

JISKOOT™

INSPEC SAMPLER CONTROLLER

Application Operation Manual

Software Version 5.14 - Volume 2



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SECTION 1: INTRODUCTION

The Jiskoot InSpec Sampler system and user definable displays for quick access to frequently used parameters. All interactions are performed at operator level access can monitor the sampling process parameters throughout the batch via the front panel. operator level access can monitor the sampling process parameters throughout the batch via the front panel.

The InSpec uses a real-time, multi-tasking operating system and can form part of a distributed control system in an Ethernet or serial network. If fully enabled, the InSpec can be networked protocol in either slave or master mode. The InSpec Sampler is able to automatically print configurable batch reports and batch logs during a batch to a serial and/or Ethernet printer. All archived batch reports, batch files and some system data can also be printed via the front display menu.

An SD flash card is available to store all batch data, system log files and configuration changes. SD flash cards up to 32 GB are supported.

The InSpec sampler also supports SMTP (Simple Mail Transfer Protocol). Batch reports and log files can be automatically emailed to a designated recipient during a batch or via selection from the front display menu. Alarm notification emails can also be configured for each individual email. System files can also be emailed via the front panel. This is useful for customer support.

The internet-based Network Time Protocol (NTP) can also be configured to run on the InSpec. This protocol is used to ensure the system time is synchronised via an external clock source on the internet. This feature can also be configured with a GMT (Greenwich Mean Time) offset to assist accurate updates in different time zones. The InSpec also supports Telnet for remote connection to the command line. This is an invaluable tool for remote customer support.

Many configuration and operational features are common across the range of InSpec controller applications (Samplers and Blenders). To aid clarity and prevent repetition, this sampler application manual will simply point the reader to the common manual where common menu items occur within the application menu tree.

1.1 MAIN FEATURES

- User friendly, simple to use.
- Details for batches can be prompted at the start of each batch.
- User-defined displays for quick access to commonly used parameters.
- LED and on-display alarm condition indicators.
- Time proportional or flow proportional operating modes.
- Alarms flash on alarm pages until acknowledged, shown until condition clears.
- Designed for easy control via a DCS or SCADA system.
- Flow can be measured, or a fixed manual flow value can be entered from the front panel.
- Analogue or pulse flow meter inputs.
- Analogue can weigh facility.
- A can selection system, automatic can change and manual can change if necessary.
- A fully configurable can architecture. Select specific start can, cans in system, cans per cycle, cans can be in sequential order.
- An "Emergency Stop" when all cans have filled to prevent spillage.
- Grab sensor option for sample probe with set/reset failure detection.
- Up to 2 grabs per second (subject to mechanical and process constraints).
- Ability to take pre grabs and post displace grabs to accommodate bespoke systems.
- Provides start/stop control signals suitable for a powered pipeline mixer and fast loop pumps.
- Performance factor calculations to check overall system integrity.
- Pre-batch Linefill - able to collect a separate sample or let a set volume pass before the main batch.
- Single or multi-batch operation.

- Product temperature live, flow-weighted average and min./ max. levels.
- Live density monitoring.
- UCL – user configurable logic. Enables bespoke internal calculations for monitoring and output purposes.
- Automatic end of batch report generation and ability to print the last report.
- Printing to RS232, RS422, RS485 and Ethernet ports Allowing printing of reports, user-definable log, UCL file (if present) and registers.
- SMTP email support. Individual Alarm notification emails for each configurable alarm, automatic emailing of batch report and log file at the end of a batch. Menu browser enables browsing, selection and emailing of report/log files from historical batches.
- Modicon Modbus Protocol support (Master/Slave) for RS232, RS422, RS485 and Ethernet.
- NTP network time synchronisation. Automatic network time updates can be provided via the internet to reset the system clock automatically. A configurable GMT offset is provided to accommodate different time zones. The automatic update feature is protected during a batch. Time updates can only occur in waiting to prevent corruption of calculated time during a batch.
- Telnet support – remote terminal access to the InSpec command line is available when the InSpec is connected to the internet. Allows some remote diagnostics and support.
- Log files stored on the SD flash card record all significant data changes during the lifetime of the instrument. This facility is invaluable for auditing purposes.
- Flash based application and bootloader software allows easy software upgrades.
- Menu driven user commands provide the ability to perform a number of simple calculations on registers values.
- Web page with graphical schematic of a 2 can system.

SECTION 2: INSTALLATION CHECKLIST

Here is a list of detailed items that you may wish to consider and check when installing the unit for the first time.

2.1 CALIBRATION AND CONFIGURATION

- Set flow units, (unit string registers and F_QTY_TO_FLOW register)
- Analogue inputs (ADC) calibration via **System/IO/Calibration** menu.
- Analogue output (DAC) calibration via **System/IO/Calibration** menu.

2.2 SAMPLE RECEIVERS

- Cans in system, cans per cycle or infinite cans, start can, number of start cans, cans in sequential order or not.
- Sample volume and change volume
- Tare weights
- Can Weigh Station - is one fitted? (Calibrate Analogues)
- Connection details. See terminal and relay block diagrams in the IO section.

2.3 FLOW METER

- Type of meter, 4-20 mA or pulse
- If pulse set the meter factor.
- Set flow meter limits (important for alarms)

2.4 SAMPLE EXTRACTOR

- Set calibrated grab size
- Is there a grab sensor fitted?
- Set grab pulse characteristics
- Are prefill or post displace grabs required to accommodate receiver tube lengths?

2.5 AUTO-PROMPTING

- Select if the system is to use auto-prompting
- If prompting is used select which prompts are to be used

2.6 ETHERNET

- Select if DHCP is used
- Configure Ethernet Printer
- Configure Ethernet email (SMTP) server
- Configure Ethernet NTP Server

2.7 MODBUS

- Set baud rate, parity, node, mode (ASCII or RTU) and word orders.
- Configure Modbus Master Queries.

2.8 PRINTER

- Select port
- Set the configurable S_CONFIG_REPORT string register.
- Customise timed period and log contents
- Configure HTML and TEXT report templates.

2.9 SYSTEM

- Set system date and time
- Set required menu options (e.g. 12 front panel display items, decimal places and whether auto scroll of these items is on or off, set menu timed auto-close etc.)
- Set items to be shown on the two front bar graph LED arrays.

SECTION 3: SAMPLER MENU TREE

The associated menu structure for each security level is now shown.

3.1 MENU SECURITY LEVEL - LOCKED

```
|--SECURITY
  |--LOGIN USER
```

3.2 MENU SECURITY LEVEL – A USER WITH OPERATOR LEVEL ACCESS

```
|--CONTROL
  |--START
  |--STOP
  |--RESET
  |--PAUSE
  |--EM.STOP
  |--VIEW BATCH
  |--NEXT BATCH CONF
    |--SETUP NEXT BATCH
    |--VIEW NEXT BATCH
|--MANUAL
  |--FLOW
  |--BATCH DENSITY
  |--PIDBLOCK SP
  |--NEW CAN
  |--NEXT CYCLIC
|--ALARMS
  |--DISPLAY ALARMS
|--RECORDS & LOGS
  |--CONFIGURE REPORT
    |--CAN CHANGE REPORT
    |--POWER CYCLE REPORT
    |--EM.STOP REPORT
    |--RESTART REPORT
    |--STOPPING REPORT
    |--PAUSING REPORT
  |--GENERATE REPORT
  |--PRINT
    |--BATCH REPORT
    |--BATCH LOG
    |--ALARM PHASE LOG
  |--EMAIL
    |--BATCH REPORT
    |--BATCH LOG
    |--ALARM PHASE LOG
|--SECURITY
  |--LOGIN USER
  |--LOGOUT
  |--WHO AM I?
  |--EDIT USER
```

3.3 MENU SECURITY LEVEL - A USER WITH ENGINEER LEVEL ACCESS

```

|--CONTROL
  |--START
  |--STOP
  |--RESET
  |--PAUSE
  |--EM.STOP
  |--VIEW BATCH
  |--NEXT BATCH CONF
    |--SETUP NEXT BATCH
    |--VIEW NEXT BATCH
|--MANUAL
  |--FLOW
  |--BATCH DENSITY
  |--PIDBLOCK SP
  |--NEW CAN
  |--NEXT CYCLIC
|--ALARMS
  |--DISPLAY ALARMS
  |--CONFIG ALARMS
  |--DELETE ALARMS
  |--SCROLL SETUP
  |--ALARM OUTPUT
|--REGISTER ACCESS
|--DISPLAY
  |--TIME
    |--CURRENT
    |--STARTING
    |--ELAPSED
    |--DATE
    |--FINISH
  |--FLOWS
    |--MEASURED
    |--REQUIRED
  |--VOLUMES
    |--MEASURED
    |--REQUIRED
    |--EXP CAN SAMPLE
    |--LIV CAN SAMPLE
    |--CAL CAN SAMPLE
    |--EXP TOT SAMPLE
    |--LIV TOT SAMPLE
    |--CAL TOT SAMPLE
  |--WEIGHT
    |--EXP CAN SAMPLE
    |--LIV CAN SAMPLE
    |--CAL CAN SAMPLE
    |--EXP TOT SAMPLE
    |--LIV TOT SAMPLE
    |--CAL TOT SAMPLE
  |--CANS
    |--CAN INPUT 1
    |--CAN INPUT 2
    |--CURRENT CAN
    |--CURRENT CAN TARE
    |--CANS USED
  |--P FACTORS
    |--TOTAL BATCH
    |--GRAB
    |--CAN

```

```

|--SHORT TERM
|--GRABS
  |--GRABS TAKEN
  |--GRABS SENSED
|--FREQUENCY
|--DENSITY
|--USER FWA BLOCK
|--ANALOGUES
  |--INPUT
    |--SCALED
    |--0-1
    |--RAW
    |--FWA
  |--OUTPUT
    |--0-1
    |--RAW
|--DISPLAY SETUP
  |--SCROLL SETUP
  |--DISPLAY ITEMS
  |--DISPLAY DEC
  |--ENGINEER DISPLAY
  |--BAR GRAPH
    |--LOCAL INSPEC
      |--BAR GRAPH 1
      |--BAR GRAPH 2
    |--REMOTE IO 1
    |--REMOTE IO 2
    |--REMOTE IO 3
    |--REMOTE IO 4
    |--REMOTE IO 5
    |--REMOTE IO 6
    |--REMOTE IO 7
    |--REMOTE IO 8
    |--REMOTE IO 9
    |--REMOTE IO 10
|--RECORDS & LOGS
  |--CONFIGURE REPORT
    |--CAN CHANGE REPORT
    |--POWER CYCLE REPORT
    |--EM.STOP REPORT
    |--RESTART REPORT
    |--STOPPING REPORT
    |--PAUSING REPORT
  |--GENERATE REPORT
  |--PRINT
    |--BATCH REPORT
    |--BATCH LOG
    |--ALARM PHASE LOG
    |--UCL PROGRAM FILE
    |--REPORT TEMPLATE
    |--START TEMPLATE
    |--REGISTERS
    |--SET PAGE LENGTH
    |--AUTO REPORT PRNT
    |--NUM. OF REPORTS
  |--DELETE BATCHES
  |--EMAIL
    |--BATCH REPORT
    |--BATCH LOG
    |--ALARM PHASE LOG
    |--REGISTER LOG
    |--MODBUS LOG
    |--REBOOT LOG

```

```

|--REPORT_TEMPLATE
|--ALL SYSTEM FILES
|--UCL PROGRAM FILE
|--CONFIG.TXT
|--CONFIG.MOVBUS.CSV
|--CONFIG.ALARM.CSV
|--CONFIG.CAL
|--CONFIG.BIN
|--AUTO REPORT MAIL
|--AUTO LOG MAIL
|--AUTO ALARM MAIL
|--LOG SETUP
    |--PERIOD
        |--LOGGING OFF
        |--LOG ON SECONDS
        |--LOG ON GRABS
        |--LOG ON QUANTITY
    |--FORMAT
|--OPERATION
    |--QTY TO FLOW
        |--60
        |--3600
        |--86400
        |--OTHER
    |--SET FLOW TYPE
        |--MANUAL
        |--ADC
        |--PULSE
        |--MOVBUS
    |--SAMPLING MODE
        |--FLOW PROP.
        |--TIME PROP.
    |--GRAB
    |--AUX CONTROL
    |--LINEFILL CONFIG
    |--P FACTORS
    |--DENSITY UNITS
        |--API
        |--SG(RD)
        |--KG/M3
        |--KG/L
        |--OTHER
    |--ADC SETUP
        |--LOCAL IO
        |--REMOTE INSPEC 0
        |--REMOTE INSPEC 1
        |--REMOTE INSPEC 2
        |--REMOTE INSPEC 3
        |--REMOTE INSPEC 4
        |--REMOTE INSPEC 5
        |--REMOTE INSPEC 6
        |--REMOTE INSPEC 7
        |--REMOTE INSPEC 8
        |--REMOTE INSPEC 9
    |--CANS
        |--NUMBER OF CANS
        |--ARCHITECTURE
        |--SET TARES
        |--VOLUMES
        |--CHANGE WEIGHT
        |--CAN LIVE INPUT
            |--OFF
            |--WEIGHT
    
```

```

|--VOLUME
|--CAN SIMULATOR
    |--SET GRAB SCALAR
    |--SET LEAK FLOW
    |--SET CAN
|--USER FWA BLOCKS
|--TUNE PID BLOCKS
|--SOURCE / PROMPT
    |--BATCH TITLES
    |--BATCH ID
    |--LINEFILL
    |--VOLUME / TIME
    |--BATCH DENSITY
    |--BATCH FLOW
    |--BATCH START
    |--SAMPLE VOLUME
    |--LFILL VOL
    |--LFILL SAMPLE VOL
    |--PID BLOCKS
    |--CUSTOM PROMPTS
|--SECURITY
    |--LOGIN USER
    |--LOGOUT
    |--WHO AM I?
    |--SECURITY TIMEOUT
    |--ADD USER
    |--EDIT USER
|--SYSTEM
    |--INSPEC ID
    |--SET DATE/TIME
    |--GMT OFFSET
    |--DATE FORMAT
    |--NTP SETUP
        |--ENABLE NTP
        |--NTP URL
        |--NTP IP ADD
        |--NTP POLL TIME
    |--EMAIL SETUP
        |--SET SMTP URL
        |--SMTP IP ADD
        |--EMAIL FROM NAME
        |--EMAIL FROM DOMAIN
        |--EMAIL TO NAME
        |--EMAIL TO DOMAIN
    |--SERIAL PORTS
        |--PORT 2
            |--OFF
            |--SHELL
            |--DISPLAY
            |--PRINTER
            |--MODBUS SLAVE
            |--MODBUS MASTER
        |--PORT 3
            |--OFF
            |--SHELL
            |--DISPLAY
            |--PRINTER
            |--MODBUS SLAVE
            |--MODBUS MASTER
    |--MODBUS TCP SLAVE
    |--MODBUS TCP MASTER
    |--IP SETTINGS
        |--CONFIGURE DHCP

```

```

|--INSPEC IP ADDR
    |--VIEW CURRENT
    |--SET STATIC
|--SUBNET MASK
    |--VIEW CURRENT
    |--SET STATIC
|--DEFAULT GATEWAY
    |--VIEW CURRENT
    |--SET STATIC
|--PRIMARY DNS
    |--VIEW CURRENT
    |--SET STATIC
|--SECONDARY DNS
    |--VIEW CURRENT
    |--SET STATIC SETTING
|--SMTP URL ADDR
    |--SMTP URL
    |--VIEW IP ADDR
|--PRINT URL ADDR
    |--PRINT URL
    |--VIEW IP ADDR
|--NTP URL ADDR
    |--NTP URL
    |--VIEW IP ADDR
|--VIEW MAC ADDR
|--USER COMMANDS
    |--INPUT
    |--OUTPUT
|--I/O
    |--CONFIGURE
        |--REMOTE MODULES
        |--DIGITAL TYPES
        |--FIND GRABS
        |--CONTROL DIGITALS
        |--REMOTE IP ADDR
    |--TESTS
        |--PULSE/FREQ.
        |--ADCS
        |--DACS
        |--DIGITAL IN
        |--DIGITAL OUT
    |--CALIBRATION
        |--ADCS
        |--DACS
    
```

A description of each menu item will now be given. In order to cover all topics, the options available under the ‘Engineer’ menu will now be explained.

3.4 CONTROL

Both the Operator and the Engineer user access levels provide the same available functions under the InSpec Sampler’s control menu. The Control menu contains the primary controls for initiating the sampler and manually controlling the parameters of the batch. These functions will be accessed frequently by the user of the InSpec and have therefore been placed at the start of the menu.

3.4.1 START

Note, when you are not in the menu the button labelled ‘Start’ on the front panel has the same functionality as this item in the control menu. For day-to-day use a user with operator level access is far more likely to stick to the three front panel control buttons (Start, Stop and Reset) rather than enter the menu tree to initiate a batch.

3.4.2 STOP

The Stop command is used to stop a running batch. On selecting this option, a confirmation prompt will appear before the stop command is executed or cancelled. Again, the front panel 'Stop' button also performs this operation.

3.4.3 RESET

The Reset command is used to reset the batch and return the InSpec to the waiting phase. A batch will normally be stopped and then reset, although it is possible to select reset whilst the sampler is running. In either case a prompt will appear asking you to confirm your decision to reset the sampler. The front panel 'reset' button also performs this operation.

3.4.4 PAUSE

In the pause mode the volume for the batch is no longer accumulated. A report is created when the sampler goes into the pause mode.

3.4.5 EM.STOP

This is an additional and quick method of stopping the sampler by putting it immediately into emergency stopped mode.

3.4.6 VIEW BATCH

This option results in a series of information pages being displayed to show the current or the last batch parameters that were used. These values consist of a Batch, Flow, Density, Batch Sample Size, Linefill Volume and Linefill sample Size. In time proportional sampling mode, the volume and flow values are replaced with the Batch Duration value which is specified in days, hours and minutes E.g., 3:12:30 would indicate that the batch duration is three days, twelve hours and thirty minutes.

3.4.7 NEXT BATCH CONF

The next batch conf menu offers two menu items as follows:

3.4.8 SETUP NEXT BATCH

This option mimics the sequence of prompts that are presented to the user when they select 'Start' from the control menu or via the front panel quick start button. The entered values are used for the next batch that is started.

3.4.9 VIEW NEXT BATCH

This option results in the same information pages as described in the View Batch section above, except the values displayed will be those used during the next batch.

3.5 MANUAL

The Manual sub-menu of the control menu contains items which users can change during an active batch.

3.5.1 FLOW

If the flow is configured for an analogue or pulse input and the user attempts to manually adjust the flow, a message box will appear stating that the application is 'not configured for manual flow'.

3.5.2 BATCH DENSITY

This allows a user with operator level access to adjust a manually entered batch density. This density will then be used from then on. Calculations before will still use the prior density value for the batch.

3.5.3 PIDBLOCK SP

This allows a user with operator level access to manually adjust the set-point of any user configured PID control blocks.

3.5.4 NEW CAN

Forces an immediate can change. A warning message will appear if there is no can to change to.

3.5.5 NEXT CYCLIC

This option is active under cyclic batch mode. It allows the user to force the sampler into the next cyclic batch. Cyclic batch is a mode of operation and is configured via the operation→sampling mode menu.

Note: If you are operating in time proportional mode then you will be prompted for the time of the next batch change during this process and asked to enter the change hour, change minutes and the change number of days between the desired changes. Note that if you are using a SCADA system and wish to amend this change time remotely, then the following registers must be written to across the DCS link.

If you wish to change the change time for the next batch, then you will need to set the following two registers with your chosen hour and minutes next settings:

C_HOUR_NXT
C_MINS_NXT

These values are then used to reconstruct the internal **S_BA_CHANGE_TIME_NXT** string register with the new hour and min values. The new string will not be constructed until a one is also written to the following register.

C_REMOTE_TIME_CHANGE

This forces the new string to be built. This register value is then automatically reset to zero.

The **I_CHANGE_BA_DAYS_NXT** register can be amended to indicate how many days there are between batch changes.

3.6 ALARMS

See common manual for a full description of the alarms.

3.6.1 DISPLAY ALARMS

This item displays the list of alarms which are currently active or unacknowledged. This can be accessed more directly from the front panel using the down key.

3.6.2 CONFIG ALARMS

This allows a user with engineer level access to configure each of the user configurable alarms. Configurable alarms allow engineer to create alarms based on the InSpec's internal registers and system phases.

A user with engineer level access steps through the process of setting the alarm text, picking the source register, this contains the value to alarm on, selecting a register for when the alarm is active, and whether this should be inverted (inverted means active when 0). Then you select the source register minimum and maximum values outside which the alarm is triggered. These values can also be inverted so that the alarm is triggered when it is between, not outside of, these min / max values. The hysteresis can then provide some tolerance for these values so that the alarms do not rapidly toggle on and off. All the phases where the alarm is active must then be selected. A delay can then be added to the alarm so that the alarm must be true for X seconds before it is triggered. The engineer must then select if this alarm will be sent to the external alarm output, they must state the type of the alarm and whether or not the alarm should have email notification.

3.6.3 DELETE ALARMS

Allows a user with engineer level access to delete any of the configurable alarms.

3.6.4 SCROLL SETUP

This item allows you to configure whether or not you want the auto scroll feature on in the alarms menu and what the time out period is between each displayed item.

3.6.5 ALARM OUTPUT

The register **C_ACTIVE_ALARM** is used to send a general output signal to indicate when there is an active alarm. The Alarm Setup menu (see above) allows for individual alarms to be excluded or included. The output signal itself can be held steady or it can toggle between being on/off. This menu allows you to choose whether you want the output signal to be steady or toggling.

3.6.6 SAMPLER SPECIFIC ALARMS

WGT ALARM 1

The two weight alarms are triggered if the scaled ADC input value is less than or greater than the configurable ADC min and max values. Note that these weigh alarms are the default alarms for ADC input 1 and 2. However the display text for the alarm title can be changed if the ADC inputs are used for an alternative input to weigh.

WGT ALARM 2

See above

FLOW INPUT ALARM

The flow input alarm is triggered if the scaled ADC input value is less than or greater than the configurable ADC min and max value. Note that an analogue flow input on ADC 3 is required for this alarm to be valid. I.e., If the flow type is changed from ADC to manual or pulse then the text for this associated alarm title becomes redundant and should be changed to reflect whatever ADC3 is setup to read as an input.

NO CANS

This alarm is triggered when a new can (Sampler Receiver) is required but there are no more available to change to, if the controller is sampling it will then go into the emergency stopped status which halts sampling.

GRABBING TOO FAST

If the minimum grab time (**I_GRAB_ON_TIME+ I_GRAB_OFF_TIME**) is greater than the time interval required between grabs, then the controller is grabbing too fast and this alarm will be triggered.

TOTAL MISSED GRABS

This alarm is triggered when the number of grabs missed exceeds the configurable alarm threshold. I.E., The number of grabs counted differs from the number of grabs expected.

CONSEC MISSED GRABS

This alarm is triggered when the number of grabs missed exceeds the configurable grabs missed max value (**C_CON_GRAB_MAX**).

BAD BATCH PF

This alarm is triggered when the calculated batch pf is less than or greater than the configurable threshold registers **F_BATCH_PF_MAX** and **F_BATCH_PF_MIN**.

BAD GRAB PF

This alarm is triggered when the calculated can pf is less than or greater than the configurable threshold registers **F_GRAB_PF_MAX** and **F_GRAB_PF_MIN**.

BAD CAN PF

This alarm is triggered when the calculated can pf is less than or greater than the configurable threshold registers **F_CAN_PF_MAX** and **F_CAN_PF_MIN**.

BAD SHORT PF

This alarm is triggered when the calculated batch pf is less than or greater than the configurable threshold registers **F_SHORT_TERM_PF_MAX** and **F_SHORT_TERM_PF_MIN**.

PROBE SERVICE REQ'D

This alarm is triggered when the accumulated grab total exceeds the configurable threshold value **L_SERVICE_GRABS_MAX**.

LOOP FAULT

This alarm is triggered by a digital in signal. This informs the controller of a loop fault.

UNSAM GRAB MAX

This alarm is triggered when the number of unsampled grabs (**F_UNSAM_GRABS**) is less than or greater than the configurable threshold registers **F_UNSAM_GRABS_MAX** and **F_UNSAM_GRABS_MIN**.

BAD TARE 1

The tare alarms are triggered when the respective can condition registers (**C_CAN_CONDITION1** & **C_CAN_CONDITION2**) indicate that the can is either above or below the accepted tare weight.

BAD TARE 2

See Above. Note: Whilst the InSpec has a 16 can configurable architecture, 2 can systems are still by far the most common. For this reason, these two alarms have been left in as default. If required, you can configure additional bad tare alarms for any additional cans in your system.

POWER FAILURE

This alarm is triggered when the InSpec has previously encountered a power cycle during an active phase. The alarm is not triggered when a power cycle occurs in the 'Waiting' phase.

SD MEMORY MIN

This alarm is triggered when the memory on the SD card is getting to a user specified minimum value. The low threshold is stored within the **C_SD_CARD_MIN** register.

SD MEMORY LOW

This alarm is triggered when the memory on the SD card is getting to a user specified low value. The low threshold is stored within the **C_SD_CARD_LOW** register.

REPORT NUM.MAX

This indicates when the maximum number of reports (per batch folder) have been generated. The maximum value for this alarm is 30 reports. The counter for the reports is held and incremented in **I_REPORT_NUMBER**.

IO COMMS FAILURE

If any remote IO InSpec devices connected to this, the master Sampler InSpec, lose connection for any reason then this alarm will be triggered to warn you that the communications have failed. By default, this is an emergency stop alarm, so if in a non-waiting phase, the InSpec will go into emergency stop. For further information, go to the IO Setup & Test → Remote Setup page. Here you will be able to see which of your devices is not responding.

IO INCOMPATIBLE

The software for the sampler and the software for the IO device are released together as a compatible pair. E.g., Sampler version 4.00 software will have an associated IO version 4.00 software that was compiled for the Sampler application. Internal data registers communicate between the devices in order to ascertain whether the correct compatible pair have been installed. If there is a mismatch between either the version number of the two installed software versions or the application type that the IO was compiled for, then the alarm will be triggered.

CAN ERROR

In the waiting phase, the sampler software continually checks the requested can architecture versus the available can architecture. If there is a mismatch between the two then the can error alarm is triggered. The operator needs to understand the can architecture and the principles of operation well in order to understand what might be wrong when the alarm is triggered. If this alarm is triggered, essentially it means that one or more of the required cans proposed are not available. Here are some example scenarios:

1. You have 8 cans in your system, you require 4 per cycle and have selected the start can as can 2. Can 2 however is out of tare. The alarm will be triggered. If you now change the start can to 'any can', the alarm will deactivate.
2. You have 3 cans in your system, you require 2 per cycle, you have selected 'can 1' to start on and have stated that the cans are in order. Can 2 is out of tare. The alarm will be triggered because there are not two available cans in order. If you change the start can to can 3, the alarm will deactivate because it will now use Cans 3 and 1 and fulfil both the required cans per cycle --- 2 and the need to be in order.
3. You have 6 cans in your system, you require 4 cans to start, 4 per cycle, you have selected any can to start and the cans do not have to be in order. Can 3 is above tare, cans 5 and 6 are below tare. Therefore, 3 of your 6 cans are unavailable. There are 3 cans remaining, but you require both 4 to start and 4 per cycle. The alarm is active. Bring can 3 back into tare and the alarm will be deactivated.
4. Alternatively to the above active alarm scenario. Reduce the start cans to 3 and select infinite cans. This will also deactivate the alarm. When infinite cans option is selected, there is no 'per cycle' requirement to be met. This simplifies the rules that enable a valid can architecture.

3.6.7 LEDs

Sampler LEDs

There now follows a short description of the LEDs as shown in the above diagram.

3.6.8 STATUS

The status LED is used to indicate what the current status (operating condition) of the controller is. The given colour is dependent on the status as follows:

- **RESETTING:** ALL OFF
- **WAITING:** ALL OFF
- **STARTING:** BLUE STEADY
- **LF_SAMPLE:** BLUE STEADY
- **LF_FINISH:** BLUE STEADY
- **LINEFILL:** BLUE STEADY
- **SAMPLING:** GREEN STEADY
- **STOPPING:** RED STEADY
- **STOPPED:** RED STEADY
- **EM_STOPPING:** RED FLASHING
- **EM_STOPPED:** RED FLASHING

3.6.9 ALARM

The Alarm LED shows the current highest level of alarm ranging from no alarms to controlled stop or emergency stop alarms (acknowledged or unacknowledged). If the LED is off it indicates no alarms, blue indicates a warning alarm and red indicates a controlled stop or emergency stop alarm. Blue (warning alarms) and red (controlled or emergency stop alarms) flash if the given alarm is unacknowledged. The following indicates the alarm led condition in accordance with what alarm types are currently active and whether they are acknowledged or unacknowledged.

ALARM TYPE	STATE	LED
NO ALARMS	N/A	OFF
WARNING ALARM	UNACKNOWLEDGED	BLUE FLASHING
WARNING ALARM	ACKNOWLEDGED	BLUE STEADY
CONTROLLED STOP ALARM	UNACKNOWLEDGED	RED FLASHING
CONTROLLED STOP ALARM	ACKNOWLEDGED	RED STEADY
EMERGENCY STOP ALARM	UNACKNOWLEDGED	RED FLASHING
EMERGENCY STOP ALARM	ACKNOWLEDGED	RED STEADY

3.6.10 ACKNOWLEDGING UNACKNOWLEDGED ALARMS

Alarms can be acknowledged in a two-step process using the front panel down key (labelled 'ACK' beneath the key). Pressing this down key once when you are not in the menu takes you straight into the alarm page. All alarms will be listed, and you can step through them in a list to see which alarms are currently active (acknowledged or unacknowledged). Pressing this key again will acknowledge all the alarms.

This is a quick method of quickly accessing the alarms. Alternatively, you can of course browse the menu structure 'Control → Alarms→ Display Alarms'. Again, pressing the down ack cursor button in this display will acknowledge all alarms.

3.6.11 RECEIVER 1

The receiver LEDs indicate the current condition of the sampler's can receivers as follows:

- In tare. Ready for filling: LED OFF.
- Can ok and filling: GREEN STEADY.
- **Below or Above Tare:** RED. Note if a can is not present then it is effectively below tare and the receiver LED will also appear RED.

3.6.12 RECEIVER 2

As for receiver 1 but for receiver 2.

Note: There are no indicators for receivers above 2 to 16.

3.7 REGISTER ACCESS

See common manual

3.8 DISPLAY

3.8.1 BASIC SCREEN LAYOUT

The InSpec display consists of a 20x2 LCD display. The display operates within several modes. A full description of the controller interface is covered in the InSpec common manual. The most common screen that a user will see during day-to-day use is the front display screen. This is a typical default screen shown during operation.



Note that the three-letter status indicator display is application specific. The following three letter abbreviations are used to denote the following Sampler status conditions:

- **RST** = RESETTING.
- **WGT** = WAITING.
- **STA** = STARTING.
- **LFS** = LINEFILL SAMPLE.
- **LFF** = LINEFILL FINISHING.
- **LFP** = LINEFILL PASSING.
- **SAM** = SAMPLING.
- **STG**=STOPPING:
- **STD** = STOPPED.
- **ESG** = EM STOPPING.
- **ESD** = EM_STOPPED.

The display menu item allows specific commonly required values to be selected for display. This section is covered in the common manual. The specific Sampler related display items that are available are now described. Selecting any of the given display items will result in a prompt appearing to ask you which one of the twelve display slots you wish to assign the item to. Most of these items are self-explanatory by their title alone. There are various options under each item:

3.8.2 TIME

CURRENT

Select this item to display the current time.

STARTING

Select this item to display the time at which the current or the last batch was started.

ELAPSED

Select this item to display the time that has elapsed since a batch was started. The elapsed time is calculated on a per batch basis.

DATE

Selecting this item will display the current date. The current format is used for display purposes. The date format is configurable via the system menu.

FINISH

Selecting this item will display the current date. The current format is used for display purposes. The date format is configurable via the system menu.

3.8.3 FLOWS

MEASURED

This displays the flow rate being used by the sampler, either a manually entered set rate or one taken from a meter.

REQUIRED

This displays the desired flow rate input when the batch was configured.

3.8.4 VOLUMES

MEASURED

This is the volume of fluid that has passed the sampler since the batch started.

REQUIRED

This is the expected volume of the batch as set in the batch configuration.

EXP CAN SAMPLE

This is the expected can sample volume of the batch.

LIV CAN SAMPLE (i.e., with weigh system)

This is the weigh system estimated sample volume in the current selected can.

CAL CAN SAMPLE

This is the calculated volume in the current selected can, calculated on number of grabs taken into the can.

EXP TOT SAMPLE

This is the expected total can sample volume of the batch.

LIV TOT SAMPLE (i.e., with weigh system)

This is the weigh system estimated sample volume in all cans in the current batch. The optional can weigh facility must be enabled for this to work.

3.8.5 CAL TOT SAMPLE

This is the total calculated volume of all cans in the current batch and is calculated from the total number of grabs taken during the batch.

3.8.6 WEIGHT

EXP CAN SAMPLE

This displays the expected weight of the sample collected in the current can.

LIV CAN SAMPLE

This is the live weight of the sample collected in the current can.

CAL CAN SAMPLE

This is the calculated weight in the current selected can, calculated on number of grabs taken into the can.

EXP TOT SAMPLE

This displays the expected weight of sample collected in all cans.

LIV TOT SAMPLE

This is the weigh system estimated sample weight in all cans in the current batch.

CAL TOT SAMPLE

This is the total calculated weight in all cans in the current batch, calculated on number of grabs taken during the batch.

CURRENT CAN TARE

This was the weight of the current can before sample grabs were added.

3.8.7 CANS**CAN INPUT 1**

This displays the raw value for can input 1.

CAN INPUT 2

This displays the raw value for can input 2.

CURRENT CAN

Display the current can in use, can 1 or can 2.

CURRENT CAN TARE

Display the current tare value for the current can.

CANS USED

Display the number of cans used. This item is particularly useful when the controller is in cyclic mode and infinite cans are in use.

Note: There is an additional feature/setting for cans on the web interface. This allows for the selection and setup of a can flow meter. This is similar to how you configure a mainline flow meter and offers settings for the type of can flow input used (Pulse, ADC etc), the Qty to Flow, Frequency and pulse source (for pulse input), meter factor, flow cutoff and flow damping. These settings will be familiar to the engineer who configured the flow meter for the Sampler and should only be set by a qualified engineer when the system is in the waiting phase of operation.

3.8.8 P. FACTORS**TOTAL BATCH**

This is the performance factor over the entire batch. It compares the expect sample volume given the batch size verses the actual sample volume measured by the can weigh.

GRAB

This is the grab performance factor. It compares the number of samples taken verses number of samples measured in the can via the can weigh.

CAN

This is the performance factor over the current can. It is the same as batch pf but for just the current can.

SHORT TERM

This is the performance factor over a configurable number of grabs.

MIN CAN VOLUME

This performance factor monitors total can sample volume versus a configurable minimum. Until this minimum has been met during a batch, the performance factor is not met.

3.8.9 GRABS

GRABS TAKEN

This displays the number of grabs taken for the current batch.

GRABS SENSED

This displays the number of grabs sensed via the grab sensor for the current batch. It is dependent on the grab sensor being present.

3.8.10 FREQUENCY

This item allows the frequency to be displayed. You will be prompted and asked for which frequency you wish to display, 1 or 2.

3.8.11 DENSITY

This displays the density value for the current batch.

3.8.12 USER FWA BLOCK

Allows the displays one of the user flow weighted averaging blocks.

3.8.13 ANALOGUES

INPUT

The ADC Input value is further broken down into the following display options

SCALED

Analogue input scaled to the user units.

0-1

Analogue input scaled 0 to 1.

RAW

Analogue input as an integer bit value direct from the hardware.

FWA

Flow weighted averaged analogue value in user scaled units.

OUTPUT

The ADC output value is further broken down into the following display options

0-1

Analogue output scaled 0 to 1.

RAW

Analogue output scaled as an integer bit value directly sent to the hardware.

3.8.14 DISPLAY SETUP

SCROLL SETUP

See common manual

DISPLAY ITEMS

See common manual

DISPLAY DEC

See common manual

ENGINEER DISPLAY

See common manual

BAR GRAPH 1

See common manual

BAR GRAPH 2

See common manual

3.9 RECORDS & LOGS

3.9.1 GENERATE REPORT

This item is used to generate an instantaneous report during a batch. It will not work whilst in the waiting phase.

3.9.2 PRINT

See common manual for more details on the print facilities.

Batch Report

Here you can select an historic batch report to be printed.

Batch Log

Here you can select an historic batch log to be printed.

Alarm Phase Log

Here you can select an historic batch alarm phase log to be printed.

UCL Program File

Here you can print the instrument UCL file.

Report Template

Here you can print the text report template file.

Start Template

Here you can print the start report template file.

Registers

Here you can print the register list.

Set page length

Here you set the desired page length for each printed page.

Auto report print

This is a flag that controls whether the report is automatically printed at the end of a batch.

NUM. OF REPORTS

Here you set the number of reports you would like to print per report request either manually or automatically during a batch due to a phase change etc.

3.9.3 DELETE BATCHES

Here you can select a previous batch for deletion, and delete all associated can delete previous batch records from the SD flash card file system.

See the common manual for more details on the SD flash card file system.

3.9.4 EMAIL

See the common manual for more information on the Ethernet/IP functions of the InSpec controller, including Email / SMTP.

Batch Report

Here you can select an historic batch report to be emailed.

Batch Log

Here you can select an historic batch log to be emailed.

Alarm Phase Log

Here you can select an historic batch alarm phase log to be emailed.

Register Log

Here you can email the log of changes to configuration registers.

Modbus Log

Here you can email the log of changes to Modbus addresses.

Reboot Log

Here you can email the log of system reboots.

Report Template

Here you can email the text report template file.

All System Files

Here you can email all the InSpec configuration files.

UCL Program File

Here you can email the instrument UCL file.

Config.txt

Here you can email the configuration file config.txt

Config.modbus.csv

Here you can email the Modbus configuration file config.modbus.csv

Config.alarm.csv

Here you can email the alarm configuration file config.alarm.csv

Config.bin

Here you can email the configuration file config.bin

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.

3.9.5 LOG SETUP

See the common manual for more details on the logging facility.

Period

Set the Log Period of the logging facility.

Format

Here you select the items to be logged and their format. You also select if the items are to be logged to the printer and associated text file or to the CSV format log file or both.

3.10 OPERATION**3.10.1 QTY TO FLOW**

This is used to define the ratio of quantity to flow. If the flow is measured in “volume per time”, this value is “time” if it was measured in seconds, i.e. 1 hour is 3600 seconds and thus we would use 3600 seconds. Typical values are provided but should these not suffice then an alternate value can be entered.

3.10.2 SET FLOW TYPE

The InSpec sampler has three flow modes: Manual, ADC, Pulse and Modbus. This menu item is used to select and configure which one of these flow types you wish to use during your batch. The option is shown below:



You will then be asked to select a specific flow type from the subset, manual, adc or pulse.

**3.10.3 SAMPLING MODE**

The InSpec sampler has two modes of operation: Flow proportional sampling and time proportional sampling.

This menu item allows you to select your mode of operation. A choice dialog with the two options appears.

Flow proportional sampling

In flow proportional sampling the required sample volume/grab rate is acquired and calculated in relation to the required volume. Every set period of volume a grab is taken. The register F_BA_VOL_B_GRABS holds this value. The inter grab volume is only calculated once at the start of a batch. Linefill can be used in flow proportional sampling.

Time proportional sampling

In time proportional sampling the sample volume/grab rate is acquired and calculated in relation to the time/duration of the batch. Every set period of time a grab is taken. Linefill is not available in time proportional sampling.

After selecting the sampler mode, you will be asked whether you wish to use cyclic batching?

If you selected flow proportional sampling mode and wish to use cyclic batching, you will then be asked whether you wish the cyclic batches to change on time or on volume.

If you are using cyclic batching, you will have to confirm whether you are using infinite cans or not. If not, simply enter the number of required cans.

3.10.4 GRAB

The grab function is integral to the accuracy of any batch sample. This section allows the software components of grab to be configured. The user is prompted for the grab size in cubic centimetres and then the number of grabs before service to the grab probe is required. You are then asked if you wish to reset this service grab counter. Typically, this is done after service. The next question asks whether a grab sensor is connected.

You must now enter the grab on time in milliseconds. This is the time taken to initiate a sample grab. Secondly the grab off time is configured, which is the minimum time to reset the probe for the next grab cycle. By default, these values are both set to 250mS. This means that together the shortest allowable time for a single grab to be taken is 500mS.

There is also the ability to enter Pre-Fill Grabs and Post Displace Grabs. This can be used to overcome scenarios in which the sample lines to the receivers are unusually long. The pre-fill grabs are configured so that enough grabs are taken to fill the entire line up to and prior to the can being sampled into. At the end of a batch the post displace grabs are then taken as fast as possible to empty the line into the can. Ideally the pre and post grab settings would be the same but in reality, they will probably need to be fine-tuned to suit the system. With this system a manual purge of the line would need to be performed between batches to prevent cross contamination.

AUX CONTROL

This configures auxiliary control. I.E., Motor control for jet mix pumps, fast loop pumps, etc.

First, we are asked to select what condition drives the auxiliary control – the status or the flow. In status mode, the motor signal is turned on in all status conditions except for in Waiting (WTG), Resetting (RST), Stopped (STD) and Emergency stopped (ESD). The current status value is held in the **I_PHASE** register and is also displayed on the bottom left of the front display. Each status has a three-letter abbreviation. In flow mode, the motor signal is on if there is any flow at all and we are not in either the emergency stopped or waiting status conditions.

You are then asked to select a value for the aux off delay. This is the number of seconds that will count down before the off signal turns the motor off. The default is 5 seconds. This off delay prevents frequent tripping of the motor around a set point. This can be very damaging for sensitive pumps.

Then you are asked to enter a value for the signal fleet time. This value stores the duration in seconds for holding the fleet output signals. The default is 2 seconds.

Finally, you are asked to enter a value for aux start delay qty, this prevents the starting of the auxiliary control until the specified amount of volume has elapsed. The default is 0.

3.10.5 LINEFILL CONFIG

Confirm if you wish to use linefill. If so, specify the linefill volume, whether you wish to sample this volume and if so, what linefill sample volume is required. You are then asked if a grab sensor will be used to sense the grabs during the linefill period. Note: on completion of linefill the controller automatically changes cans.

3.10.6 P. FACTORS

There are four performance factors (PF) in the InSpec as follows:

“Batch” performance factor is based upon the expected sample for the total batch processed so far verses the actual sample for the batch according to the can weigh. This value is calculated by dividing the live total sample volume by the expected sample volume. In an ideal system they will be identical with a performance factor of 1.

Batch PF = Measured batch sample volume/Expected batch sample volume.

“Grab” performance factor is based upon the calculated sample based on number of grabs taken verses the actual sample for the batch according to the can weigh. This value is calculated by dividing the live total sample volume by the calculated sample volume. In an ideal system they will be identical with a performance factor of 1.

Grab PF = Measured batch sample volume/Calculated batch sample volume taken.

“Can” performance factor is based upon the expected sample for the current can verses the actual sample for this can according to can weigh.

Can PF = Measured can sample volume/Expected can sample volume.

“Short term” performance factor is based upon the expected sample for a user configurable grab count verses actual sample according to the can weigh for that grab count. The short-term PF uses a sliding average of the data over the number of short term PF grabs.

Short term PF = Measured volume sliding average/Expected volume sliding average.

Batch PF and grab PF might at first look to be the same however this is incorrect, Grab PF will not show a problem when the system is unable to keep up with the required grab rate, when Batch PF will. Grab PF can be used to prove the grab probe is taking the correct amount of sample, while Batch PF should be used to validate the actual batch.

Min Can Volume = Accumulated Can Sample volume / Minimum Can Sample Volume

This factor simply compares the total can sample volume accumulated versus a configurable minimum value. Until this volume has been acquired, the performance factor has not been met. The result is stored as a ratio. Once this is above 1, the condition has been met. Less than <1 is deemed unmet. The current condition is also set in flag registers as 1 or 0. This performance factor does not use an inhibit period. It is always

3.10.7 DENSITY UNITS

Here you select or enter a custom density scaling unit. You can select from API, SG, KG/M3, KG/L or enter your own.

3.10.8 ADC SETUP

This menu item allows the ADC inputs to be scaled. You will be prompted for the min and a max scaling value and the min and max alarm threshold values for the selected ADC, 1 to 3.

3.10.9 CANS

NUMBER OF CANS

This is the number of cans that are in the system, this can be either infinite or up to 16 cans maximum.

ARCHITECTURE

Here you enter the parameters for the can architecture of the system. You will be prompted to enter the number of cans in the system (limited to 16 maximum), the number of available cans that need to be available for the sampler to start, which specific can to start on (enter can number or select any) and finally whether the cans are to be used in sequential orders.

SET TARES

Enter the max and the min tare for the specified can in the architecture, from 1 to a maximum of 16.

VOLUMES

Sets the volume for the required sample and also sets the larger can change volume where the can is considered full and must be changed.

CHANGE WEIGHT

This is the weight at which the can will change. The sampler also has a change volume. Both this and the change weight are checked during a batch. If either are exceeded, then a can change event will occur.

CAN LIVE INPUT

In this section you get to configure the can input system. You select whether it is based on weight or volume and what the input type is – analogue, Modbus or simulated.

CAN SIMULATOR

Here you can turn on a can simulator that simulates different tare and leak conditions up to 16 can architecture. This is purely used for test and demonstration purposes and should never be used in a live system.

3.10.10 USER FWA BLOCK

See common manual

3.10.11 PID BLOCKS

The InSpec has 10 configurable PID blocks. These are configured via this menu item which contains 2 sub - menus. The PID blocks items consists of three sub menus:

PID Config: here you will be prompted to turn the specific PID block on (1-10), to enter the source register (PID input), the active phases, whether the PID should jump to a specific value when it goes into a non-active phase and if so, what this value should be; what the start value should be and finally the minimum and maximum value for the PID output.

3.10.12 SOURCE / PROMPTS

At the start of each batch you will be prompted for whatever auto prompts are turned on. The required prompts can be toggled on and off in this menu section. The available menu prompts are:

BATCH TITLES

Enter a name or title of the batch.

BATCH ID

Enter a numerical ID for the batch.

LINEFILL

This is used for using and configuring Linefill.

VOLUME / TIME

This is used to enter either the time or volume of a batch depending on operating mode.

BATCH DENSITY

Enter the density of the batch.

BATCH FLOW

Enter the flow of the batch.

BATCH START

Confirmation of the start of a batch.

SAMPLE VOLUME

For entering the required sample volume size.

PID BLOCKS

For entering the required set point for any configured PID blocks. There is a prompt for each PID Block.

CUSTOM PROMPTS

For configuring user prompts at the start of a batch. This is particularly useful for UCL programs where input is required.

3.11 SECURITY

See common manual

3.11.1 LOGIN USER

See common manual

3.11.2 LOGOUT

See common manual

3.11.3 WHO AM I?

See common manual

3.11.4 SECURITY TIMEOUT

See common manual

3.11.5 ADD USER

See common manual

3.11.6 EDIT USER

See common manual

3.12 SYSTEM

See common manual

3.12.1 SET DATE/TIME

See common manual

3.12.2 DATE FORMAT

See common manual

3.12.3 NTP SETUP

See common manual

3.12.4 EMAIL SETUP

See common manual

3.12.5 SERIAL PORTS

See common manual

3.12.6 MODBUS TCP SLAVE

See common manual

3.12.7 MODBUS TCP MASTER

See common manual

3.12.8 IP SETTINGS

See common manual

3.12.9 USER COMMANDS

See common manual

3.12.10 IO

See common manual

TESTS

See common manual

CALIBRATION

See common manual

SECTION 4: SAMPLER IO

This table shows the InSpec Sampler's relay connections:

	Terminal	I/O Description	Default Duty
Plug 1 (Relay)	1	Common	Sample Grab Signal
	2	Normally Open	
Plug 2 (Relay)	1	Common	Receiver Select Signal
	2	Normally Open	
Plug 3 (Relay)	1	Common	Auxiliary Start/On Signal
	2	Normally Open	
Plug 4 (Relay)	1	Common	Auxiliary Stop/Off Signal
	2	Normally Open	

Plugs 1 to 4 - Relay Connections

This table shows the terminal 3 block connections for the InSpec Sampler.

	Terminal	I/O Description	Default Duty	
Plug No.6	1	0V (+24V DC GND)		
	2	+24V DC Supply		
	3	Digital I/O Point No.8	General Alarm Output	
	4	Digital I/O Point No.7	Can Change Input	
	5	Digital I/O Point No.6	Stop Command Input	
	6	Digital I/O Point No.5	Loop Fault Input	
	7	-	Pulse Input No.2	Grab Sense Input
	8	+		
	9	-	Pulse Input No.1	Flow Input (Pulse)
	10	+		
	11	-	Analogue Output No.2	% Batch Complete
	12	+		
	13	-	Analogue Output No.1	% Receiver Full
	14	+		
	15	-	Analogue Input No.3	Flow Input (Analogue)
	16	+		
	17	-	Analogue Input No.2	Receiver No.2 Weight
	18	+		
	19	-	Analogue Input No.1	Receiver No.1 Weight
	20	+		

Plug 6 Connections – Power, Digital, Pulse, Analogue

The InSpec sampler IO is defaulted as follows.

Analouges

Analogue Inputs*

Analogue Input 1 = Weigh 1

Analogue Input 2 = Weigh 2

Analogue Input 3 = Flow

* The Analogue inputs can be assigned to alternative input devices in a system that does not use can weigh or the analogue flow input signal.

Analogue Outputs*

Analogue Output 1 = Percent Can Full

Analogue Output 2 = Batch Percent

*The Analogue Outputs can be assigned to the desired output value via the P_DAC_SOURCE1/2 registers

Pulse Inputs

Pulse input 1 = Flow

Pulse input 2 = Grab Sensor

Digitals

Digital Outputs

(**Note:** the last 4 digitals (5,6,7 and 8) can act as either inputs or outputs. Hence digital 8 is assigned as a general alarm in the output listing below).

1 = Grab Output

2 = Can Select Out

3 = C Aux On Signal

4 = C Aux Off Signal

8 = General Alarm

Digital Inputs

5 = Loop Fault

6 = Stop command

7 = Can change

SECTION 5: SAMPLER OPERATION

5.1 BATCHES

5.1.1 TITLES

If the user batch titles option is used, then the user is prompted to enter the title for each of the batches. The entered value is stored in the **S_BATCH_TITLE** register and appears in the batch report under the heading **"BATCH NAME:"**

5.1.2 PROMPTED, NEXT BATCH, CYCLIC BATCHING

InSpec sampler batches can be initiated and/or repeated in several ways. By default, the sampler operates in single batching flow proportional mode.

Single batching flow proportional mode – a user will manually start the batch. The batch will always have to be reset manually. The requested sample size will be achieved over the specified required volume, but the principle is that whilst there is flow, the sampler will continue to operate, and the system will take grabs until the last can is filled. If the last can is filled and there are no more cans to change to then the sampler will go into emergency stop.

Single batching time proportional mode – a user will manually start the batch. The requested sample size will be achieved over the specified time duration. If the last can is filled and there are no more cans to change to then the sampler will go into emergency stop. If the system does not have infinite can architecture, the no cans left emergency stop alarm will be triggered when there are no more cans to change to.

Cyclic batching flow proportional mode – a user will manually start the first batch. The requested sample size will be achieved over the specified required volume and the sampler will stop and reset automatically and continue with the next batch parameters. If the system is setup with infinite can architecture, then this will continue indefinitely until the user manually stops and resets the system. If the system does not have infinite can architecture, the no cans left emergency stop alarm will be triggered when there are no more cans to change to.

Note: When you start a cyclic batch, you will still have to enter the initial start parameters in accordance with what auto prompts are currently configured. Once the cyclic batching process is underway you can change the parameters for the next batch via the 'Next Batch Conf' menu.

Cyclic batching time proportional mode – a user will manually start the batch. The requested sample size will be achieved over the specified time duration and the sampler will stop and reset automatically and continue with the next batch parameters. If the system is setup with infinite can architecture, then this will continue indefinitely until the user stops and resets the system. If the system does not have infinite can architecture, the no cans left emergency stop alarm will be triggered when there are no more cans to change to.

Note: Linefill is NOT available in time proportional mode. When you start a cyclic batch, you will still have to enter the initial start parameters in accordance with what auto prompts are currently configured. Once the cyclic batching process is underway you can change the parameters for the next batch via the 'Next Batch Conf' menu.

Automatic batch changes can be triggered/can occur in four different ways.

Manual (from the menu), each batch will continue to run until a batch change is requested using the start button, (touch bottom left), or via an external contact connected to a digital input.

On Volume (in cyclic batching), once the set batch volume has been reached the system will automatically change to the next batch. A manual batch change can still be initiated as in the manual mode above.

Change Time (in cyclic batching), this is where the user is prompted to enter a time in the 24-clock format at which time the batch will be changed.

Elapsed Time (in Time proportional mode), this is the amount of time to let the batch run for. On reaching this limit the batch will be changed.

5.1.3 STARTING A BATCH

To start sampling either select the soft 'Start' key button on the front display or enter the control menu and select the option start using the cursor and enter keys respectively.

The batch details and any required line-fill configuration have to be entered in accordance with which auto prompts have been enabled before it is possible to start. It is feasible to have all auto prompts turned off and if the sampler is started via the menu it will immediately start. For safety cautions you will always be asked to confirm the use of the front panel soft key 'Start' button. Before sampling commences a check is made to ensure that there is at least one valid can available, the exact number required depends on the option selected in **Configuration/Cans/Starting**. A valid can has a weight between the minimum and maximum tare limits. If a can weigh system is not present, then it is always assumed that there is a can available. If a can is not available, then the sampling system will not start.

5.1.4 STOPPING A BATCH

To stop sampling use the control screen brought up by touching the bottom left screen area and touching the **STOP** button. Alternatively use the external digital *stop* contact. While this stops the sampler sampling, it does not terminate the batch. This means that if flow is still occurring it will be totalled but no samples will be taken, thus reducing the performance factor, and eventually causing alarms. To terminate the batch, the batch must be stopped, and then reset.

5.1.5 RESUMING A BATCH

A batch can be resumed if the unit is in the *Stopped* or *Emergency Stopped* phase. If the unit performed an emergency stop this was because a new can was required but none were available or the maximum number of cans have been used. To continue sampling, place an empty can on the system and / or increase the number of cans in the **Configuration** menu, or use the external digital start contact and **START**.

5.1.6 RESETTING A BATCH

When the InSpec is in the *Stopped* or *Emergency Stopped* phase, the batch can be reset to change the phase to *Waiting* ready for the next batch.

To reset, bring up the control pad by touching the bottom left screen area and touch the **RESET** button. Alternatively use the external digital *reset* contact.

The reset command tells the InSpec that the currently loaded batch has completed and causes a batch report to be generated and stored. If enabled, a number of copies of the batch report will be automatically printed. If multiple batches are used, the reset command will also reset the batch counter so that the next batch to start will be batch one.

5.1.7 MANUAL INTERVENTION

During a batch some of the parameters can be manually altered. A manual flow can be entered, the InSpec can be switched to auto or manual flow, and a request to sample in to a fresh receiver done at any time. Batch volume and batch density can only be modified whilst the InSpec is in the *Stopped* or *Emergency Stopped* states. This change only affects the currently loaded batch, when the batch is re-run from *Waiting* or after a batch change, the values entered during batch set up will be loaded. If a batch is manually changed a warning message to that effect will be printed on the end of the batch report.

5.2 LINEFILL

The volume⁰⁰⁰ may be sampled, and if so then the sample will be held in a separate receiver to that of the main batch, so it is important to ensure that enough cans are available for use. may be sampled, and if so then the sample will be held in a separate receiver to that of the main batch, so it is important to ensure that enough cans are available for use.

A user with engineer access can configure linefill so that the auto prompt appears whenever a batch is started. At start up this prompts for whether linefill is to be performed, the linefill volume⁰⁰⁰ operator access to confirm and activate linefill at the start of a batch. A user with engineer level access can also configure the default values for linefill via the operations menu. The parameters are the same as at batch start up, with the exception that a user with engineer level access is also asked to confirm whether a grab sensor is used during the linefill period. level access is also asked to confirm whether a grab sensor is used during the linefill period.

Due to the relatively small volume of linefill, if sampling is required it is possible to drive the grab probe too fast, generating alarms. To prevent this, grab sensing can be inhibited during linefill sampling. This option is selected whilst setting up linefill.

5.3 AUX CONTROL

Aux control in the InSpec Sampler can be activated/de-activated by either flow or by status condition. The **C_AUX_MODE** register determines what the activation mode is. Setting this register to 1 puts aux control into flow control mode.

5.4 THE PERFORMANCE FACTORS

There are four performance factors within the InSpec Sampler. These are as follows:

“Batch” performance factor is based upon the expected sample for the total batch processed so far verses actual sample for the batch. This performance factor corresponds to the ANSI/ASTM D4177 standard.

“Grab” performance factor is based upon the calculated sample for the number of grabs taken verses actual sample for the batch. This performance factor corresponds to the ANSI/ASTM D4177 standard.

“Can” performance factor is based upon the expected sample for the current can verses actual sample for this can.

“Short term” performance factor is based upon the expected sample for a user configurable grab count verses actual sample for that grab count.

“Minimum Can Volume” performance factor is based upon the accumulated can sample volume versus a user configurable minimum volume ratio.

5.4.1 BATCH PERFORMANCE FACTOR CALCULATIONS

The batch performance factor is an overall system check that compares the accumulated batch sample volume to the expected one.

$$\text{BatchPF} = \frac{\text{AccumulatedBatchSampleVolume}}{\text{ExpectedBatchSampleVolume}}$$

The accumulated batch sample volume is the actual volume collected so far, where:

$$\text{AccumulatedBatchSampleVolume} = \frac{\text{AccumulatedBatchSampleWeight}}{\text{MeanDensity}_{\text{input}}}$$

The expected batch sample volume is the theoretical sample volume that should have been collected so far for the elapsed batch size, where:

$$\text{ExpectedBatchSampleVolume} = \frac{\text{MeasuredBatchVolume}}{\text{RequiredBatchVolume}} * \text{RequiredSampleVolume}$$

5.4.2 GRAB PERFORMANCE FACTOR CALCULATIONS

The grab performance factor is a grab volume check that compares the accumulated batch sample volume to the calculated one.

$$\text{GrabPF} = \frac{\text{AccumulatedBatchSampleVolume}}{\text{CalculatedBatchSampleVolume}}$$

The accumulated batch sample volume is the actual volume collected so far, where:

$$\text{AccumulatedBatchSampleVolume} = \frac{\text{AccumulatedBatchSampleWeight}}{\text{MeanDensity}_{\text{input}}}$$

The calculated batch sample volume is the actual sample so far for the number of grabs, where:

$$\text{CalculatedBatchSampleVolume} = \text{Numberofgrabstaken} * \text{GrabVolume}$$

5.4.3 CAN PERFORMANCE FACTOR CALCULATIONS

The can performance factor is a system check that compares the accumulated can sample volume for the current can to the expected one.

$$\text{CanPF} = \frac{\text{AccumulatedCanSampleVolume}}{\text{ExpectedCanSampleVolume}}$$

The accumulated can sample volume is the actual volume collected for the can so far, where,

$$\text{AccumulatedCanSampleVolume} = \frac{\text{AccumulatedCanSampleWeight}}{\text{MeanCanDensity}_{\text{input}}}$$

The expected can sample volume is the theoretical sample volume collected so far for the volume passed for this can, where:

$$\text{ExpectedCanSampleVolume} = \frac{\text{BatchVolumeThisCan}}{\text{RequiredBatchVolume}} * \text{RequiredSampleVolume}$$

5.4.4 SHORT TERM PERFORMANCE FACTOR CALCULATIONS

The short-term performance factor is a sliding system check based on the grabs that have been taken. It compares the accumulated can sample volume over a number of grabs for the current can to the calculated sample volume over the same number of short term grabs. The short-term grab count is configurable. This forms the sliding average width for the calculation. Where n = grab number,

$$\text{ShortTermPF}(n) = \frac{\text{AccumulatedCanSampleVolume}_n - \text{AccumulatedCanSampleVolume}_{n-\text{ShortTermGrabCount}}}{\text{Grab Volume} * \text{ShortTermGrabCount}}$$

5.4.5 MINIMUM CAN VOLUME PERFORMANCE FACTOR CALCULATIONS

The performance factor is a simple ratio check against the accumulated can sample volume versus a user configurable minimum volume ratio. The accumulated volume has to equal or exceed this minimum volume before the performance factor is achieved. The result is both stored as a ratio and flag registers are set to indicate whether the performance factor has been achieved (1) or not (0).

$$\text{MinCanVolumePF} = \frac{\text{AccumulatedCanSampleVolume}}{\text{MinimumVolumeRatio}}$$

SECTION 6: REMOTE IO MODULE

6.1 INTRODUCTION

The Master InSpec Controller can expand the capabilities of its core process application via expansion of the available Field IO. There is an additional InSpec application called the Remote IO (RIO) There are four Remote IO variants with a maximum slot expandability of up to 14 RIO Modules.

Using the web interface connected to the Master InSpec Controller access to the RIO is made via the IP address of the RIO unit. The RIO device can literally be remote in the field and connected to via the Master InSpec controller's web interface.

6.2 TYPE OF RIOS

There are 4 types of RIO available. The IO points and maximum number of RIO combinations are:

Type	Number of points	Max Modules	Static IP Default
DIO	8 input/outputs	6	192.168.92.100
Pulse	8 inputs	2	192.168.92.110
ADC	8 inputs	4	192.168.92.120
DAC	8 outputs	2	192.168.92.130

The remote capability of this IO can be used by the Master unit to enhance control or provide control for existing features. I.E., The Grab Output signal can reside on a remote digital.

6.3 INITIAL CONFIGURATION

Unlike the InSpec master base units (InSpec Sampler or InSpec Blender), there is very little to configure on the RIO device. The configuration and calibration of the actual RIO is done via the master unit's web interface. It is very helpful to conceptualise the InSpec RIO device as an add-on to the base unit.

6.4 RIO WEB INTERFACE

Each RIO device has a web page which can be accessed via the internet address of the device. Visually this web page looks very similar to the web page for the Master InSpec unit. 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 user, 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.

6.5 ETHERNET

This is the most important configuration option for the InSpec RIO device. All the RIO field inputs coming into the device are communicated back to the Master unit. This is only possible if the Ethernet is configured on the same immediate network or another accessible network. The IO data is then communicated across the network link between the remote device and the base unit using Modbus Master TCP/IP. The parameters for this internal Modbus Master connection cannot be reconfigured by the user.

Once determined, the IP address of the RIO device needs to be entered into the master unit in one of the designated remote URL registers. When any of these registers contain data, it forces the master unit to attempt a connection. If successful, the IO data from the remote unit is then continually communicated to the base unit.

Appendix A: Publisher Notes

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