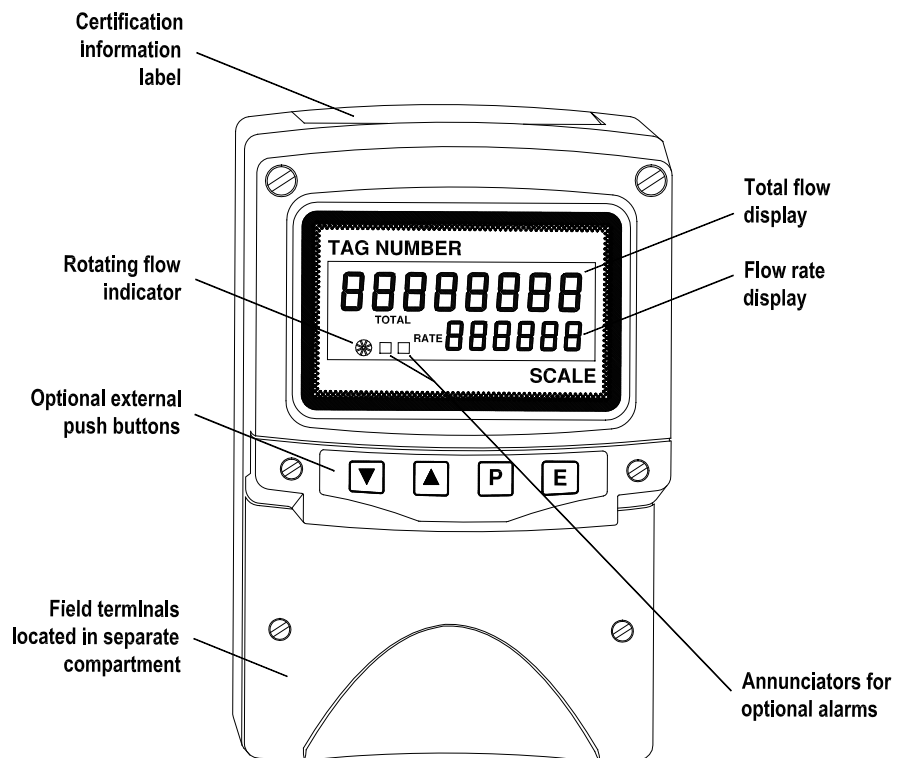


**BA334D**  
**Intrinsically safe**  
**Externally powered**  
**pulse input**  
**field mounting**  
**rate totaliser**

Issue 15



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ATEX dust certification
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FM Approval for use in the USA

The BA334D is CE marked to show compliance with the  
European Explosive Atmospheres Directive 94/9/EC  
and the European EMC Directive 89/336/EEC

## 1. DESCRIPTION

The BA334D is an intrinsically safe, externally powered pulse input 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 BA334D has been certified intrinsically safe by European Notified Body Intertek Testing Services (ITS) to the ATEX Directive 94/9/EC for use in explosive gas and combustible dust atmospheres.

ATEX dust certification is an option – see Appendix 1.

For use in the USA a version having FM intrinsic safety and nonincendive approval is available - see Appendix 2.

Housed in a robust IP66 glass reinforced polyester (GRP) enclosure with an armoured glass window, the BA334D is surface mounting, or may be pipe mounted using one of the accessory kits. A stem mounting kit is also available allowing direct mounting onto a flowmeter conduit entry.

## 2. OPERATION

Fig 1 shows a simplified block diagram of a BA334D. The instrument accepts pulses from a single source and after scaling displays the total number of pulses received and their rate on separate displays. When connected to a pulse output flowmeter the BA334D will provide an accurate display of total flow and the rate of flow.

The BA334D has two sets of input terminals for connection to high or low level voltage pulses, a switch contact, an open collector output or to a two wire proximity detector. The instrument may therefore be used with almost any type of pulse output flowmeter. The total display may be reset to zero by a remote switch contact, the internal switches or via the optional keypad on the outside of the instrument.

Optional accessories enable the flow rate to be transmitted to other equipment as an isolated 4/20mA analogue signal and the total flow to be transmitted as a pulse signal. Optional alarms, which may be programmed to function on the rate or total displays, further extend the instruments applications.

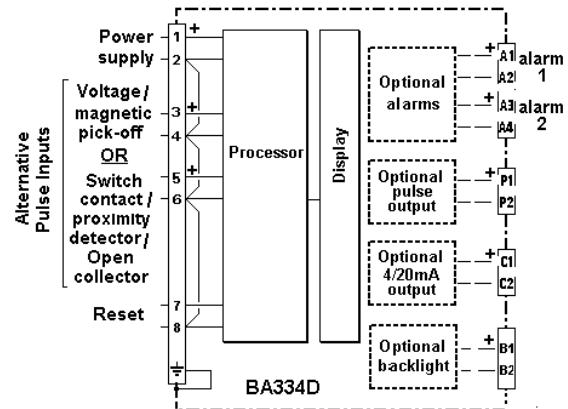


Fig 1 Simplified block diagram of BA334D

### 2.1 Initialisation

Each time power 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 2 seconds.

The product firmware part number and version number are displayed for about 2 seconds.

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

### 2.2 Controls

The BA334D is controlled and calibrated via four push-button switches which are located behind the instrument control cover, or as an option on the outside of the instrument cover. In the display mode i.e. when the instrument is displaying rate and total flow the switch functions are:

#### Description of Switch Functions

**E+ Down** While these 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 for two seconds. Selectable function from programme menu. See section 6.12

**P + Down** While these buttons are pushed the instrument will display the firmware part number and version number.

**Note:** When optional alarms are fitted, the BA334D may be programmed to provide direct access to the alarm setpoints from the display mode when the *P + Up* push-buttons are operated – see section 9.2

### 2.3 Displays

The BA334D has two digital displays and associated annunciators, plus a flow indicator as shown on page 1.

<b>Rate Display</b>	Shows the flow rate on the smaller six digit display.
<b>Total display</b>	Shows the total flow on the larger eight digit display. Set to zero when local or remote reset switch is operated.
<b>Flow indicator</b>	This disc in the lower left hand corner of the display 'rotates' for two seconds each time an input pulse is received. Therefore when the pulse input frequency exceeds 0.5Hz the disc appears to rotate continuously.
<b>Hold Annunciator</b>	Activated when input frequency is below the clip-off threshold.
<b>Reset Annunciator</b>	Activated while instrument is being reset.

## 3. INTRINSIC SAFETY CERTIFICATION

### 3.1 ATEX certificate

The BA334D has been issued with an EC-Type Examination Certificate by Notified Body Intertek Testing Services (ITS) confirming compliance with the European ATEX Directive 94/9/EC for Group II, Category 1, gas and dust atmospheres, EEx ia IIC T5. The instrument bears the Community Mark and subject to local codes of practice, may be installed in any of the European Economic Area (EEA) member countries. ATEX certificates are also acceptable for installations in Switzerland.

This manual describes installations in gas hazardous areas which conform with BS EN60079:Part14:2003 Electrical Installation in Hazardous Areas. When designing systems for installation outside the UK, the local Code of Practice should be consulted.

For use in the presence of combustible gas, please refer to Appendix 1 which describes installations complying with BS EN 50281-1-2:1999.

### 3.2 Power supply

When installed in a hazardous area the BA334D must be powered via a Zener barrier or galvanic isolator from a dc supply located in the safe area.

The input safety parameters of terminals 1 and 2 are:

$$\begin{aligned} U_i &= 28V \text{ dc} \\ I_i &= 100mA \text{ dc} \\ P_i &= 0.7W \end{aligned}$$

Any certified Zener barrier or galvanic isolator with output safety parameters within these limits may be used. The two system certificates provide guidance to help selection of suitable devices.

The maximum equivalent capacitance and inductance between terminals 1 and 2 is:

$$\begin{aligned} C_i &= 20nF \\ L_i &= 20\mu H \end{aligned}$$

To determine the maximum permissible cable parameters the above figures should be subtracted from the maximum permitted cable parameters specified for the Zener barrier or galvanic isolator powering the BA334D.

### 3.3 Pulse input terminals

The BA334D rate totaliser has two alternative pairs of input terminals enabling the instrument to count pulses from a wide variety of sources.

**Note:** Only one pair of input terminals may be used at one time.

#### 3.3.1 Voltage pulse input

Terminals 3 and 4 are intended for connection to a voltage pulse source. In Europe, sources of energy which do not generate more than 1.5V; 100mA and 25mW are, for intrinsic safety purposes, considered to be *simple apparatus* (Clause 5.4 of EN50 020:1994).

Although the BA334D indicator does not itself comply with the requirements for *simple apparatus*, the EC-Type Examination Certificate specifies that under fault conditions the voltage, current and power at terminals 3 & 4 will not exceed those specified for *simple apparatus*. This allows these input terminals to be connected to any certified intrinsically safe apparatus or circuit providing that the output parameters of the apparatus or circuit do not exceed:

$$\begin{aligned} U_o &= 28V \text{ dc} \\ I_o &= 100mA \text{ dc} \\ P_o &= 0.7W \end{aligned}$$

The certified intrinsically safe voltage pulse output of a flowmeter mounted in a hazardous area, or the output of a certified magnetic pick-off mounted in a hazardous area may be directly connected to these terminals providing:

The output parameters of the device do not exceed the figures shown above.

The device can withstand a 500V rms insulation test to earth for one minute.

The BA334D EC-Type Examination Certificate specifies that the maximum equivalent capacitance and inductance between the two pulse input terminals 3 and 4 is:

$$\begin{aligned} C_i &= 20nF \\ L_i &= 20\mu H \end{aligned}$$

To determine the maximum permissible cable parameters these figures must be subtracted from the maximum permitted cable parameters specified for the device connected to terminals 3 and 4.

The BA334D system certificates specify maximum permitted cable parameters when a 28V 300Ω Zener barrier or galvanic isolator is connected to these terminals.

#### 3.3.2 Contact, 2-wire proximity detector or open collector input

Terminals 5 and 6 are intended for connection to a switch contact, a certified open collector output or a certified intrinsically safe 2-wire NAMUR proximity detector. The output safety parameters are:

$$\begin{aligned} U_o &= 10.5V \text{ dc} \\ I_o &= 9.2mA \text{ dc} \\ P_o &= 24mW \end{aligned}$$

and the maximum permitted external capacitance and inductance is:

$$\begin{aligned} C_o &= 2.0\mu F \\ L_o &= 248mH \end{aligned}$$

Mechanically operated switch contacts comply with the requirements for *simple apparatus*. Providing the switch and the BA334D are both located in the same hazardous area, the switch may be connected directly to terminals 5 & 6. This also applies to most magnetically operated reed switches used in turbine flowmeters.

Similarly, certified intrinsically safe open collector outputs may be directly connected to terminals 5 and 6

A certified intrinsically safe 2-wire proximity detector may also be connected directly to terminals 5 & 6 providing the input safety parameters of the detector are less than the output parameters of terminals 5 & 6. For guidance the BA334D system certificates specify some of the intrinsically safe 2-wire proximity detectors that may be used.

In all cases the device and circuit connected to terminals 5 & 6 must be capable of withstanding a 500V rms insulation test to earth for one minute.

The maximum input safety parameters for terminals 5 & 6 are:

$$\begin{aligned} U_i &= 28V \text{ dc} \\ I_i &= 100mA \text{ dc} \\ P_i &= 0.7W \end{aligned}$$

and the internal capacitance and inductance is:

$$\begin{aligned} C_i &= 20nF \\ L_i &= 20\mu H \end{aligned}$$

which allows Zener barriers and galvanic isolators to be connected to these terminals. The BA334D system certificates specify the maximum permitted cable parameters when a 28V 300Ω Zener barrier or galvanic isolator is used to transfer a pulse from the safe area to the BA334D in a hazardous area.

### 3.4 Remote reset terminals

The BA334D total display may be reset to zero by connecting the reset terminals 7 and 8 together for more than one second. These two terminals have the following input and output safety parameters:

U <sub>o</sub>	=	3.8V dc
I <sub>o</sub>	=	1.6mA dc
P <sub>o</sub>	=	2.0mW
U <sub>i</sub>	=	28V dc
I <sub>i</sub>	=	100mA dc
P <sub>i</sub>	=	0.7W

The maximum equivalent capacitance and inductance between them is:

C <sub>i</sub>	=	1nF
L <sub>i</sub>	=	0μH

The total display may be reset to zero from within the hazardous area by any mechanically operated switch connected directly to terminals 7 and 8.

To reset the total display from the safe area a Zener barrier or intrinsically safe relay is required to transfer the contact closure into the hazardous area. Almost any intrinsically safe relay with certification permitting the contacts to be connected to equipment in the hazardous area may be used. A positive diode return Zener barrier may also be used as shown in Fig 2. The system certificates list suitable devices and define the maximum cable parameters.

**Note:** The BA334D may be programmed so that the total display can be reset to zero when the *Up* and *Down* push-buttons are operated simultaneously for more than two seconds. See 6.12

### 3.5 Zones, gas groups and T rating

The BA334D has been issued with an EC Type Examination certificate confirming that it complies with the requirements for Group II Category 1 G EEx ia IIC T5 (T<sub>amb</sub> -40 to 60°C) specified in the ATEX Directive. When connected to a suitable system the BA334D may be installed in:

Zone 0	explosive gas air mixture continuously present.
Zone 1	explosive gas air mixture likely to occur in normal operation.
Zone 2	explosive gas air mixture not likely to occur, and if it does will only exist for a short time.

Be used with gases in groups:

Group A	propane
Group B	ethylene
Group C	hydrogen

Having a temperature classification of:

T1	450°C
T2	300°C
T3	200°C
T4	135°C
T5	100°C

At an ambient temperature between -40 and +60°C.

**Note:** the guaranteed operating temperature range is -20 to +60°C

This allows the BA334D to be installed in all Zones and to be used with most common industrial gases.

### 3.6 Certification Label Information

The certification label is fitted in a recess on the top outer surface of the enclosure. It shows the ATEX certification information plus BEKA associates name and location. Non European certification information may also be included. The serial number and date of manufacture are recorded on a separate label inside the terminal compartment.

BA334D Externally Powered Rate Totaliser	
CE	0359 (Ex) II 1 G T <sub>amb</sub> = -40°C to +60°C
EEx ia IIC T5 ITS01ATEX2001	
Year of manufacture shown within terminal compartment	
BEKA associates Ltd Hitchin England www.beka.co.uk	

## 4. SYSTEM DESIGN FOR HAZARDOUS AREA

### 4.1 System certificates

In addition to the ATEX EC-Type Examination Certificate, ITS have issued two system certificates. One defines how the BA334D may be used with Zener barriers and the other with galvanic isolators. Both are divided into two sections to cover input signal sources in the hazardous and in the safe area.

Interface	Certificate No
Zener barriers	Ex01E2005
Galvanic isolators	Ex01E2006

This section interprets these system certificates and illustrates how to design systems with Zener barriers and galvanic isolators.

System certificates are Certificates of Conformity which are primarily issued for guidance in the UK. They do not form part of certification to the European ATEX Directive.

### 4.2 Use with Zener barriers

Zener barriers are the least expensive intrinsically safe interface between a safe and hazardous area. However they do not provide isolation and require a high integrity earth connection that may be expensive to install. For a single BA334D it may be less expensive and complicated to use galvanic isolators when a high integrity earth connection is not already available.

Any certified Zener barriers may be used with the BA334D providing their output parameters do not exceed the input parameters of the terminals to which they are connected. Only one polarity of Zener barrier i.e. positive or negative, may be used with an instrument.

To assist with system design, the Zener barrier system certificate specifies the maximum cable parameters for popular barriers and lists some of the diode return barriers that may be used.

Fig 2 illustrates the basic circuit that is used for all BA334D installations protected by Zener barriers. For simplicity, connections for the optional pulse output, 4/20mA output and backlight are included in the appendix to this manual.

Alternatively the pulse source may be located in the safe area. Fig 3 shows how an additional Zener barrier is used to transfer the signal to the rate totaliser in the hazardous

area. When more than one Zener barrier is used in a system all must have the same polarity. i.e. all positive or all negative barriers.

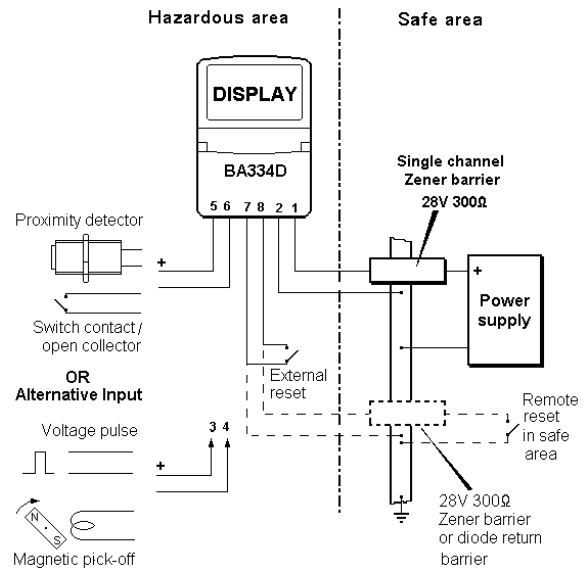


Fig 2 BA334D used with Zener barriers

When designing a system it is important to remember that terminals 2, 4, 6 and 8 are interconnected within the BA334D - see Fig 1.

#### 4.2.1 Power supply

A BA334D is powered from the safe area via a positive polarity 28V 300Ω Zener barrier which will have an end-to-end resistance of about 340Ω. When used with a proximity detector input the BA334D consumes approximately 25mA and requires a minimum voltage of 10V between terminals 1 and 2. The supply voltage in the safe area must therefore be between 18.5V and the maximum working voltage of the Zener barrier – usually about 26V.

#### 4.2.2 Pulse input

As shown in Fig 2 the BA334D will count pulses from a wide variety of sources in the hazardous area, or from the safe area as shown in Fig 3. Terminals 5 and 6 are for pulse sources that need powering e.g. a switch contact, an open collector or a 2-wire NAMUR proximity detector. Terminals 3 and 4 are for voltage pulse inputs.

**Note:** Only one input may be used at a time. i.e pulses can not be counted at terminals 3 & 4 and at 5 & 6 at the same time. No Zener barrier is required in series with the input if the intrinsically safe pulse source is located within the hazardous area.

The following table shows the switching thresholds for the various transducers, plus the maximum operating frequency and the input terminal numbers. For reliable counting the input signal must fall below the lower threshold and rise above the upper threshold.

	Switching thresholds		Freq max	Input terminals
Switch	100Ω	1000Ω	100Hz	5 & 6
Proximity detector	1.2mA	2.1mA	5 kHz	5 & 6
Open collector	2kΩ	10kΩ	5kHz	5 & 6
Magnetic pick-off	0mV	20mV peak	5kHz	3 & 4
Voltage pulse	1.0V	3.0V	5kHz	3 & 4

#### 4.2.3 Switch contact input

Any mechanically activated switch contact located in the hazardous area may be directly connected to terminals 5 & 6 providing it can withstand a 500V rms insulation test to earth. This includes most magnetically activated reed relays used in turbine flowmeters. The BA334D contains filtering to prevent contact bounce being counted, this limits the maximum operating frequency for a switch contact to 100Hz.

#### 4.2.4 2-wire proximity detector input

Any certified intrinsically safe 2-wire proximity detector complying with NAMUR switching thresholds may be used, providing the input safety parameters are greater than the output safety parameters of terminals 5 & 6. The system certificates list some of the acceptable devices.

When programmed to operate with a proximity detector, the BA334D maximum input frequency is 5kHz.

#### 4.2.5 Voltage pulse input

Voltage pulse sources should be connected to terminals 3 and 4. These terminals comply with the requirements for *simple apparatus* and may be directly connected to any certified intrinsically safe voltage source within the hazardous area which can withstand a 500V rms insulation test to earth for one minute and has output parameters equal to or less than:

$$\begin{aligned} U_o &= 28V \text{ dc} \\ I_o &= 100mA \text{ dc} \\ P_o &= 0.7W \end{aligned}$$

This enables the BA334D to be connected directly to most flowmeters incorporating a certified intrinsically safe magnetic pick-off, or

a certified intrinsically safe amplifier producing a high level pulse output. The BA334D has two programme selectable voltage switching thresholds, 'COIL' for magnetic pick-offs and 'UOLTs' for higher voltage pulses.

Maximum voltage pulse counting frequency is 5kHz.

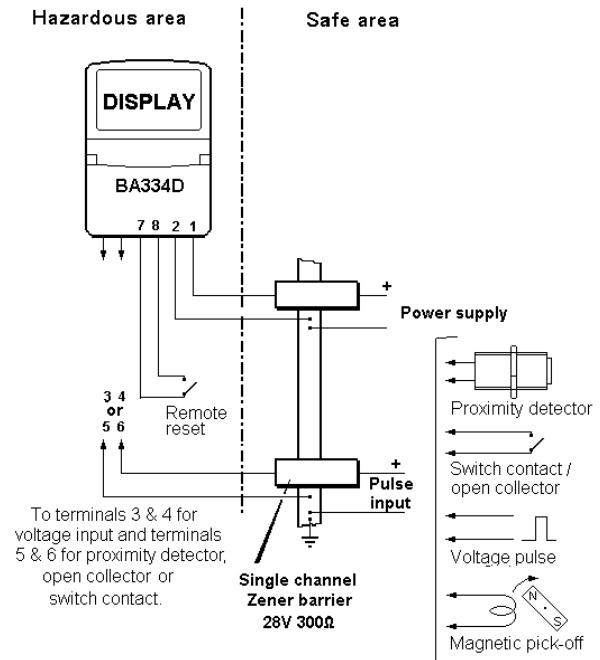


Fig 3 Pulse source in safe area

#### 4.2.6 Remote reset

The BA334D total display is reset to zero when terminals 7 & 8 are connected together for more than one second.. Permanent interconnection inhibits totalisation. Remote resetting may be accomplished by any mechanically operated switch located in the hazardous area providing it can withstand a 500V ac insulation test to earth. No Zener barrier is required.

The BA334D may be reset to zero from the safe area. Any switch may be used but a Zener barrier is required to transfer the contact closure into the hazardous area. Any one of the diode return barriers specified on the system certificate is suitable for this application and this may be combined with the supply barrier so that only one package is required. Fig 2 illustrates how the BA334D may be reset from both the safe and the hazardous area.

**Note:** The BA334D can be programmed to reset the total display to zero when the up and down push-buttons are operated simultaneously for more than two seconds. – see 6.12



### 4.3 Use with Galvanic Isolators

Galvanic isolators are probably the simplest intrinsically safe interface as they provide isolation and do not require a high integrity earth connection.

Any certified galvanic isolator with output parameters less than the input parameters of the BA334D may be used. The BA334D system certificates list some of the suitable devices together with the maximum permitted cable parameters

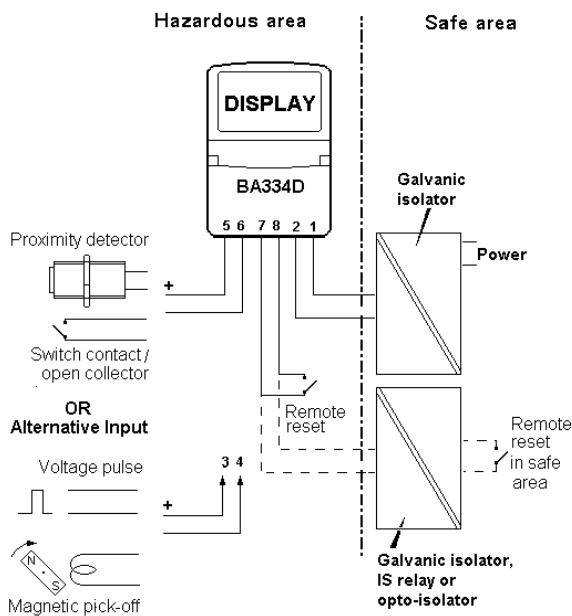


Fig 4 BA334D used with galvanic isolators

Fig 4 illustrates the basic circuit that is used for all BA334D installations protected by galvanic isolators. For simplicity, connections for the optional pulse output, 4/20mA output and backlight are included in the appendix to this manual.

Alternatively the pulse source may be located in the safe area. Fig 5 shows how an additional galvanic isolator is used to transfer the signal to the rate totaliser in the hazardous area.

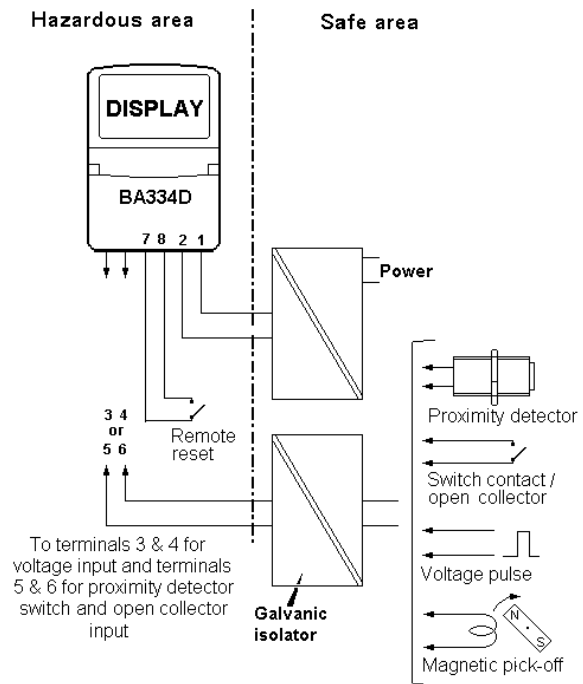


Fig 5 Pulse source in safe area

#### 4.3.1 Power supply

The BA334D galvanic isolator system certificates list a wide range of certified galvanic isolators that may be used to power the rate totaliser. If using the entity concept to select an isolator, in addition to matching the safety parameters the isolator must be capable of supplying at least 25mA at 10Vdc to the BA334D.

#### 4.3.2 Pulse input

As shown in Fig 4 the BA334D will count pulses from a wide variety of sources. Terminals 5 and 6 are for sources that need powering e.g. a switch contact or a 2-wire NAMUR proximity detector. Terminals 3 and 4 are for voltage inputs.

**Note:** Only one input may be used at a time, i.e. pulses can not be counted at terminals 3 & 4 and at 5 & 6 at the same time. No galvanic isolator is required in series with the input if the pulse source is located within the hazardous area.

The following table shows the switching thresholds for the various transducers, plus the maximum operating frequency and the input terminal numbers. For reliable counting the input signal must fall below the lower threshold and rise above the upper threshold.

	Switching thresholds		Freq max	Input terminals
<b>Switch</b>	100Ω	1000Ω	100Hz	5 & 6
<b>Proximity detector</b>	1.2mA	2.1mA	5 kHz	5 & 6
<b>Open collector</b>	2kΩ	10kΩ	5kHz	5 & 6
<b>Magnetic pick-off</b>	0mV	20mV peak	5kHz	3 & 4
<b>Voltage pulse</b>	1.0V	3.0V	5kHz	3 & 4

#### 4.3.3 Switch contact input

Any mechanically activated switch contact located in the hazardous area may be directly connected to terminals 5 & 6 providing it can withstand a 500V rms insulation test to earth for one minute. This includes most magnetically activated reed relays used in turbine flowmeters. The BA334D contains filtering to prevent contact bounce being counted which limits the maximum operating frequency for a switch contact to 100Hz.

#### 4.3.4 2-wire proximity detector input

Any certified intrinsically safe 2-wire proximity detector listed on the system certificate may be connected to input terminals 5 and 6. The BA334D input complies with the NAMUR switching standard and other certified intrinsically safe detectors may be used providing the safety parameters of the proximity detector are compatible with the BA334D.

When programmed to operate with a proximity detector, the BA334D maximum input frequency is 5kHz.

#### 4.3.5 Voltage pulse input

Voltage pulse sources should be connected to terminals 3 and 4. These terminals comply with the requirements for *simple apparatus*. They may be directly connected to any certified intrinsically safe voltage source within the hazardous area, providing it can withstand a 500Vrms insulation test to earth for one minute and has output parameters equal to or less than:

$$\begin{aligned} U_o &= 28V \text{ dc} \\ I_o &= 100mA \text{ dc} \\ P_o &= 0.7W \end{aligned}$$

This enables the BA334D to be connected directly to most flowmeters incorporating a certified intrinsically safe magnetic pick-off, or a certified intrinsically safe amplifier producing a high level pulse output. The BA334D has

two programme selectable voltage switching thresholds, 'COIL' for magnetic pick-offs and 'UOLtS' for higher voltage pulses.

Maximum voltage pulse counting frequency is 5kHz.

#### 4.3.6 Remote reset

The BA334D total display is reset to zero when terminals 7 & 8 are connected together for more than one second. Permanent interconnection inhibits totalisation. Remote resetting may be accomplished by any mechanically operated switch located in the hazardous area providing it can withstand a 500Vrms insulation test to earth for one minute. No galvanic isolator is required.

The BA334D may be reset to zero from the safe area. Any switch may be used but a galvanic isolator is required to transfer the contact closure into the hazardous area. Fig 4 illustrates how the BA334D may be reset from both the safe and the hazardous area.

**Note:** The BA334D can be programmed to reset the total display to zero when the up and down push-buttons are operated simultaneously for more than two seconds. – see 6.12.

## 5. INSTALLATION

### 5.1 Location

The BA334D rate totaliser is housed in a robust IP66 glass reinforced polyester (GRP) enclosure incorporating an armoured glass window and stainless steel fittings. It is suitable for exterior mounting in most industrial environments, including off-shore and waste water treatment. Please consult BEKA associates if high vibration is anticipated.

The BA334D enclosure is surface mounting. Accessory kits described in sections 9.7 & 9.8 of this manual enable the instrument to be mounted onto a vertical or horizontal pipe, or directly onto a flowmeter conduit entry.

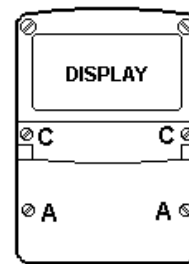
The field terminals and the two mounting holes are located in a separate compartment with a sealed cover allowing the instrument to be installed without exposing the display assembly.

The BA334D earth terminal is connected to the internal EMC filters. For maximum radio frequency interference rejection this terminal should be connected to a local earth, or to a cable screen which is earthed in the safe area. The BA334D enclosure is supplied with a bonding plate to ensure electrical continuity between the three conduit / cable entries.

### 5.2 Installation Procedure

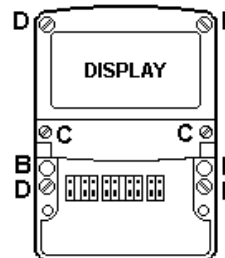
Fig 6 illustrates the instrument installation procedure.

- Remove the instrument terminal cover by unscrewing the two captive 'A' screws.
- Mount the instrument on a flat surface and secure with two M6 screws through the 'B' holes. Alternatively use one of the mounting kits described in section 9.7
- Remove the temporary hole plug and install a cable gland or conduit fitting with an appropriate IP rating. If more than one entry is required, one or both of the IP66 stopping plugs may be replaced with a cable gland or conduit fitting with an appropriate IP rating.
- Connect the field wiring to the terminals as shown in Fig 7.
- Replace the instrument terminal cover and evenly tighten the two 'A' screws.



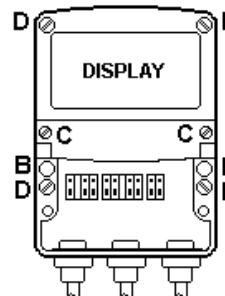
#### Step a

Remove the terminal cover by unscrewing the two 'A' screws



#### Step b

Secure the instrument to a flat surface with screws through the two 'B' holes. Alternatively use a pipe mounting kit.



#### Steps c, d and e

Remove temporary hole plug and install cable gland or conduit fitting with required ingress protection. If more than one entry is required, one or two of the IP66 stopping plugs should be replaced with a cable gland or conduit

fitting with required ingress protection. Replace the terminal cover and tighten the two 'A' screws.

Fig 6 BA334D installation procedure

### 5.3 EMC

The BA334D complies with the requirements of the European EMC Directive 89/336/EEC. For specified immunity all wiring should be in screened twisted pairs and the BA334D earth terminal should be locally earthed or connected to a cable screen which is earthed in the safe area.

To prevent circulating currents, cable screens should only be earthed at one point in the safe area.

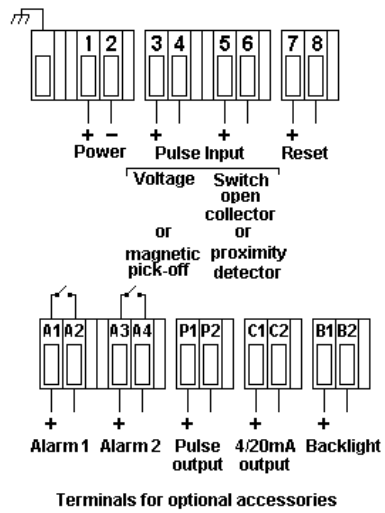
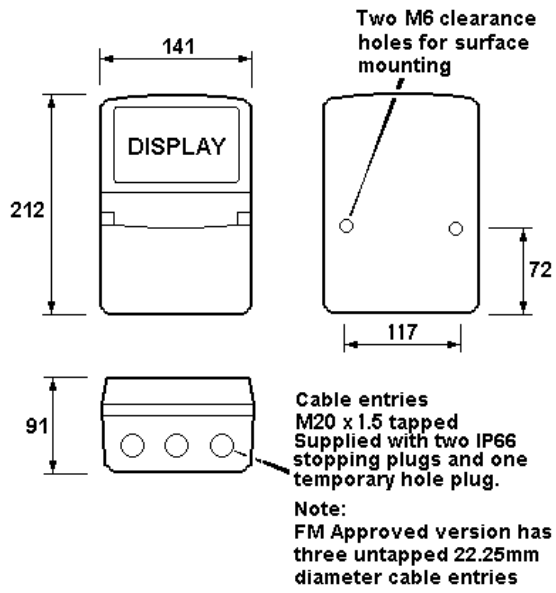


Fig 7 Dimensions and terminal connections

## 6. PROGRAMMING & CALIBRATION

The BA334D is programmed and calibrated via four push-buttons which are located behind the instrument control cover. If frequent access to the push-buttons is required, the rate totaliser can be supplied with duplicate membrane push-buttons mounted on the outside of the control cover.

All the programming functions are contained in an easy to use menu that is shown diagrammatically in Fig 9. Each function is summarised in section 6.3 and 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 6.3 is read before attempting programming or recalibration.

When the BA334D is fitted with alarms, pulse output or 4/20mA output, the basic menu is expanded to include the option(s). Section 9 of this manual explains how to programme these additional functions.

**Note:** While the instrument is being programmed or calibrated, totalisation continues so that any flow occurring during this time is recorded.

### 6.1 Calibration structure

Fig 8 shows the BA334D calibration structure. The rate and total display calibration functions are totally independent allowing the displays to have different engineering units.

For the rate display the pulse input is scaled by SCALE-r to represent engineering units and multiplied by the timebase t-bASE to calculate and display the rate of flow per second, minute or hour.

Similarly, to calculate the total flow in engineering units the number of input pulses is divided by the total scale factor SCALE-t. Total flow is continuously added to the grand total.

The BA334D displays 'real' decimal points. Moving the position of a decimal point in a scale factor will therefore affect the instrument calibration.

The BA334D updates its total flow calculation twice per second. If the instrument is used for batching applications, this resolution may define the accuracy of the system.

**Note:** The total and rate displays may be updated less frequently depending upon the display update time selected.

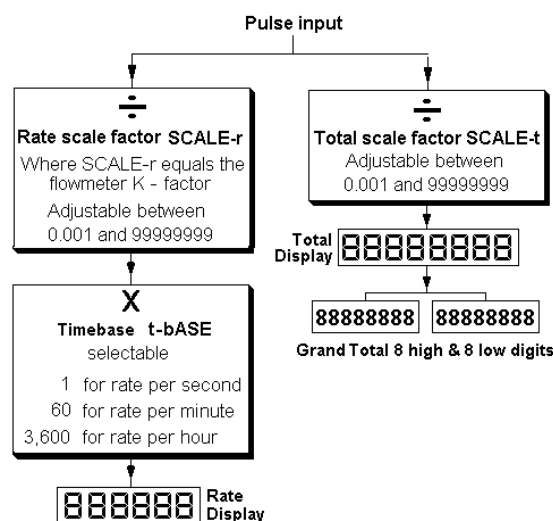


Fig 8 Calibration structure

### 6.2 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 'UPdAtE' 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-buttons 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 'UPdAtE' to be displayed. If an incorrect code is entered, or a push-button is not operated within ten seconds, the instrument will 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 Fig 9.

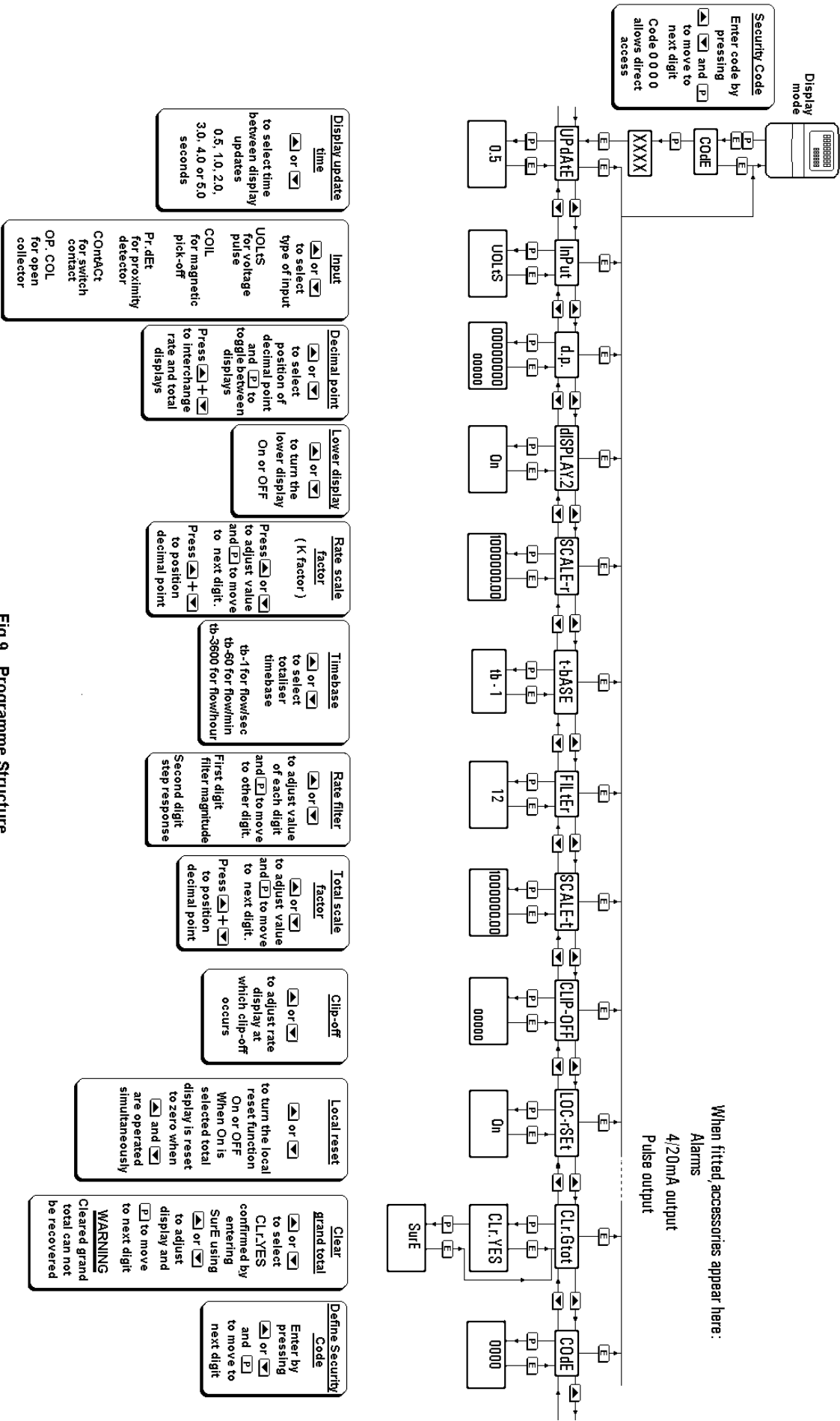


Fig 9 Programme Structure

All new BA334D rate totalisers are supplied calibrated as requested at the time of ordering. If calibration information is not supplied, the instrument will be conditioned for an open collector input, with SCALE-r and SCALE-t set to 1 and a timebase of seconds.

### 6.3 Summary of programmable functions

This section summarises all the programmable functions. When read in conjunction with Fig 9 it provides a quick aid for programming the instrument. If more detail is required, each section contains a reference to a full description of the function.

#### SUMMARY

<u>Display</u>	<u>Description of function</u>
'UpdAtE'	<p><b>Display update time</b> Allows the interval between display updates to be selected. See section 6.4</p>
'InPut'	<p><b>Type of input</b> Enables one of five types of input to be selected: UOLtS      Voltage pulse COIL        Magnetic pick-off Pr.dEt      NAMUR proximity detector.  COntACT    Switch contact OP.COL     Open collector See section 6.5</p>
'd.P.'	<p><b>Decimal points</b> Defines the position of the decimal point in both the rate and total displays and enables the rate and total displays to be interchanged. See section 6.6</p>
'dISPLAY.2'	<p><b>Lower display</b> Turns the lower display, which normally shows rate, on or off. See section 6.7</p>

#### Display    Description of function

##### 'SCALE-r' Rate Scale Factor

Defines the arithmetic relationship between the pulse input frequency and the rate display. May be adjusted between 0.001 and 99999999.

When used with a flowmeter, SCALE-r should be set to the flowmeter K factor (pulses per unit of measurement) if the display is required in the same units as the K factor.

See section 6.8

##### 't-bASE' Timebase

Selectable multiplier to display flow rate in units per second, per minute or per hour..

Select:

tb-1      for flow / second

tb-60     for flow / minute

tb-3600   for flow / hour

See section 6.9

##### 'FILtEr' Rate filter

Adjustable digital filter to reduce noise on the rate display. Two parameters each adjustable between 0 and 9.

See section 6.10

##### 'SCALE-t' Total Scale Factor

Defines the arithmetic relationship between the number of input pulses and the total display.

May be adjusted between 0.001 and 99999999.

When used with a flowmeter SCALE-t should be set to the flowmeter K factor (pulses per unit of measurement).

See section 6.11

##### 'CLIP-OFF' Clip off

To prevent the totalisation of very low flow rates, clip-off enables the user to select a flow rate below which totalisation is inhibited.

See section 6.12

**Display**    **Description of function****'LOC.rSEt' Local reset of total display**

When turned 'On' the total display may be reset to zero from the display mode by simultaneously operating the *Up* and *Down* push-buttons for two seconds.

See section 6.13

**'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 6.14

**'COdE' Security code**

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

See section 6.15

'UOLts'    Voltage pulse input  
Threshold 1V and 3V  
5kHz max.  
Input terminals 3 and 4

'COIL'    Low voltage pulse  
Threshold 20mV  
peak. 5kHz max.  
Input terminals 3 and 4

'Pr.dEt'    NAMUR proximity detector  
Threshold 1.2 and 2.1mA  
5kHz max.  
Input terminals 5 and 6

'COntACT'    Switch contact  
Threshold 100 and 1000Ω  
100Hz max  
Input terminals 5 and 6

'OP.COL'    Open collector  
Threshold 2kΩ and 10kΩ  
5kHz max.  
Input terminals 5 and 6

When the required type of input has been selected press *E* to return to the main menu.

**Note:** To count correctly, the input signal must fall below the lower switching threshold and rise above the higher switching threshold.

**6.4 Display update interval: 'UpdAtE'**

Six different intervals between display updates varying between 0.5 and 5 seconds may be selected. If either the rate or the total displays are likely to change rapidly, a longer interval between updates may simplify reading the instrument display. The selected update interval does not affect the update time of any other instrument function such as the optional 4/20mA output.

To define the update interval select 'UpdAtE' from the main menu and press *P* to reveal the current time. Pressing the *Up* or *Down* button will scroll through the six times. When the required interval has been selected press *E* to return to the main menu.

**6.5 Type of input: 'InPut'**

The BA334D may be programmed to accept pulse inputs from a wide variety of sensors. To define an input type select 'InPut' from the menu and press *P* which will reveal the current input type. Pressing *Up* or *Down* will scroll through the five options:

**6.6 Position of the decimal points: 'd.P.'**

The rate display can have up to six digits and the decimal point may be positioned between any of them, or omitted. 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 point select 'd.P.' from the main menu and press *P*. This will activate both displays with one digit plus the following decimal point of 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 point can be moved by pressing the *Up* or *Down* push-button. 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 six 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.

**Note:** Both decimal points must be repositioned after the displays have been interchanged.

### 6.7 Lower display: 'dISPLAY.2'

This function turns the lower display on or off. When turned off, the BA334D will only have one eight digit display which may be programmed to show total flow or rate of flow.

To check the status of the lower display select 'dISPLAY.2' from the menu and press *P* which will reveal if the function is 'On' or 'OFF'. The setting can be changed by pressing the *Up* or *Down* button followed by the *E* button to return to the main menu.

### 6.8 Rate scale factor: 'SCALE-r'

Together with the instrument timebase, this function defines the arithmetic relationship between the pulse input frequency and the rate display. When used with a flowmeter SCALE-r should be set to the K-factor of the flowmeter i.e. the number of pulses the flowmeter produces for a unit of flow. e.g. 45.6 pulses per litre. See section 7 for a worked example.

SCALE-r is a dividing factor that may be adjusted between 0.001 and 99999999.

To check or change the rate scale factor select 'SCALE-r' 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 in the rate scale factor, 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 rate scale factor has been entered, press *E* to store the number and return to the main menu.

### 6.9 Timebase: 't-bASE'

The timebase multiplies the rate display by 1, 60 or 3,600 depending upon whether the BA334D is required to display rate per second, per minute or per hour. See Fig 8.

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* button will index through the three options:

tb-1	for flow / second
tb-60	for flow / minute
tb-3600	for flow / hour

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

### 6.10 Rate filter: 'FILtEr'

This digital filter has two independent adjustable parameters enabling the rate display frequency response to be tailored for optimum performance.

The filter parameters are controlled by a two digit number. The first digit defines the amount of filtering applied to the display as shown below.

First digit	Filter time constant seconds
0X	0
1X	1.3
2X	4.3
3X	6.5
4X	8.7
5X	11.3
6X	15.7
7X	20.9
8X	25.2
9X	31.5

The second digit defines the deviation from the displayed rate at which the filter will be overridden and the rate display will move rapidly to the new value.

Second digit	Magnitude of step change which will produce a rapid response
X0	Off
X1	1%
X2	2%
X3	4%
X4	8%
X5	12%
X6	16%
X7	24%
X8	32%
X9	64%

By careful adjustment of the two parameters a stable display with an acceptable step input response can be obtained for most applications.

During commissioning it is recommend that

initially the second digit is set to 0 (off) and the first digit is adjusted to provide acceptable rate display stability. The second digit should then be increased until the selected step size is greater than the noise on the display signal, at which setting the rate display will again become stable. These will be the optimum filter parameters for acceptable rate display stability and a fast response to a large rate signal change.

To check or change the filter select 'FILtEr' from the main menu and press *P* to reveal the current settings. Pressing the *Up* or *Down* button will change the flashing digit and *P* will transfer control to the second digit. While making adjustments the filtered rate display is shown on the lower display so that stability can be assessed. When set as required, press the *E* button to enter the revised parameters and return to the main menu.

#### 6.11 Total scale factor: 'SCALE-t'

This factor defines the arithmetic relationship between the number of input pulses and the total display. SCALE-t is a dividing factor that may be adjusted between 0.001 and 99999999. See Fig 8.

When used with a flowmeter SCALE-t should be set to the K-factor of the flowmeter i.e. the number of pulses the flowmeter produces for a unit of flow. If the BA334D total display is required in units different from those in which the flowmeter K factor is specified, a conversion factor will be required.

e.g. If the flowmeter has a K factor of 45.6 pulses per litre and the BA334D total display is required in units of 1,000 gallons, then SCALE-t should be set to number of pulses produced by the flowmeter per 1,000 gallons:

$$45.6 \times 4.54609 \times 1000$$

$$207,301.7 \text{ pulses per } 1000 \text{ gallons}$$

(there are 4.54609 litres in a UK gallon)

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 in the scaling factor, 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* to store the number and return to the main menu.

#### 6.12 Clip-off: 'CLIP-OFF'

To prevent totalisation of very low flow rates that over long periods may result in significant totalisation errors, the BA334D may be programmed to stop totalising when the flow rate falls below an adjustable threshold.

To check or change the clip-off threshold select 'CLIP-OFF' from the main menu and press *P* which will reveal the current setting. The threshold is shown in the units already selected for the flow rate display. One digit will be flashing. The value of the flashing digit may be changed by pressing the *Up* or *Down* buttons. When this digit is correct pressing *P* will transfer control to the next digit. When clip-off is set as required, press the *E* button to enter the revised figure and return to the main programme menu.

If the flow rate falls below the entered threshold, the rate display will show zero flow, totalisation will stop and the HOLD annunciator will be activated. The flow indicator will rotate for 2 seconds each time an input pulse is received i.e. at input frequencies above 0.5Hz it will appear to rotate continuously.

**Note:** When the rate scale factor SCALE-r, the timebase t-bASE, or the position of the rate display decimal point are changed, clip-off will automatically be reset to zero. If required, a new clip-off threshold may then be entered.

#### 6.13 Local reset of total display: 'LOC. rSET'

When activated this function enables the operator to reset the BA334D total display to zero in the display mode by operating the *Up* and *Down* push-buttons simultaneously for more than two seconds. To check the status of the local reset function select 'LOC.rSET' from the menu and press *P* which will reveal if the function is 'On' or 'OFF'. If necessary press the *Up* or *Down* button to change the setting, followed by the *E* button to return to the main menu.

The total display may also be reset to zero remotely by connecting terminals 7 and 8 together. See sections 4.2.6 and 4.3.6 of this manual.

#### 6.14 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 2.2 of this manual.

The grand total counter can only be reset to zero from the 'CLr. Gtot' function in 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. Continuously press the *Up* or *Down* push-buttons until 'CLr. YES' is displayed and then press *P* which will result in a 'CLr 0000' prompt with one digit flashing. 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.**

#### 6.15 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 without entering a security code.

To enter a new security code select 'COdE' from the menu and press *P* which will cause the instrument to display the current security code. Each digit of the code can 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*.

To gain access to the security code link, remove the instrument control cover by undoing the two 'C' screws – see Fig 6. If the

instrument is fitted with external push-buttons the connecting ribbon cable should be unplugged from the outer row of the five pin connector. The security code override link is located on the inner row of the five pin connector as shown in Fig 10.

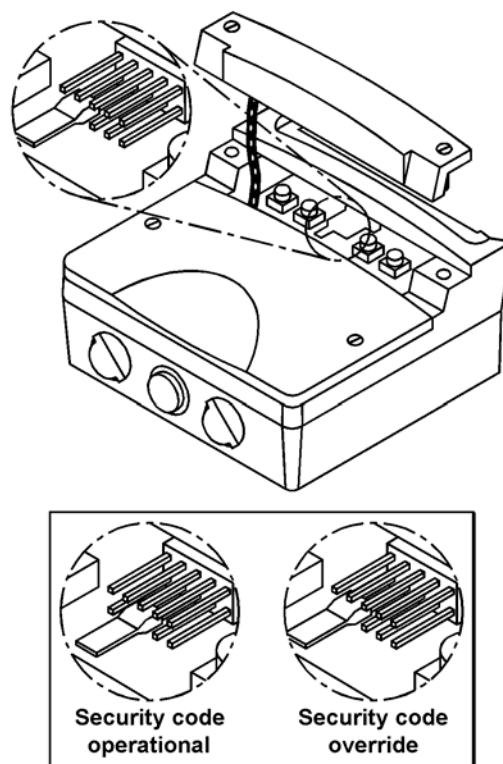


Fig 10 Location of security override link

## 7. CALIBRATION EXAMPLE

In this example a BA334D rate totaliser is connected to a turbine flowmeter having a K-factor of 1050.0 pulses per litre. The flowmeter has a magnetic pick-off with a peak output greater than 20mV at 5 litres per minute and a usable range of 5 to 60 litres per minute.

The BA334D is required to display rate of flow in litres per hour with a resolution of one litre and total flow in cubic metres with a resolution of 0.01 cubic metres. Totalisation is to stop when the flow rate falls below 300 litres per hour. The display is to be updated twice per second and filtering is required. In this application the operator needs to reset the total display to zero by simultaneously pushing the *Up* and *Down* push-buttons. To prevent tampering the instrument programme menu is to be protected by security code 1209

### 7.1 Calibration procedure

The BA334D rate totaliser may be calibrated on-site without disconnection from the power supply or from the flowmeter.

#### Step 1 Enter the programming mode

Put the BA334D 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 'UPdAtE' which is the first function in the main menu. See Fig 9.

#### Step 2 Select the interval between display updates

With 'UPdAtE' displayed, press *P* to reveal the existing interval between display updates. If this is not as required, press the *Up* or *Down* button until '0.5' is displayed. (0.5 seconds i.e. 2 display updates per second). Enter the revised time and return to the 'UPdAtE' prompt in the main menu by pressing *E*.

#### Step 3 Select the type of input

Using the *Up* or *Down* button scroll through the main menu until 'InPut' is displayed, then press *P* to reveal the existing setting. Select 'COIL', the input for a magnetic pick-off, using the *Up* or *Down* button and return to the 'InPut' prompt in the main menu by pressing *E*.

**Note:** The BA334D has two pairs of input terminals. 3 & 4 for voltage inputs and 5 & 6 for switch contact, proximity detector or open collector inputs. Ensure that the magnetic pick-off that has a voltage output is connected to terminals 3 & 4.

#### Step 4 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 third least significant digit of the total display and following decimal point are flashing. This gives the required total display resolution of 0.01

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 being displayed.

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

#### Step 5 Enter the rate scaling factor

Select 'SCALE-r' from the main menu and press *P* to show the current figure. The K factor of the flowmeter in this example is 1050.0\* pulses per litre which should be entered as the rate scaling factor.

Firstly to position the decimal point, operate the *P* push-button to move the flashing digit to second least significant position. Pressing the *Up* and *Down* buttons simultaneously will then position the decimal point in front of the least significant digit.

Using the *Up* and *Down* buttons to adjust each digit in turn and the *P* button to transfer control between digits, enter 1050.0. Finally return to the 'SCALE-r' prompt in the main menu by pressing *E*.

\* Could also be entered as 1050

**Step 6 Enter the rate timebase**

Select 't-bASE' from the main menu and press *P* to show the current setting. In this example the rate display is required in litres per hour. Using the *Up* or *Down* button scroll through the three options and select 'tb-3600' which will multiply the rate display by 3600. Return to the 't-bASE' prompt in the main menu by pressing *E*.

**Step 7 Adjust the rate filter**

The rate display filter parameters should be adjusted experimentally after installation to provide a stable rate display with an acceptable step response.

During commissioning it is recommended that initially the second digit of the rate parameters is set to 0 (step response off) and the first digit (amount of filtering) is adjusted to provide acceptable rate display stability. The second digit should then be increased until acceptable rate display stability is once again achieved.

To adjust the filter parameters select 'FILtEr' from the main menu and press *P* to reveal the current setting. The first digit will be flashing and may be adjusted using the *Up* or *Down* button. The *P* button will transfer control to the second digit. When both are set as required, return to the 'FILtEr' prompt in the main menu by pressing *E*.

**Note:** While adjusting the filter, the rate is shown on the lower display so that stability can be assessed.

**Step 8 Enter the total scaling factor**

The K factor of the flowmeter in this example is 1050.0 pulses per litre and the total display is required in cubic metres.

There are 1000 litres in a cubic metre so the BA334D is required to display 1 cubic metre for every 1,050 x 1,000 pulses received. 'SCALE-t' should therefore be set to 1,050,000

Select 'SCALE-t' from the main

menu and press *P* which will reveal the current setting with one digit flashing. To position the decimal point, operate the *P* push-button to move the flashing digit to the least significant position. Pressing the *Up* and *Down* buttons simultaneously will then remove the decimal point.

Using the *Up* and *Down* buttons to adjust each digit in turn and the *P* button to transfer control between digits, enter 1050000. Finally return to the 'SCALE-t' prompt in the main menu by pressing *E*.

**Step 9 Define clip-off**

In this example totalisation is to be inhibited at flow rates below 300 litres per hour.

Select 'CLIP-OFF' from the main menu and press *P* which will reveal the clip-off threshold in litres per hour i.e. the same units already selected for the rate display. The most significant digit of the display will be flashing, indicating that this digit may be adjusted. Pressing *P* five times will move the flashing digit to the third least significant digit.

Using the *Up* and *Down* buttons set the third least significant digit to 3 i.e. a clip-off threshold of 300. Finally return to the 'CLIP-OFF' prompt in the main menu by pressing *E*.

**Step 10 Turn local reset on**

In this example the operator needs to reset the total display to zero by pressing the *Up* and *Down* buttons simultaneously. To activate the local reset function select 'LOC.rSEt' from the main menu and press *P* to display the current setting. Pressing the *Up* or *Down* button will toggle the display between 'On' and 'OFF'. Select 'On' and press *E* to return to the 'LOCrSEt' prompt in the main menu.

**Step 11 Reset the grand total to zero**

Before completing commissioning the grand total counter should be reset 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, 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.

**Step 12 Define 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 13 Return to the display mode**

Following completion of programming and calibration, return the BA334D to the operating mode by pressing *E*. All the programming functions will now be stored in permanent memory and will be protected by the security code from accidental or unauthorised adjustment.

## 8. MAINTENANCE

### 8.1 Fault finding during commissioning

If a BA334D fails to function during commissioning the following procedure should be followed:

Symptom	Cause	Check:
No display	Incorrect wiring. Note: Terminals 2, 4, 6 & 8 are interconnected within the BA334D	That there is between 10 and 28V on terminals 1 & 2 with terminal 1 positive.
Flow indicator not rotating	No input pulses, incorrect input terminals used, or incorrect type of input selected	If the BA334D has been calibrated for the correct input.  That input signal is connected to correct input terminals and correctly polarised.
Flow indicator rotating but incorrect rate display	Incorrect calibration  Input is below clip-off threshold	That rate scale factor and timebase are correctly programmed.  That clip-off threshold is set correctly.
Unstable rate display	Noisy pulse input signal	Source of noise and try to eliminate or increase rate filter.
Correct rate display but incorrect total display	Incorrect calibration  Remote reset switch contacts closed	That total scale factor is correctly programmed.  That 'RESET' annunciator is not activated. If it is, check reset wiring and switch.
Unable to enter programme mode	Incorrect security code	That the correct security code is being used, or fit security link in override position. See Fig 10.
Clip-off does not function and 4/20mA output is constantly 3.5mA	Clip-off & 4/20mA have been automatically reset to zero following change of rate display calibration	Re-enter required clip-off and 4/20mA output calibration.
Alarms do not function	Alarms have been disabled following calibration change	Re-enable both alarms.

### 8.2 Fault finding after commissioning

#### ENSURE PLANT SAFETY BEFORE STARTING MAINTENANCE

**Live maintenance is permitted on intrinsically safe equipment installed in a hazardous area, but only certified test equipment should be used unless a gas clearance certificate is available.**

If a BA334D fails after it has been functioning correctly, the following table may help to identify the cause of the failure.

Symptom	Cause	Check:
No display	No power supply.	That there is between 10 and 28V on terminals 1 & 2.
Flow indicator not rotating	No input pulses	Output from flowmeter.  Wiring between flowmeter and BA334D.
Flow indicator rotating, but rate display indicates zero and there is no totalisation	Input below clip-off threshold	Clip-off threshold and if necessary adjust.
Unstable rate display	Noisy pulse input signal	Source of noise and try to eliminate, or increase rate filter.

If this procedure does not reveal the cause of the fault, it is recommended that the instrument is replaced.

### 8.3 Servicing

We recommend that faulty BA334D rate totalisers are returned to BEKA associates or to your local BEKA agent for repair.

### 8.4 Routine maintenance

The mechanical and electrical condition of the instrument should be regularly checked. Initially annual inspections are recommended, but the inspection frequency should be adjusted to suit the environmental conditions.

### 8.5 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.

### 8.6 Customer comments

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

## 9. ACCESSORIES

### 9.1 Units of measurement and instrument identification

All BA334D rate totalisers are fitted with a display label behind the armoured glass window. This label can be supplied printed with any units of measurement and tag information specified when the instrument is ordered. Alternatively the information may be added on-site via an embossed strip, dry transfer or a permanent marker.

To gain access to the display label remove the terminal cover by unscrewing the two 'A' screws which will reveal two concealed 'D' screws. Remove all four 'D' screws and carefully lift off the front of the instrument - see Fig 6. Add the required legend to the display label, or replace with a new pre-printed label which is available from BEKA associates.

The BA334D can also be supplied with a blank or custom engraved stainless steel plate secured by two screws to the side of the instrument enclosure. This plate can accommodate:

1 row of 9 alphanumeric characters 10mm high

or 1 row of 11 alphanumeric characters 7mm high

or 2 rows of 18 alphanumeric characters 5mm high

### 9.2 Alarms

The BA334D 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.

#### WARNING

**These alarm outputs should not be used for critical safety applications such as a shut down system.**

When the BA334D power supply is turned off or disconnected, both BA334D alarm outputs will open irrespective of whether normally open or normally closed outputs have been selected. When designing a system an open output should therefore be the alarm condition.

Alarm annunciators on the instrument display indicate the status of both alarms. 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 adjustable setpoint, alarm delay time and alarm accept time. Hysteresis may be applied to rate alarms.

The BA334D total display is up-dated and compared with the programmed alarm setpoint twice per second, irrespective of the display update time selected. This may result in the total alarm being delayed for up to half a second after the total has exceeded the setpoint.

#### 9.2.1 Solid state output

Each alarm has a galvanically isolated single pole solid state switch output as shown in Fig 11. The outputs are polarised and current will only flow in one direction. Terminals A1 and A3 should be connected to the positive side of the supply.

$$\begin{aligned} R_{on} &= 5\Omega + 0.6V \\ R_{off} &= \text{greater than } 180k \end{aligned}$$

**Note:** Because of the series protection diode some test meters may not detect a closed alarm output

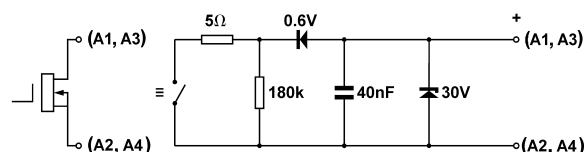


Fig 11 Equivalent circuit of each alarm output

#### 9.2.2 Intrinsic safety

Each of the two alarm outputs is a separate galvanically isolated solid state switch. The EC-Type Examination Certificate specifies that under fault conditions the voltage, current and power at each alarm output will not exceed those specified for *simple apparatus* in Clause 5.4 of EN50020:1994. This allows each of the BA334D alarm outputs to be connected to any intrinsically safe circuit protected by a certified Zener barrier or galvanic isolator providing that the output parameters of each circuit do not exceed:

$$\begin{aligned} U_o &= 28V \text{ dc} \\ I_o &= 200mA \\ P_o &= 0.85W \end{aligned}$$

No system certificate has been issued for the BA334D alarm outputs, as the system certificate for the circuit to which the alarms are connected remains valid.



The maximum equivalent capacitance and inductance of each BA334D alarm output is:

$$\begin{aligned} C &= 40\text{nF} \\ L &= 30\mu\text{H} \end{aligned}$$

To determine the maximum permissible cable parameters, the equivalent alarm output parameters must be subtracted from the maximum cable capacitance and inductance specified by the system certificate of the circuit connected to each alarm.

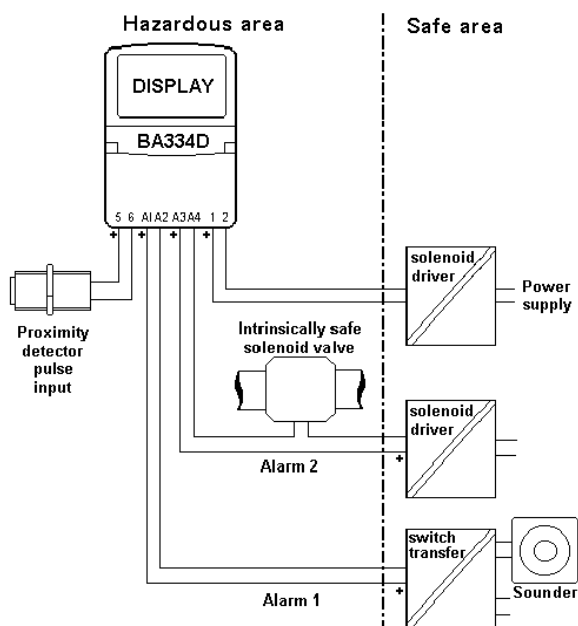


Fig 12 Typical alarm application

### 9.2.3 Programming and adjustment

When a BA334D is supplied with alarms the main programme menu is extended as shown in Fig 13. The two alarm functions appear between the 'LOC-rSEt' and the 'CLr.GtoT' functions, and each alarm may be programmed as a rate or a total alarm.

For simplicity Fig 13 only shows the programmable functions on the rate option of 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

<u>Display</u>	<u>Description of function</u>
'EnbL'	<b>Alarm enable</b> Enables or disables the alarm function without changing the alarm parameters. See section 9.2.4
'tYPE'	<b>Type of alarm</b> Defines whether the alarm operates on the rate or total display. See section 9.2.5
'SPr1' or 'SPt1'	<b>Alarm setpoint 1</b> Adjusts the alarm setpoint. The alarm is activated when the rate or total display equals the setpoint. <b>Note:</b> 'SPr1' is displayed for a rate alarm and 'SPt1' for a total alarm. See section 9.2.6
'HI.LO'	<b>Alarm function</b> Defines whether the alarm has a high or low function See section 9.2.7
'no.nc'	<b>Normally open or normally closed output</b> Determines whether the single pole alarm output is open or closed in the non-alarm condition. See section 9.2.8
'HStr'	<b>Hysteresis</b> Adjusts the alarm hysteresis. Only available on rate alarms. See section 9.2.9
'dELA'	<b>Alarm delay time</b> Adjusts the delay between the display equalling the setpoint and the alarm output being activated. See section 9.2.10
'SIL'	<b>Alarm silence time</b> Defines the time that the alarm output remains in the non-alarm condition following acceptance of an alarm. See section 9.2.11
'AcSP'	<b>Access setpoint</b> Sub-menu that enables direct access to the alarm setpoints from the display mode and defines a separate security code. See section 9.2.12

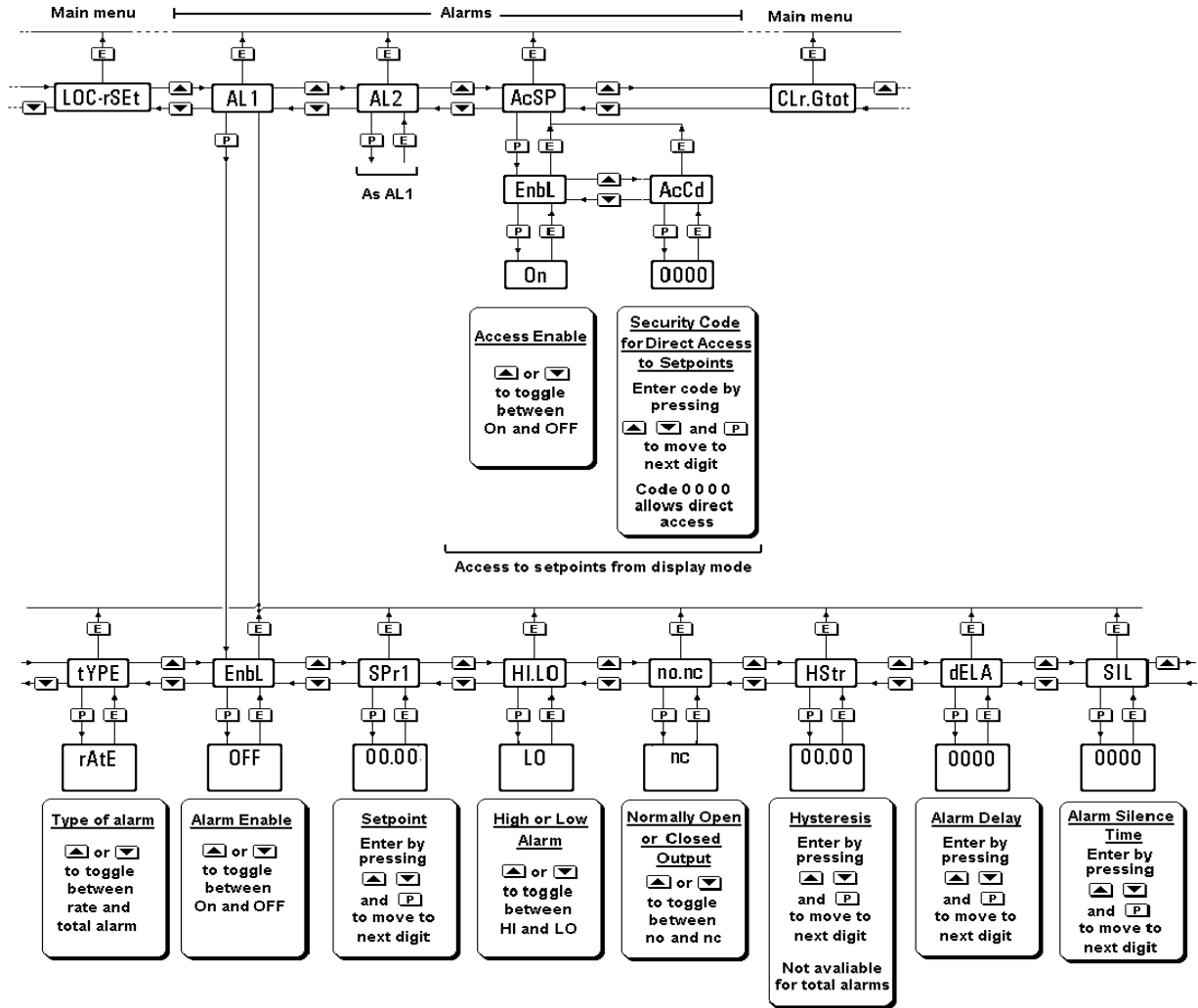


Fig 13 Alarm menu structure

**9.2.4 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.

**Note:** The alarms will be automatically disabled after the rate or total displays have been recalibrated, or the alarm type has been changed. Both alarms must therefore be enabled after calibration changes.

**9.2.5 Type of alarm: 'tYPE'**

Alarm 1 and Alarm 2 may both be 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:** When 'tYPE' is changed, the alarm parameters are automatically set to the default values and the alarm is disabled. It must therefore be reprogrammed before use.

### 9.2.6 Setpoint adjustment: 'SPx1' and 'SPx2'

The rate alarm setpoints SPr1 and SPr2 may be positioned anywhere between 0 and 999999, and the total alarm setpoint SPt1 and SPt2 anywhere between 00000000 and 99999999.

To adjust the setpoint of alarm 1 select 'SPr1' or 'SPt1', depending upon how it has been programmed, from the alarm menu. Press *P* which will reveal the existing value with one digit flashing. Each digit of the setpoint can be adjusted using the *Up* and *Down* push-buttons, and the *P* button to move to the next digit. The position of the decimal point is defined by the d.P. function which should be set first. When the required value has been entered press *E* to return to the alarm menu.

**Note:** 'SPr1' is displayed when alarm 1 has been programmed as a rate alarm and 'SPt1' when programmed as a total alarm.

### 9.2.7 Alarm function: 'HI.LO'

Each alarm must 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.

### 9.2.8 Alarm output status: 'no.nc'

The two alarm outputs may be open or closed in the non-alarm condition. When the BA334D power supply is turned off or disconnected, both the alarm outputs will open irrespective of whether normally open or normally closed outputs have been selected. Therefore, when designing an alarm system normally closed 'nc' should be selected so that the output opens when an alarm occurs or if the power supply fails.

To check 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.

### 9.2.9 Hysteresis: 'HStr'

Hysteresis is only available on rate alarms. During programming hysteresis is shown in the units of rate the BA334D 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 BA334D 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.

### 9.2.10 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 time. 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.

### 9.2.11 Alarm silence time: 'SIL'

The alarm silence 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. When an alarm is silenced the alarm annunciator will flash until the silence time expires.

To adjust the silence time select 'SIL' from the alarm menu and press *P* which will reveal the existing time. The time may be adjusted to between 0 and 3600 seconds in 1 second increments. Each digit can be adjusted using the *Up* and *Down* push-buttons, and the *P* button transfers control to the next digit. When the required time has been entered press *E* to return to the alarm menu.

### 9.2.12 Access Setpoint: 'AcSP'

This function activates a separate menu that provides direct access to the alarm setpoints when the instrument is in the display mode. See section 9.2.13 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 may be enabled and a separate security code entered from the 'AcSP' function in the main programme menu as shown in Fig 13. To change the menu parameters select 'AcSP' from the programme menu and press *P*. This 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. Return to the 'AcSP' prompt in the main menu by pressing *E* twice.

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 this four digit numeric 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 then reveal the current security code. The flashing digit of the code may be changed by operating the *Up* or *Down* push-buttons and pressing the *P* button will transfer control to the next digit. When the required code has been entered, press *E* twice to return to the 'AcSP' prompt in the programme menu.

Entering code 0000 will disable the security code allowing direct access to the setpoints in the display mode by pressing the *P* and *Up* buttons simultaneously.

New instruments with alarms are supplied with the security code set to 0000

### 9.2.13 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 14. 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 control to the next digit. If the correct code is entered pressing *E* will then cause alarm setpoint prompt 'SPx1' to be displayed. 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.

Once within the menu pressing the *Up* or *Down* buttons will toggle the display between the two alarm setpoint prompts 'SPx1' and 'SPx2'.

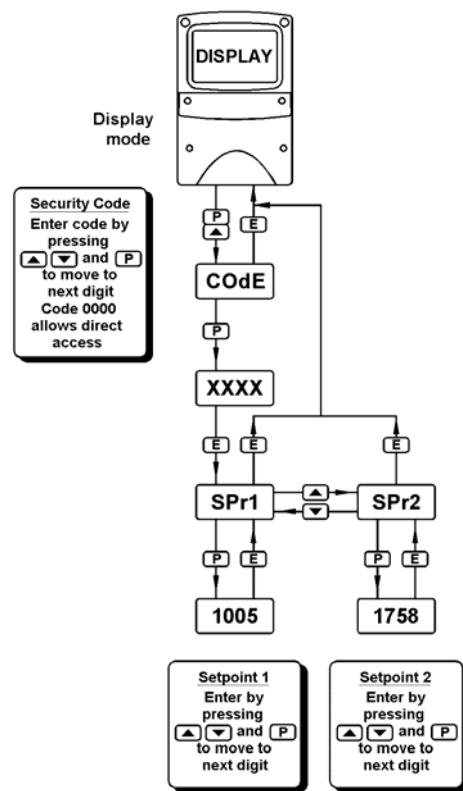


Fig 14 Setpoint adjustment from the display mode

To adjust an alarm setpoint select 'SPx1' or 'SPx2' 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 control to the next digit. When the required setpoint has been entered, pressing *E* will return the display to the 'SPx1' or 'SPx2' prompt from which the other setpoint may be selected, or the indicator may be returned to the display mode by pressing *E* again.

**Note:** Direct access to the alarm setpoints is only available when the menu is enabled - see section 9.2.12

### 9.3 Display backlight

The BA334D can be supplied with LED backlighting to improve display contrast when the instrument is installed in a poorly illuminated area. The backlight is segregated from the measuring circuit and has been certified as a separate intrinsically safe circuit. System certificates for use with Zener barriers and galvanic isolators have therefore been issued.

The backlight must be powered from the safe area via a Zener barrier or a galvanic isolator as shown in Fig 15. Any certified Zener barrier may be used, providing the output parameters do not exceed:

Uo	=	28V dc
Io	=	159mA
Po	=	0.8W
Ci	=	40nF
Li	=	30µH

Alternatively a galvanic isolator may be used in place of the barrier. For UK installations only the galvanic isolators specified on the system certificate should be used.

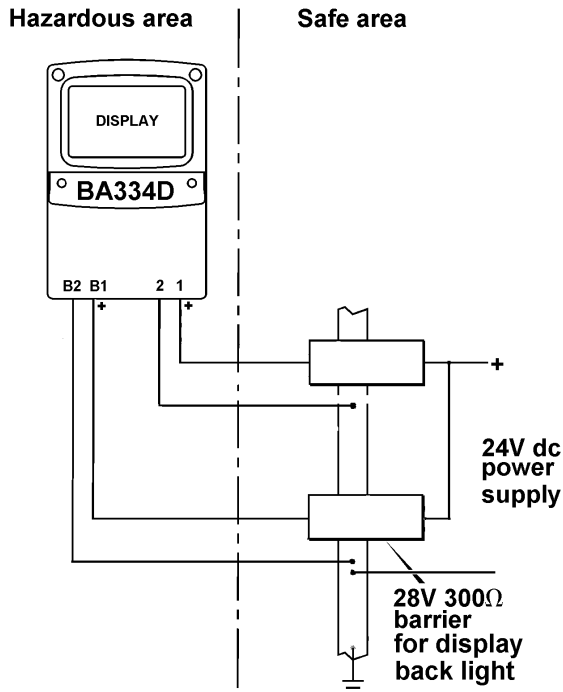


Fig 15 Backlight powered by Zener barrier

The display brilliance depends upon the current flowing through the backlight. This is determined by the supply voltage and the end-to-end resistance of the Zener barrier or output resistance of the galvanic isolator. Brilliance will not be significantly reduced until the current falls below 20mA.

$$\text{Backlight current} = \frac{V_{\text{supply}} - 18}{\text{End-to-end resistance of barrier\#}}$$

# or output resistance of galvanic isolator

### 9.4 Pulse output

The BA334D may be supplied with an opto-isolated solid state pulse output. The output is a polarised current sink that closes for a programmable duration each time the least significant digit of the BA334D display changes. A programmable divider enables the pulse output frequency to be reduced by 10, 100, 1,000 or 10,000. See Fig 17.

Ron	=	60Ω + 3V
Roff	=	1M
Isink max	=	10mA

The output pulse is non-synchronous and the maximum pulse frequency is determined by the programmed pulse width.

$$\text{Max frequency} = \frac{1}{2 \times (\text{pulse duration})} \text{ Hz}$$

If the instrument power supply fails or is disconnected, any untransmitted output pulses will be lost.

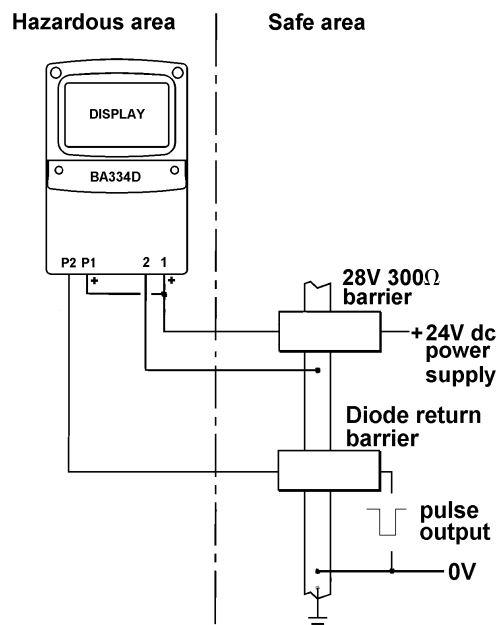


Fig 16 Application of pulse output

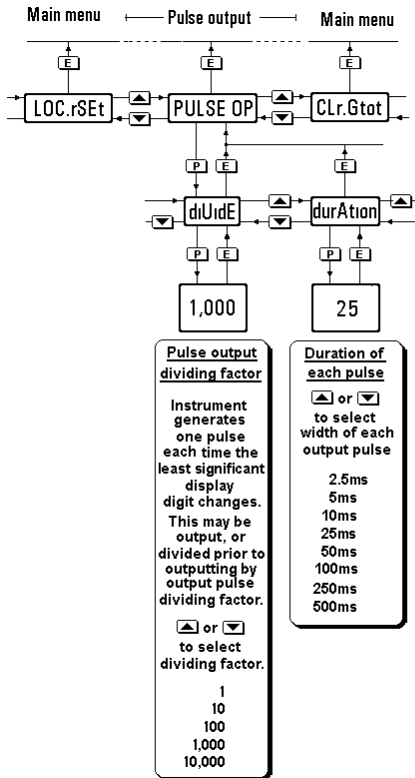


Fig 17 Pulse output menu

**9.4.1 Intrinsic safety**

The pulse output is an optically isolated separate intrinsically safe circuit which has zero output safety parameters. The output therefore complies with the requirements for *simple apparatus*. This allows terminals P1 and P2 to be connected to any intrinsically safe circuit protected by a certified Zener barrier or galvanic isolator providing the output parameters do not exceed:

$$U_o = 28V \text{ dc}$$

$$I_o = 100mA$$

$$P_o = 0.7W$$

The maximum equivalent capacitance and inductance of the BA334D pulse output is:

$$C_i = 20nF$$

$$L_i = 20\mu H$$

To determine the maximum permissible cable parameters, these figures should be subtracted from the maximum cable capacitance and inductance specified by the system certificate of the circuit connected to the BA334D. Fig 16 shows how the pulse output circuit may be powered from the BA334D supply to drive a counter in the safe area via a diode return barrier.

**9.5 4/20mA output**

The BA334D can be supplied with an isolated 4/20mA current sink which may be programmed to produce an analogue output proportional to the whole or part of the rate display.

**9.5.1 Intrinsic safety**

The 4/20mA current sink has been certified as a separate intrinsically safe circuit complying with the requirements for *simple apparatus*. This allows terminals C1 and C2 to be connected to any intrinsically safe circuit protected by a certified Zener barrier or galvanic isolator providing the output parameters do not exceed:

$$U_o = 28V \text{ dc}$$

$$I_o = 100mA$$

$$P_o = 0.7W$$

No system certificate has been issued for this output as the system certificate for the circuit to which it is connected remains valid.

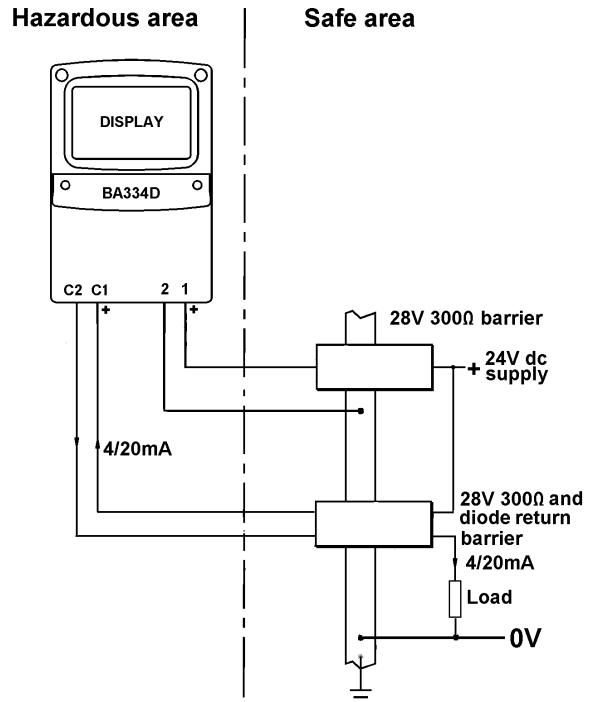


Fig 18 Application of 4/20mA output

The maximum equivalent capacitance and inductance of the optional 4/20mA output is:

$$\begin{aligned} C_i &= 2\text{nF} \\ L_i &= 8\mu\text{H} \end{aligned}$$

To determine the maximum permissible cable parameters, these figures must be subtracted from the maximum cable capacitance and inductance specified by the system certificate of the circuit connected to the BA334D 4/20mA output – usually a Zener barrier or galvanic isolator.

### 9.5.2 Programming and adjustment

The main programme menu is extended as shown in Fig 19 to accommodate the 4/20mA calibration functions.

The '4-20 OP' programme function allows the 4/20mA output current to correspond to any rate display. e.g. 4mA could represent 10 litres/minute and 20mA 100 litres/minute.

To calibrate the 4/20mA output current, enter the programme mode by operating the *P* and *E* push-buttons simultaneously. If the instrument is not protected by a security code the first parameter 'UPdAtE' will be displayed. Enter the security code if the instrument is protected.

Using the *Up* or *Down* push button select the function '4-20 OP' and press *P* which will result in the BA334D displaying '4.000' which is the prompt for setting the rate display corresponding to an output current of 4.000mA. Pressing *P* will reveal the existing setting with the most significant digit flashing. The decimal point will be fixed in the position already defined for the rate display by the 'd.P' function. The value of the flashing digit may be changed by pressing the *Up* or *Down* buttons. When this digit is set as required, pressing *P* will transfer control to the next digit.

When the flow rate corresponding to an output current of 4mA has been entered, press the *E* button to return to the '4.000' prompt.

To enter the rate display corresponding to an output current of 20.000mA, press the *Up* or *Down* button to select the '20.000' prompt followed by *P* to reveal the current setting. This may be changed in the same way as the 4mA setting. When set as required, press *E* three times to return to the display mode via the '20.000' and '4-20 OP' prompts.

The 4/20mA output may be calibrated to increase or decrease as the rate display increases, and most instruments will produce a linear output between 3.5 and 22mA.

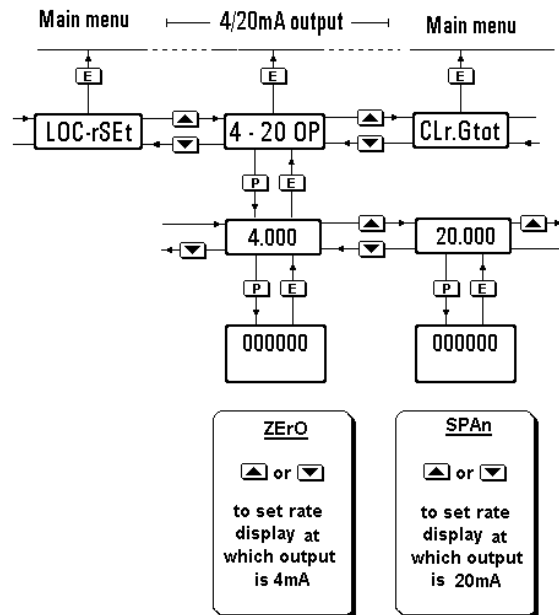


Fig 19 4/20mA output programme structure

**Note 1:** If the rate display calibration is changed by adjusting the rate scale factor SCALE-r, the timebase t-bASE, or the position of the rate display decimal point, the 4/20mA output will automatically be set to give a constant 3.5mA output irrespective of the rate display. The 4/20mA output must therefore always be recalibrated following recalibration of the rate display.

**Note 2:** If the BA334D and the 4/20mA current sink output are powered from separate supplies, the 4/20mA output current will continue to flow when the BA334D supply fails or is turned off. Powering both from a common supply as shown in Fig 18 eliminates this effect.

### 9.6 External push-buttons

For applications requiring frequent access to the programme menus the BA334D can be supplied with an external membrane keypad. These switches, which maintain the IP66 integrity of the enclosure, allow all functions to be controlled without removing either of the enclosure covers.

### **9.7 Pipe mounting kits**

Two pipe mounting kits are available for securing the BA334D to a horizontal or vertical pipe.

BA392D Stainless steel bracket secured by two worm drive hose clips for 60 to 80mm outside diameter pipes.

BA393 Heavy duty stainless steel bracket secured by a single 'V' bolt. Will clamp to any pipe with an outside diameter between 40 and 80mm.

### **9.8 Stem mounting kit**

The BA395 stem mounting kit comprises a short length of stainless steel conduit with a male M20 x 1.5 thread at both ends. Allows the BA334D to be mounted directly onto a flow transmitter.



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## Appendix 1 ATEX dust certification

### A1.0 ATEX dust certification

In addition to ATEX certification permitting installation in explosive gas atmospheres which is described in the main section of this instruction manual, the BA334D is available ATEX certified for use in the presence of combustible dusts. If ATEX dust certification is required it must be requested when the BA334D totaliser is purchased.

#### WARNING

**Before installing a BA334D totaliser in the presence of a combustible dust, ensure that the certification information label which is located on the top of the instrument specifies dust certification - see section A1.2**

### A1.1 Zones and Maximum Surface Temperature

The BA334D has been ATEX certified as Group II, Category 1 GD apparatus Tamb = -20 to 60°C, with a Maximum Surface Temperature of 80°C. When installed as specified by EN 50281 Part 1-2 'Selection, installation and maintenance of electrical apparatus protected by enclosures', the totaliser may be installed in:

- Zone 20 explosive atmosphere in the form of a cloud of combustible dust in air is continuously present, or for long periods or frequently.
- Zone 21 explosive atmosphere in the form of a cloud of combustible dust in air is likely to occur occasionally in normal operation.
- Zone 22 explosive atmosphere in the form of a cloud of combustible dust in air is not likely to occur in normal operation, but if it does occur, will only persist for a short period.



Be used with dusts having a Minimum Ignition Temperature of:

Dust cloud	120°C
Dust layer on BA334D up to 5mm thick	155°C
Dust layer on BA334D over 5mm thick.	Refer to EN500281 part 1-2

At an ambient temperature between -20 and +60°C

### A1.2 Certification Label Information

The certification label is fitted in a recess on the top outer surface of the enclosure. It shows the ATEX dust certification information including the maximum surface temperature and ingress protection, plus the ATEX gas certification information. Non European information may also be shown.

BA334D Externally Powered Rate Totaliser	
 0359 	II 1 G      Tamb = -40°C to +60°C II 1 GD T80°C Tamb = -20°C to +60°C IP66
EEx ia IIC T5 ITS01ATEX2001	
Year of manufacture shown within terminal compartment	
BEKA associates Ltd Hitchin England <a href="http://www.beka.co.uk">www.beka.co.uk</a>	

The instrument serial number and date of manufacture are recorded on a separate label inside the terminal compartment.

### A1.3 Calibration & maintenance

The ATEX dust certification relies on the instrument enclosure being dust-tight. Therefore the control and terminal covers should only be removed when dust can not enter the instrument enclosure. Before replacing the control and terminal covers ensure that the sealing gaskets are undamaged and are free from foreign bodies.

**Appendix 2**  
**FM approval for use in USA**

**A2.0 Factory Mutual Approval**

For installations in the USA, a version of the BA334D and accessories have been approved intrinsically safe and nonincendive by FM Approvals, project identification 3022309. Copies of the Certificate of Compliance are available from the BEKA associates sales office and from the BEKA web site [www.beka.co.uk](http://www.beka.co.uk).

The FM Approved version of the BA334D externally powered rate totaliser is identical to the ATEX version except the three M20 x 1,5 tapped cable entries are replaced by three plain unthreaded 22.25mm diameter entries. Approved hubs and glands are listed in note 8 of intrinsically safe control drawing CI330-32 and note 5 of nonincendive control drawing CI330-34. The certification label on the FM Approved version includes ATEX gas certification information so that the rate totaliser may be used in systems covered by either authority.

**A2.1 Intrinsic safety approval**

The BA334D is approved to the FM Class 3610 intrinsic safety standard. Installations must comply with BEKA associates Control Drawing CI330-32, which is attached to this Appendix, ANSI/ISA RP12.06.01 'Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations' and with the National Electrical Code ANSI/NFPA70.

The BA334D has a T4 rating at ambient temperatures up to +60°C and may be used with the following gases and dusts:

<b>Intrinsic Safety</b>	
Division 1 or 2	
Class I	Group A & B Group C Group D
Class II	Group E, F & G
Class III	
Zone 0, 1 or 2	
Class 1	Group IIC Group IIB Group IIA

The FM entity parameters are similar to the ATEX parameters. The intrinsically safe circuits shown in this manual may therefore be used for installations in the USA, providing the Zener barriers and galvanic isolators are FM Approved and comply with BEKA associates Control Drawing CI330-32.

**A2.2 Nonincendive approval**

The BA334D is Class 3611 nonincendive approved by Factory Mutual allowing it to be installed in Division 2 Classified Areas without the need for Zener barriers or galvanic isolators. Installations must comply with the BEKA associates Control Drawing CI330-34, which is attached to this Appendix, and with the National Electrical Code ANSI/NFPA70.

The BA334D has a T4 rating at ambient temperatures up to +60°C and may be used with the following gases and dusts:

<b>Nonincendive</b>	
Division 2	
Class I	Group A & B Group C Group D
Class II	Group E, F & G
Class III	
Zone 2	
Class I	Group IIC Group IIB Group IIA

















