vapour) and 100 (no liquid)
h_{LT1} = Enthalpy of the liquid in kJ/kg at temperature T1 ˚C
Δh_{T1} = $h_{VT1} - h_{LT1}$, where h_{VT1} is the enthalpy of vapour in kJ/kg vapour at temperature T1 ˚C
h_{LT2} = Enthalpy of the condensate liquid in kJ/kg at temperature T2 ˚C

V_{LT1} and ΔV_{T1}; h_{LT1}, Δh_{LT2} and Δh_{T1} are available from published tables (note 2), but the recorder user needs only to enter 'values' for measured flow, either the temperature or the pressure of the steam and the temperature of the condensate. These 'values' can be constants, input channels or maths channels. Figure 3.2.9b and accompanying parameter descriptions give full details.

Figure 3.2.9a is a simplified sketch of a typical installation, showing where flow rate, pressure and temperature readings are taken.

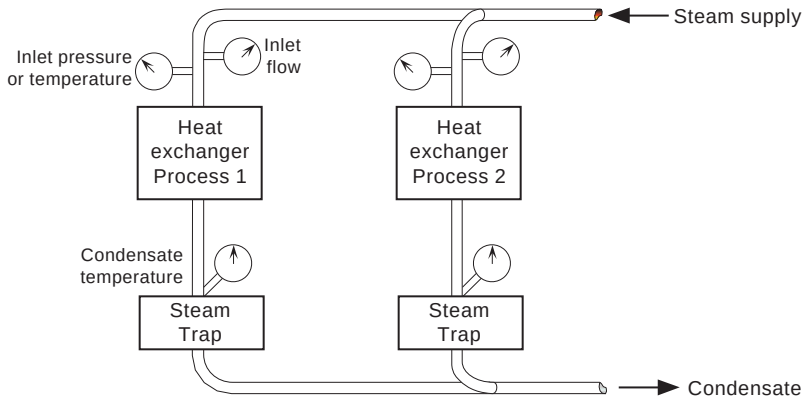


Figure 3.2.9a Measurement transducer - typical locations

Notes:
1 The units of kg/sec and m^3/sec are used above for simplicity. In fact any time unit can be used. For example if the measured flow is in m^3/hour, then the Mass flow will be in kg/hour.
2. ASME Steam tables 1999, from IAPWF IF97.

3.2.9 SATURATED STEAM HEAT CONSUMED (Cont.)

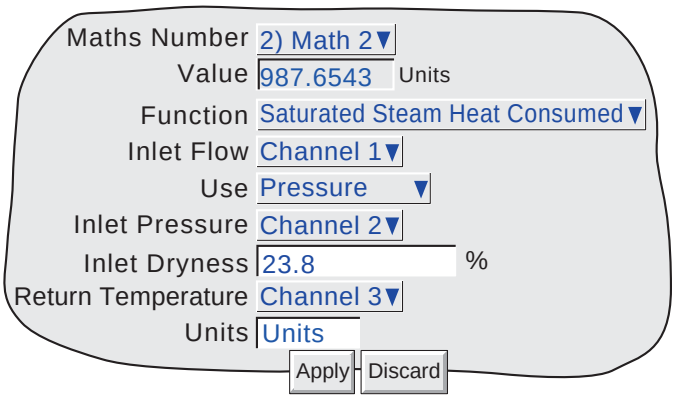


Figure 3.2.9b Typical Saturated Steam Heat Flow configuration page

PARAMETERS

Inlet Flow	Select 'Constant' or the number of the channel supplying the measured flow rate. If 'Constant' selected, a further 'box' allows the value for the constant to be entered.
Use	Allows the user to select Temperature (˚C) or Pressure (MPa) for the calculation.
Inlet Temperature	Appears only if Use = Temperature. Select 'Constant' or the number of the channel supplying the steam temperature. If 'Constant' is selected, a further 'box' allows a value for the constant to be entered.
Inlet Pressure	Appears only if Use = Pressure. Select 'Constant' or the number of the channel supplying the steam pressure. If 'Constant' is selected, a further 'box' allows a value for the constant to be entered.
Inlet Dryness	Enter a value between 0 and 100 to represent the dryness of the steam. 0 = no vapour; 100 = no liquid.
Return Temperature	Select 'Constant' or the number of the channel supplying the condensate temperature If 'Constant' is selected, a further 'box' allows a value for the constant to be entered.

*Note: See section 3.2.7, above, for details of pressure unit conversion

3.2.10 Group MKT

Similar in operation to MKT, described in section 3.2.6, above, except that the MKT is derived from a specified group of points rather than a single point.

For each sample period, the maximum and minimum values reached by any point(s) within the specified group are saved, and used as inputs to the Equation.

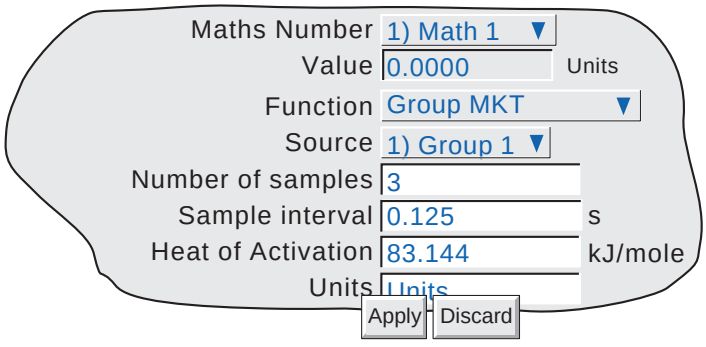


Figure 3.2.10 Group MKT configuration page

3.2.11 Rate-of-change

The equation solved is:

$$\frac{dPV}{dt} = \frac{In_t - In_{t-p}}{P} \times R$$

Where:

dPV/dt = Rate of change of PV with time

In_t = Input value 'this time'

In_{t-P} = Input value 'last time' (i.e. 'this time' - P)

P = Sample period (i.e. 'this time' - 'last time') in seconds. Only periods that are a multiple of 0.125 seconds are accepted.*

R = Scaling factor. Generally, R is the number of seconds in the required 'per unit time' value. For example: if R = 1, the rate is 'per second'; if R = 60, the rate is 'per minute'; if R = 3600, the rate is 'per hour'.

*Note: For channels being read over Modbus, the 'priority intervals' set in the Modbus Master configuration menu (section 3 of the Communications Manual) may cause the readings to be inaccurate or to be continuously zero. For this reason, a minimum sample period of 1 second is recommended.

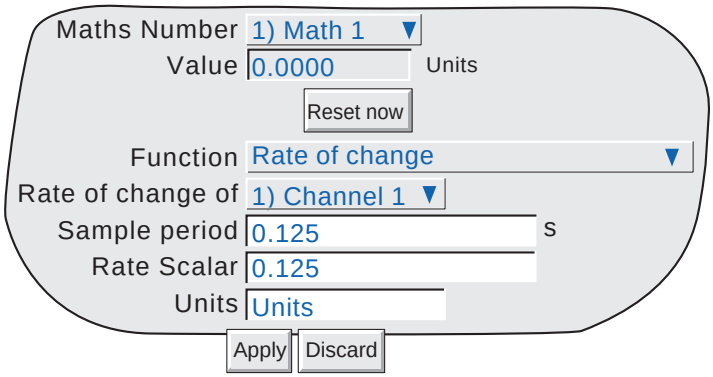


Figure 3.2.11 Rate of change configuration menu

3.2.12 Oxygen (O2) correction

This function carries out O_2 correction of gas measurements for use in Continuous Emissions Monitoring applications. The equation calculated is:

$$Correction = \frac{20.9\% - Specified\ O_2}{20.9\% - Measured\ O_2} \times Measured\ Gas$$

where,

Specified O_2 = specified oxygen entered as a constant 5-digit value (prescribed for the particular process).

Measured O_2 = measured oxygen, entered as a channel number (gas analyser input) (See application note, below).

Measured Gas = the measured gas, entered as a channel number (gas analyser input).

APPLICATION NOTE

Some Authorities allow Oxygen correction to be made ONLY if the Measured Oxygen value is above a limit specified by such Authorities.

For the oxygen correction function to conform with this requirement it is necessary to 'Filter' the Measured Oxygen value using a High Select function, with 'Measured Oxygen' and the Specified Limit constant as its inputs. The output from this function (derived channel number) is then used as the 'Measured oxygen' value.

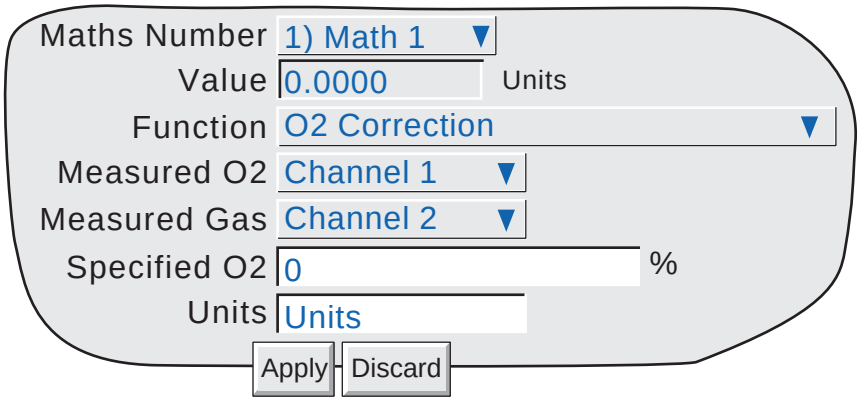


Figure 3.2.12 Oxygen correction configuration menu

3.2.13 Relative Humidity

This determines the percentage relative humidity from wet and dry temperature and atmospheric pressure inputs.

Standard temperature and pressure at sea level are defined as 1.01325 Bar, and 15˚C. Pressure varies with height as indicated in table 3.2.13. The standard psychrometric constant is 0.000666 (6.66 x 10^{-4}).

The equation solved is:

$$RH = \frac{A_0 + wA_1 + w^2A_2 + w^3A_3 + w^4A_4 + w^5A_5 - \{p \times AbsP(d-w)\}}{A_0 + dA_1 + d^2A_2 + d^3A_3 + d^4A_4 + d^5A_5}$$

Where:

RH = Percentage relative humidity
A_0 = 6.17204663 x 10^{-3}
A_1 = 4.28096024 x 10^{-4}
A_2 = 1.53342964 x 10^{-5}
A_3 = 2.40833685 x 10^{-7}
A_4 = 3.04249240 x 10^{-9}
A_5 = 2.65867713 x 10^{-11}
p = Psychrometric constant (0.000666)
AbsP = Pressure in Bar (absolute not gauge)
d = Dry bulb temperature in degrees Celsius
w = Wet bulb temperature in degrees Celsius

Geometric height (metres)	Pressure (Bar)
-250	1.04365
0	1.01325
250	0.983576
500	0.954612
750	0.926346
1000	0.898762
1500	0.845596
2000	0.795014

Table 3.2.13
Height *versus* atmospheric pressure

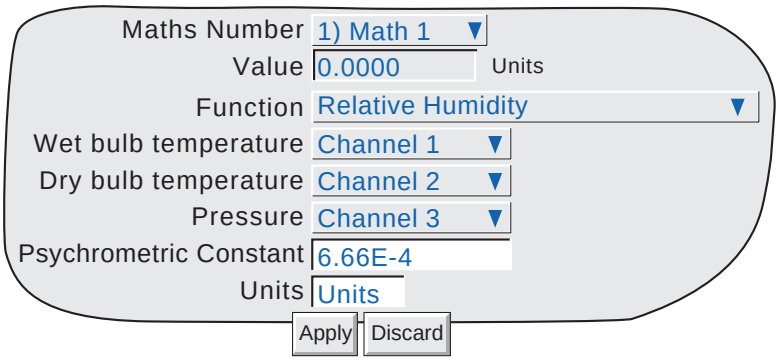


Figure 3.2.13 Relative humidity configuration menu

3.2.14 Zirconia probe

A zirconia (oxygen) probe consists of two platinum electrodes bonded to a pellet or cylinder of zirconia. At elevated temperatures, such a probe develops an emf across it which is proportional to probe temperature and to the log of the difference in oxygen partial pressure between its two ends.

OXYGEN CONCENTRATION

In order to measure oxygen concentrations, one end of the probe is inserted into the atmosphere to be measured, whilst the other is subjected to a reference atmosphere. For most applications, air provides a suitable reference (reference input = 20.95 for air).

The temperature of the probe is normally measured using a type K or type R thermocouple. The temperature efect on the thermocouple is such, that for successful operation the probe temperature must be greater than 973K (700˚C).

The equation solved by the maths function is:

$$P2 = \frac{P1}{10^{\frac{E}{0.0496 \times T}}}$$

where:

P2 = Partial pressure of oxygen in the sampled gas (%)
P1 = partial pressure of oxygen in the reference atmosphere (%) (20.95% for air)
E = Electromotive force (emf) across the probe in mV
T = Probe temperature in Kelvins

Figure 3.2.14a shows the configuration menu. Figure 3.2.14b shows oxygen concentration versus probe emf for various temperatures.

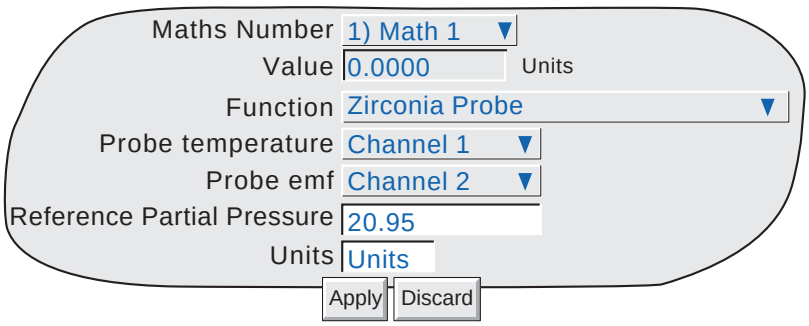


Figure 3.2.14a Zirconia probe function configuration menu

Too obtain a useful result, it is necessary to scale correctly.

The channel which is measuring the probe output would nornally need to be set to: Input Type = mV; Input low = 0; imput high = 100..

A typical temperature-measuring channel might be set up as:
Input Type = Thermocouple; Lin type = Type K; Range low = 273; Range high = 1800, Range units = K.
The maths channel scaling would typically be configured as:
Units = %; Scale Low = 0; Scale High = 5 (for boiler flues) or 10 (for kilns).

3.2.14 ZIRCONIA PROBE (Cont.)

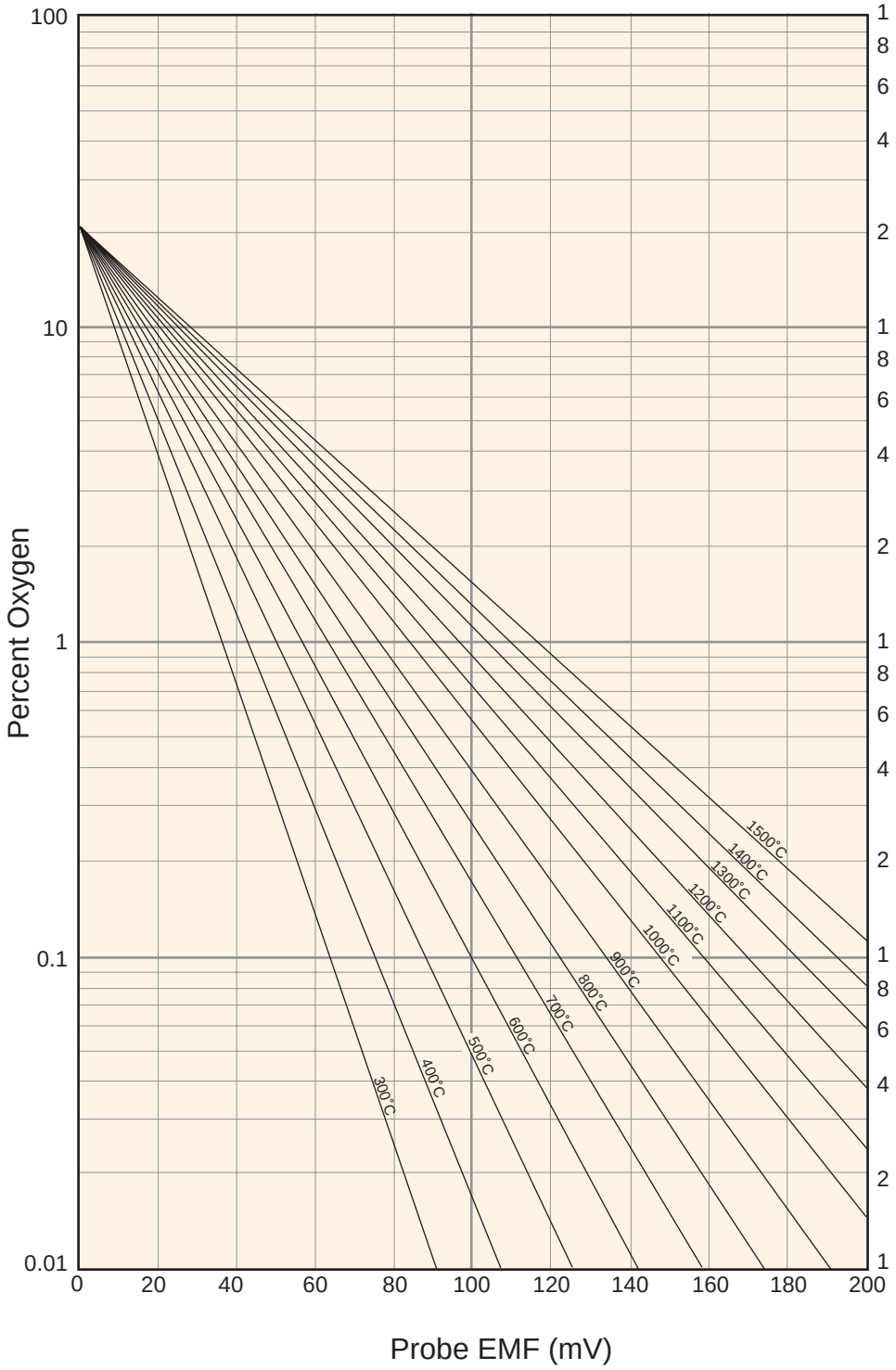


Figure 3.2.14b Probe emf *versus* temperature

3.2.14 ZIRCONIA PROBE (Cont.)

OXYGEN POTENTIAL

The oxygen potential of an atmosphere is a measurement of its ability to oxidise or reduce. for any alament, a value of oxygen potential (free energy of formation) is known. Above this value, the material will oxidise, below it, no oxidisation will occur. Figure 3.2.14c, below, is a free energy diagram for a number of oxidising processes.

Oxygen potential is given by the equation

$$Op = 0.00457 \times T \times \log Op'$$

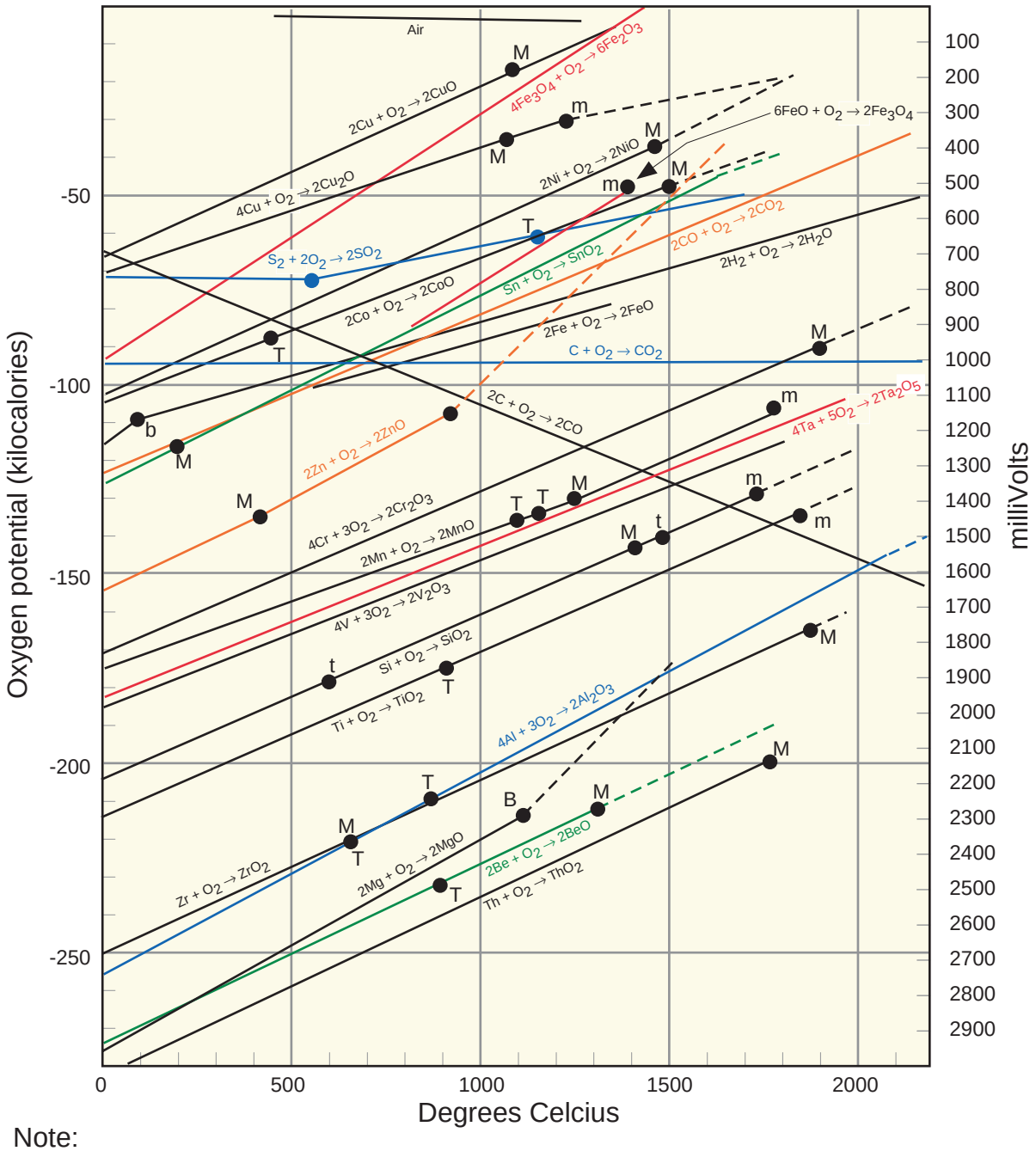
Where: Op = Required oxygen potential (in kilocalories)
T = Probe temperature (in Kelvins)
Op' = Partial pressure of oxygen in the reference atmosphere (in atmospheres)

It can be shown that, because the oxygen potential of air is essentially constant over the range 870 to 1450 kelvins, the zirconia probe output is proportional to the oxygen potential of an atmospher, according to:

$$E = (10.84 \times T) + 40 \text{ mV (in the range 870 to 1450 K)}$$

Thus, it is possible to measure oxygen potential directly from a zirconia probe, usin a standard input channel of the instrument, scaled in units of oxygen potential. A typical configuration might be:
Input Type = mV; Input low = 40; Input high = 1124; Scale low = -100; Scale high = 0; Units kCal. Such a configuration would be suitable over the temperature range 873 to 1473 K (600 to 1200 ˚C).

3.2.14 ZIRCONIA PROBE (Cont.)



Note:
Colours serve no purpose. in the figure above, other than to simplify interpretation.

Change of state	Element	Oxide
Melting point	M	m
Boiling point	B	b
Sublimation point	S	s
Transition point	T	t

Figure 3.2.14c Free energy diagram

3.2.15 Group Minimum

The following description assumes a group name of ‘Furnace 1’, which contains four channels with descriptors ‘Temp 1’, ‘Temp 2’, ‘Temp 3’ and ‘Temp 4’

The output of the Group Minimum function is the current lowest value of any of the points in the source group. The required source group is selected by picklist. Should a point return a non-valid value, it is excluded from the calculation, and the result of the function is the minimum of the remaining points.

DESCRIPTORS

As a part of the Group Minimum function configuration, it is possible to select one of two types of descriptor: ‘User Defined’ and ‘Minimum Channel’. Figure 3.2.15, below shows the relevant area of the configuration page.

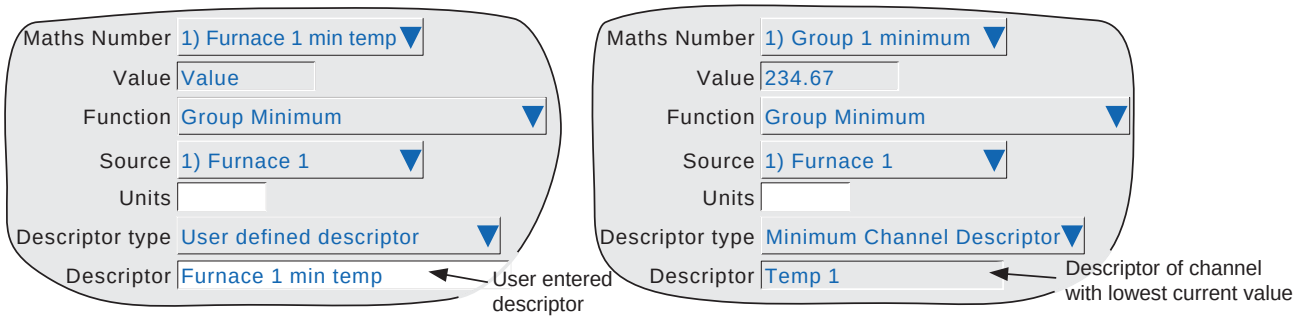


Figure 3.2.15 Group minimum configuration page

User Defined Descriptor.

This allows a descriptor to be entered in the normal way. For example ‘Furnace 1 min temp’. This descriptor is copied to the Maths Number field at the top of the display page.

Minimum Channel Descriptor

This selection causes the descriptor of the point with the instantaneous current lowest value in the group, to become the (non-editable) maths channel descriptor. For example if the four channels in the group (Temp 1 to Temp 4) have the instantaneous values 800, 950, 790 and 873 respectively, then the Descriptor will be ‘Temp 3’ . Should Temp 3 rise above 800, whilst all the others remain static, then the Descriptor would become ‘Temp 1’.

The ‘Maths Number’ field which normally copies the maths channel descriptor, contains instead the text: ‘N) Group N minimum’, where ‘Group N’ is the default name of the source group.

A typical application of the ‘Minimum channel descriptor’ would be to include the descriptor in a message sent to the chart on a regular basis by a Timer function. Section 4.3.8 of the User Guide describes the entry of the messages, and section 6 of this Options manual describes the setting up of timers.

A typical message entry would be:

Message: Lowest temperature is {1} at chan {2}
Replace {1} with: Specified Value
{1} source: Group 1 minimum
Replace {2} with: Specified Descriptor
{2} source: Group 1 Minimum

resulting in a message such as:

```
24/06/03 14:22:06  Lowest temperature is 790.00Units at chan Temp 3.
```

where ‘Units’ is the text entered in the Group Minimum maths channel configuration, not that for the input channel, although typically, they would be the same.

Note: The Group configuration checkboxes for maths channels with‘’Minimum Channel Descriptor’ selected, are ‘greyed’. thus preventing such channels from being used as inputs to thir own source group. See section 4.3.2 of the User Guide for Group configuration details.

3.3 MODBUS ADDRESSING

For units fitted with the Modbus TCP comms option, the following table gives hex addresses for maths channel 1
Generally: Maths channel N parameter address = maths channel 1 parameter address + 162 (N-1) (decimal).
For full details of the Modbus implementation, see section 2 of the User Guide.

3.3.1 Maths channel configuration data

Note: A/B switching not supported for this software version.
Span, Zone, Colour etc. are all setting A

CHANNEL 1

Parameter Name	Description	Type	Access	Start Addr. Hex (Dec)	Register Length
Ch1 Span high	Upper span value (display full scale)	Scaled	Read only	2FF1 (12273)	1
Ch1 Span low	Lower span value (display 'zero')	Scaled	Read only	2FF2 (12274)	1
Ch1 Zone high	Zone high value (two decimal places)	Scaled	Read only	2FF3 (12275)	1
Ch1 Zone low	Zone low value (two decimal places)	Scaled	Read only	2FF4 (12276)	1
Ch1 PV type	Input type 1 = Analogue input 3 = Totaliser 2 = Maths 4 = Counter	Enum	Read only	2FF5 (12277)	1
Ch1 Decimal places	Number of decimal places (0 to 9) (used by all scaled parameters except where stated)	Uint16	Read only	2FF6 (12278)	1
Ch1 Colour	Channel colour (0 to 55) (See Annex B for RGB definitions)	Enum	Read only	2FF7 (12279)	1
Ch1 Units	Units string (up to five characters)	String_5	Read only	2FF8 (12280)	3
Spare				2FFB (12283)	2
Ch1 Open string	Open Digital Input string (up to eight characters)	String_8	Read only	2FFD (12285)	4
Spare				3001 (12289)	4
Ch1 Close string	Closed Digital Input string (up to eight characters)	String_8	Read only	3005 (12293)	4
Spare				3009 (12297)	4
Ch1 Descriptor	Channel descriptor (up to 20 characters)	String_20	Read only	300D (12301)	10
Spare				3017 (12311)	10
Ch1 No of alarms	Number of alarms on this channel	Uint16	Read only	3021 (12321)	1
Ch1 PV format	0 = Numeric 1 = Digital strings	Enum	Read only	3022 (12322)	1
Spare				3023 (12323)	60
Ch1 Alarm 1 enable	Alarm 1 enable 0 = Off 2 = Latched 1 = Unlatched 3 = Trigger	Enum	Read only	305F (12383)	1
Ch1 Alarm 1 type	Alarm 1 type 0 = Absolute low 1 = Absolute high 2 = Deviation in 3 = Deviation out 4 = Rate of change rise 5 = Rate of change fall	Enum	Read only	3060 (12384)	1
Ch1 Alarm 1 setpoint	Trigger setpoint	Scaled	Read/Write	3061 (12385)	1
Spare				3062 (12386)	10
Ch1 Alarm 2 enable	Alarm 2 enable (As alarm 1 enable above)	Enum	Read only	306C (12396)	1
Ch1 Alarm 2 type	Alarm 2 type (As alarm 1 type above)	Enum	Read only	306D (12397)	1
Ch1 Alarm 2 setpoint	Trigger setpoint	Scaled	Read/Write	306E (12398)	1
Spare				306F (12399)	10
Ch1 Alarm 3 enable	Alarm 3 enable (As alarm 1 enable above)	Enum	Read only	3079 (12409)	1
Ch1 Alarm 3 type	Alarm 3 type (As alarm 1 type above)	Enum	Read only	307A (12410)	1
Ch1 Alarm 3 setpoint	Trigger setpoint	Scaled	Read/Write	307B (12411)	1
Spare				307C (12412)	10
Ch1 Alarm 4 enable	Alarm 4 enable (As alarm 1 enable above)	Enum	Read only	3086 (12422)	1
Ch1 Alarm 4 type	Alarm 4 type (As alarm 1 type above)	Enum	Read only	3087 (12423)	1
Ch1 Alarm 4 setpoint	Trigger setpoint	Scaled	Read/Write	3088 (12424)	1
Spare				3089 (12425)	10

Note: Alarms 3 and 4 are available only for instruments fitted with 32MB SRAM.

3.3.2 Maths Channel Run-Time data

This table show addresses for maths channel 1 run-time data.
Generally: channel N address = channel 1 address + 3(N-1) (decimal)

CHANNEL 1

Parameter Name	Description	Type	Access	Start Addr. Hex (Dec)	Register Length
Ch1 value	Current process value (PV)	Scaled	Read/Write	A2BA (41658)	1
Ch1 status	Channel status 0 = Good PV 5 = Ranging error 1 = Channel off 6 = Overflow 2 = Over range 7 = Bad PV 3 = Under range 8 = No data 4 = Hardware error	Enum	Read only	A2BB (41659)	1
Ch1 Alarms	Alarm information	Uint16	-	A2BC (41660)	1
	Bit 0: 0 = Alarm 1 inactive; 1 = Alarm 1 active		Read only		
	Bit 1: 0 = No alarm 1 Ack. required; 1 = Ack. required		Read only		
	Bit 2: 1 = Acknowledge alarm 1		Read/Write		
	Bit 3: Spare				
	Bit 4: 0 = Alarm 2 inactive; 1 = Alarm 2 active		Read only		
	Bit 5: 0 = No Alarm 2 Ack. required; 1 = Ack. required		Read only		
	Bit 6: 1 = Acknowledge alarm 2		Read/Write		
	Bit 7: Spare				
	Bit 8: 0 = Alarm 3 inactive; 1 = Alarm 3 active		Read only		
	Bit 9: 0 = No alarm 3 Ack. required; 1 = Ack. required		Read only		
	Bit 10: 1 = Acknowledge alarm 3		Read/Write		
	Bit 11: Spare				
	Bit 12: 0 = Alarm 4 inactive; 1 = Alarm 4 active		Read only		
	Bit 13: 0 = No Alarm 4 Ack. required; 1 = Ack. required		Read only		
	Bit 14: 1 = Acknowledge alarm 4		Read/Write		
	Bit 15: Spare				

3.3.3 IEEE 32-bit channel configuration data

The following table shows addresses for the specified 32-bit floating-point values, for Maths channel 1. Generally, Parameter address for channel N = Parameter address for channel 1 + 36(N-1) (decimal).

CHANNEL 1

Parameter Name	Description	Type	Access	Start Addr. Hex (Dec)	Register Length
Ch1 span high	Upper span value (Display full scale)	Float	Read only	DF73 (57203)	2
Ch1 span low	Lower span value (display ‘zero’)	Float	Read only	DF75 (57205)	2
Ch1 Zone high	Zone upper value (% of ‘chart’ width)	Float	Read only	DF77 (57207)	2
Ch1 Zone low	Zone lower value (% of ‘chart’ width)	Float	Read only	DF79 (57209)	2
Ch1 Alarm 1 setpoint	Trigger setpoint for alarm 1	Float	Read/Write	DF7B (57211)	2
Ch1 Alarm 2 setpoint	Trigger setpoint for alarm 2	Float	Read/Write	DF7D (57213)	2
Ch 1Alarm 3 setpoint	Trigger setpoint for alarm 3	Float	Read/Write	DF7F (57215)	2
Ch 1Alarm 4 setpoint	Trigger setpoint for alarm 4	Float	Read/Write	DF81 (57217)	2
Spare				DF83 (57219)	20

Note: Alarms 3 and 4 are available only for instruments fitted with 32MB SRAM.

3.3.4 IEEE Area Maths Channel run-time data

The following table gives addresses for the specified 32-bit floating-point values, for maths channel 1. Generally, Parameter address for channel N = Parameter address for channel 1 + 4(N-1) (decimal).

CHANNEL 1

Parameter Name	Description	Type	Access	Start Addr. Hex (Dec)	Register Length
Channel 1 value	Current process value (PV)	Float	Read/Write	F9EF (63983)	2
Channel 1 status	Channel status 0 = Good PV 5 = Ranging error 1 = Channel off 6 = Overflow 2 = Over range 7 = Bad PV 3 = Under range 8 = No data 4 = Hardware error	Enum	Read only	F9F1 (63985)	1
Channel 1 Alarms	Alarm information	Uint16	-	F9F2 (63986)	1
	Bit 0: 0 = Alarm 1 inactive; 1 = Alarm 1 active		Read only		
	Bit 1: 0 = No alarm 1 Ack. required; 1 = Ack. required		Read only		
	Bit 2: 1 = Acknowledge alarm 1		Read/Write		
	Bit 3: Spare				
	Bit 4: 0 = Alarm 2 inactive; 1 = Alarm 2 active		Read only		
	Bit 5: 0 = No Alarm 2 Ack. required; 1 = Ack. required		Read only		
	Bit 6: 1 = Acknowledge alarm 2		Read/Write		
	Bit 7: Spare				
	Bit 8: 0 = Alarm 3 inactive; 1 = Alarm 3 active		Read only		
	Bit 9: 0 = No alarm 3 Ack. required; 1 = Ack. required		Read only		
	Bit 10: 1 = Acknowledge alarm 3		Read/Write		
	Bit 11: Spare				
	Bit 12: 0 = Alarm 4 inactive; 1 = Alarm 4 active		Read only		
	Bit 13: 0 = No Alarm 4 Ack. required; 1 = Ack. required		Read only		
	Bit 14: 1 = Acknowledge alarm 4		Read/Write		
	Bit 15: Spare				

Note: Alarms 3 and 4 are available only for instruments fitted with 32MB SRAM.

4 TOTALISER OPTION

4.1 INTRODUCTION

Each totaliser allows the user to maintain a running total of any input channel, or of any maths channel. Using the maths functions, it is possible to totalise combinations of input channels, so the value of two channels added together, or the difference between two channels could be totalised if required. 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 = value of totalised channel this sample*
PSF = Period Scaling Factor (See Period scaler description below)
USF = Units Scaling Factor (See Unit scaler description below)

*Note: Time between samples (seconds) = $\frac{1}{\text{sample rate of recorder (Hz)}}$

See ‘Update information’ in Annex A for details.

4.2 CONFIGURATION

Figure 4.2, below, shows a typical (enabled) totaliser configuration page

Totaliser Number	Allows any of the available totalisers to be selected from the picklist, for configuration.
Enable	Allows the user to enable/disable the totaliser.
Value	Shows the (dynamic) current value of the selected totaliser.
Total of	Allows an input channel or a maths channel to be selected as the source to be totalised.
Low Cutoff	The value of the source channel (in engineering units) below which it is not to be totalised.
High Cutoff	The value of the source channel (in engineering units) above which it is not to be totalised.
Units	The totalised units (e.g. m^3)
Preset	Allows the entry of a 10-character positive, or nine-character negative value from which the totaliser is to start counting. Direction of counting is defined by the sign of the Unit scaler viz: + = increment; - = decrement.
Preset now	Operation of this key initiates the totaliser preset.

4.2 TOTALISER CONFIGURATION (Cont.)

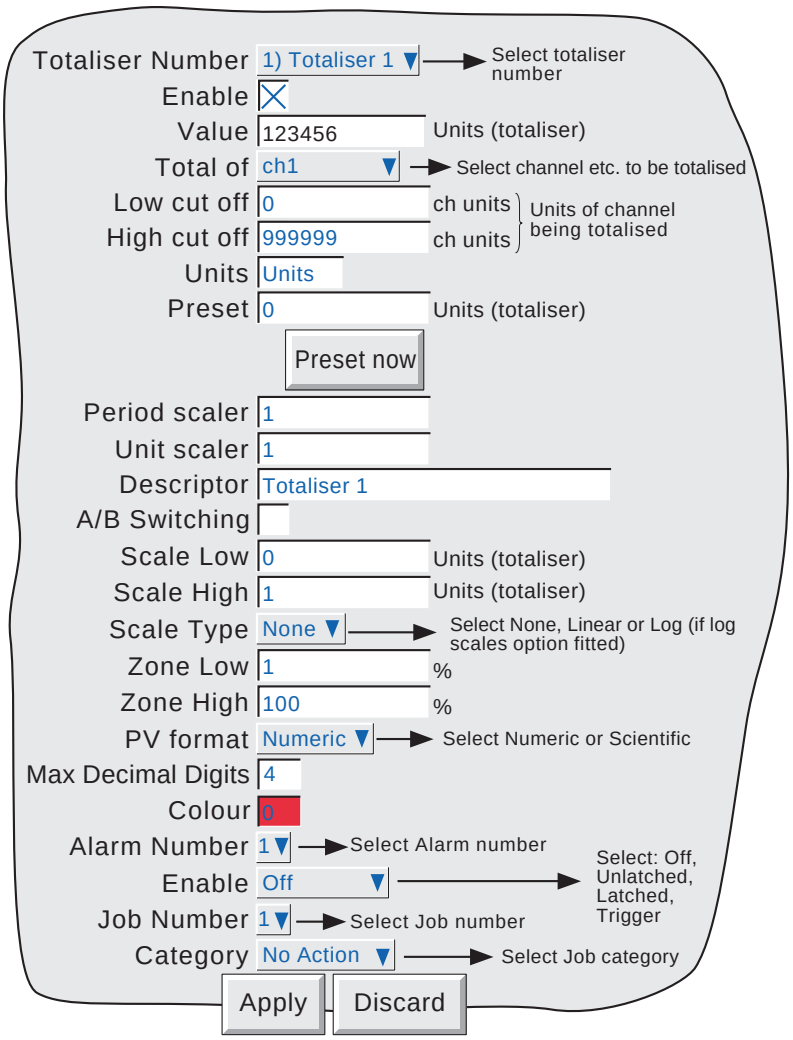


Figure 4.2 Totaliser configuration menu

Period Scaler

The totaliser equation works in seconds. If the totalised channel units are other than 'per second' a period scaler other than the default (1) must be entered. For example, if the input channel is in litres per hour, then the period scaler would have to be the number of seconds in an hour (3600).

Unit Scaler

If, for example, the input channel is in litres per hour, the totalised value will be in litres, unless the unit scaler is set to a value other than 1. If it is more convenient, the totalised value can be in thousands of litres by setting the unit scaler to 1000. Setting the unit scaler negative causes the totaliser to decrement rather than increment.

Scale Low/High

The 'zero' and full scale values for the totaliser, as traced on the screen.

If A/B switching is enabled, a second set of scale low and scale high values can be entered. 'A' values are used during normal operation. 'B' values are switched to by job action, as described in section 4.7 of the User Guide.

The remaining configuration items are identical with the relevant items in Input Channel configuration (section 4.3.3 of the User Guide). For job information, see section 4.7 of the User Guide.

4.3 TOTALISER MODBUS ADDRESSING

For units fitted with the Modbus TCP comms option, the following table gives addresses for totaliser 1 configuration data

Generally: Totaliser N parameter address = totaliser 1 parameter address + 162 (N-1) (decimal).

For full details of the Modbus implementation, see section 2 of the Communications Manual.

4.3.1 Totaliser configuration data

Note: A/B switching not supported for this software version.
Span, Zone, Colour etc. are all setting A

TOTALISER 1

Parameter Name	Description	Type	Access	Start Addr. Hex (Dec)	Register Length
Span high	Upper span value (display full scale)	Scaled	Read only	6F39 (28473)	1
Span low	Lower span value (display 'zero')	Scaled	Read only	6F3A (28474)	1
Zone high	Zone high value (two decimal places)	Scaled	Read only	6F3B (28475)	1
Zone low	Zone low value (two decimal places)	Scaled	Read only	6F3C (28476)	1
PV type	Input type 1 = Analogue input 3 = Totaliser 2 = Maths 4 = Counter	Enum	Read only	6F3D (28477)	1
Decimal places	Number of decimal places (0 to 9) (used by all scaled parameters except where stated)	Uint16	Read only	6F3E (28478)	1
Colour	Channel colour (0 to 55) (See Annex B for RGB definitions)	Enum	Read only	6F3F (28479)	1
Units	Units string (up to five characters)	String_5	Read only	6F40 (28480)	3
Spare				6F43 (28483)	2
Open string	Open Digital Input string (up to eight characters)	String_8	Read only	6F45 (28485)	4
Spare				6F49 (28489)	4
Close string	Closed Digital Input string (up to eight characters)	String_8	Read only	6F4D (28493)	4
Spare				6F51 (28497)	4
Descriptor	Channel descriptor (up to 20 characters)	String_20	Read only	6F55 (28501)	10
Spare				6F5F (28511)	10
No of alarms	Number of alarms on this channel	Uint16	Read only	6F69 (28521)	1
PV format	0 = Numeric 1 = Digital strings	Enum	Read only	6F6A (28522)	1
Spare				6F6B (28523)	60
Alarm 1 enable	Alarm 1 enable 0 = Off 2 = Latched 1 = Unlatched 3 = Trigger	Enum	Read only	6FA7 (28583)	1
Alarm 1 type	Alarm 1 type 0 = Absolute low 1 = Absolute high 2 = Deviation in 3 = Deviation out 4 = Rate of change rise 5 = Rate of change fall	Enum	Read only	6FA8 (28584)	1
Alarm 1 setpoint	Trigger setpoint	Scaled	Read/Write	6FA9 (28585)	1
Spare				6FAA (28586)	10
Alarm 2 enable	Alarm 2 enable (As alarm 1 enable above)	Enum	Read only	6FB4 (28596)	1
Alarm 2 type	Alarm 2 type (As alarm 1 type above)	Enum	Read only	6FB5 (28597)	1
Alarm 2 setpoint	Trigger setpoint	Scaled	Read/Write	6FB6 (28598)	1
Spare				6FB7 (28599)	10
Alarm 3 enable	Alarm 3 enable (As alarm 1 enable above)	Enum	Read only	6FC1 (28609)	1
Alarm 3 type	Alarm 3 type (As alarm 1 type above)	Enum	Read only	6FC2 (28610)	1
Alarm 3 setpoint	Trigger setpoint	Scaled	Read/Write	6FC3 (28611)	1
Spare				6FC4 (28612)	10
Alarm 4 enable	Alarm 4 enable (As alarm 1 enable above)	Enum	Read only	6FCE (28622)	1
Alarm 4 type	Alarm 4 type (As alarm 1 type above)	Enum	Read only	6FCF (28623)	1
Alarm 4 setpoint	Trigger setpoint	Scaled	Read/Write	6FD0 (28624)	1
Spare				6FD1 (28625)	10

Note: Alarms 3 and 4 are available only for instruments fitted with 32MB SRAM.

4.3.2 Run-Time data

This table shows addresses for totaliser 1.
Generally: totaliser N address = totaliser 1 address + 3(N-1) (decimal)

TOTALISER 1

Parameter Name	Description	Type	Access	Start Addr. Hex (Dec)	Register Length
Value	Current process value (PV)	Scaled	Read/Write	A3E6 (41958)	1
Status	Channel status 0 = Good PV 5 = Ranging error 1 = Channel off 6 = Overflow 2 = Over range 7 = Bad PV 3 = Under range 8 = No data 4 = Hardware error	Enum	Read only	A3E7 (41959)	1
Alarms	Alarm information	Uint16	-	A3E8 (41960)	1
	Bit 0: 0 = Alarm 1 inactive; 1 = Alarm 1 active		Read only		
	Bit 1: 0 = No alarm 1 Ack. required; 1 = Ack. required		Read only		
	Bit 2: 1 = Acknowledge alarm 1		Read/Write		
	Bit 3: Spare				
	Bit 4: 0 = Alarm 2 inactive; 1 = Alarm 2 active		Read only		
	Bit 5: 0 = No Alarm 2 Ack. required; 1 = Ack. required		Read only		
	Bit 6: 1 = Acknowledge alarm 2		Read/Write		
	Bit 7: Spare				
	Bit 8: 0 = Alarm 3 inactive; 1 = Alarm 3 active		Read only		
	Bit 9: 0 = No alarm 3 Ack. required; 1 = Ack. required		Read only		
	Bit 10: 1 = Acknowledge alarm 3		Read/Write		
	Bit 11: Spare				
	Bit 12: 0 = Alarm 4 inactive; 1 = Alarm 4 active		Read only		
	Bit 13: 0 = No Alarm 4 Ack. required; 1 = Ack. required		Read only		
	Bit 14: 1 = Acknowledge alarm 4		Read/Write		
	Bit 15: Spare				

4.3.3 IEEE 32-bit configuration data

The following table gives addresses for the specified 32-bit floating-point values, for Totaliser 1. Generally, Parameter address for totaliser N = Parameter address for totaliser 1 + 36(N-1) (decimal).

TOTALISER 1

Parameter Name	Description	Type	Access	Start Addr. Hex (Dec)	Register Length
Span high	Upper span value (Display full scale)	Float	Read only	ED83 (60803)	2
Span low	Lower span value (display ‘zero’)	Float	Read only	ED85 (60805)	2
Zone high	Zone upper value (% of ‘chart’ width)	Float	Read only	ED87 (60807)	2
Zone low	Zone lower value (% of ‘chart’ width)	Float	Read only	ED89 (60809)	2
Alarm 1 setpoint	Trigger setpoint for alarm 1	Float	Read/Write	ED8B (60811)	2
Alarm 2 setpoint	Trigger setpoint for alarm 2	Float	Read/Write	ED8D (60813)	2
Alarm 3 setpoint	Trigger setpoint for alarm 3	Float	Read/Write	ED8F (60815)	2
Alarm 4 setpoint	Trigger setpoint for alarm 4	Float	Read/Write	ED91 (60817)	2
Spare				ED93 (60819)	20

Note: Alarms 3 and 4 are available only for instruments fitted with 32MB SRAM.

4.3.4 IEEE Area Totaliser run-time data

The following table gives addresses for the specified 32-bit floating-point values, for totaliser 1. Generally, Parameter address for totaliser N = Parameter address for totaliser 1 + 4(N-1) (decimal).

TOTALISER 1

Parameter Name	Description	Type	Access	Start Addr. Hex (Dec)	Register Length
Totaliser 1 value	Current process value (PV)	Float	Read/Write	FB7F (64383)	2
Totaliser 1 status	Channel status 0 = Good PV 5 = Ranging error 1 = Channel off 6 = Overflow 2 = Over range 7 = Bad PV 3 = Under range 8 = No data 4 = Hardware error	Enum	Read only	FB81 (64385)	1
Totaliser 1 Alarms	Alarm information	Uint16	-	FB82 (64386)	1
	Bit 0: 0 = Alarm 1 inactive; 1 = Alarm 1 active		Read only		
	Bit 1: 0 = No alarm 1 Ack. required; 1 = Ack. required		Read only		
	Bit 2: 1 = Acknowledge alarm 1		Read/Write		
	Bit 3: Spare				
	Bit 4: 0 = Alarm 2 inactive; 1 = Alarm 2 active		Read only		
	Bit 5: 0 = No Alarm 2 Ack. required; 1 = Ack. required		Read only		
	Bit 6: 1 = Acknowledge alarm 2		Read/Write		
	Bit 7: Spare				
	Bit 8: 0 = Alarm 3 inactive; 1 = Alarm 3 active		Read only		
	Bit 9: 0 = No alarm 3 Ack. required; 1 = Ack. required		Read only		
	Bit 10: 1 = Acknowledge alarm 3		Read/Write		
	Bit 11: Spare				
	Bit 12: 0 = Alarm 4 inactive; 1 = Alarm 4 active		Read only		
	Bit 13: 0 = No Alarm 4 Ack. required; 1 = Ack. required		Read only		
	Bit 14: 1 = Acknowledge alarm 4		Read/Write		
	Bit 15: Spare				

Note: Alarms 3 and 4 are available only for instruments fitted with 32MB SRAM.

5 COUNTER OPTION

5.1 INTRODUCTION

This option introduces a number (depends on recorder model) of counters, which can be preset, disabled, incremented or decremented by Job action (see section 4.7 of the User Guide for Job details). If access is permitted, the user can preset the counter to a selected value, as and when required, from the configuration page.

If the Batch option is fitted (section 1), then batches can be started when a specified counter changes value, and if this is done, the batch number is the value of the specified counter.

5.2 CONFIGURATION

Figure 5.2 shows a typical (enabled) counter configuration page. The page is accessed from the Root menu/Operator/ Config menu.

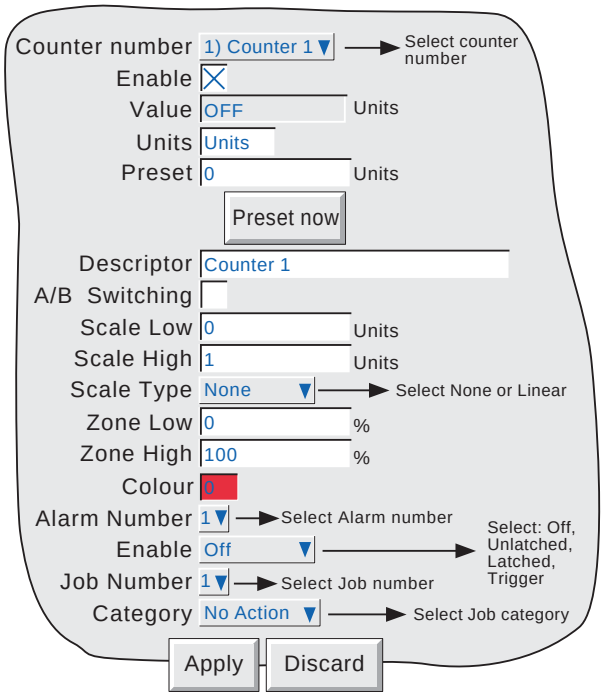


Figure 5.2 Typical Counter configuration menu

5.2.1 Configurable parameters

Counter number	Allows any of the available counters to be selected for configuration
Enable	Allows the user to start/stop counting by enabling/disabling the counter.
Value	Shows the current dynamic value of the counter
Units	Allows a text string of up to 5 characters to be entered as a units description
Preset	Allows a counter value to be entered for manual or job action preset.
Scale low/high	The values to appear at the scale endpoints. If A/B switching is enabled, a second set of scale low and scale high values can be entered. 'A' values are used during normal operation. 'B' values are switched to by job action, as described in section 4.7 of the User Guide.

The remaining configuration items are as described for input channels in section 4.3.3 of the User Guide.

Note: An absolute high alarm (for example) with a threshold of 10, will not be triggered until the value exceeds 10 (i.e. counter value = 11). In order to trip the alarm at 10, a threshold lower than 10 must be entered (e.g. threshold = 9.5). A similar situation exists for absolute low and deviation alarms.

5.3 COUNTER MODBUS ADDRESSING

For units fitted with the Modbus TCP comms option, the following table gives ddresses for counter 1 configuration data.
Generally: Counter N parameter address = counter 1 parameter address + 162 (N-1) (decimal).
For full details of the Modbus implementation, see section 2 of the Communications Manual.

5.3.1 Counter configuration data

Note: A/B switching not supported for this software version.
Span, Zone, Colour etc. are all setting A

COUNTER 1

Parameter Name	Description	Type	Access	Start Addr. Hex (Dec)	Register Length
Span high	Upper span value (display full scale)	Scaled	Read only	8EDD (36573)	1
Span low	Lower span value (display 'zero')	Scaled	Read only	8EDE (36574)	1
Zone high	Zone high value (two decimal places)	Scaled	Read only	8EDF (36575)	1
Zone low	Zone low value (two decimal places)	Scaled	Read only	8EE0 (36576)	1
PV type	Input type 1 = Analogue input 3 = Totaliser 2 = Maths 4 = Counter	Enum	Read only	8EE1 (36577)	1
Decimal places	Number of decimal places (0 to 9) (used by all scaled parameters except where stated)	Uint16	Read only	8EE2 (36578)	1
Colour	Channel colour (0 to 55) (See Annex B for RGB definitions)	Enum	Read only	8EE3 (36579)	1
Units	Units string (up to five characters)	String_5	Read only	8EE4 (36580)	3
Spare				8EE7 (36583)	2
Open string	Open Digital Input string (up to eight characters)	String_8	Read only	8EE9 (36585)	4
Spare				8EED (36589)	4
Close string	Closed Digital Input string (up to eight characters)	String_8	Read only	8EF1(36593)	4
Spare				8EF5 (36597)	4
Descriptor	Channel descriptor (up to 20 characters)	String_20	Read only	8EF9 (36601)	10
Spare				8F03 (36611)	10
No of alarms	Number of alarms on this channel	Uint16	Read only	8F0D (36621)	1
PV format	0 = Numeric 1 = Digital strings	Enum	Read only	8F0E (36622)	1
Spare				8F0F (36623)	60
Alarm 1 enable	Alarm 1 enable 0 = Off 2 = Latched 1 = Unlatched 3 = Trigger	Enum	Read only	8F4B (36683)	1
Alarm 1 type	Alarm 1 type 0 = Absolute low 1 = Absolute high 2 = Deviation in 3 = Deviation out 4 = Rate of change rise 5 = Rate of change fall	Enum	Read only	8F4C (36684)	1
Alarm 1 setpoint	Trigger setpoint	Scaled	Read/Write	8F4D (36685)	1
Spare				8F4E (36686)	10
Alarm 2 enable	Alarm 2 enable (As alarm 1 enable above)	Enum	Read only	8F58 (36696)	1
Alarm 2 type	Alarm 2 type (As alarm 1 type above)	Enum	Read only	8F59 (36697)	1
Alarm 2 setpoint	Trigger setpoint	Scaled	Read/Write	8F5A (36698)	1
Spare				8F5B (36699)	10
Alarm 3 enable	Alarm 3 enable (As alarm 1 enable above)	Enum	Read only	8F65 (36709)	1
Alarm 3 type	Alarm 3 type (As alarm 1 type above)	Enum	Read only	8F66 (36710)	1
Alarm 3 setpoint	Trigger setpoint	Scaled	Read/Write	8F67 (36711)	1
Spare				8F68 (36712)	10
Alarm 4 enable	Alarm 4 enable (As alarm 1 enable above)	Enum	Read only	8F72 (36722)	1
Alarm 4 type	Alarm 4 type (As alarm 1 type above)	Enum	Read only	8F73 (36723)	1
Alarm 4 setpoint	Trigger setpoint	Scaled	Read/Write	8F74 (36724)	1
Spare				8F75 (36725)	10

Note: Alarms 3 and 4 are available only for instruments fitted with 32MB SRAM.

5.3.2 Run-Time data

This table shows addresses for counter 1.
Generally: Counter N address = counter 1 address + 3(N-1) (decimal)

COUNTER 1

Parameter Name	Description	Type	Access	Start Addr. Hex (Dec)	Register Length
Value	Current process value (PV)	Scaled	Read/Write	A47C (42108)	1
Status	Channel status 0 = Good PV 5 = Ranging error 1 = Channel off 6 = Overflow 2 = Over range 7 = Bad PV 3 = Under range 8 = No data 4 = Hardware error	Enum	Read only	A47D (42109)	1
Alarms	Alarm information	Uint16	-	A47E (42110)	1
	Bit 0: 0 = Alarm 1 inactive; 1 = Alarm 1 active		Read only		
	Bit 1: 0 = No alarm 1 Ack. required; 1 = Ack. required		Read only		
	Bit 2: 1 = Acknowledge alarm 1		Read/Write		
	Bit 3: Spare				
	Bit 4: 0 = Alarm 2 inactive; 1 = Alarm 2 active		Read only		
	Bit 5: 0 = No Alarm 2 Ack. required; 1 = Ack. required		Read only		
	Bit 6: 1 = Acknowledge alarm 2		Read/Write		
	Bit 7: Spare				
	Bit 8: 0 = Alarm 3 inactive; 1 = Alarm 3 active		Read only		
	Bit 9: 0 = No alarm 3 Ack. required; 1 = Ack. required		Read only		
	Bit 10: 1 = Acknowledge alarm 3		Read/Write		
	Bit 11: Spare				
	Bit 12: 0 = Alarm 4 inactive; 1 = Alarm 4 active		Read only		
	Bit 13: 0 = No Alarm 4 Ack. required; 1 = Ack. required		Read only		
	Bit 14: 1 = Acknowledge alarm 4		Read/Write		
	Bit 15: Spare				

5.3.3 IEEE 32-bit configuration data

The following table gives addresses for the specified 32-bit floating-point values, for Counter 1. Generally, Parameter address for counter N = Parameter address for counter 1 + 36(N-1) (decimal).

COUNTER 1

Parameter Name	Description	Type	Access	Start Addr. Hex (Dec)	Register Length
Span high	Upper span value (Display full scale)	Float	Read only	F48B (62603)	2
Span low	Lower span value (display ‘zero’)	Float	Read only	F48D (62605)	2
Zone high	Zone upper value (% of ‘chart’ width)	Float	Read only	F48F (62607)	2
Zone low	Zone lower value (% of ‘chart’ width)	Float	Read only	F491 (62609)	2
Alarm 1 setpoint	Trigger setpoint for alarm 1	Float	Read/Write	F493 (62611)	2
Alarm 2 setpoint	Trigger setpoint for alarm 2	Float	Read/Write	F495 (62613)	2
Alarm 3 setpoint	Trigger setpoint for alarm 3	Float	Read/Write	F497 (62615)	2
Alarm 4 setpoint	Trigger setpoint for alarm 4	Float	Read/Write	F499 (62617)	2
Spare				F49B (62619)	20

Note: Alarms 3 and 4 are available only for instruments fitted with 32MB SRAM.

5.3.4 IEEE Area Counter run-time data

The following table gives addresses for the specified 32-bit floating-point values, for counter 1. Generally, Parameter address for counter N = Parameter address for counter 1 + 4(N-1) (decimal).

COUNTER 1

Parameter Name	Description	Type	Access	Start Addr. Hex (Dec)	Register Length
Counter 1 value	Current process value (PV)	Float	Read/Write	FC47 (64583)	2
Counter 1 status	Channel status 0 = Good PV 1 = Channel off 2 = Over range 3 = Under range 4 = Hardware error 5 = Ranging error 6 = Overflow 7 = Bad PV 8 = No data	Enum	Read only	FC49 (64585)	1
Counter 1 Alarms	Alarm information	Uint16	-	FC4A (64586)	1
	Bit 0: 0 = Alarm 1 inactive; 1 = Alarm 1 active		Read only		
	Bit 1: 0 = No alarm 1 Ack. required; 1 = Ack. required		Read only		
	Bit 2: 1 = Acknowledge alarm 1		Read/Write		
	Bit 3: Spare				
	Bit 4: 0 = Alarm 2 inactive; 1 = Alarm 2 active		Read only		
	Bit 5: 0 = No Alarm 2 Ack. required; 1 = Ack. required		Read only		
	Bit 6: 1 = Acknowledge alarm 2		Read/Write		
	Bit 7: Spare				
	Bit 8: 0 = Alarm 3 inactive; 1 = Alarm 3 active		Read only		
	Bit 9: 0 = No alarm 3 Ack. required; 1 = Ack. required		Read only		
	Bit 10: 1 = Acknowledge alarm 3		Read/Write		
	Bit 11: Spare				
	Bit 12: 0 = Alarm 4 inactive; 1 = Alarm 4 active		Read only		
	Bit 13: 0 = No Alarm 4 Ack. required; 1 = Ack. required		Read only		
	Bit 14: 1 = Acknowledge alarm 4		Read/Write		
	Bit 15: Spare				

Note: Alarms 3 and 4 are available only for instruments fitted with 32MB SRAM.

6 TIMERS OPTION

6.1 INTRODUCTION

This option offers a number of count-down timers which can be used for general timing purposes. The timers can be either one-shot or repeating, and can be initiated in the following ways:

1. directly by the operator from the configuration page (if access permission is granted),
2. by job action (see section 4.7 of the User Guide),
3. at a predefined time/date,
4. every ‘time period’, where the ‘time period’ can be configured to be anything from 1 second to 1 year. For example, setting seconds to ‘30’ and leaving all other fields ‘Any’, the timer will start every minute on the half minute. Setting seconds to ‘30’ and minutes to ‘0’ will cause the timer to start at 30 seconds past each hour.

Note: Times are not adjusted for Daylight Saving changes. Thus if the timer is set to trigger on a daily, weekly, etc, basis, then, during 'Summer Time', the trigger will occur an hour late (i.e. at 01:00 hrs. instead of at midnight).

The full range of jobs is available as described in section 4.7 of the User Guide. 'Timer Active' is defined as an internal event trigger (see section 4.3.6 of the User Guide).

6.2 CONFIGURATION

Figure 6.2 shows a typical timer configuration display. The page is accessed from the Root menu/Operator/Config menu.

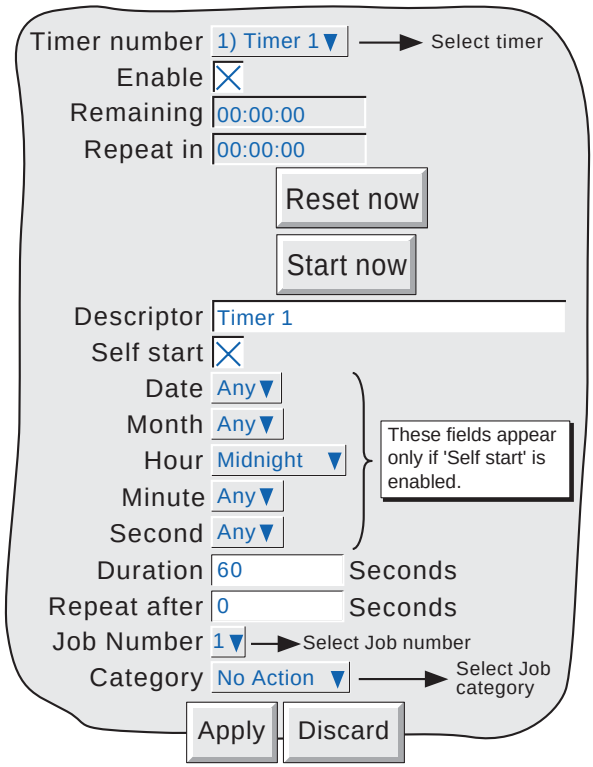


Figure 6.2 Typical timer configuration page

6.2.1 Configurable parameters

Timer number	Allows a specific timer to be selected for configuration
Enable	Allows the user to enable/disable the selected timer
Remaining	This is a dynamic display showing the time remaining in hours:minutes:seconds format.
Repeat in	For repeat timers, shows the time remaining before the repeat is initiated. Display is 00:00:00 whilst timer is counting down.
Reset now	Allows a running timer to be reset to 00:00:00.
Start now	Allows the operator to initiate the timer.
Descriptor	Allows a descriptor to be entered for the timer.
Self Start	If enabled, this causes date and time selection fields to appear as shown in figure 6.2 above. Date: allows a day number to be selected from a picklist of 1 to N and 'Any', where N is the maximum number of days in the selected month. Month: allows a month number to be entered from a picklist of 1 to 12 and 'Any'. Hour: allows an hour number to be selected from a picklist of 1 to 23, 'Midnight' and 'Any'. Minute: allows a minutes number to be entered from a picklist of 0 to 59 and 'Any'. Seconds: allows a seconds value to be entered from a picklist of 0 to 59 and 'Any'.
Duration	Allows the user to enter a count-down time period in seconds.
Repeat after	Allows the user to enter a repeat rate. It should be noted that the repeat value includes the duration time. For example, to time down from 50 seconds, every minute, a 'Duration' value of 50 seconds should be entered, with a 'Repeat after' value of 60 seconds (not 10 seconds).

Note: If Month = 'Any', and Day = 31, then the timer will not be triggered in February, April, June, September or November. Similarly, if Day = 30, the timer will not be triggered in February, and so on.

Job configuration is as described in section 4.7 of the User Guide.

SELF-START EXAMPLE

To preset Totaliser number 1 to zero, daily, at midnight:

In totaliser configuration, enter 0 as the Preset value for Totaliser 1.

In timer configuration, select:

1.	Timer number	Timer 1
2.	Enable	enabled
3	Self start	enabled
4	Date	Any
5.	Month	Any
6.	Hour	Midnight
7.	Minute	0
8.	Second	0
9.	Duration	0.125
10.	Repeat after	0
11.	Job number	1
12.	Job category	Totaliser
13.	Action	Preset
14.	Totaliser	Totaliser 1
15.	On	Active

7 EVENT INPUTS

Note: This option is not supported by all models. The maximum number of event inputs is model dependent.

7.1 INTRODUCTION

Each Event input option board offers six isolated event input circuits. Inputs can either be switch closures or voltage levels.

Section 4.3.6 'Event Configuration' in the User Guide, describes the use of events, and how they can be ANDed and ORed together to perform logic functions if required. Job lists can be triggered by any event, either 'internal' or as a result of external events wired to the event input board. If this option is fitted, 'Event Input Board' appears as an event source.

If 'Event Input Board' is selected as a source, the 'Board' number and the event 'Input' number on that board must be specified.

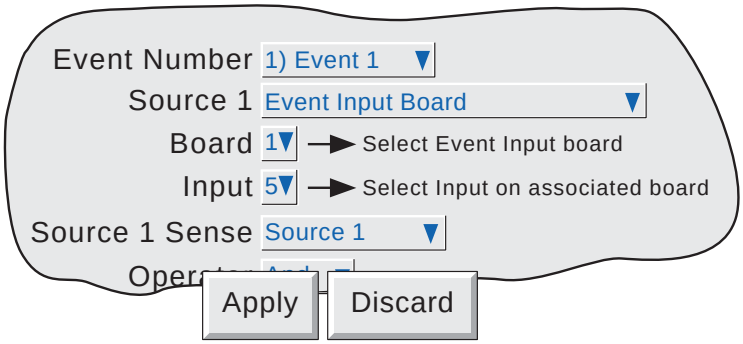


Figure 7.1 Event input selection

7.2 SIGNAL WIRING TERMINATION

Note: The 'C' terminal is isolated from recorder 0 Volts

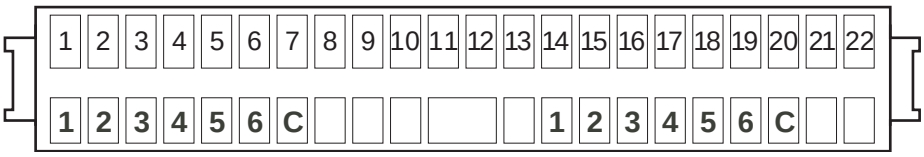


Figure 7.2 Event input option termination

7.3 INPUT WIRING

Figure 7.3 shows wiring details for the six discrete event inputs.

Note: The 'C' Terminal is isolated from recorder 0V

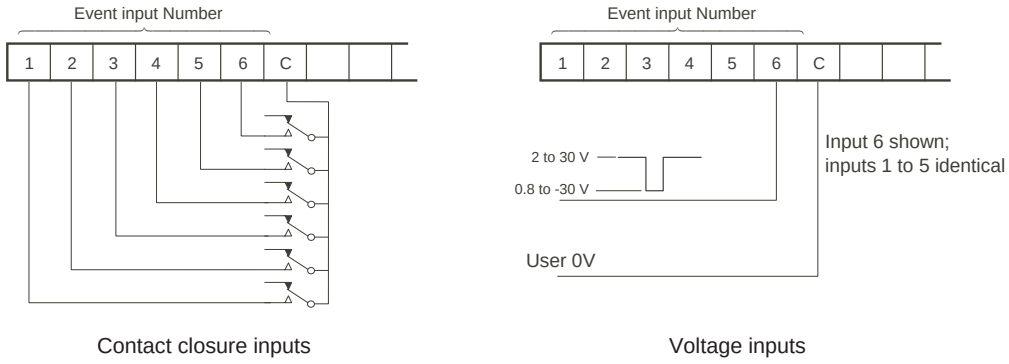


Figure 7.3 Event input wiring (discrete inputs)

7.4 SPECIFICATION

Number of inputs (maximum)

180mm recorders:	24 inputs (four boards with six inputs per board)
100 mm recorders:	12 inputs (two boards with six inputs per board)
Data logging and acquisition units:	12 inputs (two boards with six inputs per board)

Safety isolation

Safety Isolation (dc to 65 Hz: BS EN61010)	Installation category II; Pollution degree 2 (see page 1 for definitions)
Event input to event input:	0V
Event input to ground:	100V RMS or dc (double insulation)

Operating levels

Voltage levels	An event is considered to be 'Active' if the voltage at its input terminal is between +0.8 and - 30 V with respect to the 'C' terminal. It is considered 'Inactive' if the voltage is between +2V and +30V. Status is not guaranteed for voltages between the above values
Maximum input voltage	± 30V with respect to 'C'
Maximum input frequency	4 Hz
Current sink requirements (Voltage i/p)	10mA

Contact closures

Contact resistances	An event is considered to be 'Active' if the resistance between its input termninal and the 'C' terminal is less than 35kΩ. It is considered 'Inactive' if the resistance is greater 200kΩ. Status is not guaranteed for resistances between the above values

Minimum durations

Recognition time	The minimum time for which the contact closure must be maintained is 62.5 msec. This protects against switch 'bounce', and against most transients. Transients lasting more than 62.5 msec will cause a trigger to occur, lasting one iteration period (125 msec)

8 ISOLATED TRANSMITTER POWER SUPPLY (TRS) OPTION

Note: This option is not available for all Models

8.1 INTRODUCTION

WARNING!

Transmitter power supplies must not be used with dc supply voltages.

Notes:

1. Transmitter power supplies are not suitable for use with low-voltage ac supplies.
2 The transmitter power supply is available only with 100 mm. recorders.

This option consists of a circuit board, terminal block and suitable wiring inside a long terminal cover at the rear of a 100mm recorder. The board supplies three mutually isolated dc supplies (nominal 25 Volts) each of which is intended to power a single 0 to 20 mA or 4 to 20 mA current loop.

8.2 FUSING

8.2.1 Fuse Rating

The circuit board is protected by a 20 mm anti-surge (type T) fuse, the value of which depends on the supply voltage as shown in table 8.2.1, below.

Access to the output wiring and to the fuse is achieved by isolating the recorder from mains power and opening the terminal cover (after removing its securing screw). The process is fully described below.

Supply voltage	Fuse rating	Part Number
115V ac	100 mA	CH050012
230V ac	63mA	CH050630

Table 8.2.1 Transmitter power supply fuse details

8.2.2 Access to the user connections/fuse

1 Isolate the recorder from the supply voltage.
2 At the rear of the recorder remove the terminal cover securing screw (figure 8.2.2a), taking care to retain it for use in re-assembly.
3 Open the cover to reveal the circuit board, user connections etc. (figure 8.2.2b)

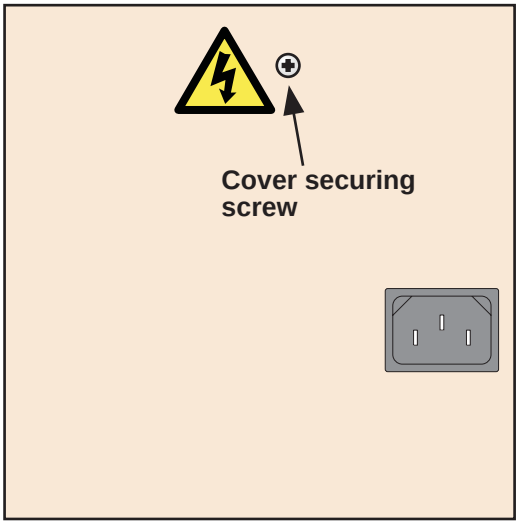


Figure 8.2.2a retaining screw location

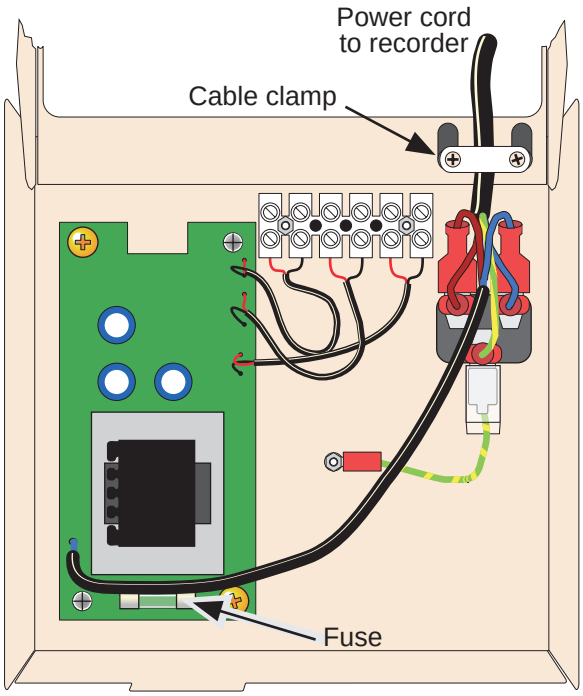


Figure 8.2.2b Inside the terminal cover

4 The fuse is located as shown in figure 8.2.2b. User wiring to the terminal block (figures 8.2.3a/b) can be carried out now, or the terminal cover can be removed for convenience, as described in steps 5 onwards below.
5. Unplug the IEC connector from the rear of the recorder connector panel
6. Remove the cable clamp, retaining the fixings for later re-assembly.
7. Close the terminal cover, and lift it off, as indicated in figure 8.2.2c.

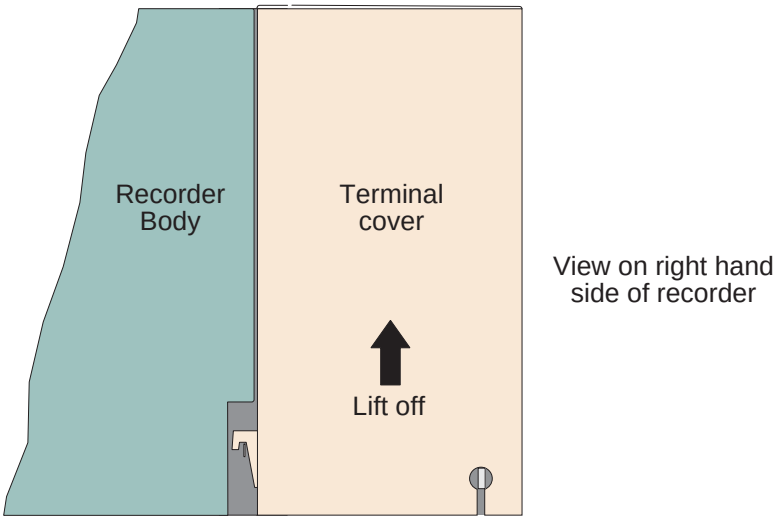


Figure 8.2.2c Lift terminal cover off its hinge.

8.2.3 User wiring

Figure 8.2.3a shows the terminal block pinout, and figure 8.2.3b shows typical applications wiring.

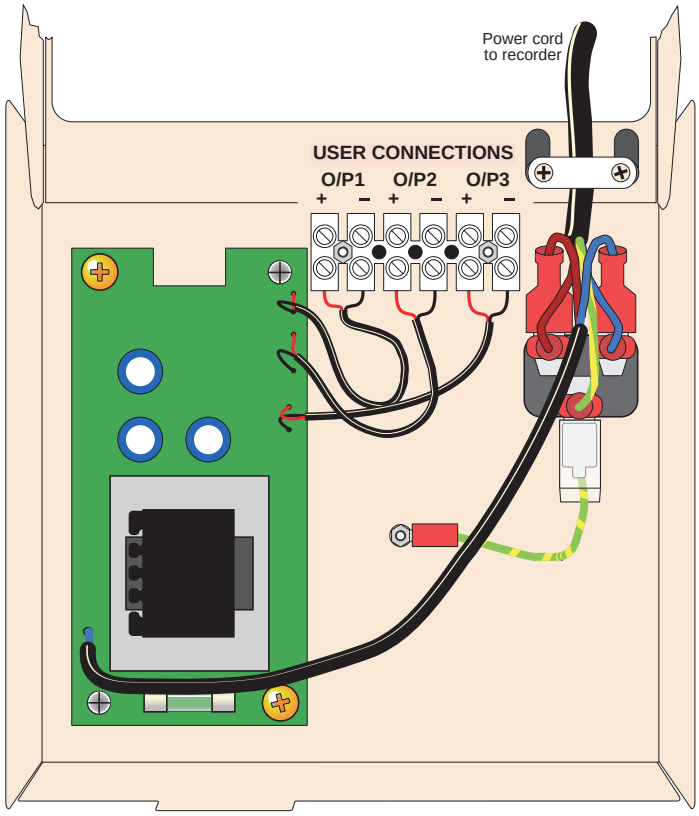
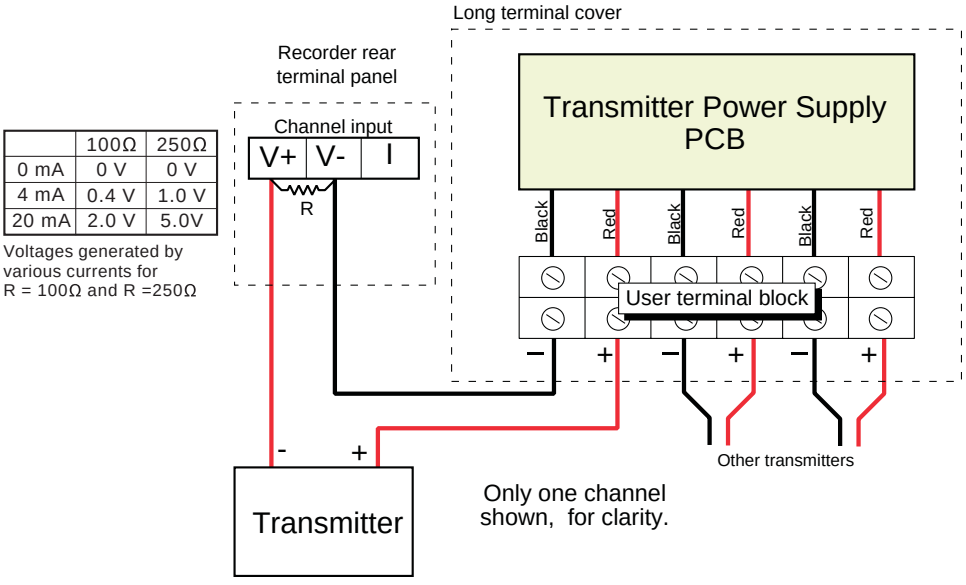


Figure 8.2.3a Terminal block wiring



	100Ω	250Ω
0 mA	0 V	0 V
4 mA	0.4 V	1.0 V
20 mA	2.0 V	5.0V

Voltages generated by various currents for R = 100Ω and R =250Ω

R (minimum spec) = 1.4W, ± 1%. 100Ω or 250Ω as required (see table)

Figure 8.2.3b Applications wiring

9 NON-ISOLATED TRANSMITTER POWER SUPPLY (TRS) OPTION

Note: This option is not supported by all recorder models

9.1 INTRODUCTION

The transmitter power supply shares the same board as the Relay/ethernet option, and is therefore available only if the Relay/Ethernet option is also fitted. The option is capable of supplying, continuously, a total of 120 mA at a nominal 24 Volts. This allows up to six 0 to 20 mA or 4 to 20 mA transmitters to be powered.

9. 2 PINOUT

Pinout is from a two-pin plug at the rear of the recorder, as shown in figure 9.3.1, below

WARNING!

The transmitter power supply is not isolated – the 0 Volt terminals are connected to Chassis ground.

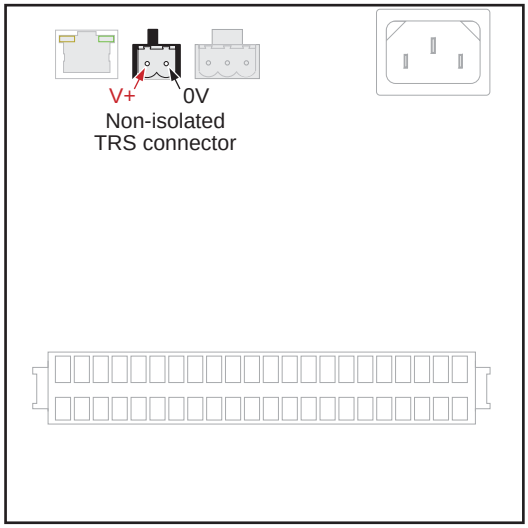
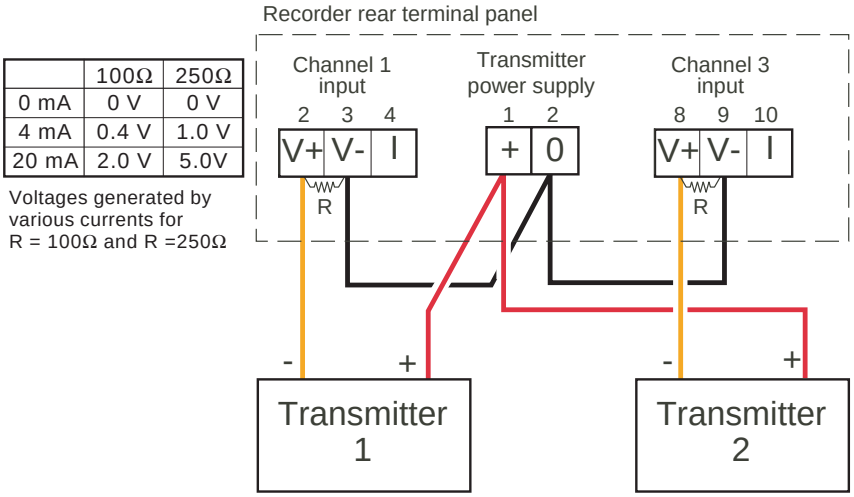


Figure 9.2 Connector location and pinout

9.3 WIRING

Typical wiring, for two transmitters, is shown in figure 9.3



	100Ω	250Ω
0 mA	0 V	0 V
4 mA	0.4 V	1.0 V
20 mA	2.0 V	5.0V

Voltages generated by various currents for R = 100Ω and R =250Ω

Notes: Only two channels shown, for clarity.
Pin/channel numbers chosen for illustrative purposes only
R (min. spec.) = 1.4W, ± 0.1%. 100Ω or 250Ω as required (see table)

Figure 9.3 Typical transmitter wiring

10 PORTABLE CASE OPTIONS

Note: Portable case options are not available for some Models

The various options described below come provided in a rugged carrying case as depicted in figure 10, below,

It is possible that input/output circuits can carry high voltages, and this might prove dangerous if the safety earth connection to the recorder is not in place (e.g. the plug is pulled out) at any time whilst such hazardous voltages are present. Therefore, the following warning must be complied with:

* WARNING

For portable case instruments only:
All I/O connections must be SELV (33V ac RMS, 46,7V ac peak, 70Vdc) unless the integrity of the instrument safety earth is maintained for as long as the I/O is connected to the recorder.

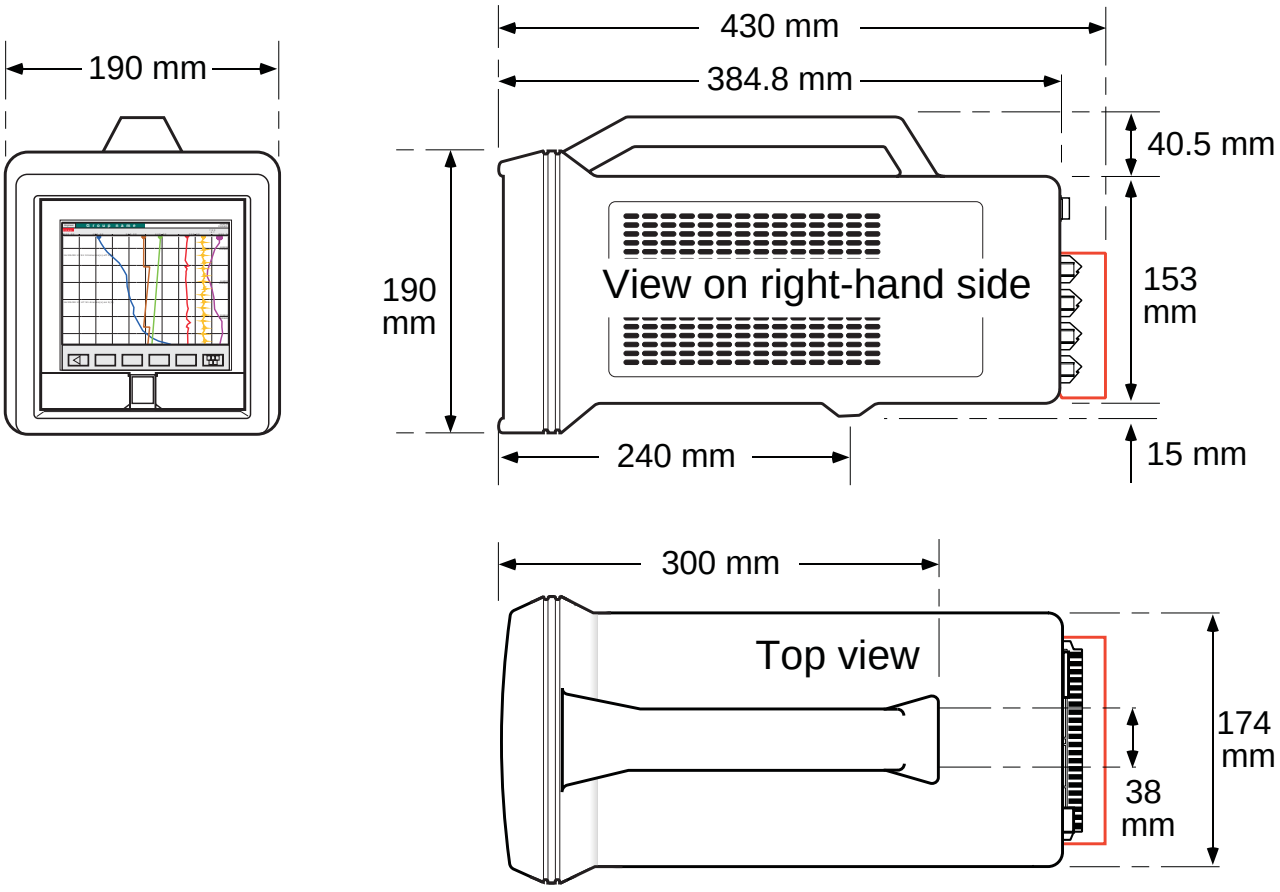


Figure 10 Portable case dimensions

Note: To maintain CE compliance, the clip-on Ferrite supplied, must be attached to the mains lead (line cord)

10.1 BASIC OPTION

10.1.1 Introduction

The basic portable case option provides up to 12 input channels and up to four option boards.

10.1.2 Wiring

Figure 10.1.2a, below, gives back panel connector layouts for the recorder.

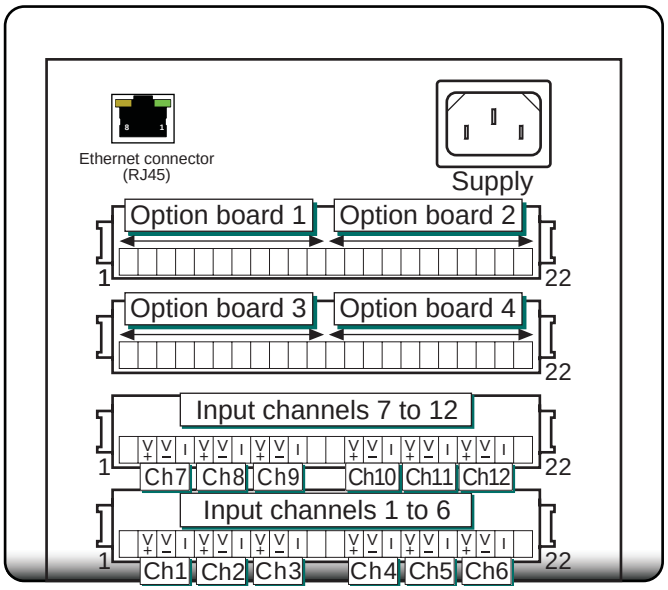


Figure 10.1.2a Back panel connector details.

SUPPLY VOLTAGE

Caution

Before powering the recorder, check that the supply voltage, to be applied, lies within the range specified on the serial number label at the rear of the recorder.

As shown in Figure 10.1.2a, above, the line supply is terminated using an IEC connector at the rear of the case. A socket is required to mate with the plug fitted at the recorder. Minimum recommended conductor size is 16/0.2 ($0.5mm^2$) (20AWG).

SIGNAL WIRING

Input and typical options pinouts are as shown in figure 10.1.2a, above. For full I/O wiring details, refer to Section 1.2 of the User Guide supplied with the instrument.

INTERNAL WIRING

Figure 10.1.2b, below, shows details of the wiring between the portable case rear panel and the recorder rear panel.

10.1.2 WIRING (Cont.)

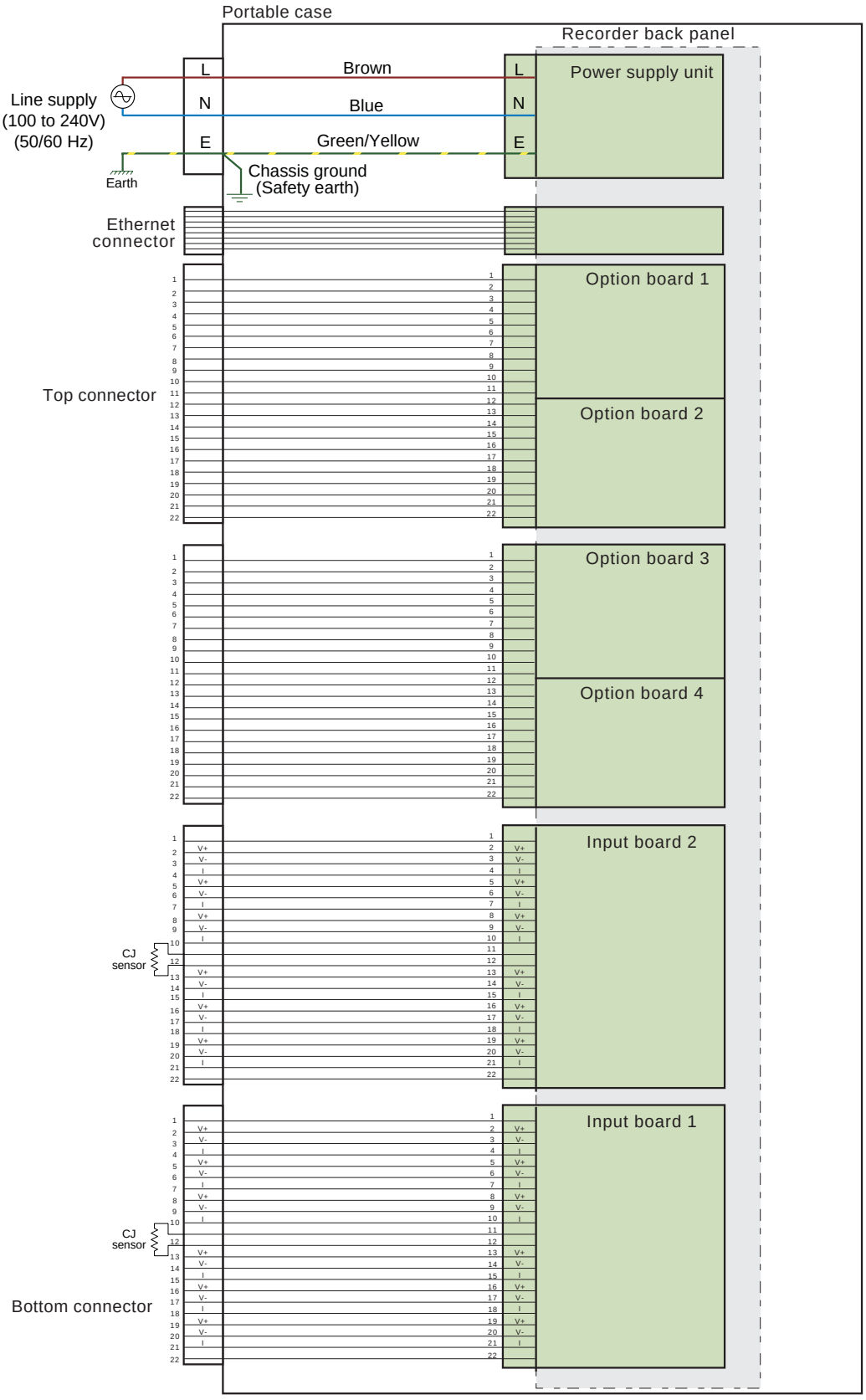


Figure 10.1.2b Basic option internal wiring

10.2 TRANSMITTER POWER SUPPLY (TRS) OPTION

This option is identical with the basic option described in section 10.1, above except that one of the four option slots is used for TRS output. The TRS pinout is given in figure 10.2, below.

Note: Only one transmitter power supply can be fitted in the portable case, and may be terminated only at option slot 2 OR option slot 4.

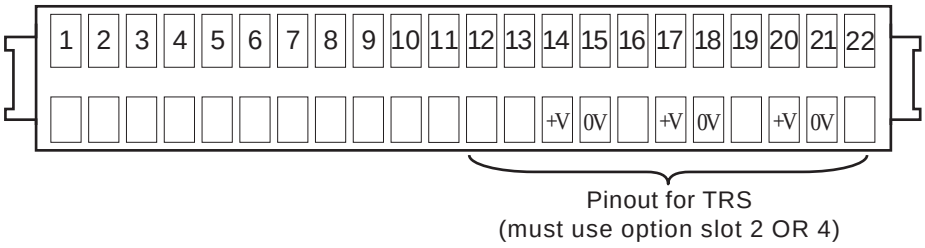


Figure 10.2 TRS pinout

10.2.1 Internal wiring

Figure 10.2.1 shows wiring details between the recorder and the back panel connectors.

10.2 TRS OPTION (Cont.)

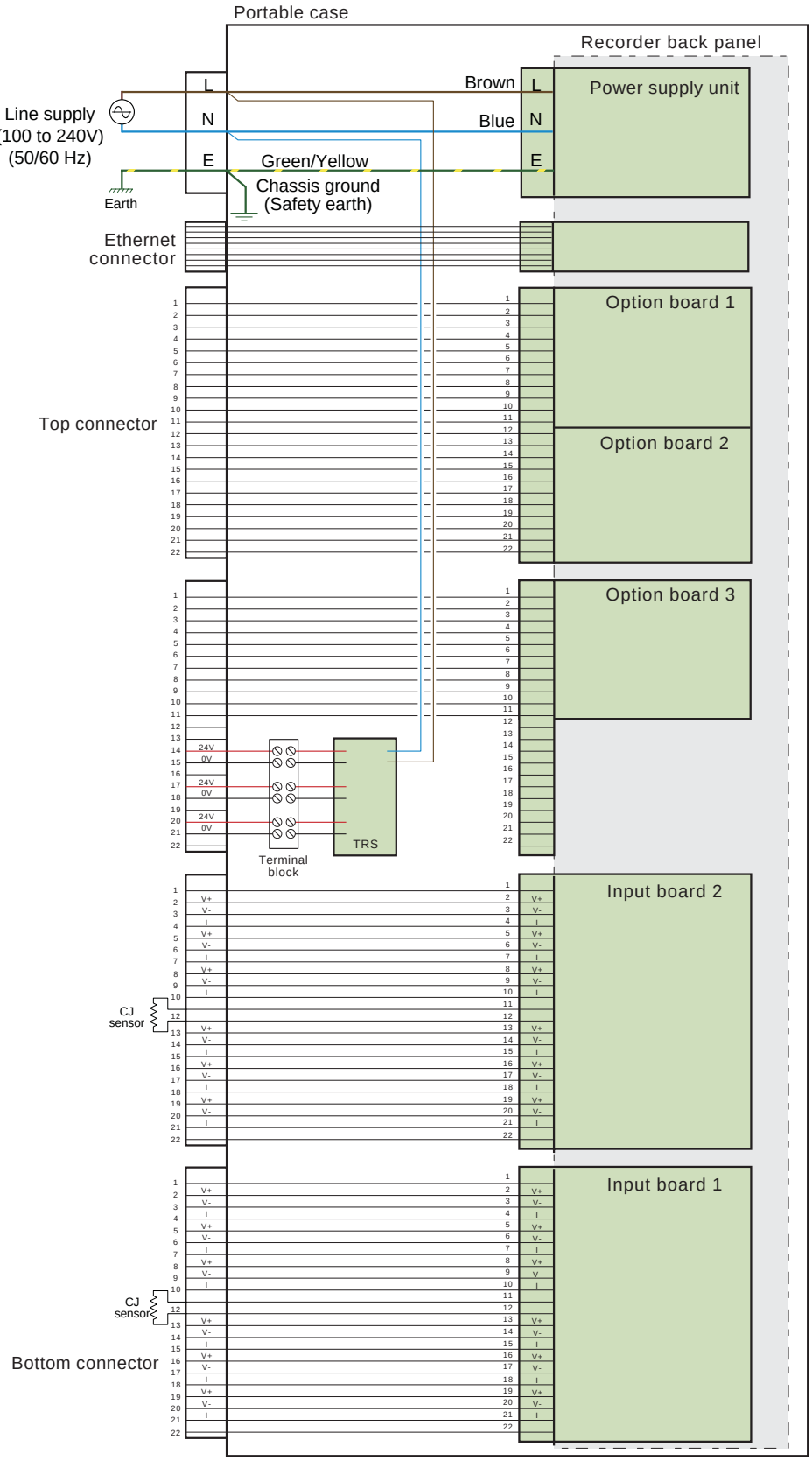


Figure 10.2.1 Typical internal wiring

10.3 HTM2010 QUARTERLY TEST KIT

10.3.1 Introduction

This option is supplied as a six-channel, 100 mm recorder in a rugged portable case, configured for five type-T thermocouples and one pressure transducer. The option comes complete with pressure transducer, insertion tubes and miniature plugs for type T thermocouples. As supplied, the recorder is for use with small, unwrapped utensil sterilisers. The default configuration for the thermocouples is: Function = Type T, Input range = 0 to 150˚C, and for the transducer: Input range = -1 to + 3 bar.

10.3.2 Wiring

SUPPLY VOLTAGE

Caution

Before powering the recorder, check that the supply voltage, to be applied, lies within the range specified on the serial number label at the rear of the recorder.

As shown in Figure 10.3.2a, below, the line supply is terminated using an IEC connector at the rear of the case. A socket is required to mate with the plug fitted at the recorder. Minimum recommended conductor size is 16/0.2 (0.5mm^2) (20AWG).

SIGNAL WIRING

Signal wiring consists of wiring the thermocouples to the relevant plugs and plugging them and the (pre-wired) pressure transducer in. Figure 10.3.2a shows the arrangement of the sockets at the rear of a six-channel recorder, and figure 10.3.2b shows the wiring of the thermocouple plugs.

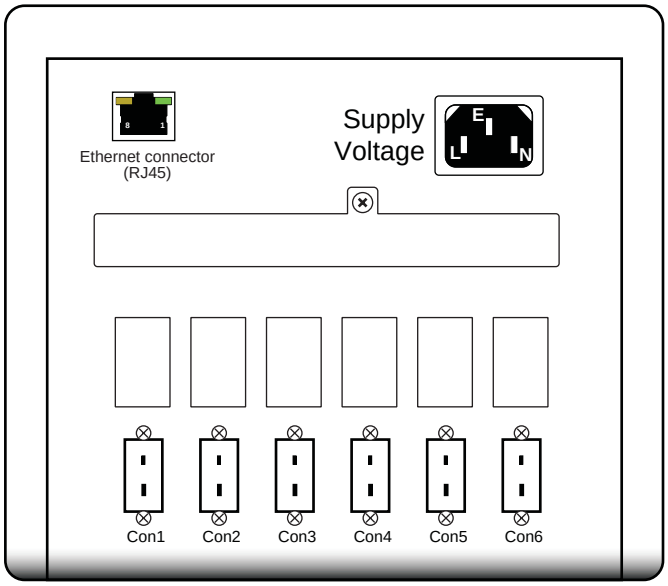
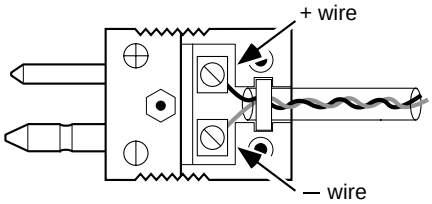


Figure 10.3.2 a Connector locations



	T/C type T colours	
	BS1843:1952	BS4937:1993 IEC584-3:1989
+	White	Brown
–	Blue	White
Sheath	Blue	Brown

Figure 10.3.2b Thermocouple plug wiring (cover removed for clarity)

10.3.2 WIRING (Cont.)

INTERNAL WIRING

Figure 10.3.2c shows the internal wiring between the portable case connectors and the recorder rear panel.

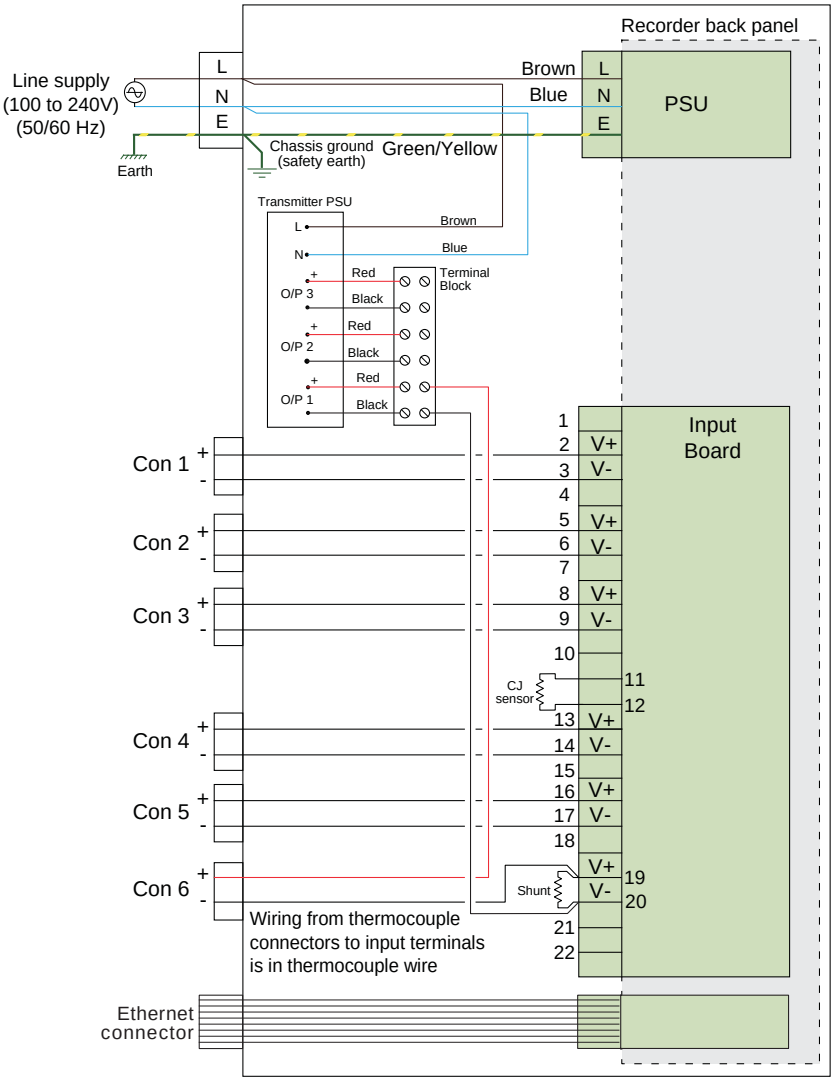


Figure 10.3.2c Internal wiring details

10.3.3 Specification

Information additional to the general specification in Annex A of the User Guide

Pressure transducer	
Input range	-1 to 3 Bar G
Output range	4 to 20 mA
Supply voltage range	12 to 32V dc
Non linearity/hysteresis	≤0.25% span
Long term stability	0.1% in 12 months

Safety isolation	
	DC to 65 Hz: BS EN61010 (Installation category II; Pollution degree 2 (see page 3 for definitions)
Channel to channel:	S.E.L.V. (i.e. 30V dc or RMS) to earth
Channel to ground	S.E.L.V. (i.e. 30V dc or RMS) to earth

10.4 THERMOCOUPLE OPTION

10.4.1 Introduction

This option allows the connection of up to 12 type J, K or T thermocouples together with up to two option boards. Transmitter power supply is not available with this option.

The type of thermocouple (the same for all channels) must be specified at time of order. Each thermocouple input channel will be configured at the factory for the specified type of thermocouple and will be set to a range of 0 to 100 degrees Celsius.

Thermocouple-style connectors with copper terminals can also be fitted, for use with non-thermocouple inputs. For such channels the recorder is pre-configured as: Function = Linear, Input range = 0 to 1 Volt.

10.4.2 Wiring

SUPPLY VOLTAGE

Caution

Before powering the recorder, check that the supply voltage, to be applied, lies within the range specified on the serial number label at the rear of the recorder.

As shown in Figure 10.4.2a, below, the line supply is terminated using an IEC connector at the rear of the case. A socket is required to mate with the plug fitted at the recorder. Minimum recommended conductor size is 16/0.2 (0.5mm^2) (20AWG).

SIGNAL WIRING

Signal wiring consists of connecting the transducer wires into the correct type of plug, and inserting the plugs into the relevant socket at the rear of the recorder.

Figure 10.4.2a shows the arrangement of the connectors at the rear panel. Figure 10.4.2b shows Thermocouple wiring details, and Figure 10.4.2c shows the wiring between the portable case rear panel and the recorder.

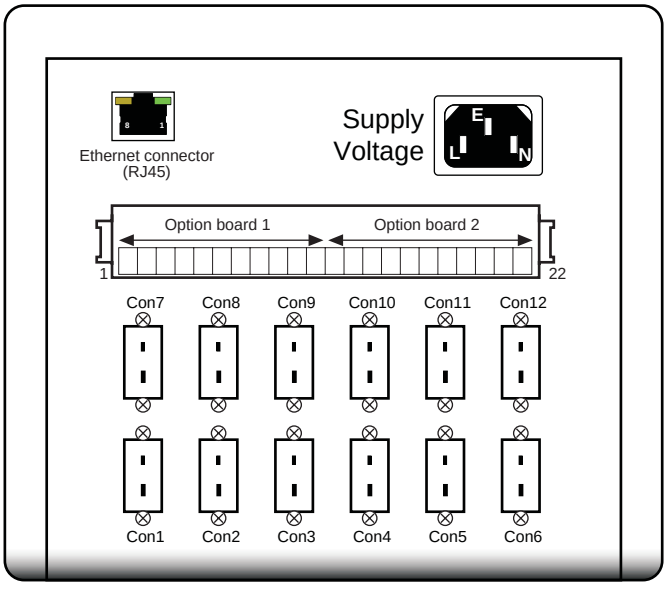
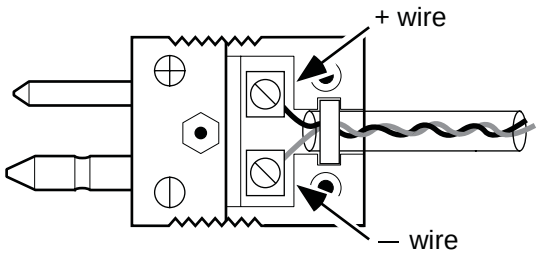


Figure 10.4.2a Rear panel connector locations

10.4.2 WIRING (Cont.)

THERMOCOUPLE WIRING



	T/C type J colours		T/C type K colours		T/C type T colours	
	BS1843:1952	BS4937:1993 IEC584-3:1989	BS1843:1952	BS4937:1993 IEC584-3:1989	BS1843:1952	BS4937:1993 IEC584-3:1989
+	Yellow	Black	Brown	Green	White	Brown
—	Blue	White	Blue	White	Blue	White
Sheath	Black	Black	Red	Green	Blue	Brown

Figure 10.4.2b Thermocouple wiring details.

10.4.2 WIRING (Cont.)

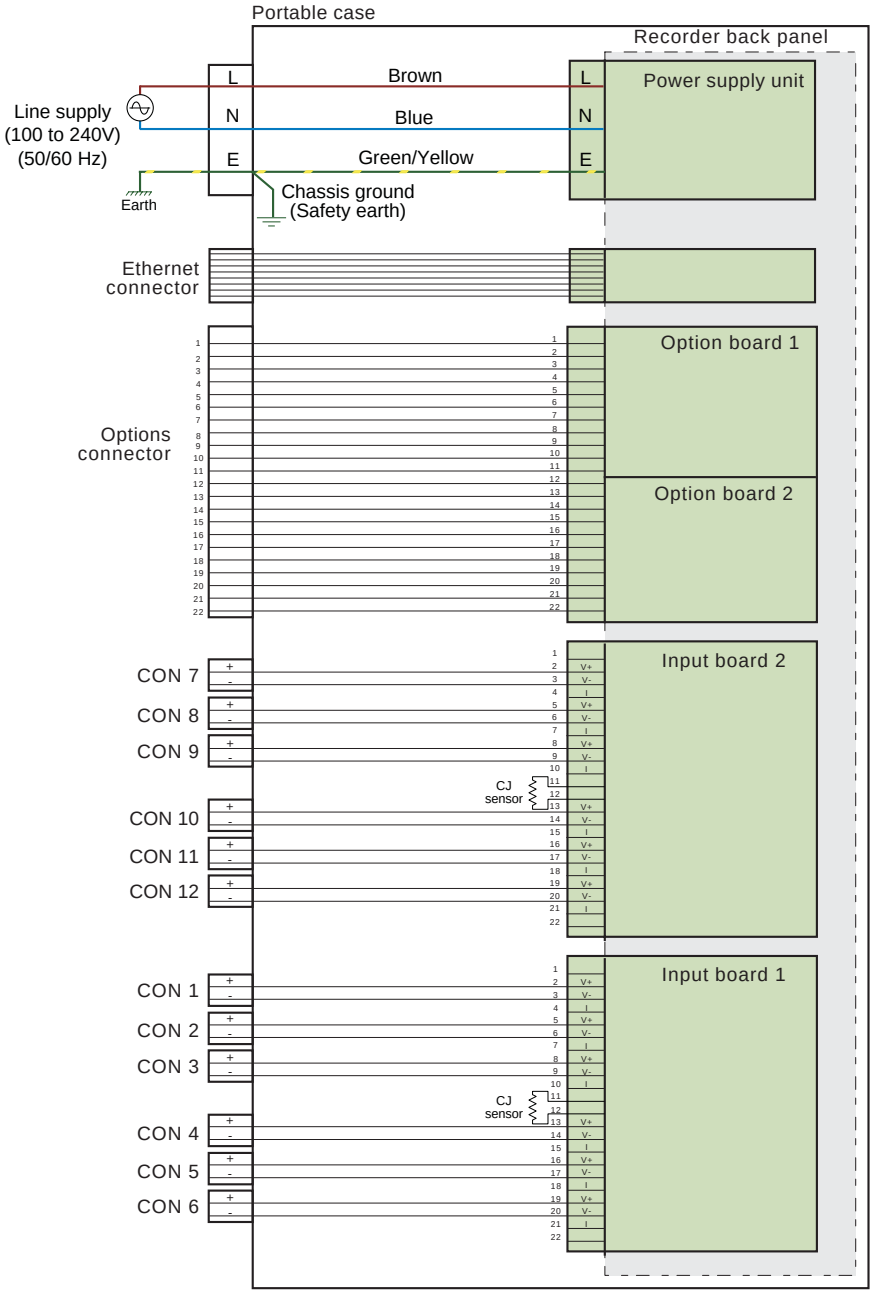


Figure 10.4.2c Internal wiring

10.4.3 Specification

Information additional to the general specification in Annex A of the User Guide

Safety isolation

	DC to 65 Hz: BS EN61010 (Installation category II; Pollution degree 2 (see page 3 for definitions)
Channel to channel:	S.E.L.V. (i.e. 30V dc or RMS) to earth
Channel to ground	S.E.L.V. (i.e. 30V dc or RMS) to earth

10.5 LOW SUPPLY VOLTAGE OPTION

Some of the portable case options described in this manual can be ordered for use with 24V (nom.) supply voltages. In such cases, the supply voltage part of the wiring diagrams is replaced with that shown in figure 10.5a unless otherwise stated. The low voltage supply is terminated by a three pin plug, as shown in figure 10.5b.

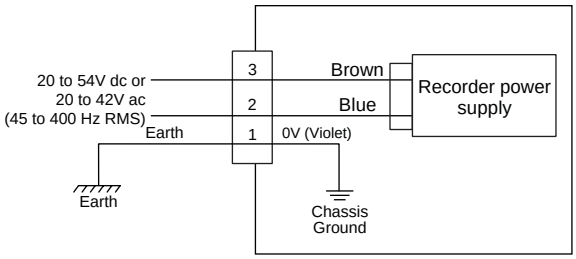


Figure 10.5a Internal wiring for low voltage options

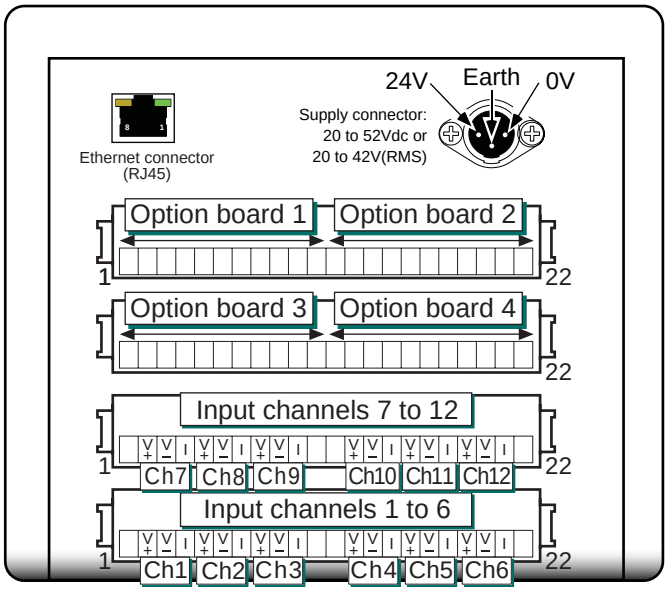


Figure 10.5b Low supply voltage connector details

11 EMAIL

This option allows e-mails to be sent by the instrument to one or more recipients. The user can enter 10 recipient e-mail addresses in each of five mailing lists, giving a maximum of 50 addresses, 10 of which can be sent to at any one time. A Recipient can appear in as many lists as required.

A number of e-mails can be set up, but which of these e-mails is sent, is defined during job or Event Button configuration. Any function capable of triggering a job, can cause any of the available e-mails to be sent. The number of e-mails available depends on the instrument model.

As well as a 'Subject', and the body text, each e-mail can include one of the messages set up in 'Message Configuration', and can thus include embedded values, alarm status, batch status etc., as described in section 4.3 of the User Guide.

11.1 E-MAIL CONFIGURATION

The figure below shows the e-mail configuration page (using fictitious names for email server/address information).

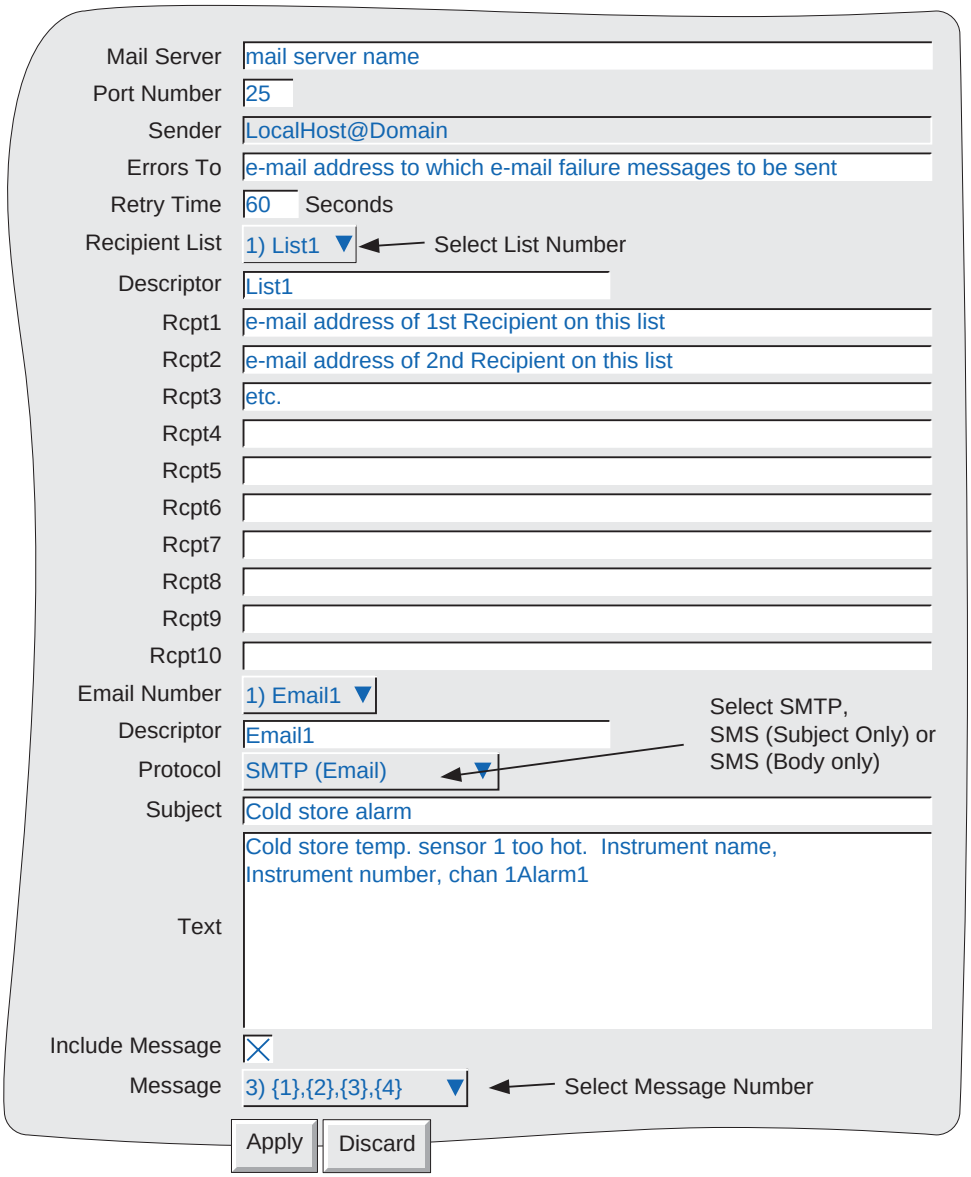


Figure 11.1 E-mail configuration (SMTP Protocol)

11.1.1 Configurable parameters

This subsection contains details of the parameters that appear in the E-mail configuration page (figure 11.1 above). Figure 11.2 (below) may also be referred-to for further explanation.

Mail Server	Enter the name of the mail server or IP address here. This is the destination to which e-mails are sent, for subsequent delivery.
Port Number	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.
Sender	For DNS operation, this is a combination of the Local Host and Domain entries set up in the 'Network/Name' area of configuration described in section 4.5 of the user guide. If Fixed I.P. Address is selected, the I.P. Address appears instead. The unit accesses the 'Sender' information automatically, and it cannot be edited here. The 'Sender' is placed in the 'From:' part of the e-mail header.
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.
Retry time	The product tries repeatedly (until successful) to dispatch the e-mail until the 'Retry time' has expired. If the e-mail has not been sent within this period, it is deleted, and a 'General' message is generated.
Recipient List	Allows a list to be chosen for entry of recipient e-mail addresses
Descriptor	Allows a name to be entered for the selected list.
Rcpt1 to Rcpt10	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.
Email Number	Allows an e-mail to be selected for configuration. The number of e-mails available depends on the instrument model.
Descriptor	Allows a descriptor to be entered for the e-mail. This appears in the list of e-mails when setting up a job, and also in the message log.
Protocol	Choose one of 'SMPT (Email)', 'SMS (Subject Only)' and 'SMS (Body Only)'. Section 11.3, below gives some details of the application of the SMS protocol in this instrument. SMPT (Email). Selecting this protocol allows both a Subject and Body text to be entered. SMS (Subject Only). Selecting this protocol allows a subject to be entered, but the entry field for the body text is not presented for use. Any text previously entered here, whilst another protocol was selected, is lost. SMS (Body Only) Selecting this protocol allows Body text to be entered, but the Subject field is not displayed. Any text previously entered as a Subject, whilst another protocol was selected, is lost.
Subject	Allows the entry of up to 100 characters to appear in the 'Subject:' part of the e-mail header. The field does not appear if 'SMS Body Only' is selected as the Protocol.
Text	Allows the entry of up to 240 characters to appear as the body of the e-mail. The field does not appear if 'SMS Subject Only' is selected as the Protocol. Also referred to as 'Body Text'.
Include message	If this checkbox in enabled, one of the messages in the 'Message Configuration' area can be selected to appear below the body text in the e-mail.

11.2 E-MAIL DETAILS

Figure 11.2 depicts an e-mail using fictitious entries.

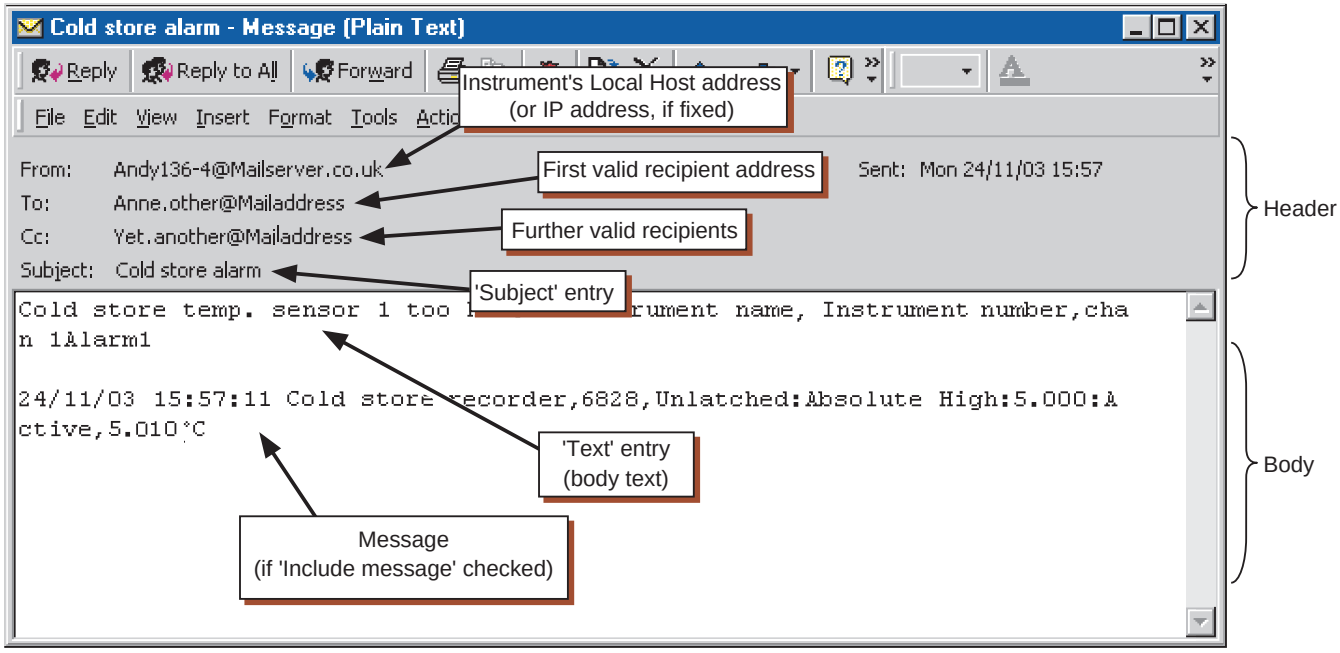


Figure 11.2 E-mail appearance

The figure above shows that the e-mail is in two distinct parts, the header (grey area) and the body (white area).

11.2.1 The header area

The header contains details of the sender, the recipient(s), the subject and the time and date.

> Note: The time and date may be local to the generating instrument, or local to the recipient, depending on the recipient's mail host configuration

The header is important in the prevention of 'spamming'. The instrument adheres to the RFC2822 standard with respect to e-mail headers. Some servers are stricter than others, and it is not guaranteed that an e-mail generated by the instrument will not be interpreted as a spam message by the receiving server.

From:
This contains either the 'Local Host' name (as defined in Network/Name Setup) and mailserver address, or the IP address if a fixed IP address is selected in Network/Address settings. See section 4.5 of the User Guide for details of the Network key.

To:
The first valid recipient address in the selected list.

CC:
The remaining valid addresses in the recipient list

Subject:
Contains the subject text entred during configuration. Empty if 'SMS Body' selected as Protocol

11.2.2 The body area

This contains the body text, along with any appended messages. In the example above the message has the embedded values of Instrument name, Instrument number, channel 1 alarm 1 status, as implied by the body text.

11.3 OPERATION

1. E-mails are generated either by job or (if the relevant options are fitted) by operation of an Event Button from a User screen (see note below).
2. Every time the sending of an e-mail is requested, a ‘General’ note is generated and appears in the message log for all groups. The format is: Date, Time Sent <e-mail descriptor> to List N, where <e-mail descriptor> represents the descriptor entered in the configuration page for the e-mail, and ‘List N’ is the recipient list to whom the e-mail was sent.
3. Access to e-mails is restricted to users with ‘Full Configuration’ permission.
4. Signing/Authorizing restrictions can be applied only to e-mails generated by Event button operation, as part of the Event button’s configuration (section 4.3 of the user guide).
5. The instrument implements the Simple Message Transfer Protocol (SMTP), incorporating Multipurpose Internet Mail extensions.
6. The instrument does not implement the Short Message Service (SMS) protocol, though it is able to send SMS messages to a mobile phone via an appropriate server or gateway. As some servers/gateways use the ‘subject’ as the SMS message, and others use the body text, these alternatives are provided for in the Protocol pick list in the Configuration page (see section 11.1).
7. A new event source ‘Email fail’ can be used to trigger a job list should an e-mail send failure occur.

Note: User screens and Event button options are not supported by all models.

12 DOOR LOCK OPTION

Both 100mm and 180mm recorders can be supplied with locking devices on their disk/PC card access flaps. The two versions are shown below.

Note: The IP rating for recorders fitted with locks is reduced to IP20.

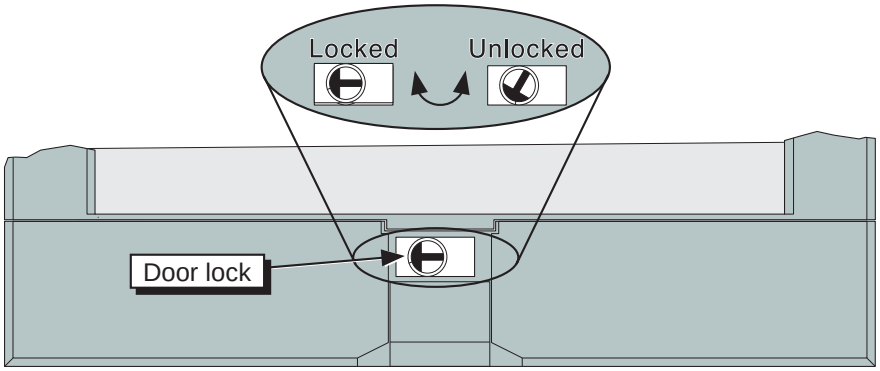


Figure 12a Door lock detail - 100 mm recorder

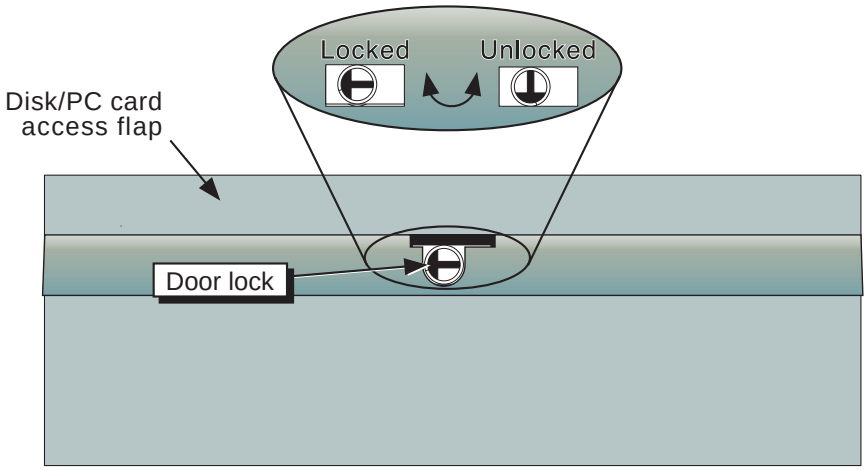


Figure 12b Door lock detail - 180 mm recorder

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W

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Y

Z

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NO-1326 Lysaker
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Telephone: 47 67 592170
Fax: 47 67 118301
http://www.eurotherm.no

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Fax: 34 91 661 90 93
http://www.eurotherm.es

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Fax: 46 40 38 45 45
e-mail:info@eurotherm.se
http://www.eurotherm.se

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