FUNCTIONAL SPECIFICATION FOR 5100V / 5180V GRAPHIC RECORDER APPLICATIONS AND 5000B DATA ACQUISITION AND LOGGING UNIT APPLICATIONS GAMP4 CATEGORY 2

SOFTWARE VERSION 2.3

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2 INTRODUCTION

2.1 Purpose

This document defines the functionality available on a 5000 series graphic recorder or data acquisition/logging unit through either standard or configured functions. It covers only functions which are built into the firmware and parameterised by the user (GAMP4 category 2). Freely configurable options (specifically user displays and complex maths functions) are excluded as they would fall under GAMP4 category 4 and require further detailed documentation.

2.2 Contractual Status

This document aims to set out the available functions for 5000 series instruments and associated standard software packages. Selected functionality for a project will be documented in the Installation Qualification documentation specific to that project.
On project completion, a copy of this document passes to the customer for archival as appropriate under their validation plan.

2.3 Relationship to Other Documents

2.3.1 Applicable Standards

The layout and content of this document is based on the procedure for production of a Functional Specification contained in the GAMP4 Guide for Validation of Automated Systems (Appendix D2) but with information provided being generic to any 5000 series instrument. Configuration details are recorded in the (project-specific) Installation Qualification documentation.

2.3.2 Documents to be Supplied

The following documentation is to be supplied as part of this project:

Functional Specification
Installation Qualification Specification

3 OVERVIEW

3.1 Key Objectives and Benefits

Key objectives from the installation of the instrument are as follows:

- High quality I/O data collection
- Provision of data to operations staff in easily interpreted format
- Secure archival of data for future off-line viewing
- The benefits of Ethernet networking for file transfer and remote viewing

3.2 Relevant GxP Regulations

Since the data collected and stored by the instrument in pharmaceutical applications is generally required under FDA 21 series rules, the instrument's system is required to be compliant with 21 CFR part 11 (Electronic Records; Electronic Signatures).

3.3 High Level Description

The 5000 series recorders can act as stand alone units gathering data via the I/O interface for display to the operator and archival onto removable media. They can also be connected to a PC (via an Ethernet network) and the archive data accessed remotely.

Data acquisition and logging units are similar, but the operator interface is a PC connected via an Ethernet network. There is no removable mass storage medium associated with the unit, all archiving being direct to the PC.

3.4 Main Interfaces

3.4.1 I/O Interfaces

The I/O interface allows the following input types to be read:

- Linear, square root, $x^{3/2}$, $x^{5/2}$, UserLin1, UserLin2, UserLin 3, UserLin4
- Thermocouple (B / C / D / E / G2 / J / K / L / N / R / S / T / U / NiMoNiCo / Platinel / NiNiMo / Pt20%Rh / Pt40%Rh)
- mV
- Voltage
- mA (via shunt resistor)
- 2 / 3 wire RTD (Cu10, Pt100, Pt100a, JPT100, Pt1000, Ni100, Ni120, Cu53)
- Resistance
- Digital (contact closure) (not channels 1, 7, 13, 19, 25, 31, 37, 43 if fitted)

Relay outputs are available, rated for 2A / 250V / 60W maximum, which can be used to drive alarm lamps and horns etc. on plant.

The instrument can also accept inputs and provide data to another device via Modbus TCP/IP.

An option is available to allow simple ASCII messages to be received, from other devices, for inclusion in the logged history.

3.4.2 Operator Interface

The operator interface provides a choice of pre-configured display formats for data (vertical trend, horizontal trend, vertical bargraph, horizontal bargraph, numeric). User configured displays are also available as an option. An option allows the vertical bargraph display mode to be replaced by a circular trend display mode

Batch functionality available as an option allows the start/end of a batch to be marked by the operator and batch details entered. The operator making the entry is logged alongside the data for future retrieval. The Batch option also allows archive files to be named by batch rather than by time/date.

Access to operator functions is controlled via a password based security system which allows users to have individual accounts with differing access levels.

The Auditor option allows electronic signatures to be applied to a variety of operator actions and generates a full audit trail of both runtime and configuration changes

3.4.3 Network Interface

The network interface allows the unit to be connected via Ethernet to a single PC or to a local area network. Current data and configurations and archive files can then be accessed remotely subject to appropriate password security.

3.5 Assumptions

3.5.1 Software Version

The functionality described in this document relates to Eurotherm 5000B, 5100V and 5180V instruments fitted with software version 2.3

3.5.2 Software Categories

The GAMP4 Guide for Validation of Automated Systems splits hardware into 2 categories and software into 5 categories with different requirements for validation and control. The hardware and software underpinning the 5100V / 5180V functionality can be categorised as follows:

HARDWARE

Cat	Hardware Type	Applicability in instrument	GAMP4 Validation Approach
1	Standard Hardware Components	Instrument Hardware	Model, version, serial number. Verify correct installation / connection. Apply change control.
2	Custom Built Hardware Components	None	As for standard components but also require a design specification and acceptance test. Supplier may be audited.

SOFTWARE

Cat	Software Type	Applicability in instrument	Applicability in Review	Applicability in Bridge 5000	Applicability in Series 5000 Config'n Editor	GAMP4 Validation Approach
1	Operating Systems	Not separable from instrument firmware.	Microsoft Windows 95/98/NT/ ME/2000/XP	Microsoft Windows 95/98/NT/ ME/2000/XP Correct Java Runtime Environment automatically installed	Microsoft Windows 95/98/NT/ ME/2000/XP Correct Java Runtime Environment automatically installed	**"Established, commercially available operating systems…"** Record version (include service pack). The Operating System will be challenged indirectly by the functional testing of the application.
2	Firmware	Instrument firmware and configuration parameters	None	None	None	**"Instrumentation and controllers…" and "Configuration of this firmware … in order to set up runtime environment and process parameters"** For non-configurable firmware record version. Calibrate instruments as necessary. Verify operation against user requirements. For configurable firmware record version and configuration. Calibrate instruments as necessary and verify operation against user requirements. Manage custom (bespoke) firmware as Category 5 software

Cat	Software Type	Applicability in instrument	Applicability in Review	Applicability in Bridge 5000	Applicability in Series 5000 Config'n Editor	GAMP4 Validation Approach
3	Standard Software Packages	None	'Review' software package	'Bridge 5000' software package	'Series 5000 Configurat-ion Editor' software package	**"commercially available, standard software packages, providing an 'off-the-shelf' solution …"** Record version (and configuration of environment) and verify operation against user requirements. Consider auditing the supplier for critical and complex applications.
4	Configurable Software Packages	User Displays Complex Maths Functions	None - Application parameters must match instrument configuration	None - Application parameters must match instrument configuration	None - Application parameters must match instrument configuration	**"… involves configuring pre-defined software modules …"** Record version and configuration, and verify operation against user requirements. Normally audit the supplier for critical and complex applications. Manage any custom (bespoke) programming as Category 5.
5	Custom Software	None	None	None	None	**"… developed to meet the specific needs of the user company …"** Audit supplier and validate complete system

3.6 Non-Conformance with User Requirements

Any non-conformance with the user requirements document is already documented in the quotation.

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4 FUNCTIONS

This section describes the available configurable functions. It should be noted that standard functionality (operator interface, networking protocols, data storage and archival) are described separately in later sections.

4.1 Security

4.1.1 Objective and Description

The object of the instrument's security functions is to allow individual security accounts to be set up with access rights appropriate to each level of user.

The instrument has four default accounts each with different security levels; **logged out**, **operator**, **engineer** and **service**. These built in accounts cannot be removed. Passwords on operator and engineer accounts can be changed or the accounts can be disabled. The service account (for use by Eurotherm engineers only) has an automatic password generation / update feature to provide security. Should the site policy require that the service account be disabled, the customer is responsible for ensuring that at least one user with 'full security' access is left enabled so that the service account can be re-enabled as necessary for use by a Eurotherm engineer.

For pharmaceutical applications the 'Auditor' option is vital in allowing compliance with 21 CFR part 11 and it is assumed throughout this description that this option has been purchased.

The '**SECURITY**' soft-key gives access to a menu containing whichever of the following options are available to the currently logged in user:

Login	Allows users to log in (user ID selected from a scroll list, password entered from keyboard display on screen) or log out (by pressing a soft key)
Access	Allows details for each user to be set up (described in configuration options below)
Management	Allows access to security management features including electronic signatures and audit trail set up (described in configuration options below)
Add User	Allows new users to be created based on an existing account and with an initial password
Remove User	Allows users to be permanently removed from the security setup. (Note that a 'disable' option is also available on individual accounts which can be used instead of 'Remove' so that details of the user remain available and uniqueness of ID is still enforced).

4.1.2 Configuration Options Available

4.1.2.1 Options available from the ACCESS menu:

The following configuration options are available for each user.

Connect from Remote	Always enabled for 5000B units. For 5100V/5180V units, this permits the user to access the recorder via an Ethernet link. Enabling this function brings up entry boxes for remote access user ID and password. Available functions via the remote access are restricted in the same way as via the touch screen according to the user access rights selected in the configuration.
Login Disable	Permits a user account to be disabled rather than removed so that details of the user remain available, for example to any future investigation.
Edit Own Password	Permits a password to be edited by its user.
Change Alarm Setpoints	Permits user to edit alarm parameters under Configuration/Channel
Acknowledge Alarms	Permits user to acknowledge alarms.
Edit Maths Constants	For instruments fitted with the Maths / Totalisers / Counters option. If one or more maths channels are configured with function 'Constant', then with this permission set, the user may edit the constant value(s).
Reset Maths	Permits the user to reset applicable maths functions (if the Maths / Totalisers / Counters option is fitted).
Preset Totalisers	Permits the user to preset totaliser values (if the Maths / Totalisers / Counters option is fitted).
Preset Counters	Permits the user to preset counter values (if the Maths / Totalisers / Counters option is fitted).
Start/Reset Timers	Permits the user to start and reset timers (if the Timers option is fitted).
Set Clock	Permits user to set the instrument time and date functions under System/Clock
Adjust Inputs	Permits user to use the ‘Input Adjust’ facility to compensate for tolerance errors etc. Note that adjusting a channel invalidates the accuracy values given in the specification.
Archiving control	Permits user to gain full access to disk archive control.
Save/Restore	Permits user to gain full access to saving and restoring functions
Paste/Delete Files	Permits user to Paste and delete files
Full Configuration	Permits user to gain full access the instrument’s configuration.
Full Security	Permits user to gain full access to all instrument security functions.

4.1.2.1 Access menu options (Cont.)

Batch Control	Permits user to gain access to batch functions (if Batch option fitted).
Can Sign	Permits user to execute electronic signatures (if Auditor option fitted)
Can Authorize	Permits user to execute electronic signatures in an 'authorisation' capacity (if Auditor option fitted)
Event permissions	If any of the five event permissions are enabled, then an event is triggered for each enabled permission, which remains active for as long as the login is active.

4.1.2.2 Options available from the MANAGEMENT menu:

The following configuration options are available provided that the Auditor option is fitted.

Option	Description
Record Logins	Enables recording of login details to audit trail
Login Timeout	Allows entry of a timeout value in minutes. The current user is automatically logged out following a period of inactivity which exceeds this time. Entry of '0' means no timeout.
With unapplied changes	Determines the behaviour on attempting to perform an automatic logout whilst changes have been made but not yet applied (can set as 'Discard changes' or 'Ignore timeout')
Password Retries	Allows the number of failed logins before disabling an account to be set to either '3' or 'unlimited'.
Passwords Expire	Allows entry of a timeout value in days after which a password will become invalid. The user is shown how long is left at each login. Should all passwords expire, the unit automatically re-enables the service account so that a Eurotherm engineer can gain entry to re-enable the other accounts.
Minimum Password Length	Allows entry of a minimum length which is then applied to all new passwords entered from that time.
Require Signing	Forces user to sign for the following actions: Making any configuration change or loading a new configuration Batch start and stop Alarm acknowledgement Adding an operator note Performing an Input Adjust
Require Authorisation	Forces second signature for all electronic signings.
Enable Audit Trail	Enables capture of all login / signature / configuration change data to historical files.

4.1.3 Safety and Security Issues

4.1.3.1 Security

Access to set up / add / delete users is only available to users with ‘Full Security’ rights.

Password entry is not shown on the screen either when setting up access or when logging in.

Input checking is therefore provided when setting up or changing passwords by requiring the password to be re-entered.

4.1.3.2 Power off and Restart

The instrument is designed to power up into the ‘Logged Out’ access level.

4.1.4 Performance Data

None applicable to this functionality.

4.2 System Setup

4.2.1 Objective and Description

The object of System functions is to allow the instrument's clock and locale to be set by a user with appropriate access rights.

The '**SYSTEM**' soft-key gives access to a menu containing whichever of the following options are available to the currently logged in user:

Clock	Allows date and time to be set
Locale	Allows language, country and time zone details to be set
Key Code	Allows access to the unique instrument number (not editable) and to the key code (used if new options are to be added).
Input Adjust	Allows access to the 'Input Adjust' facility where the user can compensate for tolerance errors by applying a low range value and a high range value in turn.
About	Supplies details of the version numbers of various aspects of the instrument and of the amounts of memory fitted.

4.2.2 Configuration Options Available

4.2.2.1 Options available from the CLOCK menu:

Current Date	Allows date to be set
Current Time	Allows time to be set

4.2.2.2 Options available from the LOCALE menu:

Language	Allows language to be selected from a pick list (English / Nederlands / Português / Deutsch / Magyar / Espanol / Italiano / Francais) Japanese language is also available.
Country	Allows country to be selected from a pick list of countries associated with the selected language. Time and date formats are determined by the language and country selected.
Time Zone	Allows time zone to be selected from a pick list (GMT, UTC, ECT, EET, ART, EAT, MET, NET, PLT, IST, BST, VST, CTT, JST, ACT, AET, SST, NST, MIT, HST, AST, PST, PNT, MST, CST, EST, IET, PRT, CNT, AGT, BET, CAT)
Use Summertime (DST)	Allows automatic change to daylight saving time. If this option is selected then the start and end rules must also be configured

4.2.2.3 Options available from the KEY CODE menu:

Instrument Number	(Not editable)
Key Code	Allows entry of a new key code supplied by Eurotherm if additional options are purchased
Key Code File	Allows new key code to be read from a file rather than entered manually

4.2.2.4 Options available from the INPUT ADJUST menu:

Note that for pharmaceutical applications access to 'Input Adjust' needs to be strictly controlled as using the adjust function invalidates the calibration certificate.

First Channel **Last Channel** **Exclude Channels**	Used in combination to select those channels available to the 'Adjust' procedure. First Channel and Last Channel provide the start and end points for a list from which individual channels can be selected / deselected using 'Exclude Channels'
Adjust Channels	Initiates 'Adjust' procedure for each selected channel in turn. The user is requested to specify the sensor low point and connect the corresponding input. Then, when the values have settled, to select Apply. This is repeated for the high point. The current adjustment status of each selected channel is shown as 'Unadjusted' or as the time and date of last adjustment.
Remove Adjust	Returns the selected channels to factory calibration

4.2.2.5 Information available from the ABOUT menu:

Config Version	Automatically generated version number incremented with each configuration change.
Security Version	Automatically generated version number incremented with each security change.
Remote Viewer Version	Always appears with 5000B units. With 5100V/5180V units, this item only at the remote viewer
Product Software Version	Overall version of instrument firmware
Java	Software version of Java application
History Files	Version of History Files format
Board Support	Software version of Board Support firmware
Target System	Software version of Target System firmware
Board Version	Hardware version of Board
FLASH	Fitted FLASH memory in MBytes
SRAM	Fitted SRAM memory in kBytes
DRAM	Fitted DRAM memory in Mbytes

4.2.2.6 Support file

Allows the user to save a file (SupportInfo.uhq initially, but the name can be edited) to a recorder's mass-storage medium (floppy disk or PC card) or, to a remote PC's filing system (if Remote Viewer is installed). This file is intended for use only when there is a problem with the instrument's operation. When the file is e-mailed to a specified address, it helps the manufacturer's engineers to isolate the problem and thus to suggest a solution. The address appears both in a pop-up dialogue box, and in a separate file (SupportInfo.txt) produced at the same time as the .uhq file.

4.2.3 Safety and Security Issues

4.2.3.1 Security

Access to the above features is only available to users with appropriate security rights. The Setup, Locale, Key Code options are restricted to users with 'Full Configuration' rights. The Clock options are restricted to users with 'Set Clock' rights. 'Input Adjust' is restricted to users with 'Input Adjust' rights.

4.2.3.2 Power off and Restart

Time and date are maintained during a power off.

4.2.4 Performance Data

None applicable to this functionality.

4.3 Network Setup

4.3.1 Objective and Description

The object of the network setup functions is to allow the instrument's network name and address to be set up for communication over an Ethernet network.

The '**NETWORK**' soft-key gives access to a menu containing whichever of the following options are available to the currently logged in user:

Address	Allows an IP address to be entered for the instrument
Name	Allows a network name to be allocated to the instrument

4.3.2 Configuration Options Available

4.3.2.1 Options available from the 'Address' menu:

Instrument Number	(Not editable) Unique number set up during manufacture to identify the unit to the manufacturer
MAC address	(Not editable) Unique address set up during manufacture to identify the unit to a remote host
IP address lookup	Determines whether IP address is manually entered or received from a BootP server
BootP Timeout	Determines the maximum time the instrument will wait, at power-up, for a response from the BootP server. If no response is received within this time, the IP address, Subnet mask and Default gateway are all set to, or remain at 0.0.0.0
IP Address	Allows manual entry of the instrument's internet protocol (IP) address only if 'Specify an IP address' is selected in the 'IP address lookup' picklist above.
Subnet Mask	This field is editable only if 'Specify an IP address' is selected in the 'IP address lookup' picklist above. The subnet mask is the network address plus the bits in the host address reserved for sub-network identification. By convention, all the network address bits are set to 1. The subnet mask is used to identify the subnet to which an IP address belongs by performing a bitwise AND on the mask and the IP address.
Default Gateway	To deliver traffic from one subnet to another, devices called 'routers' or 'gateways' are placed between segments. The default gateway address informs each network device where to send data if the target station does not reside on the same subnet as the source.

4.3.2.1 Address menu options (Cont.)

SNTP enable	Allows time synchronisation from a Simple Network Time Protocol server to be enabled. When enabled, the instrument is updated every 15 minutes. If instrument time differs from SNTP time by less than 2 seconds, no time change event is recorded and the instrument time is updated gradually (1ms change 8 times per second). A difference of more than 2 seconds is recorded as a time change event (green line drawn on chart) and instrument time is updated immediately. A 'time synchronisation failure' instrument alarm is generated if more than 5 time change events occur in 24 hours. A 'SNTP server failure' instrument alarm is generated if the SNTP server cannot be accessed or if the time received is before 2001 or after 2035. A 5000 series instrument can also act as a SNTP server with a resolution of 1msecond. On 'clock failure' error being present, the time 1/1/1900 is sent out as this is ignored by clients.
SNTP server	Allows entry of IP address for the SNTP server (automatic if 'Obtain from BootP server' is selected above).

4.3.2.2 Options available from the 'Name' menu:

Local Host	English language name for the instrument - Assigned to the IP Address
Domain	The name of the Group or area of networked units which contains the instrument
Domain Name Service	Enables the mapping of host names to IP addresses and *vice-versa.*
Primary DNS Server	Primary DNS server address (if DNS enabled)
Secondary DNS Server	Secondary DNS server address (if DNS enabled)

4.3.3 Safety and Security Issues

4.3.3.1 Security

Access to the above features is only available to users with 'Full Configuration' rights.

4.3.3.2 Power off and Restart

On restart, if the IP address lookup is set to be from a BootP server then the instrument waits for a response from the BootP server. If the configured timeout is exceeded then an error is reported and the IP address remains at 0.0.0.0.

4.3.3.3 Network Failure

The following network failure conditions are detected and logged:

- A 'Network Boot' instrument alarm is generated if the instrument is unable to establish contact with a BootP server in order to be allocated an IP address.
- An 'SNTP server failure' instrument alarm is generated if the SNTP server cannot be accessed or if the time received is before 2001 or after 2035.
- A 'Maximum Remote Viewers already connected to ...' instrument alarm is generated if an attempt is made to connect more remote viewers to the instrument than are configured in the Options menu
- A 'Network connection has timed out' instrument alarm is generated if no connection can be established between the remote viewer and the instrument. This might be caused by, for example, cable failure, network hardware failure, etc
- An 'Unable to connect to host ...' instrument alarm is generated if incorrect host address is detected
- An 'Unable to resolve hostname' instrument alarm is generated if an incorrect host address is entered or if there is a network failure whilst trying to establish remote viewer connection

4.3.4 Performance Data

Refer to section 6.3 for details of the applicable network standards and the required PC specification.

4.4 Configuration

4.4.1 Objective and Description

The object of the network configuration functions is to allow the instrument to be configured for a particular application.

The '**CONFIG**' soft-key gives access to a menu containing whichever of the following options are available to the currently logged in user:

Instrument	Allows a name to be allocated to the instrument and (for recorders only), screen saving low brightness options to be set up.
Groups	Allows pen grouping for trend display to be set up
Channels	Allows input channels to be configured
Views	Allows the available display formats to be enabled or disabled
Archive	Allows an archive strategy to be set up for saving data to disk / PC card (recorders only), or to a remote PC.
Events	Allows pre-configured events (eg presence of any alarm) to be set to drive relay outputs
Messages	Allows message text to be set up (message can then be triggered by a job set up under event or channel configuration)
User Linearisation	Allows the user to enter custom linearisation tables as a series of X (inputs) and Y (outputs) point pairs. Each table can consist of any number of point pairs between two and 66 pairs.
Batch	(If Batch option purchased) Allows batch recording to be configured.
Maths	(If Maths / Totalisers / Counters option purchased) Allows additional 'maths channels' to be set up for simple arithmetic calculations, such as addition, subtraction, multiplication and division, to be performed. Some functions, such as Group average, Group maximum and Group minimum, require multiple groups to be fitted for correct operation.
Totalisers	(If Maths / Totalisers / Counters option purchased) Allows additional 'totaliser channels' to be set up to maintain a running total of any input channel, or of any maths channel.
Counters	(If Maths / Totalisers / Counters option purchased) Allows additional 'counter channels' to be set up to maintain a count of events.
Timers	(If Timers option purchased) Allows additional 'timer channels' to be set up to record time between two events
Serial Comms	(If Serial Comms option purchased) Allows the instrument to receive simple ASCII messages and log these to group history files
Options	Touching this key calls a display showing the current instrument hardware / software setup, for example the number of input channels fitted, the number of output relay boards fitted, and how many relays are fitted per card. Subsequently, should further options be fitted, this page shows the difference between the hardware actually fitted and the hardware the instrument software is configured for. Whenever there is a difference, the 'Autoconfigure' key appears and can be pressed to alert the instrument to the fact that extra options have been added (or taken away).

4.4.2 Configuration Options Available

4.4.2.1 Options available from the 'Instrument' menu:

Instrument Name	Allows the entry of an alphanumeric name for the instrument, up to 20 characters long. This is the name which will be used in the off-line Review software so it is important that it should be set correctly to the site reference for the instrument.
Normal Display (not 5000B)	Allows normal display brightnesses to be defined.
Saver Display (not 5000B)	Allows saver display brightnesses to be defined.
Save After (not 5000B)	The number of minutes (between 1 and 99 inclusive), which are to elapse after a screen operation, before the screen brightness changes from 'normal' to 'saver'.
Modbus Security Disabled	When using MODBUS, it is possible, by 'checking' this field to allow a host computer to access the instrument without its first having to supply a valid User name and Password.
Comms Channel Timeout	Allows a number of seconds (between 1 and 999) to be entered. If none of the channels set to 'Comms' is communicated with within this period, an event source (Comms channel timeout) is set, and remains set until the next communication. An entry of 0 disables the time out.
Preset Hour **Preset Minute**	Allows a preset hour and minute to be configured so that clock can be set to these values by an event (eg by a digital input from a device acting as the time source).

4.4.2.2 Options available from the 'Groups' menu:

Group Number	For instruments with Multiple Groups fitted, this allows a particular group to be selected for configuration. Otherwise only Group 1 is available.
Trend Units	Allows mm/hr or inches per hour to be selected for the 'chart' speed. Automatically converts the trend speed field below.
Descriptor	Allows the group name to be edited.
Trend Type	'Normal' plots and stores a single value at each sample time. 'Adaptive' enables min/max capability for both the live trend display and the recorded data. When enabled, two values (max and min) are plotted and stored for each time period, allowing a lower sample rate to be used without loss of vital information. Each trace is then presented as a dual line in both the live trend display and the history mode.
A/B Switching	When enabled, two entries may be made for Trend speed/interval and for Recording speed/interval. The two entries are called 'A' and 'B'. The 'A' values are used during normal instrument operation; the B values are switched-to as a result of job action.
Trend Speed	Allows the 'chart' speed to be entered. (Units are selected in 'Trend units', above). Entering a value in this field automatically converts the value in the trend interval field described below. See also 'Circular settings', below. If A/B switching is enabled, two trend speed entries are available – Trend Speed A and Trend Speed B. Speed A is used during normal operation; speed B is switched-to as a result of job action.
Trend Interval	Allows a trend interval, in seconds, to be entered. Entering a value in this field automatically converts the value in the trend speed field described above. See also 'Circular settings', below. If A/B switching is enabled, two trend interval entries are available – Trend Interval A and Trend Interval B. Interval A is used during normal operation; interval B is switched-to as a result of job action.

4.4.2.2 Group options (Cont.)

Circular settings (180mm recorders only)	This field appears only if the Circular Trend option is fitted. When enabled, this selection allows chart speed and chart full action to be defined for circular charts. Disables 'Trend Speed' and 'Trend Interval' fields, above. A/B switching has no effect. Circular speed. Allows time/rev to be selected from picklist. Circular Chart Full. Allows 'New Chart' or 'Rotate' to be selected. If 'New Chart' selected, a further field appears 'Start at', allowing a start time and/or date to be entered.
Grid Type	Applies to the group as a whole. None: No grid lines appear on the 'chart'. Linear: Linear style grid appears on the chart, divided according to the selected Major and Minor grid divisions. Log: Appears only if Log Scales option is fitted. number of decades is selectable at 'Grid Decades' field. From Point: The grid which appears is derived from the scale settings for the point selected in the 'from' field. Scale settings are part of the point's configuration.
Recording Enable	Allows the logging of this group's data to the flash memory to be enabled/disabled. When disabled: a The recording speed/interval and Trend history duration fields do not appear. b Display trends are not preserved when changing 'Views'.
Recording Speed	Allows the speed at which data is stored to flash memory to be entered. (Units are selected in 'Trend Units', above). Entering a value in this field automatically converts the value in the Recording Interval field. If A/B switching is enabled, two speed entries are available – Recording Speed A and Recording Speed B. Speed A is used during normal operation; speed B is switched-to as a result of job action.
Recording Interval	Allows the interval at which data is stored to flash memory in seconds to be selected. Entering a value in this field automatically converts the value in the recording speed field. If A/B switching is enabled, two recording interval entries are available – Recording Interval A and Recording Interval B. Interval A is used during normal operation; interval B is switched-to as a result of job action.

4.4.2.2 Group options (Cont.)

Trend History Duration	Gives an estimated time to fill the group's trend history area of the Flash memory. The calculation is based on the archive rate, the compression ratio, the flash size and on the exact nature of the data. For instruments with more than one group, changing the contents of one group may affect the Trend History Duration of other groups because the instrument attempts to store, as nearly as possible, the same amount of history for all groups, regardless of how many points there are in the groups.
Archive to Media Enable (not 5000B)	Allows the archiving of this group's data to floppy disk / PC card. Note that for instruments with the floppy disk option it is not recommended to archive more than one group since the file size of around 400kB limits a floppy disk to 3 files. The ‘overwrite on full’ option can therefore lead to loss of data.
Archive via FTP Enable	Allows the archiving of this group's data to remote PC
Alarm Message	This box allows the printing of alarm on and off messages on the 'chart' to be enabled or disabled. Alarm messages appear on the trend display and in PC Review in the form HH:MM:SS Alarm ON n/m and HH:MM:SS Alarm OFF n/m, where 'n' is the relevant channel number and 'm' is the alarm number (1 or 2).
Ack Message	This tick box allows the printing of alarm acknowledgement messages on the 'chart' to be enabled or disabled. Acknowledge messages appear on the trend display and in PC Review in the form HH:MM:SS
Channel N	Allows channels to be allocated to the trend group
Maths N	Allows maths values to be allocated to the trend group
Totaliser N	Allows totalisers to be allocated to the trend group
Counter N	Allows counters to be allocated to the trend group

4.4.2.3 Options available from the 'Channels' menu:

Channel Number	The current channel and its descriptor are displayed. Touching the window area allows another channel to be selected for configuration.
Input Type	Select thermocouple, millivolt, Volt, milliamp, RTD, Ohms, Comms (from Modbus TCP interface), Test or Digital as input type.
Lin Type	The following linearisation tables are available as standard: Linear, square root, x $^{3/2}$, x $^{5/2}$ UserLin1 to UserLin4. Thermocouple types B, C, D, E, G2, J, K, L, N, R, S, T, U, NiMo/NiCo, Platinel, NiNiMo / Pt20%Rh / Pt40%Rh Resistance thermometer (RTD) types Pt 100 , Pt 1000 , Ni 100 , Ni 120 , JPT 100 , Pt 100 A, Cu 10, Cu53 For input ranges, accuracies etc. associated with the above, see section 6.1 of this document.
Input Low	The lowest value to be applied to the input terminals
Input High	The highest value to be applied across the input terminals
Shunt	Allows a shunt resistor value to be entered for input type = mA. Commonly used values are 100 ohms and 250 ohms. Note that the instrument cannot detect whether a shunt is fitted, or if one is, what value it has.
Range Low	The lowest value of the required linearisation range
Range High	The highest value of the required linearisation range
Range Units	Selectable from degrees Celsius, degrees Fahrenheit, Kelvin or Rankine.
Scaled	This box allows the user to select low and high values and units for a scale.
Scale Low	The scale value to correspond with input range low
Scale High	The scale value to correspond with input range high
Scale Type	None: No scale information appears Linear: Linear style scale appears. Major and minor divisions selectable at 'Scale Divisions – Major' and 'Scale Divisions – Minor' fields. Log: Appears only if 'Log Scales' option fitted. Scale appears in log style, with the number of decades derived from the scale low and scale high entries.
Scale Units	Up to eight characters of unit descriptor
Offset	Allows a fixed value to be added to or subtracted from the process variable. Instrument accuracy figures no longer apply if an offset is included.

4.4.2.3 Channel options (Cont.)

Filter	For 'noisy' slowly changing signals, damping can be used to filter noise so that the underlying trend can be seen more clearly. None, 2, 4, 8, 16, 32, 64, 128 or 256 seconds can be selected.
Input Break Response	For thermocouples and other low level inputs (i.e. input voltages less than 150mV), the instrument can be made to respond in one of the following ways, if a break in the input circuit is detected. None - trace drifts with the input wiring acting as an aerial. Drive hi - trace placed at full scale Drive lo - trace placed at scale 'zero'
Cold Junction Compensation (CJC)	For input type = thermocouple, None, internal or external can be selected for cold junction compensation. Internal CJC is by means of an RTD connected across pins 11 and 12 of the input board connector. If the cold junction is maintained (by the user) at a known, fixed temperature, 'external' should be selected.
External CJ Temperature	If 'external' is selected as cold junction compensation, enter the temperature at which the cold junction is maintained.
Descriptor	Allows a text string of up to 20 characters (including spaces) to be entered for the channel descriptor.
A/B switching	If enabled, this feature allows alternative spans, zones and trace colours to be entered for use during job action.
Spanned	This box, when selected, allows span low and high values to be entered. For example, in an input range of 0 to 600 deg C, it may be that the temperature range between 500 and 600 degrees is of most interest. In such a case, setting span low to 500 and span high to 600 would cause the instrument to display only that part of the input range. This part fills the zone width which is selected next, effectively magnifying the area of interest. If A/B switching is enabled, the single field ‘Spanned’ is replaced by ‘Spanned A’ and ‘Spanned B’, either of which may be enabled/disabled individually. If ‘Spanned A’ is enabled, values for ‘Span Low A’ and ‘Span High A’ may be entered. These values are used during normal operation, or during job operation if ‘Spanned B’ is not enabled. If ‘Spanned B’ is enabled, values for ‘Span Low B’ and ‘Span High B’ may be entered. These values are switched-to as a result of job action.

4.4.2.3 Channel options (Cont.)

Zone	This allows the portion of the chart which the channel occupies to be defined in terms of percent, where the left edge of the chart is 0% and the right hand edge is 100%. For example, setting a low value of 50 and a high value of 100 causes the channel trace to be confined to the right hand half of the chart. If A/B switching is enabled, the 'Zone Low' and 'Zone High' fields are replaced by 'Zone low A', 'Zone High A', 'Zone low B' and 'Zone High B'. 'A' values are used during normal operation. B values are switched-to as a result of job action.
PV Format	Allows the format for process values to be selected as 'Numeric' or 'Scientific'. Numeric: Values appear as normal numerical values with the selected number of decimal places. Scientific: Values appear, and are entered in scientific format, as a Mantissa followed by an Exponent. Examples: 1,000,001 numeric becomes 1.000001E6 in scientific format; 0.000035 numeric becomes 3.5E-5 in scientific format.
Maximum Decimal Digits	This defines the number of decimal places in the process value. Settable between zero and nine. Leading and trailing zeros are not displayed.
Colour	Allows the trace colour to be selected from a colour chart. Each of the 56 available colours is displayed with a number, and it is this number which is entered. If A/B switching is enabled, Colours A and B can be entered for use during normal operation, or whilst a relevant job is active, respectively.
Open Word	(Digital channel only) Allows a text string of up to 8 characters to be associated with the open circuit condition
Closed Word	(Digital channel only) Allows a text string of up to 8 characters to be associated with the closed circuit condition

4.4.2.3 Channel options (Cont.)

The following configuration options are available from within the Channel configuration for each alarm on the channel:

Alarm Number	Allows an alarm for the channel to be selected for configuration. For 16MB instruments, there are two alarms available per point. For 32MB instruments there are four alarms available per point.
Enable	Off, Unlatched, Latched or Trigger
Type	Absolute high or absolute low or 'deviation in' or 'deviation out' or 'rate of change rise' or 'rate of change fall'
Threshold	Allows value to be entered for the trigger setpoint in engineering units.
Hysteresis	Allows value to be entered for the hysteresis in engineering units.
Dwell	Allows a dwell value to entered as seconds. If an alarm trigger returns to a non-active state before the dwell period expires, then it is ignored.

The following configuration options are available from within the Channel configuration for each job on each alarm on the channel:

Job Number	Select job one or two for this alarm.
Category	Select the required job to be carried out when the channel is in alarm (Drive relay / No Action / Totaliser / Message / Math / Clock / Counter / Timer / Batch / Recording / Trend)
While	For 'drive relay', 'recording' and 'trend' jobs, allows the action of the alarm job to be chosen as whilst active, whilst inactive or whilst unacknowledged.
On	For 'totaliser', 'message', 'maths', 'clock', 'counter', 'timer', 'batch' jobs, allows the selected action to happen on alarm active, alarm inactive or alarm acknowledge

4.4.2.3 Channel options (Cont.)

Action	For ‘totaliser’ jobs, allows the action to be set to Preset or Disable For ‘maths’ jobs, allows the action to be set to Reset, Disable or Switch to B For ‘clock’ jobs, allows the action to be set to Preset (sets clock to hour / minute given under config instrument – can be used to simultaneously set clock on a number of instruments) For ‘counter’ jobs, allows the action to be set to Preset, Disable, Increment or Decrement For ‘timer’ jobs, allows the action to be set to Reset, Start or Disable For ‘batch’ jobs, allows the action to be set to Start or Stop For ‘recording’ jobs, allows the action to be set to Disable, or recording speed/interval B to be selected for the duration of the job, if A/B switching is enabled. For ‘trend’ jobs, allows Trend speed interval B, or Span/Zone B, or trace colour B to be selected for the relevant group or channel, for the duration of the job.
Relay Board	For 'drive relay' jobs, allows the specific relay to be defined for action this alarm.
Relay Number	For 'drive relay' jobs, allows the specific relay to be defined for action this alarm. The relays are normally energised (common to normally open). They are de-energised (common to normally closed) in alarm or power off conditions.
Totaliser	For ‘totaliser’ jobs, allows the affected totaliser to be specified
Send Message(s) to	For ‘message’ jobs, allows the selected message to be sent to display, all groups or a specified group only.
First Message / Last Message	For ‘message’ jobs, allows the selection of the messages to trigger.
Math	For ‘maths’ jobs, allows the affected maths channel to be specified
Counter	For ‘counter’ jobs, allows the affected counter to be specified
Timer	For ‘timer’ jobs, allows the affected timer to be specified
Group	For ‘batch’ or ‘recording’ jobs, allows the affected group to be specified

4.4.2.4 Options available from the 'Views' menu:

Home Time-Out	Determines the time after which the display returns to the home screen. Valid settings are 1-9999 minutes or 0 (do not time out)
Home Group	Selects which of the available groups should be the 'home' group
Dark Trend Background	Selects dark / light background on trend displays
Dark Review Background	Selects a dark / light background when in Review mode (ie trend not showing current data)
Scope	Determines whether the following parameters are 'instrument wide' or configured for each group individually.
Display Enable	If Scope is set to 'Group', allows a group to be enabled or disabled for display.
Home Page	Selects which of the available displays should be the 'home' display
Vertical Trend Enabled	Enables / disables vertical trend display
Horizontal Trend Enabled	Enables / disables horizontal trend display
Vertical Bargraph Enabled	Enables / disables vertical bargraph display
Circular Trend Enabled	If Circular trend option fitted, this replaces Vertical bargraph, and enables/disables circular trend display. 'Circular Settings' must be enabled in Group Configuration, or circular trend may not operate correctly.
Horizontal Bargraph Enabled	Enables / disables horizontal bargraph display
Numeric Page Enabled	Enables / disables numeric display
User Screen 1	Enables / disables user display 1 (if user screen option purchased)
User Screen 2	Enables / disables user display 2 (if user screen option purchased)
User Screen 3	Enables / disables user display 3 (if user screen option purchased)
User Screen 4	Enables / disables user display 4 (if user screen option purchased)
User Screen 5	Enables / disables user display 5 (if user screen option purchased)
User Screen 6	Enables / disables user display 6 (if user screen option purchased)

4.4.2.5 Options available from the 'Archive' menu:

Compression	Normal or high compression. 'Normal' compresses the data but still provides an exact copy. 'High' compresses more, but channel values are saved only to 1 part in 10^8 resolution.
Flash Size	(Not editable) Allows the size of the Flash memory to be viewed by the user.
Shortest Trend History	(Not editable) This shows which group has the shortest amount of Flash memory allocated to its history record. Providing the archive period is less than the value displayed in the Duration window, no data will be lost from any group. If the archive period is greater than this value, then some of the data in one or more groups will have been overwritten and therefore lost..
Duration	(Not editable) Gives an estimated time to fill the trend history area of the Flash memory. The calculation is based on the archive rate, the compression ratio, the flash size and on the exact nature of the data.
Archive To Media (not 5000B)	For Disk Settings only: None (archive to disk is initiated by the operator) Hourly (archive to disk occurs on the hour every hour) Daily (archive to disk occurs at 00:00* hrs each day) Weekly (archive to disk occurs at 00:00* hrs every Monday) Monthly (archive to disk occurs at 00:00* hrs on the 1st of each month) Automatic (the instrument selects the slowest out of Hourly, Daily, Weekly or Monthly, which is guaranteed not to lose data). * not adjusted for daylight saving time
On Media Full (not 5000B)	For Disk Settings only: Overwrite (oldest data replaced with latest data when disk is full) Stop (archiving stops when the disk is full)
Media Size (not 5000B)	For Disk Settings only: Allows the size of the Disk to be entered, for user information only. This item is not saved as part of the configuration
Disk Archive Capacity (not 5000B)	(Not editable) For Disk Settings only: Gives an estimated time to fill the disk/pc card, based on the archive rate, the compression ratio, the disk size and on the estimated nature of the data.
Media Full event limit (not 5000B)	Allows a % full value to be entered. When the disk or PC card content reaches this value, an event trigger is set. See section 4.4.2.6 for Events details

4.4.2.5 Archive options (Cont.)

Archive To Remote	For Remote Settings only: None (archive is initiated by the operator) Hourly (archive occurs on the hour every hour) Daily (archive occurs at 00:00* hrs each day) Weekly (archive occurs at 00:00* hrs Monday) Monthly (archive occurs at 00:00* hrs on 1st of month) Automatic (the instrument selects the slowest out of Hourly, Daily, Weekly or Monthly, which is guaranteed not to lose data). * not adjusted for daylight saving time
Remote Path	For Remote settings only: The route to a folder or directory on the remote host, set up as a part of that host's FTP configuration
Primary Remote Host	For Remote settings only: If a Domain Name Server (DNS) is specified in the Network key 'Name' page, then the Primary Remote Host is the server name. If DNS is not selected, then the Primary Remote Host is the IP address of the remote host.
Primary Login Name	For Remote settings only: Login name of the remote host account assigned either by the Network administrator, or in the Guest account of the remote host's FTP Server or User Manager configuration.
Primary Login Password	For Remote settings only: Password of the remote host account assigned either by the Network administrator, or in the Guest account of the remote host's FTP Server or User Manager configuration. Must be of between eight and 20 characters, must be entered twice to ensure integrity.
Secondary Remote Host	For Remote settings only: If a Domain Name Server (DNS) is specified in the Network key 'Name' page, then the Secondary Remote Host is the server name. If DNS is not selected, then the Secondary Remote Host is the IP address of the remote host.
Secondary Login Name	For Remote settings only: Login name of the remote host account assigned either by the Network administrator, or in the Guest account of the remote host's FTP Server or User Manager configuration.
Secondary Login Password	For Remote settings only: Password of the remote host account assigned either by the Network administrator, or in the Guest account of the remote host's FTP Server or User Manager configuration. Must be of between eight and 20

	characters, must be entered twice to ensure integrity.

4.4.2.6 Options available from the 'Events' menu:

Event Number	Allows the required event to be selected for configuration. Select 1 to 24 for 5000B and 5100V instruments; 1 to 48 for 5180V instruments.
Source	Allows the following to be set as the event trigger: Off (the event is disabled) Global alarm (the event is active whist any one or more alarms is active) Global Unack'd alarm (the event is active as long as there is an unacknowledged alarm present) Comms Channel Timeout (no communication has been made with 'Comms' channels within the timeout period set in instrument configuration. The source is reset when the next communication occurs.) Timer Active Batch Running Batch Start Event N (uses another event as source) Point alarm Unack'd point alarm Alarm on group (relevant group selectable) Unack'd Alarm on Group Instrument alarm. Event source active if any of the following instrument alarms is active: Any, Input channel failure, Removable media failure*, Removable media full*, No removable media fitted*, FTP primary server failure, FTP secondary server failure, Maths channel failure, Clock failure, Unrecognised PC Card*, Recording failure – overflow, Floppy disk worn*, Floppy disk corrupt*, Network boot failure, SNTP server failure, Time synchronisation failure, Battery backed RAM cleared. See section 7.1.2 for Instrument alarm descriptions. Power up Maths channel partial failure (e.g. one channel in a group average calculation has failed – the average is taken from the remaining 'good' channels). Battery Low. (Event remains active until battery is replaced) Archive media % full. (Triggered when the disk or PC Card reaches the percentage fullness specified in Archive configuration (section 4.4.2.5). Invalid Password Entry User login account disabled.

* Not 5000B units

4.4.2.6 Events options (Cont.)

Source (Cont.)	User logged in. (This becomes active whenever a user with the specified Event Permission logs in. The event remains active until all users (local and remote) with the specified permission level have logged out. Event permission levels are allocated as part of the 'Access when' configuration – see section 4.1.2.1.
On group	(For batch running/start events) If Scope = Group, in Batch configuration, the relevant group is selected here.
Descriptor	Allows a text string to be entered as the event title.
Job Number	Select job one or two for this alarm.
Category	Select the required job to be carried out when the channel is in alarm (Drive relay / No Action / Totaliser / Message / Math / Clock / Counter / Timer / Batch / Recording / Trend)
While	For 'drive relay', 'recording' and 'trend' jobs, allows the action of the alarm job to be chosen as whilst active, whilst inactive or whilst unacknowledged.
On	For 'totaliser', 'message', 'maths', 'clock', 'counter', 'timer', 'batch' jobs, allows the selected action to happen on alarm active, alarm inactive or alarm acknowledge
Action	For 'Totaliser' jobs, allows the action to be set to Preset or Disable For 'Maths' jobs, allows the action to be set to Reset, Disable or Switch to B For 'Clock' jobs, allows the action to be set to Preset (sets clock to hour / minute given under config instrument – can be used to simultaneously set clock on a number of instruments) For 'Counter' jobs, allows the action to be set to Preset, Disable, Increment or Decrement For 'Timer' jobs, allows the action to be set to Reset, Start or Disable For 'Batch' jobs, allows the action to be set to Start or Stop For 'Recording' jobs, allows the action to be set to Disable or to switch to Recording Speed/Interval B. For 'Trend' jobs, allows Span B, Colour B or Trend speed/interval B to be switched to, for the selected channel or group.
Relay Board	For 'drive relay' jobs, allows the specific relay to be defined for action this alarm.

4.4.2.6 Events options (Cont.)

Relay Number	For 'drive relay' jobs, allows the specific relay to be defined for action this alarm. The relays are normally energized (common to normally open). They are de-energised (common to normally closed) in alarm or power off conditions.
Totaliser	For ‘Totaliser’ jobs, allows the affected totaliser to be specified
Send Message(s) to	For ‘Message’ jobs, allows the selected message to be sent to display, all groups or a specified group only.
First Message / Last Message	For ‘Message’ jobs, allows the selection of the messages to trigger.
Math	For ‘Maths’ jobs, allows the affected maths channel to be specified
Counter	For ‘Counter’ jobs, allows the affected counter to be specified
Timer	For ‘Timer’ jobs, allows the affected timer to be specified
Group	For ‘Batch’, ‘Recording’ and ‘Trend’jobs, allows the affected group to be specified

4.4.2.7 Options available from the 'Messages' menu:

Message Number	The current message and its descriptor are displayed. Touching the window area allows another message to be selected for configuration.
Message	The message text including up to 6 dynamic elements entered as {1} to {6} – eg The total value is {1} at time {2}
Replace {n} with	Specifies type of item to replace {1}, {2} etc in the message text. Selectable from: Blank Source Descriptor (ie descriptor of trigger for message) Source Value (ie value of trigger for message) Specified Descriptor Specified Value
(n) source	Specifies source channel / maths channel / totaliser / counter if 'specified descriptor' or 'specified value' is selected above.

4.4.2.8 Options available from the 'User Linearisations' menu:

Descriptor	Allows the user to rename the linearisation table from the default (UserLinN)
Format	Allows 'Numeric' or 'Scientific' to be selected for table entries.
Number of points	The total number of point pairs to be entered.
Xn	The X value of the nth point in the table
Yn	The Y value corresponding to the nth X value.

4.4.2.9 Options available from the 'Batch' menu:

The following configuration options are available provided that the Batch option is fitted.

Scope	Determines whether the following parameters are 'instrument wide' or configured for each group individually.
Enable	Allows the batch function to be switched on or off.
Batch mode	Allows batch mode to be selected as Continuous or Start/Stop. The current instrument software version has no ability to start or stop batches - it can only record when the operator indicates that such events have happened.
Batch fields	Allows the maximum number of messages to be printed at batch start/stop to be selected between one and six.
Field n	These fields (up to six in number) are used as headings for batch information. When initiating the batch annotation the operator has to enter a value to be associated with each heading. Headings can be up to 20 characters long (including spaces).
Batch field 1	This defines how field 1 (batch number) is filled in: Use Text = operator entry on starting batch Use Counter = start new batch each time counter increments and use counter value as batch number.
Counter	(Only if batch number = 'use counter'). Selects counter to use for batch number.
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 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	Allows the user to clear none or more of the batch entries at each batch start. 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, is inserted into the history file name. This name is then used automatically by the off-line Review software to identify the batch.

4.4.2.10 Options available from the 'Maths' menu:

The following configuration options are available provided that the Maths/Totals/Counters option is fitted.
Note that the 'freeform' style of the 'Maths' configuration (where complex calculations can be built up crossing many channels) can make it unsuitable for treatment as GAMP4 category 2 software for anything other than very simple calculations. Should complex maths functionality be required, refer to Eurotherm for information on GAMP4 category 4.

Maths Number	The current channel and its descriptor are displayed. Touching the window area allows another maths channel to be selected for configuration.
Value	(not editable) Displays the current value
Function	This picklist allows the relevant maths function to be selected from:
	Off
	Constant
	Add
	Subtract
	Multiply
	Divide
	Group Average
	Group Minimum
	Group Maximum
	Comms (ie use channel as an additional Modbus TCP input)
	Stopwatch (can be disabled / reset by events)
	Copy (create copy value to allow, for example, extra alarms / jobs to be set up)
	Polynomial (provides curve fit using up to 8^{th} order term)
	FValue (equivalent time at sterilisation temperature given target temperature, temperature interval for factor-of-10 reduction in killing efficiency and cut-off below which sterilisation effect should be discounted)
	Switch (switch between two sources on a preset event)
	Linear mass flow
	Root mass flow
	Rolling Average
	MKT (mean kinetic temperature) over samples (up to a given number) at a given interval using a given value for heat of activation).
	10 to the Power
	Group Latched Minimum. (Outputs the minimum value reached by any of the channels, in the specified source group, since last reset. A 'Reset' job sets the function output to the current minimum value within the group.)
	Group Latched Maximum. (Outputs the maximum value reached by any of the channels, in the specified source group, since last reset. A 'Reset' job sets the function output to the current maximum value within the group.)

4.4.2.10 Maths menu options (Cont.)

Function (continued)	Sample and Hold. (Initiated by a Trigger job. The value of the channel at trigger time is taken, and held as the output value of the function.)
	Square Root. (Outputs the square root of the value of the selected point.)
	High Select. (Outputs the value of whichever of two user-specified input-point values is currently the higher.)
	Low select. (Outputs the value of whichever of two user-specified input-point values is currently the lower.)
	Saturated Steam Mass Flow. (Calculates mass flow for saturated steam.)
	Saturated Steam Heat Flow. (Calculates heat energy flow for saturated steam.)
	Saturated Steam Heat Consumed. (Calculates heat energy consumption for saturated steam.)
	Group MKT. As MKT, above, but uses a group of input channels instead of a single channel.
(Required Inputs)	Each function automatically requests entries for the required inputs which may be other channels (input or maths or totalisers) or constants. For group functions the source group must be entered. Note that the result of a group function must not be included in that group or a 'circular' calculation would be set up.
Constant Value	Allows constant values to be set.
Units	Allows a text string of up to 6 characters (including spaces) to be entered for the channel units
Descriptor	Allows a text string of up to 20 characters (including spaces) to be entered for the channel descriptor.
A/B switching	If enabled, 'Scale Low' and 'Scale High', described below, are replaced by 'Scale Low A', 'Scale High A', 'Scale Low B' and 'Scale High B'. The 'A' values are used during normal operation; the B values are switched-to by job action. 'Zone Low' and 'Zone High' and 'Colour' below, are affected in the same way.
Scale Low (A)(B)	'Low range' value for calculated value. See also A/B switching, above.
Scale High (A)(B)	'High range' value for calculated value. See also A/B switching, above.
Scale Type	None: No scale information appears Linear: Linear style scale appears. Major and minor divisions selectable at 'Scale Divisions – Major' and 'Scale Divisions – Minor' fields. Log: Appears only if 'Log Scales' option fitted. Scale appears as a log style, with the number of decades derived from the scale low and scale high entries.

4.4.2.10 Maths menu options (Cont.)

Zone (A)(B)	This allows the portion of the chart which the channel occupies to be defined in terms of percent, where the left edge of the chart is 0% and the right hand edge is 100%. For example, setting a low value of 50 and a high value of 100 causes the channel trace to be confined to the right hand half of the chart. See also A/B switching, above.
PV format	Defines the display format as Numeric (eg 123.45), Elapsed time (HH:MM:SS) or Scientific (e.g. 1.2345E2)
Maximum Decimal Digits	This defines the number of decimal places in the process value. Settable between zero and nine. Leading and trailing zeros are not displayed.
Colour (A)(B)	Allows the trace colour to be selected from a colour chart. Each of the 56 available colours is displayed with a number, and it is this number which is entered. See also A/B switching, above.

4.4.2.10 Maths menu options (Cont.)

The following configuration options are available from within the Maths configuration for each alarm on the channel:

Alarm Number	Allows an alarm for the channel to be selected for configuration. For 16MB instruments, there are two alarms available per point. For 32MB instruments there are four alarms available per point.
Enable	Off, Unlatched, Latched or Trigger
Type	'Absolute high' or 'absolute low' or 'deviation in' or 'deviation out' or 'rate of change rise' or 'rate of change fall'
Threshold	Allows value to be entered for the trigger setpoint in engineering units.
Hysteresis	Allows value to be entered for the hysteresis in engineering units.
Dwell	Allows a dwell value to entered as seconds. If an alarm trigger returns to a non-active state before the dwell period expires, then it is ignored.

The following configuration options are available from within the Maths configuration for each job on each alarm on the channel:

Job Number	Select job one or two for this alarm.
Category	Select the required job to be carried out when the channel is in alarm (Drive relay / No Action / Totaliser / Message / Math / Clock / Counter / Timer / Batch / Recording / Trend)
While	For 'drive relay', 'recording' and 'trend' jobs, allows the action of the alarm job to be chosen as whilst active, whilst inactive or whilst unacknowledged.
On	For 'totaliser', 'message', 'maths', 'clock', 'counter', 'timer', 'batch' jobs, allows the selected action to happen on alarm active, alarm inactive or alarm acknowledge
Action	For 'totaliser' jobs, allows the action to be set to Preset or Disable For 'maths' jobs, allows the action to be set to Reset, Disable, Switch to B or Trigger For 'clock' jobs, allows the action to be set to Preset (sets clock to hour / minute given under config instrument – can be used to simultaneously set clock on a number of instruments) For 'counter' jobs, allows the action to be set to Preset, Disable, Increment or Decrement For 'timer' jobs, allows the action to be set to Reset, Start or Disable

4.4.2.10 Maths menu options (Cont.)

Action (Continued)	For 'batch' jobs, allows the action to be set to Start or Stop For 'recording' jobs, allows the action to be set to Disable or 'switch to Recording speed/interval B. For 'trend' jobs, allows Trend Speed/Interval B, or Span/Zone B, or trace colour B to be selected for the relevant group or channel, for the duration of the job.
Relay Board	For 'drive relay' jobs, allows the specific relay to be defined for action this alarm.
Relay Number	For 'drive relay' jobs, allows the specific relay to be defined for action this alarm. The relays are normally energized (common to normally open). They are de-energised (common to normally closed) in alarm or power off conditions.
Totaliser	For 'totaliser' jobs, allows the affected totaliser to be specified
Send Message(s) to	For 'message' jobs, allows the selected message to be sent to display, all groups or a specified group only.
First Message / Last Message	For 'message' jobs, allows the selection of the messages to trigger.
Math	For 'maths' jobs, allows the affected maths channel to be specified
Counter	For 'counter' jobs, allows the affected counter to be specified
Timer	For 'timer' jobs, allows the affected timer to be specified
Group	For 'batch', 'recording' or 'trend' jobs, allows the affected group to be specified

4.4.2.11 Options available from the 'Totalisers' menu:

The following configuration options are available provided that the Maths / Totalisers / Counters option is fitted.

Totaliser Number	The current totaliser and its descriptor are displayed. Touching the window area allows another totaliser to be selected for configuration.
Enable	Allows the user to enable/disable the totaliser.
Value	(Not editable) Displays the current total value
Total of	Allows an input channel or a maths channel to be selected as the source to be totalised.
Low Cut Off	The value of the source channel (in engineering units) below which it is not to be totalised.
High Cut Off	The value of the source channel (in engineering units) above which it is not to be totalised.
Units	Allows a text string of up to 6 characters (including spaces) to be entered for the channel units.
Preset	Allows the entry of a 10-character positive, or nine-character negative value from which the totaliser is to start counting.
Preset Now	Operation of this key initiates the totaliser preset.
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.
Descriptor	Allows a text string of up to 20 characters (including spaces) to be entered for the channel descriptor.

4.4.2.11 Totaliser menu options (Cont.)

A/B switching	If enabled, 'Scale Low' and 'Scale High', described below, are replaced by 'Scale Low A', 'Scale High A', 'Scale Low B' and 'Scale High B'. The 'A' values are used during normal operation; the B values are switched-to by job action. 'Zone Low', 'Zone High' and 'Colour' below, are affected in the same way.
Scale Low (A)(B)	'Low range' value for calculated value. See also A/B switching, above.
Scale High (A)(B)	'High range' value for calculated value. See also A/B switching, above.
Scale Type	None: No scale information appears Linear: Linear style scale appears. Major and minor divisions selectable at 'Scale Divisions – Major' and 'Scale Divisions – Minor' fields. Log: Appears only if 'Log Scales' option fitted. Scale appears as a log style, with the number of decades derived from the scale low and scale high entries.
Zone (A)(B)	This allows the portion of the chart which the channel occupies to be defined in terms of percent, where the left edge of the chart is 0% and the right hand edge is 100%. For example, setting a low value of 50 and a high value of 100 causes the channel trace to be confined to the right hand half of the chart. See also A/B switching, above.
PV Format	Defines the display format as numeric (e.g. 234.5678) or scientific (e.g. 2.345678E2)
Maximum Decimal Digits	This defines the number of decimal places in the process value. Settable between zero and nine. Leading and trailing zeros are not displayed.
Colour (A)(B)	Allows the trace colour to be selected from a colour chart. Each of the 56 available colours is displayed with a number, and it is this number which is entered. See also A/B switching, above.

4.4.2.11 Totaliser menu options (Cont.)

The following configuration options are available from within the Totaliser configuration for each alarm on the channel:

Alarm Number	Allows an alarm for the totaliser to be selected for configuration. For 16MB instruments, there are two alarms available per point. For 32MB instruments there are four alarms available per point.
Enable	Off, Unlatched, Latched or Trigger
Type	Absolute high or absolute low or ‘deviation in’ or ‘deviation out’ or ‘rate of change rise’ or ‘rate of change fall’
Threshold	Allows value to be entered for the trigger setpoint in engineering units.
Hysteresis	Allows value to be entered for the hysteresis in engineering units.
Dwell	Allows a dwell value to entered as seconds. If an alarm trigger returns to a non-active state before the dwell period expires, then it is ignored.

The following configuration options are available from within the Totaliser configuration for each job on each alarm on the channel:

Job Number	Select job one or two for this alarm.
Category	Select the required job to be carried out when the channel is in alarm (Drive relay / No Action / Totaliser / Message / Math / Clock / Counter / Timer / Batch / Recording / Trend)
While	For ‘drive relay’, ‘recording’ and ‘trend’ jobs, allows the action of the alarm job to be chosen as whilst active, whilst inactive or whilst unacknowledged.
On	For ‘totaliser’, ‘message’, ‘maths’, ‘clock’, ‘counter’, ‘timer’, ‘batch’ jobs, allows the selected action to happen on alarm active, alarm inactive or alarm acknowledge

4.4.2.11 Totaliser menu options (Cont.)

Action	For ‘totaliser’ jobs, allows the action to be set to Preset or Disable For ‘maths’ jobs, allows the action to be set to Reset, Disable or Switch to B For ‘clock’ jobs, allows the action to be set to Preset (sets clock to hour / minute given under config instrument – can be used to simultaneously set clock on a number of instruments) For ‘counter’ jobs, allows the action to be set to Preset, Disable, Increment or Decrement For ‘timer’ jobs, allows the action to be set to Reset, Start or Disable For ‘batch’ jobs, allows the action to be set to Start or Stop For ‘recording’ jobs, allows the action to be set to Disable, or Recording Speed/Interval B to be switched-to. For ‘trend’ jobs, allows Trend Speed/Interval B, or Span/Zone B, or trace colour B to be selected for the relevant group or channel, for the duration of the job.
Relay Board	For 'drive relay' jobs, allows the specific relay to be defined for action this alarm.
Relay Number	For 'drive relay' jobs, allows the specific relay to be defined for action this alarm. The relays are normally energized (common to normally open). They are de-energised (common to normally closed) in alarm or power off conditions.
Totaliser	For ‘totaliser’ jobs, allows the affected totaliser to be specified
Send Message(s) to	For ‘message’ jobs, allows the selected message to be sent to display, all groups or a specified group only.
First Message / Last Message	For ‘message’ jobs, allows the selection of the messages to trigger.
Math	For ‘maths’ jobs, allows the affected maths channel to be specified
Counter	For ‘counter’ jobs, allows the affected counter to be specified
Timer	For ‘timer’ jobs, allows the affected timer to be specified
Group	For ‘batch’ or ‘recording’ jobs, allows the affected group to be specified

4.4.2.12 Options available from the 'Counters' menu:

The following configuration options are available provided that the Maths / Totalisers / Counters option is fitted.

Counter Number	The current counter and its descriptor are displayed. Touching the window area allows another counter to be selected for configuration.
Enable	Allows the user to enable/disable the counter.
Value	(Not editable) Displays the current count value
Units	Allows a text string of up to 6 characters (including spaces) to be entered for the channel units.
Preset	Allows the entry of a 10-character positive, or nine-character negative value from which the counter is to start counting.
Preset Now	Operation of this key initiates the counter preset.
Descriptor	Allows a text string of up to 20 characters (including spaces) to be entered for the channel descriptor.
A/B switching	If enabled, 'Scale Low' and 'Scale High', described below, are replaced by 'Scale Low A', 'Scale High A', 'Scale Low B' and 'Scale High B'. The 'A' values are used during normal operation; the B values are switched-to by job action. 'Zone Low', 'Zone High' and 'Colour' below, are affected in the same way.
Scale Low (A)(B)	'Low range' value for counter value. See also A/B switching (above).
Scale High (A)(B)	'High range' value for counter value. See also A/B switching (above).
Scale Type	None: No scale information appears Linear: Linear style scale appears. Major and minor divisions selectable at 'Scale Divisions – Major' and 'Scale Divisions – Minor' fields. Log: Appears only if 'Log Scales' option fitted. Scale appears as a log style, with the number of decades derived from the scale low and scale high entries.
Zone (A)(B)	This allows the portion of the chart which the channel occupies to be defined in terms of percent, where the left edge of the chart is 0% and the right hand edge is 100%. For example, setting a low value of 50 and a high value of 100 causes the channel trace to be confined to the right hand half of the chart. See also A/B switching (above).
Colour (A)(B)	Allows the trace colour to be selected from a colour chart. Each of the 56 available colours is displayed with a number, and it is this number which is entered. See also A/B switching (above).

The following configuration options are available from within the Counter configuration for each alarm on the channel:

Alarm Number	Allows an alarm for the counter to be selected for configuration. For 16MB instruments, there are two alarms available per point. For 32MB instruments there are four alarms available per point.
Enable	Off, Unlatched, Latched or Trigger
Type	Absolute high or absolute low or 'deviation in' or 'deviation out' or 'rate of change rise' or 'rate of change fall'
Threshold	Allows value to be entered for the trigger setpoint in engineering units.
Hysteresis	Allows value to be entered for the hysteresis in engineering units.
Dwell	Allows a dwell value to entered as seconds. If an alarm trigger returns to a non-active state before the dwell period expires, then it is ignored.

The following configuration options are available from within the Counter configuration for each job on each alarm on the channel:

Job Number	Select job one or two for this alarm.
Category	Select the required job to be carried out when the channel is in alarm (Drive relay / No Action / Totaliser / Message / Math / Clock / Counter / Timer / Batch / Recording / Trend)
While	For 'drive relay', 'recording' and 'trend' jobs, allows the action of the alarm job to be chosen as whilst active, whilst inactive or whilst unacknowledged.
On	For 'totaliser', 'message', 'maths', 'clock', 'counter', 'timer', 'batch' jobs, allows the selected action to happen on alarm active, alarm inactive or alarm acknowledge
Action	For 'totaliser' jobs, allows the action to be set to Preset or Disable For 'maths' jobs, allows the action to be set to Reset, Disable or Switch to B For 'clock' jobs, allows the action to be set to Preset (sets clock to hour / minute given under config instrument – can be used to simultaneously set clock on a number of instruments) For 'counter' jobs, allows the action to be set to Preset, Disable, Increment or Decrement For 'timer' jobs, allows the action to be set to Reset, Start or Disable

Action (Cont.)	For ‘batch’ jobs, allows the action to be set to Start or Stop For ‘recording’ jobs, allows the action to be set to Disable, or Recording Speed/Interval B to be switched-to. For ‘trend’ jobs, allows Trend Speed/Interval B, or Span/Zone B, or trace colour B to be selected for the relevant group or channel, for the duration of the job.
Relay Board	For 'drive relay' jobs, allows the specific relay to be defined for action this alarm.
Relay Number	For 'drive relay' jobs, allows the specific relay to be defined for action this alarm. The relays are normally energized (common to normally open). They are de-energised (common to normally closed) in alarm or power off conditions.
Totaliser	For ‘totaliser’ jobs, allows the affected totaliser to be specified
Send Message(s) to	For ‘message’ jobs, allows the selected message to be sent to display, all groups or a specified group only.
First Message / Last Message	For ‘message’ jobs, allows the selection of the messages to trigger.
Math	For ‘maths’ jobs, allows the affected maths channel to be specified
Counter	For ‘counter’ jobs, allows the affected counter to be specified
Timer	For ‘timer’ jobs, allows the affected timer to be specified
Group	For ‘batch’ or ‘recording’ jobs, allows the affected group to be specified

4.4.2.13 Options available from the 'Timers' menu:

The following configuration options are available provided that the Timers option is fitted.

Timer Number	The current timer and its descriptor are displayed. Touching the window area allows another timer to be selected for configuration.
Enable	Allows the user to enable/disable the timer.
Remaining	(Not editable) Displays the current timer value
Repeat in	(Not editable) Displays the current time before repeat
Reset Now	Operation of this key resets the timer.
Start Now	Operation of this key starts the timer.
Descriptor	Allows a text string of up to 20 characters (including spaces) to be entered for the channel descriptor.
Self Start	If enabled, this causes time / date selection fields to appear so that automatic start can be configured.
Date **Month** **Hour** **Minute** **Second**	Allow self start time to be configured. Each field has all possible values (eg date 1-31, month 1-12) or 'Any' as options.
Duration	Allows entry of count down time in HH:MM:SS format
Repeat After	Allows entry of repeat time in HH:MM:SS format (duration is included in this time)

The following configuration options are available from within the Timer configuration for each job on the timer:

Job Number	Select job one or two for this timer
Category	Select the required job to be carried out when the channel is in alarm (Drive relay / No Action / Totaliser / Message / Math / Clock / Counter / Timer / Batch / Recording / Trend)
While	For 'drive relay', 'recording' and 'trend' jobs, allows the action of the alarm job to be chosen as whilst active, whilst inactive or whilst unacknowledged.
On	For 'totaliser', 'message', 'maths', 'clock', 'counter', 'timer', 'batch' jobs, allows the selected action to happen on alarm active, alarm inactive or alarm acknowledge

4.4.2.13 Totaliser menu options (Cont.)

Action	For ‘totaliser’ jobs, allows the action to be set to Preset or Disable For ‘maths’ jobs, allows the action to be set to Reset, Disable or Switch to B For ‘clock’ jobs, allows the action to be set to Preset (sets clock to hour / minute given under config instrument – can be used to simultaneously set clock on a number of instruments) For ‘counter’ jobs, allows the action to be set to Preset, Disable, Increment or Decrement For ‘timer’ jobs, allows the action to be set to Reset, Start or Disable For ‘batch’ jobs, allows the action to be set to Start or Stop For ‘recording’ jobs, allows the action to be set to Disable, or Recording Speed/Interval B to be switched-to. For ‘trend’ jobs, allows Trend Speed/Interval B, or Span/Zone B, or trace colour B to be selected for the relevant group or channel, for the duration of the job.
Relay Board	For 'drive relay' jobs, allows the specific relay to be defined for action this alarm.
Relay Number	For 'drive relay' jobs, allows the specific relay to be defined for action this alarm. The relays are normally energized (common to normally open). They are de-energised (common to normally closed) in alarm or power off conditions.
Totaliser	For ‘totaliser’ jobs, allows the affected totaliser to be specified
Send Message(s) to	For ‘message’ jobs, allows the selected message to be sent to display, all groups or a specified group only.
First Message / Last Message	For ‘message’ jobs, allows the selection of the messages to trigger.
Math	For ‘maths’ jobs, allows the affected maths channel to be specified
Counter	For ‘counter’ jobs, allows the affected counter to be specified
Timer	For ‘timer’ jobs, allows the affected timer to be specified
Group	For ‘batch’ or ‘recording’ jobs, allows the affected group to be specified

4.4.2.14 Options available from the 'Serial Comms' menu:

The following configuration options are available provided that the Serial Comms option is fitted.

Protocol	Only ASCII protocol available this release.
Baud Rate	Allows a Baud rate to be chosen from a picklist of: 300, 600, 1200, 4800, 9600, 19200, 38400.
Stop Bits	Selectable as 1 or 2
Parity	Allows Parity to be chosen from a pick list of: None, Odd, Even
Data Bits	Selectable as 7 or 8
Timeout	Allows a timeout value to be entered of between 50 and 3000 msec. A value of 0 = no timeout.
Message Start / End Characters	The message can be prefixed by 0, 1 or 2 specific characters and can be suffixed by 0, 1 or 2 specific characters. The First and Second Start and End characters are entered as decimal ASCII codes between 0 and 127 as required. 0 = no character, 10 = Line Feed; 13 = Carriage Retun. See Annex D of the user guide for a list of ASCII codes. If only one start or end character is required, the first character must be entered, and the second character be entered as zero.
Group Selection	Allows groups to be deselected/selected for receipt of the messages. A checked box indicates that the associated group will receive the messages

4.4.2.15 Options available in the User Screen Editor

The ‘freeform’ style of the User Screen configuration makes it unsuitable for treatment as GAMP4 category 2 software. If user screens are required, they should be treated as category 4 software.

4.4.3 Safety and Security Issues

4.4.3.1 Security

Access to the above features is available only to users with ‘Full Configuration’ rights.
Access to preset a totaliser during runtime is limited to users with ‘Preset Totaliser’ rights.
Access to preset a counter during runtime is limited to users with ‘Preset Counter’ rights.
Access to start or reset a timer during runtime is limited to users with ‘Start/Reset Timers’ rights.
Access to change a maths constant during runtime is limited to users with ‘Edit Maths Constant’ rights.
Access to batch start/stop and data entry during runtime, is limited to users with ‘Batch Control’ rights.

4.4.3.2 Power off and Restart

The current value of batch data, totalisers, counters, timers and maths functions which have an element of history associated with them (for example: ‘stopwatch’, ‘rolling average’, ‘fValue’) are retained during power off.

4.4.4 Performance Data

Refer to section 6.1 for details of the specification for each I/O type.

4.5 Remote Viewing – 'Bridge 5000'

4.5.1 Objective and Description

This feature allows the user to view instrument standard screens, dynamically, on-line, from a remote PC. The feature is an option with 5100V/5180V recorders, but is supplied as standard, to form the Operator Interface, with model 5000B Data acquisition and data logging units.

The 'LITE' option is a view only facility (Not 5000B)
The 'FULL' option allows operator actions (eg alarm acknowledge, batch stop/start, operator messages, operator notes, archiving management, reset totalisers, disable/enable maths functions, signing, etc) and configuration changes as if from the recorder front panel

The 'look and feel' of the interface is identical to that of a recorder front panel. Menu functions and navigation buttons are the same as from the front panel and are protected by the security setup in the instrument itself. The only function not available to 'full' bridge 5000 is the file explorer (save and restore are from the PC disk only). The ability to view and interact with the file system devices (internal flash, removable media) will be the subject of a future phase of work.

Bridge 5000 main features are as follows:

- Up to 4 clients can be connected simultaneously to a single 5000 series instrument.
- All clients operate independently of one another
- The connection between the client and the 5000 series requires only that the TCP/IP protocol be running over it. This means that it could be anything from a direct cable connection, to an Internet connection.
- A workstation can look at multiple 5000 instruments. It does this by invoking multiple remote viewers.

4.5.2 Configuration Options Available

In order to connect successfully, the Bridge 5000 package needs the following configuration details to be entered:

Host Name	Must match the Local Host name from the Network / Name configuration (or the IP address from the Network/Address area if no DNS server is associated with the system).
User Name	Must match the Remote User Name for a valid user (from Security/Access configuration)
Password Required	If password entry is not required, disable the tick box (goes blank), then press 'Start' to start running the program. If a password entry is required, ensure that the password required tick box is enabled (tick visible). Press 'Start', then enter the password (as entered in the Security / Access / Remote User Name / Remote password field), followed by carriage return to start running the program.

All other configuration details are taken directly from the unit's configuration.

4.5.3 Safety and Security Issues

4.5.3.1 Security

Security for network access is controlled, in the same manner as for local access, via the Security/Access setup. Remote access can be permitted or denied for each account individually. The mechanism used for remote logon follows the same model as an FTP client:

The user enters a username and optionally a password (the user can nominate to have no password) that is sent to the 5000 series (server) when the client first attempts to connect. If those security details match one of the entries in the list of accounts, the security check passes and the client proceeds in its connection and setup with the server. If it fails a dialog box is displayed describing the failure, offering the user the opportunity to re-connect.

The user's password is not stored and must be entered on every start up. If the user does not supply a password and the server requires one for that account then authentication fails.

In other words the remote viewer uses the FTP server as its authentication service. Therefore all the security features available from the instrument are employed when a remote viewer attempts to connect.

4.5.3.2 Power off and Restart

Removing power from the instrument is equivalent to a network failure as far as the client PC is concerned.

4.5.3.3 Network Failure

Any product connected in a network can suffer from network infrastructure failures. The following lists some of the failures that can occur

1) Network connection failures
2) Invalid remote viewer and/or product network configuration
3) Transient Network disruption (The physical link is broken, the server is busy, the server is switched off / power failure)

In cases (1) and (2) the user is presented with a dialog describing the nature of the problem. Case (3) is only announced to the user if it results in data loss.

In all cases the remote viewer automatically re-connects when the network is restored. The rate for retries is limited such that it does not adversely affect the performance of the network as a whole.

4.5.3.4 Locale Compatibility

When the remote viewer is running it uses the locale settings of the instrument that it is connected to, not the PC it is running on.

4.5.4 Performance Data

None applicable to this functionality - refer to section 6.3 for specifications relating to the network interface.

4.6 Remote Configuration – 'Series 5000 Configuration Editor'

4.6.1 Objective and Description

The Series 5000 Configuration Editor allows 5000 series configurations to be created or modified off-line. The configurations can then be saved and loaded onto the instrument either through a remote file transfer or (for recorders only) via the floppy disk / PC card.

4.6.2 Configuration Options Available

Configuration options are as described in sections 4.1 to 4.4 above except that clock and locale functions are not available.

4.6.3 Safety and Security Issues

4.6.3.1 Security

Security for offline configuration is controlled, in the same manner as for local access, via the Security/Access set-up in the configuration file.

The off-line configuration utility can be used in place of real-time on-line configuration though the configuration audit trail (Auditor option) is available only for modifications made from the front panel (recorders only) or over Bridge 5000. If a configuration is modified off-line and re-loaded then only the 'restore' will appear in the audit trail.

It is therefore recommended that changes to 5000 series instruments in pharmaceutical applications should be from the front panel or from the 'FULL' bridge package.

4.6.4 Performance Data

Refer to section 6.3 for details of the applicable network standards and the required PC specification.

4.7 Off-Line Data Review – 'Review'

4.7.1 Objective and Description

The Review Software package allows the display and printing of archive data files from 5000 series instruments. Archive files can be brought into the Review database by transfer from floppy disk / PC card (recorders only) or can be transferred directly from a connected instrument in the Instrument File Services view. For on-line data transfers, it is possible to automate the backup / transfer of data either on a timed basis or on a 'transfer when new file detected' basis. A facility to auto print on end of batch is also provided (print is triggered when end of batch is detected during an automatic or manual transfer of data).

Within the Review database, data is stored by instrument tag, log group name and point identifier. Data from multiple archive files from the same log group and instrument are stored together in the database so that data can be viewed across files. Batch names may be associated with data from individual files. The batch name is automatically picked up from the file if 'store files by batch' is selected and otherwise defaults to the eight character file name, but may be entered manually during the transfer if required.

Data is viewed and printed using Charts. A Chart is a definition of a set of points along with a variety of setup options such as the number of grid divisions. Data from a chart can also be exported in tabular form for transfer to a document or spreadsheet.

4.7.2 Configuration Options Available

4.7.2.1 Instrument Setup Options

The following configuration parameters are available to allow connection to an instrument using the TCP/IP protocol:

Identifier	The name by which the instrument will be identified in Review - the same as the tag configured in the instrument.
TCP/IP Address or Host Name	The TCP/IP address of the instrument or the name by which it is known on the network (must match instrument setup under 'Network')
Transaction logging to file...	Log communications activity to the file Comm.log in the same folder as your database.
Use proxy for FTP	Use the proxy server specified in the Internet Properties dialog (in the PC Control Panel).
Use Passive FTP	Use passive FTP protocol for file transfers.

Review also permits connection to instruments using a serial link but this is not relevant for 5000 series instruments.

4.7.2.2 File Transfer Options

When transferring data from a history file to the Review database, the following configuration parameters are available. Since these parameters are used within the database to link history file information related to the same instrument it is important that they are entered correctly.

Instrument Tag	The instrument tag in the history file (as set up in the instrument 'Configure / Instrument' dialogue)
Batch Number	This reads the batch number from the history file if the batching option 'Name files by batch' is selected.

4.7.2.3 Automatic Backup / File Transfer Options

The following parameters are available when setting up automatic backup / file transfer:.

Instrument Username and Password	Define the user account to log on as for the transfer
Backup Enabled	Enables the auto backup of files from the instrument to the PC.
Files to Back Up	Defines which files are to be copied from the instrument (choice of 'Archive', 'Non-Archive' or 'All').
Destination	Defines where in the PC directory structure files should be copied to.
Archiving On During Backup	(automatically selected to 'Yes' to avoid possible data loss) .
Delete Files from Instrument after Backup	(automatically selected to 'No') .
Transfer Enabled	Enables the auto transfer of backup files to the Review database.
Files to also Transfer to the Database	Defines a filter to select those files which should also be transferred to the Review database. DOS filename wildcard characters can be used ('*' for any number of characters, '?' for a single character) and multiple entries can be separated by semi-colons.
Tag	Instrument tag under which files are stored in the database (defaults to that set up in the instrument 'Configure / Instrument' dialogue)
Next Run	Specifies month, day, time of day for the next backup (automatically updated each time an auto backup occurs)
Repeat Every	Specifies frequency of auto backup
Also Run Immediately New File Detected	Allows auto backup each time a new file is created by the instrument (eg start of new batch).
Transfer Now	Allows manual initiation of backup/transfer using the parameters set (for example to test for correct operation)

4.7.2.4 Chart Setup Options

When setting up a chart to display data from the Review database, the following are available:

Grid Major Divisions	Defines the number of major divisions shown on the chart display grid
Grid Minor Divisions	Defines the number of minor divisions shown on the chart display grid
Show Messages	Allows chart messages (alarms, acknowledges, batch start/stop) to be displayed on the Review chart.

When adding a pen to a chart, this is done by selecting from the available data in the Review database as follows:

Instrument	Pull-down list allows selection from those instruments for which data is available – by instrument tag as defined in file transfer options above.
Log Group	Pull-down list of the groups available on the selected instrument – by group descriptor as set in the instrument 'Configs / Groups' dialogue.
Point ID	Pull-down list of the tags available on the selected group – by channel descriptor as set in the instrument 'Configs / Channels' dialogue

4.7.2.5 Point Properties Options

Once a point has been added to a chart, the following display options are available. Note that only the current chart is affected - the database itself is not modified.

Tag	Automatically generated from the Point ID and trace mode entered
Descriptor	A point descriptor of up to 20 characters may be entered.
Span Low and Span High	These values specify the range in engineering units to which the trend line will be scaled. Span Low may be greater than Span High in which case the scale is reversed
Zone Low and Zone High	These values specify the region of the chart that is to be used to display the trend line. For example values of 50% and 100% would display it in the upper half of the chart.
Colour	This allows the selection of trend line colour.
Logarithmic Scale	When this box is checked the trend will show the Log base 10 value of each sample, on a scale of Log10(Span Low) to Log10(Span High).
Trace Mode	This allows a variety of options in the situations where either the chart is expanded so that the display is at a higher resolution than the database (for example data acquired at one minute intervals with the chart at one pixel per second), or where the database contains multiple values for a single pixel on the screen (for example data acquired at one minute intervals, with the chart compressed to one hour per pixel) as follows:
Normal Mode	In this case the value displayed is always that of the sample at or immediately prior to the time shown on the chart.
Average Mode	If the database contains multiple values for each pixel on the screen then the value shown is determined by taking the average of all the samples covered by the pixel.
Minimum Mode	If the database contains multiple values for each pixel on the screen then the value shown is determined by taking the minimum value of all the samples covered by the pixel.
Maximum Mode	If the database contains multiple values for each pixel on the screen then the value shown is determined by taking the maximum value of all the samples covered by the pixel.
Interpolation On	If the chart is displayed at a higher resolution than the data then the value shown is determined by interpolating between adjacent samples in the database

It is possible to have a point in a chart multiple times. For example a point could be included twice, once with Maximum mode and once with Minimum mode. In this case two trend lines will be drawn, one for each case. The two lines can be configured with different colours and descriptors as described above.

4.7.3 Safety and Security Issues

4.7.3.1 Security

Security for network access is controlled, in the same manner as for local access, via the Security/Access set-up. Remote access can be permitted or denied for each account individually. The mechanism used for remote logon is as described for Bridge5000 in section 4.5.3 above. The remote viewer uses the FTP server as its authentication service. Therefore all the security features available from the instrument are employed when Review attempts to connect.

For each login, the user enters a username and password that is sent to the 5000 series (server) when the client first attempts to connect. If those security details match one of the entries in the list of accounts, the security check passes and the client proceeds in its connection and setup with the server. If it fails a dialog box is displayed describing the failure. If the failure to connect is part of an automatic backup (using stored username and password) then an error message is logged and the automatic backup aborts until the next scheduled time.

Data files are in a packed binary format, preventing ‘after the event’ modification by any ordinary user. Use and archival of data files, once they leave the instrument, need to be procedurally controlled. It is recommended that, for applications where control of electronic records is vital, the original data files should be archived rather than their first being imported into Review and then the Review database being archived.

Instrument names are set up in the instrument configuration(s) to ensure that the default can be used when transferring a file into Review – hence minimising the potential for erroneous naming. ‘Name files by batch’ is selected where appropriate so that the batch details are automatically associated with the data in Review.

The Review database itself is protected by password (hard coded into the package and not available, for example, in the Windows NT registry) to prevent direct access to records by the users.

4.7.3.2 Power off and Restart

Removing power from the instrument is equivalent to a network failure as far as the client PC is concerned.

4.7.3.3 Network Failure

On network failure a dialog box is displayed describing the failure (if the failure occurs as part of a manual operation) or an error message is logged (if the failure occurs as part of an automatic backup). Review attempts to re-connect at next scheduled transfer time or at the next operator request.

4.7.3.4 Locale Compatibility

The package is designed to cope with the locale's setting on PC not matching that on the instrument. Since timestamps for data are passed in UTC and displayed in the time zone of the instrument, data is always time-stamped correctly.

4.7.4 Performance Data

The Review database is limited to 1Gbyte file size. Since, in a pharmaceutical application, it is normal for the original data files to be archived rather than the Review database, this does not impose a limitation since data files can be removed and re-imported as desired.

There is a further limitation to 127 points in any log group for file import. This is not relevant to 5000 series instruments as they contain a maximum of 96 points.

4.8 Remote File Transfer

4.8.1 Objective and Description

5000 series instruments allow files to be accessed remotely using the File Transfer Protocol (FTP).

4.8.2 Configuration Options Available

In order to view files, the instrument's address, the 'Remote user name' and the 'Remote password' must be supplied to an FTP client such as Review or Microsoft® Internet Explorer

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

- ftp://<instrument IP address>. This allows the user to log in as the anonymous user (if the instrument has any account with 'Remote user name' set to 'Anonymous' and a blank password).
- ftp://<user name>:<password>@<instrument IP address> to log in as a specific user.

4.8.3 Safety and Security Issues

4.8.3.1 Security

The anonymous FTP access will not accept uploads from users.

4.8.4 Performance Data

None applicable to this functionality.

5 DATA

5.1 Data Definition

The basic items of 5000 Series data are timestamped data values and timestamped messages. Values are sampled from the I/O channels at a rate of 8 samples/second. Timestamps are UTC, viewed according to the ‘locale’ and ‘country’ selected under the ‘system’ configuration.

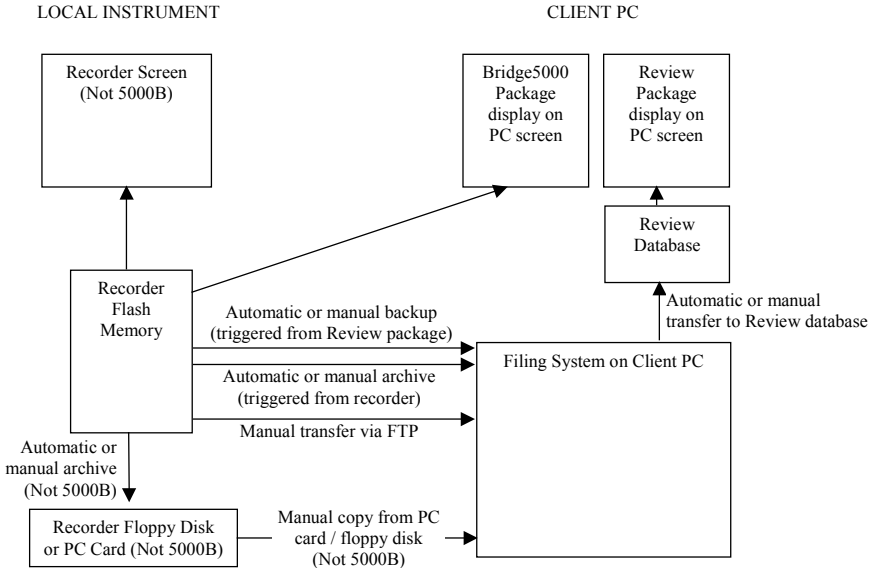
Data values for an individual channel are grouped and can be allocated a point ID in the unit’s configuration.

Channels and messages are allocated to groups in which they are viewed on the operator interface and archived. The display update is 1 second and the value displayed is the most recent sample. The archive rate is user defined and the value archived is the most recent sample.

A history file (sometimes called a UHH file, because of the '.uhh' file extension) contains recorded data for a period of time for one recording 'group'. As well as periodic data samples for the channels (each consisting of a timestamp plus one set of values per channel for normal recording or two for adaptive recording) this also includes messages and alarm status information. When batching is in use, information about this will also be present, e.g. the times at which batches were started and/or stopped, and textual information associated with the batch. For efficiency of memory usage (as well as to make it tamper-proof) the data is held in a compressed binary format. The format of the file is not published.

Note that when archive data is transferred to Review, different groupings of channels can also be set up on charts as required. If the Batch option is purchased, the Review package allows a ‘Goto Batch’ function as well as the ‘Goto Time’ which is normally available.

5.2 Data Access



5.2.1 Local Data viewing

Data is available at the operator interface in the groups defined in the instrument's configuration. The standard screens which can be selected in the configuration are vertical trend, horizontal trend, vertical bargraph, horizontal bargraph and numeric. If the Circular Trend option is fitted, Vertical Bargraph mode is replaced by Circular Chart mode.

A user display option is available but requires separate documentation as it constitutes a configurable (GAMP4 category 4) item.

5.2.2 Remote data viewing

The Bridge 5000 feature allows users (subject to appropriate access levels defined in the instrument) to view standard screens, dynamically, on-line, from a remote PC.

5.2.3 Remote file access

There are a number of ways to access history files / data from Review on a remote PC:

1) Manually copy recorder archive files from PC card or floppy disk to the PC filing system then use the Review package to transfer the data into the Review database for viewing / printing.
2) Manually copy archive files from flash memory to the PC filing system using the File Transfer Protocol (FTP) from an FTP client such as Microsoft® Internet Explorer. Then use the Review package to transfer the data into the Review database for viewing / printing.
3) Automatically archive files from flash memory to the PC filing system using the instrument 'Archive' functions (PC must be running FTP server). Then use the Review package to transfer the data into the Review database for viewing / printing.

From Review, automatically or manually copy files and transfer data into the Review database for viewing / printing (note this relies on Review being active on the PC).

5.3 Data Capacity

5.3.1 Retention Time

The instrument uses a dedicated area of its Flash memory as an archive data buffer; data is written to the disk or remote PC only when required, rather than continuously. Archive compression rate can be selected as normal or high compression. 'Normal' compresses the data but still provides an exact copy. 'High' compresses more, but channel values are saved only to 1 part in 10^8 resolution.

The ‘TREND HISTORY DURATION’ under the configure / archive menu gives an on-line estimated time to fill the trend history area of the Flash memory. The calculation is based on the archive rate, the compression ratio, the flash size and on the estimated nature of the data configured for collection. (Rapidly changing values use more space than static/slowly changing values.)

5.3.2 Archive / Restore

5.3.2.1 Manual Archive

A user with appropriate security rights can request a manual archive of data to either local media (for recorders only, a PC card or floppy disk as determined by the hardware options) or to a remote PC using FTP protocol. Data transfer is initiated by touching the relevant key for Bring Archive up to date / Archive Last Hour / Last Day / Last week / Last Month / All to define which files are to be transferred. Archiving starts as soon as the selection is made, and cannot be stopped until completed, unless the Cancel archive key is operated, in which case the archive will be stopped after a confirmatory message has been responded to.

For recorders, if the disk becomes full before archiving is complete, archiving will pause and a pop-up request appears, asking for the disk to be replaced. If this request is not responded to within 10 minutes of its appearance, archiving is aborted.

Archiving can be paused by the user (e.g. to change disks without losing data) using the 'Suspend Archiving' button. Transfer activity is indicated in the 'Archive transfer' window.

5.3.2.2 Automatic Archive

Graphic recorders can be set to archive either locally (to PC card or floppy disk as determined by the hardware options) or remotely to a folder or directory on a remote host, set up as a part of that host's FTP configuration. 5000B units always archive to the PC's filing system.

For local archive, the 'DISK ARCHIVE CAPACITY' under the configure / archive menu gives an on-line estimated time to fill the storage medium. The calculation is based on the archive rate, the compression ratio, the flash size and on the estimated nature of the data configured for collection. (Rapidly changing values use more space than static/slowly changing values.) It is also possible to select 'overwrite' or 'stop' as the strategy if the PC card / disk does become full.

Note: Should the unit be in a powered down condition at archive time, archiving will take place as soon as power is subsequently re-applied.

5.3.2.3 Restoring Data

Data is normally restored not to the instrument itself but to the 'Review' package as described in section 4.7 above.

5.4 Electronic Records

The method of compliance with the 21 CFR part 11 Electronic Signatures provisions is as follows:

5.4.1 Sub Part B – Electronic Records - 11.10 Controls for closed systems

Sub Part B – Electronic Records	
11.10 Controls for closed systems	
(a) Validation of systems to ensure accuracy, reliability, consistent intended performance, and the ability to discern invalid or altered records	Eurotherm offer assistance in validating products to GAMP guidelines. Recorded files are in binary, compressed and check-summed format proprietary to Eurotherm. Details are not published.
(b) The ability to generate accurate and complete copies of records in both human readable and electronic form suitable for inspection, review, and copying by the agency. Persons should contact the agency if there are any questions regarding the ability of the agency to perform such review and copying of the electronic records.	Complete and accurate copies on screen or printed out are available through the use of the Review package Complete and accurate electronic copies are available by copying the raw data files or by setting up a 'pdf printer' (requires adobe acrobat or similar) in order to export graphs in pdf format.
(c) Protection of records to enable their accurate and ready retrieval throughout the records retention period.	Files are held internally in Flash then archived to Removable media and/or via a network to an FTP server. Data can also be periodically pulled from the product using Review. Once data has left the instrument, its storage and backup strategy are the responsibility of the user
(d) Limiting system access to authorized individuals.	Individual password protected user accounts must be set up in the security configurator.
(e) Use of secure, computer-generated, time-stamped audit trails to independently record the date and time of operator entries and actions that create, modify, or delete electronic records. Record changes shall not obscure previously recorded information. Such audit trail documentation shall be retained for a period at least as long as that required for the subject electronic records and shall be available for agency review and copying.	Auditor option must be enabled with 'record logins' and 'enable audit trail' checked. Secure (embedded in the binary history file), computer generated, timestamped runtime audit trail of batch stop/start, alarm acknowledgements, logins, signature details, configuration changes Record changes do not obscure previous data Audit trail is embedded in the history file so guaranteeing retention alongside the records and availability for review / copying.

(f) Use of operational system checks to enforce permitted sequencing of steps and events, as appropriate.	Interlocks can be achieved using the product configuration and relay outputs. The specifics are down to configuration.
(g) Use of authority checks to ensure that only authorized individuals can use the system, electronically sign a record, access the operation or computer system input or output device, alter a record, or perform the operation at hand.	Individual password protected user accounts must be set up in the security configurator. Each user can have a unique set of Access permissions or privileges to customize what that user may do to the product.
(h) Use of device (e.g., terminal) checks to determine, as appropriate, the validity of the source of data input or operational instruction.	Instrument alarms and input channel status are logged Individual accounts can have remote access disabled in order to force changes to be made at the instrument (not 5000B).
(i) Determination that persons who develop, maintain, or use electronic record/ electronic signature systems have the education, training, and experience to perform their assigned tasks.	Procedural
(i) The establishment of, and adherence to, written policies that hold individuals accountable and responsible for actions initiated under their electronic signatures, in order to deter record and signature falsification.	Procedural
(k) Use of appropriate controls over systems documentation including: (1) Adequate controls over the distribution of, access to, and use of documentation for system operation and maintenance. (2) Revision and change control procedures to maintain an audit trail that documents time-sequenced development and modification of systems documentation.	Procedural

5.4.2 Sub Part B – Electronic Records - 11.30 Controls for open systems

11.30 Controls for open systems	
Persons who use open systems to create, modify, maintain, or transmit electronic records shall employ procedures and controls designed to ensure the authenticity, integrity, and, as appropriate, the confidentiality of electronic records from the point of their creation to the point of their receipt. Such procedures and controls shall include those identified in Sec. 11.10, as appropriate, and additional measures such as document encryption and use of appropriate digital signature standards to ensure, as necessary under the circumstances, record authenticity, integrity, and confidentiality	The product is targeted at use in closed systems. However, data stored is encrypted and passwords can be configured for use on all remote access. With appropriate external systems/procedures the product may be used in an open system.

5.4.3 Sub Part B – Electronic Records - 11.50 Signature Manifestations

11.50 Signature Manifestations	
(a) Signed electronic records shall contain information associated with the signing that clearly indicates all of the following: (1) The printed name of the signer; (2) The date and time when the signature was executed; and (3) The meaning (such as review, approval, responsibility, or authorship) associated with the signature.	Signed records contain printed name (ID), date and time, meaning. Meaning includes signed / authorised plus an automatically generated type (eg ‘config’ for a configuration change) plus an operator entered note.
(b) The items identified in paragraphs (a)(1), (a)(2), and (a)(3) of this section shall be subject to the same controls as for electronic records and shall be included as part of any human readable form of the electronic record (such as electronic display or printout).	Name (ID), timestamp and meaning are all embedded in the binary format history file.

5.4.4 Sub Part B – Electronic Records - 11.70 Signature / Record Linking

11.70 Signature / Record Linking	
Electronic signatures and handwritten signatures executed to electronic records shall be linked to their respective electronic records to ensure that the signatures cannot be excised, copied, or otherwise transferred to falsify an electronic record by ordinary means.	Signature manifestation is embedded in the binary format history file. For hybrid systems, prints created via Review for handwritten signature will always contain timestamp details which permit re-creation from the original data.

5.5 Electronic Signatures

If 'Require Signing' is enabled then signature is required for:

- start/stop batch,
- alarm acknowledge,
- adding an operator note,
- performing an input adjust,
- online timer / counter / totaliser / maths function reset,
- online modification to alarm setpoints or maths constants,
- setting the clock,
- restoring a database,
- all configuration changes.

The method of compliance with the 21 CFR part 11 Electronic Signatures provisions is as follows:

5.5.1 Sub Part C – Electronic Signatures - 11.100 General Requirements

Sub Part C – Electronic Signatures	
11.100 General requirements	
(a) Each electronic signature shall be unique to one individual and shall not be reused by, or reassigned to, anyone else.	The product ensures that no two user accounts have the same username. To ensure that a username is not reused it must NOT be deleted, just disabled, this will prevent the account being reused.
(b) Before an organization establishes, assigns, certifies, or otherwise sanctions an individual's electronic signature, or any element of such electronic signature, the organization shall verify the identity of the individual.	Procedural

(c) Persons using electronic signatures shall, prior to or at the time of such use, certify to the agency that the electronic signatures in their system, used on or after August 20, 1997, are intended to be the legally binding equivalent of traditional handwritten signatures. (1)The certification shall be submitted in paper form and signed with a traditional handwritten signature, to the Office of Regional Operations (HFC-100), 5600 Fishers Lane, Rockville, MD 20857. (2)Persons using electronic signatures shall, upon agency request, provide additional certification or testimony that a specific electronic signature is the legally binding equivalent of the signer's handwritten signature.	Procedural

5.5.2 Sub Part C – Electronic Signatures - 11.200 Electronic signature components and controls

11.200 Electronic signature components and controls	
(a) Electronic signatures that are not based upon biometrics shall:	
(1) Employ at least two distinct identification components such as an identification code and password. (i)When an individual executes a series of signings during a single, continuous period of controlled system access, the first signing shall be executed using all electronic signature components; subsequent signings shall be executed using at least one electronic signature component that is only executable by, and designed to be used only by, the individual. (ii)When an individual executes one or more signings not performed during a single, continuous period of controlled system access, each signing shall be executed using all of the electronic signature components.	Requires re-entry of userID and password during a signing. Both components will be required for all signings

(2) Be used only by their genuine owners; and	No read access to passwords is provided. Users should be set with 'Edit Own Password' rights. The 'Login Timeout' should be set so that logins time out after a set period of inactivity. The 'With Unapplied Changes' option should be set to 'Discard Changes' so that any unapplied changes are discarded on logout. The 'Password Retries' should be set to '3 times' to limit the number of login retries before an account is disabled. The 'Minimum Password Length' should be set. The 'Passwords Expire' should be set to force password expiry after a set number of days.
(3) Be administered and executed to ensure that attempted use of an individual's electronic signature by anyone other than its genuine owner requires collaboration of two or more individuals.	Users can change their own passwords and no read access to passwords is provided. Therefore, unless one user tells another his/her password, it is impossible to commit fraud without an audit trail of that fraud being evident. With signatures enabled, it is possible to create a 'security manager' access level as the only level with full security access. If users of this type have no 'sign' privilege then a second individual is required to sign acceptance of any changes.
(b) Electronic signatures based upon biometrics shall be designed to ensure that they cannot be used by anyone other than their genuine owners.	Not applicable.

5.5.3 Sub Part C – Electronic Signatures - 11.300 Controls for identification codes/passwords

11.300 Controls for identification codes/passwords	
Persons who use electronic signatures based upon use of identification codes in combination with passwords shall employ controls to ensure their security and integrity. Such controls shall include:	
(a) Maintaining the uniqueness of each combined identification code and password, such that no two individuals have the same combination of identification code and password.	Providing user accounts are not deleted then all user names are forced to be unique.
(b) Ensuring that identification code and password issuances are periodically checked, recalled, or revised (e.g., to cover such events as password aging).	The 'Passwords Expire' should be set to force password expiry after a set number of days. If a user leaves, the relevant account can be disabled.
(c) Following loss management procedures to electronically deauthorize lost, stolen, missing, or otherwise potentially compromised tokens, cards, and other devices that bear or generate identification code or password information, and to issue temporary or permanent replacements using suitable, rigorous controls.	Procedural – Compromised accounts can be disabled. On loss of password, the administrator may set a new password for an account which the account holder should then immediately replace by a password of his/her own.
(d) Use of transaction safeguards to prevent unauthorized use of passwords and/or identification codes, and to detect and report in an immediate and urgent manner any attempts at their unauthorized use to the system security unit, and, as appropriate, to organizational management.	The 'Password Retries' should be set to '3 times' to limit the number of login retries before an account is disabled.
(e) Initial and periodic testing of devices, such as tokens or cards, that bear or generate identification code or password information to ensure that they function properly and have not been altered in an unauthorized manner.	Procedural

6 INTERFACES

6.1 I/O Interfaces

This section describes the hardware interface and specifications for the various input and output types available. Configurable functionality is described in section 4.4 above.

6.1.1 Update Information

Input / relay output sample rate	8 Hz
Display update	1 Hz maximum
Archive sample value	Latest value at archive time (Max and min values during archive sample period if adaptive recording enabled)
Trended / displayed value	Latest value at display update time (Max and min values during display update period if adaptive recording enabled)

6.1.2 General Technical Specification (Universal Input Board)

Termination	Edge connector/terminal block
Max. number of inputs (5000B/5100V)	12 (two 6-input boards)
Max. number of inputs (5180V)	48 (six 6-input boards)
Input ranges (5100V/5180V)	-8 to +38mV; -30 to +150mV; -0.2 to +1Volt; -2 to + 10Volts
Input ranges (5000B)	± 38mV; ± 150mV; ± 1Volt; ± 10Volts
Input types	DC volts, dc millivolts, dc milliamps, (with external shunt), thermocouple, 2/3 wire resistance temperature detector(RTD), Ohms, Contact closure (not channels 1,7,13,19,25,31,37,43 if fitted) (Minimum contact closure = 60msec.)
Input type mix	Freely configurable
Sample rate	Input/relay output sample rate: 8 Hz.
Noise rejection (48 to 62Hz) Common mode	>140dB (Channel to channel and channel to ground)
Noise rejection (48 to 62Hz) Series mode	>60dB
Maximum common mode voltage	250Volts continuous
Maximum series mode voltage	45mV at lowest range; 12Volts peak at highest range
Isolation (dc to 65Hz; BS EN61010)	Installation category II; Pollution degree 2 300V RMS or dc channel to channel (double isolation), channel to common electronics (double isolation) and channel to ground (basic isolation)
Dielectric strength Channel to ground	1350Vac for 1 minute.
Dielectric strength Channel to channel	2300Vac for 1 minute
Insulation resistance	>10MOhm at 500V dc
Input impedance 10V range	68.8kOhm
Input impedance Other ranges	>10MOhm
Overvoltage protection	50V peak (150V with attenuator)
Open circuit detection Recognition time Minimum break resistance	± 57nA max 500mSec 10MOhm

6.1.3 DC input ranges

Range	Resolution	Maximum error (Instrument at 20 C)	Worst case temperature performance
± 38mV	1.4 µV	0.085% input + 0.073% range	80ppm of input per deg C
± 150mV	5.5 µV	0.084% input + 0.053% range	80ppm of input per deg C
± 1V	37 µV	0.084% input + 0.037% range	80ppm of input per deg C
± 10 V	370 µV	0.275% input + 0.040% range	272ppm of input per deg C

Note that for mA inputs an externally mounted resistor module is required. Additional error due to shunt is 0.1% of input

6.1.4 Resistance inputs

Low Range	High Range	Resolution	Maximum error (Instrument at 20 C)	Worst case temperature performance
0 ohm	150 ohm	5 mOhm	0.045% input + 0.110% range	35ppm of input per deg C
0 ohm	600 ohm	22 mOhm	0.045% input + 0.065% range	35ppm of input per deg C
0 ohm	6 kOhm	148 mOhm	0.049% input + 0.035% range	35ppm of input per deg C

RTD type	Overall range (deg C)	Standard	Max.linearisation error
Cu10	-20 to + 400	General Electric Co.	0.02 C
Cu53	-70 to + 200	RC21-4-1996	0.01 C
JPT100	-220 to + 630	JIS C1604:1989	0.01 C
Ni100	-60 to + 250	DIN43760:1987	0.01 C
Ni120	-50 to + 170	DIN43760:1987	0.01 C
Pt100	-200 to + 850	IEC751	0.01 C
Pt100A	-200 to + 600	Eurotherm Recorders SA	0.09 C
Pt1000	-200 to + 850	IEC751	0.01 C

Temperature scale ITS90
Values exclude influence of lead resistance
Influence of lead resistance Error: Negligible, Mismatch: 1ohm/ohm

6.1.5 Thermocouple data

TC type	Overall range (deg C)	Standard	Max.linearisation error (degC)
B	0 to + 1820	IEC584.1	0 to 400 C = 1.7 400 to + 1820 = 0.03
C	0 to + 2300	Hoskins	0.12
D	0 to + 2495	Hoskins	0.08
E	-270 to + 1000	IEC584.1	0.03
G2	0 to + 2315	Hoskins	0.07
J	-210 to + 1200	IEC584.1	0.02
K	-270 to + 1372	IEC584.1	0.04
L	-200 to +900	DIN43700:1985 (To IPTS68)	0.02
N	-270 to +1300	IEC584.1	0.04
R	-50 to +1768	IEC584.1	0.04
S	-50 to +1768	IEC584.1	0.04
T	-270 to +400	IEC584.1	0.02
U	-200 to + 600	DIN43710:1985	0.08
NiMo/NiCo	-50 to +1410	ASTM E1751-95	0.06
Platinel	0 to +1370	Engelhard	0.02
NiNiMo	0 to +1406	Ipsen	0.14
Pt20%Rh /Pt40%Rh	0 to +1888	ASTM E1751-95	0.07

Temperature scale ITS90
Bias current 0.05nA
Cold junction types Off, internal, external, (Remote CJ not currently implemented)
CJ error 1°C max with instrument at 25°C
CJ rejection ratio 50:1 minimum
Remote CJ via any user-defined input channel (Remote CJ not currently implemented)
Upscale/downscale drive Types: 'High'. 'low' or 'none' selectable for each channel.
Additional error: Typically 0.01°C - depends on wiring. (Detect current = 57nA.)

6.1.6 Contact Closure Inputs

(not available on channels 1,7,13,19,25,31,37,43 if fitted).

Minimum contact closure = 60msec

6.1.7 Relay Outputs

Maximum number of relay boards

5100V 4 (maximum no. of relay outputs = 12)
5180V 9 (maximum no. of relay outputs = 27)
5000B 1 relay (standard) + 2 relay option boards = 7 max.

Number of relays per board

5000B standard: One
Changeover option board: Three

Estimated mechanical life	30,000,000 operations
Maximum switching power	500VA or 60W
Maximum contact voltage	250V providing this does not cause the maximum switching power to be exceeded
Maximum contact current	2 Amps providing this does not cause the maximum switching power to be exceeded

Safety isolation

Isolation (dc to 65 Hz; BS EN61010)	Installation category II; Pollution degree 2
Relay to relay	300V RMS or dc (double insulation)
Relay to ground	300V RMS or dc (basic insulation)

All figures given are for resistive loads. For reactive or inductive loads, de-rate in accordance with manufacturer's data sheets.

Note: For the model 5000B, option boards are physically located in the same slot that input board two would occupy, if fitted. Thus, if relay or other option boards are fitted, the number of input boards that can be fitted is limited to one (i.e. the maximum number of input channels is 6 if any hardware options are fitted). No such restriction applies to the 5100V/5180V recorders.

6.1.8 Transmitter power supply (Isolated) (OPTION – Model 5100V only)

Number of outputs	Three
Output voltage	25V nominal
Max. current	20mA per output
Isolation (dc to 65Hz BS EN61010)	Installation category II; Pollution degree 2.
Channel to channel:	100V RMS or dc (double insulation)
Channel to ground:	100V RMS or dc (basic insulation).

6.2 Operator Interface

This section describes the standard functionality of the operator interface. Configurable functionality is described in section 4 above.

6.2.1 Status display

This appears across the top of the display, and contains the following items:

Current User	User ID of the currently logged in user.
Page/batch details	Current page name (eg 'login' for login display) or group name (if a trend / bargraph / numeric display is selected) If the Batch option is fitted then the first line of batch information (usually the batch number) is displayed. Touching this area calls the batch status page from which batches can be stopped and started (subject to user security access)
Error/alarm indicators	May contain any of the following icons: **Instrument alarm** - appears, flashing, if any instrument alarms are active. The view messages page shows any active alarms (eg Archive failed, Clock failure, Channel failure, Network connection has timed out) **Channel alarm** - red 'bell' indicator appears if any channel is in alarm. The symbol is illuminated continuously if all alarms are acknowledged or flashes if any active alarm is unacknowledged., To acknowledge all unacknowledged alarms, the flashing indicator is touched, and the 'Ack all Alarms' key in the resulting 'pop-up' page is touched. To view current alarms, the flashing indicator is touched, and the Alarm Summary' key in the resulting 'pop-up' page is touched. **Battery change** - This flashing indicator first appears when the battery voltage indicates that the battery is approaching the end of its useful life. The indicator continues to flash until the battery is replaced **Disk status** - shows the free space available on the mass storage medium (disk or data card as fitted). The disk icon appears soon after a disk or data card is inserted. Only archiving activity is indicated; during archiving, the central area of the disk icon flashes green, regularly. No other disk activity is indicated.
Date/Time	Normally indicates current system date and time. When the instrument is 'busy', however, the date is masked by an animated display of a sequence of coloured boxes. Though normally pale blue, these boxes are gold in colour if the instrument is 'locked' because another client is currently updating the configuration via the Remote Viewer option.

6.2.2 Navigation

Along the lower edge of the display screen are six keys (as listed below) which allow the user to perform various context-related tasks such as to change the display mode, to access the instrument configuration, to archive data etc. In addition to this, left and right arrow keys or open/close folder keys appear where relevant.

Page up	Used, as appropriate, to recall the previous (higher level) display page, to call the previous display mode and to scroll through previous text entries. Where relevant, the function of this key is mimicked by the 'Close folder' key
Page down	Used, where appropriate, to call a further (lower level) display page, to call the next display mode (as for Cycle' below) and to scroll through previous text entries. Where relevant, the function of this key is mimicked by the 'Open folder' key
Left arrow	Used to navigate backwards through a text string, when editing. Where relevant, the function of this key is mimicked by the 'Left cursor' key
Right arrow	Used to navigate forwards through a text string, when editing. Where relevant, the function of this key is mimicked by the ‘Right Cursor' key
Option	Used for a number of functions depending on the context. For example, entering or exiting trend Review mode, or calling the filer option pop-up.
Root	Calls the 'Root Menu'. To quit the Root menu, touch the root key again

Calling the ‘Root Menu’ gives access to the following on-screen softkeys:

Home	Causes a return to the configured 'Home' page.
Operator	Causes the top level Operator menu to appear. The appearance of this display is dictated by the by the access level of the user. It contains those softkeys from: Archive, Save/Restore, Config, Security, Network, System which are permitted to the current user. These keys in turn give access to submenus containing those options available to the user.
File	Allows the file system in that area of Flash memory that is accessible to the user, and the file system on any floppy disk or data card fitted to be viewed
Goto View	Allows a view (eg vertical trend) to be selected from those enabled for the group.
Go To Group	Allows a group to be selected for display

6.2.2 Navigation (Cont.)

Calling the 'Option Menu' gives access to functions dependent on the current display mode. From a typical trend / bargraph page the following on-screen softkeys are offered:

Batch	Calls up the batch control screen
Note	Calls up the note entry screen which allows a user to enter a note of up to 60 characters which is then logged (with userID and timestamp) to the log file of the currently displayed group.
Face-plates on/off	Toggles faceplate display on and off on right hand side of screen (vertical trend display)
Channel Cycling on/off	Toggles on/off the cycling through each channel in the group which displays each in turn as the 'current channel' for 10 seconds (vertical and horizontal trend displays)
Enter /Exit History	Enters / Exits History mode

6.2.3 Instrument Alarm Summary

The instrument alarm summary display is accessed by touching the alarm area on the status bar and selecting 'Instrument Alarm Summary' on the pop-up which is displayed.

The instrument alarm summary display provides a list of currently active instrument alarms. For error messages see section 7.2.

6.2.4 Alarm Summary display and Alarm Acknowledgement

The alarm summary display is accessed by touching the alarm area on the status bar and selecting 'Alarm Summary' on the pop-up which is displayed. A 'Goto Group' pop-up is then displayed, allowing the alarm summary for the desired group to be selected. The alarm summary can also be accessed from the 'Goto View' button on the root menu.

The alarm summary provides a list of currently active or unacknowledged alarms in channel number order (I/O channels then maths, totalisers and counters).

Each alarm entry gives channel and alarm number, channel descriptor, alarm threshold (absolute alarms only), current process value, alarm type symbol (eg high absolute), The alarm symbol flashes for unacknowledged alarms.

Alarms can be acknowledged individually by touching the appropriate entry on the alarm summary and confirming 'YES' on the pop-up confirmation box which appears.

Alarms can be acknowledged for the whole group by selecting the option menu whilst viewing the group alarm summary and choosing 'Ack Group Alarms'.

Alarms can be globally acknowledged by touching the alarm area on the status bar and selecting 'Ack All Alarms'.

6.2.5 Message Log display

The message log display for a group is accessed from the root menu by selecting ‘goto view’ then ‘message log’. It can also be accessed from the option menu whilst in history mode, in which case the message log is entered at the time/date being viewed in the history.

The message log provides a time/date order list of the following message types:

- System messages (including instrument alarms)
- Alarms
- General messages (includes custom messages)
- Power Up
- Batches
- Logins (when recorded logins are enabled)
- Audit Trail (when audit trail is enabled)
- Signings (when signing is enabled)
- Clock Changes
- Configuration Changes
- Input Adjustments

The filters that can be applied to the message log are selectable from scroll lists at the top of the page. One list enables selection of the type of events/operations that are of interest and the other defines how far to look back in the history for these. Apart from the ‘all’ category the types selectable reflect the categories listed above. The time frames selectable are Last Hour, Last Day, Last Three Days, Last Week, Last Month and All History.

On entry the page defaults to ‘all messages’ for the ‘last hour’. Any changes to these settings are lost on leaving the page.

Entering the Message Log page normally shows messages at the current time. When entering the page from the Trend History page this shows messages for that time in the history.

A ‘goto chart’ feature enables the trend history to be shown at the time corresponding to a particular message. This can be achieved by either holding a finger down on the required message until the history is automatically displayed or after selecting the message, use of a key in the options menu for the page.

Where the full content of the message is not visible, using the option menu ‘Full Details’ enables display of the entire message.

Note: The message log does not update on arrival of new messages, it is necessary to use the ‘Refresh’ option to achieve this.

6.2.6 Batch Control Display

The batch control display (accessible only if the Batch option is installed - from the options menu or by touching the batch area of the status display) is used to stop and start batches and to enter any necessary batch details.

The display shows the group to which it applies (if batch is on a per group basis), the current status (eg 'Batch in Progress') and the current batch details. Operator controls are as follows:

STOP – stops current batch (available only if batching configured as stop/start)
NEW – allows entry of new batch details which can either be stored for the next automatically started batch or used immediately to start a new batch manually
START – ends current batch and starts new batch immediately
CLOSE – closes the batch control display

6.2.7 History Mode

Trace history, allows the user to view the history of the display group. The maximum amount that can be reviewed depends on a number of factors, including how many points are configured, how rapidly the traces are changing and so on. At a recording rate of 20mm/hour, with all channels configured, a minimum of 30 day's worth of traces is available for viewing, provided that the group contents are not re-configured during this period (in which case, the history starts at the end of the re-configuration). The amount of trace visible on the screen depends on the recording rate, the higher the rate, the less trace is visible at any one time.

To enter Trend History, the option key can be used, or the trace area of the screen can be continuously touched until the screen blanks prior to re-drawing. A 'Preparing History, please wait' message appears whilst the re-drawing calculation is taking place. Although tracing stops during Trend History, no data is lost. Process Variable values are saved in the instrument memory. Alarms are still scanned-for and any associated action taken.

The History display is similar to the real-time trend display, with the addition of a slider control and up and down keys for selecting that part of trend history which is on display. The controls are used as follows:

1 Touching the up/down key causes the trace history to move an incremental amount.
2 Holding the up/down key continuously, causes continuous movement.
3 Touching the bar above or below the slider causes a page-height shift. The Page up and Page down keys can also be used to provide this function
4 Touching and dragging the slider, whilst observing the time/date display, allows the user to select the section of history exactly.

On first entry to History mode, the channel value and the time and date shown in the faceplate are those at the top edge of the chart. Touching the screen causes a cursor to appear at point of screen contact. This cursor can be touched and dragged up and down the screen to provide a reference point on the current trace. The displayed value date and time refer to the cursor intersection with the current channel. To return to real-time trending, the Option key is operated, followed by 'Exit History'.

6.2.8 Security

The operator interface is subject to a password security system as described in section 4.1 above. Security functions are accessed from the 'operator' menu page which is available from the root menu.

The '**SECURITY**' soft-key gives access to a menu containing whichever of the following options are available to the currently logged in user:

Login	Available to all users - allows users to log in (user ID selected from a scroll list, password entered from keyboard display on screen) or log out (by pressing a soft key)
Access	Allows details for each user to be set up (described in configuration options below)
Management	Allows access to security management features including electronic signatures and audit trail set up (described in configuration options below)
Add User	Allows new users to be created based on an existing account and with an initial password
Remove User	Allows users to be permanently removed from the security setup. (Note that a 'disable' option is also available on individual accounts which can be used instead of 'Remove' so that details of the user remain available.

6.2.9 Manual Archive

Configuration of archive paths and setting up of automatic archives has already been covered in section 4.4.2 above. In addition, manual archive functions are available (subject to user status) accessed from the 'operator' menu page which is available from the root menu.

The '**ARCHIVE**' soft-key gives access to a menu containing whichever of the following options are available to the currently logged in user:

Disk (not 5000B)	Allows data transfer to PC card / floppy disk to be initiated by touching the relevant key for Bring Archive up to Date / Archive Last Hour / Last Day / Last week / Last Month / All to define which files are to be transferred. Archiving starts as soon as the selection is made, and cannot be stopped until completed, unless the Cancel archive key is operated, in which case the archive will be stopped after a confirmatory message has been responded to. The disk archive page also provides the operator with details of the media size and current free space.
Remote	Allows data transfer to a remote PC to be initiated by operating the relevant key for Bring Archive up to Date / Archive Last Hour / Last Day / Last week / Last Month / All to define which files are to be transferred. Archiving starts as soon as the selection is made, and cannot be stopped until completed, unless the Cancel archive key is operated, in which case the archive will be stopped after a confirmatory message has been responded to.

6.2.10 Save/Restore

File transfer utilities are available (subject to user status) accessed from the ‘operator’ menu page which is available from the root menu.

The ‘**Save/Restore**’ soft-key gives access to a menu containing whichever of the following options are available to the currently logged in user:

Save	Touching this item allows the current configuration to be saved in the instrument's memory. Files saved in this way are not in a 'readable' format and are used only for archive /security purposes or for transfer to offline configuration or another, similar, instrument.
Restore	Touching this item allows the user to select or type-in a previously saved configuration file name, which will then be used as the current configuration. Touching the 'Restore' key completes the operation. Checkboxes allow one or more of Configuration Data, Security data and Network data to be chosen for the restore function. For instruments with the user screen option, a further tick box is displayed - 'Screen Data'
New	Touching this item causes the factory entered default configuration to be loaded for use, or for editing. Operation of the New/Default key completes the operation. Touching the 'Restore' key completes the operation. Checkboxes allow one or more of Configuration Data, Security data and Network data to be chosen for the restore function. For instrumentss with the user screen option, a further tick box is displayed - 'Screen Data'
Text	This is identical to the 'Save' function described above, but the configuration is saved in ASCII format, and can be transferred to a computer and read, printed etc. as required. It is not possible, using this means, to modify the configuration and then re-load it
Import User Linearisation	This allows a user linearisation table to be imported either (for recorders only) via a mass storage medium (e.g. floppy disk) or, if the Remote Viewer option is fitted, directly from the host pc.
Export User linearisation	This allows a user linearisation table to be exported either (for recorders only) via a mass storage medium (e.g. floppy disk) or, if the Remote Viewer option is fitted, directly to the host pc.
Import screen	This field appears only if the User Screens option is fitted, and allows a previously exported User Screen file to be imported.
Export screen	This field appears only if the User Screens option is fitted, and allows a User Screen to be exported to disk or Flash memory. The exported screen can subsequently be imported into offline configuration, to this instrument or into a different instrument.

6.2.10 Save/Restore (Continued)

If a filename has to be entered, this is carried out as follows:
Touching (or, for 5000Bs, clicking on) the filename window causes a pop-up menu to appear, giving a list of 'Volumes' in the Flash memory, or (for recorders) on the mass storage medium (if inserted) or in the host PC. The volume contents list is displayed by touching the name then operating the down arrow or 'open folder' key. Once the correct folder is open, either select an existing file, or enter a new filename, by touching the FileName window and entering the name using the pop-up keyboard.

6.2.11 Remote Viewing (Bridge 5000)

The 'look and feel' of the Bridge 5000 operator interface is identical to that of a recorder front panel. Menu functions and navigation buttons are the same as from the front panel and are protected by the security setup in the instrument itself. The only function not available to 'full' bridge 5000 is the file explorer (save and restore are from the PC disk only). The ability to view and interact with the file system devices (internal flash, removable media) will be the subject of a 3rd phase of work.

6.2.12 Remote Configuration (Series 5000 Configuration Editor)

The 'look and feel' of the Series 5000 Configuration Editor operator interface is identical to that of a recorder front panel. Menu functions and navigation buttons are the same as from the front panel and are protected by the security setup in the instrument itself except that audit trail of actions is not available.

6.2.13 Offline Data Review (Review)

The Review Software package allows the display and printing of archive data files from 5000 series instruments on a remote PC. The package has a Windows style interface with functions selectable from pull-down menus or toolbar icons.

The following menu selections are available:

File		
	New Chart	Creates a new chart.
	Open Chart	Opens an existing chart.
	Close Chart	Closes an opened chart.
	Save Chart	Saves an opened chart using its existing name.
	Save Chart As	Saves an opened chart to a specified file name.
	Transfer Files	Transfers archive files to the PC database
	Maintain Database	Remove obsolete data from database.
	Export	Export data to a file or another application via the clipboard.
	Print	Prints a document, according to your specifications.
	Exit	Exits Review.

6.2.13 Offline data review (Cont.)

(File)		(additional if instrument interface is enabled)
	Delete	Deletes files from an instrument disk.
	Copy To...	Copies files from an instrument disk to the Desktop.
	Copy From...	Copies files from the Desktop to an instrument disk.
	Save...	Saves an instruments configuration to a file on the instrument disk.
	Load...	Loads an instrument configuration from a file on the instrument disk.
	Properties	Displays the properties of an instrument or selected instrument files.
Edit		(available from the Instrument File Services view)
	Select All	Selects all displayed instrument files.
	Invert Selection	Inverts the selection of instrument files.
View		
	Toolbar	Shows or hides the toolbar.
	Status Bar	Shows or hides the status bar.
(View)		(additional if instrument interface is enabled)
	List	Displays only the names of files in the directory, initially in alphabetical order.
	Details	Displays all details on the files in the directory, initially in reverse order of date and time last modified.
	Arrange Icons by Name	Shows files in file name alphabetical order.
	Arrange Icons by Type	Shows files in file type alphabetical order.
	Arrange Icons by Size	Shows files in file length order.
	Arrange Icons by Date	Shows files in order of date and time last modified.
	Refresh	Fetches up to date information on the instrument and files of the currently selected type.
Instrument		
	File Services	Provides password-controlled access to instruments, with disk maintenance and file transfer facilities.
	Log Off	Terminates session on some or all instruments.
	Log Off This	Terminates session on the currently selected unit in Instrument File Services view.
	Auto Backup + Transfer	Presets the unmanned periodic Backup and Transfer of instrument files.
	Setup...	Defines instrument connections.
Chart		
	Setup	Sets up chart options and specifies which points to display
	Go To...	Navigates along the chart’s time axis by time or group name

6.2.13 Offline data review (Cont.)

Options		
	Fonts	Specifies fonts to use.
Window		
	New Window	Creates a new window that views the same document.
	Cascade	Arranges windows in an overlapped fashion.
	Tile	Arranges windows in non-overlapped tiles.
	Arrange Icons	Arranges icons of closed windows.
	Window 1, 2, ...	Goes to specified window.
Help		
	Help Topics	Offers you an index to topics on which you can get help.
	About	Displays the version number of this application.

6.3 Network Interface

The network interface allows the unit to be connected via Ethernet to a single PC or to a local area network. This section describes the hardware interface and specifications for network connection. Configurable functionality is described in section 4.3 above.

6.3.1 Network specification

Type	IEEE802.3 10BaseT
Cable Type	CAT5
Maximum length	100 metres
Termination	RJ45

For direct connection between a PC and the instrument, a crossover cable is required. For all other connections, a 'straight-through' connection is required.

The following TCP ports are made use of by the instrument. (This information would be needed by anyone involved in setting up 'firewalls', which may be used selectively to block incoming or outgoing access to specific ports.)

PORT	Usage
20	File Transfer Protocol - data
21	File Transfer Protocol - control
502	Modbus/TCPIP communications
1264	Remote Viewer communications - general
50010	Remote Viewer communications - trend Review

6.3.2 PC Specification for Networked Applications

The minimum specification of client PC for the Bridge5000 viewer is as follows:

- Pentium – P90, 32Mb RAM, 100Mb Disk space

6.3.3 Supported PDA Configuration

Compaq iPAQ 3850 with Jeode EVM version 1.9. Refer to document HA027871 for details of PDA installation and operation.

6.4 Modbus TCP Interface

MODBUS TCP allows one or more instruments to act as 'slave' devices to one or more host computers connected an the RJ45 connector. Each instrument must have a unique Internet Protocol (IP) address.
MODBUS TCP (Transmission Control Protocol) is a variant of the MODBUS family of communications protocols intended for supervision and control of automated equipment specifically covering the use of MODBUS messaging in an intranet or internet environment, using TCP/IP protocols. Further detail and implementation guidelines for users is contained from the document openmbus.doc, available at

http://www.modicon.com/openmbus/standards/openmbus.doc

The instrument automatically allocates addresses to individual instrument functions (refer to user manual supplied with the instrument, for full addressing details) so that a Modbus master device can be set to read from or write to the desired registers. Available data includes:

- instrument data
- channel configuration data
- channel runtime data (value, status, alarm status)
- group data (including current on-screen message and batch fields)

Feature identification and indirection tables are also supported.

6.5 Serial Communications Interface

This option allows 5000 series instruments to receive simple ASCII messages from, for example, barcode readers, Programmable Logic Controllers (PLCs), Global Positioning Systems (GPSs) (NMEA-0183 protocol) etc. Messages are sent to as many groups as are set up to receive them, and become a part of these groups' histories, and appear on vertical and horizontal trend displays in the following format:

Date and time	Source	Message
13/09/01 10:25:06	(Serial)	Message of up to 60 characters

The communications standard is either EIA232 OR EIA485 as specified at time of order.
Isolation (dc to 65Hz BS EN61010) Installation category II; Pollution degree 2.
Terminals to ground: 100 V RMS or dc (basic insulation)

Characters are read into a buffer, until the end of message characters are received, or until the time-since-last-character exceeds the entered Timeout value. Date, Time and '(Serial)' are then prefixed to the message, which is then sent to the selected groups. The date and time relate to when the first buffered character was received. If Start-of-message characters are configured, characters will be read into the buffer only after these characters have been received. The buffer holds up to 60 characters. Further characters are discarded until End-of-message is received, or timeout occurs. These 60 characters do not include date/time etc. or start/end-of-message characters.
Message characters below Hex 20 (decimal 32) will be replaced by question marks (?).
Message characters above Hex 7F (decimal 127) will be treated as Unicode.

7 NON-FUNCTIONAL ATTRIBUTES

7.1 Reliability

The 5000B product is too new to have MTBF figures calculated from field service report data. The 5100V has MTBF data as follows:

PRODUCT TYPE	MTBF(yrs) Jan. to Dec. 2002	MTTR (min)	UK POPULATION at 31/12/2002	TOTAL Production	PRODUCT RELEASE
5100V	15	30	987	3621	Oct 1999

These figures are based on the warranty U.K. Field Service Reports for the period stated under “MTBF (yrs)” in the table. The population is based on the monthly output data from Eurotherm Ltd. and averaged over the measurement period. The number of faults during the time period have been derived from the Field Service Reports ignoring the fault categories ‘Re-Calibration’, ‘Re-Range’, ‘Hardware Update’, ‘Software Update’, ‘Support Call’, ‘Customer Error’, ‘No Fault Found’, ‘Corrosion’.

MTBF is calculated using an estimated population assuming that 70% of the delivered units are in continuous use.

7.2 Error Indication

The following errors produce a instrument alarm message viewable by the user on the instrument alarm summary and drawn to the operators attention via the status bar:

Archive failed -(message)	Message explains archive failure - due to disk being missing, write protected, faulty, full etc.
Clock failure	Internal clock was corrupt at power up, or the time has never been set. Can be caused by battery failure, in which case the battery icon will also be visible. The error is cleared by setting the time and date.
Battery-backed RAM cleared	This message appears if the battery has failed, and the unit has been switched off.
Channel failure	Indicates a hardware failure in the input channel circuit
Channel error	Indicates a hardware failure in the channel circuit or in the internal CJ temperature measurement
Failed to authenticate the user name and/or password supplied	Appears if an incorrect user name or password has been entered whilst trying to establish remote viewer connection
Floppy disk worn (not 5000B)	Appears if a number of attempts had to be made before write to the disk was successful. No data is lost, but the disk should be replaced as soon as is practicable
Floppy disk corrupt (not 5000B)	This appears if all attempts to write to the disk fail. In such a case, some data may be lost. If the damaged area of the disk is in the system part of the disk, it might appear to the instrument that it is unformatted, and the disk icon will disappear. The disk should be replaced immediately.
FTP Primary Server Failure	This error is set if the instrument fails, after two attempts, to establish communications with the primary server. After the second atempt has failed, the Secondary server is tried.
FTP Secondary Server Failure	This error is set if the instrument fails, after two attempts, to establish communications with the secondary server.
Internal flash: \user\ required repair	Error found (in the internal file system) at power-up, and corrected
Internal flash: \user\ required repairInternal flash: \user\ is full	Error found (in the internal file system) at power-up, and correctedAppears if the User partition is full. To clear, either user screens must be simplified or files must be deleted from \User\, or both
Internal flash: \user\ is fullInternal flash: \system\ required repair	Appears if the User partition is full. To clear, either user screens must be simplified or files must be deleted from \User\, or bothError found (in the internal file system) at power-up, and corrected.
Internal flash: \system\ required repairInternal flash: \history\ required repair	Error found (in the internal file system) at power-up, and corrected.Error found (in the internal file system) at power-up, and corrected

7.2 Error indication (Cont.)

Internal flash: \history\ required repairMaximum	Error found (in the internal file system) at power-up, and corrected.
Remote Viewers already connected to ...	Appears if an attempt is made to connect more remote viewers to the instrument than are configured in the Options menu
Maths Channel failure	Appears if, for example, the divisor of a divide function passes through zero.
Maximum Remote Viewers already connected to ...	Appears if an attempt is made to connect more remote viewers to the instrument than are configured in the Options menu
Network connection has timed out	Appears if no connection can be established between the remote viewer and the instrument. This might be caused by, for example, cable failure, network hardware failure, etc
Network connection has timed out	Appears if no connection can be established between the remote viewer and the instrument. This might be caused by, for example, cable failure, network hardware failure, etc.
Unable to connect to host ...	As for 'Network connection has timed out' message above but with the addition of 'incorrect host address' as a possible cause
Recording failure - (message)	Message explains recording failure (file error, internal overflow etc.)
Removable media failure (Not 5000B)	Appears if the disk or PC card is corrupt, wrongly formatted etc. Can be active only during Archiving activity.
Removable media full (Not 5000B)	Active if the floppy disk or PC card is full. Can be active only during Archiving activity.
Unable to connect to host ...	As for 'Network connection has timed out' message above but with the addition of 'incorrect host address' as a possible cause
Unable to resolve hostname	Message appears if an incorrect host address is entered or if there is a network failure whilst trying to establish remote viewer connection

7.3 Maintainability

7.3.1 Diagnostic Facilities (not 5000B)

At power-up, continuously holding a finger in contact with the screen for approximately 30 seconds causes the diagnostic display to appear. This provides the following:

MAC ETHERNET ADDRESS
This unique hex address is for factory use only.

COLOUR TEST BARS
This colour 'swatch' allows a judgement to be made as to the correctness of the display colour rendering

SOFTWARE VERSION NUMBER
This shows the version number of the software fitted to the instrument.

SELF-TEST STATUS BARS
These four areas show the status of the main circuit board (MAIN), the disk or Card fitted (Media) the battery and the Ethernet (not yet implemented). In each case, if the bars are grey, then no faults have been detected; if any one or more of them is flashing red/white, then a fault has been found.
MAIN - tests the Dynamic RAM (DRAM), the Static RAM (SRAM) and the flash memory. The results can be displayed by operating the 'Detail' key.
MEDIA - sends a message to the disk or card, and then tries to read it back.
BATTERY - This area flashes when the battery needs to be replaced. The test is performed once every 15 minutes.
ETHER - Not applicable to this release.

CIRCUIT BOARD FIT
The major part of the display screen is taken up with a representation of the rear of the recorder, showing what input and output cards are fitted in each circuit board slot. 3_Relay is a three-relay output board; AI_6 is a six channel analogue input board.

TOUCH CAL
This key initiates the display calibration (offset correction) procedure which ensures that the display screen image is positioned correctly compared with the touch screen (so that 'what you touch is what you get').

DETAIL
Touching this key causes the main board test results to be displayed.

To quit diagnostics, the recorder must be switched off, then, after a few seconds, on again.

7.3.2 Expansion Capability

The 5100V can have up to 2 x input boards (12 inputs) and 4 x relay output boards (12 outputs).
The 5180V can have up to 8 x input boards (48 inputs) and 9 x relay output boards (27 outputs).
The 5000B can have:
1 x input board (6 channels) and 2 relay boards (6 outputs) + 1 standard relay or
2 x input boards (12 channels) + 1 standard relay.
Further input or output channels would require the use of additional instruments.

7.4 Environment

7.4.1 Environmental Performance

Temperature limits Operation	0 to 50°C (5 to 40°C if Floppy disk drive fitted).
Storage	-25°C to +70°C (-20 to + 50°C if floppy disk drive fitted)
Humidity limits Operation	5% to 80% RH (20% to 80% if floppy disk drive fitted) both non - condensing
Storage	5% to 90% RH (8% to 80% if floppy disk drive fitted) both non - condensing
Altitude	< 2000 metres
Protection	Recorder bezel and display = IP65 Recorder sleeve = IP20 5000B = IP20
Shock	BS EN61010
Vibration	(10 Hz to 150Hz) 2g peak

7.4.2 Physical

7.4.2.1 Model 5100V/5180V recorders

Panel mounting	DIN43700
Bezel size Small frame Large frame	 144mm x 144mm 288mm x 288mm
Panel cutout Small frame Large frame	 138mm x 138mm (-0.0 + 1.0) mm 281mm x 281mm (-0.0 + 1.0) mm
Depth behind bezel Small frame Large frame	 248 mm (213mm without terminal cover) (284mm cover closed, 399mm cover open if isolated transmitter PSU option fitted) 305 mm (254mm without terminal cover)
Weight Small frame Large frame	 3 kg. max. 7 kg. max.
Mounting angle Hard disk option Floppy disk version Other versions	 Vertical ±15 ° from vertical ±45 ° from vertical

A portable case version for the 5100V is also available. Refer to user manual for details.

7.4.2.2 Model 5000B

Mounting method	T35 DIN rail or wall mounting
Size (WxHxD) (mm)	208.9 x 176.5 x 68.2
Face front distance from wall Face front distance from rail	79 mm Back mounting: 73.5 mm from front face of rail End mounting: 215 mm from front face of rail
Weight	<1500 gm
Mounting angle	If thermocouple inputs are fitted, the connector(s) must be horizontal to ensure that cold junction performance meets specification. Otherwise, there is no restriction on mounting angle.

7.4.3 Electromagnetic compatibility (EMC)

Emissions	BS EN50081-2
Immunity	BS EN50082-2

7.4.4 Electrical safety

BS EN61010	Installation category II, Pollution degree 2

7.4.5 Power requirements

7.4.5.1 Model 5100V/5180V recorders

Line voltage (standard)	85 to 265VRMS 47 to 63 Hz, or 110 to 370Vdc (DC supply may not be used to power instruments fitted with the Transmitter Power Supply option.)
Low voltage option	20 to 42V RMS; 45 to 400 Hz or 20 to 54V dc (This option is not suitable for instruments fitted with the Transmitter Power Supply option. In particular, dc supply may not be used to power instruments fitted with the Transmitter Power Supply option)
Power (max.)	60 VA (Inrush current 36A)
Fuse type	None
Interrupt protection	200msec. at 240V ac, with full load.
Low voltage option	20msec at 20Vdc or RMS, with full load

7.4.5.2 Model 5000B

Line voltage (standard)	18 to 30 v dc
Power (max.)	10 Watts
Inrush current	18 Amps
Fuse type	None

7.4.6 Back-up battery

Type (Current instruments)	Poly-carbonmonofluoride/lithium (BR2330). Part Number PA261095
Type (Older recorders)	Lithium Manganese (CR2032). Part Number PA250983
Support time	A fully-charged, new battery supports the Real-Time Clock for a minimum of 1 year with the instrument unpowered
Replacement period	3-years

8 GLOSSARY

10 Base T	10Mbps baseband data transmission over twisted-pair copper wire
BootP	Bootstrap Protocol [Internet] A TCP/IP protocol used by a network computer to obtain its IP address and other network information such as server address and default gateway. Upon startup, the client station sends out a BOOTP request to the BOOTP server, which returns the required information.
CAT5	Category 5 UTP Cable (used for connecting computer networks)
Channel	Individual input or output to graphic instrument.
DRAM	Dynamic Random Access Memory
FTP	File Transfer Protocol [Internet protocol]
FLASH memory	A memory chip that can be rewritten and hold its content without power
GAMP4	GAMP4 Guide for Validation of Automated Systems
Group	Set of channels configured to be displayed / archived together.
Installation Category II	The rated impulse voltage for equipment on nominal 230V ac mains is 2500V.
JAVA	A general purpose, high-level, object-oriented, cross-platform programming language developed by Sun Microsystems
Pollution degree 2	Normally, only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation shall be expected.
RJ45	Registered Jack - 45 (8 wire connector used in networking)
RTD	Resistance Temperature Detector
SNTP	Simple Network Time Protocol
SRAM	Static Random Access Memory
SVGA	Super Video Graphics Array Large frame recorder has SVGA TFT Resolution= 800 x 600 pixels
TCP/IP	Transmission Control Protocol/Internet Protocol
TFT	Thin-Film Transistor (screens)
UTC	Co-ordinated Universal Time - Replaced Greenwich Mean Time (GMT) as the World standard for time in 1986. It is based on atomic measurements rather than the earth's rotation.
VGA	Video Graphics Array (minimum standard for PC video display 640 x 480 pixels) Small frame recorder has 1/4 VGA Resolution = 320 x 240 pixels

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