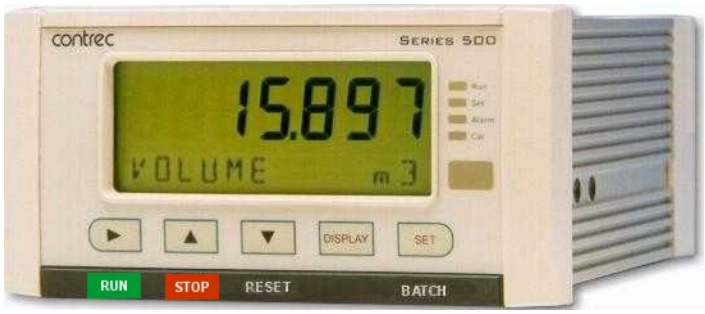
# Model 505 Flow Computer

## Operation Manual

### Application BC01

**Dual Stage Batch Controller**
**for**
**Volumetric Frequency Flowmeters**




17 June 2017

**Model 505 Flow Computer - Operation Manual**



The instructions given herein cover the general description, installation, operation and maintenance of the subject equipment. Contrec Ltd reserves the right, without prior notice, to make engineering refinements that may not be reflected in this manual.

Should any questions arise which cannot be answered specifically by this manual, they should be directed to Contrec Ltd for further detailed information and technical assistance.

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# Safety Notice

**The information in this safety notice is for the prevention of injury to personnel and damage to the instrument.**

**The manufacturer assumes no liability for injury or damage caused by misuse of the instrument or for modifications made to the instrument.**

## Qualified Personnel

The instrument must be installed, operated and serviced by persons who have been properly trained and authorised. Personnel must read and understand this manual prior to installation and operation of the instrument.

## Static Hazard

The 500 series flow computer uses high speed CMOS circuitry which is sensitive to static damage. The user should observe accepted safety practices for handling electronic devices, especially during servicing. Once the unit is installed, grounded and interconnected, the chances of static damage are greatly reduced.

## Voltage Hazard

Before connecting power to the instrument, ensure that the supply voltage for the AC or DC input is suitable. The AC voltage rating is as stated on the instrument rating plate. Personnel should take all due care to avoid electric shock. For safe operation it is essential to connect a mains safety earth to the A.C. power inlet. Do not operate at altitudes above 2000m.

## Welding Hazard

Do not perform electric welding in close proximity to the instrument or its interconnecting cables. If welding in these areas must be performed, disconnect all cables from the instrument. Failure to do so may result in damage to the unit.

## Moisture Hazard

To avoid electrical faults and corrosion of the instrument, do not allow moisture to remain in contact with the instrument.

## Disconnection Device

When powered from a mains supply this unit requires the provision of a suitable mains isolation device to be accessible near to the installed instrument.

# Contents

# List of Figures

# Chapter 1
# Introduction

## Features

- Tailored for volumetric frequency flow input
- Single or Dual stage control
- Quick access to common batch quantities
- No-flow, leakage and overflow error detection
- Remote RUN/STOP/RESET
- Allows for non-linear correction
- Storage of 100 transactions with time and date stamp
- Selection of second language and user tags
- Pulse width and scaling of pulse output
- 4-20mA retransmission
- Selectable protocols on serial ports including Modbus RTU and Printer output
- Front panel adjustment of 8-24V DC output voltage
- Backlit display with LCD backup

## Overview

The 505 BC01 application is a dual stage batch controller for reliable measurement of preset quantities using a volumetric frequency input. Used as a single or dual stage controller it is suitable for fast batch applications.

It provides the operator with clear local readout and can be controlled via communications in more automated systems. There is quick access to commonly used preset values directly from the front panel if access has been authorized. Automatic overrun compensation caters for system delays such as valve closure for precise volumes.

The instrument is compatible with a wide range of flowmeter frequency outputs, including millivolt signals, reed switches, Namur proximity switches and pulse trains via its smart front-panel program selection.

## Calculations

The total and flowrate are derived from accurately measured frequency and the number of received pulses.

*volume = pulses / k-factor*

*volume flow = frequency / k-factor*

Automatic overrun compensation calculates the new valve closure point to ensure correct delivery by averaging the overrun amount from the last three complete batches.

The overrun compensation value is valid for a new preset value provided the stored overrun is less than 20% of the new preset.

## Displayed Information

The front panel display shows the current values of the input variables and the results of the calculations.

The instrument can be supplied with a real-time clock for storage of up to 100 transactions with time and date stamps.

## Main Menu Variables

| Main Menu Variables | Default Units | Variable Type |
|---|---|---|
| Volume | L | Total |
| Volume Flowrate | L/min | Rate |

Refer to **Available Units of Measurement** on page 62 for the list of available units.

## Communications

There are two communication ports available as follows:

- RS-232 port
- RS-485 port

The ports are available for remote data reading, printouts and for initial application loading of the instrument.

## Retransmission & Control Outputs

The instrument can retransmit any main menu variable. The digital outputs can retransmit totals as pulses or operate as logic levels for control or error outputs. If the instrument has the advanced option, it outputs rates as a 4-20mA signal.

## Relay Outputs

The relay outputs 1 and 2 are used to control the flow of product for each delivery. These contacts are normally open and can be used to drive external relays, valves, pump circuits etc.

## Software Configuration

The instrument can be further tailored to suit specific application needs including units of measurement, custom tags, second language or access levels. A distributor can configure these requirements before delivery.

Instrument parameters including units of measurement can be programmed in the field, according to the user access levels assigned to parameters by the distributor.

All set-up parameters, totals and logged data are stored in non-volatile memory with at least 30 years retention.

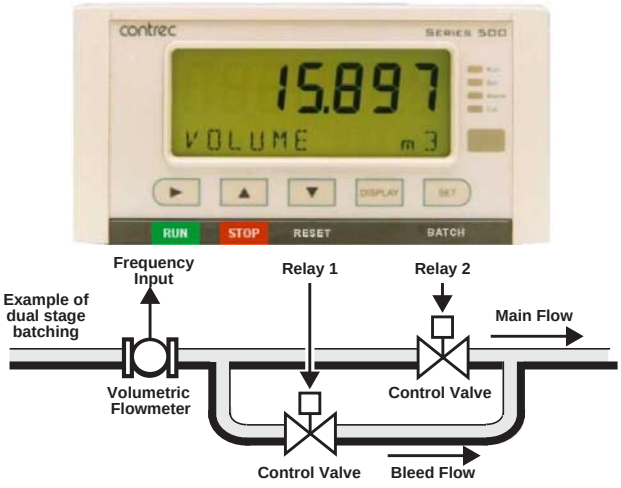



*Figure 1 Typical Application Diagram*

## Approvals

This instrument conforms to the EMC-Directive of the Council of European Communities 2014/30/EU, the LVD safety directive 2014/35/EU and the following standards:

- *EN61326:2013* Electrical equipment for measurement, control and laboratory use – EMC requirements: Industrial Environment.
- *EN61010:2010* Safety requirements for electrical equipment for measurement, control, and laboratory use.

In order to comply with these standards, the wiring instructions in **Chapter 3 - Installation** must be followed.

### FCC Declaration

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, might cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. Contrec Ltd is not responsible for any radio or television interference caused by using other than recommended cables and connectors or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device might not cause harmful interference, and (2) this device must accept any interference received, including interference that might cause undesired operation.

# Chapter 2
# Specifications

## Specification Table

### Operating Environment

| | |
|---|---|
| **Temperature** | 0°C to +60°C (conformal coating)<br>+5°C to +40°C (no coating) |
| **Humidity** | 0 to 95% non condensing (conformal coating)<br>5% to 85% non condensing (no coating) |
| **Power Supply** | 95-135 V AC or 190-260 V AC<br>or 12-28 V DC |
| **Consumption** | 6W (typical) |
| **Protection** | Sealed to IP65 (Nema 4X) when panel mounted |
| **Dimensions (panel option)** | 147mm (5.8") width<br>74mm (2.9") height<br>167mm (6.6") depth |

### Display

| | |
|---|---|
| **Type** | Backlit LCD with 7-digit numeric display and 11-character alphanumeric display |
| **Digits** | 15.5mm (0.6") high |
| **Characters** | 6mm (0.24") high |
| **LCD Backup** | Last data visible for 15min after power down |
| **Update Rate** | 0.3 second |

### Non-volatile Memory

| | |
|---|---|
| **Retention** | > 30 years |
| **Data Stored** | Setup, Totals and Logs |

### Approvals

| | |
|---|---|
| **Interference** | CE compliance |
| **Enclosure** | IECEx, ATEX and CSA approved enclosures available for hazardous areas |

### Real Time Clock (Optional)

| | |
|---|---|
| **Battery Type** | 3 volts Lithium button cell (CR2032) |
| **Battery Life** | 5 years (typical) |

### Frequency Input (General)

| | |
|---|---|
| **Range** | 0 to 10kHz |
| **Overvoltage** | 30V maximum |
| **Update Time** | 0.3 sec |
| **Cutoff frequency** | Programmable |
| **Configuration** | Pulse, coil or NPS input |
| **Non-linearity** | Up to 10 correction points |

### Pulse

| | |
|---|---|
| **Signal Type** | CMOS, TTL, open collector, reed switch |
| **Threshold** | 1.3 volts |

### Coil

| | |
|---|---|
| **Signal Type** | Turbine and sine wave |
| **Sensitivity** | 15mV p-p minimum |

### NPS

| | |
|---|---|
| **Signal Type** | NPS sensor to Namur standard |

### Remote Logic Inputs

| | |
|---|---|
| **Signal Type** | Voltage free contact, open collector |

### Relay Output

| | |
|---|---|
| **No. of Outputs** | 2 relays |
| **Voltage** | 250 volts AC, 30 volts DC maximum |
| **Current** | 3A maximum |

### Communication Ports

| | |
|---|---|
| **Ports** | RS-232 port<br>RS-485 port |
| **Baud Rate** | 2400 to 19200 baud |
| **Parity** | Odd, even or none |
| **Stop Bits** | 1 or 2 |
| **Data Bits** | 8 |
| **Protocols** | Modbus RTU, Printer* |

| Transducer Supply | |
|---|---|
| **Voltage** | 8 to 24 volts DC, programmable |
| **Current** | 70mA @ 24V, 120mA @ 12V maximum |
| **Protection** | Power limited output |

| Pulse/Digital Output | |
|---|---|
| **Signal Type** | Open collector, non-isolated |
| **Switching** | 200mA, 30 volts DC maximum |
| **Saturation** | 0.8 volts maximum |
| **Pulse Width** | Programmable: 10, 20, 50, 100, 200 or 500ms |

| 4-20mA Output (Optional) | |
|---|---|
| **Supply** | 24 volts DC internal, non-isolated |
| **Resolution** | 0.05% full scale |
| **Accuracy** | 0.05% full scale (20°C)<br>0.1% (full temperature range, typical) |

*Important: Specifications are subject to change without notice.*
*Printer protocol is available only if RTC option is installed.*

# Chapter 3
# Installation

## Panel Mounting

The instrument should be located in an area with a clean, dry atmosphere that is also relatively free of shock and vibration.

The standard mounting procedure is panel mounting in a cutout that is 139 mm wide by 67 mm high. Two side clips secure the unit into the panel.

Figure 2 shows the panel mounting requirements for the 500 Series Instrument.

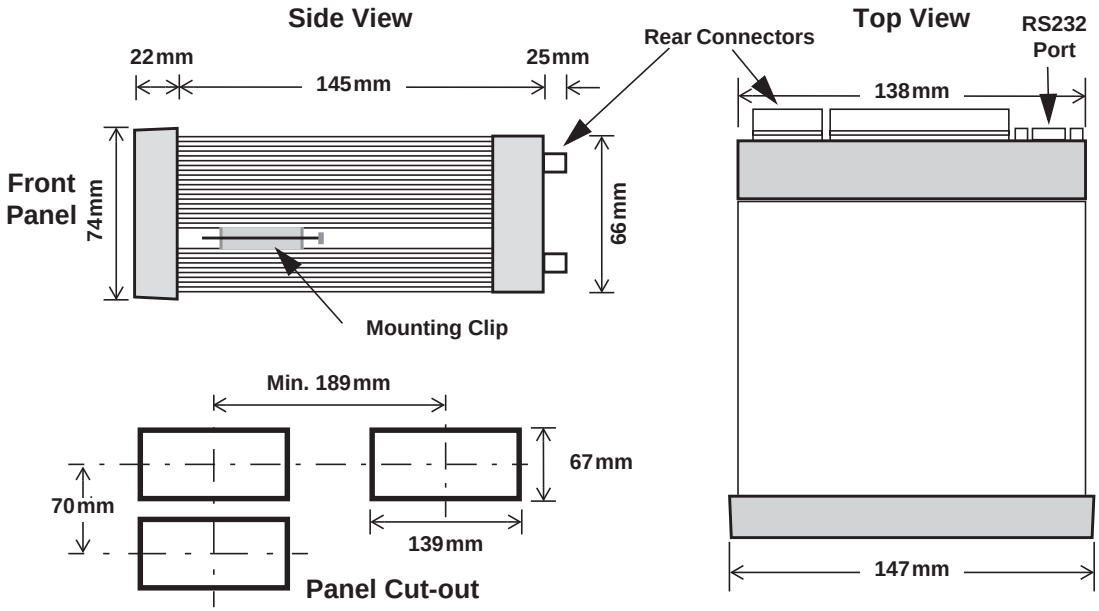



*Figure 2 500 Series Instrument Panel Mounting*

# Electrical Connection

## Rear Panel Connections

Figure 3 shows the connections on the rear panel of the instrument.

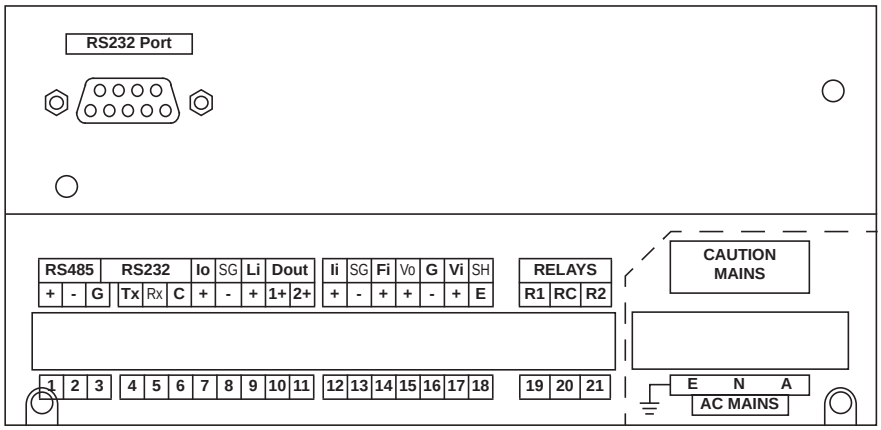



*Figure 3 Rear Panel Connections*

## Terminal Designations

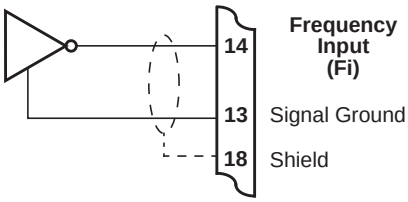
| Terminal | Label | | Designation | Comment |
|---|---|---|---|---|
| 1 | RS485 | + | RS485 (+) | |
| 2 | | - | RS485 (-) | |
| 3 | | G | Comms ground | |
| 4 | RS232 | Tx | RS232 data out | Same RS232 port as DB9 connector |
| 5 | | Rx | RS232 data in | |
| 6 | | C | CTS (Clear to send) | |
| 7 | Io | + | 4-20 mA output | Advanced option |
| 8 | SG | - | Signal Ground 0 V | |
| 9 | Li | + | Logic input | Remote run |
| 10 | D OUT | 1+ | Open collector o/p 1 | Digital outputs |
| 11 | | 2+ | Open collector o/p 2 | |
| 12 | Ii | + | Signal input | Remote stop/reset |
| 13 | SG | - | Signal Ground 0 V | |
| 14 | Fi | + | Frequency input | Volumetric flow |
| 15 | Vo | + | 8-24 volts DC output | 70 mA power limited |
| 16 | G | - | DC Ground | |
| 17 | Vi | + | DC power input | DC power in 12-28 V |
| 18 | SH | E | Shield terminal | |
| 19 | RELAYS | R1 | Relay 1 | Single stage |
| 20 | | RC | Relay Common | |
| 21 | | R2 | Relay 2 | Dual stage |
| E | AC MAINS | E | Mains ground | AC power in 95-135 V or 190-260 V |
| N | | N | Mains neutral | |
| A | | A | Mains active | |
| RS232 port | | | 9-pin serial port | |

# Inputs

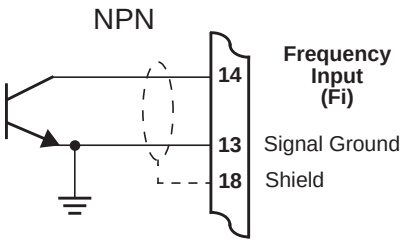
## Frequency Input Connection

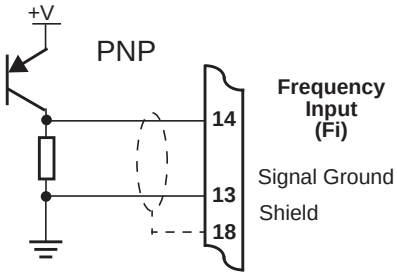
Connect pulse or frequency input signals from devices such as: TTL, CMOS, open collector, reed relay switch, coil and Namur proximity switch, as shown below. For better signal integrity, it is recommended to use shielded cable. Refer to **Terminal Designations** on page 8 for specific terminal numbers for this application.

Squarewave, CMOS or TTL

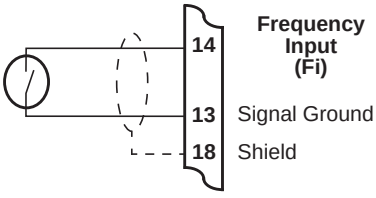



Open Collector

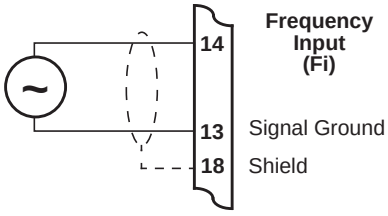


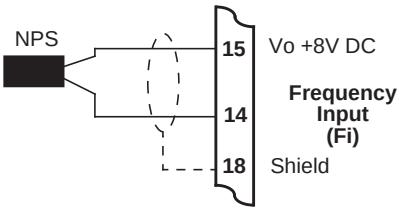

Reed Relay Switch




Coils - with 15 millivolts peak to peak AC minimum




Namur Proximity Switch



## Logic Input Connection

These input(s) are designed to be connected to open collector signals or a voltage free contact switch. A minimum activation time of 300ms is required to guarantee reading of an input.

### Remote Run Input

A remote push-button key can be connected to the Logic Input (Li, terminal 9) as shown below.

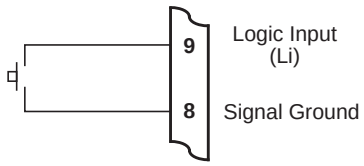



*Figure 4 Logic Input Connection Diagram*

### Remote Stop/Reset Input

A remote push-button key can be connected to the multipurpose Signal Input (Ii, terminal 12) as shown below. A momentary press of the remote key is recognised as a Stop signal, while a press and hold for 2 seconds is recognised as a Reset.

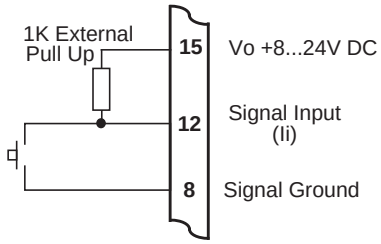



*Figure 5 Signal Input Connection Diagram*

# Outputs

The basic instrument has two digital outputs. The advanced option also provides a 4-20mA output port.

## 4-20mA Output Connection

Figure 6 shows the connections for a 4-20mA output.

Maximum Load Resistance = 900 ohms

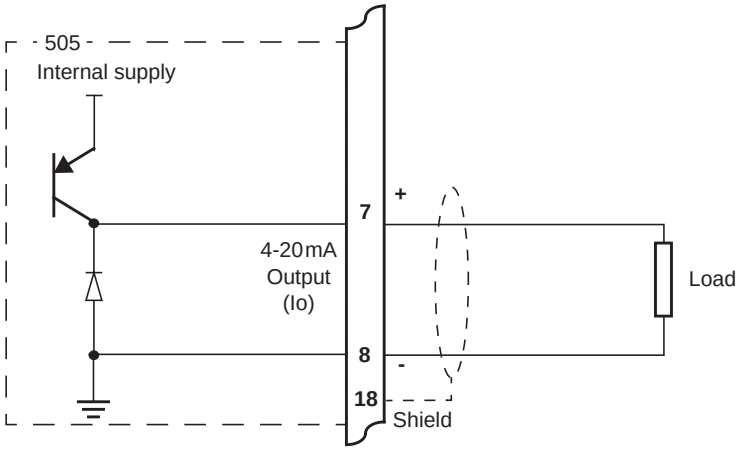



*Figure 6 Output 4-20mA Connection Diagram*

## Digital Output Connection

The digital outputs can be programmed in calibration to function as either a flow error signal, end of batch signal, pump control output or a pulse output for retransmission of totals.

Figure 7 shows a connection example for a pulse output. Output channel 1 uses terminals 10 (+) and 8 (-). Output channel 2 uses terminals 11 (+) and 8 (-).

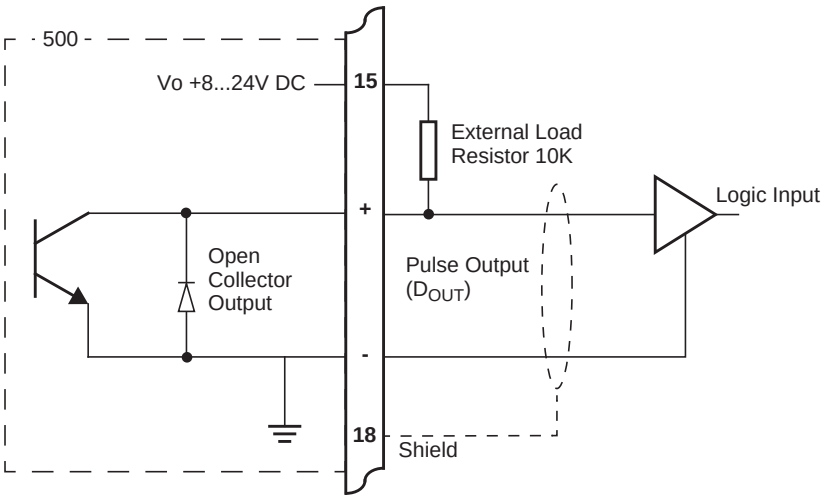



*Figure 7 Output Pulse Connection Diagram*

# Control Relays

The standard instrument has two relays, which are used for the dual stage batch control. The relays can drive external devices such as valves, pump circuits or external relays.

The output characteristics of the relays are:

| | |
|---|---|
| Maximum Voltage | 30 volts DC or 250 volts AC |
| Maximum Current | 3 A |

**Note:** Solid state relays use AC voltage only.

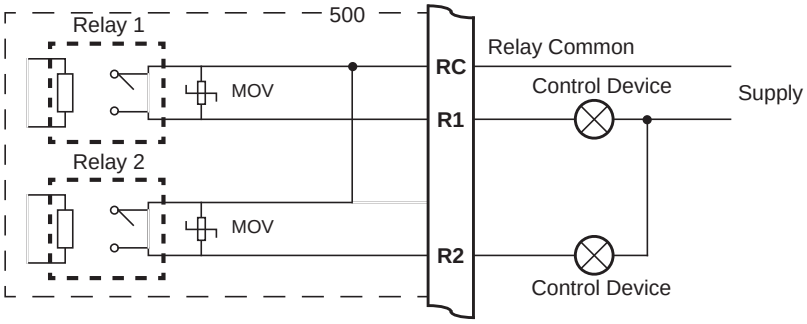



*Figure 8 Relay Connection Diagram*

## RC Network for Interference Suppression

When driving highly inductive loads with the relay outputs, it is recommended to use RC suppression networks (often called “Snubbers”) for the following reasons:

- To limit the amount of electrical noise caused by arcing across the contacts, which may, in extreme cases, cause the microprocessor to act erratically.
- To protect the relay contacts against premature wear through pitting.

RC suppression networks consist of a capacitor and series resistor and are commonly available in the electrical industry. The values of R and C are dependent entirely on the load. However, if the user is unsure of the type of snubber to use, values of 0.25 µF and 100 Ω will usually suffice. Note that only mains-approved RC suppression networks should be used.

The basic principle of the operation is that the capacitor prevents a series of sparks arcing across the contact as the contact breaks. The series resistor limits the current through the contact when the contact first makes.

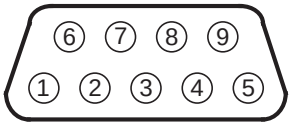
# Communications

The communication protocols are described in **Communications** on page 45.

## RS-232 Port

The standard RS-232 port uses terminals 4, 5 and 6 on the rear panel.

The extra RS-232 port 9-pin DB female connector has the following pinout:




| | |
|---|---|
| Pin 1 | Not used |
| Pin 2 | Transmit (TxD) |
| Pin 3 | Receive (RxD) |
| Pin 4 | Not used |
| Pin 5 | Ground |
| Pin 6 | Not used |
| Pin 7 | Handshake line (CTS) |
| Pin 8 | RTS Out |
| Pin 9 | Not used |

**Note:** The instrument does not require a null-modem cable for connection to a personal computer. Refer to **Hardware Interconnection** on page 45 for cable termination requirements.

## RS-485 Port

Up to 32 units can be connected to a common RS-485 bus. Each unit has a unique address that the host computer uses to identify each instrument.

Figure 9 shows the connection of several instruments to a computer using the RS-485 port.

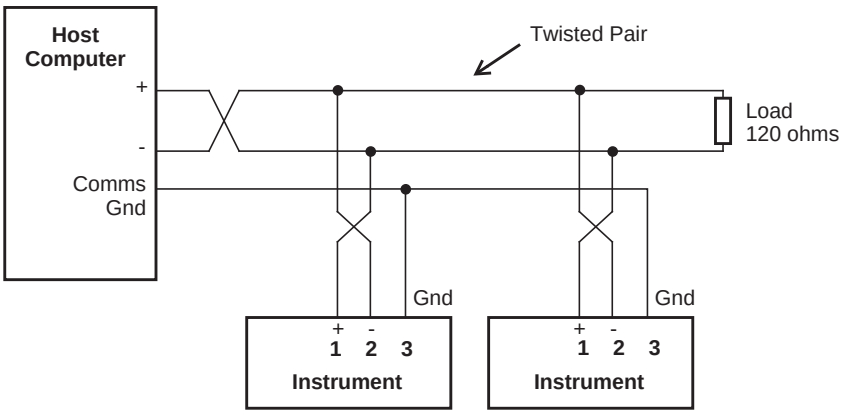



*Figure 9 RS-485 Interface Connections*

## Earthing and Shielding

It is a good practice to use shielded cable for all signal connections to the instrument. Care must be taken to separate signal cables from power cables to minimize interference.

Overall earth should be connected at the instrument end only. This connection should be as short as possible and connected to the earthing point on the rear terminal at pin 18.

# Chapter 4
# Operation

## Front Panel Operation

In normal operation, press the buttons on the front panel to control the operation of the batch controller or to display the values recorded and calculated by the instrument.

There are several categories of information that the instrument can display:

- Totals
- Rates
- Batch preset values
- Instrument settings

For each total, there is an associated rate as follows:

| Total | Rate |
|---|---|
| Volume | Volume Flowrate |

### Default Variable

In some applications, a particular variable is of more interest than others, and for this reason a default variable can be assigned during instrument calibration. The default variable is used in the following ways:

- Determines what the display returns to when the Stop key is pressed while viewing other items in the main menu list.
- Determines what the display returns to if the display timeout option is enabled and no buttons are pressed for the selected period (usually 30 seconds).
- Determines what is displayed on power up or exit of Calibrate mode.

### Status LEDs

The status LEDs illuminate to show the following conditions:


**Run** Solid led: The instrument has a batch in progress.
Fast flashing led: Batch paused.
Slow flashing led: Waiting for valves to close.
**Set** Solid led: The instrument is in Calibrate Set mode.
Flashing led: Count down to automatic restart of next batch.
**Alarm** The instrument has an error, as indicated on the display panel.
**Cal** The instrument is in Calibrate View mode.

## Front Panel Keys

**RUN** Press the **RUN** key to start or resume a batch. The run led will illuminate.

**STOP** Press the **STOP** key to halt a current batch. The instrument will go into pause mode and the run led will flash at a steady pace. The incomplete batch can be resumed or the **STOP** key can be held again to end the batch and the run led will turn off. The **STOP** key is also used to stop the next batch if in automatic restart count down, can be used to return the display directly to the default variable (total) when scrolling through the main menu items and can be used to acknowledge flow errors without resetting the total.

**RESET** Use the **RESET** key to step directly to the HOLD.SET - TO RESET prompt within the main menu items. Holding SET at this point will clear the batch totals or the DISPLAY key can be pressed to step onto the HOLD.SET - TO PRINT prompt if the printer option has been selected.

The instrument makes three beeps when it resets the totals and two beeps when a printout is started.

**DISPLAY** Press the DISPLAY key to step or scroll through the main menu items.

**BATCH** Hold the **BATCH** key to display the current batch preset value. Continue to hold for two seconds to enter edit mode for the preset if access is authorised. Pressing the **BATCH** key briefly displays the accumulated total.

## Main Menu Items

The main menu in this instrument consists of the following items. The DISPLAY key is used to step or scroll through the list. The full menu can only be viewed if the batch controller has been stopped and reset .

| DISPLAY ↓ | Description | Options |
|---|---|---|
| VOLUME | Volume | Hold the SET key to display (or edit) the batch preset or briefly press to view the accum total |
| FLOW | Volume flowrate | |
| TO RESET | | Hold the SET key to manually reset the current delivery (batch) total. |

| DISPLAY ↓ | Description | Options |
|---|---|---|
| TO PRINT | Only shown if print option is selected | Hold the SET key to manually print a delivery docket. |
| REPORT PRINT | Only shown if print option is selected | Hold the SET key to print log report as defined in the TM/LOG section of calibration. |
| LOGGED DATA | Only shown if real-time clock option is installed | Hold the SET key to display data logs as described in **Data Logs** on page 18. |
| MODEL INFO | | Hold the SET key to display the Model information as described in **Model Information** on page 19. |
| CAL MENU | | Hold the SET key to enter Calibration View mode as described in **Calibration View Mode** on page 23. |

## Setting the Batch Preset

SET The batch preset can only be set while the instrument is in the non-operational state, i.e. batch is complete or has been stopped and reset. Hold the SET key to display the current preset value while viewing the total variable. The display of the preset will change from view mode to edit mode after 2 seconds if access has been enabled in calibration. Once in edit mode the **Set** indicator will illuminate and the preset value can be changed in the same way as in calibration set mode, see **Changing Numeric Settings** on page 25. The SET key is used to exit edit mode.

### Limit on Batch Size

To prevent accidental entry of large batch quantities, a maximum batch limit can be programmed during calibration. The operator is then prevented from entering a batch quantity which exceeds this value.

### Common Preset Values

If the batching application continually uses a regular set of preset values then quick access can be provided to these. In calibration, there is the opportunity to enter up to 10 commonly used preset values.

These can then be accessed whilst in batch edit mode (described above) by pressing the DISPLAY key. The pre-programmed values will appear in the order they were entered in calibration. The display will step through the presets back to the currently entered value which can still be manually edited. While displaying the desired preset value, press the SET key to accept the value and exit edit mode.

## Data Logs

The instrument will log up to 100 deliveries (batches) if the real-time clock option is installed. The logs are taken at the end of each batch or upon reset if a batch has been aborted before the preset total has been reached. Each entry has a log number, a delivery number and a time and date stamp.

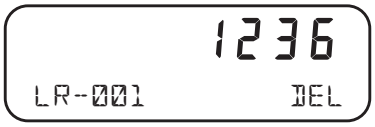
When the number of log entries exceeds 99 the oldest log entry is overwritten by the newest one.

### View Data Logs

Use the following procedure to view the data that has been logged by the instrument:

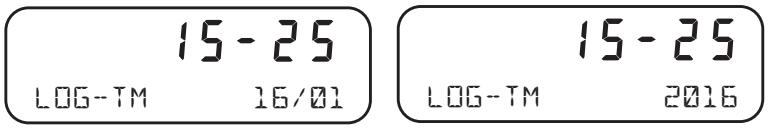
1. Press the DISPLAY key to scroll through the menu to the LOGGED DATA prompt.
2. Hold the SET key.

The system displays the most recent log record first. The log record number and corresponding delivery number are shown, for example LR-001 and DEL 1236.




3. Use the ▲ or ▼ keys to scroll to the delivery number or log record of interest.
4. Press the DISPLAY key to show the information stored in the selected log record. Each log record consists of:
   - time and date stamp,
   - error code
   - totals for the delivery.
5. While holding the DISPLAY key use the ▶ key to step through the stored information.
6. While holding the DISPLAY key use the RESET key to print the data for the displayed log if the printer option has been selected.

The following example shows the format of the time and date stamp at 15:25 (3:25 pm) on 16 January 2016. The day and month alternate with the year in the bottom right hand corner.




## Model Information

The model information items display the hardware, software and application versions of the instrument. This information is mainly for service personnel. Typical examples are shown below.

| DISPLAY ↓ | Description |
|---|---|
| 1-1--5-<br>505 MODEL | The hardware model information.<br>Refer to **Product Codes** on page 59 for full information. |
| F-<br>BC01 INPUT | The Application number and the assignment of the inputs. Refer to **Application Information Code** on page 60 for more information. |
| 0 10 1.002<br>BC01 VERS | The version of software loaded into the instrument. |
| 026357<br>CUSTOM VERS | The Customer version code for this installation. Refer to **Custom Version Codes** on page 60 for more information. |
| 123456<br>ABC123 S/N | The instrument serial number and unit tag. The serial number is on the top line and unit tag is on the bottom left. Both items are entered when the instrument application software is initially loaded. If the unit tag is not used the default tag, UNIT, will be used. |
| 16-15<br>EDITED 27/08 2016 | The time and date when the calibration of the instrument was last edited. The format of the time and date is the same as for the data logs. This example shows 16:15 (4:15pm) on the 27th August 2016.<br><br>This function is available only if the instrument has the real time clock option. |

Press SET at any time to exit from the Model information.

# Batch Operation

## Starting a Batch

The delivery (batch) will start when the **RUN** key is pressed. The RUN led will illuminate and the instrument will begin to totalise from zero or, if programmed for count down mode, the display will decrement from the preset quantity.

The batch controller's two relays can be used to control the delivery of product. These are energised and de-energised as described below.

## Stopping a Batch

The delivery (batch) can be stopped at any time by pressing the **STOP** key. Once the process has been interrupted in this way it can be continued (if the **STOP** key functionality is programmed to PAUSE) by pressing the **RUN** key or the batch can be stopped completely by holding the **STOP** key until the run led turns off.

When the process is in pause mode, the RUN led will flash to prompt the operator to restart or abort the batch.

## Resetting a Batch

The instrument can be programmed to reset by different means.

- After the end of a batch, the **RESET** key can be pressed to step directly to the HOLD.SET - TO RESET prompt in the main menu list. Holding the SET key at this point will reset the batch total. If the instrument is programmed to count down, the display will revert to the preset value. If it is programmed to count up, the batch total will clear to zero. The next batch cannot be started until the previous batch total has been reset.
- If Auto Reset is enabled in the parameters section of calibration, the batch total will automatically reset when the next delivery (batch) is started.

## Logic Input Control

This instrument allows for remote operation via the logic inputs on the rear terminals. The logic input have the following functions:

-

The Remote Stop input can also be used to reset the batch total by holding the logic input low for 2 seconds if the batch is already complete.

- Logic Input - Remote Run
- Signal Input - Remote Stop/Reset (inhibits remote Run)

For connection details, refer to **Logic Input Connection** on page 10.

## Batch Flow Errors

The instrument has the ability to raise an alarm when it detects a loss of flow, a quadrature input error, an unexpected/overflow or a leakage in the system.

- **No Flow Error** - The no flow condition is detected when the flow timeout expires during a delivery. There must not be a period of no flow greater than the timeout value during the delivery.
- **Unexpected/Over Flow Error** - The overflow condition is detected when the flow continues longer than the timeout period after the controller has attempted to stop (or pause) the flow.
- **Leakage Error** - The leakage condition is detected when an amount greater than the acceptable total is received without flow being initiated by the batch controller.

The point at which these errors are detected is dependant on the values programmed into the calibration parameters such as Batch Flow Timeout and Acceptable Total. The open collector outputs can be assigned to activate whenever one of the flow errors occur. Refer to **Instrument Settings** on page 28 for more details.

A ‘No Flow’ or ‘Unexpected/Over Flow’ error can be cleared by pressing the **STOP** key without resetting the totals. A paused batch may be restarted or the delivered total remain until a reset action is carried out.

If logging and/or printing is enabled, the highest priority Error/Exception that occurred during the batch will be included as part of the recorded data. Refer to **Error Messages** on page 42 for details on the order of priority.

## Batch Control Processes

The batch controller can be programmed to operate in various ways including:

- Manual Reset (manual start).
- Automatic Reset (manual start).
- Automatic Restart for continuous batches.

In each of the above modes and configurations the parameters can be programmed to determine the behaviour and timing of relays and output signals. The following figures provide examples of some batch operations. Refer to **Instrument Settings** on page 28 for more details.

## Manual and Automatic Reset

If Manual Reset the **RESET** key must be pressed at the end of the batch to clear the batch total. This must be done before another batch can be started. If Automatic Reset is programmed, a new batch is commenced each time the **RUN** key is pressed.

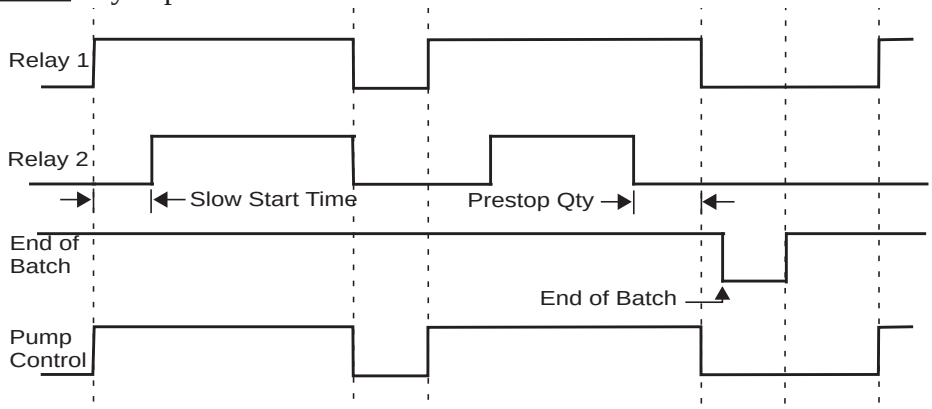



*Figure 10 Batch Operation with Manual or Automatic Reset*

## Automatic Restart

If Automatic Restart is enabled the next batch will commence automatically when the restart timer expires after the end of batch has occurred. The SET led will flash while the instrument is waiting to automatically restart.

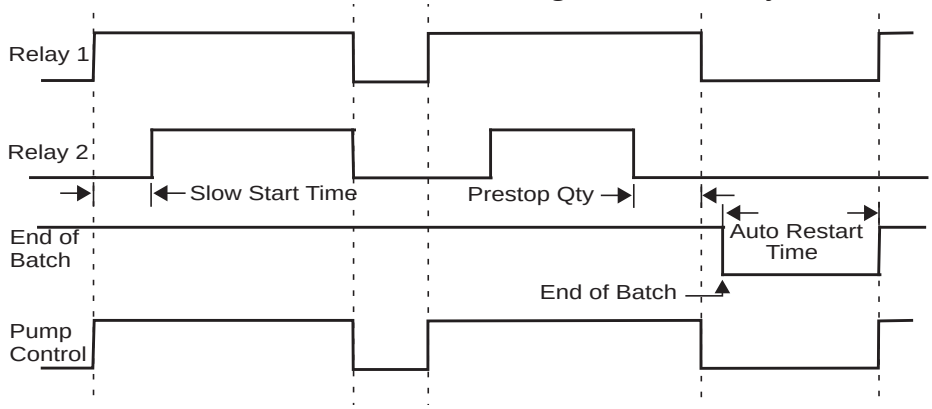



*Figure 11 Batch Operation with Automatic Restart*

# Chapter 5
# Instrument Calibration

## Introduction

You can view or change the settings of the instrument according to the access level for each parameter as set by the manufacturer. There are four levels of access to the parameters as follows:

- **Not visible** - you cannot display or edit the parameter.
- **Display Only** - you can display the parameter, but you cannot change the setting.
- **Programmable** - you can change the setting of the parameter in Calibration Set mode.
- **Password protected** - you can change the setting of the parameter in Calibration Set mode only if you enter the correct password.

**Note:** When you enter Calibration Set mode, the instrument requests you to enter a password. Any value will allow to change the settings of the "programmable" parameters, but the correct password must be entered to change the password-protected parameters.

## Calibration View Mode

Use the following procedure to view the calibration settings of the instrument:

**1.** Press DISPLAY to scroll to the CAL MENU prompt.

**2.** Hold the SET key.


The instrument beeps once, illuminates the **Cal** indicator and shows CAL on the display panel.

- Press ▶ to scroll through the flashing menu headings.
- Press SET to scroll through submenu items.
- Press DISPLAY to return to the main calibration menu.

**3.** To exit from the Calibration View mode, press ▶ to scroll to the END option and press SET.

The instrument returns to Normal Operation mode.

# Calibration Set Mode

In Calibration Set mode, you can change the settings of the “programmable” parameters. You must enter the system password to change the setting of the “password-protected” parameters.

Use the following procedure to enter Calibration Set mode:

**1.** Press DISPLAY to scroll to the CAL MENU prompt.

**2.** Hold the SET key.

Run
Set
Alarm
Cal

The instrument beeps once, illuminates the **Cal** indicator and shows CAL on the display panel.

**3.** Press ▶ to select any flashing menu heading except END.

**4.** Hold SET for two seconds.

The instrument requests a password.

**5.** Press ▲ or ▼ to change the value of the current digit. To select the next digit, press ▶.

**6.** Press SET to accept the password.

- The instrument makes two beeps for a correct password entry and enables you to change the “programmable” and “password-protected” parameters.
- The instrument makes one beep for an incorrect password entry and enables you to change only the “programmable” parameters.

Run
Set
Alarm
Cal

The instrument illuminates both the **Cal** and **Set** indicators.

**7.** Edit the instrument parameters as required. The programmable values are indicated by the flashing display.

- To change a numerical value, press ▲ to increase a value, or press ▼ to decrease a value. Press a key momentarily to change the value one number at a time. Hold a key to scroll through the numbers. To proceed to next digit, press ▶.
- To change an option setting, press ▲ or ▼ to scroll through the options.

**8.** Press SET to accept the currently displayed value and proceed to the next parameter. You can press DISPLAY to return to the main calibration menu.

**9.** To exit from Calibrate Set mode, press ▶ to scroll through the main calibration menu to END, then press SET. Otherwise, from any menu, you can press and hold SET for two seconds.

Run
Set
Alarm
Cal

The instrument makes two beeps and cancels the **Cal** and **Set** indicators.

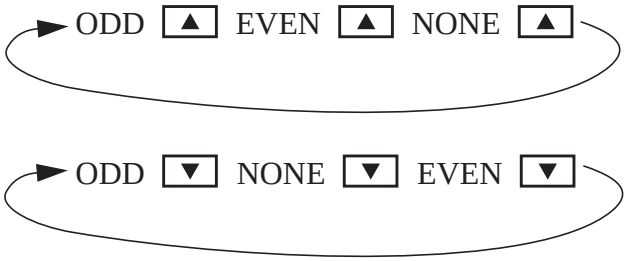
## Changing the Instrument Settings

In Calibration Set mode, the display flashes the item that can be changed. For option settings, the display flashes the complete option. For a numeric parameter, the display flashes one digit at a time, you can change the value of the flashing digit as required, then move the flashing cursor to change another digit.

**Note:** When you change the setting of a parameter, the instrument records the result as soon as you move to another parameter, or exit from the Calibration Set mode.

### Changing Option Settings

When you display an option that can be changed, the entire option flashes on the display, such as the choices of ODD, EVEN or NONE for the communications parity bit checking. Press ▲ or ▼ to change the option. You can "scroll" through the options in either direction to make a selection as shown below.




### Changing Numeric Settings

The display flashes the digit that can be changed.


Press ▶ to select the digit that you wish to change.

Press ▲ or ▼ to increase or decrease the value of the selected digit.

#### Changing the Decimal Point

To change the position of the decimal point, press ▶ to move the flashing selection until the decimal point flashes. Press ▲ or ▼ to move the decimal point to the right or left as required.

### Units of Measurement

The calibration of some parameters is based on the units that are defined for the relevant variables. These units of measurement can been viewed in the UNITS menu in calibration below.

# Calibration Menu Tree

Figure 12Figure 12 and Figure 13 show the keys for moving around the calibration menu tree in Calibration View or Set mode.

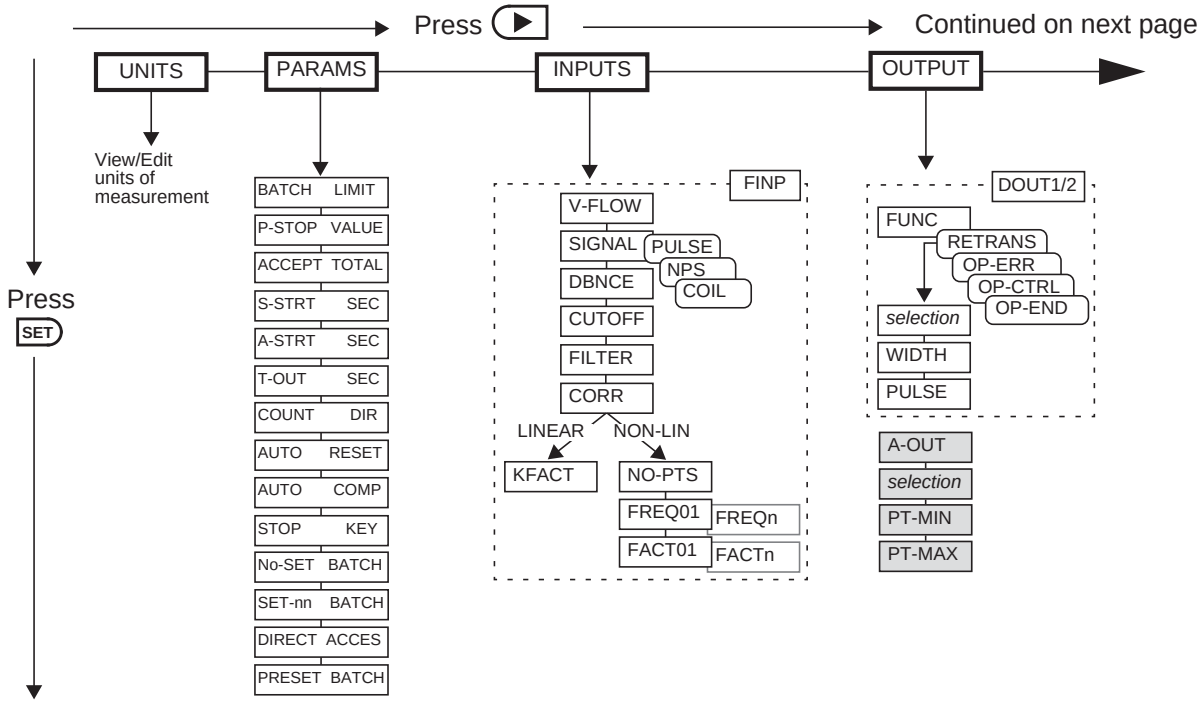
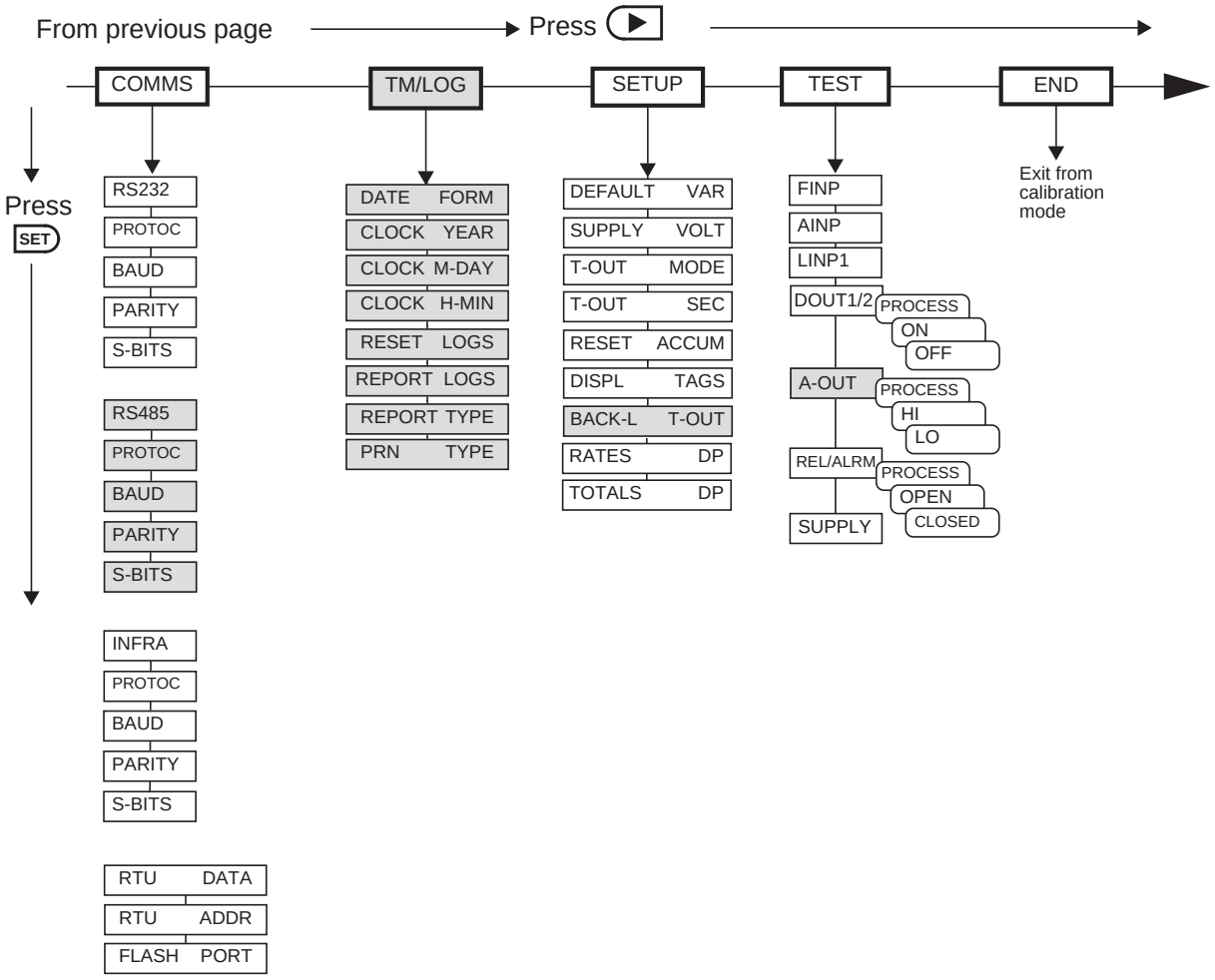



*Figure 12 Calibration Menu Tree Sheet 1*




The shaded boxes indicate advanced options

Press DISPLAY at any point to return to the main calibration menu.

Press ▶ at any I/O assignment position to move to the next I/O assignment in the submenu (eg pressing ▶ on ALRM1 will move you to ALRM2)

*Figure 13 Calibration Menu Tree Sheet 2*

# Instrument Settings

## Units of Measurement

The Units menu allows the units to be viewed and edited if necessary without the reloading of new application software. Any change in units will result in a full reset to initially downloaded settings. Therefore, any required changes to units of measurement should be made before changing any other settings.

| SET ↓ | ▶ → **UNITS** PARAMS INPUTS OUTPUTS COMMS TM/LOG SETUP TEST END |
|---|---|
| ITEM *n* *unit* | The units for main menu or calibration items can be viewed by pressing the SET key.<br><br>The units of measurement are password protected. To edit the units the correct password must be entered on entry to EDIT mode.<br><br>Press ▲ or ▼ to select the required units. Refer to **Available Units of Measurement** on page 62 for the list of available units. |
| ACCEPT UNITS | The Accept Units prompt will only appear if one or more of the units have been changed.<br><br>**IMPORTANT:** Accepting the change of units will initiate a master reset. All calibration parameters will revert to their default value (i.e. those values included in the downloaded instrument software). All totals and any logged information will be cleared.<br><br>Press ▲ or ▼ to select YES, then press the SET key. The instrument makes three beeps to confirm the reset command.<br><br>The message -RESET- PLEASE WAIT will be displayed as the instrument exits calibration mode and completes a full re-boot sequence. |

## Parameters

| SET ↓ | ▶ → UNITS **PARAMS** INPUTS OUTPUTS COMMS TM/LOG SETUP TEST END |
|---|---|
| BATCH LIMIT | The batch limit determines the maximum batch preset value that can be entered. If a value of zero is entered for this parameter then no limit is applied.<br><br>Enter the value in the engineering units of the batch preset. |
| P-STOP VALUE | The prestop value determines when relay 2 deactivates as the batch approaches the preset quantity.<br><br>Enter the value in the engineering units of the batch preset. |
| ACCEPT TOTAL | The batch acceptable total is the minimum total for the system leakage to be logged (a value of zero disables logging of leakages). It also allows small totals due to “meter skips” and vibration to be discarded without being considered as a valid delivery.<br><br>Enter the value in the engineering units of the batch preset. |
| S-STRT SEC | The batch slow start time determines when relay 2 activates after the start or resumption of a batch.<br><br>Enter the value in seconds. |
| A-STRT SEC | The batch automatic restart time determines the time that will elapse between the end of one batch and the start of the next. A value of zero disables the auto restart feature.<br><br>Enter the value in seconds. |
| T-OUT SEC | The batch flow timeout determines the length of no flow time that the instrument will wait during a batch before raising a no flow error. It also determines when an overflow error is raised if flow does not cease within the timeout period after the controller attempts to stop the flow. A value of zero disables these flow timeout features.<br><br>Enter the value in seconds. |
| COUNT DIR | The batch count direction determines whether the batch total counts up from zero to the preset value or down from the preset to zero.<br><br>Press ▲ or ▼ to select UP or DOWN. |

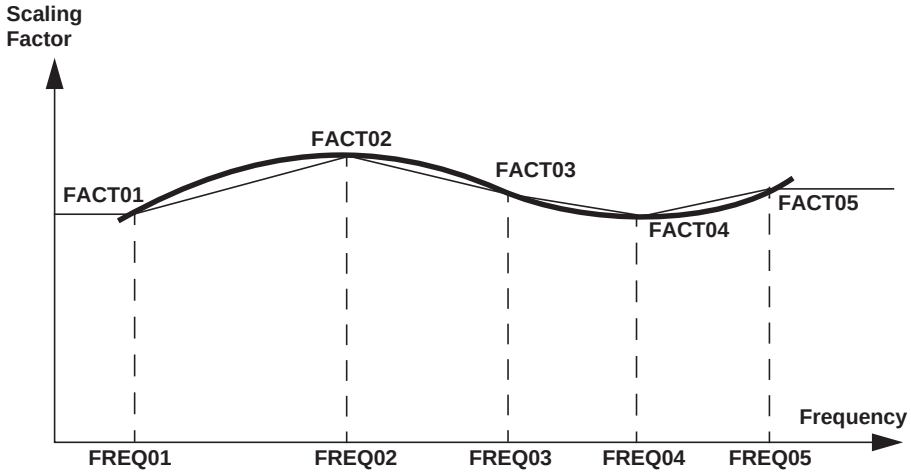
| SET ↓ | ▶ → UNITS **PARAMS** INPUTS OUTPUTS COMMS TM/LOG SETUP TEST END |
|---|---|
| AUTO RESET | *This parameter is available for viewing and editing only when the batch automatic restart time is set to zero.*<br><br>The automatic reset feature allows the previous batch total to be reset automatically when a new batch is started with the RUN key.<br><br>Press ▲ or ▼ to select ENABLE or DISABLE. |
| AUTO COMP | The batch automatic overrun compensation allows the instrument to automatically compensate for any consistent overrun at the end of the batch. Overrun is typically due to the slowness of a valve to close or a pump to stop on receiving a signal from the batch controller and results in the delivered quantity being greater than the entered preset.<br><br>In calculating the amount to be compensated for the instrument uses the average overrun from the last three batches. An overrun of more than 20% is considered invalid and will not be included in the calculations.<br><br>Press ▲ or ▼ to select ENABLE or DISABLE. |
| STOP KEY | The function of the Stop key can be set to either Pause or Stop the delivery.<br><br>Press ▲ or ▼ to select PAUSE or STOP. |
| No-SET BATCH | To provide faster access to commonly used preset values a number of batch presets can be preprogrammed into the instrument. This parameter allows the number of batch presets to be entered.<br><br>Press ▲ or ▼ to select a number between 1 and 10. |
| SET-01 BATCH<br>*to*<br>SET-*n* | Enter the commonly used preset values for quick access via the front panel.<br><br>Enter the value in the engineering units of the batch preset. |
| DIRECT ACCES | If the direct access is enabled then the operator is able to enter edit mode for the batch preset directly from the main menu by holding the SET key while viewing the preset. If disabled, the changes can only be made from within the calibration set mode (or via serial communications, see below). Select the direct access mode as required.<br><br>Press ▲ or ▼ to select ENABLE or DISABLE. |

| SET ↓ | ▶ → UNITS **PARAMS** INPUTS OUTPUTS COMMS TM/LOG SETUP TEST END |
|---|---|
| **Modbus Accessible Parameters**<br><br>The following PARAMS menu items are also accessible via Modbus communications. For a complete Modbus parameter listing, refer to **Instrument Configuration Parameters** on page 53. | |
| PRESET BATCH | Enter the batch preset quantity. This setpoint is only available for PRESET batch mode.<br><br>Enter the value in the engineering units of the assigned variable. |

## Inputs

| SET ↓ | ▶ → UNITS PARAMS **INPUTS** OUTPUTS COMMS TM/LOG SETUP TEST END |
|---|---|
| **Frequency Input** | |
| INPUT<br>PFLOW FINP | For this application, the Frequency Input Channel 1 is assigned to volume flowrate. |
| SIGNAL FINP | Frequency input signal type.<br><br>Press ▲ or ▼ to select COIL, NPS or PULSE. |
| DBNCE FINP | Switches and relays have metal contacts to make and break circuits. The contact bounce introduces random signals into the circuit. The instrument has a debounce circuit to eliminate this problem.<br><br>**Note:** When the debounce circuit is enabled, the maximum input frequency for large amplitude signals is limited to approximately 500 Hz. For low amplitude signals, the maximum frequency can be approximately 200 Hz.<br><br>Press ▲ or ▼ to select ENABLE or DISABLE. |
| CUTOFF FINP | The Cut-off is the lowest frequency for which the instrument continues to calculate a rate from the flowmeter.<br><br>The value for the cut-off is specified as the frequency of the flowmeter in Hertz.<br><br>Be careful when setting low cut-off values because the display update time for the flow rate becomes very long. For example if the cut-off is set to 0.01 Hz, and the measured flow stops, the instrument continues to display the flow rate for 100 seconds before it can determine that the flow has actually stopped. |

<table>
<tr><td>SET ↓</td><td>▶ → UNITS PARAMS INPUTS OUTPUTS COMMS TM/LOG SETUP TEST END</td></tr>
<tr><td>FILTER FINP</td><td>Input fluctuations caused by pulsating flow tend to create distortion in the input readings of the rate. The instrument has a digital filter that averages out these fluctuations.<br><br>As a guide to the degree of filtering to use, the following table shows the response time (in seconds) to reach 90% and 99% of a step change in input.<br><br>The value A is the filter constant that the user can set.
<table>
<tr><th>Filter setting A</th><th>Seconds to reach 90% of full swing</th><th>Seconds to reach 99% of full swing</th></tr>
<tr><td>0</td><td>0</td><td>0</td></tr>
<tr><td>2</td><td>2</td><td>4</td></tr>
<tr><td>4</td><td>4</td><td>8</td></tr>
<tr><td>6</td><td>5</td><td>10</td></tr>
<tr><td>10</td><td>8</td><td>15</td></tr>
<tr><td>15</td><td>12</td><td>23</td></tr>
<tr><td>20</td><td>14</td><td>27</td></tr>
<tr><td>25</td><td>18</td><td>34</td></tr>
<tr><td>35</td><td>25</td><td>48</td></tr>
<tr><td>45</td><td>32</td><td>62</td></tr>
<tr><td>60</td><td>42</td><td>82</td></tr>
<tr><td>75</td><td>52</td><td>102</td></tr>
<tr><td>90</td><td>62</td><td>122</td></tr>
<tr><td>99</td><td>68</td><td>134</td></tr>
</table>
The input filter range is from 0 to 99. A setting of 0 (zero) means that there is no filtering.</td></tr>
<tr><td>CORR FINP</td><td>If the input sensor has non-linear characteristics, select NON-LINEAR to apply correction factors to the input signal.<br><br>Use ▲ or ▼ to select LINEAR or NON-LINEAR.</td></tr>
<tr><td>KFACT unit</td><td>This parameter is available for viewing and editing only when the correction type is set to Linear.<br><br>The K-factor of the flowmeter is the number of pulses from the flowmeter per unit of volume (or mass). The K-factor cannot be 0 (zero).</td></tr>
</table>

| SET ↓ | ▶ → UNITS PARAMS **INPUTS** OUTPUTS COMMS TM/LOG SETUP TEST END |
|---|---|
| NO-PTS FINP | *This parameter is available for viewing and editing only when the correction type is set to Non-linear.*<br><br>Enter the number of non-linearity correction points.<br><br>Press ▲ or ▼ to select a number between 1 and 10 for the number of correction points. |
| FREQ01 FINP<br>*to*<br>FREQ*n* | *This parameter is available for viewing and editing only when the correction type is set to Non-linear.*<br><br>Enter the frequency for this correction point.<br><br>The instrument uses linear interpolation between the correction points except that the correction factor for FREQ01 is used from 0 Hz up to FREQ01. Similarly, the instrument maintains the correction factor for the highest frequency setting up to the maximum input frequency.<br><br>The following diagram shows the scaling factors at different frequencies for a hypothetical flowmeter. The heavy black line represents the actual scaling factor of the flowmeter. The light black line is the approximation that the instrument uses.<br>  <br><br><br>Enter the lowest correction factor frequency as FREQ01 and proceed up to the highest frequency. You can press the DISPLAY key to skip the non-linear points and go to the next item. |
| FACT01 FINP<br>*to*<br>FACT*n* | *This parameter is available for viewing and editing only when the correction type is set to Non-linear.*<br><br>Enter the scaling factor for this correction point in the same units of measure as the single K-factor above.<br><br>The correction factor cannot be 0 (zero). |

## Outputs

| SET ↓ | ▶ → UNITS PARAMS INPUTS **OUTPUTS** COMMS TM/LOG SETUP TEST END |
|---|---|
| FUNC OUT*n* | The digital output can function as either a pulse output for retransmission of totals, a no flow error signal, a pump control output or an end of batch signal.<br><br>Press ▲ or ▼ to select RETRANS, OP-ERR, OP-CTRL or OP-END |
| PULSE OUT*n* | *The Output Assignment and associated parameters are available for viewing and editing only when the Output Functionality has been set for retransmission.*<br><br>You can assign any of the "total" main menu variables to a pulse output.<br><br>Press ▲ or ▼ to select the variable that is required as an output. |
| WIDTH OUT*n* | Pulse output is usually used to drive remote counters. Set the pulse width (in milliseconds) as required by the remote counter.<br><br>Press ▲ or ▼ to set to: 10, 20, 50, 100, 200 or 500 ms. |
| PULSE OUT*n* | The Output Pulse Factor is the scaling factor for the retransmission of the measured total quantity.<br><br>For example, if "volume" is chosen as an output variable and engineering unit is cubic metres, then a pulse factor of 1.000 generates one pulse for $1 m^3$. Similarly, a pulse factor of 3.000 generates one pulse for $3 m^3$.<br><br>For more information, see **Output Pulse Factor** on page 35.<br><br>The output pulse factor cannot be 0 (zero). |
| 4-20 A-OUT | You can assign any of the "rate" main menu variables to the 4-20 mA output.<br><br>Press ▲ or ▼ to select the variable that is required as an output. |

| SET ↓ | ▶ → UNITS PARAMS INPUTS **OUTPUTS** COMMS TM/LOG SETUP TEST END |
|---|---|
| PT-MIN A-OUT<br>PT-MAX A-OUT | The output minimum value corresponds to the 4 mA point and the output maximum value corresponds to the 20 mA point.<br><br>Setting the output range differently from the input range enables the instrument to amplify the input signal. You can drive a chart recorder that "zooms in" on a specified range of values instead of displaying the full operating range of the transducer.<br><br>For example, if "volume flow" is chosen as an output variable and engineering unit is cubic metres per minute, then setting the minimum point to 30 and the maximum point to 100 would reflect the volumetric flow rate range of 30 to 100 $m^3$/min. At rates above the maximum and below the minimum points, the output remains at 20 mA and 4 mA respectively. |

### Output Pulse Factor

Increasing the output pulse width reduces the maximum frequency at which a total variable can be retransmitted. Pulses will be missed if the output cannot "keep up" with the rate of total counts. You can use the output pulse factor to ensure that this maximum is not reached.

The maximum pulse output frequency is determined by:

$$\frac{1000}{(2 \times \text{pulse width in ms})}\text{Hz}$$

The minimum pulse factor required is determined by:

$$\frac{\text{max rate of total}}{\text{max pulse output frequency}}$$

For example: To calculate the required pulse factor to avoid losing counts in retransmission if a total counts at a maximum rate of 75 units/sec (Hz) and the required pulse width of a remote counter is at least 50 ms:

The maximum pulse output frequency is: $\frac{1000}{2 \times 50} = 10\text{Hz}$

The minimum pulse factor for that frequency is: $\frac{75}{10} = 7.5$

## Communications

The instrument has three communication ports:

- **RS-232 Port** - Three terminals on the rear of the instrument. There is also an optional 9-pin female connector on the rear panel of the instrument.
- **RS-485 Port** - Terminals on the rear panel.
- **Infra-red Port** (optional) - Discontinued - Although program settings may be visible in calibration, the required hardware is no longer available. The Infra-red protocol assignment (PROTOC INFRA) should be set to NONE and the remaining INFRA settings can be ignored.

| SET ↓ | ▶ → UNITS PARAMS INPUTS OUPUTS **COMMS** TM/LOG SETUP TEST END |
|---|---|
| PROTOC RS232<br>RS485<br>INFRA | The Communications Protocols can be assigned to the communication ports as follows (a protocol cannot be assigned to more than one port at a time):<br>• **RTU** - Modbus RTU available for all ports<br>• **PRN** - Printer Protocol available for RS232 and RS485<br>• **NONE** - If a port is not being used, set the protocol to NONE.<br><br>Printer Protocol (PRN) is only available if the option with Real Time Clock is installed.<br><br>For the selected port, press ▲ or ▼ to select the desired protocol. |
| BAUD RS232<br>RS485<br>INFRA | The Baud setting is the speed of the communication port in data bits per second.<br><br>The baud rate of the instrument must match the baud rate of the communication device that the instrument is connected to.<br><br>Use ▲ or ▼ to select 2400, 4800, 9600 or 19200 baud. |
| PARITY RS232<br>RS485<br>INFRA | The Parity bit helps to detect data corruption that might occur during transmission.<br><br>The parity bit setting of the instrument must match the parity bit setting of the communication device that the instrument is connected to.<br><br>Press ▲ or ▼ to select EVEN, ODD, or NONE. |
| S-BITS RS232<br>RS485<br>INFRA | The Stop bit indicates the end of a transmission. Stop bits can be 1 or 2 bit periods in length. The stop bit setting of the instrument must match the stop bit setting of the communication device that the instrument is connected to.<br><br>Press ▲ or ▼ to select 1 or 2 stop bits. |

| SET ↓ | ▶ → UNITS PARAMS INPUTS OUPUTS **COMMS** TM/LOG SETUP TEST END |
|---|---|
| RTU DATA | The Modbus RTU data format for the 2-register (4-byte) values can be set as either floating point or long integer values.<br><br>Use ▲ or ▼ to select FLOAT or INTEGER. |
| RTU ADDR | The Modbus RTU protocol address must be in the range of 1 to 247. When multiple instruments (slaves) are connected to one communication device (master), each assigned address must be unique.<br><br>**Note:** The master device uses the RTU address 0 (zero) for broadcasting to all connected slave units. |
| FLASH PORT | The Flash Driver Port assignment defines the communication port for downloading software into the instrument.<br><br>The default setting of this assignment is the RS-232 port.<br><br>Press ▲ or ▼ to select RS-232, RS-485, or INFRA. |

## Time Settings and Data Logging

### Instrument Clock

**Note:** The real-time clock is part of the advanced option package.

The instrument has a real-time clock for recording logged events. The clock displays the time and the date. The date format can be set to European format (day/month/year) or American format (month/day/year). The time clock uses the 24-hour format.

The clock will continue to operate for up to 5 years (typically) on the internal battery if there is no power connected to the instrument. Therefore, after an interruption to the power supply, the instrument recommences normal operation although there will be no data recorded during the period without a power supply.

**Note:** If there is an interruption to the power supply and the battery has failed, the instrument displays an error message when the power supply is restored. In this case, you should set the current time and date so that the instrument continues to log data at the correct times.

### Data Logging

The instrument will log a total of 100 deliveries (batches) if the real-time clock option is installed. The logs are taken at the end of each batch or upon reset if a batch has been aborted before the preset total has been reached.

| SET ↓ | ▶ → UNITS PARAMS INPUTS OUPUTS COMMS **TM/LOG** SETUP TEST END |
|---|---|
| DATE FORM | Clock Date Format<br><br>The European date format is: dd/mm/yyyy or (Day-Month).<br><br>The American date format is: mm/dd/yyyy or (Month-Day).<br><br>Press ▲ or ▼ to select DAY-M or M-DAY |
| CLOCK YEAR | The Clock Year defines the current year for the real-time clock. |
| CLOCK M-DAY | The Clock M-DAY setting defines the current month and date for the real-time clock. This parameter is programmed in Month-Day format for both European and American date formats. |
| CLOCK H-MIN | The Clock H-MIN setting is the current time in hours and minutes for the real-time clock. |
| RESET LOGS | Reset the logged data. You may need to reset (clear) the logged data if you change the time/log settings.<br><br>Press ▲ or ▼ to select YES, then press the SET key. The instrument makes three beeps to confirm the reset command. |
| REPORT LOGS | The Printer Protocol Report Logs defines the number of latest logs to be included into a printable report.<br><br>Enter the number of logs between 0 and 99. |
| REPORT TYPE | The Printer Protocol Report Type determines the nature of the printout from the REPORT PRINT - HOLD.SET prompt in the main menu. The following report types available in this instrument are:<br>• REP-10 Preset number of latest logs<br><br>Press ▲ or ▼ to select Report Type. |
| PRN TYPE | The Printer Protocol Printer Type allows the nature of the printer being used to be specified. The following printer types available in this instrument are:<br>• PRN-01 Generic computer printer<br>• PRN-02 Generic roll printer (prints first line first)<br>• PRN-03 Slip printer TM295<br><br>Press ▲ or ▼ to select Printer Type. |

## General Setup Parameters

| SET ↓ | ▶ → UNITS PARAMS INPUTS OUPUTS COMMS TM/LOG **SETUP** TEST END |
|---|---|
| DEFAULT VAR | Select the main menu variable to display on power up or when the display timeout period has elapsed if it is enabled.<br><br>Press ▲ or ▼ to select the default variable display. |
| SUPPLY VOLT | The instrument provides a power-limited supply for external transducers.<br><br>Press ▲ or ▼ to set the transducer supply voltage between 8 and 24 volts DC as required. |
| T-OUT MODE | If the Display Timeout mode is enabled, and there is no user activity for the defined timeout period, the display panel returns to the default display.<br><br>This function is useful for the following reasons:<br>• to return the display to a preferred variable after the user has finished reading other information,<br>• to cancel the calibration mode and return to the default display if the user does not exit from the calibration mode for any reason.<br><br>Press ▲ or ▼ to select the display timeout function as follows:<br>• **DISABLE** - Timeout is completely disabled.<br>• **EN DISP** - Timeout is enabled during Normal mode and Calibration View mode.<br>• **EN EDIT** - Timeout is enabled during Calibration Set mode.<br>• **EN ALL** - Timeout is enabled for all modes. |
| T-OUT SEC | The Display Timeout period defines the delay for the Display Timeout mode if it is enabled.<br><br>The display timeout period can be from 10 to 99 seconds. |
| RESET ACCUM | The Reset Accumulated Totals function clears all of the accumulated totals and the non-accumulated totals.<br><br>Press ▲ or ▼ to select YES, then press the SET key. The instrument makes three beeps to confirm the reset command. |

| SET ↓ | ▶ → UNITS PARAMS INPUTS OUPUTS COMMS TM/LOG **SETUP** TEST END |
|---|---|
| DISPL TAGS | The Display Tags option determines whether the instrument displays the default display tags or the user-defined tags. The display tag setting also defines whether the instrument displays the default error and warning messages, or the user-defined messages.<br><br>**Note:** The user-defined tags can be entered into the instrument only by the manufacturer or the distributor.<br><br>Press ▲ or ▼ to select the Display Tags option as follows:<br>• **DEFAULT** - the instrument displays the default (English) tags<br>• **USER** - the instrument displays the user-defined tags. |
| BACK-L T-OUT | If the backlight timeout is enabled, and there is no user activity (any keys pressed) for a period of 10 seconds, the display backlight switches off to save power. The backlight switches on when a key is pressed. Select the backlight timeout mode as required.<br><br>Press ▲ or ▼ to select ENABLE or DISABLE. |
| RATES DP | This parameter sets the maximum number of decimal places for displaying or printing main menu rates. |
| TOTALS DP | This parameter sets the maximum number of decimal places for displaying or printing main menu totals. |

## Test Menu

The Test menu enables you to view the inputs and outputs to and from the instrument.

In Calibration Set mode, (by entering the system password) you can control the outputs and the alarms as described in the table below.

| SET ↓ | ▶ → UNITS PARAMS INPUTS OUPUTS COMMS TM/LOG SETUP **TEST** END |
|---|---|
| FINP Hz | The frequency of the input to FINP is displayed in Hertz. |
| AINP mA | The current of the signal input to AINP is displayed in milliamps. |
| LINP*n* STATE | You can view the state of the logic input. If the input is an open contact or inactive it will display **HI**. If the input is a closed contact or active it will display **LO**. |

| SET ↓ | ▶ → UNITS PARAMS INPUTS OUPUTS COMMS TM/LOG SETUP **TEST** END |
|---|---|
| OUT*n* STATE | You can control the state of the outputs. Press the ▲ or ▼ keys to set the output state as follows:<br>• **PROCESS** - the output depends on the current values of the inputs and the calculations that the instrument performs.<br>• **ON** - the output is a pulse train with a pulse width as set for the particular output in the Outputs menu.<br>• **OFF** - no output. |
| A-OUT STATE | You can control the state of the outputs. Press the ▲ or ▼ keys to set the output state as follows:<br>• **PROCESS** - the output depends on the current values of the inputs and the calculations that the instrument performs.<br>• **HI** - the output is set to 20mA.<br>• **LO** - the output is set to 4mA. |
| ALRM*n* STATE<br>*or*<br>REL-*n* | You can control the state of the relays (alarms). Press the ▲ or ▼ keys to set the selected relay as follows:<br>• **PROCESS** - the relay operates according to the current values of the inputs and the relay settings as programmed.<br>• **OPEN** - the relay output contacts are set to “open”.<br>• **CLOSED** - the relay output contacts are set to “closed”. |
| SUPPLY V | You can display the actual DC output supply voltage, which may help with troubleshooting.<br><br>If the actual supply voltage is lower than the preset value (refer to **General Setup Parameters** on page 39) it may indicate that the output is overloaded. |

# System Messages

The instrument displays messages for defined events and fault conditions.

The manufacturer or distributor can enter user-defined text for the messages. This user-defined text is displayed, instead of the default (English) messages, when the Display Tags option in the Setup menu is set to USER.

## Error Messages

The system displays error messages, and records the associated exception status code, in the order of highest to lowest priority as listed in the following table:

| **Error Messages** | **Status Code** | **Description -** (Highest Priority at top of table). |
|---|---|---|
| CPU Card Failure | 20 | There are failed components on the CPU card and technical support is required. |
| Power Supply is Low | 21 | The input and/or output power supply voltage is too low, ensure that:<br>(a) input power supply voltage is within the specified range<br>(b) output power supply is not overloaded. |
| New/Failed Battery - Set Time | 22 | The real-time clock has lost the correct time because the battery has failed, or there is a new battery. Set the current time and date (in the TM/LOG menu) to clear the error message and to continue data logging at the correct times.<br><br>**Note:** The instrument can continue operating with a failed battery, but the correct time will be lost if there are interruptions to the power supply. |
| No Flow Detected | 12 | The no flow condition is detected when the flow timeout expires during a delivery. There must not be a period of no flow greater than the timeout value during the delivery. |
| Unexpected/ Over Flow | 13 | The unexpected/over flow condition is detected when the flow continues longer than the timeout period after the controller has attempted to stop (or pause) the flow. |
| Leakage Detected | 14 | The leakage condition is detected when an amount greater than the acceptable total is received without flow being initiated by the batch controller. |

## Warning Messages

The system displays warning messages as described in the following table:

| **Warning Messages** | **Description** |
|---|---|
| Value Has Been Set to Default | You have entered an invalid value for a parameter. Therefore, the instrument has set the default value. |

| Warning Messages | Description |
|---|---|
| Already Assigned to Other Port | You have tried to assign a particular protocol type to more than one serial communication port. The instrument has set the protocol to NONE. |
| Preset Over Limit - Max Set | You have exceeded the preset limit. The instrument will set the maximum allowed value. |

# Chapter 6
# Communications

## Overview

This chapter describes the communications between the instrument and another communicating device such as a computer or a printer. You should have relevant information about the devices to which the instrument will be connected. Some connection examples are included in this manual, however, the operation and connection of other devices is outside the scope of this manual.

### Hardware Interconnection

The instrument has two communication ports:

- RS-232 port on the rear panel (plus extra DB9 female connector)
- RS-485 port on the rear panel

The appropriate interface and protocols are selected during calibration.

#### RS-232 Port

The RS-232 port provides communication between the instrument and one other device such as a host computer or a printer.

**Note:** A printer must have a serial port to be able to be directly connected to the flow computer. It is not possible to communicate directly with a printer via a parallel port.

Computers use either a DB9 or a DB25 connector, and the connections to each type are shown in Figure 14.

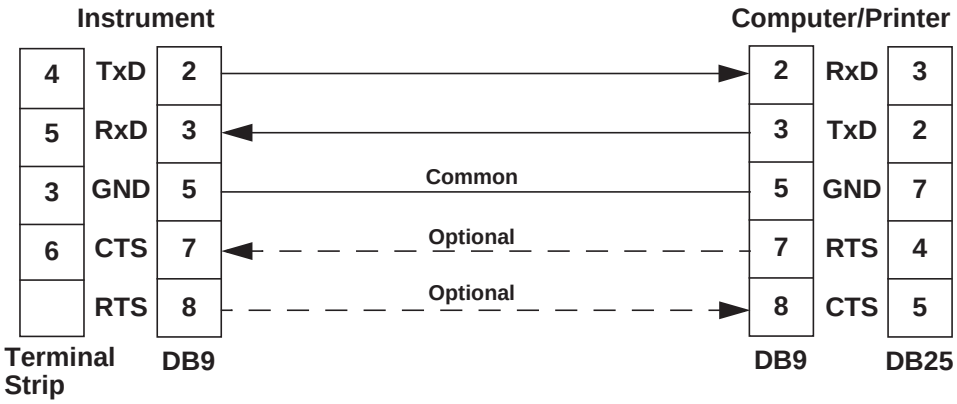



*Figure 14 RS-232 Cable Connections to a Computer*

**Note:** The instrument requires a cable with straight-through connections. Do not use a null modem cable for RS-232 connection to a computer.

## RS-485 Port

The RS-485 port enables communication with multiple devices. Each device has a unique address so that the “master” device can communicate with specific “slave” devices.

On RS-485 links, an external terminating resistor must be connected at the furthest end of the cable. When multiple instruments are connected, they should be “daisy chained” in a multidrop configuration as shown in Figure 15. Up to 32 units can be connected to the interface at a maximum distance of 1200 metres.

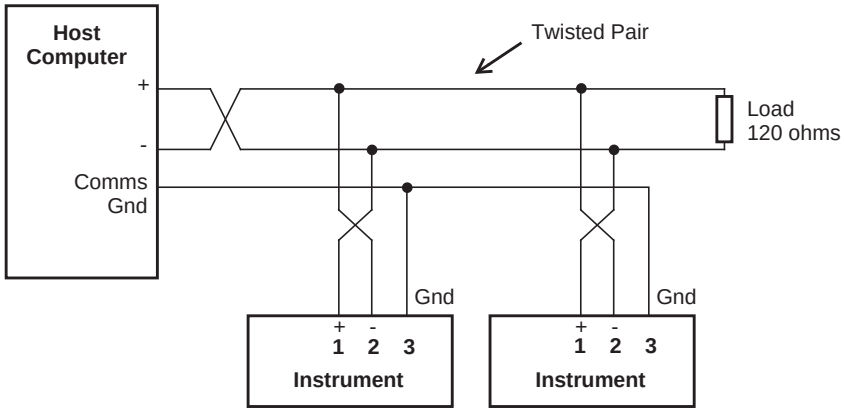



*Figure 15 RS-485 Connections*

# Protocols

The communications protocols can be assigned to the communication ports on the instrument as follows:

- **RTU** - Modbus RTU available for all ports
- **PRN** - Printer Protocol available for RS232 and RS485
- **NONE** - If a port is not being used, set the protocol to NONE.

**Note:** The Printer Protocol is only available if the option with Real Time Clock is installed. Also a protocol cannot be assigned to more than one port at a time as described in **Communications** on page 36.

- **Modbus RTU** - Modbus RTU is an industry-standard protocol which allows the instrument to be easily connected to computers running supervisory software systems.
- **Printer** - In the Printer protocol there is a selection of printer types. Please refer to the **Printer Protocol** on page 54 for full details.

# Modbus RTU Protocol

Modbus RTU (remote terminal unit) is an industry standard protocol that allows the instrument to be easily interfaced to other communication devices.

The instrument implements the Modbus protocol as detailed in the *Modicon Modbus Protocol Reference Guide* PI-MBUS-300 Rev J (June 1996).

## Message Format

In RTU mode, messages start with a silent interval of at least 3.5 character times. The first field transmitted is the device address. Following the last transmitted character, a similar interval of at least 3.5 character times marks the end of the message. A new message can begin after this interval. The entire message frame must be transmitted as a continuous stream. A typical message frame is shown below:

| Address | Function | Data | CRC Check |
|---|---|---|---|
| 1 byte | 1 byte | n bytes | 2 bytes |

Except for broadcast messages, when a master device sends a query to a slave device, it expects a normal response. One of four possible events can occur from the master's query:

- If the slave device receives the query without a communication error, and can handle the query normally, it returns a normal response.

- If the slave does not receive the query due to a communication error, no response is returned. The master program has to process a timeout condition for the query.
- If the slave receives the query, but detects a communications error (parity or CRC), no response is returned. The master program has to process a timeout condition for the query.
- If the slave receives the query without a communication error, but cannot handle it (for example, if the request is to read a nonexistent register), the slave will return an exception response informing the master of the nature of the error.

### Instrument Address

The address of the instrument is programmable in the range from 1 to 247. Some addresses are reserved according to PI-MBUS-300 and have a special meaning:

- 0 = Broadcast, no response required from slave devices
- 248 to 255 Reserved

### Function Codes

The instrument accepts the following function codes:

| Code | Name | Description |
|---|---|---|
| 03 | Read data register(s) | Obtain the content of one or more 2-byte data registers. |
| 06 | Preset data register | Preset one 2-byte data register. |
| 07 | Read status register | Obtain the content of 1-byte status register. |
| 16 | Preset data register(s) | Preset one or more 2-byte data registers. |

### Exception Response

The instrument forms an exception response by adding 80H to the function code and using an exception code as the 1-byte data field in the returned frame. Implemented exception codes are as follows:

| Code | Name | Description |
|---|---|---|
| 01 | Illegal function | The function code is not a legal action for the slave. |
| 02 | Illegal data address | The data address is not a legal address for the slave. |
| 03 | Illegal data value | The data value is not a legal value for the slave. |
| 05 | Acknowledge | The slave has accepted the request and is processing it, but a long duration of time will be required to do so. |
| 06 | Slave device busy | The slave is engaged in processing a long duration program command. The master should re-transmit the message later when the slave is free. |

## List of Data Registers

The following list describes the addresses and meaning of the data registers in the instrument. The data values are expressed in the engineering units that were selected for the variables when the instrument settings were configured. The “Data Type” for the 2-register (4-byte) data values can be set in programming mode as Floating Point or Long Integer as described in **Communications** on page 36.

The registers are grouped in blocks that relate to a particular function of the instrument.

**Note:** Conventional numbering of registers often starts from 1, therefore be aware that “register 1” in this case has “address 0” and so on.

### Current and Logged Process Data

This block of registers is available for the retrieval of current or logged process data with its matching time and date information.

Use the log timebase and log number to retrieve the logged information from the appropriate register. If a particular log number does not exist, or the instrument does not have the optional real-time clock, the time and date stamp and associated variables are set to zero.

| Register | Name | Comments | Read Only or Read/Write | Type |
|---|---|---|---|---|
| 1 | Volume | Process Variables<br><br>By default totals are the Accumulated values. If current Non-accumulated (resettable) totals are required, set register 37 to 06. | R | DT* |
| 3 | Flowrate | | R | DT |
| 5 | | | R | DT |
| 7 | | | R | DT |
| 9 | | | R | DT |
| 11 | | | R | DT |
| 13 | | | R | DT |
| 15 | | | R | DT |
| 17 | | | R | DT |
| 19 | | | R | DT |
| 21 | | | R | DT |
| 23 | | | R | DT |
| 25 | | | R | DT |
| 27 | | | R | DT |
| 29 | | | R | DT |
| 31 | Year | Current Date/Time or<br>Logged Date/Time Stamp<br>(see register 38 Log Number).<br>Only current Date/Time can be edited | R/W | I† |
| 32 | Month | | R/W | I |
| 33 | Date | | R/W | I |
| 34 | Hour | | R/W | I |
| 35 | Minute | | R/W | I |
| 36 | Second | | R | I |
| 37 | Log Type | 00 - hourly or log records<br>01 - daily<br>02 - weekly<br>03 - monthly<br>04 - yearly<br>05 - last edit of calibration<br>06 -current totals are non-accumulated values, register 38 is ignored. | R/W | I |
| 38 | Log Number | If set to 0, current variables and Date/Time are retrieved | R/W | I |
| 39 | Clear Data | 01 - clear logs<br>02 - clear accumulated totals<br>03 - clear non-accumulated totals | W | I |
| 40 | Reserved | | | |

* DT = Data Type of 2-register (4 byte) values can be set as Floating Point or Long Integer values

† I = Integer (2 bytes) (Holding Registers)

**Note:** The Floating Point variable is represented in IEEE-754 Floating Point 4-byte format and requires two 2-byte data registers:

| IEEE-754 | Modicon Registers |
|---|---|
| 1st byte | low byte (register X) |
| 2nd byte | high byte (register X) |
| 3rd byte | low byte (register X+1) |
| 4th byte | high byte (register X+1) |

This means that two data registers must be read or written to obtain, or preset, one data value.

### Instrument Exception Status

This register is available to verify the status of the instrument.

| Register | Name | Comments | Read Only or Read/Write | Type |
|---|---|---|---|---|
| 41 | Exception Status | 00 = no error<br>01 = analog input 1 failure<br>02 = analog input 2 failure<br>03 = analog input 3 failure<br>04 = analog input 4 failure<br>05 = invalid calibration parameter<br>06 = invalid reference parameter<br>07 = invalid property<br>08 = quadrature input error<br>09 = quadrature input frequency over limit<br>10 = process parameters out of range<br>11 = input is over limit<br>12 = no flow error detected<br>13 = overflow error detected<br>14 = leakage error detected<br>20 = system failure<br>21 = power supply is low<br>22 = new or failed clock battery<br>23 to 29 reserved<br>30 = alarm 1 active<br>31 = alarm 2 active<br>32 = alarm 3 active<br>33 = alarm 4 active | R | I* |

* I = Integer (2 bytes) (Holding Registers)

### Instrument Control and I/O

This block of registers is available in some applications to give access to important information in the instrument.

| Register | Name | Comments | Read Only or Read/Write | Type |
|---|---|---|---|---|
| 42 | Reserved | | R | I* |
| 43 | Reserved | | | |

| Register | Name | Comments | Read Only or Read/Write | Type |
|---|---|---|---|---|
| 44 | Operation State | Representation of operation status<br><br>0 = Reset<br>1 = Maintenance<br>2 = Completed<br>3 = Waiting to restart<br>4 = Paused<br>5 = Waiting for timeout<br>6 = Running (Slow Start)<br>7 = Running (Prestop)<br>8 = Running (Full Flow) | R | I |
| 45 to 47 | Reserved | | | |
| 48 | Delivery Number | Provides the delivery number (batch record) for a stored transaction (determined by Modbus register 38). | R | L† |
| 50 | Control Mode | 0 = Idle/Local Control from logic inputs<br>1 = Stop Suspend current batch<br>2 = Run Resume/start batch<br>3 = Reset Clear current batch totals | R/W | I |
| 51 to 99 | Instrument Parameters | See next table for details. | R/W | DT‡ |
| 101 | Analog Input | The input is configured for 4-20mA.<br>The value will be read in Amperes. | R | DT |

* I = Integer (2 bytes) (Holding Registers)

† L = Long Integer (2 register = 4 bytes)

‡ DT = Data Type of 2-register (4 byte) values can be set as Floating Point or Long Integer values

### Instrument Configuration Parameters

This block of registers is available in applications to give access to some important instrument parameters (i.e. fluid properties etc.).

The usage of these parameters can be dependent on other instrument settings. For full description, please refer to the **Modbus Accessible Parameters** on page 31.

| Register | Name | Comments | Read Only or Read/Write | Type |
|---|---|---|---|---|
| 51 | Batch Preset Value | | R/W | DT |
| 53 to 99 | Reserved | | R/W | DT |

# Printer Protocol

A printer protocol is available in the 500 Series. It provides the ability to print out live data, individual logged data and to do some report-style printing of logged data. The method of printing these and the format of the printouts is described below.

**Note:** Printer output is only available if the Real Time Clock option is fitted.

The selection of Printer Protocol can be made for the Communications Protocol options for the RS232 or RS485 port. A list of log report types and printer types available at the end of the TM-LOG calibration menu.

### Report Types

The list of report types is as follows:

- REP-10 Latest Logs Report

The number of logs printed in each report are determined by the values programmed for Report Logs in the TM-LOG menu.

### Printer Types

The list of available printers is as follows:

- PRN-01 Generic computer printer
- PRN-02 Generic roll printer (printing first line first)
- PRN-03 Slip Printer TM295

### Customizing a Printout

A customized printout can be provided which can have up to 4 header lines and 3 footer lines. It is also possible to include or exclude each main menu items on the printout. If any customizing of the printout is required discuss this with the distributor.

## Types of Printouts

### Live Data

The HOLD.SET - TO PRINT prompt in the main menu, is used to initiate a printout of the current delivery if the printer protocol has been selected. A printout can only be initiated if a batch is not in progress. If printing is not required, do not select printer protocol.

The format of this printout will be:

*Custom Header Line 1*
*Custom Header Line 2*
*Custom Header Line 3*
*Custom Header Line 4*

*Instrument Serial No. & Tag*

*Current Delivery No.*
*Current Date & Time & Status*
*Variable unit value*
*Variable unit value*
*etc.*

*Custom Footer Line 1*
*Custom Footer Line 2*
*Custom Footer Line 3*
---------- *<separation line>*

(Note that blank header and footer lines are not printed).

**Instrument Serial Number and Unit Tag**

The instrument serial number and unit tag is the same as the information shown in the Model Info menu. For more details refer to **Model Information** on page 19

**Delivery Number**

The delivery number that appears on the live data printout shows the assigned delivery number that is stored with the logged data. This number is cleared when the Logs are cleared in the TM/LOG menu. If a second print or docket of the same delivery is generated, the words “(DUPLICATE DOCKET)” are included at the top of the printout. i.e.

*(DUPLICATE DOCKET)*

*####*

*DELIVERY No. 000256*

## Individual Log Data

When in the Log Menu and while holding the DISPLAY key to view the data of the log of interest, the RESET key can be pressed to initiate a printout of that log entry. The printout will have the time and date stamp corresponding to when the log was taken. After the print has been initiated there will be the opportunity to scroll to view another log entry and print again.

Since each log entry stores the delivery totals only, the printout will not have any accumulated totals. The format of the printout with this exception is the same as the LIVE DATA printout:

*Custom Header Lines*

*Instrument Serial No. & Tag*

*Logged Delivery No.* *number*
*Date & Time & Status*
*Variable* *unit* *value*
*Variable* *unit* *value*
*etc.*

*Custom Footer Lines*
---------- *<separation line>*

## Log Report Printing

As there is the likelihood that the reports can be of a considerable length it is strongly recommended that only the 80 Column printer with Z fold (tractor feed) paper be used. This is just as much for the memory storage of printer as it is for the reliable paper supply.

There is a HOLD.SET REPORT PRINT prompt under the main menu with the ability to print the pre-selected type of report. Pressing and holding the SET key for two seconds will initiate the printout. Any of the Log Reports will have the following format:

*Custom Header Lines*

*Title of Report* *<internally set, indicates report type>*

*Current Date & Time*
*Instrument Serial No. & Tag*

---------- *<separation line>*
*Delivery No.*
*Date & Time & Status*
*Variable* *unit* *value*
*Variable* *unit* *value*
*etc.*

---------- *<separation line>*
*Delivery No.*
*Date & Time & Status*
*Variable* *unit* *value*
*Variable* *unit* *value*
*etc.*

*---------- <separation line>*
*Delivery No.*
*Date & Time & Status*
*Variable unit value*
*Variable unit value*

*ETC*

*Custom Footer Lines*
*---------- <separation line>*

Reports such as “Latest Logs” will print in the historical order, and for those logs that have no data (e.g. unit was powered off at the time) the print will show “Data not available”. i.e.

*---------- <separation line>*
*Del No. Data Not Available*

*---------- <separation line>*
*Delivery No.*
*Date & Time & Status*
*Variable unit value*
*Variable unit value*
*etc.*

If the unit is programmed for 0 logs for the latest log reports then the report will only consist of the header and ID information and a “Data Not Available” message.

*Custom Header Lines*

*Title of Report*

*Current Date & Time*
*Instrument Serial No. & Tag*

*Data Not Available*

*Custom Footer Lines*
*---------- <separation line>*

## Printer Data Control

Some printers have limited data buffers and are therefore unable to collect all the print data being transmitted. The 500 Series has the capability of software handshaking. The Xon/Xoff characters can be used by any of the printer types to control the flow of data to ensure that data is not lost.

Some printers will also transmit an Xoff character in response to other events such as printer being off-line, print head not engaged or power being removed. The specific behaviour of the printer being used should be noted.

## Error Messages

There are two printer error messages that can be displayed.

**PAPER OUT**

This message is related to the Printer Type PRN-03 TM295 Slip printer. It is standard procedure with this printer to check for paper status before printing. If a print is attempted but there is no paper the PAPER OUT message will be scrolled. The instrument will continue to poll the printer for paper and if paper is detected before a communications timeout expires the print will commence.

**COMMS TIMEOUT**

This message is relevant for all printer types and will be activated for the following conditions.

1. If the flow of data is stopped due to software or hardware handshaking and is not allowed to resume before the communications timeout.

2. If Printer Type is PRN-03 Slip printer and a paper status is requested but no response is received within the timeout period.

3. Paper Out has been detected for Printer Type PRN-03 but no paper is inserted within the timeout period.

When communications timeout error has been activated the message COMMS TIMEOUT will be scrolled once, the request to print will be cleared and the instrument will return to its normal mode.

# Appendix A
# Model Numbers

## Product Codes

| Model | Supplementary Code | | | | | | | Description |
|---|---|---|---|---|---|---|---|---|
| **505 .** | | | | | | **- BC01** | | |
| **Enclosure** | 1 | | | | | | | Panel mount enclosure |
| | 2 | | | | | | | Field mount enclosure (NEMA 4X / IP66) |
| | 3/5 | | | | | | | Explosion proof Ex d (IECEx/ATEX), metric glands (5 specifies heater) |
| | 4/6 | | | | | | | Explosion proof Ex d (CSA), NPT glands (6 specifies heater) |
| **Output Options** | | 0 | | | | | | **Basic** - RS232 and RS485 serial ports, 2 relays, 2 pulse outputs, rear key input |
| | | 1 | | | | | | **Advanced** - also includes 4-20mA o/p and Real-time clock for printer output and logging (100 logs) |
| **Extra Options** | | | 2 | | | | | 9-way DB connector for RS232 serial port |
| **Power Supply** | | | | A | | | | Inputs for 12-28VDC and 110/120 VAC, 50-60Hz |
| | | | | E | | | | Inputs for 12-28VDC and 220/240 VAC, 50-60Hz |
| | | | | D | | | | Input for 12-28VDC power only |
| **Display Panel Options** | | | | | S | | | Standard option (now with backlight & LCD backup) *(original Full option: F, with Infra-Red comms, no longer available)* |
| **PCB Protection** | | | | | | C | | **Conformal coating** - required for maximum environmental operating range. Recommended to avoid damage from moisture and corrosion. |
| | | | | | | N | | **None** - suitable for IEC standard 654-1 Climatic Conditions up to Class B2 (Heated and/or cooled enclosed locations) |
| **Application Pack Number** | | | | | | | **BC01** | Defines the application software to be loaded into the instrument |
| For example: Model No. 505.112ESC<br>Displayed on the 500 Series as:<br>Note: The first character represents the CPU installed (factory use only). The remaining 6 characters only represent hardware that affects the operation. | | | | | | | | 1- 1- - 5-<br>505 MODEL |

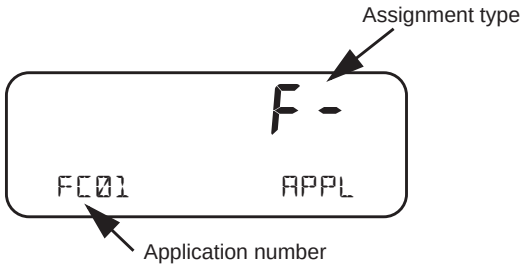
**Note:** Example full product part number is 505.112ESC-BC01 (this is the number used for placing orders).

# Custom Version Codes

| | Code | | Description |
|---|---|---|---|
| **Origin Code**<br><br>**Identifies Distributor** | 00 | | Factory Default Application |
| | 01 | | Contrec Systems Pty. Ltd. Melbourne Australia |
| | 02 | | Contrec Limited. West Yorkshire UK |
| | 03 | | |
| | 04 | | Contrec-USA, LLC. Pelham AL 35124 USA |
| | 05 | | Flowquip Ltd. Halifax UK |
| | 06 | | |
| | etc. | | |
| **User Language** | 0 | | English (Default) |
| | 1 | | German |
| | 2 | | Dutch |
| | 3 | | French |
| | 4 | | Spanish |
| | 5 | | |
| | etc. | | |
| **Distributor's Code** | | 000<br>…<br>999 | Distributor's own choice. Possibly a code that identifies the customer and the application. |
| For example: 02 3 157<br>Displayed on the 500 Series as: | | | 023157<br>CUSTOM VERS |

# Application Information Code

The Application Information code is an aid for users and service personnel to determine the type of inputs that are used in a particular application. The Application Information code is displayed on the instrument as shown below.



The Application number identifies the application as in the following examples:

- BC01 - single channel batch controller for frequency flow input.
- FC01 - single channel flow computer for frequency flow input

The Input Assignment type indicates the physical input that is assigned to each input on the instrument. The code is made up from two characters as follows:

| FINP | AINP |
|---|---|
| X | X |

The codes are as follows:

- - - not used in this application
- A - indicates an analog flow input such as for volume or mass
- F - indicates a frequency flow input such as for volume or mass
- L - indicates a level input
- d - indicates a density input
- t - indicates a temperature input.

For example, FL is an instrument with FINP (frequency input) assigned to a flow input, AINP (analog input) assigned to a level input.

# Appendix B
# Units of Measurement

## Available Units of Measurement

The following is a list of the available units of measurement used across the range of 500 Series applications.

| Units Type | Available units of measurement |
|---|---|
| Volume | $m^3$, $Km^3$, Ltr, mL,Gal, KGal, MGal, $ft^3$, $kft^3$, $Mft^3$, bbl |
| Volume Flowrate | $m^3/s$, $m^3/min$, $m^3/h$, $m^3/D$, L/s, L/min, L/h, L/day, mL/s, mL/min, mL/hr, Gal/s, Gal/min, Gal/h, KGal/D, MGal/D, $ft^3/s$, $ft^3/min$, $ft^3/h$, $Mft^3/D$, bbl/s, bbl/min, bbl/h, bbl/D |
| Volume K-Factor | $P/m^3$, P/Ltr, P/mL, P/Gal, $P/ft^3$, P/bbl |
| Mass | kg, g, Ton, lb, Klb |
| Mass Flowrate | kg/s, kg/min, kg/h, g/s, g/min, g/h, Ton/min, Ton/h, Ton/D, lb/s, lb/min, lb/h, Klb/min, Klb/h, Klb/D |
| Mass K-Factor | P/kg, P/g, P/Ton, P/lb, P/Klb |
| Energy | kJ, MJ, GJ, kWh, MWh, kBTU, Ton.h, therm, cal, kcal, Mcal |
| Power | kJ/h, MJ/h, GJ/h, kW, MW, kBT/M, kBT/h, Ton, therm/min, therm/h, kcal/h, Mcal/h |
| Energy K-Factor | P/kJ, P/kWh, P/kBTU, P/Ton.h, P/therm, P/kcal |
| Temperature | Deg K, Deg C, Deg F, Deg R |
| Pressure | Pa, $kg/m^2$, $kg/cm^2$, kPa, MPa, mbar, bar, psi, Atm, $inH_2O$, $mmH_2O$ |
| Density | $kg/m^3$, kg/Ltr, $lb/ft^3$, SG60F |
| Specific Volume | $m^3/kg$, L/kg, $ft^3/lb$ |
| Specific Enthalpy | kJ/kg, BT/lb, cal/g, cal/kg, kcal/kg, Mcal/kg |
| Reynolds Number | E+0, E+3, E+6 (scaling for unitless variable) |
| Length (Level) | m, mm, cm, INCH, FOOT |
| Velocity | m/s, m/M, m/h, ft/s, ft/M, ft/h |
| Length K-Factor | P/m, P/cm, P/INCH, P/FOOT |
| Area | $m^2$, $ft^2$ |
| Ratio | % |
| General Input | Pressure, Temperature, Density, Length (Level), Factor |

# Index