JISKOOT™ MEASUREMENT SYSTEMS

InSpec Sampler Controller

Application Operation Manual

Software Version 5.10 - Volume 1

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GENERAL

WARNING!

This instrument is designed for connection to hazardous electric voltages.

Ignoring this warning can result in severe personal injury or mechanical damage.

To avoid the risk of electric shock and fire, the safety instructions of this manual must be observed and the guidelines followed.

The specifications must not be exceeded, and the unit must only be applied as described in the following.

Prior to the installation and commissioning of the unit, this manual must be examined carefully.

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

HAZARDOUS
VOLTAGE

CAUTION!

WARNING!

Until the instrument is fixed, do not connect hazardous voltages to the instrument.

The following operations should only be carried out on a disconnected module and under ESD-safe conditions: -

Dismantlement of the instrument for setting of dipswitches and jumpers.

General mounting, connection and disconnection of wires.

Troubleshooting the module.

REPAIR OF THE INSTRUMENT MUST ONLY BE DONE BY JISKOOT.

INSTALLATION

WARNING!

Installation may only be carried out by electrically skilled and instructed personnel in accordance with national legislation, including the relevant standards.

All technical data on the instrument is to be observed.

Changes to the design and modifications to the equipment are not permitted.

The equipment shall only be operated as intended and only in undamaged and perfect condition.

Sufficient segregation must exist between different cables and wires carrying different types of signal or power and all other circuits.

All wires must be terminated, complete with crimping lugs. Unused cores should be terminated to the earth bus bar.

INTELLIGENT ACTION

ATTENTION!

GENERAL

Cet instrument est conçu pour la connexion à des tensions électriques dangereuses.

Ignorer cet avertissement peut entraîner des blessures graves ou des dommages mécaniques.

Pour éviter tout risque de choc électrique et d'incendie, les consignes de sécurité de ce manuel doivent être observées, et les orientations suivies.

Les spécifications ne doivent pas être dépassées, et l'unité ne doit être appliquée que comme décrit dans le texte suivant.

Avant la mise en service et l'installation de l'unité, ce manuel doit être examiné avec soin.

Si l'équipement est utilisé d'une manière non spécifiée par le fabricant, la protection assurée par l'équipement peut être altérée.

ATTENTION!

TENSION
DANGEREUSE

ATTENTION!

Ne pas connecter des tensions dangereuses à l'instrument avant que celui-ci ne soit fixé.

Les opérations suivantes doivent être effectuées avec le module débranché et dans des conditions DES:-

Démantèlement de l'instrument pour régler les *dipswitches* et cavaliers.

Montage, connexion et déconnexion des fils.

Dépannage du module.

LA REPARATION DE L'APPAREIL DOIT UNIQUEMENT ETRE EFFECTUEE PAR JISKOOT.

ATTENTION!

INSTALLATION

L'installation ne peut être effectuée que par du personnel électricien qualifié, conformément à la législation nationale, y compris les normes pertinentes.

On doit observer toutes les données techniques sur l'instrument.

Les changements au niveau de la conception ou de l'équipement ne sont pas autorisés.

L'équipement doit être utilisé comme prévu et uniquement s'il est dans un état intact et parfait.

Une séparation suffisante doit exister entre les différents câbles et les fils transportant différents types de signaux ou de puissance et tous les autres circuits.

Tous les fils doivent être terminés, avec pattes de sertissage. Les noyaux non-utilisés doivent être terminés au jeu de barres de la terre.

SECTION 1: INTRODUCTION

1.1 INTENDED USE

The Jiskoot InSpec is used for Sampling, Blending or Wildstream control applications as determined by the application software installed within it.

The controller is not intended to be used as a standalone piece of equipment and must be built-in to the end product and mounted in the vertical plane.

1.2 IDENTIFYING THE PARTS OF THE INSPEC FRONT DISPLAY

1.2.1 FRONT PANEL

Figure 1 - InSpec Front View

INTELLIGENT ACTION

A brief description of the indicated front display items follows:

A   The Alarm RGB LED indicator.

B   Receiver 2 Tri-Colour LED. The text 'Receiver' is specific to the InSpec Sampler Controller. If you have purchased an InSpec Blender Controller this text will state 'Stream 2'. In either case the LED's indicate which current sampling can/or blending stream is in use. In the case of the sampler, you would always expect either Receiver 1 or Receiver 2 to be lit; whereas in the case of the Blender both streams 1 and 2 will often be active at the same time. The given colour is dependent on the application (Sampler or Blender) and will be explained in the application section of the manual.

C   Bar Graph Indicator 2. This ten-barred array of LED's represents the user-configured value for the bar graph. A designated register value and associated min and max graph 2 registers (F_GRAPH_MIN2/F_GRAPH_MAX2) are used to determine the output.

D   MENU. There are five indented secondary button functions on the front display interface. This one indicates that the ENTER button (see E that follows) also enables the user to enter/go into the InSpec menu structure.

E   ENTER. Along with the directional cursor buttons, the ENTER button will be one of the most used buttons of the instrument. This button allows you to confirm entered alphanumeric values, to confirm control decisions and navigate into selected menu items.

F   DELETE. This indented secondary button function is associated with the RESET button. When the instrument is being configured the secondary key functions MODE, CANCEL and DELETE are likely to be used far more than their primary button purpose of START, STOP and RESET. The DELETE button allows users to cancel decisions and erase alphanumeric characters from an entered value/text.

G   RESET. This is the primary function of the button and will be used daily/regularly by operators of the instrument to reset a batch/blend. Selecting this button when there is no batch/blend in process will result in a message explaining that there is no batch to reset

H   CURSOR BUTTONS. H points to the right cursor button. Let's look at all of the cursors. The four cursors are primarily used to navigate around the menu. Left and right step you through the available options at any given sub-menu or decision and up and down take you into or out of the current sub-menu. The cursor keys have alternative uses within specific menu functions. i.e., when an engineer is in the register access screen, the right or left cursor will search through the registry looking for a user specified search string. Within the same screen the up and down cursor buttons travel through the registers numerically. During text entry, the cursor buttons are used to enter text using the up and down buttons and to move through the string with the left and right buttons. On the front panel, the left and right cursor buttons can be used to move between the 12 configurable front display items. In the alarm display screen, the down cursor acts as an acknowledgement button to 'ACK' all active alarms. (See I below).

I   ACK - Acknowledgement. The indented ACK button forms the secondary function of the Down cursor button. ACK is used to acknowledge all unacknowledged alarms in the alarm display screen in a two-step process. Pressing this cursor once will take you straight into the display alarms menu option (browsed via the 'Alarms→Display Alarms' option). Pressing it again will acknowledge all the alarms in the display. This gives the operator the ability to examine new alarms before acknowledging them.

J   Numeric Entry Keypad. 1 thru 9, and '.', 0 and -. These keys are used during configuration and batch/blend setup to enter values/titles. When the menu is closed these twelve keypad buttons are each associated with the 12 user configurable display items allow the user to jump quickly to a particular item (See Display Section).

K   Centre Cursor Button. This button doubles up as an alternative Enter key (See E above). Engineers' may find it more convenient to use during configuration when they are spending a lot of time using the other directional cursors.

L   STOP. This is the primary function of the button and will be used daily/regularly by operators of the instrument to stop a batch/blend. Selecting this button when there is no batch in process will result in a message explaining that there is no batch to reset.

M   CANCEL. This indented secondary button function is associated with the STOP button. The cancel button can be used to step out of each sub-menu (repeatedly pressing cancel will close the menu and bring you out to the front display) and can be used to cancel out of a control sequence. I.e., when starting a batch/blend the user will be prompted and taken through a series of questions that the user can cancel out of using this button.

N   START. This is the primary function of the button and will be used daily/regularly by operators of the instrument to start a batch/blend. If the instrument is currently running a warning message will appear to tell them a process is currently running.

O   MODE. This is the secondary function of the START button. It will only ever be used by an engineer whilst configuring/changing the current controller's parameters. The mode button is used in the register access screen to bring up a list of function choices that can be performed on any given register (Set Current, Description, Display, Search, View Modbus Address and Set Modbus Address). It can also be optionally used when the engineer selects 'Set Current' on an integer or long integer value to toggle between Decimal and Hexadecimal number entry mode.

P   Bar Graph Indicator 1. This ten-barred array of LED's represents the user-configured value for the bar graph. A designated register value and associated min and max graph 1 registers (F_GRAPH_MIN1/F_GRAPH_MAX1) are used to determine the output.

Q   The 20x2 LCD front display screen.

R   Receiver 1 Tri-Colour LED. The text 'Receiver' is specific to the InSpec Sampler Controller. If you have purchased an InSpec Blender Controller this text will state 'Stream 1'. In either case the LED's indicate which current sampling can/or blending stream is in use. In the case of the sampler, you would always expect either Receiver 1 or Receiver 2 to be lit; whereas in the case of the Blender both streams 1 and 2 will often be active at the same time. The given colour is dependent on the application (Sampler or Blender) and will be explained in the application section of the manual.

S   Status RGB LED. This lamp is used to indicate what the current status of the controller is. Both the sampler and the blender have recognised status conditions indicating the current operating condition of the controller. The given colour is dependent on the application (Sampler or Blender) and will be explained in the application section of the manual.

T   The up cursor button is primarily used to scroll through the given character set to look for a required alphanumeric character during data entry and to scroll through the register list. It can also be used from the front display to turn 'scrolling' on and off. Scrolling is described in the display section.

1.3   BASIC OPERATION OF THE INSTRUMENT (START, STOP, RESET, MANUAL)

The Start, Stop and Reset buttons act in their primary function when the menu is closed and showing the front display. This allows a batch or blend to be started, stopped or reset quickly from the front panel. Within the menu they take on their secondary functions of Mode, Cancel and Delete – where appropriate. The self-explanatory functions of the start, stop and reset buttons are duplicated within the menu. Selecting the very first 'Control' item of the menu (as shown above) will result in the user being taken down into the control menu where, amongst other commands, the 'Start', Stop' and 'Reset' commands are duplicated.

Figure 2 - Control Menu

Within the menu, the operator can also select the 'Manual' item to change specific batch parameters. These available parameters depend on the given application.

The following table briefly summarises the five primary / secondary key buttons

PRIMARY KEY NAME	SECONDARY KEY NAME	FUNCTION IN MAIN DISPLAY	FUNCTION IN MENU
START	MODE	To start the application	Bring up register options and toggle between integer and hex entry modes.
STOP	CANCEL	To stop the application	Cancel out of a menu or entry mode.
RESET	DELETE	To reset the application	Delete entered alphanumeric characters or cancel out of a decision.
ENTER	MENU	Enter the menu from the front display	Enter menu / select menu item / confirm values / confirm control decisions
DOWN CURSOR	ACK	Acknowledge all active / unacknowledged alarms	Go down / enter menu items / scroll down through alphanumeric characters.
UP CURSOR		Toggle between scrolling and non-scrolling on main display and alarms	Go up / exit menu items / scroll up through alphanumeric characters.

SECTION 2: COMMON SOFTWARE FEATURES

The Jiskoot InSpec is used for Sampling, Blending and Wildstream control applications. As such, many of the fundamental operating principles are the same regardless of the installed software. This manual will cover the common features of your controller and an additional manual section will cover the application specific software that is currently installed on your unit.

2.1   MAIN FEATURES

- Simple user-friendly Web and front panel interface.

- Configurable 'hot-keys' to display key parameters or alarms.

- Standard configurations can be saved and loaded.

- Quick release panel mounting latches and wiring connectors.

2.2   INSPEC SECURITY

Different InSpec menu options are available depending on the logged in user's current level of security. A defined user has one of two levels of security access – they will have either operator access or engineer access. The available configuration and display menus associated with each level of access can be viewed in the application manual.

By default, a defaulted InSpec controller has 3 defined users. These are:

Jiskoot - The highest level of user access and is reserved for Jiskoot engineering staff only and cannot be edited or removed.

Operator level access allows minimal access to the menu interface. This access level allows a user to start batches, change manual batch parameters, view alarms, print batch reports and select files for email etc. Note that for all levels of security password entry, the character entered for the password will each appear as an asterisk (*). Upon acceptance, the InSpec will switch into operator level and the menu will change accordingly. Available options will decrease if you log out from engineer level down to operator level. When the operator mode is selected from the engineer level, it returns the sampler to the operator security level without prompting for a password.

IMPORTANT: The default password for the Operator user is 789. For security purposes, you will need to change this password to prevent undesirable access to the system. Should you ever default the instrument, the password will revert to the default of 789.

Engineer level allows full access to the menu interface and allows a user to fully operate and configure the InSpec.

IMPORTANT: The default password for the Engineer user is 456. For security purposes, you will need to change this password to prevent undesirable access to the system. Should you ever default the instrument, the password will revert to the default of 789.

2.2.1   COMMON SECURITY MENU ITEMS

LOGIN USER

This option is always available regardless who is currently logged in. If no-one is logged in this will be the only available option under the security menu. On selecting this item, you will be presented with a choice of defined usernames. On selecting the desired user, you will then be presented with the password prompt. On entering a successful password, you will then be logged into the InSpec with the associated level of security access.

ENTERING A PASSWORD

If the password is entered from the front panel numeric keypad then each number will appear as the asterisk (*) character. As the numeric keypad is not accessible for the Ex InSpec, you must use the cursors to enter text as explained below.

Selecting either the up or down key to scroll through and display the numeric characters. Selecting either the right or the left key will result in moving back/forward one character. When you move between characters, the previously selected character immediately changes to an asterisk '*'. If no keys are pressed for a second, then the currently selected numeric character on display will also change to an asterisk. This feature allows passwords to be entered using only the cursor keys.

LOGOUT

This simply logs out the current user. The only option available then will be the LOGIN USER option described previously above.

WHO AM I?

This allows quick identification of who is currently logged into the system. It may be useful for various reasons, e.g., if an unattended InSpec is still logged in you can see who previously logged in.

SECURITY TIMEOUT

Only users logged in with engineer level access can set the security timeout value. If you have adequate access and select this option, you will be asked whether you want to enable a timeout value for both an operator and an engineer. If you select yes for either, you will then be prompted to enter the timeout value in minutes. When this timeout value occurs, the user will be logged out and the only option then available will be LOGIN USER as described previously above. A user must now log back in to initiate a batch or make any changes.

The timeout facility is very useful when users with engineering access are configuring the system. They can then lengthen the timeout period to prevent repeated user logins. For day to day operation of the InSpec we advise enabling the timeout facility.

ADD USER

Only users logged in with engineer level access can add new users to the InSpec security system. The process of adding a user involves entering the username, password, level of access (Operator or Engineer), and their user ID (Note: A user ID can be used to group users together for notification purposes. E.g., UCL script files can be written to setup email addresses for notification depending on which user id is currently logged in etc).

The username must be unique. If the user already exists, the process of adding the new user will be automatically cancelled.

Note: As the numeric keypad is not accessible for the InSpec-Ex, you must use the cursors to enter text via scrolling through the character sets using the cursor keys. For this reason, we strongly advise only using numerical passwords on an InSpec-Ex to avoid spending a long time scrolling through the entire character set looking for specific characters.

Note: Blank passwords are also acceptable. If for whatever reason this is acceptable within your system. We would naturally suggest you add passwords to enable security.

EDIT USER

All users logged in to the InSpec can access this edit option. Users with engineer access can edit\delete other engineer accounts but operators can only edit their own account. Operators cannot change engineer accounts or any other operator's account. The edit user menu interface allows for the password, security access level and user id to be changed.

SECURITY TIMEOUT

This item allows a user with Engineer access to enable/disable the menu timeout facility and to specify the length of the timeout in minutes. This is very useful when users with engineering access are configuring the system. They can then lengthen the timeout period to work around having to keep log back in every couple of minutes. For day to day operation of the InSpec we advise enabling the timeout facility. When the menu time out occurs, it reverts back to the logged out mode. A user must now log back in to initiate a batch or make any changes.

2.3   NAVIGATING THE INSPEC DISPLAY

2.3.1   BASIC SCREEN LAYOUT

The InSpec display consists of a 20x2 LCD display. The display operates within several modes. We will look at each of these briefly. The most common screen that an operator will see during day-to-day use is the front display screen. This is the default screen shown during operation.

Figure 3 - InSpec Front Display Screen

The above front display shows the current value in the F_FLOW register, the associated flow units and the current status of the controller is indicated as 'Waiting' by 'WTG' to the bottom left of the display. Each application has a set of specific three letter abbreviations for each status condition of the controller. These abbreviations will be listed and explained in the specific 'status' section of your Sampler / Blender application manual.

In normal display mode, the front display shows one register value and its associated configurable display title. This is 'FLOW' in the above example. There is also a configurable scrolling feature and, at a user defined time period (in seconds), the screen will scroll through a series of up to twenty-four defined register values. The scrolling mode can be turned on or off from the front display by pressing the up cursor button. Items that appear in the scroll list are chosen and set up via the **'Display→Display Setup→Scroll Setup'** menu item. To enter the menu press either the enter button, the centre cursor button or the down button. You will see the following display.

Figure 4 - Entering The Menu

On entering the menu, you will see the current depth of the menu listed in the top left hand side of the menu display. In the above picture number '1' indicates that you are in the first level of the menu. The X/Y indicator to the right shows that in this level, under current security conditions, there are 4 items in level '1' of the menu and we are currently on item '1'. The arrow indicator to the bottom right of the display shows that there are more options available to the right which can be accessed using the right cursor button. A left arrow can also be displayed when there are options to the left of the current position. **Note: The X/Y number indicators will vary depending on which application you are running and what your current level of security is.**

HINT: When you are at either end of a list of options you can use the left or the right button to wrap back around the list. In the above example pressing the left cursor button will take you to option 4 of 4 at the other end of the list. This is very helpful when you enter a list of many options and you already know that the item you wish to select is at the far end of the list. In this case, simply go backwards instead of forwards to quickly select the required item.

Only an engineer can configure which values can be displayed on the front display. In the above screen (figure 3) you would first have to navigate to the Security item (4/4) and login as an Engineer.

The following display shows a menu at greater depth:

Figure 5 - Menu Depths

The top left hand part of the display indicates that this is level 4 of the menu and there are 5 items in this particular sub menu branch. Whenever you are in the menu, pressing either the **cancel** or the **up** cursor button the same number of times as the depth (in this case 4) will bring you back right up and out of the menu to the front display screen. If you press the cancel key again when you are on the front display screen it will of course be interpreted as a 'Stop' command, however for a stop to occur the enter key must then be pressed and pressing cancel again aborts the stop. Repeatedly cancelling will always return you to the front display wherever you are in the menu. If you decide to cancel back out of the menu whilst you are in the middle of a question or a series of questions, then you may also have to confirm cancellation of the decision(s) you are in before you are able to cancel right up and out of the whole menu.

2.4   DATA ENTRY

If the related prompts are enabled the operator will have to enter data at the beginning of a batch/blend. Data is entered as follows.

2.4.1   NUMERIC ENTRY

There is no difference to the method of entry between numeric and alphanumeric characters. The only difference is that the character symbols are not available in numeric entry mode.

Figure 6 - Numeric Data Entry

The above example of numeric data entry shows the cursor under the 5th position. Use of either the up or down button at this location will result in the user scrolling through the available numerical character set. Selecting the right cursor button will insert the character currently displayed and the cursor will move along to the 6th position.

Selecting the left and right cursor buttons within the existing value will result in the cursor stepping backwards or forwards over existing characters. The up and down cursors can be used within a value to change a specific digit. For example, you may wish to change the above value of 2000 to 2100. You could step back three positions using the left cursor button and press the up cursor button once to move from 0 to 1, thus changing the entire value to 2100.

Selecting the delete key (primary function labelled RESET key) will delete the character preceding the cursor and the cursor will move back one space. Many data entry points will result in the last entered value being displayed the next time the question is repeated. Deleting every character and again at the far left of the entered line will result in the original value being re-displayed. This is to help operators recover a forgotten and accidentally scrambled pre-set. Complicated floating-point numbers with extended decimal point notation will be hard to remember so this is a very useful escape option!

Selecting the ENTER key will complete the operation and the current value on display will be written to the associated internal register.

2.4.2   ALPHANUMERIC ENTRY

The principle operations are as above. The only difference being that the available character set is wider. Strings up to 48 characters can be entered. The screen itself is only 20 characters wide. If you go beyond 20 characters, arrows ← → indicating that you are within a longer string are shown on the top right of the entry screen.

2.4.3   PASSWORD ENTRY

The same data entry screen is used for entering passwords. The difference here is that each number selected is displayed as an asterisk when you use the numeric keypad to hide the password. However, the up/down buttons can also be used, and the real numeric values are briefly displayed before timing out to an asterisk. This was put in for the Ex version where only the cursor keys are available for data entry.

2.4.4   QUESTIONS & DECISIONS

Both an operator and an engineer will frequently encounter the need to make a decision. The majority of these are confirmed using the YES/NO dialogue. Alternatively, there is also an ON/OFF dialogue that behaves in the same manner.

Figure 7 - Examples of decision boxes

Decisions with more than two optional answers appear in list form and can be scrolled through from left to right using the cursor buttons.

2.4.5   SELECT/ASSIGN KEY

The twelve circular entry keys '1' thru '-' are used to represent each of the twelve available screen display values. As such the following two dialog boxes are shown when you are being prompted to select or assign a specific display value (1 thru 12). An example of the assign option is shown in the display section further on.

Figure 8 - Select & Assign Screens

2.5   REGISTERS

A register is a piece of memory that can be thought of as a location containing a single data item of a certain type. The registers are stored in memory that is non-volatile so that when the unit is turned off the contents of the registers remains intact. Registers are used by the system for storing information that must be remembered, e.g. calibration constants, accumulated volumes, etc. Each register has a unique number and a descriptive name. The name begins with a character plus an underscore. This prefix character identifies what sort of register it is (see the types listed below). Some registers are given a default value but can be changed to suit the particular application. Registers are split into six groups for storing different types of data.

Figure 9 - Register Display Screen

Each register is displayed with its associated number and value. In the above example, register 0 is shown with its title F_VERSION and value 22.9999 above. The 'F_' preceding the name indicates that this is a floating-point register. The prefixes for each type are:

- F_   → Floating Point Register
- I_   → Integer (Int16) Register
- L_   → Long (Int32) Register
- P_   → Pointer Register
- C_   → Char (Int8) Register
- S_   → String Register (20 characters long)

N: B: If you have previously entered a search pattern, pressing the left or the right cursor button in the above (figure 6) register screen will invoke the previous search pattern. Otherwise, pressing the left or right cursor button will bring up the search options as described in the register mode options section below.

2.5.1   REGISTER MODE OPTIONS

Six operations can be performed within the register display. Pressing the Mode (START) button will bring up a list with the following options.

Set current, description, display, search, view mod add, set mod address.
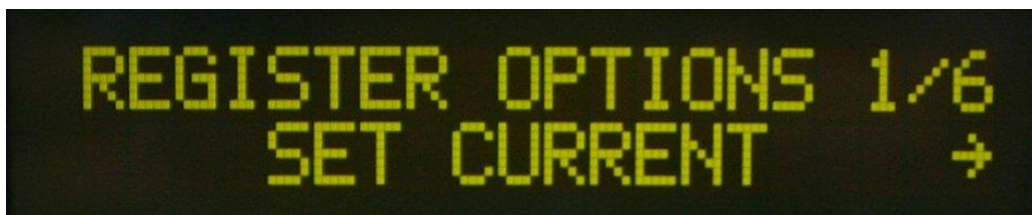
Figure 10 - Register Options Menu

2.5.1.1 Set Current

Selecting Set current enables an engineer to change the current register value using the data entry methods previously described.

2.5.1.2 Entering Register Values In Engineer Mode

A user with engineer level access entering or amending register values will have a different set of characters depending on the register type. To test this out simply go to one of each register type (Float, Integer, Long, Pointer, String), attempt to 'Set Current' value using the mode button and then use the up and down cursor buttons to scroll through the entire character set available for this register type. You will note how:

- Floating-point registers have a decimal point character and a capital E for exponential notation.
- Int16 and Int32 (long) registers have the A-F characters for hexadecimal notation. To switch between decimal and hexadecimal modes use the Mode button as described above.
- String Registers unsurprisingly have the full alphabet and every available required character for creating user-defined titles etc.

2.5.1.3 Description

Brings up a definition/help listing for the current register on display.

2.5.1.4 Display

Selecting the display option assumes you wish to make the current register value one of the front display values. You can assign up to 24 values for display. There are twelve buttons (1 thru Minus Symbol). Each of these buttons can be assigned a display value on first key press or second key press. When you select an item to be displayed a prompt appears asking you whether you want this assignment for the first key press. If you select no, then it will default to the second key press. If you confirm a screen asking you to 'Assign Display Key 1 Thru Minus' will appear. If the value concerns a floating point number you will be prompted for the number of decimals to display, you will then be prompted for a title and units. Finally, you will be asked if you wish for this item to be included in the automatic display scroll list.

Figure 11 - Assign Display Key

2.5.1.5 Search

The facility to search registers by either name or content. Selecting this option brings up a small sub menu to confirm whether you wish to search by name or by contents. Either selection results in an entry screen being displayed for you to enter your chosen name or contents search pattern. On entering the pattern and selecting enter the search will begin. The register list stops at any register where a portion of the search string matches the desired name or contents search string. If the name 'flow' is searched for then every register with the word 'flow' in the title will be flagged. The left and right cursor buttons move between matching registers. I.e., Move backwards (left cursor) or forwards (right cursor) through the register list stopping at every occurrence of the search pattern. In the event that the entered pattern is not found in any register, a message will appear simply stating 'No Match For [pattern]'.

                                                  INTELLIGENT ACTION

2.5.1.6 View Mod Add

The View Mod Add option allows you to view the Modbus address that is assigned to the current register. If no Modbus number is assigned to the register a message will appear to say so.

2.5.1.7 Set Mod Add

The Set Mod Add option allows you to set the Modbus address for the current register. If an address is already assigned to the register a confirmation prompt will appear asking if you want to remove the currently assigned address.

2.6   DISPLAY SETUP

In the above register description, the mode option 'display' allows a value to be quickly selected from a register and displayed as one of the 24 front panel items. Both the blender and the sampler applications have a dedicated display menu item where specific application and system parameters can be selected for display quickly without having to search for the values in the register. The display sub menu is large due to the sheer amount of options available. As an example, the picture below shows 12 items in a Sampler display sub menu.

Figure 12 - Assign Display Key

Many of these items will each in turn have another set of options beneath. E.g., in the above, selecting 'Volumes' will bring up another menu prompting you to select which volume - required, measured etc.

The following display configuration items form part of the same menu and can be found toward the end of the list of items. Remember that the left arrow can be used in the above example to wraparound and get to item 12 quicker than you could by travelling forward 3 to 12.

2.6.1   SCROLL SETUP

Turn the front panel scroll feature on/off and set the time period between each of the configured front display scroll items.

2.6.2   DISPLAY ITEMS

Configure all of the parameters for any one of the 24 display items. You will be asked to select which display you want to configure before being prompted for the source register. This is done via the select 'DISPLAY KEY 1 THRU MINUS' entry screen as described in the previous, the number of decimal places if applicable, the display title and the units for the item.

2.6.3   DISPLAY DEC

This allows you to configure the number of decimal places for any given display item [1 to 24]. The maximum number of decimal spaces for each item is 6.

2.6.4   ENGINEERING DISPLAY

The engineering display is a useful feature, which commissioning engineers/ authorised personnel can use to view more than one process variable on the front panel. In engineering mode, there is no scrolling feature. Instead six values are shown as follows:

Figure 13 - Engineering Display

The engineer will have to write down or memorise exactly what variables they have selected for the engineering display to make full use of it. The engineer display options are configured as if they are items 1-6 in the normal operator display with items 1 to 3 on the top line and 4 to 6 on the bottom.

2.6.5 BAR GRAPH 1

Selecting this option from the Display Setup menu will result in the register screen being displayed. Scroll through or jump to a known register number by entering the numerical value from the front panel and select it using the enter key. Once selected you will be prompted for a min and a max value. This is the range over which the chosen value will be scaled so that it can be represented as a percentage using the ten available bar graph LEDs.

A simple example is to select a min of 0 and a max of 100 (I.e., Imagine we are using the bar graphs to represent batch percent). Each LED of the bar graph represents 10%. E.g., 10% of the batch has passed or the can is 10% full.

The bar graph LEDs are also able to show gradual changes and can indicate when the scale (100%) has been exceeded. For example, using the example of batch percent, when the batch is between 0-10% the first LED will be solid. When it is between 10-20% the first 2 LED's will remain solid.

The LEDs are also able to indicate when a given value exceeds 100%, as may be the case in the InSpec Sampler when batch percent is exceeded but flow is still present. When the value is higher than 100% but less than 110%, all LED segments will be lit solid except the first led which will be off. If the value is between 110 – 120 % then all segments will be lit solid except the second LED which will be off. Again, this is a repeated pattern. If the value was between 190 – 200% then all segments will be lit solid but the 10th LED will be off. Above 200%, all ten LED segments flash on/off repeatedly. At this point, the bar graphs have exceeded their resolution and no meaningful value can be displayed other than to say it is above 200%. This is very unlikely to happen except during an error condition.

Figure 14 - Bar Graphs 1 & 2

In the above picture Bar Graph 1 indicates 30% and Bar Graph 2 60%

2.6.6 BAR GRAPH 2

As above

          INTELLIGENT ACTION

2.7   THE ALARMS MENU

Figure 15 - The Alarms Menu

The InSpec controller has 60 configurable alarms. For each application (InSpec Sampler or InSpec Blender), there will be a set of default system alarms. These are alarms that are considered very common/useful for the general process. You may wish to keep and use these alarms; simply disable or edit the way they work or even delete them form the list of alarms. There are still many empty slots in the alarm table for you to create new alarms from scratch.

The Alarms menu now has 5 options – **'Display Alarms'**, **'Config Alarms'**, **'Delete Config Al'**, **'Scroll Setup'** and **'Alarm Output'**. The operator can only display the alarms. An engineer can display and configure the Alarms. Selecting the 'Display Alarms' options or pressing the down cursor key on the front panel when you are not in the menu brings up the alarm page as follows:

Figure 16 - The Alarms Menu

The Alarm display page shows all the current active alarms. The configurable alarm title is shown on the top line. To the bottom left a similar X/Y indicator is used to show how many alarms are in the current page and which alarm you are currently on. To the right of this is the label indicating whether the alarm is acknowledged or unacknowledged. Alarms will be displayed if they are active and unacknowledged, still active and acknowledged or inactive but still unacknowledged from a previous trigger condition.

Figure 17 - Configurable Alarms Menu

Each of the 60 configurable alarms has a defined name or the alarm is not configured. When a configurable alarm is not configured the title defaults to **'Empty Slot'**. Selecting an empty configurable alarm begins the process of setting up a new alarm. The setup sequence prompts you for the following items:

2.7.1   Set Display Text

This is the title of the alarm. You will see this on the alarm page when the alarm is triggered.

2.7.2   Set Source Register

This is the register that is monitored for an alarm condition.

2.7.3   Set Active Register

This register is monitored to see if the alarm itself is currently enabled. A non-zero value makes that the alarm active. This is useful for UCL programs. Under certain conditions, possibly for a specified period, you may wish an important alarm to be suppressed.

2.7.4   Invert Active?

If the active register is inverted a zero value in the active register makes the alarm active.

2.7.5   Minimum Value

Minimum register contains a value that the source register is compared against. If it falls below this value the alarm is activated

2.7.6   Maximum Register

Maximum register contains a value that the source is compared against. If it rises above this value the alarm is activated.

2.7.7   Invert Rslt?

Normally, when the source register is less than the minimum value or when it is greater than the maximum value, the alarm is active. If inverted the logic, then says that the alarm is active/on all the while we are between the minimum and maximum range.

2.7.8   Hysteresis (%)

This is a hysteresis on the minimum and maximum registers and is used to prevent the alarm toggling active/inactive on a trigger threshold.

2.7.9   Set phases

You are now prompted for whether you want the alarm enabled for each individual application phase. This flexibility helps to account for most process scenarios.

2.7.10   Alarm Delay

The value, in seconds, between the alarm becoming active and the alarm being triggered in software. A delay of zero means that the alarm will be triggered immediately.

2.7.11   Send to output

The InSpec alarms have a generic alarm output. Say yes to this question if you want this specific alarm to generate an output signal. The toggling 'fleet' alarm condition toggles the output signal for [n] seconds. This can be configured via the C_ALARM_FLEET_TIME register. The default is 2 seconds.

2.7.12   Alarm Type

The alarm type is used to indicate the severity of the alarm, and the action that is taken. There are 4 types - "OFF" / "WARNING" / "CONTROLLED STOP" and "EMERGENCY STOP".

2.7.13 Email notification

This decision is asking whether you want a new live occurrence of this alarm to result in email notification. If the answer is yes and an associated alarm is triggered, an email will be sent to the current user as configured in S_MAIL_TO_NAME @ S_MAIL_TO_DOMAIN.

2.7.14 Inhibit Trim

This simple yes/no decision prompt is asking whether you want this alarm to be disabled whilst the blender is trimming.

2.8 SECURITY

The level of security determines the available menu structure. In the following two examples you will note how the available options at the same level change between operator level access and engineer level access. A menu tree at the start of the application manual indicates which options are available under each security access level. A user with operator level access is restricted to performing day-to-day operation and auditing tasks, whilst a user with engineer level access has full access to the menus and configuration items.

Figure 18 - First Level Menu In Operator Mode – 1 of 4 options available

Figure 19 - First Level Menu In Engineer Mode – 1 of 8 options available

2.9 THE SYSTEMS MENU

The systems menu is only available to users with engineer level access. The System menu contains functions common to all variants of InSpec application software. The items within the systems menu are as follows:

2.9.1 InSpec ID

This is the descriptor for the instrument. This alpha/numerical string is used in emails and on the web page to identify the InSpec. Clearly this is particularly useful for any system that has more than 1 InSpec.

2.9.2 Set date/time

Set the system date and time. The user is taken through a series of titled prompts to enter the day, month, year, hour, minutes and seconds. Pressing the cancel button at any point will result in all previously entered values being discarded. (System status must be in waiting for this to work).

2.9.2.1 GMT Offset

You are also prompted for the offset from GMT. This is required in order to make use of the web-based graph facility.

2.9.2.2 Date format

There are six available date formats. The user can choose from the following options. Note that the first three options allow for the year to be entered in full four-digit format. The latter three options have the year truncated to two digits (i.e., 2006 = 06). These are offered so that if required the year parameter can be printed out to the application log with even spacing.

- DD/MM/YYYY
- MM/DD/YYYY
- YYYY/MM/DD
- DD/MM/YY
- MM/DD/YY
- YY/MM/DD

2.9.2.3 NTP Setup

The NTP (Network Time Protocol) menu allows you to enable the ability to periodically update the system time of the InSpec automatically via a reliable internet clock source. This is useful to maintain an accurate time. All systems lag eventually. Over weeks, months and years a significant amount of time lag can accrue.

Enable NTP

The first item in the NTP menu asks you if you wish to enable the feature. The options are simply on or off.

NTP URL

The next item, 'View IP URL', allows you to view the current IP address of the NTP server. This is the IP address of the server providing an external time source.

NTP IP ADD

The next item 'Set NTP Server' shows the current Server/IP Address of your NTP server. This entry allows for both text based, and numerical IP Address based entry. By default, the NTP server is setup to be 'POOL.NTP.ORG'. This is an internationally recognised free NTP URL. It consists of a pool of shared NTP servers that allow external devices such as the InSpec to connect and request a time update. If you would prefer to use your own internal NTP server then simply enter the IP Address of your local NTP server into this menu item.

NTP Poll Time

The 'NTP Poll Time' is the period between NTP updates. I.e., 30 seconds, 60 seconds etc.

GMT Offset

Depending on your global location, you can adjust for local time by entering the offset from GMT (+/-) into this menu item.

2.9.3   Email Setup

This section contains the settings required to send email to the specified recipient. The options available are:

SET SMTP URL

Change the current setting for the SMTP URL.

SMTP IP ADD

View the current IP address for the SMTP URL.

Email From Name / Email From Domain & Email To Name / Email To Domain

You must enter the "from" and "to" fields for the email. There is no facility to enter the '@' symbol whilst entering email addresses. You will be prompted to enter both a name and a domain field for the sender and recipient values. E.g., 'theengineer' (*name*) and 'c-a-m.com'(*domain*). The @ symbol is inserted automatically between the two. These fields must be completed before email can be sent. Of course, the InSpec itself does not process reply emails. It only sends them. Therefore the "from" field should be set to either a non-existing email address or the real email address of someone who will follow up any investigations of field equipment. The "to" email field can be set so that it is sent to an operator or engineer's email account. This is a useful feature and can enable them to receive reports and alarm notifications remotely whilst they are away from the site.

2.9.4   Serial ports,

2 ports (named 2 & 3) are available can be configured to be

- **Off –** The port is assigned no task.

- **A shell –** for interacting with the controller at the command line. **See the section on the command line for details of how to interact with the shell.**

- **A display –** This is used to communicate with optional extra InSpec displays, allowing a maximum of three displays. InSpec displays use a RS422 interface.

- **A printer –** A serial printer has a dedicated serial port. Once a printer is selected to work on the port the user will we asked for the desired baud rate and the number of lines per page. If a printer is currently configured on any serial port and the user attempts to initiate another printer on an alternative port a message will be displayed informing them that a printer is already assigned to a port. A yes/no confirmation screen will ask them if they wish to move the printer. The InSpec supports multiple printers on serial ports and Ethernet. The InSpec serial ports can run a printer using either RS232 or RS422.

- **Modbus Slave –** Each instance of Modbus Slave must have its own dedicated serial port. The InSpec serial ports are able to run Modbus using RS232, RS422 or RS485 interface protocols. Once Modbus is selected to work on the port the following are standard configuration options when running Modbus over a serial link

    - **Select RS Mode –** (This is the electrical characteristic of the serial communication). The InSpec supports the following internationally recognised RS modes: RS232, RS422 or RS485.

    - **Node number –** Modbus slave identifier number on a control system.

    - **Baud rate –** (the communication rate)

    - **Mode –** The Protocol Type (RTU or ASCII), Modbus RTU is a compact, binary representation of the data and uses 8 bits. Modbus ASCII is human readable, and a more verbose protocol which uses 7 bits.

    - **Parity setup –** (simple error check in serial data transmission). As per the Modbus standard, Modbus has 1 stop bit when parity is either odd or even and 2 stop bits when parity is none.

    - **Modbus String Size –** Here you can enter the configurable length of Modbus strings. The default is 20.

    - **Float Mode –** This implementation of the Modbus protocol supports both 32 bit and 64 bit floating point numbers. Here you can indicate which method you wish to use.

    - **The float and the long word order –** Floating point registers and long registers each require two or more Modbus addresses / consecutive reads. The order of these addresses may be swapped to communicate with a customer's interface.

    - **RTU Timeout –** If in RTU mode, you are now prompted for the RTU timeout value (in milliseconds). The default is 40 milliseconds.

- **Modbus Master –** instance of Modbus master must have its own dedicated serial port. The InSpec serial ports are able to run Modbus on either an RS232, RS422 or an RS485. Once Modbus is selected to work on the port the following are standard configuration options when running Modbus over a serial link

  - **Select RS Mode –** (This is the electrical characteristic of the serial communication). The InSpec supports the following internationally recognised RS modes: RS- 232, RS 422/485.

  - **Baud rate –** (the communication rate)

  - **Parity setup –** (simple error check in serial data transmission). As per the Modbus standard, Modbus has 1 stop bit when parity is either odd or even and 2 stop bits when parity is none.

  - **Mode –** The Protocol Type (RTU or ASCII), Modbus RTU is a compact, binary representation of the data and uses 8 bits. Modbus ASCII is human readable, and a more verbose protocol which uses 7 bits.

  - **Modbus String Size –** Here you can enter the configurable length of Modbus strings. The default is 20.

  - **Float Mode –** This implementation of the Modbus protocol supports both 32 bit and 64 bit floating point numbers. Here you can indicate which method you wish to use.

  - **The float and the long word order –** Floating point registers and long registers each require two or more Modbus addresses / consecutive reads. The order of these addresses may be swapped to communicate with a customer's interface.

  - **RTU Timeout –** If in RTU mode, you are now prompted for the RTU timeout value (in milliseconds). The default is 40 milliseconds.

  - **Poll Retries –** In master mode the InSpec polls connected slave devices. In the event of a poll timeout, the node can be polled again. This is the number of retries to attempt.

  - **Delay between Polls –** This configurable value in milliseconds can be set to fine tune a Modbus connection when communication problems occur, typically when using half-duplex communication system.

  - **Modbus Start Offset – T**he Modbus address offset can vary between different devices/implementations. This allows a variable offset to be entered for this session.

  - **Query To Edit –** Here you are asked which query, 1 thru 20, that you wish to edit. In Modbus master you can create/edit up to 20 queries. These are individual or sequences that query a specific slave device on the Modbus network. When editing a query, you will be prompted for the following:

    - **Enable Query –** First you are asked if you wish to enable this specific query. It can be configured but disabled for later use if required.

    - **Node to access –** Here you enter the number of the specific slave device node that you are querying.

    - **Function (read/write) –** Here you state whether this query is a read or a write command.

    - **Write / Read Modbus address –** Here you enter which Modbus address you are writing to or reading from.

    - **Source register –** This is the name of the first register to be acted on.

    - **Number of registers –** Now enter the number of registers that you wish to read/write to/from. The minimum is 1.

By default, the four ports are set up as follows

- Port 0 → Shell (Not Configurable)

- Port 1 → Display (Not Configurable)
- Port 2 → Off
- Port 3 → Off

2.9.5   MODBUS TCP SLAVE

This menu item allows you to setup Modbus TCP slave. You are prompted for the Modbus string size, the float word order and the long word order. These items are covered in the serial setup above. Note that setting up Modbus TCP slave is simpler than serial Modbus slave. There is no node number. The IP address of the machine is the unique identifier. There is also no need to set up the RS-mode, protocol mode, baud rate or parity.

2.9.6   MODBUS TCP MASTER

This menu option enables you to setup Modbus TCP Master. You are prompted for the query block (the device), the associated block URL (IP address), the Modbus start offset, the Modbus string size, the float mode (32 bit or 64 bit) and the float and long word orders. You are then prompted to edit the specific master queries, entering a node for specific devices on the network.

2.9.7   IP SETTINGS

Note: As an operator of the InSpec you may not understand or appreciate the specific details and needs of each IP setting. If you wish to enable the IP features of this controller then you will almost certainly configure the IP settings in conjunction with the authorised local InSpec engineer and your local network administrator. There is a more detailed section in the manual concerning these points and one that can be presented to the local network administrator if required. See section 0 for a more in-depth look at the IP settings required to deploy the InSpec onto a network and use the related features.

CONFIGURE DHCP

The Dynamic Host Configuration Protocol (DHCP) is a computer networking protocol used by hosts (DHCP clients) to retrieve IP address assignments. In this menu you are first asked if you wish to enable DHCP, if it is disabled the user will have to enter static IP addresses etc. If you select yes, you are prompted for the DHCP timeout period. The default is 30 seconds. This is the period after which a poll to the DHCP server is considered to have failed/timed out.

INSPEC IP ADDR

This item allows you to view the current IP address and to set a static IP address if required. Note: If DHCP is enabled and working then the IP address you see via the view IP address menu item is the IP address that has been provided by DHCP server.

SUBNET MASK

A subnetwork, or subnet, is a logically visible, distinctly addressed part of a single Internet Protocol network. The process of subnetting is the division of a computer network into groups of computers that have a common, designated IP address routing prefix. By default, this is set to 255.0.0.0 within the InSpec. If DHCP is enabled, then the subnet mask is obtained from the DHCP server. However, you can still enter a static subnet mask address. This will then act as a fall-back if the DHCP server fails to provide the subnet mask address or DHCP is disabled in the InSpec. Naturally, the specific configuration you chose will depend on the advice of your local network administrator.

DEFAULT GATEWAY

The default gateway is used to connect the internal networks and the outside network (Internet or intranet). If DHCP is enabled the default gateway is obtained from the DHCP server. However, you can still enter a static default gateway. This will then act as a fall back if the DHCP server fails to provide a default gateway or DHCP is disabled in the InSpec. Naturally, the specific configuration you chose will depend on the advice of your local network administrator.

PRIMARY DNS

The Primary DNS server translates domain names meaningful to humans into the numerical identifiers called IP address that are associated with networking equipment for locating and addressing devices worldwide. An often-used analogy to explain the Domain Name System is that it serves as the "phone book" for the Internet by translating human-friendly computer hostnames into IP addresses. For example, *www.example.com* will translate to an IP address like *192.0.32.10*. If DHCP is enabled the primary DNS server address is obtained from the DHCP server. However, you can still enter a static primary DNS server address. This will then act as a fall back if the DHCP server fails to provide the address of the primary DNS server or DHCP is disabled in the InSpec. Naturally, the specific configuration you chose will depend on the advice of your local network administrator.

SECONDARY DNS

If the primary DNS server fails, a secondary DNS server is often provided as a fall back. If DHCP is enabled the secondary DNS server address should be obtained from the DHCP server. However, you can still enter a static secondary DNS server address. This will then act as a fall back if the DHCP server fails to provide a secondary DNS server address or DHCP is disabled in the InSpec. Naturally, the specific configuration you chose will depend on the advice of your local network administrator.

SMTP URL ADDRESS

The InSpec can email reports, configuration files and notify a specified recipient of active alarms as they occur. To do this a valid SMTP server URL address has to be entered. This section has nothing to do with DHCP. You will need to obtain the address of a local server that supports the simple mail transfer protocol from your network administrator. An alpha-numerical SMTP server name can be entered, e.g., *our.mailserver.com*, or an IP address like *192.168.0.10.*

PRINT URL ADDRESS

The InSpec can print batch reports, logs, register files and UCL files. To do this a valid URL address for an Ethernet printer has to be entered. You will need to obtain the URL address of a local printer from your network administrator. An alpha-numerical SMTP server name can be entered, e.g., *our.printserver.com*, or an IP address like *192.168.0.10.*

NTP URL ADDRESS

In this section you can set the NTP URL server address and view the associated IP Address of the URL.

VIEW MAC ADDRESS

The MAC address (Media Access Control address) is a unique identifier assigned to most network enabled devices (network cards/pc's etc) by the manufacturer for identification. This unique identifier is essential, at a hardware level, for higher protocol/software layers to recognise individual devices on a network. The MAC address is associated with a specific hardware device. The MAC address is sometimes referred to as the 'Ethernet hardware address'. Conversely, you can think of an IP address as being associated with the software layer on the physical device. Unique MAC addresses are purchased in blocks from an IEEE standards authority.

In this menu item you can only view the MAC address. An operator will never set the MAC address. A Jiskoot Engineer sets this at the factory. Once the MAC address has been set it can never be changed. For this reason, great caution has to be exercised when setting the MAC address onto a new InSpec.

2.9.8   USER COMMANDS

User commands is a method by which an input or output calculation can be derived from two source registers and the result is then assigned to a destination register. It is best to think of this as a very simple one off UCL style calculation. Likely, anything more complicated is likely to require UCL anyway. However, this facility remains as a simpler option.

2.9.9   IO

The InSpec IO menu for a Sampler or a Blender consists of 3 sub-menus. Note, this menu is not available on the remote IO InSpec. This is to ensure all calibration and configuration of the IO for a remote device is performed via the menus (Web or front panel) on the master InSpec.

IO→Configure – option for configuring the digital types (Inputs, Outputs or Grab (Sampler only)), setup the control digitals and enter the URL/IP address of any configured remote devices.

IO→Tests – option for testing the Pulse/Frequencies, ADC's, DAC's, Digital IN's and Digital OUT's.

IO→Calibration – option for calibrat the ADC's and DAC's.

For a sampler and a Blender, you will initially be prompted to choose whether you want to configure the IO options for the local device or one of the remote devices.

Note on a Sampler there is also the useful option to 'Find Grab'. With the facility for the master unit to host 10 remote IO units and for the Grab signal to be on any one of the digitals on these additional cards, it might be common to forget exactly where the digital grab is configured. This menu option tells you which card and which digital to look at.

2.9.9.1 IO TESTS

Figure 20 - Selecting tests from the IO tests menu

The image above shows the IO test selection menu. The five available test options are:

Pulse Frequency.

The user will be prompted for which pulse / frequency test channel they wish to test, and the following test screen will appear:
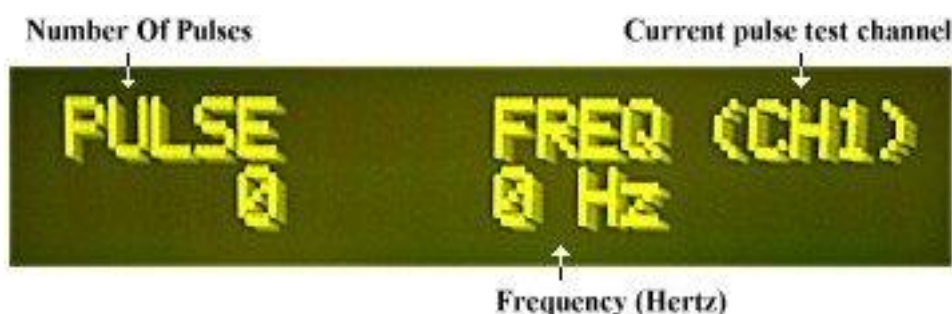
Figure 21 - The Pulse / Frequency test screen from the IO tests menu

This display shows the raw pulse count coming into the pulse input. This value converted to a frequenc   y is displayed on the right. Use the UP and DOWN buttons to switch between channels 1 and 2. The values for pulse and frequency will naturally deviate on the display.

ADCS.

Test the three ADC values. Again, the user will be prompted for which pulse/ frequency test channel they wish to test and the following test screen will appear:
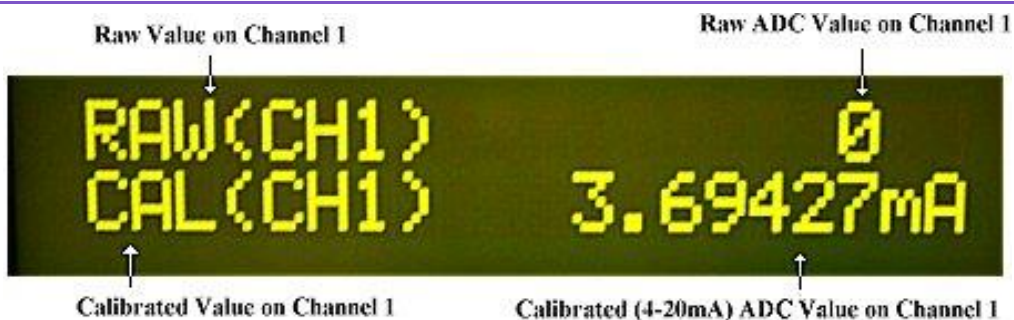
Figure 22 - The ADC test screen from the IO tests menu

The upper line of the display gives the raw value coming in on the ADC channel. The lower line then shows the associated calibrated value scaled for a 4-20mA signal. Use the UP and DOWN buttons to switch between ADC channels 1 to 3.

DACS.

Test the two DACS.
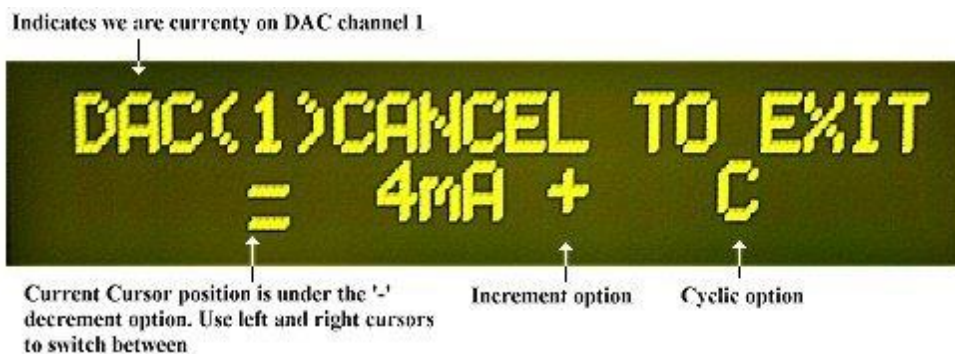
Figure 23 - The DAC test screen from the IO tests menu

The DAC test screen allows the engineer to check and test that the DAC output signals respond correctly in the field. Use the UP and DOWN buttons to switch between DAC channels 1 & 2 and the left and right cursor buttons to move between the three available options of '-', '+' and 'C'. In the above example the cursor is positioned after the '-' decrement option. With the cursor beneath it looks like a '=' symbol above. The cursor flashes beneath the decrement symbol to avoid this potential confusion. Selecting enter whilst on the decrement symbol will step down through the 4-20 mA range. The decrement option would not affect any change above since it is already at the lowest end of the 4-20mA range.

Selecting enter whilst on the '+' symbol will step up one by one through the 4-20mA range. Selecting enter with the cursor beneath the '+' symbol in the example above will move the current DAC output value from 4 to 5 mA.

Selecting the upper-case C to the right of the increment option makes the DAC test go into cyclic mode. In cyclic mode the output will ramp up and down repeatedly between 4 and 20 mA. The output values can be checked on the output DACs with a multi-meter. **Note:** Engineers can toggle the register 'C_DAC_HOLD_TIME' to set the number of seconds to hold the output at the upper and lower test points of 4 and 20 mA. The default is 5 seconds. This can be very useful in the field to properly test and check that valves are at and do make their fully open and closed positions at 4 and 20 mA respectively.

Cyclic mode can be stopped by either entering select again on any of the three function symbols (capital C, the '+' or the '-' symbol) or by selecting the cancel button to exit the entire test screen.

On exiting the DAC test screen, a yes/no decision box appears asking the engineer if they wish to re-calibrate the DACs. This is a handy short cut feature that will allow quick switching between the testing and the calibrating of the DACs to fine tune the settings.

Digital Tests

The display for both the digital in and out tests shows whether the specific digitals are available for test. In the following two pictures you will see that certain digital inputs or outputs are shown as an X. This informs you that they are not configured as an input or output so are invalid for the specific test.

Digital Input tests

Figure 24 - The Digital Input test screen from the IO test menu. Note: In this example only, the last digital is an input. The rest have been configured as either outputs or as a grab signal.

This test display requires no interaction from the user and the state of the digital inputs is simply displayed as either being off=0 or on=1. This screen is very useful to test remote IO signals coming into the controller.

Digital Output Tests

Figure 25 - The Digital Output test screen from the IO test menu. Note: In this example only digitals 2, 3 4, 5 and 7 are outputs. The rest have been configured as either inputs or as a grab signal.

2.9.9.2 IO CALIBRATION

ADC Calibration

As in the test screens you will initially have to enter the number of the ADC channel that you wish to calibrate. You will then be taken through the calibration steps as follows:

Figure 26 - Set 4mA calibration point during ADC calibration routine.

Once your input test signal settles, enter the value for the default 4mA calibration point. On doing so you will then be presented with a very similar 20mA screen.

Figure 27 - Set 20mA calibration point during ADC calibration routine.

Once your input test signal settles, enter the value for the default 4mA calibration point. On doing so you will then be presented with a very similar 20mA screen.

To calibrate between 4 and 20ma, the values entered have to be within a given range else a message box will appear stating that the calibration is 'Invalid'.

DAC Calibration

Using a meter, the engineer calibrates the DAC's by reading and entering the recorded output signals for 4 and 20mA. After entering the calibration values the user is asked if they wish to go into the DAC test screen to check the calibrated values. The calibrate/test cycle repeats until the user exits either routine.

Figure 28 - Set 4mA calibration point during DAC calibration routine.

Figure 29 - Set 20mA calibration point during DAC calibration routine.

2.10 RECORDS AND LOGS

2.10.1 GENERATE REPORT

Selecting this during a batch will create an intermediate batch report. This is effectively a snapshot of the current batch. Each intermediate report contains a numerical suffix. E.g., REPORT00.TXT, REPORT01.TXT, REPORT02.TXT, REPORT03.TXT etc. Note: An intermediate batch report is also created whenever the application goes into the paused, stopped, emergency stopped or restarting mode. The end of batch report will still be generated regardless of how many intermediate reports are generated.

2.10.2 PRINT

Printers on an InSpec can be serial and/or Ethernet. Within the print menu of Records and Logs, the following items are available:

BATCH REPORT

This menu item allows you to navigate to previous reports and select them for printing. On selection you will be prompted to navigate down through the historical files that are stored on the flash SD card. First, you will be prompted to select the year, then the month, then the day, then the specific batch.

Note: If the C_AUTO_REPORT register is set, the end of batch report will be printed automatically at the end of a batch. If the SMTP service is configured and the C_AUTO_MAIL_REPORT register is set, then the end of batch will be automatically emailed to the specified recipient.

BATCH LOG

This menu item allows you to navigate to previous batch logs and select them for printing. On selection, you will be prompted through the historical files that are stored on the flash SD card. First, you are prompted to select the year, then the month, then the day, then the specific batch where the log resides.

Note: If the SMTP service is configured and the C_AUTO_MAIL_LOG register is set then at the end of batch the log will be automatically emailed to the specified recipient.

ALARM PHASE LOG

This menu item allows you to navigate to previous batch alarm and phase logs and them for printing. On selection, you will be prompted down through the historical files that are stored on the flash SD card. First, you are prompted to select the year, then the month, then the day, then the specific batch where the alarm phase log resides.

Note: If the SMTP service is configured and the C_AUTO_MAIL_ALPH_LOG register is set then at the end of batch the alarm phase log (AL_PH.CSV file) will be automatically emailed to the specified recipient.

UCL PROGRAM FILE

If it exists, this menu item will print the UCL.TXT file stored in the SYSTEM directory.

REPORT TEMPLATE

This menu item will print the REPORT_TEMPLATE.TXT file stored in the SYSTEM directory.

REGISTERS

This option will print out the entire register list, listing each register's number, register title and register contents. It is a useful tool for capturing a snapshot of the registers. Be warned, it does take a while to print so many registers.

SET PAGE LENGTH

This sets the page length for any attached printer (serial or Ethernet). When this length is reached the page is printed out.

AUTO REPORT PRINT

This sets the page length for any attached printer (serial or Ethernet). When this length is reached the page is printed out.

NUM. OF REPORTS

This sets the number of report copies to print per print report request.

2.10.3 DELETE BATCHES

This item will prompt you to select a batches or batch files for deletion. If you confirm this process, then all data for the batch will be destroyed. This includes the report and all log data.

2.10.4 EMAIL

Note: All items in this section depend on the SMTP service being configured.

BATCH REPORT

Allows you to navigate the directory structure and select a batch folder. The report from this folder will then be printed. You will be notified if the report file does not exist.

BATCH LOG

Allows you to navigate the directory structure and select a batch log. The log from this folder will then be printed. You will be notified if the log file does not exist.

ALARM PHASE LOG

Allows you to navigate the directory structure and select a batch alarm phase log (AL_PH.CSV). The alarm phase log from this folder could then be printed. You will be notified if the alarm phase log file does not exist.

REGISTER LOG

The reglog csv file contains information on specific register changes. This acts as an audit trail. In the event of any problems, a historical data trail will reveal what parameters were altered prior to an issue arising. The Reglog.csv file contains the name of the user who was logged in when the change was made, and each line of the file contains a terminating checksum to validate the contents of each entry.

MODBUS LOG

The modlog csv file contains information on specific Modbus address changes. This acts as an audit trail. As with the reglog file, this file provides a historical data trail for the Modbus address data. The modlog.csv file contains the name of the user who was logged in when the change was made, and each line of the file contains a terminating checksum to validate the contents of each entry.

REBOOT LOG

This file records the number of reboots initiated by the software watchdog. This comma separated file records the time and date of each reboot and, most importantly, which application software task instigated the reboot. Ideally this file should never exist!

REPORT TEMPLATE

The report template file is a copy of the current report format. You may wish to email this to someone who wishes to verify and/or edit the contents. The format of the report file is highly configurable in the InSpec.

ALL SYSTEM FILES

This option will send all the InSpec configuration files to the specified recipient. This facility is likely to be initiated on site by an engineer. The system files can be sent to a Jiskoot engineer for analysis.

UCL PROGRAM FILE

If a UCL file exists it will be emailed. If not, a message will appear telling you that the file does not exist.

CONFIG.TXT

The config.txt file is a file containing the entire contents of the registers and Modbus address table. This is the same content generated by the CS command line.

CONFIG.MODBUS.CSV

This comma separated file contains a full listing of the current Modbus assigned data.

CONFIG.ALARM.CSV

This comma separated file contains a full listing of the current alarm configuration.

CONFIG.CAL

This simply contains the current values for the ADC and DAC registers. It is a snapshot of the current IO status.

CONFIG.BIN

This binary file is a direct copy of the memory containing the register data.

AUTO REPORT MAIL

Here you set the configuration option to set if a batch report is automatically emailed at the end of a batch.

AUTO LOG MAIL

Here you set the configuration option to set if a batch log is automatically emailed at the end of a batch.

AUTO ALARM MAIL

Here you set the configuration option to set if a batch alarm phase log is automatically emailed at the end of a batch.

BACKUP IMAGE

Create an image of the InSpec configuration and email to the specified address.

2.10.5 LOG SETUP

The Log is a shared application feature that enables up to 20 data variables to be printed out consecutively in a running log. There are two options within the log menu:

Period: This set the interval for each log print out. The interval period for a sampling application can be set to either 'On Grab' where n amount of grabs have to pass between each log printout, or 'On Secs', where n seconds have to pass before a log line is printed out. In the Blender application the only format is the time based 'On Secs'.

Format: The format option allows each of the items for the display to be configured. You are prompted for which item you wish to configure, following by whether or not you want the item to be printed and stored as a text file, weather you wish the log item to be stored in the log CSV file. Next, you are asked for the log items source register, the text width of the log items and, if appropriate, the required number of decimal places. Lastly you are prompted to enter a title for the given log field, where the log titles are limited to the previously configured item width.

2.11 SOFTWARE DESCRIPTION

2.11.1 OPERATING SYSTEM

The unit uses Keil's RTX operating system. The operating system will usually remain invisible to the user, as the unit will be supplied fully configured for your application and will automatically start when switched on. If any major changes are required to the system during its lifetime then there is the facility to connect a terminal to a debug port (Serial Port 1/Console) to gain access to the operating system shell. This port is an RS232 serial link and has default settings of 9600 baud, 8 bits, 1 stop bit and no parity. WARNING, using this facility can seriously damage the configuration of the instrument and should only be used under the guidance of experienced Jiskoot Engineers.

2.11.2 FILES

The file system for the InSpec stores and retrieves data from the supplied SD card. This is a standard off the shelf SD or SDHC card and could be replaced with a similar card from a local supplier. The InSpec supports both the SD format (up to 2Gb. Formatted to FAT16 or FAT32). If a replacement is required locally, the preference is to use the SD format.

Data for application batches are stored on the SD card in the following date format:

YEAR/MONTH/DAY/BATCH. E.g., 2010/06/14/BATCH2_0.1

The folder BATCH2_0.1 will contain the report.txt file on batch completion. The report file is created on batch reset. The various batch log files for each batch are also stored in this folder e.g. LOG.TXT.

The root directory of the SD card should always contain a folder called **SYSTEM**. This contains the system files for the application. This includes the report template files (both in text and html format), the system log files (reglog, modlog and rebootlog) and any system files that have been generated during an upgrade or backup procedure. These files can be   emailed to a specified user via the front panel menu. There is no reason to alter, delete or amend these files. Upon reboot the application looks to find certain files. If it cannot find them on the SD card it will automatically create them. This makes it possible to replace your existing SD card with a new blank card. You only need to reboot the instrument with the new card inserted to continue operating as before.

There are various file commands that can be executed via the command line that specifically cover the use of the SD file system. These will be covered in the software command line section.

SECTION 3: DATA COMMUNICATIONS

3.1   WHAT IS IT?

The purpose of data communications is to transfer information between two or more units. As a rule, it is characters (text or numbers) and/or instructions (commands) that are transmitted. The simplest level of computer language is binary digits where each character is composed of seven to eight binary 1's or 0's.

The computer processes binary characters made up of 1's or 0's. Each of the characters is called a bit. By combining several bits, a binary character set can be constructed. The most common system, ASCII, contains 128 characters, each of which is made up of 7 bits, ASCII is commonly extended to 8 bits, or 256 characters. 8 bits are known as a byte and a kilobyte (kB) is made up of 1024 extended ASCII characters.

All communication is carried out at this level, internally within the computer as well as externally with other units. Internal communication within the computer is simple. However, as soon as the computer must communicate with external units, a series of factors must be synchronised and controlled to ensure that the transmission of data takes place correctly.

3.2   ONE BIT AT A TIME, OR A WHOLE BYTE?

There are two ways of transmitting data, by parallel or serial transmission.

3.3   PARALLEL TRANSMISSION

The InSpec does not support parallel data communication.

Parallel transmission is faster and simpler since the entire character with its 8 bits is transmitted in a single operation using 8 transmission paths, one for each bit. All communication within the computer itself takes place via parallel paths in the internal data bus so that the entire character or several characters can be simultaneously transmitted.

Parallel transmission via a multi-conductor cable (Centronics-type) can only be carried out at short distances for practical and economic reasons. Therefore, the majority of all external data communications is achieved through serial transmission; i.e. the bits are sent one at a time on a single transmission path.

3.4   SERIAL TRANSMISSION

Serial transmission places higher demands on the receiver and the transmitter that must keep track of when the character starts and ends, and of the inherent sequence of bits. The transmitter and receiver must transmit and receive at the same rate. This is known as the transmission speed and is expressed in bit/s (bits per second).

To tell the receiver where a character starts and ends the transmitter sends out extra bits, a start bit and one or more stop bits.

3.5   SIMPLEX, HALF DUPLEX OR FULL DUPLEX?

The following is based on a simple RS232 connection.

3.6   SIMPLEX

When communication only takes place in one direction e.g. a computer sends an 'on/off' signal to a motor. This is called simplex transmission. However, if the motor then has to reply that it is functioning then duplex transmission is required.

3.7   HALF DUPLEX

Half-duplex transmission means that the communicating units must take turns in sending out signals, i.e. communication can take place in both directions but not simultaneously.

3.8   FULL DUPLEX

Full-duplex transmission is two-way simultaneous transmission.

3.9   THE RIGHT CONNECTION

The following is based on a simple RS232 connection.

- Two terms that recur in data communications are DTE (Data Terminal Equipment) and DCE (Data Communication Equipment).

- Computers and terminals are usually DTE's, modems and communications hardware are generally DCE's while other equipment such as multiplexers and printers can be either.

- DTE's transmits and receive on different pins in the connector than DCE's.

- Therefore, to avoid common errors when connecting equipment it is important to know the definition of the particular item of equipment.

- If you connect a DTE with a DCE, the DTE will transmit data on pin 2 while the DCE will receive data on pin 2 (in spite of the fact that the signal name is the same in both cases). This can be achieved with a 'straight through' type cable.

- If you connect to DTE's, you have to connect pin 2 and pin 3 in order for the transmitter to be connected to the receiver. This can be achieved with a 'null modem' type cable.

Minimum Null Modem Cable
For 9 Way D-Type Connection

Minimum Straight Cable
For 9 Way D-Type Connection
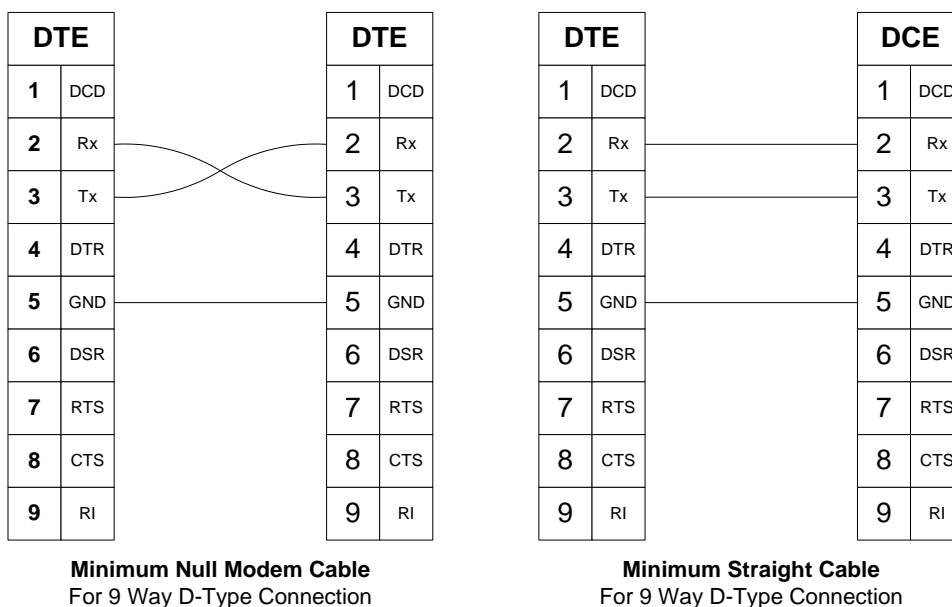
Figure 30 - Communications Cable Build

The InSpec debug communications port uses a DTE connection and a cross cable will be required to connect and debug the instrument.

3.10 RS232

EIA-232 or RS232 is perhaps the most common interface for data communications via a 9 or 25-pin D-type connector serial port V.24 standard.

The V.24 standard recommends that the cable should be no longer than 15 metres. V.24 (the CCITT standard) or RS-232-C (the EIA standard) are two standards which are similar, in principle, and for most of applications can be treated as the same. V.24 is the physical standard that defines how units should be connected to each other and this also defines the appearance of the connector. V.28 is the electrical standard. For this reason, the interface is sometimes described as V.24/V.28.

The InSpec serial ports support RS232 on all of it serial communication ports.

3.11 RS422

EIA-422 or RS422 is a physical layer electrical specification of a four-wire, full-duplex, point to point or multi-drop serial connection.

RS422 is a standard interface that is suitable for industrial applications. It was created for the construction of multi-drop data busses, between a main computer and a number of terminals. The interface is balanced, uses a four-wire format and is relatively immune to interference. The interface changes polarity of the wire pair depending on whether a 1 or a 0 is to be transmitted.

RS422 was originally designed to handle 10 units and can now be set up with up to 32 units connected. The maximum recommended distance is 1200m at 100kb/s (100 kilobits per second). RS422 can be integrated with RS485, RS423-A and RS449 via converters.

The InSpec serial ports support RS422.

3.12 RS485

EIA-485 or RS485 is a physical layer electrical specification of a two-wire, half-duplex, multi-point serial connection. It uses a differential form of signalling where the voltage difference between the wires coveys the data. One polarity of voltage indicates a logic 1, the reverse polarity indicates logic 0. The InSpec serial ports.support RS485.

3.13 Line Termination and Fail-Safe

It is recommended to terminate the line with a circuit of equal impedance to the characteristic impedance of the transmission line. For RS422 and RS485 a 120-ohm resistance is recommended.

The purpose of the termination is to prevent the reflection of data at the ends of the cable. If there is no active driver on the network the line can be forced into a known idle state with a fail-safe circuit. Without this circuit it is likely that the line will pick up noise and falsely trigger the receivers leading to problematic communications.

SECTION 4: IP SETTINGS

As well as providing legacy serial connectivity, the InSpec has an Ethernet port and, if configured correctly, can provide Modbus TCP (Master/Slave), Network Time Protocol (NTP) updates, SMS email notification for alarms, batch reports, log files and diagnostic files etc, Ethernet printing, Telnet sessions and an extensive Web browser interface to configure and monitor the application.

The InSpec IP settings must be configured correctly on the local network in order for all of the above features to be readily available and used to their full potential. Adding third party IP equipment to a local network governing process control equipment is historically viewed with suspicion. The important point to note is that **none of the InSpec IP related features are enabled by default.** The following IP settings will need to be determined and entered via the local network administrator for the InSpec to be deployed successfully onto the local network. Once the local administrator has enabled the InSpec on a LAN (Local Area Network) they may wish to open the InSpec to an external network for communication/support processes. To do this the local administrator will need to configure/map their network in accordance with their local network infrastructure. **The local IT team are responsible for enabling\allowing both local and external access.** The following bullet points identify the key settings for IP connectivity and the specific parameters for each IP related feature.

4.1   IP Settings

The IP settings of the System menu have been covered already in the menu section 2.9.7. The purpose of this section is to introduce some basic knowledge to internet connectivity and to cover each specific IP setting in a little more detail and within one section that can be taken in isolation to the customer's local network administrator.

Before addressing the individual IP settings in the InSpec, let us look at what an IP Address is:

4.1.1 What is an IP Address?

As a term, "IP address" has and will continue to become a well-known expression as more and more devices become IP enabled. Your computer has an IP address, your phone has an IP address and now even unsuspecting devices like large cumbersome drinks dispensers have IP addresses. What exactly is an "IP address"?

An IP address is an "internet protocol address". This is a unique identifying number given to every single computer on the internet. Like a car license plate, an IP address is a special   serial number used for identification. Any machine connected to the internet has   an IP address. In every case, the IP address acts both like a car license plate or a telephone number: The IP address indicates ownership and allows the machine to be located by other machines.

4.1.2 What do IP addresses look like?

IP addresses are comprised of four numbers separated by dots:

- e.g. 127.0.0.1
- e.g. 253.16.44.22
- e.g. 72.48.108.101

All the InSpec IP settings of IP address, subnet mask, default gateway and both the Primary and Secondary DNS share the same format. They each consist of 4 numbers (called octets, separated by dots). Certain addresses are reserved for internal, loopback or broadcast tests. Each octet is limited between 0 and 255.

An IP address is a 32-bit number (in IPV4) that identifies each sender or receiver of information that is sent in packets across an internet network. As an example, when you request a HTML page or send an e-mail, the Internet Protocol, part of TCP/IP, includes your IP address in the message (in each of the packets if more than one is required). The request is sent to the IP address that is obtained by looking up the domain name in the web page address (URL - Uniform Resource Locator) you requested or in the e-mail address you are sending an email to. At the other end, the recipient can see the IP address of the web page requestor or the e-mail sender's IP address and can respond by sending another message using the IP address it received.

Now, turning to the specific configuration components of the InSpec IP settings, you will learn how a protocol called DHCP *(Dynamic Host Configuration Protocol)* is used to determine whether the InSpec IP address is obtained automatically via the DHCP protocol or whether it is entered manually.

4.1.3   Configure DHCP

InSpec Menu Options = DHCP enabled / timeout

What is DHCP? DHCP is the *Dynamic Host Configuration Protocol,* this protocol   is   used   by hosts connected to a network (DHCP clients) to obtain IP address assignments and other configuration information from the server. It is very common in a business for each individual PC (DHCP client) to obtain its IP address from the server via the DHCP protocol. In effect each PC (or in our case, InSpec) asks the server for the information it requires to partake in the local network. DHCP is very popular with Internet Service Providers because it allows them to provide hosts with a temporary IP address, allowing the allocation of resources to be managed. The alternative to DHCP is to manually configure the static IP address of each connecting device. This is both time consuming and error prone.

This menu item provides two simple options. Either the DHCP protocol is enabled or disabled and, if enabled, a timeout period can be specified. This is the period in which you wait for the IP address and configuration information to be assigned. If this timeout period is exceeded, the InSpec will revert to a set of static IP settings.

If DHCP is enabled but repeatedly times out, then this is something that can only be fixed with the local network administrator. If DHCP cannot be rectified, the local network administrator should provide a static IP address, a subnet mask and a default gateway that are known and proven to work. These items will be discussed amongst others further below.

4.1.4 IP Address

InSpec Menu Options = View current / set static

The IP address for the InSpec is either entered manually via the set static menu option or it has been obtained via the DHCP protocol enabled as described above in the configure DHCP section. If DHCP is enabled but fails to provide a DHCP assigned IP address, the IP address will revert to the default static settings. If your intention is to use a static IP address then you must ensure that DHCP is disabled and that the other required settings have also been configured manually (subnet mask, default gateway, primary DNS and secondary DNS all need to use static settings).

4.1.5 Subnet mask

What is a subnet mask?

A subnet mask is used to divide internet addresses into blocks called subnets. The mask number represents   the   number   of   1s   in   the   binary   of   the   address   that   are   'masked'.   E.g.,   255.255.255.0 technically provides 256 network addresses (0-255 in the final octet). However, there are only 254 as certain addresses are reserved. If you were to unmask the next bit to 255.255.254.0 you would technically have 512 network addresses.

The masked bits in the address are not accessible. Subnets masks are useful within large networks to ring fence protective areas of a network. For instance, for security reasons you might wish to block access to specific IP addresses /devices on a network that deal with specific data. The ability to ring fence specific nodes on a network is very useful in an environment where tiered security access is an important part of the network architecture. In the case of the InSpec, a range of addresses may be provided specifically for Ethernet enabled industrial devices.

By default, the InSpec subnet mask is set to 255.255.255.0

Because the first three octets are set to their maximum value of 255, this means that the first 3 octets of any IP address are always assumed to be on the local network.

For instance, consider a subnet mask of **255.255.255.0** and an IP address of **120.45.67.75** Here, the first three octets of **120.45.67** are the network portion of the address. The final octet of **75** is a specific device on the **120.45.67** local network. In this case, with a subnet mask of **255.255.255.0**, the valid number of IP addresses within this local network will be **120.45.67.1 – 120.45.67.254**. Note that **120.45.67.0** and **120.45.67.255** are reserved IP addresses.

These 8 bits give 254 possible network addresses.

InSpec Menu Options = View current / set static.

The subnet mask is either entered manually via the set static menu option or it is obtained via the DHCP protocol. If DHCP is enabled but fails to provide a subnet mask, the subnet mask will revert to the default static settings. If your intention is to use a static subnet mask then you must ensure that DHCP is not enabled and that the other required settings have also been configured manually (i.e. subnet mask, default gateway, primary DNS and secondary DNS all need to use static settings).

4.1.6 Default gateway

What is a default gateway?

The default gateway is the interface between the local network and all external networks beyond (i.e., the Internet or Intranet). To understand the default gateway address, consider the subnet mask again as being analogous to the mail/postal service. If you put mail in the letterbox and from there it went directly to the destination address, it would require the sorter at the local post office to know exactly where it went out of hundreds of millions of places. The possibilities are too immense! Of course, instead the sorter only needs to know what regional hub the mail must go to next and from there it will be taken care of likewise. Only the local mail stays within the local postal network (i.e., local post = local network. This was anything between **120.45.67.1 – 120.45.67.254** in the previous example**).** In a sub-network the devices in that sub-network exchange packets directly until something needs to go to an address outside of the local sub-network. Anything outside of the local sub-network goes via the default gateway (hub) and the routing algorithm there takes care of the rest**.**

Consider the following IP addresses. If you understand why they do or do not require the gateway, then you have grasped the concepts of subnet masks and the default gateway. Again, consider a single subnet with an IP range of **120.45.67.1 – 120.45.67.254**

IP ADDRESS	WITHIN SUBNET	SEND TO GATEWAY
120.45.67.96	✓	X
120.45.66.124	X	✓
120.42.19.78	X	✓
120.45.67.101	✓	X
93.24.22.13	X	✓

InSpec Menu Options = View current / set static.

The default gateway is either entered manually via the set static menu option or it is obtained via the DHCP protocol. If DHCP is enabled but fails to provide a default gateway, the default gateway will revert to the default static settings. If your intention is to use a static default gateway then you must ensure that DHCP is not enabled and that the other required settings have also been configured manually (i.e., subnet mask, default gateway, primary DNS and secondary DNS all need to use static settings).

4.1.7   Primary DNS

What is a primary DNS?

A primary DNS server is a computer that runs special purpose networking software that translates domain names meaningful to humans into the numerical (binary) identifiers associated with networking equipment for locating and addressing devices worldwide. An often-used analogy to explain the Domain Name System is that it serves as the "phone book" for the Internet by translating human-friendly computer hostnames into IP addresses. For example, the URL *www.example.com* translates to *192.0.32.10*. If DHCP is enabled the primary DNS server address is obtained from the DHCP server. However, you can still enter a static primary DNS server address. This will then act as a fall back if the DHCP server fails to provide the address of the primary DNS server.

InSpec Menu Options = View current / set static.

4.1.8   Secondary DNS

What is a secondary DNS?

If the primary DNS server fails, a secondary DNS server is often provided as a fall back. If DHCP is enabled the secondary DNS server address should be obtained from the DHCP server. However, you can still enter a static secondary DNS server address. This will then act as a fall back if the DHCP server fails to provide a secondary DNS server address. Naturally, the specific configuration you chose will depend on the advice of your local network administrator.

InSpec Menu Options = View current / set static.

4.1.9 SMTP URL Address

What is an SMTP URL?

This is the IP address of the SMTP Server. SMTP = Simple Mail Transfer Protocol. This is the protocol that sends emails between machines. Besides the SMTP IP address, you will also need to configure the username settings for the InSpec email function to work. This is configured via Email Setup in the system menu.

InSpec Menu Options = View current / set SMTP IP.

4.1.10 Print URL Address

What is a Print URL?

This is the IP address of the network printer that you wish to print to via the Ethernet.

InSpec Menu Options = View current / set print IP.

4.1.11 NTP URL Address

What is the NTP URL?

See 4.2 NTP Setup (Network Time Protocol Setup)

InSpec Menu Options = View current / set NTP IP.

4.1.12 View MAC Address

See "VIEW MAC ADDRESS" in section 2.9.7.

4.2   NTP Setup (Network Time Protocol Setup)

The NTP (Network Time Protocol) menu allows you to enable the ability to periodically update the system time of the InSpec automatically via a reliable internet clock source. This is useful to maintain an accurate time. All systems lag eventually. Over weeks, months and years a significant amount of time lag can accrue.

By default, the NTP server on the InSpec is set to be 'POOL.NTP.ORG'. This is an internationally recognised free NTP URL. It consists of a pool of shared NTP servers that allow external devices such as the InSpec to connect and request a time update. The underlying IP address of this URL will regularly change as the InSpec obtains the network time from a different location. If you use the POOL.NTP.ORG URL you will never need worry about entering a numerical IP address. The resolving of IP addresses is explained next.

4.3   Resolving IP Addresses

The InSpec continually resolves the internal URL string registers into IP addresses. You can see via the InSpec registers how a URL address is changed into the four octets of an IP address. The internal URL string registers used to specifically identify a server or a device and the associated INT16 registers that store the octets are:

4.3.1 EMAIL – DEFAULT SMTP PORT = 25

String Register	4 IP Registers
S_SMTP_SERVER_URL	I_SMTP_IP_ADDR0,I_SMTP_IP_ADDR1,I_SMTP_IP_ADDR2, I_SMTP_IP_ADDR3

4.3.2 NETWORK PRINTER – DEFAULT PORT = 515

String Register	4 IP Registers
S_PRINT_SERVER_URL	I_PRINT_IP_ADDR0,I_PRINT_IP_ADDR1,I_PRINT_IP_ADDR2, I_PRINT_IP_ADDR3

4.3.3 NTP TIME – DEFAULT PORT = 123 (UDP/IP PROTOCOL)

String Register	4 IP Registers
S_NTP_SERVER_URL	I_IP_NTP0, I_IP_NTP1, I_IP_NTP2, I_IP_NTP3

4.3.4 MODBUS TCP – DEFAULT NETWORK PORT = 502

String Register	4 IP Registers
S_MODBUSETH_IP_URL0-9	I_MODBUS_Q_IP0-9_0,I_MODBUS_Q_IP0-9_1,I_MODBUS_Q_IP0-9_2, I_MODBUS_Q_IP0-9_3

To change the underlying IP address of any device/server location you have to write to the string register. E.g., If you write www.myprinter.com to the S_PRINT_SERVER_URL string register, the associated octets will update. Of course, it only works on strings (URLs) that can be resolved! If you only know the IP address of the device/server then you must also enter this as a string into the string register. E.g., suppose you know the IP address of the print server is "34.67.89.154" then you must write this to the S_PRINT_SERVER_URL register. You will then see each of the numbers in each of the INT16 octet registers. The exception to this is the IP address itself. DHCP or yourself, via the menu, writes directly to the Octet int registers, not via a String URL.

SECTION 5: SD CARD FILE SYSTEM

A secure digital memory card is used in the InSpec to store batch and system data. The InSpec supports the SD format (up to 2Gb. Formatted to FAT16). Please avoid using higher capacity SDHC cards. It is not something we currently recommend due to performance issues.

Many files are in a CSV format, which is accessible to a number of standard computing packages, typically spreadsheets, for instance freely available packages include "LibreOffice" and "OpenOffice".

5.1   System Directory

This directory contains the system configuration files and file system should always contain a folder called 'SYSTEM'.

When a new card is inserted, or an existing card is formatted, the system folder and report template files (both text and html versions) are automatically created the next time the InSpec is rebooted. Therefore, it is important that you reboot the InSpec after performing this operation via the command line otherwise you will not have any reports on completion of the next batch/blend.

Files located within this directory are now explained

5.1.1 MODLOG.CSV

This is a protected log of changes to the Modbus Address registers.

5.1.2 REGLOG.CSV

This is a protected log of changes to the instrument configuration registers. The best method for querying this data on the instrument is via the shell command D. This will produce a record of every change to a particular register. Alternatively, the file can be listed and the most recent changes will be visible at the end of the file.

5.1.3 REBOOTLOG.CSV

This is a log of reboots experienced by the system and is purely for diagnostics.

5.1.4 SECLOG.CSV

This file is a log of the users' actions within the system, this allow the tracking of when who did what to the system.

5.1.5 USERS.BIN

This encrypted file contains the currently configured users for the system.

5.2   Backup Directory

This directory contains system configuration backups. Where each backup is organised into a directory structure of the kind.

BACKUP/YEAR/MONTH/DAY/HHMMSS/

Backups and restores should always be performed from the system configuration menu.

Once a backup has been made this directory can be copied to another machine so that a full service history of the machine can be maintained.

Also, within this directory is a log of the backups and restores that have been made called "BACKUPLOG.TXT"

5.3   Temp Directory

During operation of the InSpec application you may notice a folder called temp in the root of the file system. This folder stores temporary system files that are used for logging/printing purposes. On each reboot, the contents of the TEMP folder are deleted.

Within a backup the following directories are created.

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5.3.1   CSDATA

This directory contains all the instrument data created by the shell command SAVECS. Where there are the following 4 files.

5.3.1.1 CONFIG.BIN

This file contains a binary copy of the instrument FRAM. It is only compatible with software of the same version.

5.3.1.2 CONFIG.CAL

This file keeps a copy of the instrument calibration data as a text file which can be loaded back into the instrument by either using LOADCS or by pasting to a terminal at the shell.

5.3.1.3 CONFIG.CSV

This file keeps a copy of the Modbus address to register mapping as a CSV file which can be loaded back into the instrument by using LOADMODBUSCSV.

5.3.1.4 CONFIG.TXT

This file keeps a copy of the instrument registers as a text file which can be loaded back into the instrument by either using LOADCS or by pasting to a terminal at the shell.

5.3.2   IMAGES

This directory has a binary image of the application (APPLICATION.IMG) and bootloader software (BOOTLOADER.IMG). This can be reprogrammed using the normal software programming methods if required.

5.3.3   SYSTEM

This is a full copy of the entire system directory.

5.4   Batch Directory

The data for each given batch is stored under the path /YEAR/MONTH/DAY/BATCHNAME/ folder. So, assume the date is June 30th, 2010 and we have both the batch title and batch id prompts turned on as prompts during the start sequence of a batch/blend. When prompted for the title, we enter 'BATCHNOW' and when prompted for the ID we enter '876'. If you navigate to the year and month in the batch path directory and type the DIR command you will see that a batch folder has been created called 'BATCHNOW_876.1':

```
\2010\06\30\> DIR

Directory of \2010\06\30\*

.                              DIR   30.06.2010  14:03  ATT[    ]
..                             DIR   30.06.2010  14:03  ATT[    ]
BATCHNOW_876.1                 DIR   30.06.2010  14:03  ATT[    ]
        3 File(s)                      0 bytes
                        2,039,152,640 bytes free.
\2010\06\30\>
```

The .1 extension is taken directly from the register **'I_TOTAL_BATCH_COUNT'.** This is the total number of batches that have been run since the registers were last defaulted.

Within the batch folder itself you should see the following files listed:

```
Directory of \2010\07\30\BATCH2_0.1\*

.                                    DIR   30.07.2010  11:47  ATT[   ]
..                                   DIR   30.07.2010  11:47  ATT[   ]
LOG.TXT                              270   30.07.2010  11:47  ATT[   ]
LOG.CSV                              137   30.07.2010  11:47  ATT[   ]
AL_PH.CSV                            298   30.07.2010  11:47  ATT[   ]
REPORT.TXT                           657   30.07.2010  11:49  ATT[   ]
REPORT.HTM                        29,886   30.07.2010  11:49  ATT[   ]
          7 File(s)              31,248 bytes
                          2,038,857,728 bytes free.
\2010\07\30\BATCH2_0.1\>
```

The batch name in this path is taken from the S_BATCH_TITLE and S_BATCH_TITLE_NXT registers. The _NXT register is used when setting up the next batch/blend during a current batch/blend. There are similar _NXT registers for all batch/blend parameters. I.e., flows, volumes etc.

5.4.1   LOG.TXT

When the log is on (the log period is set either for n seconds or n grabs) a log file in both .TXT and .CSV format is also produced in the batch directory on the SD card. This log file is updated in accordance with the given log period. This is useful for historical purposes and very useful if for whatever reason (no paper/cabling fault) the log is not successfully sent to the printer during the batch.

5.4.2   LOG.CSV

As above in .CSV format.

5.4.3   AL_PH.CSV

```
\2010\07\30\BATCH2_0.8\> TYPE AL_PH.CSV
2010/07/30,14:24:05,WAITING,STARTING
2010/07/30,14:24:06,STARTING,SAMPLING
2010/07/30,14:24:10,LOOP FAULT,WARNING
2010/07/30,14:24:21,GRABBING TOO FAST,WARNING
2010/07/30,14:24:21,UNSAM GRAB MAX,WARNING
2010/07/30,14:24:33,GRABBING TOO FAST,CLEAR
2010/07/30,14:24:34,SAMPLING,STOPPING
2010/07/30,14:24:35,STOPPING,STOPPED
2010/07/30,14:24:37,STOPPED,RESETTING
2010/07/30,14:24:37,UNSAM GRAB MAX,CLEAR
2010/07/30,14:24:38,RESETTING,WAITING
2010/07/30,14:24:38,LOOP FAULT,CLEAR
\2010\07\30\BATCH2_0.8\>
```

This file records each change of system phase, alarm on and alarm off in the comma separated file format (.CSV). Each batch has an individual AL_PH.CSV file. The phase change entries consist of the date, the time, the previous phase and the new phase. The alarm on entries consist of the date, the time, the alarm title (e.g., "UNSAM GRAB MAX") and the alarm type (e.g., "WARNING"). The alarm off entries consist of the date, the time, the alarm title and a "CLEAR" statement. This is to indicate that the alarm has been cleared.

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5.4.4   REPORT.TXT

This file and the related report.htm file will not appear until the batch has been reset. Report files are produced for each batch.

5.4.5   REPORT.HTM

See report.txt above. This is the HTML version of the report file.

SECTION 6: FTP FILE SYSTEM ACCESS

The entire file system can be accessed from a network using the standard FTP (file transfer protocol), for instance to allowing access to batch logs.

FTP has security which is given as, at present this password cannot be changed.

Username: admin

Password: jiskoot

For windows, we suggest using a freeware FTP program called WinSCP for access purposes. This is feature rich software package that can be used for both occasional accesses in a file manager like environment and can also be used to automatically upload and download files.

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SECTION 7: INSITU PROGRAMMING

7.1   Programming from the Bootloader

Upon each reboot of the InSpec you will see the following text.

```
InSpec bootloader version 2.04
Press the space key to abort application booting
```

The 'press the space key' prompt offers the ability to interrupt the boot sequence to access the bootloader command shell. You may wish to do this to review and manage the contents of the SD flash card prior to application load or to reprogram the application manually from the bootloader command with a file on the SD card. After pressing the space key, you should see the following bootloader command prompt:

```
BOOTLOADER: \>
```

Note: If the SD card is not present a warning will appear prior to application start as follows:

```
SDCARD failure or absent
```

The application will then attempt to start. The following conveys this:

```
Starting application
```

At this point, if the application flash bank is programmed then the application will start, and you will see the usual command prompt as follows:

```
Enter password to access shell:
```

In the event that the application flash bank is not programmed, or a fault exists, the bootloader application will cyclically reboot until the sequence is either interrupted by pressing the space key or an SD card is inserted containing a valid application image called '**FLASH_APP.ONE**'.

7.1.1   Automatic Software Update via the bootloader.

To automatically update the version of your application, you simply have to rename the latest binary release file, e.g., rename SAMPLER_XX.BIN to FLASH_APP.ONE Now simply reboot the machine. Upon reboot the bootloader will detect this file as follows:

```
InSpec bootloader version 2.04
Press the space key to abort application booting
FLASH Application file found
```

You are offered the option of interrupting this process via the space key. If you skip this option, you will see messages informing you that the flash is being erased (followed by repeated dots). Once this is done you will see a message informing you that the flash is being programmed (followed by repeated dots). After programming is confirmed and the verification process is completed, a message appears telling you that the flash file has been renamed and the application is starting. Upon successful re-programming the flash application file is renamed from FLASH_APP.ONE to FLASH_APP.FIN. This prevents the file from being redetected and initiating another flash programming sequence the next time the InSpec is rebooted. The full sequence of events is reported to the terminal window as follows:

```
InSpec bootloader version 2.04
Press the space key to abort application booting
FLASH Application file found
Press the space key to abort FLASH programming
Erasing flash, ..............................
flash erased
Programming flash, ...................................
Completed Programming
Verifying flash,   ...................................
Completed verification successfully
FLASH File renamed

Starting application

Enter username to access shell:
```

After successful application programming, type DIR at the command line and you will see that the flash file has now been renamed:

```
M:\> DIR

Directory of M:\*

SYSTEM                        <DIR>  29.01.2018 15:25 [   ]
2018                          <DIR>  29.01.2018 16:01 [   ]
BACKUP                        <DIR>  29.01.2018 15:36 [   ]
flash_app.fin       2,097,152  04.07.2018 11:28 [   ]
      4 File(s)     2,097,152 bytes
                1,922,465,792 bytes free.
M:\>
```

7.1.2   Manual Software Update Via The Bootloader.

As well as the provision for automatic software updates, the InSpec can also be manually re-programmed from the command line using the **PGMFLASH** command. In this case, the file can be called anything. It does not have to be called flash_app.one. The **PGMFLASH** command tells the bootloader specifically what is to be programmed. For example, if the file SAMPLER_RELEASE.BIN was a valid application program, you simply need to press the space key to interrupt the application start, enter the bootloader command prompt and type the following:

```
BOOTLOADER: \> PGMFLASH SAMPLER_RELEASE.BIN
FLASH Application file found
```

The flash re-programming sequence as shown in the Automatic Software Update section now follows. The main difference is that the file is not renamed at the end of the process (it is not necessary) and the application does not automatically boot. After programming is complete you are returned to the bootloader command prompt. To launch the application from here you can either reboot the application and let it start automatically or type the **GO** command at the prompt as follows:

```
BOOTLOADER: \> GO
Starting application


Enter username to access shell:
```

7.2   Upgrading Existing Software Via Testcard

A current version of software can be upgraded via the command line when you enter the testcard prompt. After typing testcard at the prompt you will be prompted to 'terminate all other tasks y/n'. You are advised to stop all other tasks when you enter the testcard prompt for this upgrade process.

To perform the upgrade, you simply type **UPGRADE** followed by the name of the file on the SD card that you are upgrading to. This file can be called anything. In the example below, it is called TEST.BIN. As you will see the first thing it does is copy the new software file to flash_app.one.

```
M:\ TESTCARD$ UPGRADE TEST.BIN
Copying M:\flash_app.fin to \flash_app.one, 810,036 bytes
Saving configuration data for upgrade
Restarting system
```

You may recall that this is the name of the file that is used to automatically program the application flash from the bootloader. The InSpec then saves the current configuration status, restarts the system and the bootloader automatically starts to reprogram the application flash with the flash_app.one file.

You will then see the familiar flash re-programming steps below:

```
InSpec bootloader version 2.04
Press the space key to abort application booting
FLASH Application file found
Press the space key to abort FLASH programming
Erasing flash, ...............................
flash erased
Programming flash, ...................................
Completed Programming
Verifying flash,  ...................................
Completed verification successfully
FLASH File renamed

Starting application
```

After the application is started you will see further information unique to the UPGRADE task as follows:

```
Erasing FRAM
Defaulting registers
................................................................
Loading registers and Modbus addresses from prior
version
................................................................
Upgrade completed


Enter username to access shell:
```

After the upgrade is completed the application will start and you will see the usual shell username/password prompt.

7.3   Upgrading – The upgrade data folder.

After you upgrade the application you will notice that the process creates an upgrade folder on the SD card system. The flash_app.one file that was created from a copy of the new software image is also deleted.

```
M:\> DIR

Directory of M:\*

SYSTEM                                 <DIR>          29.01.2018 15:25 [   ]
2018                                   <DIR>          29.01.2018 16:01 [   ]
BACKUP                                 <DIR>          29.01.2018 15:36 [   ]
UPGRADE                                <DIR>          04.07.2018 12:07 [   ]
       4 File(s)              0 bytes
                    1,924,136,960 bytes free.
M:\>
```

The contents of the Upgrade directory are as shown below:

```
M:\> CD UPGRADE
M:\UPGRADE\> DIR

Directory of M:\UPGRADE\*

.                                      <DIR>          04.07.2018 12:07 [   ]
..                                     <DIR>          04.07.2018 12:07 [   ]
software_upgrade.fin                        119,589   04.07.2018 12:09 [   ]
software_upgrade.MODBUS.CSV                  25,200   04.07.2018 12:07 [   ]
software_upgrade.CALIBRATION.TXT                171   04.07.2018 12:07 [   ]
software_upgrade.BIN                         65,536   04.07.2018 12:07 [   ]
software_upgrade.ALARMS.CSV                   1,965   04.07.2018 12:07 [   ]
UPGRADE.LOG                                       0   04.07.2018 12:09 [   ]
       8 File(s)         212,461 bytes
                    1,924,136,960 bytes free.
M:\UPGRADE\>
```

In addition to these files you may also have a file called UPGRADE.LOG This file exists if any registers have not been found between versions during the upgrade. The bad register numbers / names are listed in the upgrade.log file. This is very useful when upgrading between versions as registers are often removed or renamed between software versions.

The files in the upgrade folder listed above contain information concerning the software that was loaded prior to the upgrade.

software_upgrade.fin = This contains all the data as if a CS command had been performed on the software version prior to upgrade.

software_upgrade.CSV = This contains the CS format as in the .fin file but within the .CSV file format.

software_upgrade.CAL = This contains the specific DAC and ADC values where the previous calibration data was stored prior to the upgrade. It is just a small set of IO specific registers.

software_upgrade.BIN = This binary file contains a block copy of the FRAM register memory prior to the upgrade. If required, this file can be loaded back into memory via the LOADFRAM shell command. However, note that this BIN file is dependent on software version. The reason for this is that register names and their position within memory can move between versions. Please check to make sure the versions are compatible. You may wish to rename this .BIN file after an upgrade so that the filename contains the software version from which it was created.

7.4   Upgrading The Bootloader Software Via The Application

WARNING: This process is not to be performed unless instructed by a trained Jiskoot engineer. Incorrect programming can result in the instrument needing to be returned to the factory for repair.

Just as the application software (sampler / blender) can be updated via the bootloader application prior to the application starting, the bootloader software can be updated via the application in testcard mode. The process is the same as upgrading the application. You must stop all other tasks when entering the testcard prompt for the upgrade process. The command to run is called:

PGMBOOTLOADER fn - Reprogram the bootloader flash with a file named fn

When you execute this command, you will be warned as follows:

```
M:\ TESTCARD$ PGMBOOTLOADER ER_IROM1
WARNING: Loss of power or incorrect programming of bootloader will
result in the instrument needing to be returned to the factory.
All other tasks will be stopped before flashing.
File to program is 'M:\ER_IROM1', if you wish to continue press Y
```

These warnings are emphasised for good reason. If you scramble the bootloader flash sector, then you will not be able to restart the InSpec at all.

Similar warnings appear if anything goes wrong during the reprogramming itself, such as during verification:

```
Verifying flash
Failed verify at address 00200001 read F0 should be FFFFFFF0
*** VERIFY FAILED! IT IS IMPORTANT THAT YOU REPROGRAM THIS AGAIN BEFORE REBOOTING ***
*** FAILURE TO DO SO WILL REQUIRE THE INSTRUMENT TO BE RETURNED TO THE FACTORY ***
```

If anything fails during the bootloader programming sequence, then you need to ascertain what has gone wrong and attempt to re-program it again. **DO NOT REBOOT** or **POWER DOWN THE INSPEC** at this point.

A successful bootloader re-programming sequence should appear as follows:

```
Erasing flash, ........
Flash erased, now Programming,................................
Verifying flash,.................................................
Completed verification successfully
A reboot is now required
M:\ TESTCARD$
```

If anything fails during the reboot process and you are unable to recover and re-program the bootloader then unfortunately the InSpec will need to be returned to the factory. It is for this reason that re-programming the bootloader is something that should only be done by a qualified Jiskoot engineer.

SECTION 8: SD CARD SYSTEM FILES

On the SD card there should always be a SYSTEM folder. If it does not exist when the instrument is powered up, then it is created automatically to create the two required report template files (REPORT_TEMPLATE.TXT and REPORT_TEMPLATE.HTM).

REBOOTLOG.CSV – If this file exists then the InSpec has been forced to reboot by the software watchdog facility, which monitors all the other tasks. If any given task stops working, then the InSpec is forced to reboot. Prior to this forced reboot, an entry is made into the rebootlog.csv file if it is possible. If it is the first occurrence, then the rebootlog file is created. Each entry into the file contains important information such as the time, the date and the name of the task that stopped working and consequently initiated the reboot. If the InSpec ever reboots unexpectedly, go straight to this folder/file and check to see if a new entry has just been made. If so, this needs to be reported to a Jiskoot engineer.

MODLOG.CSV – This file is used to record all changes to Modbus addresses. Whenever a Modbus address is changed, the change is logged within this file. A checksum to protect the integrity of the file is also added. Essentially this is used as an audit tool. Any sudden changes in Modbus communication can be immediately inspected against any recent change in address assignment.

REGLOG.CSV – As with the Modlog file, this file is used to record all changes to specific InSpec register values. The specific registers that are checked cannot be changed. Whenever the value in one of these defined registers is changed, the change is logged within this file. A checksum to protect the integrity of the file is also added. Essentially this is used as an audit tool. Most of the defined registers that are logged are associated with system configuration. Any sudden changes in system function can be immediately inspected against any recent changes in the associated InSpec register values.

Both the modlog and reglog files are created automatically whenever you wipe the instrument BBRAM and default the registers. This is because both the Modbus addresses and the register values are changed. For this reason, the defaulting of registers always takes longer when an SD card is inserted into the InSpec than when it is not present.

SECLOG.CSV – the seclog.csv file contains security audit information about who has logged into or out of the InSpec from various sources – serial ports / telnet ports etc. See the image below:

```
\SYSTEM\> TYPE SECLOG.CSV
12:43:14,2011/03/20,LOGIN,NAME:ENGINEER,LEVEL:ENGINEER,ID:0,FROM:SERIAL PORT 1
12:43:35,2011/03/20,LOGIN,NAME:JISKOOT,LEVEL:ENGINEER,ID:0,FROM:SERIAL PORT 0
12:43:46,2011/03/20,LOGIN,NAME:OPERATOR,LEVEL:OPERATOR,ID:0,FROM:SERIAL PORT 1
12:44:10,2011/03/20,LOGIN,NAME:ENGINEER,LEVEL:ENGINEER,ID:0,FROM:SERIAL PORT 1
12:45:03,2011/03/20,LOGIN,NAME:JISKOOT,LEVEL:ENGINEER,ID:0,FROM:SERIAL PORT 0
12:45:07,2011/03/20,LOGOUT,NAME:JISKOOT,LEVEL:ENGINEER,ID:0,FROM:SERIAL PORT 0
12:45:19,2011/03/20,LOGOUT,NAME:ENGINEER,LEVEL:ENGINEER,ID:0,FROM:SERIAL PORT 1
12:45:32,2011/03/20,LOGIN,NAME:ENGINEER,LEVEL:ENGINEER,ID:0,FROM:SERIAL PORT 1
12:51:07,2011/03/20,LOGIN,NAME:JISKOOT,LEVEL:ENGINEER,ID:0,FROM:SERIAL PORT 0
13:43:04,2011/03/20 SYSTEM STARTING - NO USERS LOGGED IN.
13:43:24,2011/03/20,LOGIN,NAME:ENGINEER,LEVEL:ENGINEER,ID:0,FROM:SERIAL PORT 1
13:43:52,2011/03/20,LOGIN,NAME:JISKOOT,LEVEL:ENGINEER,ID:0,FROM:SERIAL PORT 0
13:43:59,2011/03/20 SYSTEM STARTING - NO USERS LOGGED IN.
13:44:12,2011/03/20,LOGIN,NAME:OPERATOR,LEVEL:OPERATOR,ID:0,FROM:SERIAL PORT 1
13:44:28,2011/03/20,LOGIN,NAME:JISKOOT,LEVEL:ENGINEER,ID:0,FROM:SERIAL PORT 0
13:44:54,2011/03/20 SYSTEM RESTARTING - ALL USERS WILL BE LOGGED OUT AUTOMATICALLY
13:44:55,2011/03/20 SYSTEM STARTING - NO USERS LOGGED IN.
13:45:10,2011/03/20,LOGIN,NAME:OPERATOR,LEVEL:OPERATOR,ID:0,FROM:SERIAL PORT 1
\SYSTEM\>
```

You will see from the picture above how most entries in the seclog.csv file concern users logging in from a serial port (E.g., Display (InSpec menu), debug terminals etc). Each login entry shows the time and date of login followed by the task (I.e., LOGIN, LOGOUT etc), the username (OPERATOR, ENGINEER, JISKOOT, [USER ADDED]), the level of access (OPERATOR or ENGINEER access), the ID and the location from which they logged in from – which serial port, telnet port etc.

In the above photo two lines are highlighted to show how an entry is also made in the seclog file whenever the system first starts (See 'SYSTEM STARTING' above) and whenever the system is restarted (See 'SYSTEM RESTARTING' above). The system is often restarted in between certain configuration changes. E.g., when any of the IP settings are changed etc. The following are valid task entries for the SECLOG file:

Security Log Entry	Associated Content
LOGIN	Who logged in when and from which serial port.
LOGOUT	Who logged out when and from which serial port.
USER_DELETED	Which user was deleted by who, when and from which serial port.
USER_ADDED	Who added a new user when and from which serial port.
PASSWORD_CHANGED	Whose password was changed by whom, when and from where.
LEVEL_CHANGED	Which user had their access level changed by whom, when and from which serial port.
ID_CHANGED	Which user had their ID changed by whom, when and from which serial port.
TELNET_LOGIN	Which user logged in when and from which telnet port.
TELNET_LOGOUT	Who logged out when and from which telnet port.
SYSTEM RESTARTING	System restarted when.
SYSTEM STARTING	System started when.

REPORT TEMPLATES

The InSpec provides a default report template. This template is used to create each report file at the end of a batch. This default template can be changed or extended to suit your own reporting needs. This is very useful when it comes to adding additional reporting values and for amending the language of the report file. Whilst the underlying internal register names are in English, you will see that you can write anything you want in the headings/title fields of the report file.

To explain how the template works and how it can be edited we will now look at an example template file.

```
CAMERON JISKOOT QUALITY SYSTEMS
-------------------------------
SAMPLE COLLECTION REPORT
-----------------------
XXXXXXXX SAMPLING INSTALLATION
------------------------------
$S_REPORT_VARIABLE$
BATCH NAME                 :$S_BATCH_TITLE$
START TIME/DATE            :$S_START_TIME$ $S_START_DATE$
END TIME/DATE              :$S_FINISH_TIME$ $S_FINISH_DATE$
EXPECTED BATCH VOLUME      :$F_RQD_VOL$
DELIVERED BATCH VOLUME     :$F_VOL$
MEASURED SAMPLE VOLUME     :$F_CAL_CAN_SAM_VOL$
TOTAL GRABS TAKEN          :$L_GRABS_TAKEN$
NUMBER OF CANS USED        :$L_CANS_USED$
BATCH PERFORMANCE FACTOR   :$F_BATCH_PF$
AVERAGE BATCH DENSITY      :$F_FWA_DENSITY$
```

```
PATH                                                                  =
/$I_START_YEAR$/$C_START_MONTH$/$C_START_DAY$/$S_BATCH_TITLE$_$L_BATCH_ID$.$
I_TOTAL_BATCH_COUNT$
REPORT ENDS
-----------
```

The report file begins with a series of headings. E.g., "CAMERON JISKOOT QUALITY SYSTEMS", "SAMPLER COLLECTION REPORT" etc. The first line of the report that is configurable is:

$S_REPORT_VARIABLE$

This is a register name between two $ symbols. The $ delimiter is used to state when a register name is being used. In all such instances, the value/contents of the register between the $ symbols is then displayed in the report. The S_REPORT_VARIABLE register is a string that could contain a value specific to the location/ID of the sampling installation. Entering a meaningful name/ID here enables it to appear as a heading on each and every report that is generated.

The following line contains a full report entry with title and associated register name;

BATCH NAME   :S_BATCH_TITLE

The title can be anything you want it to be. Simply enter the text you want. Of course, it is best associated with the register name that follows between the two $ symbols. For an alternative language, simply change the title fields that precede the $register$ to the language of your choice.

The path entry that appears towards the end of the report template file contains the location on the SD card where the report file is stored. This is the batch directory.

PATH   =
/I_START_YEAR/C_START_MONTH/C_START_DAY/S_BATCH_TITLE_L_BATCH_ID.$I_TOTAL
_BATCH_COUNT$

The template is designed to fit on one side of printed A4 paper. However, the report can be as long as you wish, and you can be terminated anyway you wish. In the template the text Report Ends' followed by a short set of dashed hyphens concludes the file. This is purely cosmetic and plays no part in generating the file.

Three important points:

1) References to *register_names* must appear between 2 $ symbols - *$F_VERSION$*

2) If you amend the report template file then make a copy of your custom template files. If the InSpec has to be defaulted back to factory settings (e.g., software upgrade, re-commissioning) then the report_template files will revert back to their default formats. You will then have to replace the defaults with the backup of your custom files.

3) The report_template.htm file is a html version of the report_template.txt file. If you wish to create a custom version of the .txt report file and wish to reflect the same changes in the .HTM version, then we advise you to open the .txt template in a text editor that allows you to create and save files in the .htm/.html format. You can then simply 'save as'.htm to create a new custom version of the htm file.

SECTION 9: MODBUS INFORMATION

9.1   General

Modbus is a communications protocol designed by Modicon Inc. Industrial Automation Systems. The version supported is that as specified in the Protocol Reference Guide[1], with extensions for handling 32bit IEEE floating-point numbers, 32bit integers (including alarms) and Strings.

The InSpec supports Modbus RTU and ASCII over serial ports and ModbusTCP over Ethernet and TCP/IP.

Modbus serial works in a master / slave configuration. This means that one, and only one, of the nodes on the network is designated as master and all the others are designated as slaves. The master has a list of queries for each slave and transmits this to the entire network. Each slave reads all the queries, discarding any not intended for it. Modbus can be configured on the two serial ports simultaneously, if available, allowing communication dual redundancy.

The InSpec can operate simultaneously as both a ModbusTCP master and a slave. ModbusTCP does not have the limitation of having only one master per port. Therefore, multiple masters can poll the InSpec for data at the same time. This greatly reduces the need for multiple ports especially when combined with the much higher throughput of Ethernet / ModbusTCP.

9.2   Invalid addresses

Accessing any invalid Modbus address will result in an error packet being returned. When addressing many Modbus addresses in one query you must make sure all addresses are valid, as any invalid address will result in the error packet being returned.

9.3   MODBUS Serial Set-up

Modbus runs over a serial communication line that must be configured before data may be sent and received. The communications port type is configured within the menu as are the pull up/down resistors and line termination options. If RS422 or RS485 is chosen the system will be in a multi-dropped configuration.

The user can only configure the port from the menu if in *engineer* mode, protocol mode, word order, node number, baud rate and parity for the connection must be chosen. These must be the same on both the slave and master units.

NOTE: *If you select no parity then there are 2 stop bits, if you select odd or even parity then there is only 1 stop bit, as per the Modicon Modbus standard.*

9.4   Ethernet ModbusTCP Setup

To use ModbusTCP, you will need to configure the IP settings under the system menu item with your local administrator.

9.5   Node Number

This is the identifying number for the slave unit, a Modbus master does not have a node number. When a query is to be addressed to a node it will include the node number. All units attached to the cable will receive the query, but only the specified node will reply to it. In standard Modbus, using a node address of 0 will cause all attached units to reply to the query, but this feature is currently not supported on the InSpec controller.

In ModbusTCP slave the IP address of the InSpec is the instrument identifier, and the node number is ignored by InSpec ModbusTCP slaves. However, it is possible that other clients make use of the node number when polled from the ModbusTCP master.

9.6   Mode

There are two basic modes for Modbus serial, ASCII and RTU. RTU is the faster of the two as it has greater character density, while the ASCII format is more human readable and less prone to timing errors.

---

[1] Modicon Modbus Protocol Reference Guide, PI-MBUS-300 Rev.J June 1996

9.6.1   ASCII

Only the characters 0-9 and A-F are transmitted as data. A ':' is used to start the message, and Carriage Return, Linefeed pair used to terminate it. A delay of 1 second may be tolerated between characters. If the delay is greater than this, it is considered to be the end of the message. This usually results in the message being discarded.

Start	Slave Number	Function	Data	LRC Check	End
1 Char	2 Chars	2 Chars	n Chars	2 Chars	2 Chars CR/LF

9.6.2   RTU

In RTU each 8 bit byte contains two 4bit hexadecimal characters, thus the data is packed more densely than the ASCII protocol. The end of a message is taken as being a delay equal to 3.5 times the time taken to send a character.

Start	Slave Number	Function	Data	CRC Check	End
	8 bits	8 bits	n x 8 bits	16 bits	Time Delay

9.6.3   TCP

ModbusTCP data packets are similar to that of Modbus RTU, however the transmission of packets is performed by the TCP/IP protocol. TCP/IP makes sure a packet is sent successfully and is not corrupted over the network infrastructure, performing any retries automatically. ModbusTCP only must confirm that queries and responses make sense and are valid. From the point of view of an engineer the message is

Slave Number	Function	Data
8 bits	8 bits	n x 8 bits

9.7   Word Order

The Modbus was originally designed to support only 16bit integer numbers but over the years this has been extended to support various other data types. As a result, various manufacturers use different word orders for reading and writing data types that use 32bits and 64bits. As a result, we have allowed the ability to select the ordering of these data types. If least significant word order is selected the first Modbus register (word) contains bits 16-1 while the second contains bits 32-17. If most significant word order is selected the first Modbus register contains bits 32-17 while the second contains bits 16-1. This ordering can be configured for register types float and long.

9.8   Functions Supported

Not all the standard Modbus functions are required or supported in the slave mode. Only the following functions are supported:

Function	Code (HEX)
Read Holding Registers	03
Read Input Registers	04
Pre-set Single Register	06
Pre-set Multiple Registers	10

Not all the standard Modbus functions are supported in the master mode. Only the following functions are supported:

Function	Code (HEX)
Read Holding Registers	03
Read Input Registers	04
Pre-set Multiple Registers	10

9.9   Modbus Addresses

Modbus addresses can be allocated to every register that is required to be accessed as a slave. This can either be accomplished via the register access feature of the menu or configured via the debug port using the RM and WM commands.

A typical list of Modbus addresses is provided as default, these addresses can be changed to fit the user requirements if required. If Modbus addresses are grouped together data transfer speeds can be optimised.

NOTE: The reading of Modbus addresses that are unallocated will result in an error packet being returned. This is often an indicator that the Modbus address may have been miscalculated. The start offset (normally 40001) must be taken from the Modbus addresses to obtain the correct value in the request packet for Holding registers.

NOTE: Input registers normally start with a 30001, but within the InSpec this is the same as 40001. Therefore, any register can be read as either a holding register or Input register.

9.10   Comms Data Registers

For naming conventions alone, the InSpec also has the following assigned registers that the operator may find useful when communicating with the InSpec using Modbus. They are as follows:

> *i_comm_data1… i_comm_data10*
> *l_comm_data1… l_comm_data10*
> *f_comm_data1… f_comm._data10*

An operator may wish to use these registers to immediately identify the registers that are being used in Modbus communication. Formerly people would return to an InSpec configuration and have trouble recalling which registers they had set up for Modbus communication. This offers a consistent remedy.

Any dedicated Modbus communication registers also have the word "comm" in their name for example F_COMMS_FLOW1.

9.11   RTU Delay (serial only)

This value controls the timeout period for an incomplete RTU packet and is measured in milliseconds. The timeout is not used if a packet appears to be complete, thus improving   performance. If only partial packets are being received extending this period may resolve the problem.

9.12   String size

String sizes are configurable in Modbus allowing up to the InSpec maximum string size of 48 characters.

9.13   Float size

InSpec stores all internal floating-point data as 64bit IEEE floating point numbers. This setting allows Modbus to access these floating points with either a truncated 32bit accuracy or the full 64bit accuracy. Most systems now support 32bit floating point accuracy however only a few support 64bit accuracy. Thus, this only needs to be enabled when accuracy is of prime importance and if the connecting device supports it.

9.14   Start offset

This allows the operator to select the Modbus offset for holding registers normal this will default to 40001 however this can be used to move address when an offset of 1 is seen, where some suppliers incorrect assume the offset should be 40000. Alternatively, this can also be used to implement the non-standard 6-digit addressing seen in some systems where the offset becomes 400001, etc.

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9.15   Modbus Slave

This is the 'client' of the master unit. Each slave is given a unique identifier in the range 1 to 247. When in this mode, the slave listens on the appropriate port until a query from a master unit is heard. When the query is received, the slave address is decoded and if it is not the same as the instruments, the packet is ignored. In the standard protocol, an address of 0 indicates that all slaves should reply. This is not yet implemented in the InSpec.

9.16   Modbus Master

The Modbus master initiates the reading and writing of information from all the slave units attached to the communication link. On Modbus serial there is only one master per communication link and the master cannot be changed during operation. In ModbusTCP however a device can be a slave and master simultaneously and no master is in overall control of the link.

9.16.1   General

The master initiates the queries from a list of queries which specify what is required to be read or written. The master works its way through the list of queries, sending each one in turn. If a query is not responded to in time or not correctly, then the query will be retried a configurable number of times before the next query is processed.

9.16.2   Queries Blocks

The instrument has 10 Modbus query blocks these can be used by 10 ModbusTCP masters to simultaneously connect to 10 IP address to poll for data. However, block 2 and 3 are also used by serial ports 2 and 3 are not available if Modbus master is used by these serial ports.

Modbus master queries are created and edited in the menu. A maximum of 20 queries can be enabled for each query block, and these can be any combination of reading and writing of Modbus addresses.

To configure a query, you must select the slave's node number that is to be accessed, whether you wish to read or write to that slave and what the associated Modbus address is within the slave. Different nodes can be selected within each block if required.

You must then select which register in the InSpec the data is read from or written to.

Finally, you must select the number of consecutive InSpec registers that are to be used for this query. If the number of registers is more than one, then consecutive Modbus registers are read or written so handling the extra InSpec registers. For ModbusTCP master you will also need to provide the associated block URL or IP address as 4 bytes separated by dots (e.g., 0.0.0.0).

9.16.3   Modbus poll delay (serial only)

The Modbus poll delay is the delay between receiving a reply to a message and sending a new query. Some systems especially RS485 based ones will require a delay small delay so that that systems can tell the difference between the end of one packet and the start of the next.

9.16.4   Modbus retries

This is the number of times a Modbus master will try and resend a request to slave if there is an error in the reply. A value of zero means if any error is encountered the master will just move onto the next query.

SECTION 10: USER COMMANDS

The InSpec includes a facility to perform a number of simple calculations on registers. These are known as user commands.

NOTE: This is only designed to solve simple problems and so more complex problems will require using the programming language UCL.

10.1 Introduction

There are two sets of 20 user commands that can be executed, which are called either the INPUT or OUTPUT set. The first set of commands (INPUT) is executed just before the application cycle executes and the second set (OUTPUT) is executed just after the application cycle completes.

Each command requires two source registers a destination register and a command that is to be executed on the two source registers, the result of which is stored within the destination register. If the destination register is not large enough to store the result, the result will be truncated.

10.2 Command types

The types of commands that can be executed depend on the type of the destination register. These are arranged into three groups, Integer registers support all commands, Floating point registers support some commands and strings do not support commands. The following table shows all commands

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Command	Supported in float destinations	Example
MULTIPLY	YES	SOURCE1=3, SOURCE2=4 DESTINATION = SOURCE1 $\times$ SOURCE2 = 3 $\times$ 4 = 12
DIVIDE	YES	SOURCE1=12, SOURCE2=3 DESTINATION = SOURCE1 / SOURCE2 = 12 / 3 = 4
ADD	YES	SOURCE1=3, SOURCE2=4 DESTINATION = SOURCE1 + SOURCE2 = 3 + 4 = 7
SUBTRACT	YES	SOURCE1=3, SOURCE2=4 DESTINATION = SOURCE1 - SOURCE2 = 3 - 4 = -1
REMAINDER	NO	SOURCE1=13, SOURCE2=3 DESTINATION = SOURCE1 % SOURCE2 = 13 % 3 = 1
BIT AND	NO	SOURCE1=5 (101), SOURCE2=6 (110) DESTINATION = SOURCE1 AND SOURCE2 = 5 (101) AND 6 (110) = 4 (100)
BIT NAND	NO	SOURCE1=5 (101), SOURCE2=6 (110) DESTINATION = SOURCE1 NAND SOURCE2 = 5 (101) NAND 6 (110) = 3 (11)
BIT OR	NO	SOURCE1=4 (100), SOURCE2=1 (1) DESTINATION = SOURCE1 OR SOURCE2 = 4 (100) OR 1 (1) = 5 (101)
BIT NOR	NO	SOURCE1=4 (100), SOURCE2=1 (1) DESTINATION = SOURCE1 NOR SOURCE2 = 4 (100) NOR 1 (1) = 2 (10)
BIT XOR	NO	SOURCE1=5 (101), SOURCE2=6 (110) DESTINATION = SOURCE1 XOR SOURCE2 = 5 (101) XOR 7 (111) = 3 (11)
BIT LEFT SHIFT	NO	SOURCE1=5 (101), SOURCE2=2 DESTINATION = SOURCE1 BIT LEFT SOURCE2 = 5 (101) BIT LEFT 2 = 20 (10100)
BIT RIGHT SHIFT	NO	SOURCE1=5 (101), SOURCE2=1 DESTINATION = SOURCE1 BIT RIGHT SOURCE2 = 5 (101) BIT RIGHT 1 = 2 (10)
BIT NOT	NO	SOURCE1=5 (101), SOURCE2=UNUSED DESTINATION = SOURCE1 BIT NOT = 5 (101) BIT NOT = 2 (10)

SECTION 11: USER CONFIGURABLE LOGIC (UCL)

UCL is a programming language for creating additional logic features in the InSpec controller. It provides the ability to alter register values on a real time basis, according to a set of predefined commands.

UCL is a functional language. This means that every statement is a function - a calculation with specified input and output. UCL is not a procedural language (such as Pascal or C).

Before going any further let us look at a simple UCL program.

$$i\_user\_int1 = i\_user\_int2;$$

This program consists of a single statement. The "i_user_int1" is the target register. This is where the result of the equation will be stored. Every UCL statement must start with the name of an existing register. The "=" is part of the syntax of the language and separates the target register from the rest of the statement. The semicolon marks the end of the statement.

In this example, the statement consists of a single register, i_user_int2. The operation of the program copies the value of i_user_int2 into the register i_user_int1. Effectively, the i_user_int1 register stores the output of the i_user_int2 function.

11.1 How does UCL run?

When a UCL program is running, each statement is executed sequentially once per second. So, the effect of the above program would be to update the contents of i_user_int1 with i_user_int2, once per second.

Another example is shown below:

$$i\_user\_int1 = i\_user\_int1 + 1;$$

This simple program is a counter, incrementing once per second. It shows how a UCL program can use the target register inside the equation.

11.2   How to write a UCL program

Programs must be stored in the SYSTEM folder on the InSpec SD card and the program file MUST be called UCL.TXT. This is the filename that the UCL task looks for. When it starts. If this name is not used, your file will not be compiled or executed. There are several ways to get the UCL file onto the SD card. You could write one by hand at the shell terminal using the BLD command, you could create one on your PC in a text editor of your own choice and then copy it to the SYSTEM folder using the web interface upload feature or copy it to the SD card with a card reader attached to a PC.

11.3 How to use build - Part 1

Making sure you are in the SYSTEM folder, type the following and then hit return:

\SYSTEM\> BLD UCL.TXT

Text can be typed in, as if using a text editor program. When you have typed in your program use ctrl+c to quit. At this point the text you typed will be saved to the SYSTEM folder with the filename you entered.

You can then use the 'TYPE' command to check to check that your file has been created and the contents are as you expected.

\SYSTEM\>TYPE UCL.TXT

NOTE: Files created with BLD are only ASCII text files.

11.4 How to execute a UCL program

Once you have a completed UCL program saved into the BBRAM, you can start it at the command line, either by typing:

START DEBUG

Or alternatively, you can simply reboot the InSpec. On each reboot the InSpec looks for the UCL.TXT file. If found it attempts to compile the file and then, if successful, it starts executing the UCL logic once a second. Note that the file is interpreted at compile time for execution. When started, the UCL program interprets the text from the UCL.TXT file into an internal software structure that the InSpec can understand. This may take up to ninety seconds for a large program. When complete the program will start to run.

When you first run a UCL program it is advised to run the task in DEBUG mode. To do this, follow these steps. First, we will assume that the UCL.TXT file has been created already. At the terminal type:

> `DEBUG UCL`

Followed by:

> `START UCL`

If there are errors in the program, the interpreter will be unable to make sense of the program and will raise a message via debug indicating in what line the error is and what the error may be concerning. Here is an example of a compile failure as seen via debug:

```
\SYSTEM\> DEBUG UCL
SET UCL DEBUG ON
\SYSTEM\> START UCL
UCL task stopped....
UCL task is now running....
\SYSTEM\> File contains I_USER_INT1=I_USER_IT1+1;
Processing Equation 1 ...
Error (readEquation function) - register name I_USER_IT1
not recognised.The UCL task will now exit.
\SYSTEM\>
```

Here you can see that the register name has been entered into the file incorrectly. I_USER_IT1 should be called I_USER_INT1. Of course, this is a very simple example of a compile error. As UCL files get increasingly more complicated there can be one or many compile errors that take time to identify and correct. A good principle to adopt is to regularly compile each new line of your program to ensure it is compiling as you progress, rather than wait until you have one big file that has had no prior testing.

A successful compilation will result in the compilation being listed. After this debug repeatedly prints out the output from each function (line) of the UCL file.

```
\SYSTEM\> File contains I_USER_INT1=I_USER_INT1+1;
Processing Equation 1 ...
Resolve brackets.Setting priorities...
List contains:
REG NUM  612.00        PRIO -2147483639,
PRIO 2147483617,
REG NUM  612.00        PRIO -2147483639,
SYMBOL +       PRIO 2147483623,
INTEGER  1.00   PRIO -2147483639,
Equation 1 OK.
##################################################
######
Reg   612 INTEGER =         1
##################################################
######
```

This last line will repeat indefinitely until either debug is turned off or the UCL task is terminated. In practise it is normal to run debug until you are happy that all is being calculated correctly before turning debug off. You can quickly turn UCL debug (and all other debug) off if required by simply typing the following at the command line:

> `DEBUG`

If at any point you wish to stop your UCL program, simply type the following at the command line:

> `STOP UCL`

A UCL program can only be halted, by obtaining the UCL processes ID and then performing an ID stop.

11.5 What makes up a UCL program?

A program is a text file, stored on the SD card, that contains one or more UCL statements. A statement comprises of a target register, an equal's sign, then an expression, and the statement is ended with a semicolon, E.g.

> `<register_name> = <expression>;`

An expression can be as simple as a single integer value, or as complex as a nested set of equations.

Carriage returns and spaces can be included in the file, enabling the programmer to customise the layout. It is suggested that each new statement should be started on a new line to make reading of the program easier.

Comments can also be included anywhere in the program. When the program is interpreted, anything inside square brackets is ignored. e.g.

> *[This is a comment.]*

Definitions can also be included within UCL programs. These are used to make the programs easier to read. Here is the general layout of a definition:

> *#define "new word or symbol" = "old word or symbol";*

All definitions begin with the word "#define". This means that the next word or symbol can be replaced (is a direct replacement for) with the word or symbol after the equals sign.

The following code makes "local_control" a direct replacement for "C_DIGITAL_IN1".

> *#define local_control=C_DIGITAL_IN1;*

Please Note: All #define's must be at the start of the program (excluding comments), otherwise the program will fail to compile correctly.

11.6 Types and Type Casting

In programming a data value can have different meanings depending on its type. For example, consider the data value 1.2. If a floating-point value, it is indeed 1.2. If considered an integer value it is 1. If a boolean value it is TRUE.

Casting is the conversion of a value from one type to another.

UCL supports four types.

11.6.1 Integer Type

These are whole numbers, positive or negative, including zero.

> e.g. 0, 1, 2, 7865, -3 etc.

11.6.2 Floating Point Type

This is the type used to express fractions.

> e.g. 0.54325, -3, 2.5 etc.

11.6.3 Boolean Type

This type consists of only two values, TRUE and FALSE. FALSE has a numerical value of 0, and TRUE is anything other than 0. In a UCL program, if a boolean value is returned it will have the numerical value of 0 (FALSE), or 1 (TRUE).

11.6.4 Register Names

This type allows the use of register values within a UCL program. A register is identified in the program by entering its textual name. The type of the value read will depend on the type of the register. Register values of type: character, int16, int32, alarms and pointers are cast into integers. Register values of type float are cast into floating point.

Note: When a register name is entered, ensure you include any underscores within the document.

11.6.5 Casting

Two types of casting are performed by UCL. The first type is the casting of the result from an expression into the type of the register it is to be stored in. For example, consider the following statement.

> *I_USER_INT1 = 5.2;*

The value 5.2 must be cast into an int16 type to be stored in the register i_ispare1. In this case, it is cast to the value 5, because I_USER_INT1 is an integer register. Casting of this type always rounds down.

Similarly, consider the statement:

> ***F_USER_FLOAT1 = FALSE;***

In this case FALSE is interpreted as zero and stored as a floating-point value.

The other type of casting is performed when an argument is passed to an operator. Each operator operates on a certain type. If an argument does not match this type, then it must be cast into the correct type before the operator can modify it. For example, consider:

> ***F_USER_FLOAT1 = F_USER_FLOAT2 && F_USER_FLOAT3***

The && operator takes boolean values, so if both F_USER_FLOAT2 and F_USER_FLOAT3 are non-zero, F_USER_FLOAT1 will be 1.0.

Both types of casting are performed automatically. Although necessary, casting may occasionally result in an unexpected result. Care must be taken, especially when dealing with large numbers, that casting is not causing an erroneous result.

11.7 Arithmetic Operators (+, -, *, /, %)

These are the basic arithmetic operators. An example of each is given below.

- +   ADDITION   (float + float = float)   (6 + 4 = 10)
- -   SUBTRACTION   (float - float = float)   (6 - 4 = 2)
- *   MULTIPLICATION   (float * float = float)   (6 * 4) = 24)
- /   DIVISION   (float / float = float)   (6 / 4 = 1.5)
- %   REMAINDER   (integer % integer = integer)   (6 % 4 = 2)

Note: Division by 0 returns the answer 0.

11.8 Boolean Logical Operators (&&, ||, ^^, !)

UCL includes four operators for evaluating boolean logical operations. These are shown below.

- && AND   (boolean && boolean = boolean)   (1 && 0 = FALSE)

Evaluates to TRUE if both arguments are TRUE.

- || OR   (boolean || boolean = boolean)   (0 || 1 = TRUE)

Evaluates to TRUE if either, or both arguments are TRUE.

- ^^   EXCLUSIVE OR (boolean ^^ boolean = boolean)   (1^^ 1 = FALSE)

Evaluates to TRUE if one or the other (but not both) are TRUE.

- !   NOT   (! boolean = boolean)   (!1 = 0)

The NOT operator is a unary operator; it operates on one argument alone. It returns the boolean opposite of the argument.

11.9 Boolean Comparison Operators (==, !=, >, <, >=, <=)

UCL includes six operators for evaluating boolean comparison operations. These are shown below.

- == EQUALS TO   (float == float = boolean) (0 == 0 = TRUE)

  Evaluates to TRUE if both arguments are logically equal, or FALSE otherwise.

- != NOT EQUAL TO   (float != float = boolean)   (0 != 0 = FALSE)

  This is the opposite of EQUALS TO.

- >   GREATER THAN   (float > float = boolean)   (1 > 2 = FALSE)

  If left argument is greater than right argument, return TRUE, else return FALSE.

- < LESS THAN   (float < float = boolean)   (1 < 2 = TRUE)

    If left argument is less than right argument, return TRUE, else return FALSE

- \>= GREATER THAN OR EQUAL TO   (float >= float = boolean) (1 >= 1 =TRUE)

    If left argument is greater than or equal to right argument, return TRUE, else return FALSE.

- <= LESS THAN OR EQUAL TO   (float <= float = boolean) (1 <= 2 =TRUE)

    If left argument is less than or equal to right argument, return TRUE, else return FALSE.

11.10 Bit-wise Operators (&, |, ^)

These operators allow bit-wise calculations. Bit-wise algebra is a specialist and complex subject and is not discussed here in depth. Please refer to a suitable programming textbook for a detailed discussion of how to use bit-wise algebra.

11.11 Shift Operators (>>, <<)

Shift operators >> and << are used to move bits right and left in an integer and are often used in the manipulation of packed coils etc.

- 1<<2   resulting in 4

This will shift left the number 1 by two binary positions and is equivalent to multiplying by 4.

- 64>>1   resulting in 32

This will shift right the number 64 by one binary positions and is equivalent to dividing by 2.

Shift operators generally produce clearer code.

11.12 Pointer Arithmetic Operators

There are two operators for manipulating register pointers. Each register in the InSpec has three data values associated with it. Firstly, it has type, i.e. integer or character etc. Secondly it has value (the actual data that is stored and can be changed). Lastly it has two means of identification, a text string and a number. The UCL language allows the passing of a register's value into an equation by entering the registers textual name (i.e. i_ispare1 = i_ispare1 + 1;). The following two unary operators enable conversion between register identification and value.

- @ ADDRESS   (@ register name = integer)   (@ i_ispare1 = 330)

The ADDRESS operator returns the integer ID number of the register passed to it.

- # POINTER   (# register ID name or number = any)   (# 330 = 0)

The POINTER operator returns the value held within the register passed to it, either by name or number.

11.13 Complex Math Operators (LOG, LN, POW, SIN, COS, TAN, ASIN, ACOS, ATAN)

These complex math operators are easily utilised in equations as the following single line equations show:

11.13.1 LOG EXAMPLE

```
F_USER_FLOAT2=LOG(F_USER_FLOAT1);
```

This produces the log to base 10 for the value of register F_USER_FLOAT1.

11.13.2 LN EXAMPLE

```
F_USER_FLOAT2=LN(F_USER_FLOAT1);
```

This produces the natural log for the value of register F_USER_FLOAT1.

11.13.3 POW EXAMPLE

F_USER_FLOAT2=POW(F_USER_FLOAT3, F_USER_FLOAT4);

This raises F_USER_FLOAT3 to the power F_USER_FLOAT4. These are floating power powers and so can also be used in the calculation of roots, a square root would be to the power 0.5

11.13.4 SIN EXAMPLE

F_USER_FLOAT2=SIN(F_USER_FLOAT1);

This calculates the sin of F_USER_FLOAT1, where F_USER_FLOAT1 is measured in radians.

11.13.5 COS EXAMPLE

F_USER_FLOAT2=COS(F_USER_FLOAT1);

This calculates the cosine of F_USER_FLOAT1, where F_USER_FLOAT1 is measured in radians.

11.13.6 TAN EXAMPLE

F_USER_FLOAT2=TAN(F_USER_FLOAT1);

This calculates the tangent of F_USER_FLOAT1, where F_USER_FLOAT1 is measured in radians.

11.13.7 ASIN EXAMPLE

F_USER_FLOAT2=ASIN(F_USER_FLOAT1);

This calculates the inverse sin (arcsin) of F_USER_FLOAT1, where the result F_USER_FLOAT2 is measured in radians.

11.13.8 ACOS EXAMPLE

F_USER_FLOAT2=ACOS(F_USER_FLOAT1);

This calculates the inverse cosine (arccos) of F_USER_FLOAT1, where the result F_USER_FLOAT2 is measured in radians.

11.13.9 ATAN EXAMPLE

F_USER_FLOAT2=ATAN(F_USER_FLOAT1);

This calculates the inverse tangent (arctan) of F_USER_FLOAT1, where the result F_USER_FLOAT2 is measured in radians.

11.13.10   RAND EXAMPLE

I_USER_INT1=RAND(1000);

This produces a random number between 0 and 999.

11.14 Operators Decision Making (? :)

This operator varies from every other, because it takes three arguments. If the first argument evaluates to TRUE, then the second argument is returned, otherwise it returns the third argument.

<variable> = <evaluation> ? <expression if true> : <expression if false> ;

Example

i_ispare2 = i_ispare2 + 1;

```
i_ispare2 = i_ispare2 == 60 ? 0 : i_ispare2 ;
```

This sets up a counter which is incremented every second. When the counter reaches 60, it is then reset back to 0.

11.15 Operator Priority and Parenthesising

Operator prioritising means you may occasionally get unexpected results from an equation. Rather than must consider the priorities of each operation, and write your equation accordingly, it is easier to specify the order in which you want your calculation evaluated yourself. This can be performed using the parentheses, or brackets. For example:

8 - 3 * 2 = 2

or (8 - 3) * 2 = 10

It is possible to layer parentheses. In this case the innermost expression will be evaluated first. i.e.

(2 * ((6 - 3) * 3)) = 18

It is possible to have up to 100 levels of nested parentheses.

The priorities are given in the list below, highest priority first. Those symbols adjacent have the same priority, in which case they are evaluated left to right in the equation.

1	(	)	
2	!	@	#
3	*	/	%
4	+	-	
5	<	<=	>	>=
6	==	!=	
7	&		
8	^		
9	|		
10	&&		
11	^^		
12	||		
13	?	:	
14	LOG POW SIN COS TAN ASIN ACOS ATAN LN		

11.16 Operators: Conditional Jump Loop Labels (IF$LABEL, $LABEL:)

InSpec UCL can jump to sections of code depending on the logical result (True/False) of a conditional equation. This is a powerful tool that allows actions to take place only when certain conditions are calculated and met in other areas of the UCL file. In algorithm terms this allows for the implementation of conditional loops. A UCL file can switch between functional blocks of code based on user defined conditions.

Every Conditional Jump Loop MUST have two parts.

1 - The conditional part label, **IF$TEST1 = [condition to be met. Returns True or false];**

and

2 – The jump section label. If the condition to be met is true, then the code will jump to the first line after **$TEST1:** The next equation/line in the file after this label will then be calculated.

Note that the 2 parts (conditional label and jump label) are associated by sharing the same name – **TEST1** in the example above. This is important when you include several conditional statements in a file. E.g.,

```
IF$TEST1=equation; requires associated jump label $TEST1:
IF$TEST2=equation; requires associated jump label $TEST2:
IF$TEST3= equation; requires associated jump label $TEST3:
```

If there are mismatching conditional/jump section labels, then the file will fail to compile. The simple premise is that a conditional statement needs to know where the code will jump to (go to) when the conditional equation returns true.

In order to understand this feature in UCL, we will set a scenario and work towards building the UCL file.

Scenario:

An oil rig wants any active alarm to result in a horn being sounded periodically across the oil rig.

When an alarm becomes active, there is a 30 second delay before the horn is sounded. If the alarm is cleared during this 30 second window, then nothing happens. The horn is not activated.

After 30 seconds, if the alarm is still active, the horn will sound for 15 seconds. There will then be a further 30 second period of silence.

Again, if the alarm is not cleared after the next 30 second period then the horn will sound again for 15 seconds. This cycle repeats continually until the ACTIVE_ALARM is cleared (I_USER_INT4=0).

What do we need?

ACTIVE_ALARM = BOOLEAN. [System/user sets this flag to TRUE/FALSE externally]
ALARM_DELAY_COUNTER = INTEGER_COUNTER (needed to count up to 30 before the horn is sounded.)
ALARM_SOUND_HORN = BOOLEAN [IF ALARM_DELAY_COUNTER > 30 = TRUE, ELSE = FALSE]

HORN_OUTPUT_COUNTER = INTEGER_COUNTER (Counts up whilst horn sounds. If it reaches 15, the ALARM_SOUND_HORN flag is set to FALSE and both the ALARM_DELAY_COUNTER and HORN_OUTPUT_COUNTER are reset to 0).

Note: Nothing within the program sets the ACTIVE ALARM boolean flag register. If this is never set, the program does nothing. If it is TRUE and is then never set to FALSE then the cycle period of delay, alarm, horn, delay, alarm, horn etc will repeat ad infinitum.

What conditions are there?

1 If the ALARM_SOUND_HORN is TRUE, trigger the horn [ALARM_SOUND_HORN is only true when ACTIVE_ALARM is TRUE and ALARM_DELAY_COUNTER has exceeded 30].

2 If ALARM_SOUND_HORN remains TRUE, increment the HORN_OUTPUT_COUNTER.

3 If the HORN_OUTPUT_COUNTER is > 15, set the ALARM_SOUND_HORN to FALSE and reset the counters.

This program is triggered by manually setting InSpec register I_USER_INT4, defined as ACTIVE_ALARM in our UCL file to 1.

If there is an ACTIVE_ALARM, increment the ALARM_DELAY_COUNTER. If the user sets the ACTIVE_ALARM to zero before the ALARM_DELAY_COUNTER reaches 20 then the ALARM_DELAY_COUNTER is reset and the program sleeps, waiting for the next ACTIVE_ALARM.

If the ALARM_DELAY_COUNTER reaches 30, the ALARM_SOUND_HORN output flag is set to true. This remains true whilst the HORN_OUTPUT_COUNTER is counting up to 15.

On reaching 20, the ALARM_SOUND_HORN output flag is set back to FALSE and both the ALARM_DELAY_COUNTER and HORN_OUTPUT_COUNTER are reset to zero. If the
ACTIVE_ALARM is still TRUE (I_USER_INT4 = 1) then the ALARM_DELAY_COUNTER will count up to 30 again and the ALARM_SOUND_HORN flag will be set once more.

Conditional loops - pseudocode.

```
1 If ALARM_SOUND_HORN is TRUE
        jump to 2 ALARM_TRIGGERED section of code
else
        if ACTIVE_ALARM = TRUE,
                increment the ALARM_DELAY_COUNTER counter + 1
        else
                set the ALARM_DELAY_COUNTER counter = 0


2 ALARM_TRIGGERED
If ALARM_SOUND_HORN is FALSE
        jump to 3 ALARM_END section of code 3
else
        increment the HORN_OUTPUT_COUNTER + 1
```

If HORN_OUTPUT_COUNTER less than 21
          jump to 3 ALARM_END section of code 3
else
          HORN_OUTPUT_COUNTER must equal 20.
        Set ALARM_SOUND_HORN to FALSE, the ALARM_DELAY_COUNTER = 0 and
HORN_OUTPUT_COUNTER=0;

3 ALARM_END

        The UCL File

#define ALARM_DELAY_COUNTER = I_USER_INT1;
#define ALARM_SOUND_HORN = I_USER_INT2;
#define HORN_OUTPUT_COUNTER = I_USER_INT3;
#define ACTIVE_ ALARM = I_USER_INT4;

IF$ALARM_TRIGGERED= ALARM_SOUND_HORN ==TRUE;
ALARM_DELAY_COUNTER = (ACTIVE_ALARM==1)?ALARM_DELAY_COUNTER +1:0;
ALARM_SOUND_HORN = (ALARM_DELAY_COUNTER==20)? TRUE:FALSE;

$ALARM_TRIGGERED:
IF$ALARM_END = ALARM_SOUND_HORN ==FALSE;
[Else ALARM_SOUND_HORN is TRUE, INCREMENT HORN_OUTPUT_COUNTER TIL IT REACHES 20]
HORN_OUTPUT_COUNTER= HORN_OUTPUT_COUNTER +1:0;

IF$ALARM_END = HORN_OUTPUT_COUNTER<21;
[Else HORN_OUTPUT_COUNTER has reached 20. HORN now goes off]
ALARM_SOUND_HORN =FALSE;
ALARM_DELAY_COUNTER=0;
HORN_OUTPUT_COUNTER=0;

$ALARM_END:

SECTION 12: FLOW WEIGHTED AVERAGING

Flow weighted averaging allows a variable to be averaged on the lifetime of a batch. Correctly averaging it for the flow throughout. The following simple formula is used

$$average = \frac{\sum \Delta quantity \times value\_to\_average}{quantity}$$

It should be noted that the variable needs to have a linear relationship to be suitable to be averaged, some linearization calculations maybe needed on variables that are not linear, for example viscosity. (Viscosity would have to be set up via one of the 10 configurable Flow Weighted Averaging blocks).

The various instruments typically come with the averaging of some variables implemented as standard, for example averaging of density and analogue inputs. These standard average values can be displayed as normally and may be included on the printed reports.

It is also possible to average any other register in the instrument, for example a variable obtained from a remote device like pressure. This is accomplished by using user flow weighted averaging blocks, as mentioned in relation to viscosity above. You will need to select the register that is to be averaged, give the average a title and units, and in some instruments, you will also need to select what you are averaging with.

The InSpec menu allows for 10 variables (register values) to be averaged during a batch. The USER FWA BLOCKS menu item in the Operations menu (or the 'Application→ Averaging' page on the web interface) prompts you for the register to be averaged and the associated display title for the averaged item and the units to display for the result.

SECTION 13: PID BLOCKS

The InSpec has 10 users configurable PID blocks. These are configured via the field menu. The PID block items consists of 2 sub menus:

PID Config – Here you are prompted to turn the specific PID block on, enter the source register (PID input), the active phases and whether the PID should jump to a specific value when it goes into a non-active phase. If it should jump, you also need to enter what the value that it should jump to

You must enter the initial start value and the minimum and maximum allowable values for the PID output. The STANDARD PID form = P, I, D control using integral and derivative time and overall proportional gain, across all industry this is the most common form of PID.

SECTION 14: STORING CONFIGURATION BACKUPS

Backups of the instrument software, registers and configuration files can be easily performed from the InSpec start up system menu to the SD card or, if configured, you can do this from the web interface.

Once a configuration has been backed up it can be copied to a PC or server either via the web interface (the easiest option), by moving the SD card to a PC or via an FTP command or application.

The InSpec system menu is accessed by powering the instrument on while holding down the delete key. Then the "enter username" option should be selected. This will display a list of engineer level users who can access this menu. A user should be selected followed by entering the correct user password. Upon which the system menu will be displayed. A backup is initiated by selecting the option "system save". The will create a full backup of the entire system.

A log entry is created for each backup made in the BACKUPLOG.TXT file located in BACKUP directory.

Backups are stored in the BACKUP directory where the structure is explained in further detail in the SD card file system section of this manual

To perform a backup via the web interface you simply enter the advanced settings page and select backup from the backup and restore section of the page.

On the Web Interface in the advanced settings page there is also an option called 'Email Backup'. Here you can select any previous backup and email it to a chosen destination. A backup contains many different data files. To do this the chosen backup is compressed into a single archive file. It is this archive file that is then emailed to the recipient. All compressed archive files have the Jiskoot InSpec Zip file extension .JIZ.

Jiskoot Engineers will have a Windows based executable file on their laptops which will enable them to decompress a .JIZ file in Windows so that they can view the contents of an emailed archive file.

SECTION 15: RESTORING CONFIGURATION BACKUPS

Backups of the instrument software, registers and configuration files can be easily restored from the InSpec start up system menu or, if configured, you can do this from the web interface.

The InSpec system menu is accessed by powering the instrument on while holding down the delete key. Then the "enter username" option should be selected. This will display a list of engineer level users who can access this menu. A user should be selected followed by entering the correct user password. Upon which the system menu will be displayed. To restore a previous backup simply select the option "system restore". A list of previous backups are then listed via a year, month, day, batch path. You must select the year, month, day and time of the backup that you wish to restore. Once a backup has been selected, you are asked to confirm that you want to restore this backup.

To perform a restore via the web interface you simply enter the advanced settings page and browse to the previous backup image from the backup and restore section of the advanced settings page.

NOTE: The bootloader is not restored through this process as it is a dangerous operation, however a copy is made during the backup process. The bootloader should only be restored following the advice of Jiskoot, where it can be accomplished from the shell command line.

INTELLIGENT ACTION

SECTION 16: SYSTEM START UP MENU

When the unit is switched on for the first time or after new software has been installed the InSpec will boot to the system start-up menu. Alternatively, this menu can be accessed by rebooting the system and holding down the delete/reset key.

The full system starts up menu is not available until a username and associated password with engineering level access has been successfully entered. The full system menu consists of the following options:

16.1 EXIT

Exit to the application. If the application has been newly loaded it is strongly advised that you wipe the BBRAM and default the registers before exiting to the application.

16.2 TOGGLE WDOG

The InSpec software runs a specific watchdog task that monitors all of the other actively running tasks. Each task has its own internal running counter. If any of these individual running counters are not incremented automatically by the task, then the task is considered to have stalled/crashed. The task name, time and date are logged to the rebootlog.csv file in the system folder on the SD card and the processor is forced to reboot.

This watchdog facility can be disabled by selecting the 'toggle wdog' option in the system menu. This is a useful fall-back option if a system fault results in repetitive watchdog reboots.

16.3 ENABLE DEBUG

The enable debug menu allows all or individual debug flags to be turned on for independent programmes/tasks to locate and report on a specific data variable, sequence of logic.

16.4 DEFAULT UK

This item defaults the InSpec registers to the UK standard.

16.5 DEFAULT US

This item defaults the InSpec registers to the US standard.

16.6 DEFAULT MODBUS

This item defaults the InSpec Modbus registers to their default address/register settings.

16.7 CLEAR MODBUS ADDRS

This item clears the InSpec Modbus registers by writing–1 to each registers Modbus. Address field.

16.8 DEFAULT FILES

This option is selected when you wish to default the report template files for the controller.

16.9 WIPE INSTRUMENT

This item is commonly selected when setting up an InSpec for the first time. The wipe instrument option is followed by a series of prompts asking whether you wish to keep the current users, keep the calibration settings, the TCP settings, wipe the BBRAM, format the SD card and finally whether you want to default to UK or US defaults.. This is the memory where all the register configuration data is stored. After selecting which, you will see the default process initiated on the front panel display. On completion, the InSpec will reboot and the application will start.

16.10 FORMAT SD CARD

This item wipes the BBRAM. Any configuration values/settings will be lost as a result. Upon exiting the system menu, the System folder and report template files will be recreated. Note if you format the SD card you will lose all the current users and the InSpec will default back to having just the 3 default users – Jiskoot, Operator & Engineer.

16.11 STARTUP CTRL

This feature allows individual tasks to be started up once the system menu is exited. If this item is selected an internal flag is set and on exiting the system menu you will be asked whether you wish to start each task (Serial0, Serial1, Serial2, Serial3 & Maths). The Maths task is the APP task as shown in the previous TASK command output example.

16.12 CLEAR REG CHECK

When the InSpec starts up it checks internally to see whether the S_COMPILED_DATE_TIME register has changed since the last reboot. If it has changed the software has been modified and it is necessary to wipe BBRAM and default the registers before continuing. The 'Clear Reg Check' option allows you to overrule this check. This prevents Jiskoot engineer's having to zap the instrument when the software has been changed. This is useful when there are no register changes between versions and we wish to test the new software with a previous configuration.

16.13 REGISTER EDITOR

See Register section 2.5 for a description of what this item does. It is a duplication of the register access screen in the full menu. It has been included in the system menu to allow an engineer to amend a register value before starting the sampler. A fully authorised engineer may prefer to use the software command line via Windows hyper terminal tool to amend and change registers.

16.14 SYSTEM BACKUP

Selecting and confirming this item initiates the saving of the entire instrument configuration to a time stamped folder in the backup directory on the root of the SD card. Within the specific backup folder, three folders are created containing the following data:

CSDATA – CONFIG.TXT, CONFIG.CSV. CONFIG.CAL.CONFIG.BIN

SYSTEM – REPORT_TEMPLATE.TXT, REPORT_TEMPLATE.HTM,

USRS.BIN, REGLOG.CSV, SECLOG.CSV, REBOOTLOG.CSV

(Note the contents of the System folder will vary)

IMAGES – BOOTLOADER.IMG, APPLICATION.IMG

16.15 SYSTEM RESTORE

Selecting this item results in having to browse to a selected restore folder in the backup directory on the SD card. Once you have selected a time stamped folder from this directory and confirmed your decision to restore the instrument configuration the restore process will begin. This takes a little time to execute.

INTELLIGENT ACTION

SECTION 17: WEB (HTTP) INTERFACE

Each InSpec Controller (Sampler, Blender, Remote IO) comes with a built in alternative web interface that can be viewed by most browsers (e.g., Google Chrome™, Mozilla Firefox™, Microsoft™ Internet Explorer™) which allows the system to be monitored and controlled from a web browser. If possible, this interface should always be used in preference to the front panel menu as it is far more intuitive for setup and for understanding the many parameters available for configuring the control system. If access to the remote network is possible, this interface is very useful for remote support purposes. Across all the pages, the web interface consists of 4 panels. 1) The top panel is the title bar, 2) the left panel presents the menu, 3) the centre panel contains the main screen and the 4) right panel contains a content sensitive help screen. The following shows these four panels on the opening screen before someone has logged in:
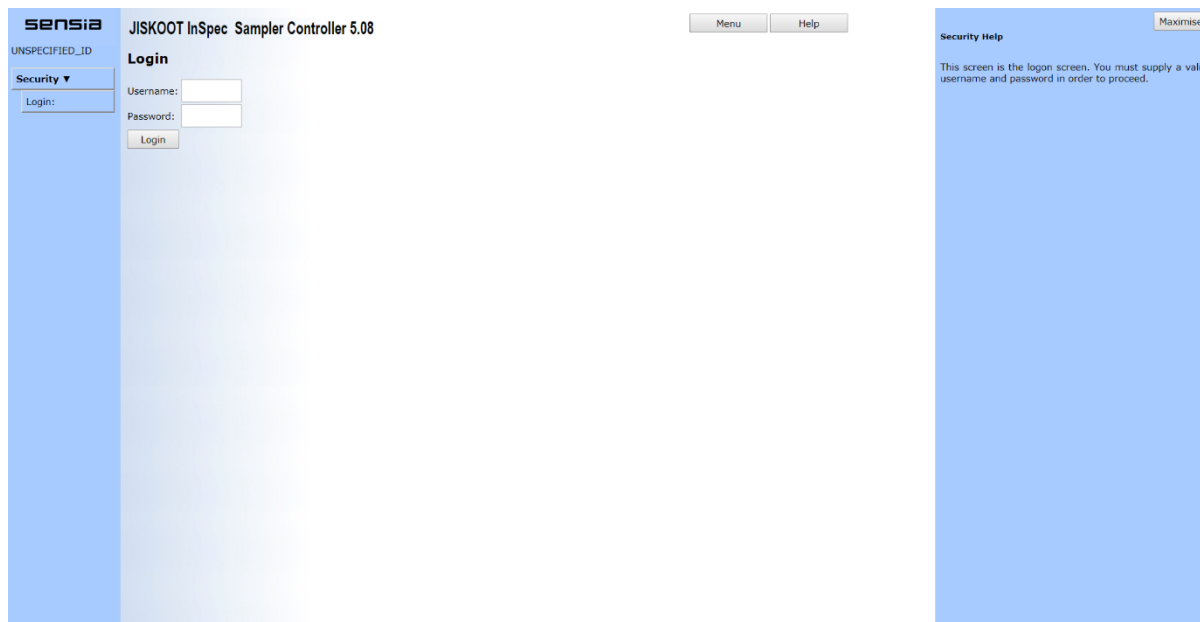
Figure 31 - Display Panels of the Web Interface

Note how panel 1 contains two checkboxes labelled Menu and Help. Toggling these buttons results in removing the associated menu panel (panel 2) and the help panel (panel 4). This then leaves a much larger scaled central display area (Panel 3)

You can login to the web page using the same security login details as used on the front panel interface. You will then see an extended menu in panel 2 listing the options that are available under your associated security access. There is a dedicated help page for each selected menu page. Therefore, this manual will not cover the web interface in any detail. Simply login and learn using the context sensitive online help.

SECTION 18: SVG SCHEMATIC - WEB INTERFACE
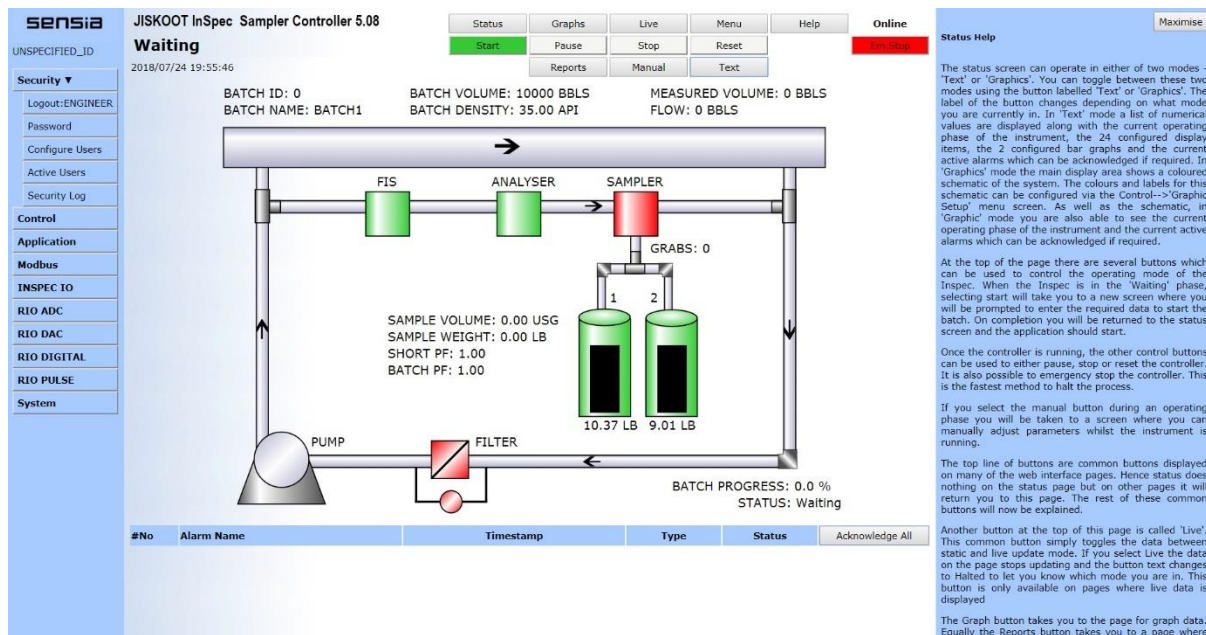
Figure 32 – The Default Sampler Graphics Page

On the status page there is a button labelled graphics. When you click this the graphical schematic will appear. This is designed to show a layout of the system (Sampler or Blender). Note that in the case of the sampler there are currently 4 different types of system available via an internal register. The setting of the **C_SVG_SAMPLER_MODE** register determines which of the following systems is drawn: Cojetix, Fastloop, Inline with Jetmix or inline without Jetmix.
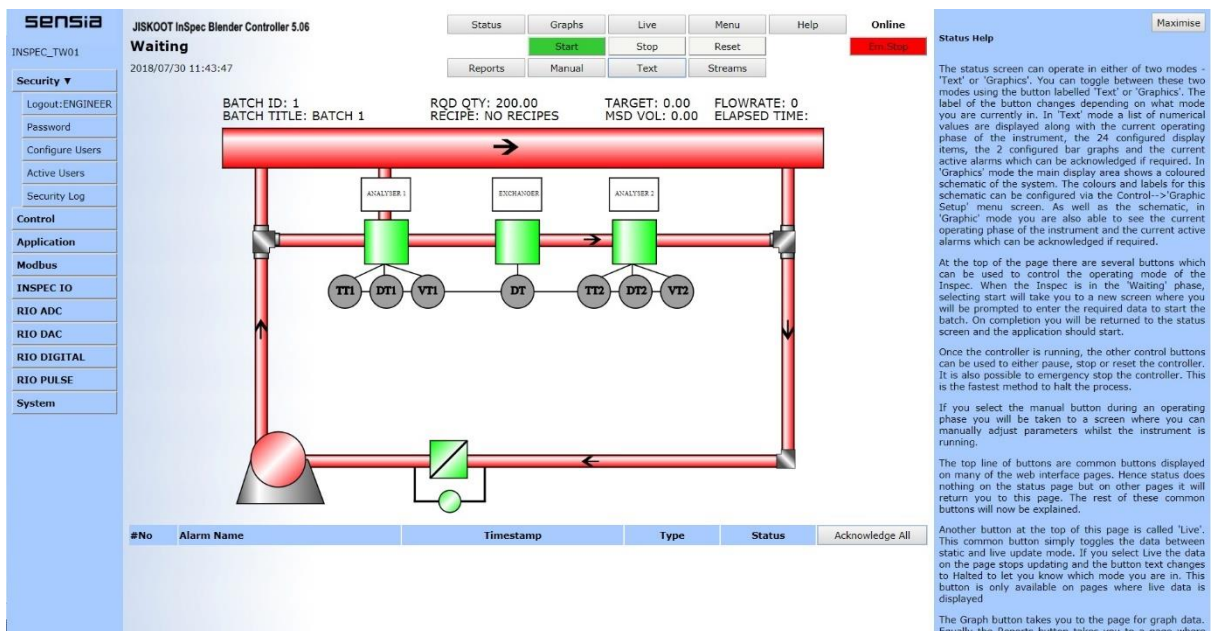
Figure 33 – The Default Blender Overview Graphics Page

INTELLIGENT ACTION
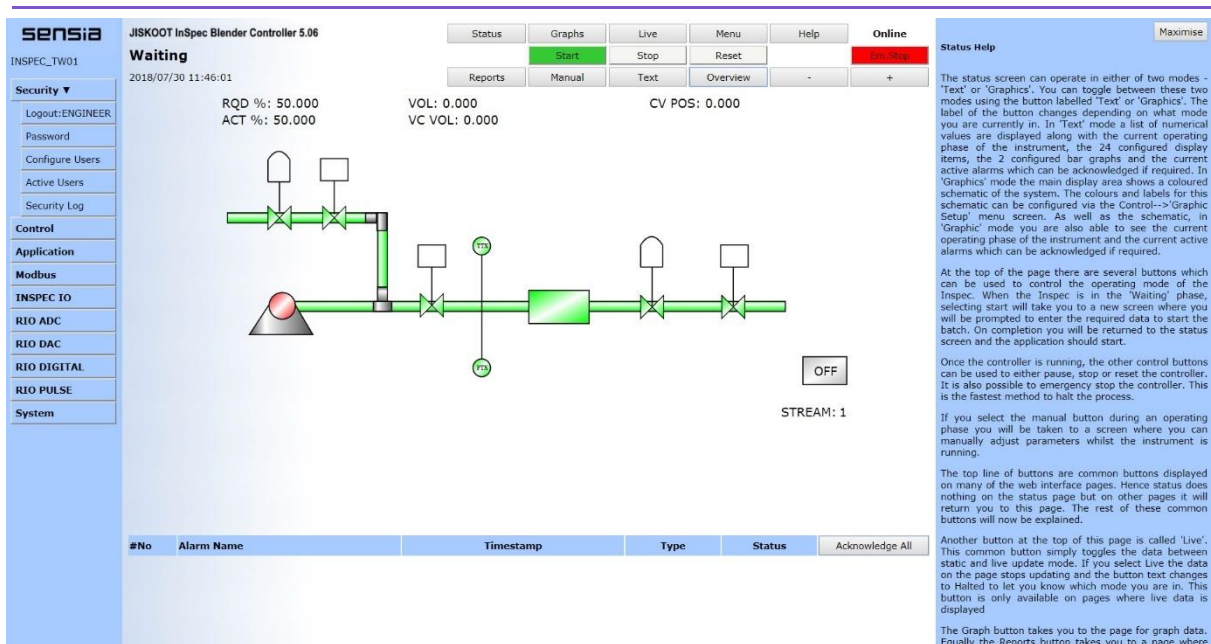
Figure 34 – The Default Blender Streams Graphics Page

There are 20 labels for each of the displays. Each label has the following associated internal registers:

S_SVG_TITLE1-20 – These registers contain the title that will be displayed for this specific label.

P_SVG_DISP1-20 – These registers contain the register value to be displayed. If they point to the F_VERSION register, then the display is disabled and will not be shown on the screen.

C_SVG_DEC_PLACES1-20 – These registers contain the number of decimal places to be used for the value of the label. This can of course be set to zero when not appropriate for the value type.

S_SVG_UNITS_DISP1-20 – These registers contain the units to display after the value. The string can be blank if required.

The colours on the schematic can be configured to any chosen colour. For example, in the sampler schematic you can change the value of the pump when it is on or off. Likewise, you can do the same with the colour of the pipes. The RGB colour values are stored in the following INT32 registers in hexadecimal format:

L_PUMPON_SVG

L_PUMPOFF_SVG

L_PIPEON_SVG

L_PIPEOFF_SVG

Here are some examples of the configuration screens.

Overview Screen Graphic Setup

Dropdown Filter: [ ]   Name Filter ▼

Optional Components

Analyser 1	☑	Analyser 2	☑	Heat Exchanger	☑
Filter	☑	Pump	☑		

Select Colours

Item	Source Register	RGB On Value	New Value	Colour	RGB Off Value	New Value	Colour
ANALYSER 1	F_VERSION ▼	65280	65280	(green)	16711680	16711680	(red)
ANALYSER 2	F_VERSION ▼	65280	65280	(green)	16711680	16711680	(red)
HEAT EXCH	F_VERSION ▼	65280	65280	(green)	16711680	16711680	(red)
FILTER	F_VERSION ▼	65280	65280	(green)	16711680	16711680	(red)
PUMP	C_AUX_RUN1 ▼	65280	65280	(green)	16711680	16711680	(red)
PIPES	F_FLOW_GROSS_ ▼	65280	65280	(green)	16711680	16711680	(red)

Control Buttons

Button	RGB On Value	New Value	Invert Text
Start	3394611	3394611	☐
Pause	16711680	16711680	☐
Stop	16711680	16711680	☐
Reset	16711680	16711680	☐
Em.Stop	16711680	16711680	☐
Button Disabled	16119281	16119281	☐

Figure 35 – The Blender Overview Graphic Setup Page

Stream Screen Graphic Setup

Stream: 1 ▼   Dropdown Filter: [ ]   Name Filter ▼

Optional Components

Spillback Line	☑	Pump	☑	Block Valve 1	☑
Block Valve 2	☑	Str CV	☑	Pressure TX	☑
Temp TX	☑	Pipes	☑		

Select Colours

Item	Source Register	RGB On Value	New Value	Colour	RGB Off Value	New Value	Colour
PIPES	F_VERSION ▼	65280	65280	(green)	16711680	16711680	(red)
PUMP	C_AUX_RUN1 ▼	65280	65280	(green)	16711680	16711680	(red)
SPILLBACK FCV	F_VERSION ▼	65280	65280	(green)	16711680	16711680	(red)
SPILLBACK BV	F_VERSION ▼	65280	65280	(green)	16711680	16711680	(red)
STREAM FCV	F_VERSION ▼	65280	65280	(green)	16711680	16711680	(red)
STREAM BV 1	F_VERSION ▼	65280	65280	(green)	16711680	16711680	(red)
STREAM BV 2	F_VERSION ▼	65280	65280	(green)	16711680	16711680	(red)
STR TEMP TX	F_VERSION ▼	65280	65280	(green)	16711680	16711680	(red)
STR PRESSURE TX	F_VERSION ▼	65280	65280	(green)	16711680	16711680	(red)
STR FLOW METER	F_VERSION ▼	65280	65280	(green)	16711680	16711680	(red)

Figure 36 – The Blender Stream Graphic Setup Page

Edit Labels

SVG TAG	Register	Title	Units	X	Y	Decimals
1	L_BATCH_ID	BATCH ID:		30	23	
2	X_BATCH_TITLE	BATCH TITLE:		30	35	
3	F_RQD_QTY	RQD QTY:		220	23	2
4	X_CURRENT_RECIPE	RECIPE:		220	35	
5	F_RQD_TRIM_TARGET1	TARGET:		380	23	2
6	F_QTY_GROSS_P	MSD VOL:		380	35	2
7	F_FLOW_GROSS_P	FLOWRATE:		480	23	0
8	S_ELAPSED_TIME	ELAPSED TIME:		480	35	
9	F_VERSION			0	168	0
10	F_VERSION			0	182	0
11	F_VERSION			0	196	0
12	F_VERSION			0	210	0
13	F_VERSION			0	224	0
14	F_VERSION			0	238	0
15	F_VERSION			0	252	0
16	F_VERSION			0	266	0
17	F_VERSION			0	280	0
18	F_VERSION			0	294	0
19	F_VERSION			0	308	0
20	F_VERSION			213	320	0

Figure 37 – The Blender 'Edit Labels' Setup Page

SECTION 19: REMOTE IO MODULE

19.1 FIELD CONNECTIONS

See InSpec Remote I/O (RIO) Module manual (H109).

19.2 CONNECT WITH WEB INTERFACE

The web page interface of the master InSpec has pages for configuring these remote devices. To configure a device, it must be accessible on the same network. The IT administrator at your location will need to assist this process. You then enter the IP address of the remote device into a free slot on the master InSpec's remote setup page. After doing so the master attempts to establish communication with the remote device. You will see there is a fail count and a fail count max for this process. The maximum count is configurable. If this is exceeded the connection is deemed to have failed. Although this is the case the master will continually try to establish a connection. When an InSpec is successfully connected to you will see the 'Connected' text in the adjacent status field and Example screenshots below:

This screen allows for additional remote IO modules to be added by IP address.

Each type has its own limit on available slots. These are ADC=4, DAC=2, DIGITAL=6, PULSE=2.

In the event that more than one of the same variant of RIO Module is required, then each RIO Module will need their own individual IP address.

<u>URL</u> The IP address for this device.

<u>Timeouts</u> The number of machine cycles over which communication has been lost. If this exceeds Timeout Max, an alarm is triggered.

<u>Timeout Max</u> The maximum number of machine cycles over which communication can be lost. E.g., if a machine cycle is two seconds and the max timeout is 5, then after 10 seconds the connection will be deemed a failure.

<u>Device Status</u> This shows the current status and any error condition if there is one.

<u>GoTo</u> This opens the browser on the remote IO device. These are currently not available with this release.

Figure 38 – Remote IO Module (Unable to Connect)

INTELLIGENT ACTION
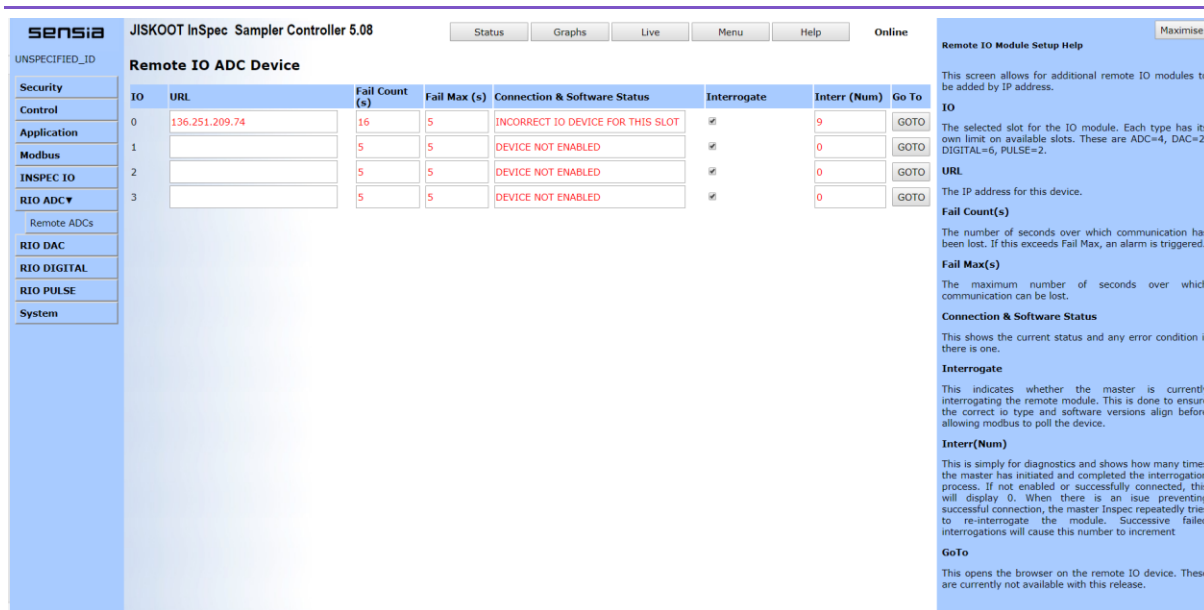
Figure 39 – Remote IO Module (Incorrect IO Device)

Figure 40 – Remote IO Module (Connected and Compatible)

19.3 REMOTE ADC DEVICE

This page contains the items required to both test and calibrate a Remote ADC module.

The ADC table shows the ADC number, the raw integer valve of the ADC, the scale 0 to 1 value of the ADC, the calibration points at 4mA and 20mA, the ADC title, the output scaled value minimum, maximum and resulting scaled value, finally the cal button allows the ADC's to be calibrated.

Figure 41 – Remote ADC 0, Option in Menu Sidebar for Setup and Test

19.4 REMOTE DAC DEVICE

This page contains the items required to all configure, test and calibrate a Remote DAC module.

The DAC table shows the DAC number, the DAC test output in mA, the calibration slope and intercept (ITC), the output source register, the source register minimum and maximum. The DAC test output can be controlled either by a user entering a number, clicking the + and - buttons, or cycled with the cyclic button. DAC's are calibrated by clicking the cal button.

Figure 42 – Remote DAC 0, Option in Menu Sidebar for Setup and Test

INTELLIGENT ACTION

19.5   REMOTE DIGITAL DEVICE

This page contains the items required to both configure and test a Remote Digital module.

The digital outputs can be set to on or off by clicking the 'ON|OFF' button or made to toggle automatically by clicking the toggle button. The digital inputs show when a signal is present. Signal can be inverted by selecting the checkbox.

Figure 43 – Remote DIGITAL 0, Option in Menu Sidebar for Setup and Test

19.6   REMOTE PULSE DEVICE

This page contains the items required to test a Remote Pulse Input module.

The pulse table shows the pulse number, the title, the raw pulse counter value, the pulses per cycle, the pulse frequency and pulse circuit threshold. The pulse title and threshold can be edited.

Figure 44 – Remote PULSE 0, Option in Menu Sidebar for Setup and Test

INTELLIGENT ACTION

SECTION 20: REMOTE IO WEB PAGE

Each remote IO module has a web page with a similar layout to the Inspec web page. It is a cut down version of this web page with a set of similar menus which can be accessed via clicking the left-hand side menu select buttons. This provides configurable security, a configurable status display screen for the RIO displaying up to 24 custom register values, configurable internal Modbus table and the ability to set up and view Modbus master queries (ethernet / serial), view, set and search internal registers, configure serial ports and default the RIO device. Some example Remote IO web pages are shown below. Note, the module type is displayed at the top of each selected page (Pulse, ADC, DAC or Digital). Anyone familiar with using the Inspec web page will intuitively understand the RIO web interface.
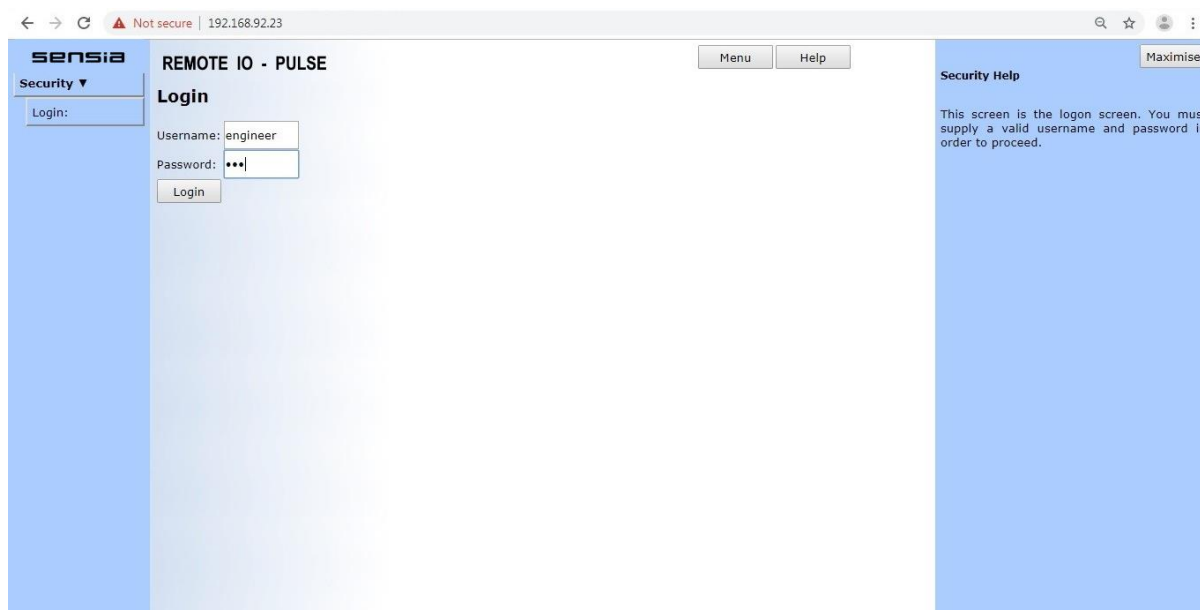

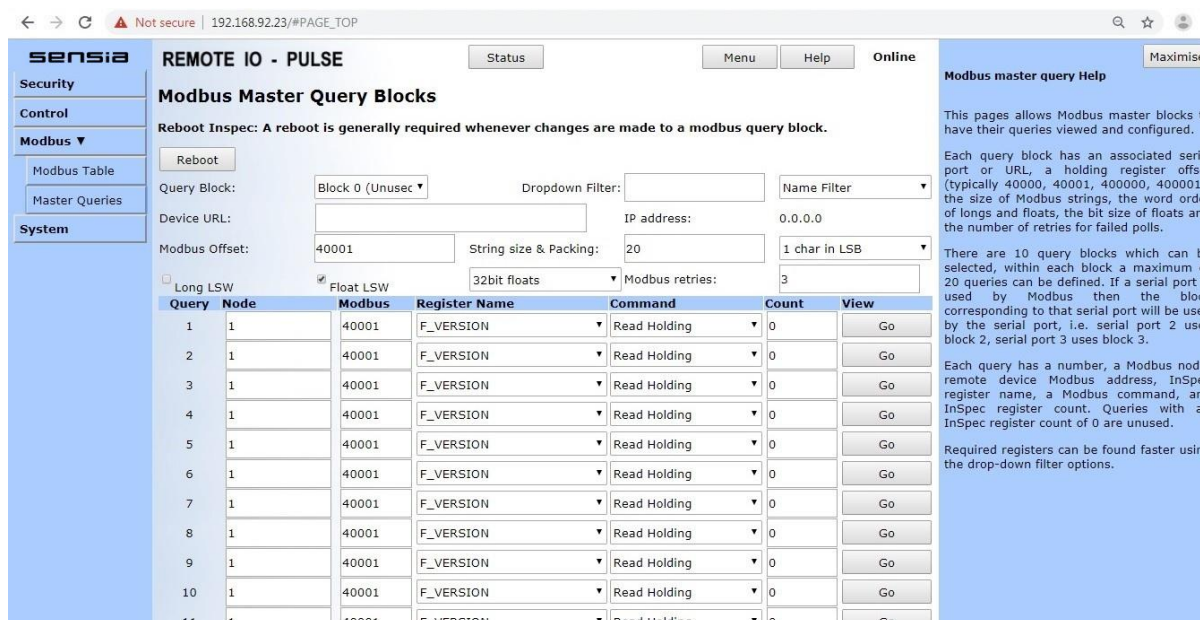**Figure 50 – Remote IO Pulse module login screen**

Figure 51 – Remote IO Modbus Master Queries

SECTION 21: SAFETY INFORMATION

Refer to the latest revision of the InSpec Controller Safety Instructions manual (H84).

SECTION 22: INSTALLATION DETAILS

This instrument is designed for the following: -

- **Equipment Class I**
- **Installation Categories**
    - **AC Power Inlet – Installation Category II**
    - **Relay Outputs – Installation Category III**
- **Pollution Degree 2**

22.1 GENERAL

Ensure that: -

- ✓ the instrument is mounted at eye level for ease of use;
- ✓ ventilation is provided;
- ✓ the operating environment fulfils the requirements of section 25.1.

Avoid: -

- ✗ mounting the unit in direct sunlight;
- ✗ dusty areas;
- ✗ heavy moisture and prolonged condensation;
- ✗ temperature extremes;
- ✗ mechanical vibration and shock.

22.2 LOCATION

The instrument is designed for use in a dry and ventilated indoor environment, where neither explosive atmosphere or flammable materials exist.

The instrument must be mounted so that the front panel is only accessible by trained operators and the rear of the instrument by trained service/installation engineers.

22.3 MOUNTING

2.5mm Hexagon Wrench or Allen Key

4mm Hexagon Wrench or Allen Key

The instrument is designed to be mounted into a control panel, which must have the correct size cut-out – See **Error! Reference source not found.**.

At least 250mm clear space is required to the rear to allow for cable routing.

The recommended panel thickness for mounting the InSpec is 3mm or more (The latches that fix the unit into a panel can accommodate panel thicknesses of 1mm to 8mm).

For detailed of the full mounting process, please refer to **Error! Reference source not found.**.

SECTION 23: MAKING CONNECTIONS

23.1 Field and Power Connections (Rear)

There are seven external connectors on the rear of the controller and full descriptions for these are found in the sections that follow: -
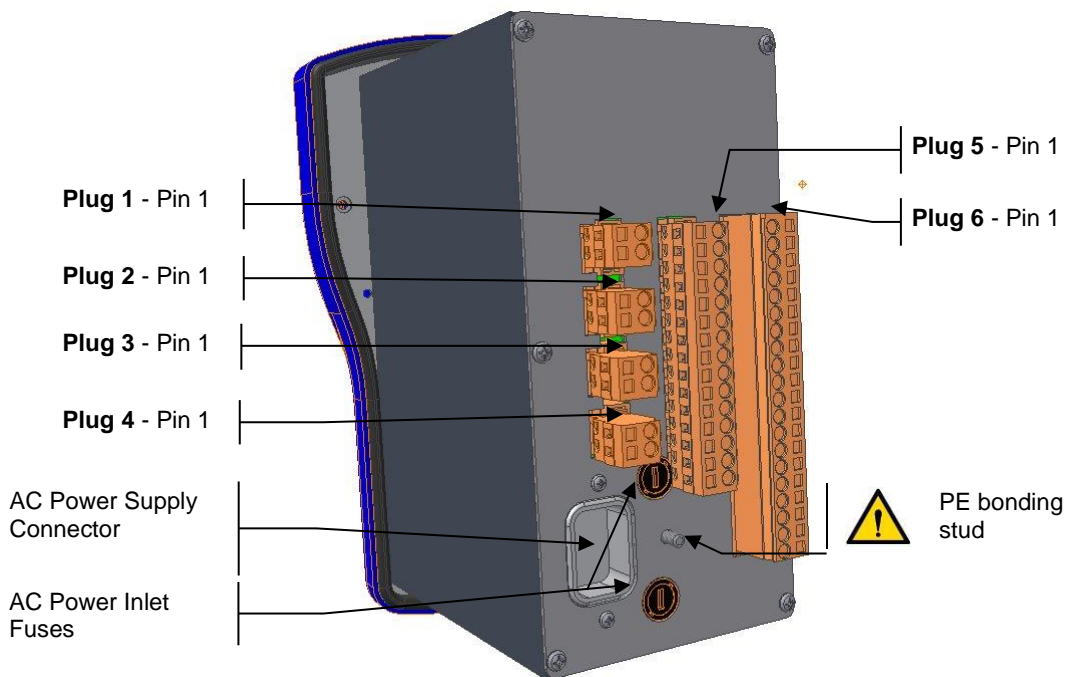

Plug 1 - Pin 1

Plug 2 - Pin 1

Plug 3 - Pin 1

Plug 4 - Pin 1

AC Power Supply Connector

AC Power Inlet Fuses

Plug 5 - Pin 1

Plug 6 - Pin 1

PE bonding stud

Figure 45 - InSpec Rear Connections

Plug	Description
AC Power	Instrument AC Power Supply Inlet
1 – 4	Relay Outputs (Electromechanical)
5	Serial Communications Ports (RS232/RS422/RS485) ⚠ All circuits wired to Plug 5 must be connected to SELV circuits.
6	Analogue Inputs & Outputs, Pulse Inputs, Digital Inputs/Outputs and 24VDC Input/Output. ⚠ All circuits wired to Plug 6 must be connected to SELV circuits.

23.2 INPUT POWER

Refer to the latest revision of the InSpec Controller Safety Instructions manual (H84).

23.2.1 EARTHING REQUIREMENTS

AC Powered Units

When the instrument is powered from an AC main supply using the IEC AC power inlet connector, the instruments protective earth is achieved via the IEC inlet.

DC Powered Units

When the instrument is powered from a regulated 24V DC supply using Plug 6, a protective earth (PE) conductor should be connected to the earth stud on the rear of the instrument.

23.3 SHIELDED (SCREENED) CABLES

Any signal or control cable screens and drain wires should be terminated onto a low-impedance earth (ground), preferably using a 360° shield (screen) clamp. If pigtails are used, where the screen is brought down to a single wire and connected to the earth point, then these must be as short as possible; otherwise the inductance of the pigtail renders it ineffective at high frequencies.

Note: Pigtails just 25mm long have been seen to completely ruin any shielding effect in a 3-metre-long cable at frequencies above 30 MHz

- For a circuit with an ungrounded source the screen should be terminated at the input end, whereas if the input is floating and the source is grounded then the screen should be terminated at the source end.

- If both the signal source and signal inputs are both grounded, terminating the screen at both ends may reduce the performance of the system.

- To shield against low-frequency electric fields terminate the screen at one end only.

- To shield against low-frequency magnetic fields terminate both ends of the screen.

Using a shielded twisted pair cable with the screen terminated at only one end gives a good compromise as the twisting minimizes the magnetic coupling, and the screen reduces external capacitive coupling. The circuit loop area should be kept small, and the screen should not form part of the circuit.

SECTION 24: FIELD CONNECTIONS

⚠️ SELV Circuits

All circuits wired to Plugs 5 & 6 must be connected to SELV circuits.

Please refer to section 0 for a definition of SELV circuits

⚠️ *Circuits TBTS*

Tous les circuits câblés aux fiches 5 & 6 doivent être reliés à des circuits TBTS.

Veuillez vous référer à la section 0 source de référence pas trouvé pour une définition des circuits TBTS.

24.1 CABLE SCREENS & DRAIN WIRES

Please refer to Section 23.3.

To eliminate earth loops screens and drain wires should be left unconnected and taped back at one end.

24.2 PLUG NO'S 1, 2, 3 & 4

These plugs provide connections to the relay outputs that can switch circuits designated as Installation Category III.

Terminal assignments are as follows: -

	Terminal	Duty
Plug 1 (Relay No.1)	1	Common
	2	Normally Open
Plug 2 (Relay No.2)	1	Common
	2	Normally Open
Plug 3 (Relay No.3)	1	Common
	2	Normally Open
Plug 4 (Relay No.4)	1	Common
	2	Normally Open

Figure 46 - Plugs 1 to 4 Relay Connections

Insulation Coordination: -

Coil to Contact   -   Reinforced

Normally Open Contact   -   Functional

Relay to Other   -   Reinforced

24.2.1 RELAY OUTPUTS (4 OFF)

Each relay output is rated to switch a 2 Amp resistive load.

All wiring connected to any relay output must have a suitably sized protection device fitted to protect the relay circuit and load being switched by it. Relay outputs are fitted with a varistor, for suppression of voltage spikes that may be generated during switching, to extend the life of the relay contacts.
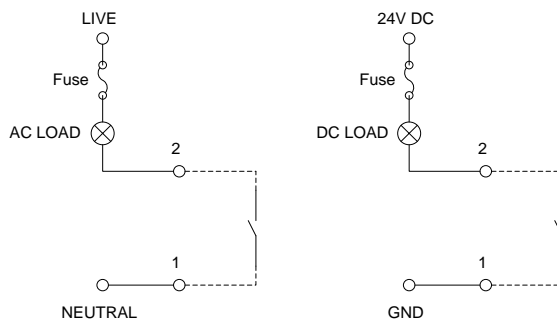
Figure 47 - Connecting a Relay Output

24.3 PLUG NO. 5

IMPORTANT: Cables terminating to this terminal block must be screened.

This terminal block is carries connections for Serial Communications (RS232, RS422 & RS485). Its terminal assignments are as follows: -

	Terminal	RS232 (DTE) Duty		RS422/485 Duty	
Port 1	1	NC			
	2	Rx	←	Not Applicable	
	3	Tx	→		
	4	NC			
	5	GND		GND	
Port 2	6	NC		Rx +	←
	7	Rx	←	Rx -	←
	8	Tx	→	Tx -	→
	9	NC		Tx +	→
	10	GND		GND	
Port 3	11	NC		Rx +	←
	12	Rx	←	Rx -	←
	13	Tx	→	Tx -	→
	14	NC		Tx +	→
	15	GND		GND	

Figure 48 - Plug 5 Connections

IMPORTANT : Duty shown in blue are for RS232 (DTE) mode only, and those in yellow are for RS422 and RS485 mode only. NC means No Connection (DO NOT CONNECT).

24.3.1 RS422 & RS485 TERMINOLOGY

The terminology for RS422 and RS485 terminations does vary between manufacturers, but generally is as follows: -

Rx +	=	R+	=	A'
Rx -	=	R-	=	B'
Tx +	=	T+	=	A
Tx -	=	T-	=	B

Figure 49 – RS-422 and RS-485 Terminology

24.3.2 RS422 & RS485 TERMINATION

For correct operation of the multi-drop bus, the communication lines must be held in the default fault tolerant position. For RS422 this is done at each receiver and Rx+ is pulled low (0V) and Rx- is pulled high (5V).For RS485 this is done at each transceiver and Tx/Rx+ is pulled low (0V) and Tx/Rx- is pulled high (5V). See Section 3.13 for information on configuring this option.
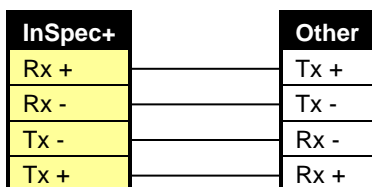
24.3.3 RS422 & RS485 CONNECTIONS

InSpec+	Other
Rx +	Tx +
Rx -	Tx -
Tx -	Rx -
Tx +	Rx +

Figure 50 - RS422 (4-Wire)

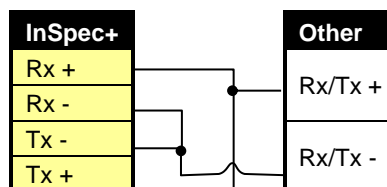| InSpec+	Other
Rx +	Rx/Tx +
Rx -	
Tx -	Rx/Tx -
Tx +	

Figure 51 - RS485 (2-Wire)

24.4 PLUG NO. 6

IMPORTANT: Cables terminating into Pulse Inputs or Analogue Inputs/Outputs in this terminal block must be screened and kept separate from the digital I/O.

This terminal block is carries connections for: -

- 1 off 24V DC Supply;
- 4 off Digital I/O points;
- 2 off Pulse Inputs (Voltage or Current Pulse);
- 2 off Analogue Outputs;
- 3 off Analogue Inputs

Its terminal assignments are:

Terminal	Duty	
1	0V (+24V DC GND)	
2	+24V DC Supply	
3	Digital I/O Point No.8	
4	Digital I/O Point No.7	
5	Digital I/O Point No.6	
6	Digital I/O Point No.5	
7	-	Pulse Input No.2
8	+	
9	-	Pulse Input No.1
10	+	
11	-	Analogue Output No.2
12	+	
13	-	Analogue Output No.1
14	+	
15	-	Analogue Input No.3
16	+	
17	-	Analogue Input No.2
18	+	
19	-	Analogue Input No.1

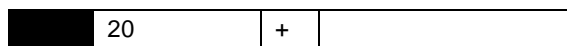*Plug No.6*

	20	+	

Figure 52 - Plug 6 Connections

24.4.1 24V DC POWER (1 OFF)

If the controller is powered via the AC mains connector then these connections supply a fused and regulated 24V DC supply, suitable for powering 4-20mA loops, pulse transmitters, and low power DC resistive devices. **Do not connect inductive loads to these terminals.**

Alternatively, if an AC power supply is not available, the controller can be powered via these terminals with a suitably clean and regulated 24V DC supply Ensure that a suitable means of disconnect is provided and that any associated components are suitably sized

FUSE: Terminal 2 is fused by a 'PTC Resettable Fuse' rated at 0.3A @ 23°C. If the fuse goes high impedance, equivalent to a conventional fuse blowing, the unit needs to be powered down for more than 1 minute in order to reset the fuse; before powering the unit up again.

24.4.2 DUAL FUNCTION DIGITAL INPUTS/OUTPUTS (4 OFF)

Each digital I/O point is capable of being either a digital input or a digital output as defined by the software application.

Digital inputs require the I/O point to be connected to the Digital I/O Common (Terminal 1 DC ground) to activate the input.

Digital outputs switch the I/O point to the Digital I/O Common Terminal 1 DC ground), which should be connected to the system DC ground (0V).

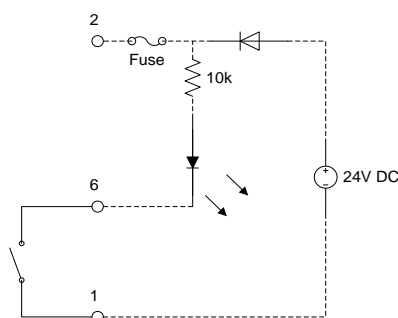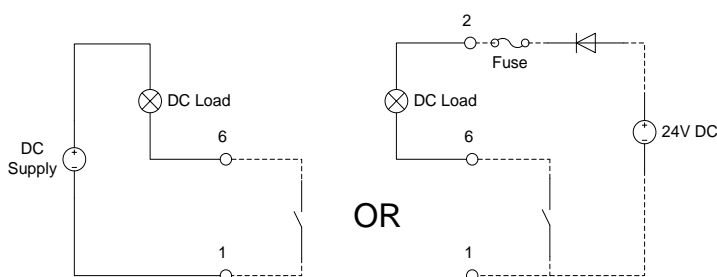**Figure 53 - Connecting a Digital Input**

Figure 54 - Connecting a Digital Output

24.4.3 VOLTAGE OR CURRENT PULSE INPUTS (2 OFF)

Each Pulse Input is configurable for either voltage or current pulse duty and has a differential input type. If required, the trigger threshold of each input can be adjusted to suit a specific application, although the default setting will suit most applications.
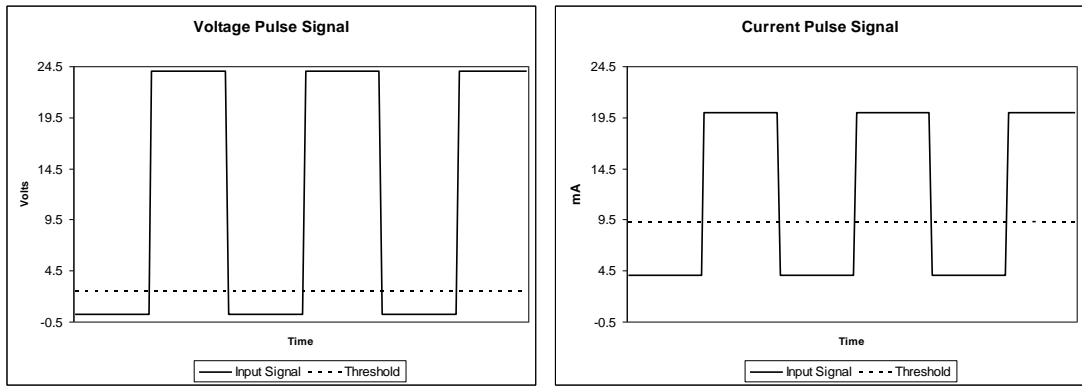
Figure 55 - Voltage and Current Pulse Signals
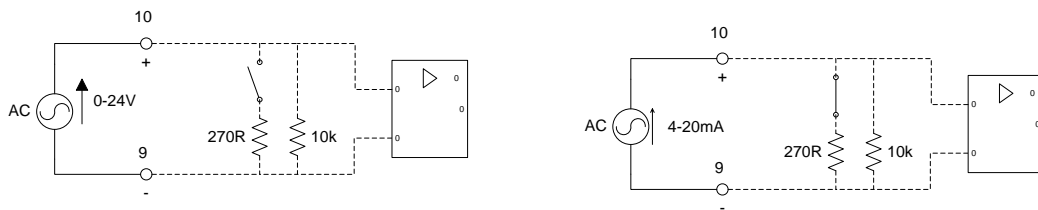
Figure 56 - Connecting a Voltage or Current Pulse Input

24.4.4 4-20mA ANALOGUE OUTPUT (2 off)

Each analogue output is a current source, sometimes referred to as a 'powered' or 'active' output.

Figure 57 - Connecting an Analogue Output

24.4.5 4-20mA ANALOGUE INPUT (3 off)

Each analogue input has a 'passive' differential input type.

Figure 58 - Connecting an Analogue Input

INTELLIGENT ACTION

SECTION 25: INSTRUMENT SPECIFICATIONS

25.1 GENERAL SPECIFICATIONS

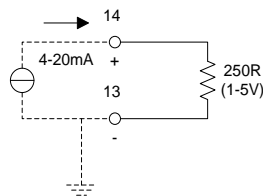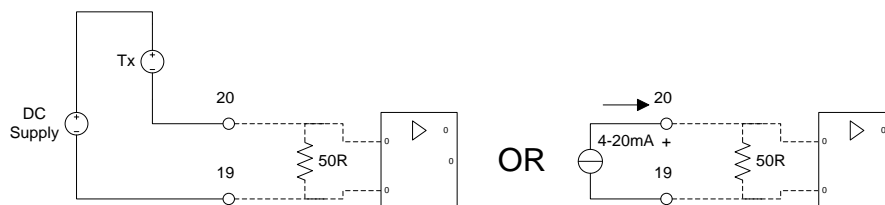| Design Area	Item	Description
Physical	Size (mm)	130 x 220 x 165 (W x H x D) Approx. inc. PE stud Depth including connectors approx. 220mm
	Weight	1.8 kg
	Wire Connections	IEC Socket: 3 x 2.5mm² (3 x 14 AWG) max. Other: 0.08mm² to 2.5mm² (28 – 12 AWG)
Operating Environment	Equipment Class	I
	Installation Category	II
	Pollution Degree	22
	Operating Temperature	5°C to 40 °C (41°F to 104°F)
	Relative Humidity	80% up to 31°C decreasing linearly to 50% at 40°C
	IP Rating	IP42 at front and IP20 at rear of unit.
	Altitude	2000 metres max. (6562 feet)
User Interface	Display	20 Character x 2 lines.
	LED Indicators	4 multicolour LED's
	Keys	21
Power Supply	Voltage, Frequency	AC : 100 to 240 V AC, 50/60 Hz DC : 24V DC ± 10%
	Power Consumption	15 Watts Max.
	Inrush Current	20A @ 115V AC, 40 @ 230V AC (Full Load)
	Fuses	2 off T 500mA H 250V AC
Relay Outputs	Quantity	4
	Contact Form	SPST – NO
	Installation Category	III
	Max. Switching Voltage	250V AC, 30V DC
	Max. Switching Current	2 Amps
	Over Voltage Protection	275V rms max. MOV (350V DC max.)
Digital I/O Points	Quantity	4
	Over voltage Protection	26VDC TVS
	When configured as an output	
	Contact Form	Solid State Relay
	Load Voltage	24V DC
	Continuous Load Current	0.12A
	Max. On Resistance	35 ohms (Typical 23.5 ohms)
	Max. Leakage Current	1uA (in off state)
	Over Current Protection	Cut off Current: 160 to 240mA
		Detection Time: 50us
	When configured as an Input	
	Input Type	Volt-free contact
	Max. Excitation Current	2.4mA
Analogue Outputs	Quantity	2
	Output Type	4-20mA Current Source (24V DC Loop Supply)

[2] Pollution Degree 2 – Normally only non-conductive POLLUTION occurs. Occasionally, however, a temporary conductivity caused by condensation must be expected.

	Accuracy	±0.1% of FSD (12-bit resolution)
	Output Protection	Over Voltage (26VDC TVS)
Analogue Inputs	Quantity	3
	Input Type	4-20mA
	Accuracy	±0.1% of FSD (12-bit resolution)
	Input Impedance	50 ohms
	Input Protection	Over Voltage (26VDC TVS)
Pulse Inputs	Quantity	2
	Input Type	0 - 24V DC Voltage Pulse or 4 – 20mA DC Current Pulse Max. Frequency 10kHz
	Accuracy	± 1 count in any given sampling period
	Input Impedance	10 k ohms - Voltage input 263 ohms - Current input
	Adj. Trig Threshold Range	Approx. 2.2 to 24 V DC (8 to 20mA DC)
	Input Protection	Over & Reverse Voltage (26VDC TVS)
Communications	Quantity	3 (User Ports) + 2 (System Ports)
	Type	2 off configurable RS232/422/485 ports. 1 off Ethernet port.
	Input Protection	Over Voltage (26VDC TVS)

25.2 INSULATION CO-ORDINATION

25.2.1 AC POWER INLET CREEPAGE/CLEARANCE

Creepage / Clearance from PE to Live or Neutral　　$\geq$ 3 / 3 mm

25.2.2 RELAY OUTPUTS CREEPAGE/CLEARANCE

Creepage / Clearance from Coil to Contact Circuits　　$\geq$ 8 / 8 mm

Creepage / Clearance between Relay Circuits　　$\geq$ 6 / 6 mm

25.3 COMPLIANCE TO INTERNATIONAL STANDARDS

EN 61010-1 IEC 61010-1 UL 61010-1 CAN/CSA-C22.2 No. 61010-1	Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements.
EN 61326	Electrical equipment for measurement, control and laboratory use – EMC requirements.
FCC CFR47 Part 15	Radio Frequency Devices.

SECTION 26: INSTRUMENT BREAKDOWN

☑ No.1 Pozidriv (cross-head) Screwdriver

☑ 2.5mm Hexagon Wrench or Allen Key

☑ 4mm Hexagon Wrench or Allen Key

☑ 7mm Combination Spanner

Modern electronic devices are very sensitive to static electric charges.

Use a grounding wrist strap at all times - See section 0 for more details

26.1 DISASSEMBLY

The following flowchart provides an overview of dismantling the unit into its component parts, which maybe required for configuration, service or repair. **Only suitably instructed or skilled persons should carry out this work**: -
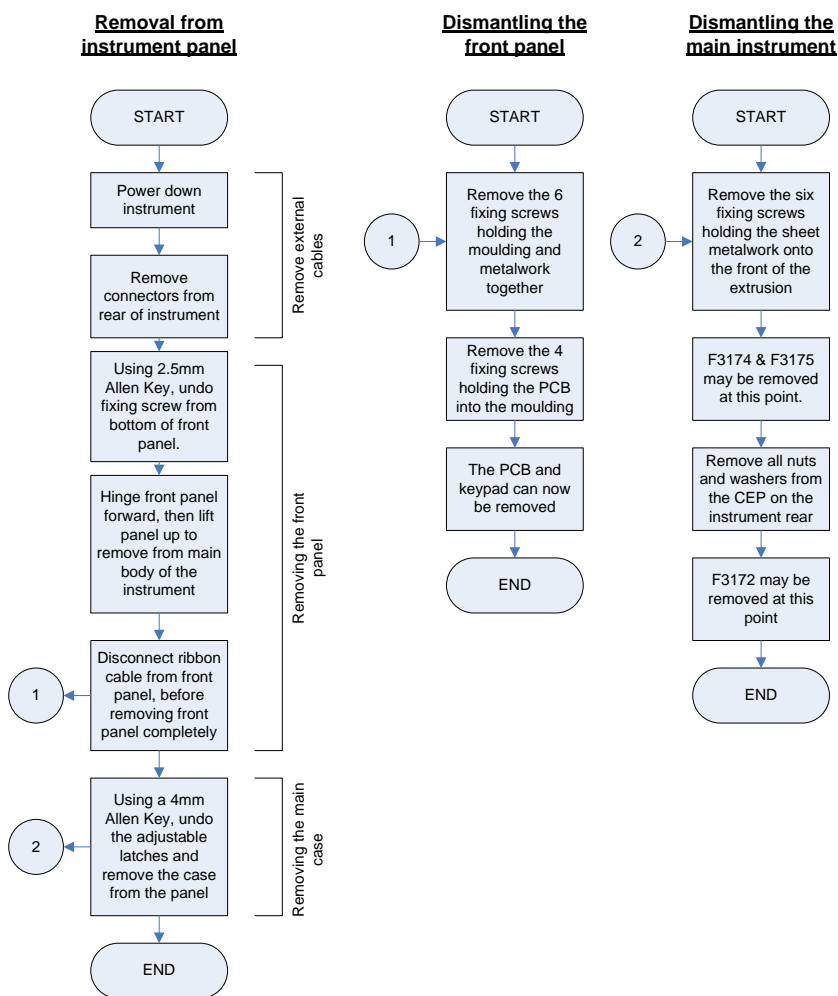

Figure 59 - InSpec Disassembly Flowchart

26.2 REASSEMBLY

Reassembly is the reverse of disassembly.

Protective Earth (PE)

Pay particular attention to the reassembly of the CEP when rebuilding the instrument.

SECTION 27: PRINTED CIRCUIT BOARDS

Warning:

- Instructions for adjustments while covers are removed and for servicing are for use by service trained personnel only.

- To avoid dangerous electric shock, do not perform such adjustments or servicing unless qualified to do so.

Modern electronic devices are very sensitive to static electric charges.

Use a grounding wrist strap at all times - See section 0 for more details

☑ No.1 Pozidriv (cross-head) Screwdriver

☑ 2.5mm Hexagon Wrench or Allen Key

☑ 4mm Hexagon Wrench or Allen Key

☑ 7mm Combination Spanner

27.1 FITTING & REMOVAL

27.1.1 MAIN CASE/EXTRUSION

If any of the following operations need to be carried out on the instrument, it will be necessary to remove one or more of the PCBs (For more information see sections 0 & 27.2): -

- Upgrade application software (Sampler or Blender Controller)

- Change communications protocol or line termination (RS232/RS422/RS485)

- Change Pulse Input configuration (Current/Voltage pulse)

- Replace battery for battery backed memory

- Replace a PCB

F3172 PCB
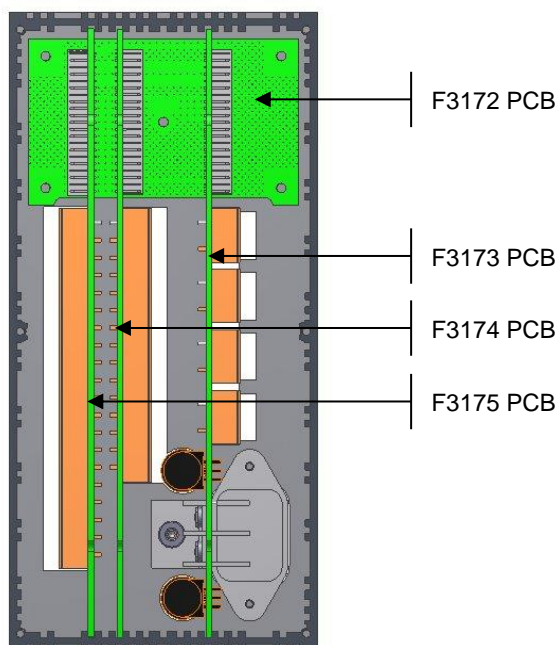
F3173 PCB

F3174 PCB

F3175 PCB

Figure 60 - PCB locations within the main case

27.1.2 FRONT PANEL

If the software contained within the front panel needs upgrading or the PCB requires replacing then it will be necessary to dismantle the front panel (For more information see sections 0 & 27.2).

27.2 PRINTED CIRCUIT BOARD CONFIGURATION

27.2.1 PCB HANDLING PRECAUTIONS

Handle electronic components and printed circuit card assemblies only when you are properly grounded in an ESD Protected Area (EPA). You are a source of ESD unless you are grounded properly.

Modern electronic devices are very sensitive to static electric charges.

Use a grounding wrist strap at all times.

Place all electronic components on a static-dissipative surface or in a static-shielded bag when they are not in the chassis.

Store and transport ESD-sensitive items in static-shielding containers, such as specially marked bags or boxes.

27.2.2 PCB IDENTIFICATION & DESCRIPTION

There are four Printed Circuit Boards (PCBs) held within the main case/body of the unit and another in the front panel. These are: -

PCB Ident.	Description	Configuration Required	Location
F3172	Backplane: Provides connectivity between the next three PCBs described.	No	Main Case
F3173	Power & Relay Outputs: Converts the AC or DC supply into the various voltages required throughout the unit and contains the Relay Outputs	No	Main Case
F3174	Processor & Communications: Contains the unit's processor, memory, application software and communications ports	No	Main Case
F3175	Field I/O: Contains the units Analogue I/O, Pulse Input and Digital I/O circuitry.	Yes	Main Case
F3176	Front Panel: Contains a processor, communications port, LEDs, LCD and DC power supply conditioning necessary for operation of the front panel.	No	Front Panel

27.3 F3174 CONFIGURATION

The figure below shows the location of all the configurable items on the F3174 PCB.
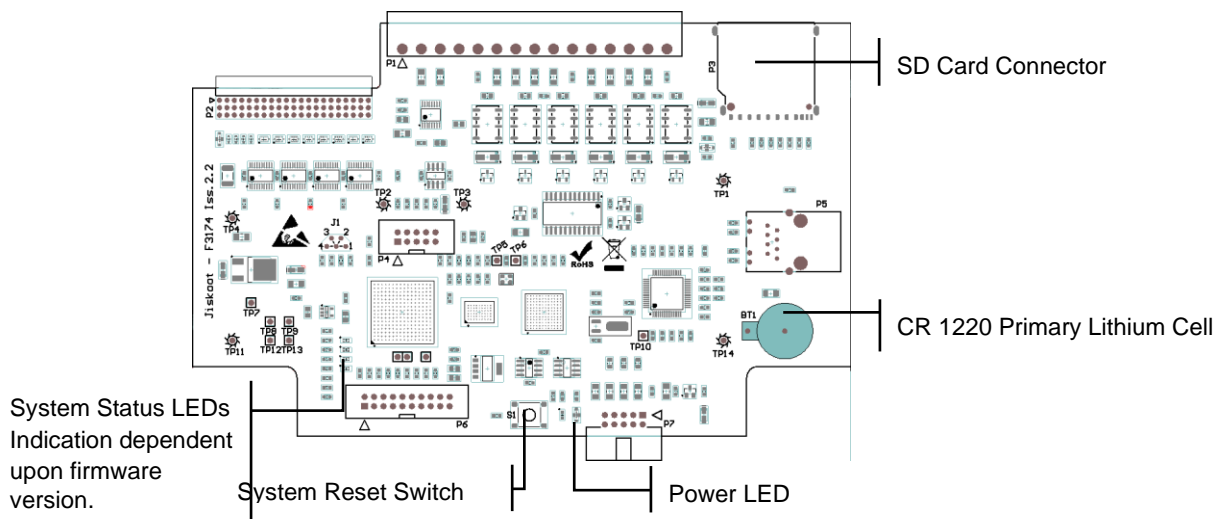

Figure 61 - F3174 Overview

27.3.1 BATTERY REPLACEMENT

 is preferable to replace the battery before it is exhausted, during planned maintenance. Once the battery is exhausted the calendar/clock will be lost whenever the unit loses power.

- Use only IEC Type Designated CR 1220 Lithium Batteries

- Units are shipped with a VARTA CR 1220 35 mAh battery.

- (12mm diameter, 3V, CR Series, Lithium Manganese Dioxide, Primary Cell)

☑ As a precaution, first save the 'InSpec Configuration File' (See section 0 for more details)

☑ Remove the F3174 PCB (See sections 0 & SECTION 27: for more details)

☑ Carefully remove the Lithium cell from the battery holder.

☑ Insert the new battery into the battery holder, ensuring that the part is correctly orientated (positive side upwards).

27.4 F3175 CONFIGURATION

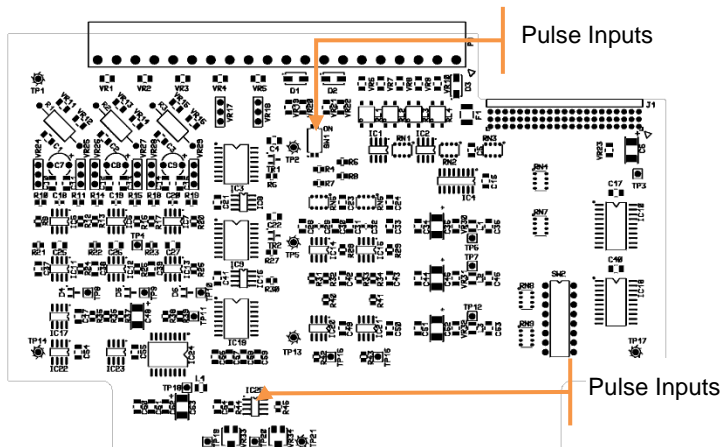The figure below shows the location of all the configurable items on the F3175 PCB.

Pulse Inputs

Pulse Inputs

Figure 62 - F3175 Configurable Items

27.4.1 SWITCH SETTINGS FOR 'SW1'

Switch SW1 allows each pulse input to be configured as either Voltage Pulse input or Current Pulse input, as follows: -

Pulse Input No. 1	
1	Off = Voltage Pulse
	On = Current Pulse
Pulse Input No. 2	
2	Off = Voltage Pulse
	On = Current Pulse
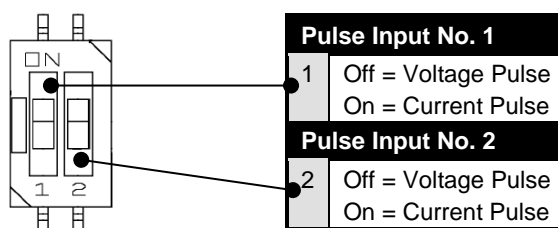
Figure 63 – Pulse Input Configuration Switches

27.4.2 TRIGGER THRESHOLD ADJUSTMENT

☑ Multi-meter (To measure 0 to 24V DC)

☑ 2.5mm Hexagon Wrench or Allen Key

☑ 1.5mm wide parallel tip screwdriver

The trigger threshold for each pulse input can be changed by the manual adjustment of a potentiometer; accessible only by removing the front panel of the instrument.
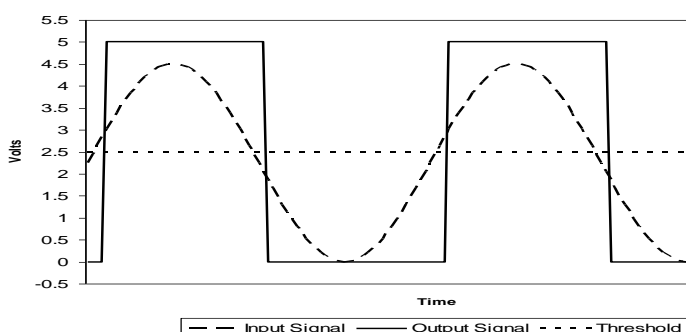
Figure 64 - Pulse Input Trigger Threshold Operation

Test Point	Description	Adjust Trimmer
TP19	Pulse I/P No.1 Trigger Threshold (Volts)	VR33
TP20	Pulse I/P No.2 Trigger Threshold (Volts)	VR34
TP21	Signal Ground	N/A

Procedure: -

☑ Power down the instrument

☑ Remove the front panel

- Remove the front panel fixing screw

- Unhook the front panel at the top of the unit

- Leave the front panel power/communications cable connected and hang/support the front locally so that you can see the results of any adjustment.

☑ Locate and attach to the appropriate test points (See above table) a multi-meter, or similar, to measure a DC voltage up to 24V maximum.

☑ Power up the unit.

☑ Adjust the appropriate trimmer (See table above) so that the trigger threshold is at least 1 volt above the minimum input signal amplitude.

☑ Monitor the results of the adjustment on the front panel.

☑ When the adjustment has been completed satisfactorily

- Turn off the unit

- Remove multi-meter and its connections.

- Re-fit the front panel including fixing screw

- Power up the unit again if required.

The default setting for the trigger threshold is 3.0 Volts, which should suit most situations. This equates to a threshold of 11.4mA when set up for current pulse.

The Voltage setting at test points TP19 and/or TP20 for a current pulse input can be calculated multiplying the desired mA trip point by 263, as follows: -

$$V_{set} = A_{trig} \times 263$$

If the pulse/frequency signal is noisy then it maybe beneficial to increase the trigger threshold towards 50% of the signal amplitude i.e. for a 24V pulse, increase the threshold up to a maximum of 12V DC.

In general, set the threshold voltage to $2.25 \leq V_{trig} \geq 12$ Volts DC to avoid problems.

27.5 F3176 CONFIGURATION

27.5.1 DISPLAY CONTRAST ADJUSTMENT

2.5mm Hexagon Wrench or Allen Key

1.5mm wide parallel tip screwdriver

By carefully removing the front panel, the LCD contrast can be adjusted using a small screwdriver. The adjustment is located towards the top of the panel, see below: -

Access to LCD contrast
adjustment
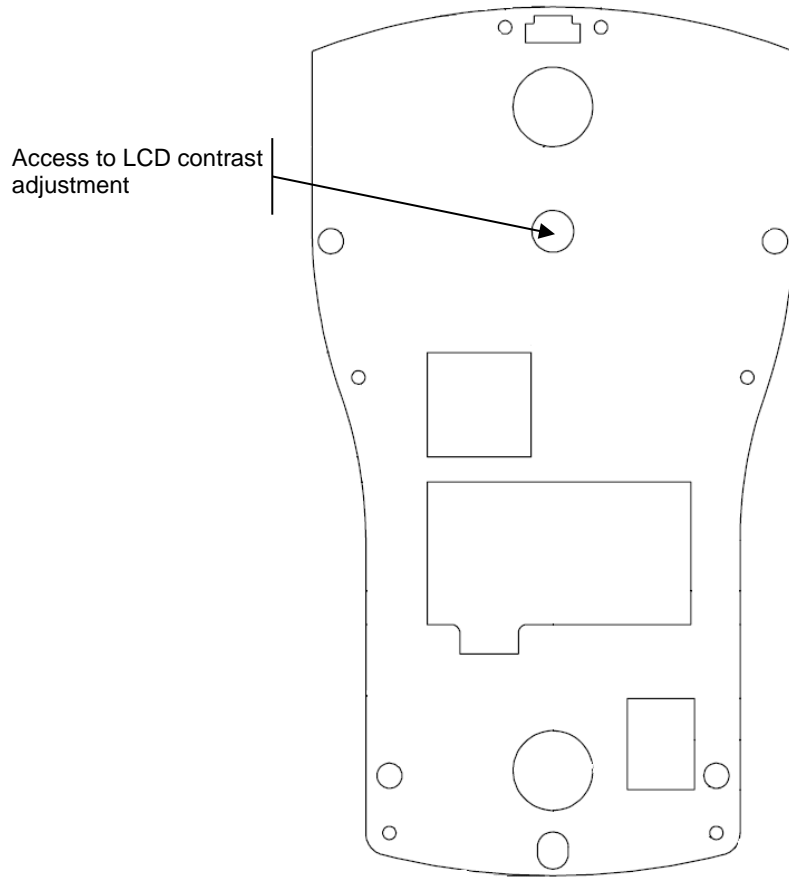
Figure 65 – Location of LCD Contrast Adjustment

SECTION 28: FREQUENTLY ASKED QUESTIONS

28.1 BATTERY STORAGE LIFE

The storage life of the Lithium battery used to maintain the real-time clock during power failure is approximately 10 years.

Unused batteries should be stored at room temperature. During service, the batteries may be safely used within the specifications of the unit.

28.2 DATA RETENTION TIME

The expected data retention time for the controller is a minimum of 10 years. However, the Real Time Clock will only be maintained for about 3 years, when using the original or recommended replacement battery. Note that the battery is only used when the unit is turned off.

28.3 LCD BACKLIGHT LIFE EXPECTANCY

The expected life of the backlight under normal operating temperatures as specified in Section 25.1 is 100,000 hours (> 10 Years).

INTELLIGENT ACTION

SECTION 29: MAINTENANCE / ENTRETIEN

WARNING / ATTENTION

This Instrument Has No User Serviceable Parts
Any Attempt to Repair the Instrument May Invalidate the Warranty
Cet instrument n'a pas de pièces réparables par l'utilisateur.
Toute tentative de réparation de l'instrument peut annuler la garantie.

29.1 HEALTH AND SAFETY PRECAUTIONS / PRECAUTION SANTE ET SECURITE

Warning!

Opening Up The Instrument Will Reveal Hazardous Voltages.

Always completely disconnect the power cord from the instrument whenever you are working on it. Do not make connections while the power is on because sensitive electronic components can be damaged by the sudden rush of power. Only trained engineers or technicians should open the instrument chassis.

ATTENTION!

L'ouverture de l'instrument révélera des tensions dangereuses.

Veillez à toujours débrancher le cordon d'alimentation de l'instrument lorsque vous travaillez dessus. Ne faites pas de connexions lorsque l'appareil est allumé, car les composants électroniques sensibles peuvent être endommagés par l'irruption soudaine de la puissance. Seuls les ingénieurs ou techniciens formés peuvent ouvrir le châssis de l'instrument.

Caution!

Handle electronic components and printed circuit card assemblies only when you are properly grounded in an ESD Protected Area (EPA). You are a source of ESD unless you are grounded properly.

Modern electronic devices are very sensitive to static electric charges.

Use a grounding wrist strap at all times.

Place all electronic components on a static-dissipative surface or in a static-shielded bag when they are not in the chassis.

Store and transport ESD-sensitive items in static-shielding containers, such as specially marked bags or boxes.

ATTENTION!

Ne manipulez les composants électroniques et les assemblages de cartes de circuits imprimés que quand vous êtes correctement relié à la terre, dans une zone protégée contre les DES. Vous êtes une source de DES sauf si vous êtes relié à la terre correctement.

Les dispositifs électroniques modernes sont très sensibles aux charges d'électricité statique.

Utilisez un bracelet relié à la terre en tout temps.

Placez tous les composants électroniques sur une surface antistatique ou dans un sac statique blindé quand ils ne sont pas dans le châssis.

Conserver et transporter des articles sensible aux DES dans des conteneurs statiques blindés, comme des sacs ou boites spécialement marqués à cet effet.

29.2 CLEANING THE INSPEC

Use only a dry cloth to clean the instrument.

SECTION 30: TROUBLESHOOTING

Please observe all safety warnings and precautions at the front of this handbook and in sections 0 and

Error! Reference source not found..

30.1 SOLVING COMMON PROBLEMS

30.1.1 POWER & BATTERY PROBLEMS

30.1.1.1 Instrument does not power up?

☑ Check the integrity of the power supply up to the unit and that it is within the acceptable limits (See Section 25.1 "Power Supply").

AC mains powered units: -

☑ Check that the 20mm fuses in the instruments IEC mains inlet are good and of the correct size and type (See section **Error! Reference source not found.**).

DC 24V powered units: -

The 24V DC power supply to the unit is protected by a 'PTC Resettable Fuse' if the fuse has 'blown' the unit needs to be powered down for more than 1 minute to reset the fuse, before powering the unit up again.

☑ Power down the unit for 2 minutes before trying again.

30.1.1.2 Instrument power fuses keep blowing?

If the AC power fuses or 24V DC fuse blow regularly the most likely cause of the problem is the external wiring.

☑ Check that the external wiring is correct and is without faults.

☑ Check that none of the unit's inputs or outputs are being overloaded.

☑ Check that the 20mm fuses in the instruments IEC mains inlet are good and of the correct size and type (See section **Error! Reference source not found.**).

If the power supply is of poor quality, internal circuits for suppression of voltage transients may prematurely age the fuses and cause them to blow.

30.1.1.3 Loss of data?

Registers - The unit utilises Ferroelectric (FRAM) to store its configuration and registers. These devices have a minimum data retention period of 10 years (T_A = -40°C to +85°C).

Real Time Clock (RTC) - The unit contains one lithium battery that allows the RTC to function even when the unit is not powered. If the unit losses date/time information after the unit has been turned off, it is quite likely that the battery will need replacing. Typically, the battery will support the RTC for a minimum of 3 years.

☑ See section 0 for information on battery storage life and data retention times.

☑ Refer to Section 27.3 for information on battery replacement.

30.1.2 DISPLAY PROBLEMS

Any front panels should display a start-up message as soon as they are powered up, but it will take about 5 to 10 seconds for the application software to run up and start updating the display: -

☑ If none of the LED's or LCD light up soon after power up, check the integrity of the power supply (See above).

☑ Power down the unit for 2 minutes before trying again.

If the LCD contrast is not satisfactory, refer to section 27.5.1 and adjust the contrast.

30.1.3 SERIAL PROBLEMS

If the serial link has never worked then double-check the wiring. Connection terminology for RS422 and RS485 does vary between manufacturers and causes a lot of confusion.

SECTION 31: SUPPORT

31.1 CONTACT INFORMATION

Sensia UK Ltd.
Jiskoot Technology Centre
Longfield Road
Tunbridge Wells,
Kent
 TN2 3EY
 UK

TEL + 44 (0) 1892 518000
FAX + 44 (0) 1892 518100

Inquiries measurement@sensiaglobal.com

Service   ms-service@sensiaglobal.com

31.2 RECOMMENDED SPARES

When requesting assistance or spare parts, please advise the Instrument Model and Serial Numbers to ensure that the correct options are supplied.

31.2.1 First 10 Years Operation

During Commissioning and for approximately the first 10 years of operation, Sensia only anticipate the requirement for spare fuses (Two spare fuses are shipped with each unit).

31.2.2 10+ Years Operation

At about 10 years, the internal battery and LCD backlight may fail.

31.3 REPACKAGING FOR SHIPMENT

If the instrument is to be shipped to Sensia for service or repair, be sure you do the following:

- Place the instrument in its original container with appropriate packaging material.
- Secure the container with strong tape or metal bands.

If the original shipping container is not available, place your unit in a container that will ensure at least 100mm (4 inches) of compressible packaging material around all sides of the unit. Use static free packaging materials to avoid additional damage to your unit.

SECTION 32: DEFINITION OF TERMS & SYMBOLS

32.1 ABBREVIATIONS & ACRONYMS

AC	-	Alternating Current
ADC	-	Analogue to Digital Converter
ASCII	-	American Standard Code for Information Interchange
BBRAM	-	Battery Backed RAM
CCITT	-	Consultative Committee of International Telephony and Telegraphy
DAC	-	Digital to Analogue Converter
DC	-	Direct Current
DCE	-	Data Communicating Equipment
DCS	-	Distributed Control System
DIP	-	Dual In-line Package
DTE	-	Data Terminal Equipment
EEPROM	-	Electrically Erasable & Programmable Read Only Memory
EMC	-	Electromagnetic Compatibility
EPA	-	ESD Protected Area
ESD	-	Electro-Static Discharge
FLASH	-	Bank arranged form of EEPROM
FSD	-	Full Scale Deflection
GND	-	Ground (0V DC
I/O	-	Input or Output
I/P	-	Input
IC	-	Integrated Circuit
IEC	-	The International Electrotechnical Commission
LCD	-	Liquid Crystal Display
LED	-	Light-Emitting Diode
MOV	-	Metal Oxide Varistor (Protective device against voltage surges)
MTBF	-	Mean Time Between Failures
N/A	-	Not Applicable
NC	-	1. Normally Closed
		2. Not Connected (DO NOT CONNECT)
NO	-	Normally Open
O/P	-	Output
PCB	-	Printed Circuit Board
PE	-	Protective Earth

Pollution	-	Addition of foreign matter, solid, liquid or gaseous (ionized gases), that may produce a reduction of dielectric strength or surface resistivity.
PLCC	-	Plastic Leaded Chip Carrier
PROM	-	Programmable Read Only Memory
PSU	-	Power Supply Unit
PTC	-	Positive Temperature Coefficient
RAM	-	Random Access Memory
RGB	-	Red/Green/Blue
rms	-	Rout-mean-square (rms value of an AC sine wave is 0.707 times the peak value.)
ROM	-	Read Only Memory
RS232	-	Physical Link Layer Telecommunications Protocol
RS422	-	Physical Link Layer Telecommunications Protocol
Rx	-	Receive – Telecommunications (RS232
Rx +	-	Receive (non-inverted) – Telecommunications (RS422 or RS485
Rx -	-	Receive (inverted) – Telecommunications (RS422 or RS485
SCADA	-	Supervisory Control and Data Acquisition
SELV	-	Safety Extra-Low Voltage circuit
		An SELV circuit is defined as a circuit that is so designed and protected that under both normal and single fault conditions, its voltages do not exceed a safe value.
		Under normal conditions, the voltage of such a circuit cannot exceed 33 V rms and 46.7 V peak or 70 V DC In the event of a single fault, the voltage cannot exceed 55V rms and 78 V peak or 140 V DC.
SOT	-	Select On Test
SPST	-	Single Pole, Single Throw (Switching Terminology)
SRAM	-	Static RAM
SSR	-	Solid State Relay
TVS	-	Transient Voltage Suppressor
Tx	-	Transmit – Telecommunications
Tx +	-	Transmit (non-inverted) – Telecommunications (RS422 or RS485)
Tx -	-	Transmit (inverted) – Telecommunications (RS422 or RS485

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32.2 SYMBOLS / SYMBOLES

Triangle with an exclamation mark:

Warning / demand. Potentially lethal situations.

Triangle avec point d'exclamation:

Avertissement / Exigence. Situations potentiellement mortelles.

Triangle with a flash:

Caution, risk of electric shock

Triangle avec un flash:

Attention, risque de choc électrique

Hand prohibited:

All precautions against electro-static discharge (ESD) must be observed to avoid damaging electronic circuits

Ne pas toucher:

Toutes les précautions contre les décharges électrostatiques doivent être respectées afin d'éviter d'endommager les circuits électroniques.

Read all instructions:

Failure to follow all instructions listed below may result in electric shock fire and/or serious injury.

Lisez toutes les instructions:

Le défaut de suivre toutes les instructions ci-dessous peut entraîner un incendie, un choc électrique et / ou des blessures graves.

Disposal:

Monitoring and Control Instruments, accessories and their packaging should be sorted for environmental-friendly recycling.

Only for EC countries:

Do not dispose of Monitoring and Control Instruments into household waste! According to the European Directive 2002/96/EC on waste electrical and electronic equipment (WEEE and its incorporation into national law, Monitoring and Control Instruments that are no longer suitable for use must be separately collected and sent for recovery in an environmental-friendly manner.

Destruction:

Les instruments de surveillance et de contrôle, les accessoires et leur emballage doivent être triés pour recyclage respectueux de l'environnement.

Uniquement pour les pays de la CE:

Ne jetez pas les instruments de surveillance et de contrôle dans les ordures ménagères! Selon la directive européenne 2002/96/CE relative aux déchets d'équipements électriques et électroniques (et son incorporation dans les législations nationales), les instruments de surveillance et de contrôle qui ne sont plus utilisables doivent collectés séparément et envoyés à la récupération d'une manière respectueuse de l'environnement.

Tools Required:

Tools listed next to this symbol will be required to perform the task outlined in the text that follows.

Outils Requis:

Les outils figurant à côté de ce symbole seront nécessaires pour effectuer les tâches décrites dans le texte qui suit.
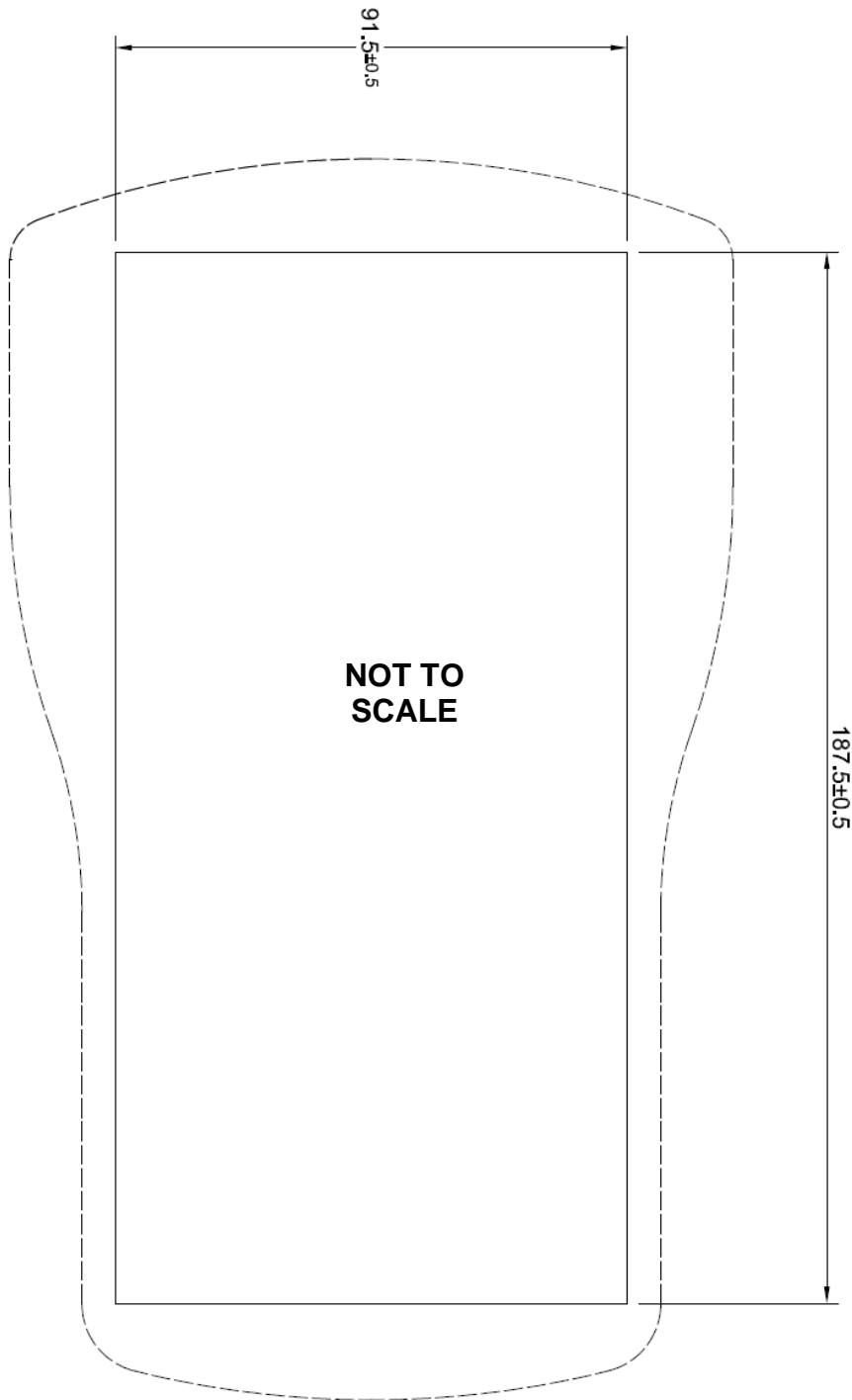
Hints & Tips:

Text may help answer some questions or aid configuration.

Trucs et Astuces:

Le texte peut aider à répondre à certaines questions ou aider à la configuration.

Appendix A: **InSpec Controller Panel Cut-out Detail**

InSpec Controller Panel Cut-out Detail (Drawing D29844)

91.5±0.5

**NOT TO
SCALE**

187.5±0.5

Note: When printed to scale on A4 paper this drawing is approximately 75% of full size.

Appendix B: **Installation Sequence (Safe Area Unit)**

☑ 2.5mm Hexagon Wrench or Allen Key

☑ 4mm Hexagon Wrench or Allen Key

⚠ The controller is not intended to be used as a standalone piece of equipment and must be built-in to the end product and mounted in the vertical plane to maintain compliance with international safety standards.

a) Take one Safe Area Instrument	**b)** Remove the front panel by undoing the fixing screw using a 2.5mm Allen Key…

c) …and then lift the front panel off the hook at the top.	**d)** Carefully disconnect the ribbon cable from the main body of the instrument. Carefully store the front panel so that it is not damaged.

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e) Ensure that latches located at the top and bottom of the unit are undone and that the arms are inside the unit as shown.	**f)** Insert the main body in the correct size cut-out.
g) Using a 4mm Allen Key tighten the two latches. The arms should automatically swing out and grip the mounting panel.	**h)** Reconnect the ribbon cable from the front panel and then hook the front panel on the body of the instrument.

i) Locate the front panel fixing screw with the main body in the panel and tighten with a 2.5mm Allen Key.

Appendix C: **Remote I/O (RIO) Configuration**

Configuring multiple InSpec Remote I/O (RIO) Module of the same variant.

A.1   Requirements

1. Computer with Terminal emulation software e.g. HyperTerminal or TeraTerm (Port setting 9600 Baud, 8 Data bits, No Parity, 1 Stop Bit and No Flow Control). If you cannot communicate properly with the modules of the USB, you may need to install Virtual Com Port (VCP) drivers from the FTDI website (**HTTP://WWW.FTDICHIP.COM/DRIVERS/VCP.HTM**)

2. Proper RIO Module

3. USB cable Type A to B

4. 24VDC Power Supply

A.2   How to change Static IP Address

1. Install power wiring to RIO module

2. Connect USB B connector to RIO module

3. Open Terminal emulation software and confirm connection

4. At the prompt "Enter username…" press up arrow to get 'Engineer', or type it in. Press the Enter/Return key:

    Enter username to access shell: ENGINEER

5. At the prompt "Enter password:", type '456', Press the Enter/Return key:

    Enter password: ***

6. To change, type "IPCONFIG (IP) (SUBNET) (GATEWAY) Press the Enter/Return Key to except the new static IP Address:

    DIO M0:\> IPCONFIG 192.168.92.20 255.255.255.0 192.168.92.93

    IP address is now configured

7. To confirm change reread IPCONFIG:

    DIO M0:\> IPCONFIG

    Ethernet State: Running

    IP ADDRESS = 192.168.92.20

    IP MASK   = 255.255.255.0

    IP GATEWAY = 192.168.92.93

    IP PRI DNS = 0.0.0.0

    IP SEC DNS = 0.0.0.0

    MAC ADDR   = 00:50:C2:BE:3F:EF

    HOST NAME = UNSPECIFIED_ID

    DHCP: Off

A.3   Configure Static or Dynamic Host Configuration Protocol (DHCP)

If required, the RIO module may be configured for DHCP, RIO module will be defaulted with DHCP disabled.

Below is example for RIO DIGITAL Module.

1. To enable DHCP, locate the C_TCP_DHCP_TIMEOUT register with the read command followed by register name:

    DIO M0:\> R C_TCP_DHCP_TIMEOUT

2. The result will be displayed as:

    01621 C_TCP_DHCP_TIMEOUT   char = 0x00 0

3. Use the Write Command to change the register value

    DIO M0:\> W C_TCP_DHCP_TIMEOUT 10

4. The confirmation of the change will be displayed as (the value 10 is in seconds to receive the IP address from the Network. This can be adjusted accordingly):

    01621 'C_TCP_DHCP_TIMEOUT' char = 0 to 10

5. The RIO will require reboot to establish a connection to the Network. Either remove power or type REBOOT command and 'Y':

    M0:\> REBOOT

     Execute 'REBOOT'? [Y/N]

    Rebooting...

6. Confirmation can be tested by the checking "IPCONFIG" command:

    DIO M0:\> IPCONFIG

    Ethernet State: Running

     IP ADDRESS = 134.32.38.245

     IP MASK   = 255.255.255.192

     IP GATEWAY = 134.32.38.193

     IP PRI DNS = 192.23.23.192

     IP SEC DNS = 192.23.23.193

     MAC ADDR   = 00:50:C2:BE:3F:EF

     HOST NAME = UNSPECIFIED_ID

     DHCP: On

Appendix D: **Publisher Notes**

SUPPORT

For further support, contact:

Sensia UK Ltd.
Jiskoot Technology Centre
Longfield Road
Tunbridge Wells,
Kent
TN2 3EY
UK

TEL + 44 (0) 1892 518000
FAX + 44 (0) 1892 518100

Toll Free Support	1-866-7 SENSIA (+1 866 773 6742)
Inquiries	measurement@sensiaglobal.com
Service	ms-service@sensiaglobal.com

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CONTACT US

Regional Offices	Telephone
Canada, AB	+1 587 291 2190
Duncan, OK	+1 580 736 7600
Coraopolis, PA	+1 724 218 7800
Tunbridge Wells, UK	+44 1892 518000
Midland, TX	+1 432 247 6020
Mexico	+1 52 55 5246 2000
Toll Free Support	**1-866-7 SENSIA (+1 866 773 6742)**
Inquiries	measurement@sensiaglobal.com
Service	ms-service@sensiaglobal.com

Manufacturing Facilities	Sales Offices	Sales Offices
Sensia UK Limited Longfield Rd, Tunbridge Wells TN2 3EY, UK	**Sensia Limited** 709 64th Ave SE 103, Calgary, AB T2H 2C3	**Sensia Oil & Gas Technical Development (Shanghai) Company Limited** No. 1801 Hongmei Road, Shanghai, 200233, P R China
Sensia LLC 7000 NIX DRIVE DUNCAN, OK 73533-8733 USA	**Sensia LLC** 200 Westlake Park Blvd Houston, Texas 77079	**Sensia Energy SA DE CV** Ave Santa Fe 481, Piso 3, Col Cruz Manca, Cuajimalpa, Mexico City, D.F., C.P. 05349, Mexico
Sensia LLC 1000 MCCLAREN WOODS DR CORAOPOLIS, PA 15108-7766 USA	**Sensia FZE** Schlumberger Transitrex Facility, Jebel-Ali, P.O.BOX 16776, Plot WWA 115, DUBAI, U.A.E	**Sensia Energy Private Limited** Commercezone, Bldg No.6, Office No. 701, S. No. 144&145, Samrat Ashoka Path, YERAWADA, Pune, Maharashtra, India, 411006

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