BA550P and BA550C
Batch Controllers

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The BA550P and BA550C are CE marked to show compliance with EMC Directive 98/336/EEC

CONTENTS

Illustrations

1. HOW TO USE THIS MANUAL

This instruction manual has been written so that the reader can quickly obtain the information he or she requires without having to read unnecessary sections. However, we recommend that whatever your interest you read sections 2 and 3, Description and Operation followed by the sections covering your particular requirements.

2. DESCRIPTION

The BA550 enables batch control of liquids, solids or components to be performed simply and economically. Although incorporating sophisticated features the instrument is very easy to use and can operate as a stand-alone controller, or form part of a more complex control system. Two independent output relays may be programmed for one or two stage control which, together with automatic overrun compensation, minimises batching errors caused by actuator delays.

Front panel push-buttons enable the operator to start and stop the batch, adjust the batch setpoint and to select one of four different operating displays: current batch total, input rate, batch setpoint or grand total. The display may be in any engineering units and the input rate can be shown per second, minute or hour. A light emitting diode (LED) above each front panel push-button clearly indicates which display has been selected. For applications where large or remote push-buttons are required, control may be transferred to external switches with or without the front panel push-buttons inhibited.

Two alternative versions of the BA550 batch controller are available. For pulse signals the BA550P accepts inputs from a wide range of transducers including 2-wire proximity detectors, switch contacts, open-collector transistors or any device with a voltage pulse output. The BA550C has a galvanically isolated analogue input which may be connected in series with any 4/20mA linear or square law current loop.

Both versions of the BA550 may also be used for totalising and rate indicating applications. To simplify operation for totalising applications, all the batch control functions may be inhibited by one programme command.

Adjustment of the batch setpoint and programming of all functions is performed via the five front panel push-buttons. To prevent accidental or unauthorised adjustments three levels of access are defined by the position of two security links connected between terminals at the rear of the instrument. These links may be hard-wired, or connected to a panel mounting key switch when frequent changes are required.

A Light emitting diode (LED) on the front panel indicates when the batch controller is in the programme mode, and the display has helpful plain language menus which guide the user through the selection procedure.

An optional plug-in RS232 serial communication board enables the BA550 to be interrogated and controlled remotely, and thus to be integrated with supervisory computers.

For hazardous area applications the complementary intrinsically safe BA350BP and BA350BC batch controllers are available.

3. OPERATION

Basically the BA550 batch controller is a digital counter which switches two output relays on and off at pre-set numbers. Fig 1 shows a simplified block diagram of the instrument and illustrates some of the additional features.

The BA550P incorporates programmable input scaling to convert input pulses into meaningful engineering units. For example, a controller connected to a turbine flowmeter producing 107 pulses per litre may be programmed to display this signal in litres, gallons or any other units by selecting the appropriate scale factor. Similarly, the rate parameters, which are totally independent, may be programmed to display the flowrate in litres, gallons or any other units per second, minute or hour.

The BA550C incorporates similar scaling functions which enable a 4/20mA analogue signal to be displayed in engineering units.

The batch controller has two independent output relays: Output 1 and Output 2. Output 1 is energised immediately the *Start* push-button on the controller is operated, followed by Output 2 after a programmable time delay. Towards the end of the batch, Output 2 is de-energised a programmable number of counts before the batch setpoint is reached, when Output 1 is also de-energised. Fig 2 illustrates a typical application of two stage control. By operating a small bypass valve from Output 1, and the main control valve from Output 2 the flow can be started and stopped slowly which will reduce batching errors and flow surges.

With the batch control functions disabled the BA550 becomes a very flexible totaliser and rate indicator which can be used in many applications, including the integration of a 4/20mA flow signal to calculate and display total flow.

4. OPERATING A BA550P or BA550C

This section is primarily intended for users who wish to operate a BA550P (pulse input) or a BA550C (4/20mA input) instrument after it has already been installed, programmed and conditioned.

4.1 Initialisation

Each time a BA550 is connected to a power supply it goes though an initialisation sequence which briefly displays 8.8.8.8.8.8.8.8 and illuminates the eight front panel LED indicators. The instrument then enters the operating mode in the stop state.

4.2 Operation as a batch controller

The BA550 is operated via five front panel push-buttons, each of which has a single function in the operating mode shown in bold black letters on the front panel. Operation of any push-button is acknowledged by a red light emitting diode (LED) located immediately above the button. Three additional red LEDs show the status of the two control output relays and indicate when the controller is in the programme mode.

Throughout this manual push-buttons and front panel LEDs are shown in italics eg. *Batch* push-button *and STOP* LED. Legends displayed by the BA550 are shown within inverted commas eg. 'CLEAR' and 'DELAY'.

The function of the push-buttons are:

Start Causes one or both of the outputs to be energised which will start the batch. The *Start* LED will remain illuminated until the batch is finished, or the *STOP* push-button is operated. If a start delay has been programmed, Output 1 will be energised immediately the *Start* button is pushed, followed by Output 2 after the start delay time.

STOP Operating this button during a batch immediately de-energises both Output 1 and Output 2 relays causing the batch to pause. During a pause any input signal continues to be counted, the *Start* LED is extinguished and the *Stop* LED flashes to indicate that the batch is not complete.
The batch may be resumed at any time by pressing the *Start* button. If a start delay has been programmed, Output 1 will be energised immediately the *Start* button is pushed, followed by Output 2 after the start delay time. At the end of each batch Output 1 and Output 2 relays will be de-energised, the *Start* LED extinguished and the *STOP* LED continuously illuminated.

Special case: When overrun compensation is enabled, Output 1 is de-energised before the batch setpoint is reached to compensate for measured delays in the process. If a pause is initiated by pressing the *STOP* button close to the end of the batch, and process delays cause the calculated setpoint to be exceeded, pressing the *Start* button will not resume the batch.

Reset After completion of a batch the display must be reset before the next batch can be started, unless automatic reset or restart have been selected - see note at the end of this section. The display may also be reset following an operator initiated pause resulting from the *STOP* button being operated during a batch. After resetting the display the *Reset* and the *STOP* LEDs are continuously illuminated. Whilst reset the batch controller ignores input signals until the *Start* button is pressed to initiate the next batch.

Batch This button has two functions: when pressed and held the display initially shows the programmed batch setpoint for three seconds, followed by the grand total.

Rate This button toggles the display between the current batch total and the current input rate. The LED above the button is illuminated when rate is being displayed.

Two software selectable options modify the function of these push-buttons:

Automatic reset eliminates the need to manually reset the BA550 at the end of each batch. The *Stop* LED is illuminated at the end of the batch and it is only necessary to press the *Start* button to initiate the next batch - see section 7.3.9

Automatic restart on completion of a batch and following a programmable time delay, the display is reset and the next batch started automatically. This sequence continues until the *STOP* button is operated - see section 7.5.10

4.2.1 Adjusting the batch setpoint

The batch setpoint can only be adjusted when level 2 or 3 access has been selected - see section 7.1

To prevent accidental selection of a dangerously high setpoint, a programmable setpoint limit 'SP LIMIT' is included above which the batch setpoint can not be adjusted - see section 7.4.2. When the batch parameter menu is selected, 'SP LIMIT' will be displayed first if the setpoint limit is off. The BA550 may be operated without a setpoint limit, or a limit may be entered prior to entering the batch setpoint.

To select the batch parameter programme menu press the *Prog* and *Batch* push-buttons simultaneously until the display shows 'SETPOINT' and the *Prog* and *Batch* LEDs are illuminated. If 'SP LIMIT' is displayed first, which indicates that the setpoint limit is off, press the *Up* push-button until 'SETPOINT' is displayed. The BA550 is now in the batch parameter programme menu and the white legends show the function of the front panel push-buttons.

Press *Ent* and the existing batch setpoint will be displayed with the most significant left hand digit flashing to show that this may be adjusted by pressing the *Up* or *Down* button. When set to the required figure, or if no adjustment of this digit is required, press *Ent* to move to the next digit. Adjust each digit in turn until all have been set to the required figures and then return to the operating mode by pressing *Prog* twice. Fig 11 shows this procedure diagrammatically.

4.3 Operation as a totaliser

Both versions of the BA550 may be used for totalising and rate indicating applications when the batch control functions are not required. To simplify operation for these applications, the batch control functions and the *Start* and *STOP* push-buttons may be inhibited by one programme command.
Operation of the *Reset*, *Rate* and *Batch* push-buttons is acknowledged by a red light emitting diode (LED) located immediately above each button. An additional red LED indicates when the instrument is in the programming mode. The LEDs indicating the status of the two output relays are inhibited.

When programmed as a totaliser the function of the push-buttons are:

Start No function

STOP No function

Reset This push-button resets the display to zero. The reset LED will remain illuminated until the next input pulse is received when totalising will begin again. Operating the *Reset* button does not reset the grand total. Input pulses are ignored while the *Reset* push-button is pressed.

Batch When pushed the display will show 'NO LIMIT' for approximately three seconds followed by the grand total.

Rate This button toggles the display between the current total and the current input rate. The LED above the button is illuminated when the rate is being displayed.

5. SYSTEM DESIGN

This section should be read before designing a system incorporating a BA550. All the input and output functions are described together with examples of how the BA550 may be used to control solids, fluids or components.

Two versions of the BA550 batch controller are available. The BA550P accepts pulse signals from a wide range of transducers including 2-wire proximity detectors, switch contacts, open -collector transistors or any device with a voltage pulse output. The BA550C has a galvanically isolated analogue input which may be connected in series with any 4/20mA linear or square law current signal. All other functions are the same for both versions.

5.1 BA550P Pulse Input

The negative input terminal of the BA550P is internally connected to the negative power supply terminal see Fig 1. Although this is irrelevant when the instrument is used with an isolated transducer such as a proximity detector or a voltage free switch contact, care must be taken when connecting the BA550P to a voltage pulse source. The negative side of the pulse source must be at the same potential as the negative side of the BA550 supply voltage.

5.1.1 Use with a 2-wire proximity detector

A 2-wire proximity detector is a solid state switch which is activated when it comes close to a target. Proximity detectors are available in many shapes and sizes, but most conform to the NAMUR electrical specification which defines the output current in the activated and unactivated conditions.

When correctly conditioned the BA550P batch controller will count the output from any 2-wire proximity detector which complies with the NAMUR standard.

The output from open-collector transistors and photo-transistors can also be counted by a BA550P when conditioned to operate with a proximity detector - see Fig 3. The transistor must have an 'on' voltage of less than 2V, and an 'off' leakage current of less than 1mA. These requirements are not restrictive, unless the transistor is fitted with protective diodes, and allow the BA550P to work with a wide variety of solid state detectors.

When conditioned for use with a 2-wire proximity detector the maximum input frequency is 5kHz

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5.1.2 Use with voltage free contacts

The number of times that a pair of voltage free contacts opens may be counted by the batch controller provided that the resistance of the contacts when closed is less than 100 , and the resistance when open is greater than 1,000 .

To eliminate multiple counting resulting from contact bounce, the BA550 ignores inputs for 4ms after counting a contact opening. This limits the maximum input frequency with voltage free contacts to 100Hz.

When conditioned for use with switch contacts, the BA550P has an open circuit input voltage greater than 6V which will break down most surface contaminating films.

5.1.3 Use with voltage pulses

The BA550P can be conditioned by two internal plug-in links to accept low or high voltage input pulses. Input switching thresholds are shown below.

Input voltage thresholds	**Low**	**High**
For low voltage input	10mV	30mV
For high voltage input	1V	3V

The maximum permissible input voltage is 8V when conditioned for a low voltage pulse input, and 28V when conditioned for a high voltage pulse input.

For voltage inputs the maximum input frequency is 5kHz.

Note: The BA550P input terminals are not galvanically isolated - see 5.1 and Fig 1.

5.2 BA550C 4/20mA analogue input

The BA550C has a galvanically isolated input which may be connected in series with any 4/20mA linear or square law current loop. The BA550C introduces an additional 0.75V drop into the current loop. Providing this extra voltage is available, the loop will not be affected.

5.3 Output control relays

The two output relays each have single pole changeover contacts which may be used for switching valves, actuators or contactors in high power applications. When reactive loads are being controlled it is essential that the output relay contacts are protected by a suppresser to prevent contact damage and radio frequency interference. A 0.1µF capacitor in series with a 100 resistor, which can be purchased as a proprietary encapsulated assembly from many electrical suppliers, will usually provide adequate suppression. Please note that BEKA associates' guarantee excludes damage to the output relay contacts.

5.4 Auxiliary outputs

In addition to the two output control relays the BA550 has three isolated auxiliary outputs which are referenced to a common return - terminal 6. Each output is an open-collector NPN transistor protected by a 1.6k series resistor and a 33V Zener diode. For connection to other equipment a 'pull-up' resistor will normally be required as shown in Fig 4.

5.4.1 Retransmitted pulse

When enabled this output closes for 0.8ms each time the least significant digit of the grand total is incremented, allowing a remote instrument or counter to record the grand total in engineering units. The maximum output frequency is 500Hz.
The retransmitted pulse output from a BA550C (4/20mA input) may also be used to operate a remote counter,. Again the output represents an integral of the input; in flow applications, the total flow.

5.4.2 Reset status

This output closes when the batch controller is reset, and opens when the *Start* button is operated.
When the batch controller is programmed as a totaliser the reset status output closes when the display is reset, and opens when the first input pulse is received.

5.4.3 Missing pulse detection (Flow alarm)

It should be noted that missing pulse detection closes (energises) the solid state output in the alarm condition.

BA550P (Pulse input)

The flow alarm output closes when the time between successive input pulses exceeds a programmed missing pulse time - see 7.3.5. A flow alarm also de-energises both Output 1 and Output 2 relays causing the batch to pause. In the alarm condition the *Start* LED is extinguished, the *STOP* LED flashes and the controller displays 'ALARM'. The alarm may be cleared by pushing any of the front panel buttons. This will open the flow alarm output and briefly display 'CLEAR' until the button is released when the last batch total will be displayed. After the flow alarm is cleared the batch may be resumed by operating the *Start* button,. However, if input pulses are not received within the programmed missing pulse time the alarm will recur.

When programmed as a totaliser, the flow alarm output 'closes' if the time between successive input pulses exceeds the programmed missing pulse time. In this alarm condition the BA550 display alternates between 'ALARM' and the selected display.
The alarm is automatically cleared when the next input pulse arrives, but will recur if a second pulse is not received within the programmed missing pulse time. Therefore when totalising continuous pulses with a period greater than the programmed missing pulse time, the flow alarm will be cleared for the missing pulse time when each pulse is received.

BA550C (4/20mA input)

The BA550C converts a 4/20mA analogue input current into a 0 to 1kHz internal pulse signal. The flow alarm may be set to operate at any input current by calculating the equivalent missing pulse time in seconds from the formula shown below:

$$\text{Missing pulse time} = \frac{1}{62.5 \times (\text{Input current mA} - 4)}$$

5.5 Remote switches

For applications where large or remote push-buttons are required, control may be transferred to external switches with normally open contacts - see section 7.3.2. The front panel *Start*, *Reset* and *STOP* push-buttons may be inhibited or operated in parallel with the remote switches. Although the remote switches are monitored with a 5V supply that will overcome most surface contaminating films, for industrial applications it is recommended that high quality switches with sealed contacts are used. See Fig 5.

Note: If the external switches are disconnected while the front panel push-buttons are inhibited, control can be re-established by briefly connecting terminals 15, 16 & 17 together. This connection automatically reprogrammes the BA550 to respond to the front panel push-buttons.

5.6 Power supply

Any dc supply between 20.0 and 32.5V may be used to power the BA550, providing that the output ripple is small enough to prevent the instantaneous value of the supply voltage falling below 20V. Almost all 24V industrial power supplies comply with these requirements.

If the power supply fails the batch total, grand total and the operating mode parameters are stored in non-volatile memory and automatically retrieved when the power is restored. If the power failure occurs during a batch, restoration of the supply will return the batch controller to a pause condition in which both output relays are de-energised and the *Stop* LED is flashing. The BA550 will show the batch total displayed at the time of power failure, plus any pulses that were being processed at that time. If the retransmitted pulse output is activated any input pulses being processed at the time of the power failure will be retransmitted when the supply is restored. Pressing the *Start* push-button will cause the batch to resume.

6. INSTALLATION

6.1 Location

The BA550 batch controller is housed in a 144 x 72mm panel mounting DIN enclosure which may be installed into any panel providing the environmental limits shown in the specification are not exceeded. The BA550 has an IP65 sealed front panel. If the joint between the controller and the panel is also to be sealed, the panel cut-out must comply with the tighter tolerances shown in Fig 7, and the instrument should be secured with four panel mounting clips.

6.2 Input conditioning

6.2.1 BA550P(pulse input)

The BA550P, which is fitted with a pulse input card, may be conditioned by internal plug-in links to accept one of four types of input:

Input	Switching threshold
2-wire proximity detector	1.2 & 2.1mA
Voltage free contact	100 & 1,000
High voltage pulse	1 & 3V
Low voltage pulse	10 & 30mV

Access to the conditioning links is gained by removing the rear panel of the BA550; the link positions are shown in Fig 6.

CAUTION

Before removing the BA550 rear panel disconnect the 24V dc supply, and any power supply connected to the relay contacts.

To remove the rear panel unscrew the four corner screws and gently pull the panel backwards taking care not to bend any of the connector pins. There are two plug-in links, one on the main instrument board and one on the inside of the rear panel. By using a pair of long nosed pliers the main board link can be repositioned without removing the instrument from the enclosure.
When refitting the rear panel the connector pins must be aligned with the socket before the panel is pushed into position.

6.2.2 BA550C(4/20mA input)

The BA550C, which is fitted with an analogue input card, only accepts a 4/20mA current, so no input conditioning is required.

6.3 Installation procedure

a. Insert the BA550 into the panel aperture from the front ensuring that the sealing gasket is correctly positioned.

b. Clip two or four panel mounting clips to the enclosure and evenly tighten the screws until the instrument is held firmly in position.

Connections to the BA550 are made via three removable terminal blocks. Terminals 19 to 28, which are connected to the output control relays, are protected by an insulating cover as these relay contacts may be used to switch high voltages. This cover, which is secured by two M3 screws, should be fitted after the terminals have been wired. An additional nine way 'D' socket is fitted to controllers incorporating the serial communications option. When this option is not fitted, the socket is replaced by a blanking plate.
The terminal connections are shown in Fig 8.

7. PROGRAMMING

7.1 Security

To prevent unauthorised or accidental access to the programme functions, three different levels of access may be selected by linking terminals on the rear panel.

Level	Link terminals	Access
1	None	No programme functions
2	17 & 15	Only batch setpoint
3	17 & 16	All programme functions

The selection can be made by fitting a wire link between the terminals, or where frequent changes are required, the terminals may be wired to a key operated switch to maintain security.

7.2 Programme structure

Conditioning and calibration of the BA550 is performed via the front panel controls. For simplicity the adjustments are divided into three separate programme menus as shown in Fig 9.

Programme menu	Refer to
Mode parameters	section 7.3 & Fig 10
Batch parameters	section 7.4 & Fig 11
Rate parameters	section 7.5 & Fig 12

Access to each of the menus is gained by pressing *Prog* plus either the *STOP, Batch* or *Rate* push-buttons simultaneously. Once within the selected menu the required parameter can be reached by scrolling the display using the *Up* or *Down* push-buttons.
The three programme menus are described in the following sections and are shown diagrammatically in Figs 10, 11 and 12. Each section of this manual starts with a brief summary of all the parameters within the menu cross referenced to full descriptions later in the section. With a little practice this simple menu driven system enables most adjustments to be made without repeated reference to this manual.

7.3 Programming the mode parameters

see Fig 10

The mode parameters define the basic functions of the BA550 and should be programmed first. Each parameter is summarised below and cross referenced to a full description in a following section.

To access the mode parameter menu press the *Prog* and the *STOP* front panel push-buttons simultaneously. The display will show 'FUNCTION' which is the first parameter in the menu, other parameters may be accessed by scrolling through the menu using the *Up* or *Down* push-buttons. After selecting the required parameter press *Ent* to reveal the current value or status.

The status of parameters can be changed by pressing the *Up* push-button which will toggle the display between the options. When the display shows the required option press *Prog* to return to the programme menu from which another parameter may be selected for adjustment, or the BA550 may be returned to the operating mode by pressing the *Prog* push-button a second time.

Parameters, such as the Missing Pulse Time, which require a number to be entered are initially displayed with one digit flashing indicating that this digit may be adjusted by pressing the *Up* or *Down* push-buttons. When this digit has been set to the required number, press *Ent* to adjust the next digit. When all the digits have been adjusted press *Prog* to return to the programme menu from which another parameter may be selected for adjustment, or the BA550 may be returned to the operating mode by pressing the *Prog* push-button a second time.

Fig 10 shows a diagrammatic representation of the mode parameter menu and the method of moving between the parameters.

Summary of mode parameters

Parameter	Description
FUNCTION	**Function of BA550** Conditions the BA550 as a batch controller and rate indicator or as a totaliser and rate indicator. When conditioned as a totaliser, parameters which only affect batch control are omitted from the mode and batch menus. See section 7.3.1
CONTROL	**Local or remote control.** Determines whether the BA550 is controlled by the five front panel push-buttons, by remote switches or by both the front panel push-buttons and the remote switches. See section 7.3.2
RTX O/P	**Retransmitted pulse** Turns the retransmitted pulse output 'ON' or 'OFF'. When 'ON' is selected, the auxiliary output closes for 0.8ms each time the least significant digit of the grand total is incremented. See section 7.3.3
ROOT EXT	**Square root extraction** Turns the square root extraction for linearising the output from differential flowmeters 'ON' or 'OFF'. See section 7.3.4
TIMEOUT	**Missing pulse time (flow alarm)** When the time between successive input pulses exceeds the specified missing pulse time, the flow alarm is activated. See section 7.3.5
INHIBIT *	**Missing pulse time delay** Inhibits the missing pulse detection for a programmable time after the start of a batch. See section 7.3.6
S/COMMS	**Serial communication** Turns the serial communications port 'ON' or 'OFF'. Note: This function is only available when the optional serial communications board is fitted. See section 7.3.7

UP/DOWN * **Direction of count**
Determines whether the batch controller counts upwards from zero, or downwards from the batch setpoint.
See section 7.3.8

AUTO RST * **Automatic reset**
Automatically resets the previous displayed batch count when the *Start* button is pushed to initiate another batch.
See section 7.3.9

AUTO-S * **Automatic restart**
Automatically resets the displayed batch count and starts another batch a programmable time after completion of the previous batch.
See section 7.3.10

OVERRUN * **Overrun compensation**
Measures and compensates for delays within the batching system.
See section 7.3.11

TEST **Display test routine**
Checks that the display is functioning correctly and shows the software version number.
See section 7.3.12

LANGUAGE **Display language**
Selects the language in which the menus are displayed.
See section 7.3.13

Note: Parameters marked with an * are only included in the menu when the BA550 is conditioned as a batch controller.

Full description of mode parameters

7.3.1 Function of BA550: FUNCTION

The BA550 may be conditioned as a batch controller and rate indicator or as a totaliser and rate indicator. When the totaliser function is selected, all the functions associated with batch control are disabled and the batch parameters are omitted from the mode and batch menus.
To define the function of the BA550 select 'FUNCTION' from the mode programming menu, and press *Ent* to reveal if the instrument is conditioned as a batch controller 'BATCHER' or as a totaliser 'TOTALISE'. If the function is correct press the *Prog* button to return to the menu, or press the *Up* button to change the function followed by the *Prog* button to return to the menu.

7.3.2 Local or remote control: CONTROL

The BA550 may be controlled by the five front panel push-buttons, by remote switches or by both the front panel push-buttons and remote switches. Selection of control by remote switches will inhibit the operation of the front panel *Start, Reset* and *STOP* push-buttons. To choose the method of control, select 'CONTROL' from the mode setting menu and press *Ent* which will reveal the current setting.

Display	Controlled by
'LOCAL'	Front panel push-buttons
'REMOTE'	Remote switches
'REM+LOC'	Front panel push-buttons and remote switches

To change the control setting press the *Up* button until the required display is obtained, followed by the *Prog* push-button to return to the mode parameter menu. The change will not be executed until the BA550 is returned to the operating mode.
When 'REMOTE' has been selected, local control may be re-established in the absence of remote switches by briefly linking terminals 15, 16 and 17 together.

7.3.3 Retransmitted output: RTX O/P

The retransmitted output closes for 0.8ms each time the least significant digit of the grand total is incremented. The maximum output frequency is 500Hz, above which retransmitted output errors will begin to occur.
To activate the retransmitted output select 'RTX O/P' from the mode parameter menu and press *Ent* which will reveal if the option is 'ON' or 'OFF'. If the option is set as required press *Prog* to return to the menu, or press the *Up* button to change the option followed by the *Prog* button to return to the menu.

7.3.4 Square root extraction: ROOT EXT

This function is primarily intended for use with non-linear differential flowmeters which have a square law 4/20mA output. It may also be used with pulse inputs up to 1kHz. To prevent cumulative errors resulting from totalising the output of a flowmeter operating at very low flows, below 5% of full flow (4.04mA) totalisation is inhibited and the rate display zeroed.

To activate the square root extractor select 'ROOT EXT' from the mode parameter menu and press *Ent* which will reveal if the option is 'ON' or 'OFF'. If the option is set as required press *Prog* to return to the main menu, or press the *Up* button to change the option followed by the *Prog* button to return to the menu.

7.3.5 Missing pulse detection: TIMEOUT (Flow alarm)

Missing pulse detection measures the time between successive input pulses and compares this with a pre-set time which is adjustable between 0.001 and 3600 seconds. When the time between input pulses exceeds the pre-set time, the flow alarm output will close, the BA550 will enter a pause condition. and the display will show 'ALARM'.

To set the missing pulse time select 'TIMEOUT' from the mode parameter menu and press *Ent* to reveal the existing time which may be adjusted by pressing the *Up* or *Down* buttons. When set to the required time return to the main menu by pressing the *Prog* push-button.

Missing pulse detection may also be used with a BA550C which has an analogue 4/20mA input. The flow alarm may be set to operate at any input current by calculating the equivalent missing pulse time in seconds from the formula shown below.

$$\text{Missing pulse time} = \frac{1}{62.5 \times (\text{Input current mA} - 4)}$$

If missing pulse detection is not required set the missing pulse time to less than 0.001. The BA550 will display 'OFF' and missing pulse detection will be disabled.

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See section 5.4.3 for additional information on missing pulse detection.

7.3.6 Missing pulse time delay: INHIBIT

(Batch controller only)

This function disables the flow alarm for a programmable time after the start of a batch to prevent false alarms occurring while the system is accelerating.

The inhibit time during which the flow alarm is disabled may be adjusted between 1 and 3600 seconds in 1 second increments.

If a delay is not required, the inhibit time should be set to 0.

To set the inhibit time select 'INHIBIT' from the mode parameter menu and press *Ent* to reveal the existing time which may be adjusted by pressing the *Up* or *Down* buttons. When set to the required time return to the main menu by pressing the *Prog* push-button.

7.3.7 Serial communication: S/COMMS

The serial communications port can only be activated when a serial communication board is fitted to the BA550.

To activate the serial communications port select 'S/COMMS' from the mode parameter menu and press *Ent* which will reveal if the option is 'ON' or 'OFF'. If the required option is selected press *Prog* to return to the main menu, or press the *Up* button to change the option followed by the *Prog* button to return to the menu.

7.3.8 Direction of count: UP/DOWN

(Batch controller only)

The direction of count determines whether the batch controller display counts upwards from zero to the batch setpoint, or downwards from the batch setpoint to zero.

To set the direction of count select 'UP/DOWN' from the mode parameter menu and press *Ent* to reveal the existing direction. If the direction is set as required press *Prog* to return to the main menu, or press the *Up* button to change the direction followed by the *Prog* button to return to the menu.

7.3.9 Automatic reset: AUTO RST

(Batch controller only)

The automatic reset option causes the displayed batch count from the previously completed batch to be automatically reset when the *Start* push-button is operated, which reduces the number of push-button operations required to start a batch.

To activate automatic reset select 'AUTO RST' from the mode parameter menu and press *Ent* which will reveal if the option is 'ON' or 'OFF'. If set as required press *Prog* to return to the main menu, or press the *Up* button to change the option followed by the *Prog* button to return to the menu.

7.3.10 Automatic restart: AUTO-S

(Batch controller only)

The automatic restart option causes the BA550 to start another batch a programmable time after completion of the previous batch without operator intervention. The delay before the next batch starts may be adjusted between 1 and 3600 seconds in 1 second increments.

To set the automatic restart time select 'AUTO-S' from the mode parameter menu and press *Ent* to reveal the existing time which may be adjusted by pressing the *Up* or *Down* buttons. When set to the required time return to the main menu by pressing the *Prog* push-button.

If automatic restart is not required, set the delay time to less than 1 second. The BA550 will display 'OFF' and automatic restart will be disabled.

7.3.11 Overrun compensation: OVERRUN
(Batch controller only)

Overrun compensation automatically corrects for time delays in the batching system which may cause the product to be dispensed after Output 1 has been de-energised.

When overrun compensation is selected, the number of input pulses received after Output 1 is de-energised are counted and used to calculate an average correction which is automatically subtracted from the batch setpoint.

If missing pulse detection is 'ON', overrun pulses will be counted between the time Output 1 is de-energised and the time at which the input pulse interval exceeds the programmed missing pulse time. If missing pulse detection is 'OFF', overrun pulses will be counted from the time Output 1 is de-energised until the *Reset* push-button is operated.

To activate overrun compensation select 'OVERRUN' from the mode parameter menu and press *Ent* which will reveal if the option is 'ON' or 'OFF'. If the option is set as required press *Prog* to return to the main menu, or press the *Up* button to change the option followed by the *Prog* button to return to the menu.

Note: When root extraction is selected, up to 20 counts of overrun error may be caused by computation delays within the BA550 batch controller.

7.3.12 Display test: TEST

This function tests the eight digit alphanumeric display and the eight front panel LED indicators without changing any of the instrument outputs. During the test routine the issue number of the BA550 software is displayed.

To run the test routine select 'TEST' from the mode parameter menu and press *Ent.* To stop the routine press *Prog* which will return the display to the mode menu.

7.3.13 Display language: LANGUAGE

This function enables the menu language to be selected. The number of languages available depends upon the issue of software which has been installed.

To change the display language, select 'LANGUAGE' from the mode parameter menu and press *Ent.* Pressing the *Up* push-button will scroll the display through the options available.

When the required language has been selected press *Prog* twice to return to the operating mode, after which all menu prompts will be displayed in the new language.

7.4 Programming the batch parameters

See Fig 11

The batch parameters define the operation of the batch control and totalising functions. When the BA550 is programmed as a totaliser the batch control parameters are omitted from the menu.

To access the batch parameter menu the *Prog* and *Batch* front panel push-buttons should be pressed simultaneously.

If the BA550 has been programmed as a batch controller, the display will show 'SETPOINT' unless the setpoint limit is turned off. In this case, the setpoint limit 'SP LIMIT' will be displayed as the first parameter. Other parameters may be accessed by scrolling through the menu using the *Up* or *Down* push-buttons.

If the BA550 has been programmed as a totaliser, the position of the dummy decimal point 'DP(T)' will be the first parameter displayed.

After selecting the required parameter press *Ent* to reveal the current value or status. The status of parameters can be changed by pressing the *Up* push-button which will toggle the display between the options. When the display shows the required option press *Prog* to return to the programme menu from which another parameter may be selected for adjustment, or the BA550 may be returned to the operating mode by pressing the *Prog* push-button a second time.

Parameters which require a number to be entered are initially displayed with one digit flashing indicating that this digit may be adjusted by pressing the *Up* or *Down* push-buttons. When this digit has been set to the required number, press *Ent* to adjust the next digit. When all the digits have been adjusted press *Prog* to return to the programme menu from which another parameter may be selected for adjustment, or the BA550 may be returned to the operating mode by pressing the *Prog* push-button a second time.

Fig 11 shows a diagrammatic representation of the batch parameter menu and the method of moving between the adjustments. Each parameter is summarised below and cross referenced to a full description in a following section.

Summary of batch parameters

Parameter	Description
SETPOINT *	**Batch setpoint** The batch setpoint defines the size of the batch. When counting up, Output 1 is de-energised when the batch total equals the batch set-point. See section 7.4.1
SP LIMIT *	**Setpoint limit** This parameter defines the maxi-mum setpoint which may be entered. See section 7.4.2
DELAY *	**Start delay time for Output 2** De-fines the time delay between Output 1 and Output 2 being ener-gised at the start of a batch. See section 7.4.3
PRE-STOP *	**Stop delay count for Output 2** Defines the number of counts be-fore the end of the batch at which Output 2 is de-energised. See section 7.4.4
DP (T)	**Decimal point** This parameter defines the position of the dummy decimal point when the BA550 is displaying total. See section 7.4.5
SCALE(T)	**Batch scale factor** A dividing factor which defines the relationship between the number of input pulses received and the dis-played total. Used to convert the in-put into engineering units. See section 7.4.6
GRANDTOT	**Grand total** Is the sum of all the batch totals and is not affected by the front panel *Reset* push-button. The grand total may be viewed as a sixteen digit number and may also be reset to zero. In the operating mode the grand to-tal can be viewed in the form n.nnnnEnn by pressing and holding the *Batch* push-button. See section 7.4.7

Note: Parameters marked with an * are only included in the menu when the BA550 is conditioned as a batch controller.

Full description of batch parameters

7.4.1 Batch setpoint: SETPOINT

(Batch controller only)

The batch setpoint is the batch total at which Output 1 is de-energised when counting up, and the display starting point when counting down. The batch setpoint may be adjusted between 0 and 99999999 or the setpoint limit 'SP LIMIT' if this has been programmed to a lower number.

To adjust the batch setpoint select 'SETPOINT' from the batch parameter menu and press *Ent* to reveal the existing number which may be adjusted by pressing the *Up* or *Down* buttons.

7.4.2 Batch setpoint limit: SP LIMIT

(Batch controller only)

To prevent accidents, the batch setpoint limit defines the maximum batch setpoint which may be entered.

To adjust the batch setpoint limit select 'SP LIMIT' from the batch parameter menu and press *Ent* to reveal the existing number which may be adjusted by pressing the *Up* or *Down* buttons.

If the batch setpoint limit is not required, set the limit to less than 00000001. The BA550 will display 'OFF' and the setpoint limit will be disabled.

7.4.3 Start delay time for Output 2: DELAY

(Batch controller only)

At the start of a batch, Output 1 is energised immediately the *Start* button is operated. Output 2 may be energised at the same time, or delayed by up to 3600 seconds.

To set the delay time select 'DELAY' from the batch parameter menu and press *Ent* to reveal the existing delay time in seconds which may be adjusted by pressing the *Up* or *Down* buttons.

When the delay time is set to zero both relays are energised at the same time.

7.4.4 Stop delay count for Output 2: PRE-STOP

(Batch controller only)

Output 1 is de-energised when the batch total equals the batch setpoint. Output 2 may be de-energised at the same time or at a programmable number of display counts before the batch setpoint.

To set the number of display counts between de-energising of the two outputs select 'PRE-STOP' from the batch parameter menu and press *Ent* to reveal the existing number which may be adjusted by pressing the *Up* or *Down* buttons.
The pre-stop value remains fixed when the batch setpoint is adjusted, but can not be greater than the batch setpoint.

7.4.5 Decimal point: DP (T)

This parameter defines the position of the dummy decimal point when the BA550 is displaying the total. The dummy decimal point may be positioned between any of the eight digits or may be omitted.
To position the decimal point select 'DP (T)' from the batch parameter menu and press *Ent* to reveal the existing position which may be changed by pressing the Up or Down buttons.
Note: If the Batch scale factor is changed the decimal point will not be automatically repositioned.

7.4.6 Batch scale factor: SCALE(T)

The batch scale factor defines the relationship between the number of input pulses received and the total displayed by the BA550. It is a dividing factor which is used to convert the number of input pulses into meaningful engineering units and may be adjusted between 0.01 and 999999.99

For a BA550P (pulse input)

$$\text{SCALE(T)} = \frac{\text{Number of input pulses received}}{\text{Required total display}}$$

When calculating the batch scale factor the 'Required total display' must include all the digits on both sides of the displayed dummy decimal point, but the decimal point should not be included in the calculation. eg. for a required total display of 500.0 enter 5000 in the formula. The following table illustrates how the scale factor changes depending upon the display resolution required.

Required display after 1000 input pulses have been received	Scale factor
20	50.00
20.0	5.00
20.00	0.50

For a BA550C (4/20mA input)

The BA550C converts a 4/20mA analogue input current into an internal pulse signal which is counted and scaled to provide the total display. With an input of 20mA the internal current to frequency converter produces 1000 input pulses per second. To calculate the scale factor it is therefore necessary to specify the required display after 1 second with a 20mA input.
When calculating the batch scale factor the 'Display after 1 second with a 20mA input' must include all the digits on both sides of the displayed dummy decimal point, but the decimal point should not be included in the calculation. eg. for a required display of 500.0 after 1 second enter 5000 in the formula.

$$\text{SCALE(T)} = \frac{1000}{\text{Display after 1s with 20mA input}}$$

To adjust the batch scale factor select 'SCALE(T)' from the batch parameter menu and press *Ent* to reveal the existing dividing factor which may be changed by pressing the *Up* or *Down* buttons.

7.4.7 Grand total: GRANDTOT

The grand total is stored in a separate counter which is not zeroed by the front panel *Reset* push-button. This counter contains the total of all batches which have been produced, or when programmed as a totaliser, the absolute total ignoring resets.

In the operating mode the grand total can be viewed at any time by pressing and holding the *Batch* push-button. For figures up to 99999999 the grand total is displayed with a decimal point in the same position selected for the batch total display - see 7.4.5 and 7.4.6. Above 99999999 the display changes to an exponent form, n.nnnnEnn which is equivalent to $n.nnnn \times 10^{nn}$ and retains the significance of the decimal point.

The maximum contents of the grand total register is 2.814×10^{14}. When a decimal point is specified for the batch total display the maximum grand total is reduced to $2.814 \times 10^{(14-N)}$ where N is the number of digits on the right hand side of the decimal point.

In the programming mode the grand total can be read to sixteen significant figures and if required reset to zero. To access the grand total counter select 'GRANDTOT' from the batch parameter menu and press *Ent* which will reveal a sub-menu with three options.

The grand total counter is divided into two eight digit numbers, to view the most significant eight digits select 'VIEWHI' from the sub-menu and press and hold the *Ent* button to reveal the number. To view the least significant eight digits select 'VIEWLO' and again press and hold *Ent.* Viewing the grand total register does not change the contents.
To zero the Grand total register select 'ZERO GT' from the sub-menu, and press the *Ent* button to reset the grand total register to zero.

CAUTION
After zeroing, the old grand total can not be recovered

7.5 Programming the rate parameters

See Fig 12

To access the rate parameter programming menu the *Prog* and *Rate* front panel push-buttons should be pressed simultaneously. The display will show 'SCALE(R)' which is the rate scale factor, other parameters may be accessed by scrolling through the menu using the *Up* or *Down* push-buttons. After selecting the required parameter press *Ent* to reveal the current value or status.

The status of parameters can be changed by pressing the *Up* push-button which will toggle the display between the options. When the display shows the required option press *Prog* to return to the programme menu from which another parameter may be selected for adjustment, or the BA550 may be returned to the operating mode by pressing the *Prog* push-button a second time.

Parameters which require a number to be entered are initially displayed with one digit flashing indicating that this digit may be adjusted by pressing the *Up* or *Down* push-buttons. When this digit has been set to the required number, press *Ent* to adjust the next digit. When all the digits have been adjusted press *Prog* to return to the programme menu from which another parameter may be selected for adjustment, or the BA550 may be returned to the operating mode by pressing the *Prog* push-button a second time.

Fig 12 shows a diagrammatic representation of the rate parameter menu and the method of moving between the adjustments. Each parameter is summarised below and cross referenced to a full description in a following section.

Summary of rate parameters

Parameter	Description
DP (R)	**Decimal point** This parameter defines the position of the dummy decimal point when the BA550 is displaying rate. See section 7.5.1
SCALE(R)	**Rate scale factor** A multiplying factor which defines the relationship between the input frequency and the displayed input rate per second. See section 7.5.2
TIMEBASE	**Display timebase** Additional multiplying factors which determine whether the rate is displayed in engineering units per second, minute or hour. See section 7.5.3
FILTER	**Rate display filter** This parameter adjusts the amount of filtering applied to the rate display. See section 7.5.4

Full description of rate parameters

7.5.1 Decimal point: DP (R)

This parameter defines the position of the dummy decimal point when the BA550 is displaying rate. The decimal point may be positioned between any of the eight digits or may be omitted. To position the decimal point select 'DP (R)' from the rate parameter menu and press *Ent* to reveal the existing position which may be changed by pressing the *Up* or *Down* button.

Note: If the Rate scale factor or the Timebase are changed the decimal point will not be automatically repositioned.

7.5.2 Rate scale factor: SCALE(R)

The rate scale factor defines the relationship between the input pulse frequency and the rate displayed by the BA550. It is a multiplying factor used to convert the input frequency into a meaningful rate in engineering units per second and may be adjusted between 0.000001 and 99.999999

The rate may also be displayed per minute or per hour using the additional TIMEBASE multiplying factors which are described in section 7.5.3

BA550P (Pulse input)

$$\text{SCALE(R)} = \frac{\text{Required rate display per sec}}{\text{Number of input pulses per sec}}$$

When calculating the rate scale factor the 'Required rate display per second' must include all the digits on both sides of the displayed decimal point, but the decimal point should not be included in the calculation. eg. if the required rate display per second is 60.00 enter 6000 in the formula. The following table illustrates how the scale factor changes depending upon the display resolution required.

Required rate display per second with an input of 120 pulses per second	**Scale factor**
30	00.250000
30.0	02.500000
30.00	25.000000

BA550C (4/20mA input)

The BA550C converts the analogue input current into an internal 0 to 1kHz pulse signal which is scaled to provide the rate display. For a BA550C the formula to calculate the rate scale factor becomes:

$$\text{SCALE(R)} = \frac{\text{Required rate display per second}}{1000}$$

When calculating the rate scale factor the 'Required rate display per second' must include all the digits on both sides of the displayed decimal point, but the decimal point should not be included in the calculation. eg. if the required rate display per second is 10.0 enter 100 in the formula.

To minimise the affects of temperature drift within the BA550, it is recommended that the rate scale factor for a BA550C (4/20mA input), is limited to about 5.

To adjust the rate scale factor select 'SCALE(R)' from the rate parameter menu and press *Ent* to reveal the existing factor which may be adjusted by pressing the *Up* or *Down* push-buttons.

7.5.3 Display timebase: TIMEBASE

The rate scale factor described in the previous section defines the relationship between the input pulse frequency and the rate display in Hz (Cycles per second). The display timebase provides additional multiplying factors of 60 and 3600 so that the rate can be displayed in engineering units per minute or per hour.
Select 'TIMEBASE' from the rate parameter menu and press *Ent* to reveal the existing setting which may be changed by pressing the *Up* or *Down* buttons.

Note: Changing the timebase does not automatically change the position of the displayed dummy decimal point which must be manually positioned to suit the timebase selected - see section 7.5.1

7.5.4 Rate display filter: FILTER

The BA550 contains an adjustable rate display filter to reduce noise and provide a stable rate display. The amount of filtering required, which will depend upon the application, is controlled by a filter constant entered during programming. The filter constant is adjustable in integers between minus 6 and 11 with a default of 0. minus 6 provides no filtering and 11 maximum filtering.
To adjust the filter constant, select 'FILTER' from the rate parameter menu and press *Ent* to reveal the existing number, if more filtering is required increment the number by pressing the *Up* button, if less filtering is required decrement the number by pressing the *Down* button.

8. APPLICATIONS

This section contains examples of how the BA550 may be used as both a batch controller and as a totaliser.

8.1 Use as a totaliser & rate indicator

The BA550P (pulse input) may be programmed to count the number of input pulses and display the total in engineering units, and to display the input pulse rate (frequency) in the same of different units.
In this first simple example the instrument is used to display the speed and total number of screws produced by a screw forming machine. Each completed screw is detected by a sensor which produces a single 5 volt pulse.

The BA550P is required to:

Count and display the total number of screws manufactured.

Display the rate of screw manufacture per hour.

Initiate an alarm if output falls below five screws per second.

Fig 13 illustrates this example and the required conditioning and programming is shown below:

Input conditioning		**refer to**
To accept a 5V pulse both internal plug-in links should be put in the high voltage position. See Fig 6.		6.2.1

Programming		**refer to**
Mode parameters		
FUNCTION	select TOTALISE	7.3.1
CONTROL	select LOCAL	7.3.2
RTX O/P	select OFF	7.3.3
ROOT EXT	select OFF	7.3.4
TIMEOUT	set 00000.200	7.3.5
S/COMMS	select OFF	7.3.7
Batch parameters		**refer to**
DP (T)	select no point	7.4.5
SCALE(T)	set 0000001.00	7.4.6
Rate parameters		**refer to**
DP (R)	select no point	7.5.1
Scale(R)	set 01.000000	7.5.2
TIMEBASE	select HOUR	7.5.3
FILTER	select 00	7.5.4

The second application shown in Fig 14 illustrates how a BA550C (4/20mA analogue input) may be used with a magnetic flowmeter to display the total flow and flow rate in a water supply pipe.

The BA550C is required to:

Display total flow in m^3, with a resolution of $0.01m^3$.

Transmit a pulse to a remote counter.

Display flow rate in litres per minute, with a resolution of one litre.

The magnetic flowmeter produces a 20mA output at a flow of 50 litres per second.

Input conditioning		**refer to**
None required BA550C only accepts a 4/20mA input.		6.2.2

Programming		**refer to**
Mode parameters		
FUNCTION	select TOTALISE	7.3.1
CONTROL	select LOCAL	7.3.2
RTX O/P	select ON	7.3.3
ROOT EXT	select OFF	7.3.4
TIMEOUT	set 00000.000	7.3.5
C/COMMS	select OFF	7.3.7
Batch parameters		**refer to**
DP (T)	two decimal places required, position point N.N N	7.4.5
SCALE(T)	set 0000200.00 see following calculations	7.4.6

$$\text{SCALE(T)} = \frac{1000}{\text{Display after 1s with 20mA input}}$$

50 litres/s is equivalent to $0.05m^3/s$

The required display resolution is $0.01m^3$ therefore after one second the display should be 0.05 Ignoring the decimal point, enter 5 as the required display in the formula.

$$\text{SCALE(T)} = \frac{1000}{5} = 200$$

Rate parameters		**refer to**
DP (R)	select no point	7.5.1
SCALE(R)	set 00.050000 see following calculations	7.5.2

$$\text{SCALE(R)} = \frac{\text{Required rate display per second}}{1000}$$

$$\text{SCALE(R)} = \frac{50}{1000} = 0.05$$

TIMEBASE	select MINUTE	7.5.3
FILTER	select 00	7.5.4

8.2 Use as a batch controller & rate indicator

The BA550 may be used for most batch control applications where the input signal is a pulse or a 4/20mA analogue signal representing flow. The following example illustrates how the instrument may be used with a turbine flowmeter to control the filling system shown in Fig 15.

The BA550P (pulse input) is required to:

Dispense 1800 gallons of liquid into a tank.

Display the dispensed total with a resolution of 0.1 gallons.

Control two parallel valves (2 stage control).

Compensate for errors resulting from actuator delays.

Initiate an alarm if flowrate falls below 0.5 gallons per second.

Display the rate of filling in gallons per second with a resolution of one gallon.

The turbine flowmeter incorporates a 2-wire proximity detector which produces 137 pulses per gallon.

Input conditioning	**refer to**
To accept a 2-wire proximity detector both the internal plug-in links should be put in the proximity detector position see Fig 6.	6.2.1

Programming		**refer to**
Mode parameters		
FUNCTION	select BATCHER	7.3.1
CONTROL	select LOCAL	7.3.2
RTX O/P	select OFF	7.3.3
ROOT EXT	select OFF	7.3.4
TIMEOUT	set 00000.015 see following calculation	7.3.5

Alarm to be activated at 0.5 gallons/s
Flowmeter output 137 pulses per gallon which is equivalent to 68.5pulses/s
Maximum time between consecutive pulses

$$= \frac{1}{\text{Frequency}} = \frac{1}{68.5} = 0.015 \text{ seconds}$$

S/COMMS	select OFF	7.3.7

Batch parameters		**refer to**
DP (T)	One decimal point required position point N.N	7.4.5
SCALE(T)	set 0000013.70 see following calculations	7.4.6

$$\text{SCALE(T)} = \frac{\text{Number of input pulses received}}{\text{Required total display}}$$

$$= \frac{137 \times 1800}{18000} = 13.7$$

Rate parameters		**refer to**
DP (R)	select no point	7.5.1
SCALE(R)	set 00.007299 see following calculations	7.5.2

$$\text{SCALE(R)} = \frac{\text{Required rate display per second}}{\text{Number of input pulses per second}}$$

$$= \frac{1}{137} = 0.007299$$

TIMEBASE	select SECONDS	7.5.3
FILTER	select 00	7.5.4

9 MAINTENANCE

9.1 Fault finding

If a problem occurs while commissioning a BA550 refer to the following table which lists solutions for common problems. If you are unable to resolve the difficulty please telephone the BEKA sales office on (01462) 438301 or our agent in your area.

Symptom	Solution
Programme menus not accessible	Security link incorrectly positioned See section 7.1
Batch controller programme functions not available	BA550 has been conditioned as a totaliser, batch parameters therefore omitted from menus. See section 7.3.1
BA550 continuously repeats initialisation sequence.	Check that the power supply is above 20V, and that the ripple does not cause the instantaneous value to fall below 20V. See section 5.6
Front panel push-buttons do not function.	Instrument programmed for control by remote switches. See section 7.3.1
Outputs are not energised when Start push-button is operated.	Check that the Setpoint limit is correctly adjusted. See section 7.4.2
BA550 batch controller continues counting after batch setpoint is reached	The BA550 will only stop counting when the input pulse source stops, or the input current falls below 4mA. The control loop must be closed so that the BA550 output relays control the input signal.
Voltage pulse source disappears when BA550P is connected.	The BA550P (pulse input) does not have a galvanically isolated input. Ensure that the negative side of the input signal is at the same potential as the negative side of the 24V power supply. See section 5.1
BA550P will not count input pulses.	Incorrect input conditioning; check that both internal plug-in links are correctly positioned. See section 6.2.1 and Fig 6. Input connections reversed.
BA550C will not provide a rate or total display.	Input connections reversed.

9.2 Servicing

It is not easy to service a BA550 on site, we therefore recommended that faulty instruments are returned to BEKA associates or one of our agents for repair. The instrument has plug-in terminal blocks so a faulty unit can easily be replaced without disconnecting the field wiring.

The BA550P and BA550C are identical apart from a plug-in card which can easily be fitted on-site. One spare controller may therefore be used to replace any instrument which fails. For customers who are unable to justify purchasing a spare, BEKA associates and many of our agents can supply replacement instruments from stock.

9.3 Warranty

Instruments which fail within the warranty period should be returned to BEKA associates or the local agent from whom the instrument was purchased. It is helpful if a brief description of the fault symptoms is provided.

Please note that this guarantee excludes damage to relay contacts.

10 ACCESSORIES

10.1 Scale card

The BA550 has a window on the right hand side of the eight digit display to hold a scale card showing the units of measurement. Instruments can be supplied fitted with a scale card printed with any unit(s) specified by the customer at the time of ordering. If a printed card is not requested when the instrument is ordered a blank card will be supplied.

Scale cards can easily be marked or changed on site as follows:

CAUTION

Before removing the BA550 rear panel disconnect the 24V dc supply, and any power supply connected to the relay contacts.

1. Remove the rear panel by unscrewing the four corner screws and gently pull the panel backwards taking care not to bend any of the connector pins.

2 Slide the plastic scale card carrier out of the enclosure and remove the card which is secured by a self-adhesive pad.

3 Mark legend onto the card using a stencil or transfer, fix the card to the carrier and replace in the enclosure. Ensure that the legend is aligned with the front panel window.

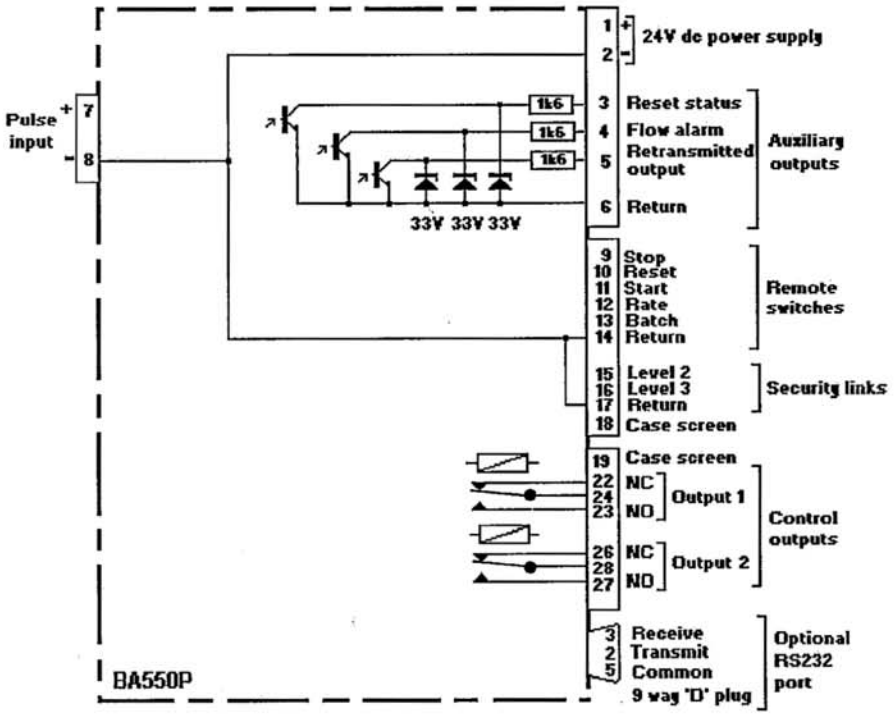
4 Replace the rear panel taking care not to damage or bend the connector pins.

10.2 Tag strip

Instruments can be supplied with a thermally printed plastic tag strip secured by screws to the rear of the enclosure. This tag is not visible from the front of the instrument after installation.

11. CUSTOMER COMMENTS

BEKA Associates is always pleased to receive comments from customers about its products and services. All communications are acknowledged, and whenever possible suggestions are incorporated into revisions and new products.



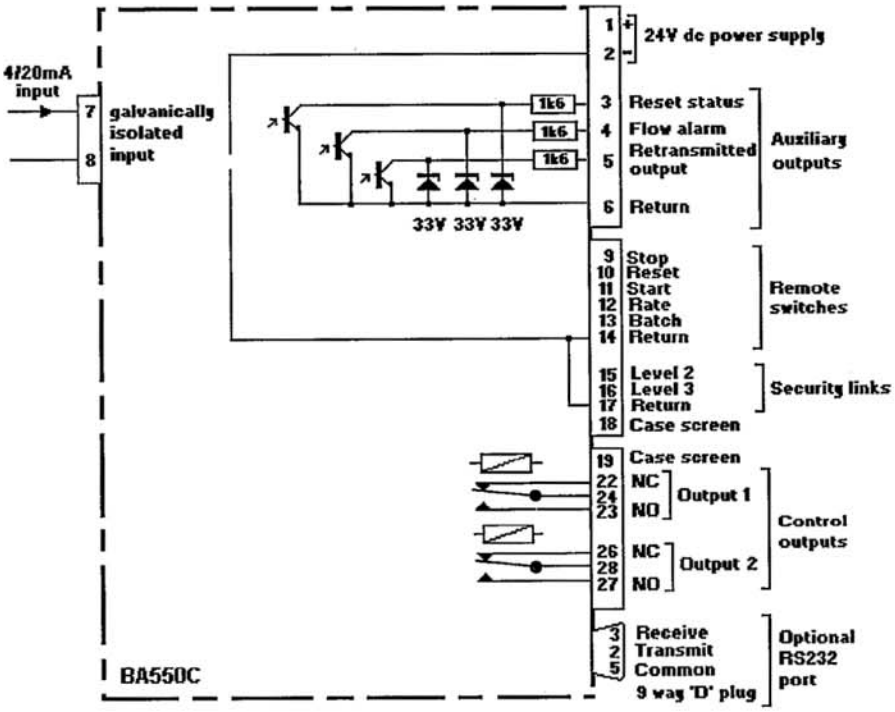


Fig 1 Simplified block diagram of BA550P and BA550C

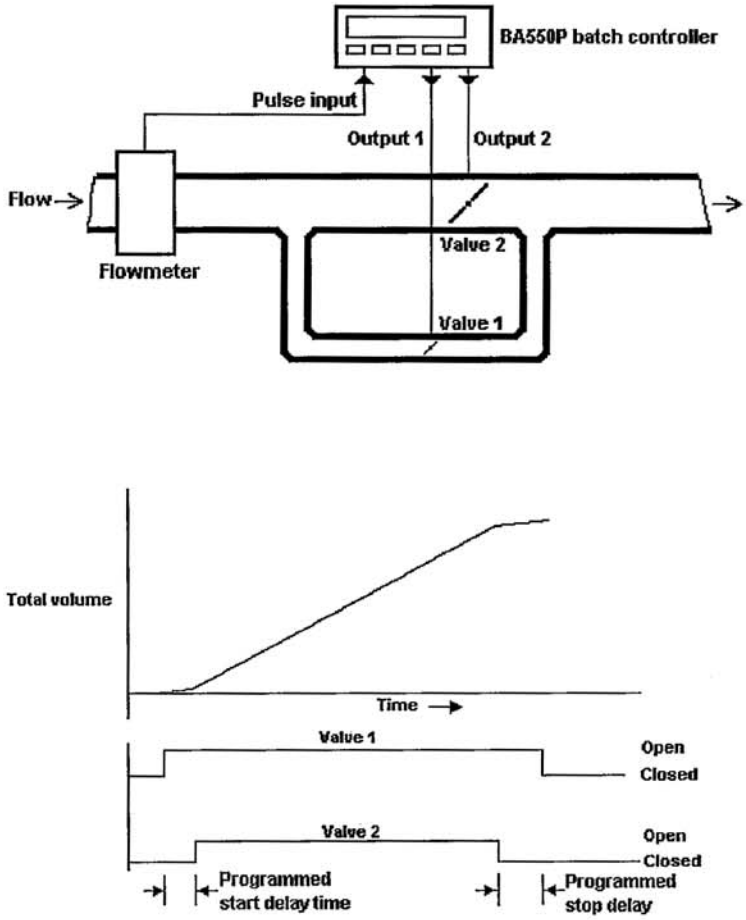


Fig 2 Example of 2 stage batch control

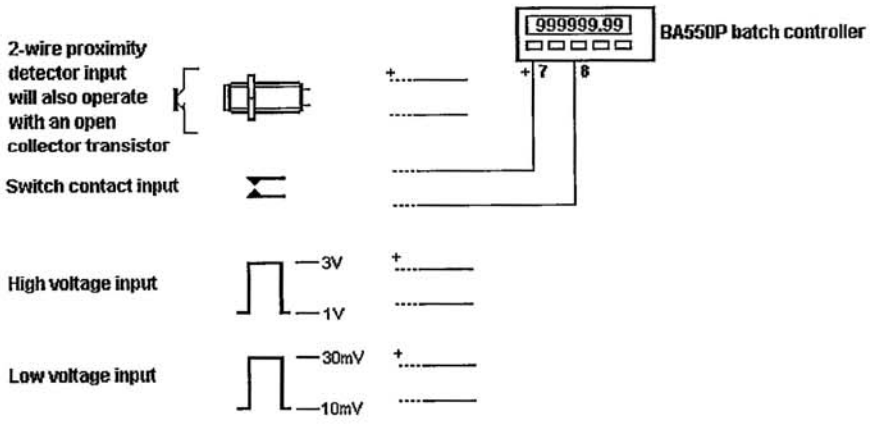


Fig 3 Alternative pulse inputs

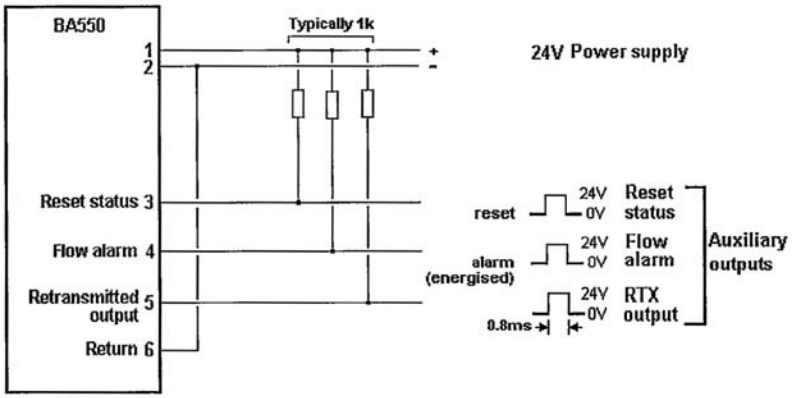


Fig 4 Pull-up resistors convert output from auxiliary outputs to voltage signals

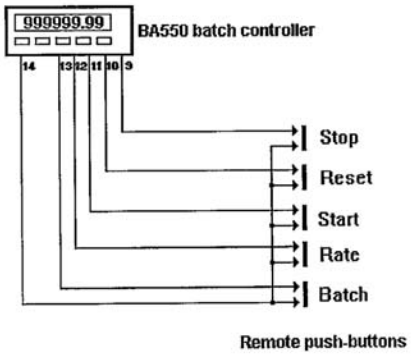


Fig 5 Remote switches

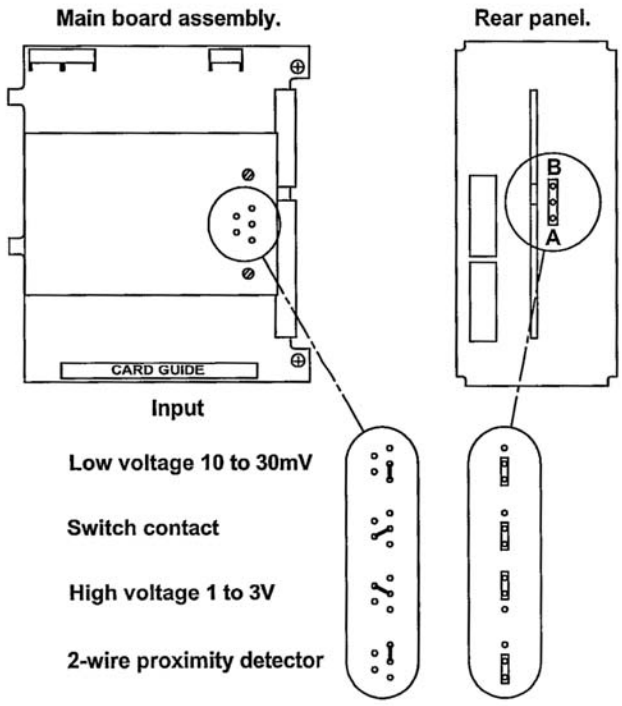
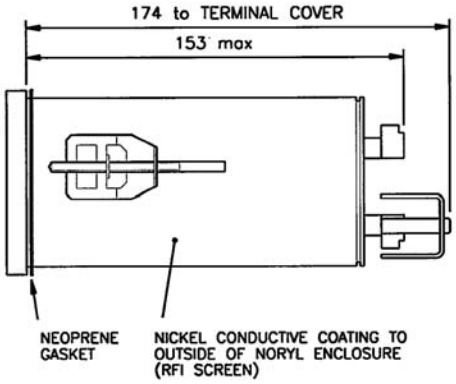
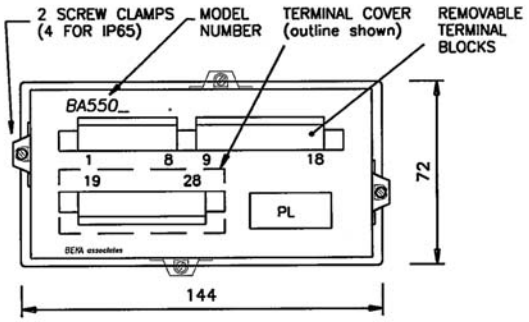


Fig 6 Position of BA550P input conditioning links





RECOMMENDED PANEL CUTOUT:

DIN 43 700:
138 +1.0/−0 x 68 +0.7/−0

To achieve an IP65 seal between instrument and panel:
136 +0.5/−0 x 66.2 +0.5/−0

Note: Four panel clips may be required

INSTALLATION:

1 INSERT INDICATOR INTO PANEL CUTOUT FROM FRONT.

2 SCREW CLAMPS ARE CLIPPED TO THE INDICATOR AND TIGHTENED FROM THE REAR.

TERMINAL CONNECTIONS:

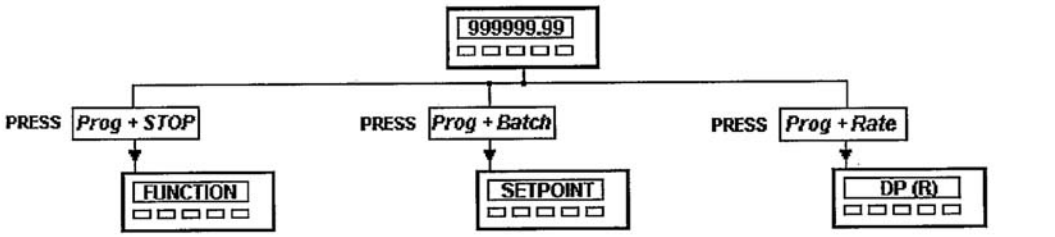
1	+	24V POWER SUPPLY
2	−	
3	RESET STATUS	AUXILIARY OUTPUTS
4	FLOW ALARM	
5	RTX PULSE	
6	RETURN	
7	+	SIGNAL INPUT
8	−	
9	STOP	REMOTE SWITCHES
10	RESET	
11	START	
12	RATE	
13	BATCH	
14	RETURN	
15	LEVEL 2	SECURITY LINKS
16	LEVEL 3	
17	RETURN	
18	CASE SCREEN	
19	CASE SCREEN	
20	NOT USED	
21	NOT USED	
22	NC	OUTPUT 1 (RELAY)
23	NO	
24	COMMON	
25	NOT USED	
26	NC	OUTPUT 2 (RELAY)
27	NO	
28	COMMON	
PL	SERIAL COMMS (if card fitted)	

NOTE:

For BA550P
TERMINALS 2, 8, 14 & 17 ARE INTERNALLY CONNECTED.

For BA550C
TERMINALS 2, 14 & 17 ARE INTERNALLY CONNECTED.

Fig 7 & 8 Terminal connections



Mode parameters - see Fig 10

FUNCTION Batcher or totaliser
CONTROL Local and/or remote control
RTX O/P Retransmitted output
ROOT EXT Square root extraction
TIMEOUT Missing pulse time
INHIBIT Flow alarm delay time *
S/COMMS Serial communication
UP/DOWN Direction of count *
AUTO RST Automatic reset *
AUTO-S Automatic restart *
OVERRUN Overrun compensation *
TEST Display test
LANGUAGE Display language

Batch parameters - see Fig 11

SETPOINT Setpoint *
SP LIMIT Setpoint limit *
DELAY Start delay time for Output 2 *
PRE-STOP Stop delay for Output 2 *
DP (T) Decimal point
SCALE (T) Batch scale factor
GRANDTOT *Grand total sub-menu*
VIEW HI 8 highest digits
VIEW LO 8 lowest digits
ZERO GT Zero grand total

Rate parameters - see Fig 12

DP (R) Decimal point
SCALE(R) Rate scale factor
TIMEBASE Display timebase
FILTER Rate display filter

Parameters marked with a * are only included in the menus when the BA550 is conditioned as a batch controller

Fig 9 Programming structure

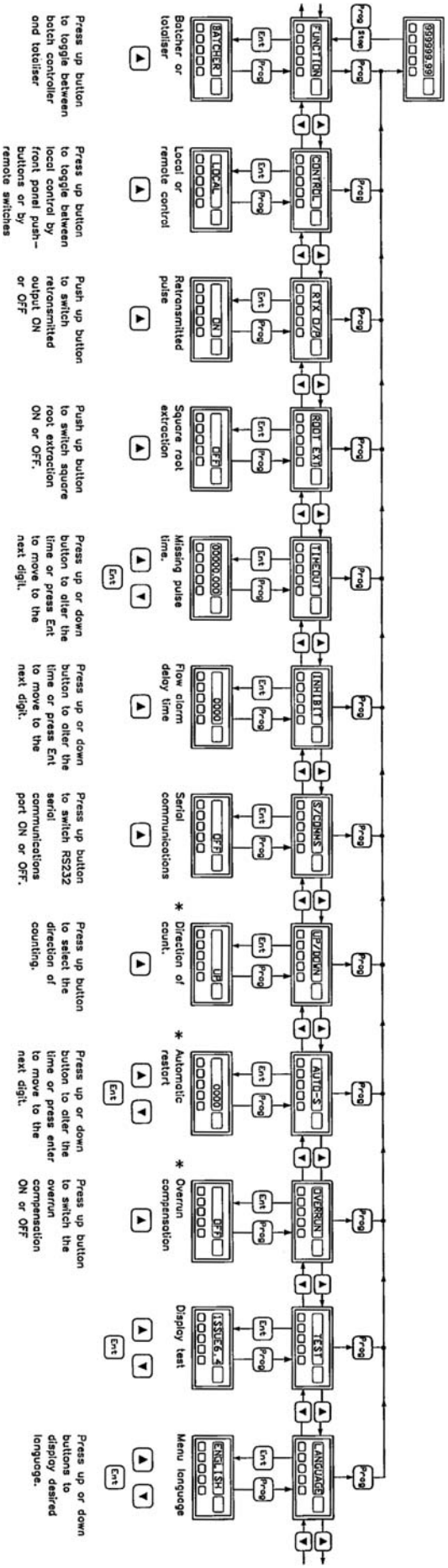
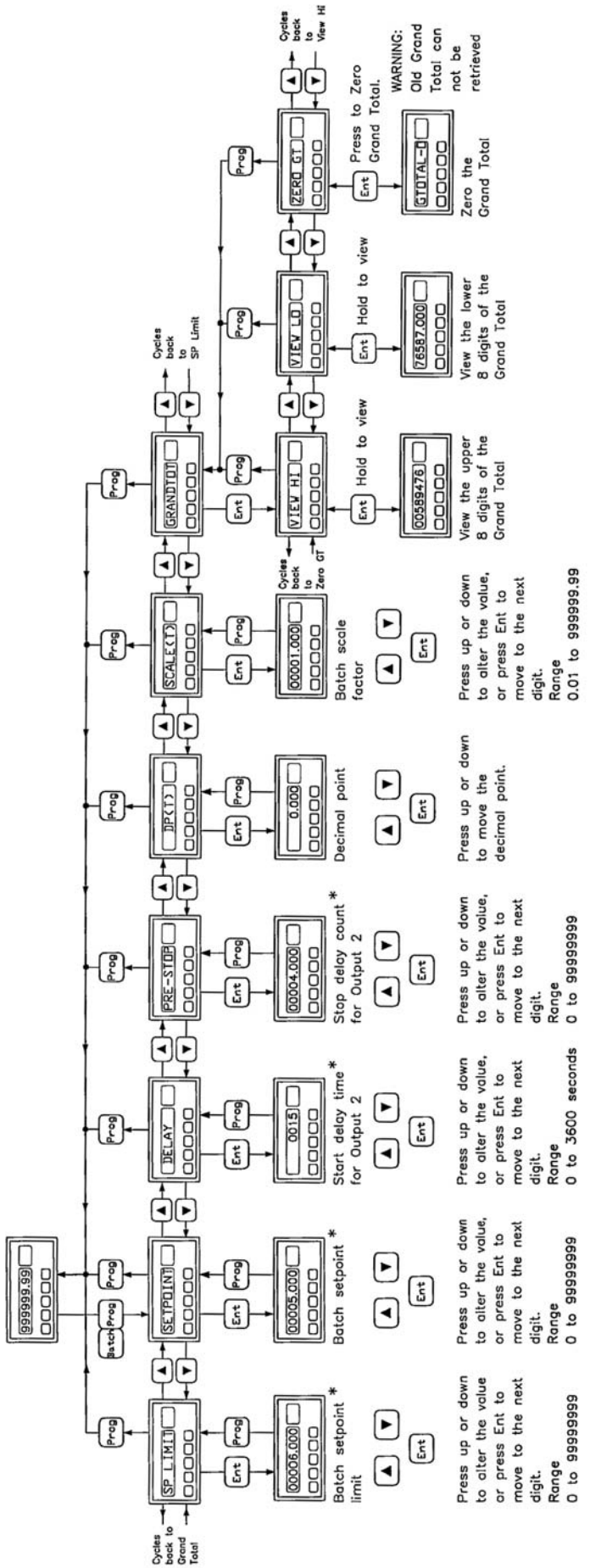


Fig 10 Mode parameter menu

Parameters marked with an * are only included in the menu when FUNCTION is set to BATCHER.



Parameters marked with an * are only included when FUNCTION in the mode parameter menu is set to BATCHER.

Fig 11 Batch parameter menu

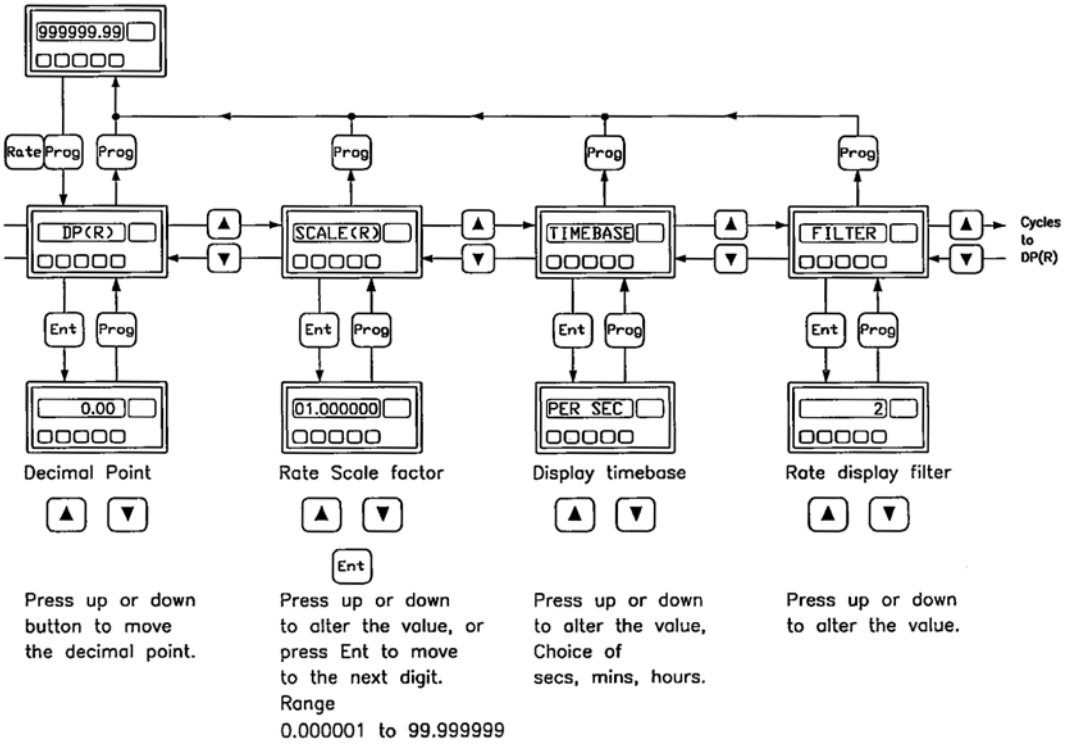


Fig 12 Rate parameter menu

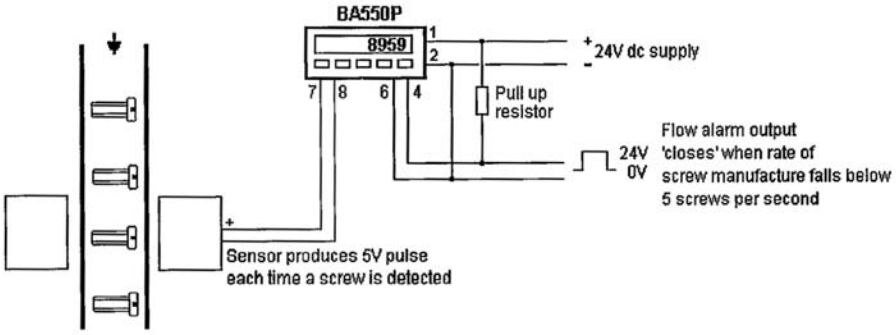


Fig 13 BA550P conditioned as a totaliser displaying total and rate of screw manufacture

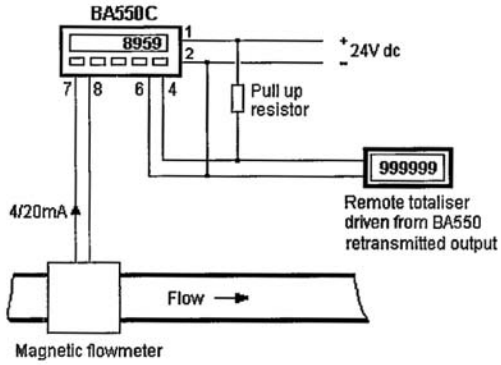


Fig 14 conditioned as a totaliser displaying rate and total flow

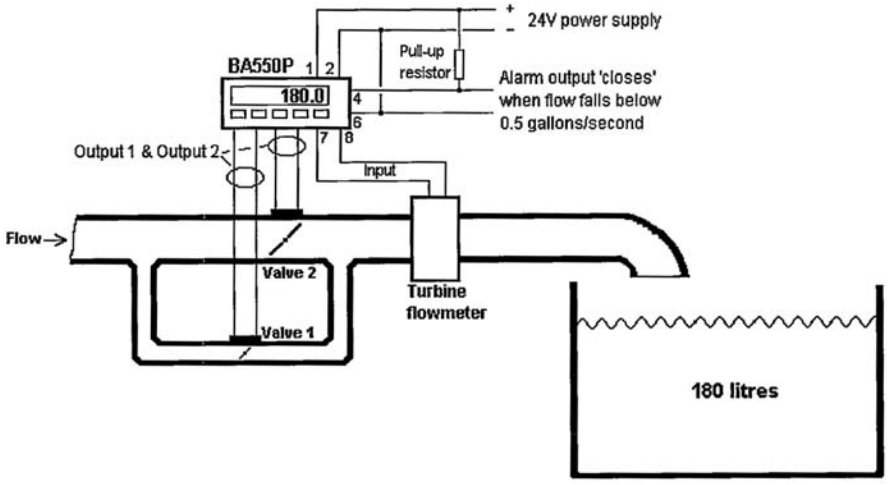


Fig 15 BA550P conditioned as a batch controller