BA558C
4/20mA loop powered
panel mounting
rate totaliser
issue 3

Label
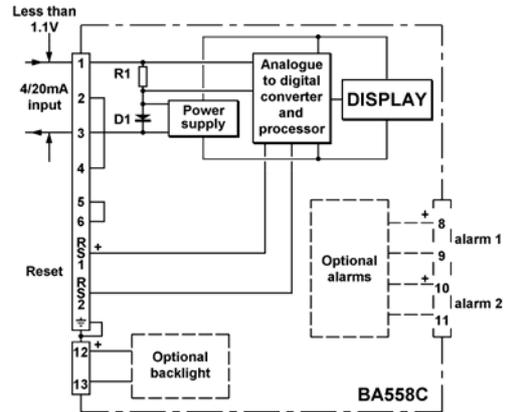
BA558C

Total display

TOTAL

RATE

SCALE CARD

Rate display

BEKA associates

Rotating flow indicator

Annunciators for optional alarms

CONTENTS

The BA558C is CE marked to show compliance with the European EMC Directive 2004/108/EC

1. DESCRIPTION

The BA558C is a 4/20mA loop-powered rate totaliser primarily intended for use with flowmeters. The instrument simultaneously displays the rate of flow and the total flow in engineering units on two separate displays. The BA558C only introduces a 1.1V drop which allows it to be installed into almost any 4/20mA flow loop. No additional power supply or battery is required.

Housed in a robust 72 x 144 panel mounting DIN enclosure, the BA558C has an IP65 front panel and is supplied with a gasket to seal the joint between the instrument and the panel.

2. OPERATION

Fig 1 shows a simplified block diagram of a BA558C. The 4/20mA input current flows through resistor R1 and forward biased diode D1. The voltage developed across D1, which is relatively constant, is multiplied by a switch mode power supply and used to power the instrument. The voltage developed across R1, which is proportional to the 4/20mA input current, provides the input signal for the analogue to digital converter.

Each time a 4/20mA current is applied to the instrument, initialisation is performed. After a short delay the following display sequence occurs:

All segments of the display are activated for about 3 seconds.

Decimal points on large display are sequentially activated for about 3 seconds.

Rate display and totaliser start to function using calibration information stored in the instrument's permanent memory.

If the 4/20mA current is disconnected during operation the latest total and grand total are stored in permanent memory.

Fig 1 Simplified block diagram of BA558C

2.1 Controls

The BA558C is controlled and calibrated via four front panel push-button switches. In the display mode i.e. when the instrument is displaying rate of flow and total flow, these switches have the following functions:

Summary of Switch Functions

P	Displays input current in mA or as a percentage of span.
Down	Shows rate display calibration at 4mA input
Up	Shows rate display calibration at 20mA input
E+Down	Grand total – displays least significant 8 digits
E+Up	Grand total – Displays most significant 8 digits.
Down +Up	Resets total display programmable function

Note: When optional alarms are fitted the push-buttons may be programmed to have alternative functions – see section 8.3

Full Description of Switch Functions

P   While this button is pushed the rate display will show the input current in mA, or as a percentage of the instrument span depending upon how the instrument has been programmed. When the button is released the normal display in engineering units will return. The function of this push-button may be modified when alarms are fitted to the instrument.

Down   While this button is pushed the instrument will show the calibrated rate display with 4mA input - usually zero for flow applications. When the button is released the flow rate will again be displayed.

Up   While this button is pushed the instrument will show the calibrated rate display with 20mA input. When the button is released the flow rate will again be displayed.

E+
Down   While these two buttons are pushed the total display will show the least significant eight digits of the grand total, and the grand total annunciator will be activated.

E+
Up   While these two buttons are pushed the total display will show the most significant eight digits of the grand total and the grand total annunciator will be activated.

Down+
Up   Resets the total display to zero when these two push-buttons are operated simultaneously. Selectable function from programme menu. See section 6.15

2.2 Displays
The BA558C has two digital displays and associated annunciators, plus a flow indicator as shown on page 1.

Rate display   Shows the flow rate on the smaller five digit display.

Total display   Shows total flow since the instrument was last reset on the larger eight digit display.

Flow indicator   Disc in the lower left hand corner of the display 'rotates' when the input current exceeds 4mA.

3. SYSTEM DESIGN

3.1 Flow transmitter loops
The BA558C rate totaliser may be connected in series with any 4/20mA flow loop and calibrated to display the rate of flow and total flow in engineering units. Fig 2 illustrates a typical flow loop application. The 4/20mA loop must be able to tolerate the additional 1.1V required to operate the indicator; increases to 1.2V at -20ºC.
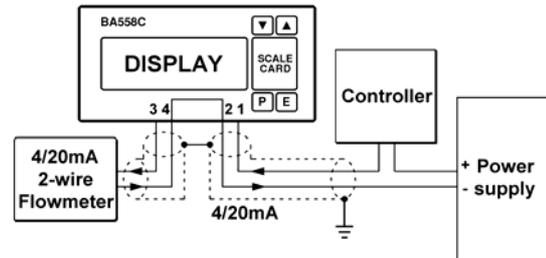
Fig 2 BA558C in a flow loop

Considering the example shown in Fig 2, the sum of the maximum voltage drop introduced by each component in the loop must be less than the minimum power supply voltage.

Min operating voltage of 2-wire flowmeter   10.0
Maximum voltage drop caused by controller   5.0
Maximum voltage drop caused by BA558C   1.2
Maximum voltage drop caused by cables   0.4
                                            ——
                                            16.6

At 20mA the power supply must therefore have an output greater than 16.6V

3.2 Remote indication
The BA558C rate totaliser may be driven from any 4/20mA signal to provide a remote indication of rate and flow. Fig 3 shows a typical application in which the 4/20mA output from a flowmeter drives a remote BA558C. Again it is necessary to ensure that the 4/20mA loop is able to supply the 1.1V required to operate the indicator; increases to 1.2V at -20ºC.

Fig 3 Remote indication from a flowmeter
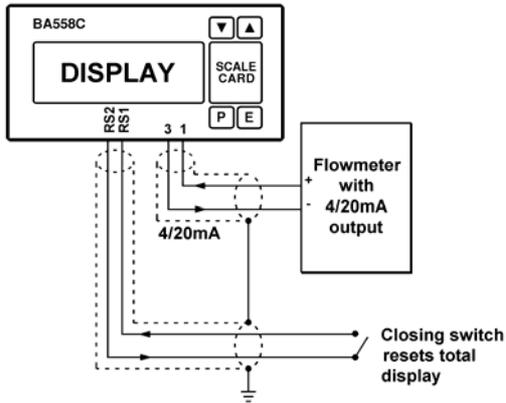
3.3 Reset terminals

The BA558C total display may be reset to zero by connecting a switch between reset terminals RS1 and RS2 as shown in Fig 3. There is no practical limit on the distance that the reset switch may be from the rate totaliser.

Alternatively, the BA558C may be programmed so that the total display is reset to zero when the Up and Down push-buttons are operated simultaneously for two seconds.

4. INSTALLATION

4.1 Location

The BA558C rate totaliser is housed in a robust aluminium enclosure with a polyester membrane front panel surrounded by a Noryl bezel. The front of the instrument provides IP65 protection, and a gasket seals the joint between the instrument enclosure and the panel. The instrument may be installed in any panel providing the environmental limits shown in the specification are not exceeded.

Fig 4 shows the overall dimensions of the BA558C and the panel cut-out. To achieve an IP65 seal between the instrument enclosure and the panel the smaller cut-out must be used and the instrument secured with four panel mounting clips.

The BA558C liquid crystal display has maximum contrast when viewed from directly ahead and slightly below the centre line of the instrument. For reflective displays there is little degradation of contrast when viewed from above the centre line, but slight degradation may be noticeable when the instrument is fitted with a backlight.
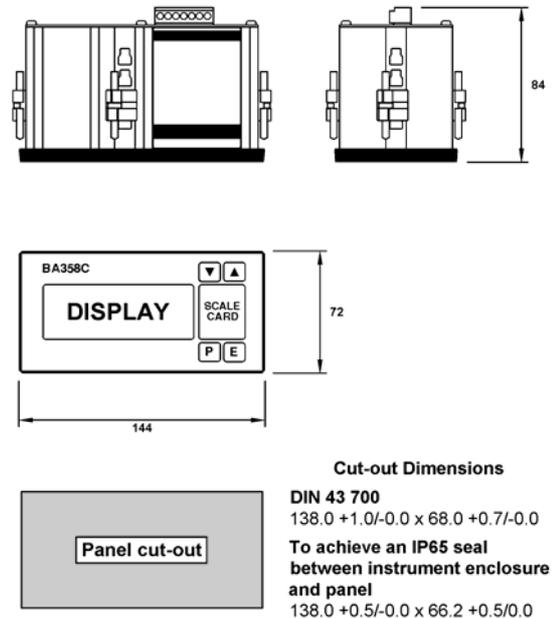

Cut-out Dimensions
DIN 43 700
138.0 +1.0/-0.0 x 68.0 +0.7/-0.0

To achieve an IP65 seal between instrument enclosure and panel
138.0 +0.5/-0.0 x 66.2 +0.5/0.0

Fig 4 BA558C dimensions

4.2 Installation Procedure

a. Insert the BA558C into the instrument panel cut-out from the front of the panel.

b. Fix panel mounting clips to opposite sides of the instrument and tighten until the instrument is secure as shown in Fig 5. Four clips are required to achieve an IP65 seal between the instrument enclosure and the panel.

c. Connect the panel wiring to the rear terminal block(s) as shown in Fig 5 To simplify installation, the terminals are removable so that panel wiring can be completed before the instrument is installed.

4.3 EMC

The BA558C complies with the requirements of the European EMC Directive 2001/108/EEC. For specified immunity all wiring should be in earthed screened twisted pairs.

Position gasket behind instrument bezel

Insert instrument into the panel from the front
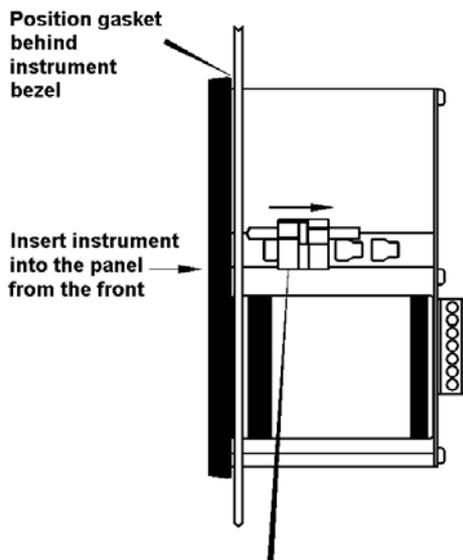
Slide panel mounting clip into the slotted rail on the side of the enclosure. Four clips are required to achieve an IP65 seal between instrument and panel.

| 8 | 9 | 10 | 11 |

+   +
Alarm   Alarm
1   2
Optional

| 12 | 13 |

+   -
Backlight optional

RS1 RS2

| 1 | 2 | 3 | 4 |

Terminals 2 & 4 internally linked for joining return 4/20mA wire.

+   -   +
4/20mA   Reset
input

Fig 5 Installation and terminal connections

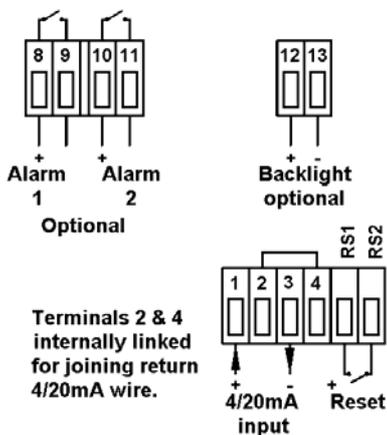## 5. PROGRAMMING & CALIBRATION

The BA558C is programmed and calibrated via four front panel push-buttons. All the programming functions are contained in an easy to use menu which is shown diagrammatically in Figs 7A and 7B. Each function is summarised in section 5.3 which includes references to more detailed information. Although this simple menu driven system enables most adjustments to be made without repeated reference to this manual, it is recommended that at least the summary of the programmable functions in section 5.3 is read before attempting programming or recalibration.

When the instrument is fitted with alarms, the basic menu is expanded to include the alarm functions that are described in section 8.3 of this manual.

Note: While the instrument is being programmed or calibrated totalisation is suspended, any flow occurring during this time will not be recorded.

5.1 Calibration structure

Fig 6 shows the BA558C calibration structure. The 4/20mA input current, which in flow applications represents flow rate, is displayed on the five digit rate display. Using the instrument 'CAL' or 'SEt' functions this display may be calibrated to show the flow rate in engineering units. Both the zero (display at 4mA) and the span (display at 20mA) are adjustable, although for flow application the display at 4mA is usually zero.

The position of the decimal point in the rate display is defined by the d.p. function. To simplify calibration the BA558C uses floating point arithmetic, moving the rate display decimal point position will therefore affect totalisation.

The BA558C total display is calculated from the rate display using two serial factors: the timebase 't-bASE' and the total scaling factor 'SCALE-t'. To calculate total flow the timebase divides the rate display according to whether the rate display represents flow per second, per minute or per hour. The total scaling factor 'SCALE-t' is a wide range programmable dividing factor allowing the total display to be in different units from the rate display.

For example, if a BA558C is displaying rate in litres per minute, setting 'SCALE-t' to 4.5461 produces a total display in UK gallons. Alternatively, setting 'SCALE-t' to 4546.1 will produce a total display in thousands of UK gallons.
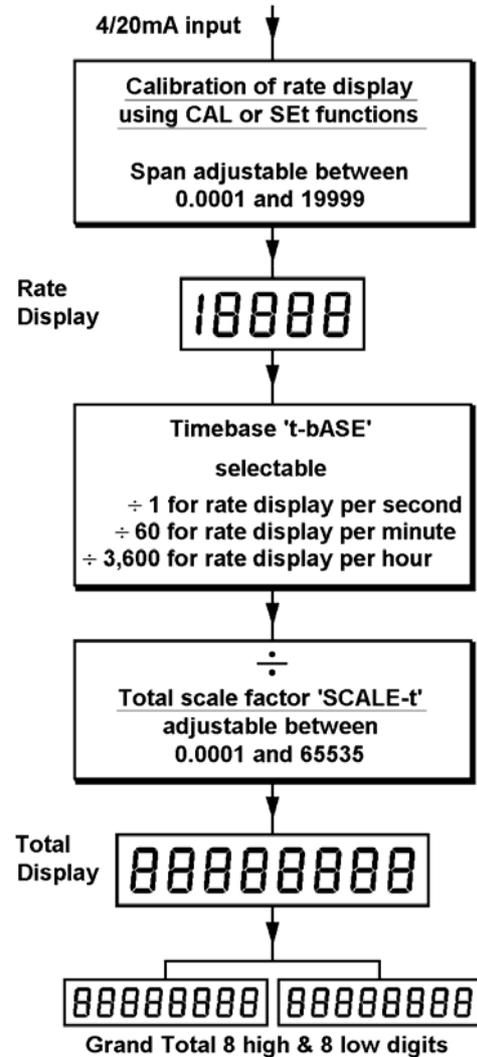

Fig 6 Calibration structure

The total is calculated and the display updated once per second. When total alarms are used for batching applications, this resolution may define the accuracy of the system.

5.2 Accessing programming functions

Throughout this manual push-buttons are shown in italics e.g. *P* or *Up* push-button, and legends displayed by the instrument are shown within inverted commas e.g. 'CAL' and ' ALr2'.

Access to the programme menu is obtained by operating the *P* and *E* push-buttons simultaneously. If the instrument is not protected by a security code the first parameter 'root' will be displayed. If a security code other than the default code 0000 has already been entered, the instrument will display 'COdE'. Press *P* to clear this prompt and enter the security code for the instrument using the *Up* or *Down* push-button to adjust each digit, and the *P* push-button to move control to the next digit. If the correct code has been entered pressing *E* will cause the first parameter 'root' to be displayed. If an incorrect code is entered, or a push-button is not operated, the instrument will timeout after ten seconds and automatically return to the display mode.

Apart from defining the position of the decimal point in the rate display all programme functions and prompts are shown on the large eight digit display.

Once within the main programme menu the required parameter can be reached by scrolling through the menu using the *Up* and *Down* push-buttons as shown by the programme structure in Figs 7A and 7B. When returning to the operating mode following recalibration or changes to any parameters, the total display will show circulating decimal points for a few seconds while the new information is stored in permanent memory.

All new BA558C rate totalisers are supplied calibrated as requested at the time of ordering. If calibration information is not supplied, the BA558C will be set to display a rate of 0.00 with 4mA input and 100.00 with 20mA input. The total scale factor will be set to 1.0000 with a timebase of flow per second. The instrument can easily be recalibrated on-site.

5.3 Summary of programmable functions

This section summarises all of the BA558C programmable functions. When read with Figs 7A and 7B it provides a quick aid for calibrating the instrument. If more detail is required, each section contains a reference to a full description of the function.

SUMMARY

Display	Description of function

'root'   **Square root extractor**
Enables the square root extractor for linearising the output from differential flowmeters.
Percentage CLIP-OFF, below which the instrument does not totalise, is automatically set to 5% of rate when the 'root' function is turned 'On'.
See section 5.4

'rESn'   **Display resolution**
Selects the resolution of the least significant digit of the rate display. May be set to 1, 2, 5 or 10 digits.
See section 5.5

'd.P.'   **Decimal points**
Defines the position of the decimal point in both the rate and total displays.
See section 5.6

'CAL'   **Calibration of rate display using external current source.**
Enables the zero and span of the rate display to be adjusted using an external current source such as a calibrator. Also enables a complete loop to be calibrated from primary element to the indicator display.
When used with an accurate traceable current source this is the preferred method of calibration.
See section 5.7

Display	Description of function

'SEt' **Calibration of rate display using internal references**.

Enables the zero and span of the rate display to be adjusted without the need for an accurate input current or disconnection from the 4/20mA loop.
See section 5.8

'Cond' **Indicator conditioning**

This is a protected sub-menu which contains the calibration routine for the two internal references 'rEF', and the mains (line) frequency selection function 'FrE'.
See section 5.9

CAUTION
Please read sections 5.9 and 5.9.1 of this manual before changing any of the parameters in this sub-menu. Incorrect adjustment may result in reading errors.

'CLr. Gtot' **Clears grand total**

This function resets the grand total to zero when 'CLr YES' is selected, and 'SurE' is entered to confirm the instruction.
Note: Once cleared, a grand total can not be recovered.
See section 5.10

't-bASE' **Timebase**

Three selectable divisors which define whether the rate display represents flow per second, per minute or per hour.
See section 5.11 & Fig 6.

'C - - P' **Function of *P* push-button in the display mode**

The instrument may be programmed to show on the rate display the input current in milliamps, or the input as a percentage when the *P* push-button is operated in the display mode. Select 'PC' for % of span and '4-20' to display current.
See section 5.12

Display	Description of function

'SCALE-t' **Total Scale Factor**

Defines the arithmetic relationship between the rate and total displays. May be adjusted between 0.0001 and 65535

$$\text{SCALE-t} = \frac{\text{Units of rate display}}{\text{Units of total display}}$$

To calculate SCALE-t the required units of measurement for the total display must be converted to the units of measurement used for the rate display.

See section 5.13 and Fig 6.

'CLIP-OFF' **Percentage Clip off**

To prevent the totalisation of very low flow rates, this function enables the user to select a percentage rate below which the rate display is forced to zero. Adjustable between 0 and 10% of flow for linear inputs, and 5 to 10% when the root function is used to linearise a square law input.
See section 5.14

'LOC.rSEt' **Local reset of total display**

When turned 'On' this function enables the total display to be reset to zero by simultaneously operating the *Up* and *Down* push-buttons.
See section 5.15

'COdE' **Security code**

Defines a four digit numeric code which must be entered to gain access to programmable functions. Default code 0000 disables the security function and allows unrestricted access to all programmable functions.
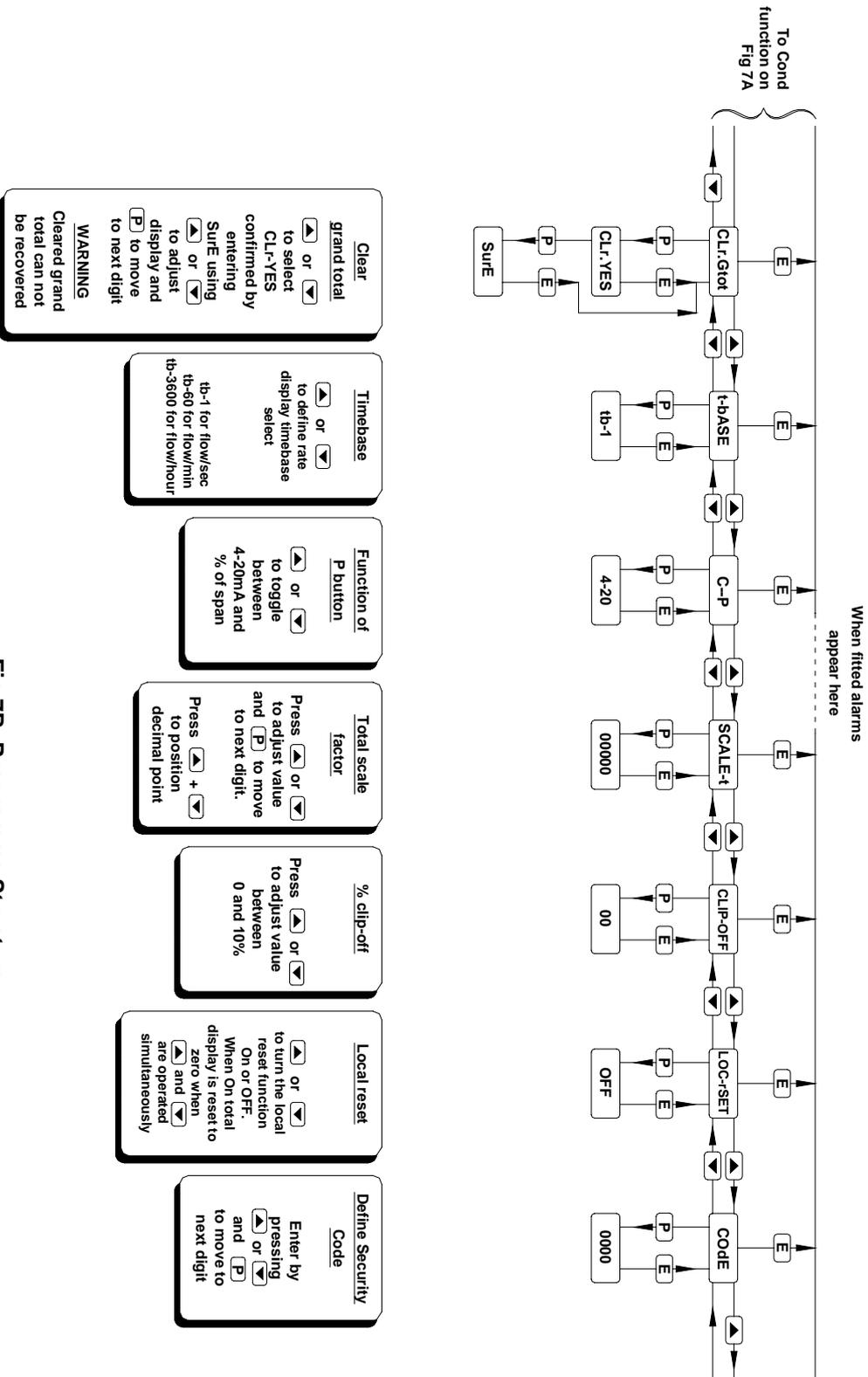See section 5.16

To Cond function on Fig 7A

When fitted alarms appear here

CLr.Gtot — P — CLr.YES — P — SurE
CLr.Gtot — E
CLr.YES — E

t-bASE — P — tb-1
t-bASE — E

C-P — P — 4-20
C-P — E

SCALE-t — P — 00000
SCALE-t — E

CLIP-OFF — P — 00
CLIP-OFF — E

LOC-rSET — P — OFF
LOC-rSET — E

COdE — P — 0000
COdE — E

Clear grand total
▲ or ▼ to select CLr-YES confirmed by entering SurE using ▲ or ▼ to adjust display and P to move to next digit

WARNING
Cleared grand total can not be recovered

Timebase
▲ or ▼ to define rate display timebase select
tb-1 for flow/sec
tb-60 for flow/min
tb-3600 for flow/hour

Function of P button
▲ or ▼ to toggle between 4-20mA and % of span

Total scale factor
Press ▲ or ▼ to adjust value and P to move to next digit.
Press ▲ + ▼ to position decimal point

% clip-off
Press ▲ or ▼ to adjust value between 0 and 10%

Local reset
▲ or ▼ to turn the local reset function On or OFF. When On total display is reset to zero when ▲ and ▼ are operated simultaneously

Define Security Code
Enter by pressing ▲ or ▼ and P to move to next digit

Fig 7B. Programme Structure

Fig 7A. Programme Structure

Display mode

DISPLAY

Security Code
Enter code by pressing ▶ ▼ and P to move to next digit. Code 0000 allows direct access

CodE — XXXX — root — On

rESn — 10

d.P. — 00000000 / 00000

CAL — ZErO — 19999 / SPAn — 19999

SEt — ZErO — 19999 / SPAn — 19999

Cond — SurE — FrE — 50 / rEF — .004A — Ent / .020A — Ent

Square root extraction
▲ or ▼ to toggle between On and OFF

Resolution
▲ or ▼ to select 1, 2, 5 or 10 digit rate display resolution

Decimal point
▲ or ▼ to select position of decimal point and P to toggle between displays

Calibration of rate display using external current source
With accurate 4mA input current set required zero display by pressing ▲ or ▼ and P to move to next digit
Similarly set the required full scale display using an accurate 20mA input current

Calibration of rate display using internal references
Without need for accurate input current set required display at 4mA by pressing ▲ or ▼ and P to move to next digit
Similarly set the required full scale display

Calibration of internal references
WARNING
READ INSTRUCTION MANUAL BEFORE ATTEMPTING TO ADJUST THESE REFERENCES

To GLr.tot function on Fig 7B

5.4 Root extractor: root

This function is primarily intended for use with differential flowmeters that have a square law 4/20mA output. The root extractor linearises the flow signal and enables the BA558C to display flow and total in linear units.

To activate the square root extractor select 'root' from the menu and press *P* which will reveal if the function is 'On' or 'OFF'. If the function is set as required, press E to return to the menu, or press the Up or Down button to change the setting, followed by the E button to return to the main menu.

For reference, the following table shows the output current from a non-linearised differential flowmeter.

% of full flow	Current output mA
2.5	4.01
10.0	4.16
25.0	5.00
50.0	8.00
75.0	13.00
100.0	20.00

5.5 Resolution: rESn

This function defines the resolution of the least significant rate display digit. Decreasing the display resolution can improve the readability of a noisy signal. Select 'rESn' from the menu and press *P* which will reveal the current display resolution. To change the resolution press the *Up* or *Down* button to select 1, 2, 5 or 10 digits, followed by the *E* button to return to the menu.

5.6 Position of the decimal points: d.P.

This function positions the decimal point in both the rate and total displays.

The rate display can have up to five digits and the decimal point may be positioned between any of them, or omitted. The BA558C uses floating point arithmetic so moving the position of the rate display decimal point will affect totalisation. Similarly the total display has eight digits and the decimal point may be positioned between any of them, or may be omitted.

To adjust the position of either decimal points select 'd.P.' from the main menu and press *P* which will activate both displays with one digit and the following decimal pointof the total display flashing. If only the least significant digit is flashing, this indicates that the decimal point is omitted.

The position of the decimal points can be moved by pressing the *Up* or *Down* push-buttons. Operating the *P* push-button will toggle control between the two displays. When both decimal points have been correctly positioned press *E* to return to the main menu.

If the application requires flow rate to be the primary display i.e. shown on the large display, the d.P. function enables the rate and total displays to be interchanged. The rate display will continue to have five digits but the total display will be reduced from eight to six digits. The rate and total annunciators will also be interchanged. Pressing the Up and Down buttons simultaneously will interchange the displays.

5.7 Calibration of the rate display using an external current source: CAL

This function enables the zero and span of the rate display to be adjusted using an external current source such as a 4/20mA calibrator. When used with an accurate traceable current source this is the preferred method of calibration.

To calibrate the instrument select 'CAL' from the main menu and press *P*. The indicator will display 'ZErO' which is a request for a 4mA input current. Adjust the external current calibrator to 4.000mA and again press *P* which will reveal the current instrument zero display. For flow applications this will usually be zero. Each digit of the rate display can be changed by pressing the *Up* or *Down* buttons. When the first digit is correct pressing *P* will transfer control to the next digit. When all the digits have been adjusted, press *E* to enter the new zero. The indicator will display 'Ent' for a few seconds while the information is being stored in memory, and will then return to the 'ZErO' prompt .

To adjust the rate display at 20mA, press the *Up* button which will cause the instrument to display 'SPAn'. Adjust the external current calibrator to 20.000mA and again press *P* which will reveal the existing full scale display. Each digit of the rate display can be changed by pressing the *Up* or *Down* buttons. When the first digit is correct pressing *P* will transfer control to the next digit. The most significant digit, which can be 1 or 2, is set by rolling over the previous digit. When all the digits have been adjusted press *E* to enter the new span. The instrument will display 'Ent' for a few seconds while the information is being stored in memory, and will then return to the 'SPAn' prompt. Finally press *E* again to return to the main menu.

This function may also be used when calibrating a complete loop including the flow meter.

5.8 Calibration of the rate display using internal references: SEt

This function enables the zero and span of the rate display to be adjusted without the need for an accurate external current source, or for disconnection from the 4/20mA loop.   The accuracy of this method depends upon the accuracy of the internal references which should be regularly calibrated as described in section 5.9.2

To calibrate the rate display select 'SEt' from the main menu and press *P*.   The instrument will display 'ZErO', pressing *P* again will reveal the current display at 4mA.   For flow applications this will usually be zero.   Each digit of the rate display can be changed by pressing the Up or Down buttons.   When the first digit is correct pressing P will transfer control to the next digit.   When the least significant digit has been adjusted, press E to return to the 'ZErO' prompt which completes the adjustment.

To adjust the rate display at 20mA, press the *Up* button which will cause the instrument to display 'SPAn'.   Pressing *P* again will reveal the existing full scale rate display.   Each digit can be changed by pressing the *Up* or Down buttons. When the first digit is correct, pressing *P* will transfer control to the next digit. The most significant digit can only be adjusted by rolling-over the previous digit. When all the digits have been adjusted press *E* to return to the 'SPAn' prompt, followed by *E* to return to the main menu.

5.9 Conditioning sub-menu: Cond

This sub-menu allows the mains (line) frequency at which the instrument has maximum ac rejection to be selected and the two internal references to be calibrated. To minimise the possibility of accidental adjustment these functions are contained in a protected sub-menu. To gain access to this sub-menu select 'Cond' from the main menu and press *P* which will cause the instrument to display '0000'. Using the *Up*, and *Down* buttons and the *P* button to move to the next digit, enter the password 'SurE'. 'S' is entered as '5'. Pressing *E* will then give access to the sub-menu.

5.9.1 AC rejection: FrE

WARNING
If the mains filter frequency is changed, the rate display and the internal references (if used) must be recalibrated.

To provide maximum low frequency rejection the internal digital filter may be set to operate at 50 or 60Hz to correspond with the local mains (line) frequency.   To change the frequency select 'FrE' from the 'Cond' sub-menu and press *P* which will reveal the current setting.   The setting can be changed by pressing the *Up* or *Down* buttons followed by the *E* button to return to the sub-menu.

5.9.2 Calibration of internal references: rEF

The BA558C contains two references representing 4 and 20mA. These are used in the 'SEt' function that enables the rate display to be calibrated without an external current calibrator.   They are also used in the 'C--P' function when the *P* push-button is programmed to display the input current in the display mode.   If either of these two functions are used, the internal references should be routinely calibrated against an external 4/20mA calibrator connected to the input terminals of the instrument.   See section 7.4

To calibrate the internal references select 'rEF' from the sub-menu and press *P* which will result in a '.004A' prompt being displayed. Adjust the external current calibrator to 4.000mA and again press *P*. The instrument will display 'Ent' while the 4mA reference is being updated and will then return to the '.004A' prompt.

To re-calibrate the 20mA internal reference, press the *Up* button which will cause the instrument to display '.020A'. Adjust the external current calibrator to 20.000mA and again press *P*. The BA385C will display 'Ent' while the 20mA reference is being updated and will then return to the '.020A' prompt. This completes calibration of the internal references, two operations of the *E* button will return the instrument to the 'Cond' prompt in the main menu.

5.10 Resetting grand total: CLr. Gtot

The grand total is a separate sixteen digit counter which duplicates the total display, but is not zeroed when the total display is reset to zero. The grand total may be viewed in the display mode in two eight digit sections as described in section 2.1 of this manual.

The grand total counter can only be reset to zero from the 'CLr.Gtot' function within the main programme menu. To zero the grand total counter select 'CLr. Gtot' and press *P* which will cause the instrument to display 'Clr. no' with 'no' flashing. Press the *Up* or *Down* button until 'CLr. YES' is displayed followed by *P* which will result in a '0000' prompt. Using the *Up* and *Down* buttons and the *P* button to move to the next digit, confirm the request by entering the password 'SurE'. Note 'S' is entered as '5'. Pressing *E* will then reset the grand total counter to zero and return the instrument to the 'CLr. Gtot' prompt in the main menu.

WARNING
After resetting the grand total counter to zero the old grand total can not be recovered.

5.11 Timebase: t-bASE
Together with the total scale factor 'SCALE-t', this function defines the arithmetic relationship between the rate and total displays. The timebase divides the rate display by 1, 60 or 3,600 depending upon whether the BA558C rate display represents flow per second, per minute or per hour. See Fig 6.

To check or change the timebase select 't-bASE' from the main menu and press *P* which will reveal the current setting. Pressing the *Up* or *Down* buttons will index though the following three options.

BA558C Rate display represents flow	Select In t-base menu	Total display = rate divided by
Per second	tb – 1	1
Per minute	tb – 60	60
Per hour	tb – 3600	3600

Select the required divisor and press *E* to return to the main menu.

5.12 Function of the *P* push-button: C - - P
This parameter defines the function of the *P* push-button when the BA558C is in the display mode. Either the input current in milliamps or the input as a percentage of span may be shown.

To check or change this parameter select 'C - -P' from the main menu and press *P* to reveal the current setting. Pressing the *Up* or *Down* button will toggle the instrument between the two options. Select '4-20' if the input current in milliamps is required, or 'PC' if the input as a percentage of span is required. When the required option is displayed press *E* to store the selection and return to the main menu.

Accuracy of both these options depends upon the accuracy of the internal references which should be periodically calibrated - see section 5.9.2

5.13 Total scale factor: SCALE-t
Together with the timebase 't-bASE', this is a dividing factor which defines the arithmetic relationship between the rate and total displays. The total scale factor may be set to any value between 0.0001 and 65535* allowing the total flow and rate of flow to be displayed in different engineering units.

$$SCALE\text{-}t = \frac{\text{Units of rate display}}{\text{Units of total display}}$$

When calculating SCALE-t the required units of measurement for the total display must be converted to those used for the rate display as shown in following example:

The BA558C rate display represents litres per second but the total flow display is required in UK gallons. There are 4.5461 litres in a UK gallon.

$$SCALE\text{-}t = \frac{\text{Units of rate display}}{\text{Units of total display}}$$

$$= \frac{1 \text{ litre}}{1 \text{ gallon}} = \frac{1 \text{ litre}}{1/(4.5461) \text{ litres}}$$

$$SCALE\text{-}t = 4.5461$$

Alternatively if the total display is required in thousand of UK gallons

$$= \frac{1 \text{ litre}}{1 \text{ gallon}} = \frac{1 \text{ litre}}{1/(4546.1) \text{ litres}}$$

$$\text{SCALE-t} = 4546.1$$

The total scale factor SCALE-t is not dependent on the rate display units of time. i.e. flow units per second, minute or per hour. The timebase t-bASE accounts for these differences.

To check or change the total scale factor select 'SCALE-t' from the main menu and press *P* to reveal the existing setting, one digit will be flashing. The value of the flashing digit can be changed by pressing the *Up* or *Down* buttons. When this digit is correct pressing *P* will transfer control to the next digit.

To position the decimal point, move the flashing digit to the left hand side of the required decimal point position and simultaneously press the Up and Down buttons.

When the required total scale factor has been entered, press *E t*o store the number and return to the main menu.

*Note: The maximum numerical value of SCALE-t is 65535 irrespective of the decimal point position. i.e. 6.5535; 65.535; 655.35; 6553.5 and 65535.

5.14 Percentage clip-off: CLIP-OFF
To prevent errors resulting from the totalisation of very low flow rates over long periods, the BA558C rate display can be forced to zero when the flow rate falls below a specified value. This threshold may be adjusted between 0 and 10% of flow for linear inputs, and between 5 and 10% of flow for square law inputs linearised by the root extractor.

To check or change the cut-off point select 'CLIP-OFF' from the main menu and press *P* to reveal the current setting. This clip-off threshold is shown as a percentage of total flow and may be adjusted in one percent increments using the *Up* or *Down* buttons. When set as required, press the *E* button to enter the revised figure and return to the main programme menu.

5.15 Local reset of total display: LOC. rSET
When turned on this function enables the operator to reset the BA558C total display to zero by operating the *Up* and *Down* push-buttons simultaneously. To check the status of the function select 'LOC. rSET" from the menu and press *P*. If required press the *Up* or *Down* button to change the setting, followed by the *E* button to return to the main menu.

5.16 Security code: COdE
The calibration and conditioning of the instrument may be protected by a four digit security code which must be entered before access to the programme menu is granted. New instruments are programmed with the default security code 0000 which allows unrestricted access to all programming functions.

To enter a new security code select 'COdE' from the menu and press *P.* The current security code will be displayed which may be changed using the *Up* and *Down* push-buttons, and the *P* button to move to the next digit. When the required code has been entered press *E* to return to the main menu. The revised security code will be activated when the indicator is returned to the display mode.

If the security code is lost, access to the programmable functions can be obtained by moving the internal security link to the override position. The original security code can then be viewed by selecting 'CodE' from the main menu and pressing *P*.
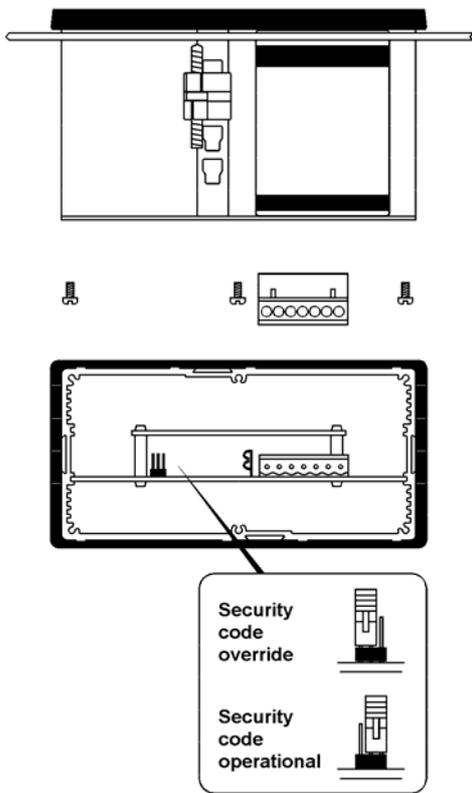
Fig 8 Location of security code override link

To gain access to the security code link, remove the instrument terminal block(s) by gently pulling. Remove the six screws securing the rear panel, and lift off the panel which will reveal the link - see Fig 8.

5.17 Over and under-range
If the rate display range is exceeded, the four least significant digits will be blanked. Under-range is indicated by a flashing '-1' and over-range by a flashing '1'. Under and over-range are also indicated if the input current falls below approximately 3.6mA or rises above approximately 21mA.

If the input current falls below approximately 3mA, the instrument initialisation sequence is performed as described in section 2.

When the total display exceeds 99999999 it will automatically roll-over to zero and continue counting. The most significant eight digits of the grand total counter can count the number of times the total display rolls-over. If it is anticipated that in normal operation the total display will exceed 99999999, the grand total should be reset to zero during commissioning. Up to 10^8 roll-overs can be counted.

6. CALIBRATION EXAMPLES
This section includes two examples illustrating how a BA558C rate totaliser may be programmed and calibrated to display the rate of flow and total flow measured by a flowmeter with a 4/20mA output. Section 7.1 describes the preferred method of calibration using an external traceable 4/20mA calibrator. Section 7.2 contains an example of calibration using the BA558C internal 4 and 20mA references, which although not traceable, are adequate for many industrial applications.

6.1 Calibration example
Using an external current source
In this example the BA558C rate totaliser is connected to a flowmeter having an output of 20mA at a flow of 1100 litres / minute. The BA558C is required to display flow in litres per minute and total flow in cubic metres with a resolution of 0.1 cubic metres. Totalisation is to occur for flow rates between 1 and 100% of maximum flow. The frequency of the mains supply is 50Hz and a security code of 1209 is required. In the display mode the BA558C is required to display the input current as a percentage of span when the *P* push-button is operated.

Step 1 Connect instrument to calibrator
Connect the BA558C to an accurate current source such as a calibrator. Terminal 1 positive and terminal 3 negative. The instrument will perform the initialisation routine described in section 2, and then display the input current on the rate display using the existing calibration information.

Step 2 Enter the programming mode
With an input current between 4 and 20mA put the instrument in the programming mode by simultaneously pressing *P* and *E*. Assuming a security code has not already been entered the instrument will respond by displaying 'root' which is the first function in the main menu. See Figs 7A and 7B.

Step 3 Turn square root extractor off
With 'root' displayed, press *P* which will reveal the root extractor status. The root extractor can be turned on or off by operating the *Up* or *Down* buttons. Select 'OFF', and press *E* to return to the 'root' prompt in the main menu.

Step 4 Select frequency of maximum mains (line) rejection
Scroll though the main menu until 'Cond' is displayed; press *P* which will result in the instrument displaying '0000' with the most significant digit flashing. To prevent accidental adjustment the Cond sub-menu is protected by the code word 'SurE'' which must be entered character by character using the *Up* and *Down* buttons plus *P* to move control to the next digit. Note: S is entered as 5. When 'SurE' has been entered pressing *E* will result in the 'FrE' prompt. Press *P* to enter the function and using the *Up* or *Down* buttons select '50'. Finally, press *E* twice to return to the 'Cond' prompt in the main menu.

Step 5 Define function of *P* push-button Select 'C--P' from the main menu and press *P* to reveal the function of the *P* push-button in the operating mode. Select percentage 'PC' and return to the main menu by pressing *E.*

Step 6 Define rate display resolution
Select 'rESn' from the main menu and press *P* to reveal the current resolution of the rate display. Using the *Up* and *Down* push-buttons select a resolution of '1' and return to the 'rESn' prompt in the main menu by pressing *E.*

Step 7 Position rate & total decimal points
Select 'd.P.' from the main menu and press *P*. The rate and total displays will be activated with one digit of the total display flashing. Press the *Up* or *Down* push-button until the second least significant digit and following decimal point of the total display flash. This gives the required total display resolution of 0.1

Press *P* to move control to the rate display. Using the *Up* or *Down* push-button move the flashing digit to the least significant position (right hand side) which will result in no decimal point in the rate display.

Finally press *E* to return to the 'd.P'. prompt in the main menu.

Step 8 Calibrate the rate display
Scroll through the main menu until 'CAL' is displayed. Press *P* and the instrument will request a 4mA input by displaying 'ZErO'. Set the input current to 4.0000mA and press *P* again which will reveal the existing rate display. Using the *Up*, *Down* and *P* push-buttons enter the required zero display of 0000 Press *E* to enter this calibration figure. The instrument will display 'Ent' for a few seconds before returning to the 'ZErO' prompt.

Press the *Up* push-button and the instrument will request a 20mA input by displaying 'SPAn'. Set the input current to 20.0000mA and again press *P* which will reveal the existing rate display at 20mA. Using the *Up*, *Down* and *P* push-buttons enter the required display of 1100 Press *E* to enter this calibration figure. The instrument will display 'Ent' for a few seconds before returning to the 'SPAn' prompt.

Finally press *E* again to return to the 'CAL' prompt in the main menu.

Step 9 Define the timebase
In this example the rate display represents flow per minute so it is necessary to set the instrument timebase to 60. This will divide the rate display by 60 to provide the correct total display.

Select 't-bASE' from the main menu and press *P* to reveal the current setting. Using the *Up* or *Down* button select 'tb – 60' and press *E* to return to the main menu.

Step 10 Define the total scale factor

In this example the rate display is in litres per minute but the total display is required in cubic metres:

SCALE-t = Units of rate display / Units of total display

There are 1,000 litres in a cubic metre thus:

= litres / cubic metres

= 1 litre / (1/(1000) litres)

SCALE-t = 1000

From the main menu select 'SCALE-t' and press *P* to reveal the current five digit dividing factor. Using the *Up* and *Down* buttons to adjust the flashing digit, and the P button to transfer control between digits, set 'SCALE-t' to 1000.0

The position of the decimal point is defined by moving the flashing digit to the second least significant position and operating the *Up* and *Down* buttons simultaneously.

When 'SCALE-t' has been set to 1000.0 press *E* to return to the main menu.

Step11 Define percentage cut-off

Totalisation is to be inhibited at flow rates below 1% of maximum flow. To define the clip-off point select 'CLIP-OFF' from the main menu and press *P* which will reveal the current setting. Using the *Up* and *Down* buttons select 1 and return to the main menu by pressing *E*.

Step 12 Reset the grand total to zero

To reset the grand total to zero select 'CLr.Gtot' from the main menu and press *P* which will cause the instrument to display 'Clr. no'.   Toggle this to 'CLr. YES' using the *Up* or *Down* push-buttons and press *P* which will result in a '0000' prompt. Using the *Up*, and *Down* buttons and the *P* button to move to the next digit, enter the password 'SurE' which protects this function.   Pressing *E* will then reset the grand total counter to zero and return the instrument to the 'CLr. Gtot' prompt in the main menu.

Step 13 Set the security code

Defining a security code prevents unauthorised access to the programme functions.   Select 'COdE' from the main menu and press *P* which will reveal the existing security code. Using the *Up* and *Down* buttons enter the new code 1209 digit by digit.   The *P* button will transfer control between digits. When the new code has been entered, press *E* to return to the main programme menu.

Step 14 Return to the display mode

Following completion of programming and calibration, return the instrument to the display mode by pressing *E*. All the BA558C programming functions will now be stored in permanent memory and protected from accidental adjustment by the security code.

6.2 Calibration example
    Using the internal references
In this example the internal references within the BA558C are used to calibrate the rate display. Except for steps 1, 2 and 8 the procedure is identical to that in the previous example in section 6.1 The advantages of using the internal references are that the instrument does not have to be disconnected from the measurement loop and no calibration equipment is required.

Steps	**Enter the programming mode**
1 & 2	The BA558C may be recalibrated without disconnection from the 4/20mA measurement loop. With any input current between 4 and 20mA put the instrument in the programming mode by simultaneously pressing *P* and *E*. Assuming a security code has not already been entered the instrument will respond by displaying 'root' which is the first function in the main menu.
Steps	Perform as described in the
3 to 7	previous calibration example see section 6.1
Step 8	**Calibrate the rate display**
	Scroll through the main menu until 'SEt' is displayed. Press *P* and the instrument will display 'ZErO', pressing *P* will reveal the existing rate display at 4mA. Using the *Up, Down* and *P* push-buttons enter the required zero display of 0.0 Press *E* to enter this calibration figure. The instrument will display 'Ent' for a few seconds before returning to the 'ZErO' prompt.
	Press the *Up* push-button and the instrument will display 'SPAn'. Pressing *P* again will reveal the existing display at 20mA. Using the *Up, Down* and *P* push-buttons enter the required display of 1100 Press *E* to enter this calibration figure. The instrument will display 'Ent' for a few seconds before returning to the 'SPAn' prompt.
Steps	Perform as described in the
9 to 14	previous calibration example see section 6.1

7. MAINTENANCE

7.1 Fault finding during commissioning
If a BA558C fails to function during commissioning the following procedure should be followed:

Symptom	Cause	Check
No display	Incorrect wiring	There should be 1.1V between terminals 1 & 3 with terminal 1 positive
No display and no voltage between terminals 1 & 3	Incorrect wiring or no power supply.	Check wiring and confirm that a 4/20mA current is flowing in the loop.
Rate displays flashing 1	Positive over-range	The rate display has been incorrectly calibrated & is trying to display a number greater than 20500.
Rate displays flashing −1	Negative over-range	Input current is less than approximately 3.4mA.
Unstable rate display	4/20mA current is noisy or the flow signal is unstable	Eliminate source of electrical noise . Reduce resolution of the rate display to mask flow noise
Unable to enter programme mode	Incorrect security code	Enter the correct security code or fit security link in override position. See Fig 8

7.2 Fault finding after commissioning

ENSURE PLANT SAFETY BEFORE STARTING MAINTENANCE

If a BA558C fails after it has been functioning correctly, the following table may help to identify the cause of the failure.

Symptom	Cause	Check
No display and no voltage between terminals 1 & 3	No power supply.	Confirm that a 4/20mA current is flowing in the loop.
Unstable rate display	4/20mA current is noisy or the flow signal is unstable	Eliminate source of electrical noise . Reduce resolution of the rate display to mask flow noise
Incorrect calibration	Digital filter 'FrE' has been changed after indicator was calibrated	Recalibrate indicator with digital filter FrE set to required frequency
Unable to enter programme mode	Incorrect security code	Enter the correct security code or fit security link in override position. See Fig 8

If this procedure does not reveal the cause of the fault, it is recommended that the instrument is replaced. This can be achieved without disconnecting the panel wiring by unplugging the terminals on the suspect instrument, and plugging them into a replacement rate totaliser.

7.3 Servicing
We recommend that all faulty BA558C rate totalisers are returned to BEKA associates or to our local agent for repair.

7.4 Routine maintenance
The mechanical condition of the instrument and electrical calibration should be regularly checked. The interval between inspections depends upon environmental conditions. We recommend that initially instrument calibration should be checked annually.

7.5 Guarantee
Instruments which fail within the guarantee period should be returned to BEKA associates or our local agent. It is helpful if a brief description of the fault symptoms is provided.

7.6 Customer comments
BEKA associates is always pleased to receive comments from customers about our products and services. All communications are acknowledged and whenever possible are implemented.

8. ACCESSORIES

8.1 Scale card
The BA558C has a window on the right hand side of the display to hold a card showing the units of measurements e.g. Litres, Gallons, M^3. Instruments can be supplied with a printed scale card showing any units specified at the time of ordering. If a printed card is not requested, a blank card will be supplied.

Scale cards can easily be marked on-site as follows:

    a. Remove the rear terminal block(s) and the rear panel as shown in Fig 8.

    b. Carefully pull the rate totaliser assembly from the enclosure.

    c. Gently pull and then slide the blank scale card towards the display window until the card is free. Mark the card with the required legend and replace in the slot.

    d. Reassemble the instrument.

8.2 Tag number
The BA558C can be supplied with a thermally printed tag number on the rear panel. This tag number is not visible from the front of the instrument after installation.

8.3 Alarms
The BA558C can be supplied with two solid state single pole outputs which may be independently programmed as high or low, rate or total alarms with normally open or normally closed outputs.

Fig 9 illustrates the conditions available for a rate alarm and shows which are fail safe, i.e. output is in the alarm condition (open) when the 4/20mA input current is zero. Similarly, when programmed as a total alarm, the output should be open in the alarm condition.

WARNING
These alarm outputs should not be used for critical safety applications such as a shut down system.
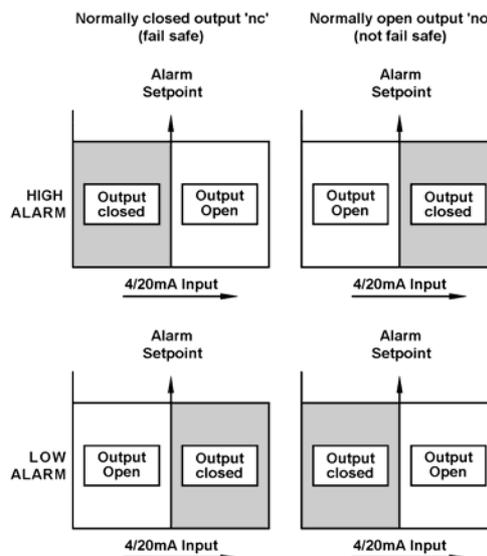
Fig 9 Rate alarm outputs

The status of each alarm output is indicated by an alarm annunciator on the instrument display. If an alarm delay or silence time has been selected the annunciator will flash during the delay or silence period.

Programmable functions for each alarm include an adjustable setpoint, alarm delay time, alarm accept time and hysteresis for rate alarms.

The BA558C total display is up-dated and compared with the total alarm setpoint once per second. This may result in the total alarm being delayed for up to a second after the total has exceeded the setpoint.

8.3.1 Solid state output
Each alarm has an isolated single pole solid state switch output as shown in Fig 10. The outputs are polarised and current will only flow in one direction. Terminals 8 and 10 should be connected to the positive side of the supply.

Vmax	30V dc
Imax	250mA dc
Ron	less than 5Ω + 0.6V
Roff	greater than 180k

Note: Because of the series protection diode some test meters may not detect a closed alarm output.
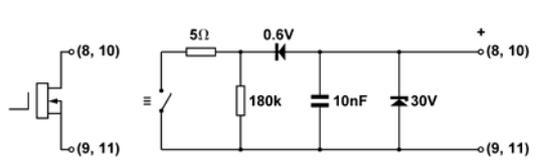
Fig 10 Equivalent circuit of each alarm output
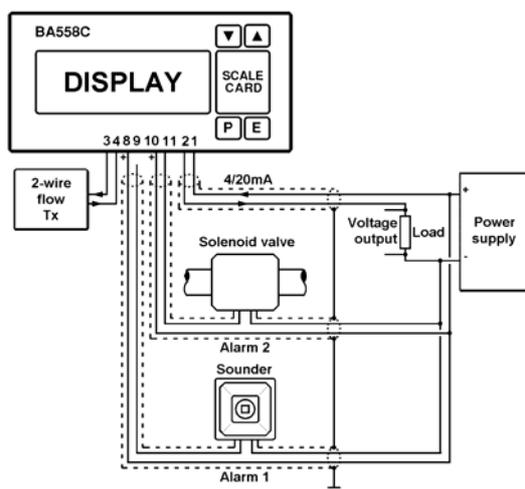
Fig 11 Typical alarm application

8.3.2 Programming and adjustment

When a BA558C is supplied with alarms the main programme menu is extended as shown in Fig 12. The two alarm functions appear between the 'C--P' and the 'SCALE-t' functions, and each alarm may be programmed as a rate or a total alarm.   Both alarms may be conditioned as rate alarms or both as total alarms, or one rate and one total alarm may be selected.

For simplicity Fig 12 only shows the programmable functions for alarm AL1.   Alarm 2 and the total options are identical except that the total alarms do not have hysteresis.

The following table summarises each of the alarm programme functions and includes a cross reference to more detailed information.   Again only the functions on alarm AL1 are listed.

Summary of programmable alarm functions

Display	Description of function
'EnbL'	**Alarm enable** Enables or disables the alarm function without changing the alarm parameters. See section 8.3.3
'tYPE'	**Type of alarm** Defines whether the alarm operates on the rate or total display. See section 8.3.4
'SPr1' or **'SPt1'**	**Alarm setpoint 1** Adjusts the alarm setpoint . The alarm is activated when the rate or total display equals the setpoint. See section 8.3.5
'HI.LO'	**Alarm function** Defines whether the alarm has a high or low function See section 8.3.6
'no.nc'	**Normally open or normally closed output** Determines whether the single pole alarm output is open or closed in the non alarm condition. See section 8.3.7
'HStr'	**Hysteresis** Adjusts the alarm hysteresis. Only available on rate alarms. See section 8.3.8
'dELA'	**Alarm delay time** Adjusts the delay between the display equalling the setpoint and the alarm output being activated. See section 8.3.9
'SIL'	**Alarm silence time** Defines the time that the alarm output remains in the non-alarm condition following acceptance of an alarm. See section 8.3.10
'AcSP'	**Access setpoint** Sub-menu which enables direct access to the alarm setpoints from the display mode and defines a separate security code. See section 8.3.11
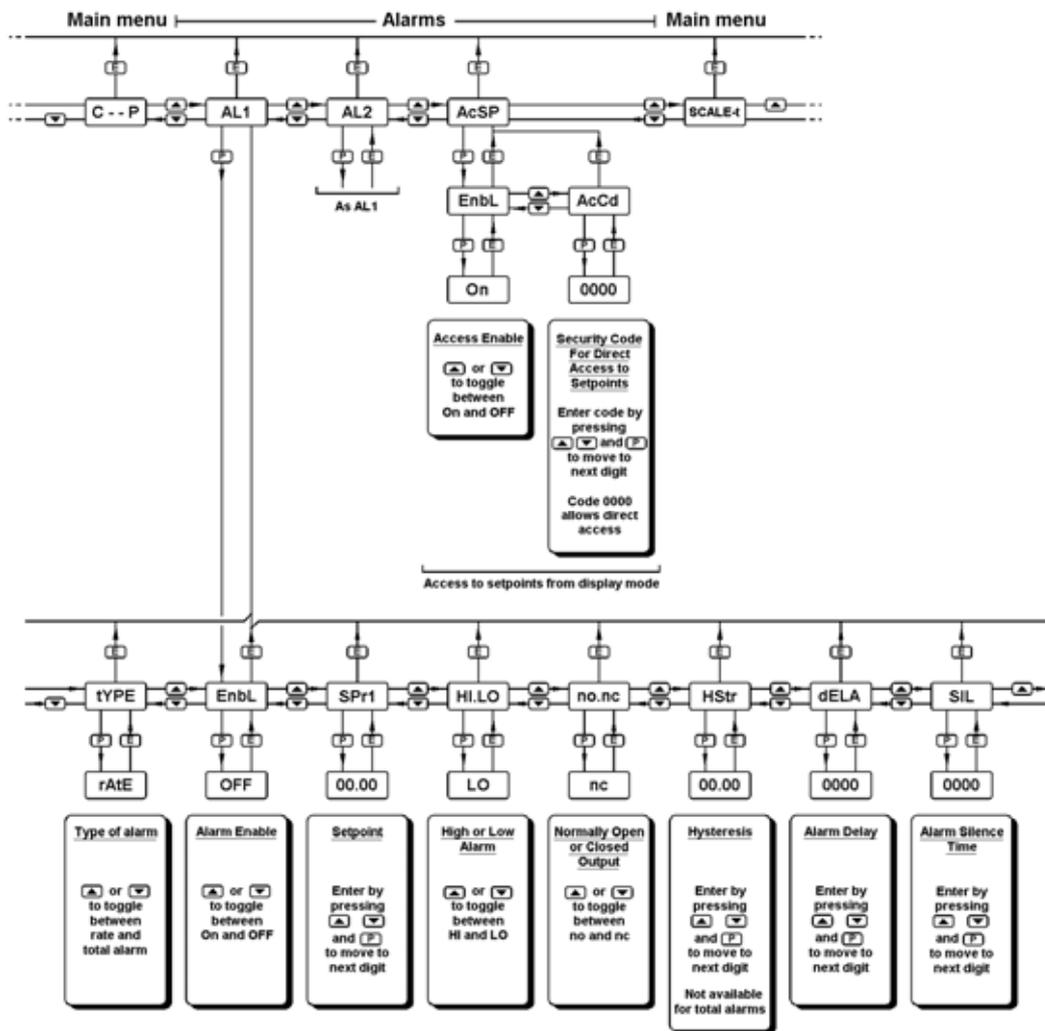
Fig 12 Alarm programme menu

8.3.3 Alarm enable: EnbL

This function allows the alarm to be enabled or disabled without altering any of the alarm parameters. To check or change the function select 'EnbL' from the alarm menu and press *P* which will reveal the current setting. The function can be changed by pressing the *Up* or *Down* button followed by the *E* button to return to the alarm menu.

8.3.4 Type of alarm: tYPE

This function conditions the alarm to operate on the rate or total display. Alarm 1 and Alarm 2 may both be conditioned as rate or total alarms, or one may be conditioned for rate and the other for total.

To check or change the type of alarm, select 'tYPE' from the alarm menu and press *P* which will reveal the current setting. The function can be changed by pressing the *Up* or *Down* button followed by the *E* button to return to the alarm menu.

Note: To prevent accidental setting, the alarm must be re-enabled after the alarm type has been changed – see 8.3.3

8.3.5 Setpoint adjustment: SPx1 and SPx2

The rate alarm setpoints SPr1 and SPr2 may be positioned anywhere between 0 and 20000 providing this corresponds to an input current between 3.8 and 20.2mA. The total alarm setpoint SPt1 and SPt2 may be positioned anywhere between 00000000 and 99999999 To adjust the setpoint select 'AL1' or 'AL2' from the alarm menu and press *P* which will reveal the existing alarm setpoint. Each digit of the setpoint can be adjusted using the *Up* and *Down* push-buttons, and the *P* button to transfer control between digits. When the required setpoint has been entered press *E* to return to the alarm menu.

8.3.6 Alarm function: HI.LO

Each alarm can be conditioned as a high or low alarm. To check or change the alarm function select 'HI.LO' from the alarm menu and press *P* to reveal the current setting. The function can be changed by pressing the *Up* or *Down* buttons followed by the *E* button to return to the alarm menu.

8.3.7 Alarm output status: no.nc

This function allows the alarm output to be open or closed in the alarm condition. When deciding which is required, care must be taken to ensure that the alarm output is fail safe. See Fig 9.

CAUTION

When the 4/20mA supply is removed both alarm outputs will open irrespective of conditioning. Therefore for fail safe operation both alarm outputs should be programmed to be open in the alarm condition.

To check or change the alarm output status select 'no.nc' from the alarm menu and press *P* to reveal the current setting. The function can be changed by pressing the *Up* or *Down* button followed by the *E* button to return to the alarm menu.

8.3.8 Hysteresis: HStr

Hysteresis is only available on rate alarms. During programming hysteresis is shown in the units of rate the BA558C has been calibrated to display.

To adjust the hysteresis, select 'HStr' from the alarm menu and press *P* which will reveal the existing figure. Each digit can be adjusted using the *Up* and *Down* push-buttons, and the *P* button to move to the next digit. When the required hysteresis has been entered, press *E* to return to the alarm menu.

e.g. A BA558C calibrated to display a flow of 0 to 5000, with a high alarm set at 4000 and hysteresis of 100 will perform as follows:

High alarm will be activated when flow equals or exceeds 4000, but will not reset until the flow falls below 3900.

8.3.9 Alarm delay: dELA

This function enables activation of the alarm output to be delayed for a fixed time following the alarm condition occurring. The delay can be programmed in 1 second increments up to 3600 seconds. If a delay is not required zero should be entered. To adjust the delay select 'dELA' from the alarm menu and press *P* which will reveal the existing delay. Each digit of the delay can be adjusted using the *Up* and *Down* push-buttons, and the *P* button to move to the next digit. When the required delay has been entered, press *E* to return to the alarm menu.

The alarm annunciator will start flashing immediately an alarm occurs and continue for the delay time after which the alarm output will be activated.

8.3.10 Alarm silence time: SIL

This function is primarily intended for use in small installations where the alarm output directly operates an annunciator such as a sounder. When the alarm silence time is set to any figure other than zero, the *P* push-button becomes an alarm accept button. After an alarm has occurred, operating the *P* button will cause the alarm output to revert to the non-alarm condition for the programmed alarm silence time. The silence time may be adjusted between 0 and 3600 seconds in 1 second increments.

To adjust the alarm silence time select 'SIL' from the alarm menu and press *P* which will reveal the existing time. Each digit can be adjusted using the *Up* and *Down* push-buttons, and the *P* button to move to the next digit. When the required time has been entered press *E* to return to the alarm menu. When an alarm is silenced the alarm annunciator will flash until the silence time expires.

8.3.11 Access Setpoint: AcSP

This function controls a separate menu which provides direct access to the alarm setpoints when the instrument is in the operating mode. See section 8.3.12 for a full description. An operator may therefore adjust the alarm setpoints without having access to the programme and alarm menus. Further protection is provided by a separate security code.

This direct access menu is enabled and a separate security code entered from the 'AcSP' function in the main programme menu. To change the menu parameters select 'AcSP' from the programme menu and press *P* which will display the enable prompt 'EnbL'. Press *P* again to reveal if the direct access menu is 'On' or 'OFF'. The *Up* or *Down* buttons will toggle the display between the two conditions.

If 'OFF' is selected, the operator will not have access to the setpoints from the display mode. Press *E* twice to return to the 'AcSP' prompt in the main menu.

If 'On' is selected, the operator will have direct access to the alarm setpoints from the display mode via a separate optional security code. To define the four digit numerical code press *E* to return to the 'Enbl' prompt followed by the *Up* or *Down* button to select the access code prompt 'AcCd'. Pressing *P* will reveal the current security code. Each digit of the code may be changed by operating the *U*p and *Down* push-buttons, and the *P* button to move to the next digit. When the required code has been entered, press *E* twice to return to the 'AcSP' prompt in the Programme Menu.

The default code 0000 will disable the security code allowing direct access to the setpoints by pressing the *P* and *Up* buttons simultaneously.

New instruments with alarms are supplied with this function disabled and the security code set to 0000

8.3.12 Adjusting alarm setpoints from the display mode

Access to the two alarm setpoints from the indicator display mode is obtained by operating the *P* and *Up* push-buttons simultaneously as shown in Fig 13. If the setpoints are not protected by a security code the alarm setpoint prompt 'SPr1' or 'SPt1' will be displayed depending upon whether a rate or total alarm has been programmed. If the setpoints are protected by a security code, 'COde' will be displayed first.

Pressing *P* again will enable the alarm security code to be entered digit by digit using the *Up* and *Down* buttons to change the flashing digit, and the *P* push-button to move to the next digit. If the correct code is entered pressing *E* will cause alarm setpoint prompt 'SPr1' or 'SPt1' to be displayed. Pressing the *Up* or *Down* button will then toggle the display between the two alarm setpoint prompts.

If an incorrect security code is entered, or a button is not pressed within ten seconds, the instrument will automatically return to the display mode.
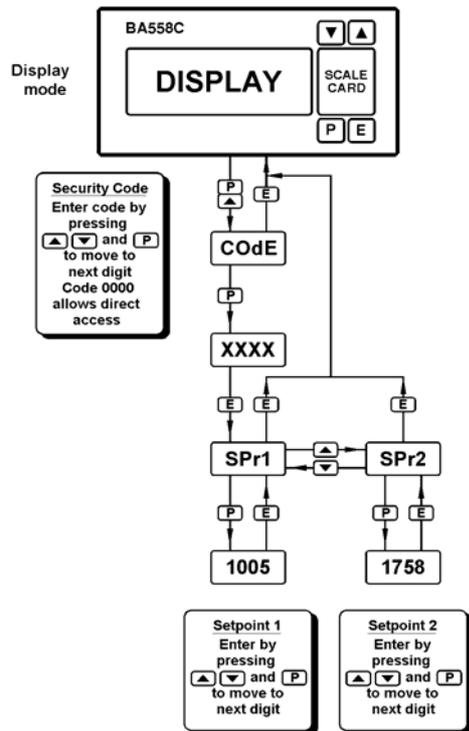
Fig 13 Setpoint adjustment from the display mode

To adjust an alarm setpoint select the required alarm prompt and press *P* which will reveal the current setting. Each digit of the setpoint may be adjusted using the *Up* and *Down* push-buttons, and the *P* button to move to the next digit. When the required setpoint has been entered, pressing *E* will return the display to the alarm prompt from which the other setpoint may be selected, or the BA558C may be returned to the display mode by pressing *E* again.

Direct access to the alarm setpoints is only available when the menu is enabled - see section 8.3.11

8.4 Display backlight

The BA558C can be supplied with LED backlighting to improve display contrast when the instrument is installed in a poorly illuminated area. The backlight is electrically segregated from the measuring circuit and may be powered from any 18 to 30V dc supply.
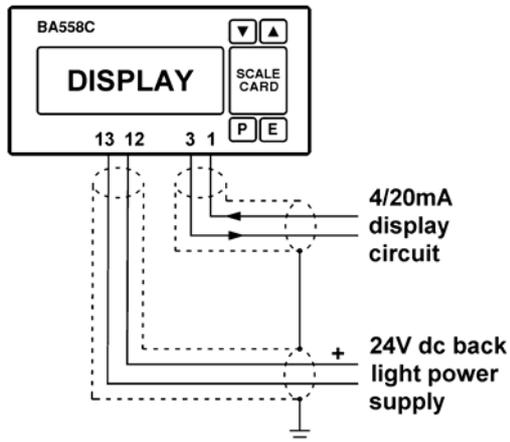
Fig 14 Display backlight

Reducing the supply voltage below 18V, or fitting a current limiting resistor in series with the supply will reduce the display brilliance

8.5 Additional front panel protection

Although the BA558C has an IP65 sealed front panel, for installations in hostile environments where the instrument is likely to be damaged by impact an additional front cover is available.

The BA398 is a robust transparent cover which is secured to the panel by six screws and sealed with a neoprene gasket.   It completely covers the front of the rate totaliser and therefore prevents the BA558C front panel push-buttons being operated.

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