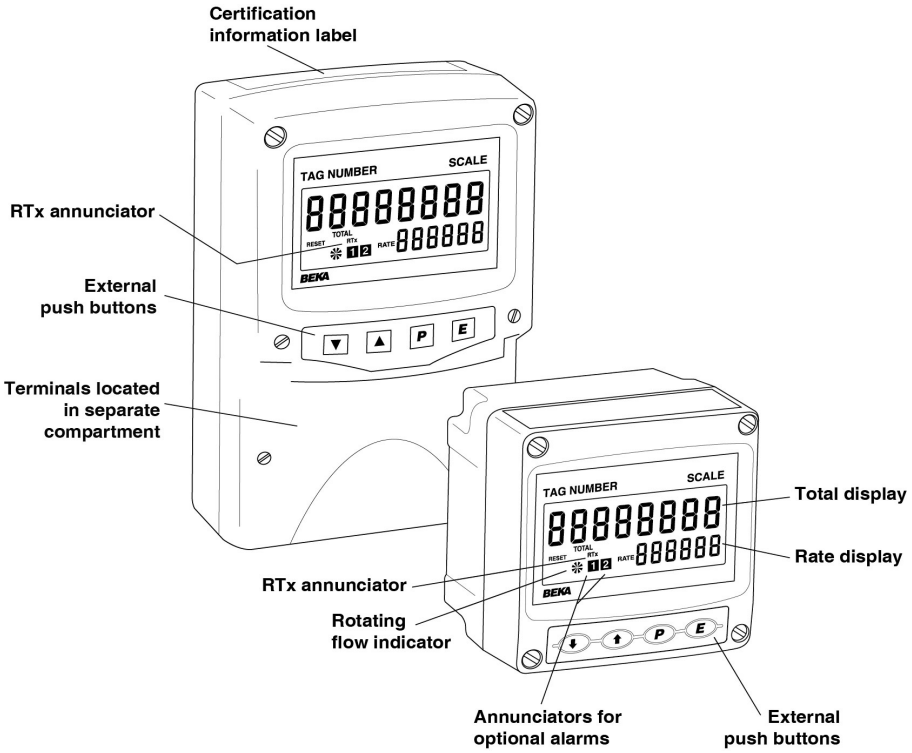
BA334G & BA334E
Intrinsically Safe
Externally powered
Rate Totaliser

Issue 4



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9th July 2019

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The BA334G and BA334E are CE marked to show compliance with the European Explosive Atmospheres Directive 2014/34/EU and the European EMC Directive 2014/30/EU

1. DESCRIPTION

These intrinsically safe, one input rate totalisers are primarily intended for use with a pulse output flowmeter. The BA334G and the BA334E are functionally identical and have similar certifications, but differ in mechanical construction and options.

The differences are summarised in the following table.

	BA334G	BA334E
Separate terminal compartment.	No	Yes
Pulse output	Yes	Yes
Backlight	Option	Yes
4/20mA output.	Option	Yes
Dual alarms	Option	Yes
Certification		
IECEx	Gas & dust	Gas
ATEX	Gas & dust	Gas
ETL & cETL	Gas & dust	Gas & dust

The main sections of this instruction manual describe the BA334G, but also apply to the BA334E. Details of the BA334E mounting and terminals are contained in Appendix 4.

The BA334G and BA334E have been ATEX certified intrinsically safe by Notified Body Intertek Testing and Certification Ltd and comply with the European ATEX Directive 2014/34/EU. The BA334G has gas and dust certification, but the BA334E only has ATEX gas certification.

The main sections of this manual describe ATEX gas certification.

For international applications the BA334G and BA334E also have IECEx certification which is described in Appendix 2. The BA334E does not have IECEx dust certification.

For applications in the USA and Canada the BA334G and BA334E have ETL & cETL certification which is described in Appendix 3.

The BA334G and BA334E simultaneously display the rate of flow and the total flow in the same or different engineering units. The instruments are controlled and configured via the four front panel push buttons, a user defined four digit code may be entered to prevent accidental access to the instrument's configuration menu.

2. OPERATION

Fig 1 shows a simplified block diagram of the BA334G Rate Totaliser. The instrument can accept pulses from most flowmeter transducers. When connected to a pulse output flowmeter the BA334G will provide an accurate display of the rate of flow and the total flow in the same or different engineering units. The internal lineariser, which can have up to sixteen straight-line segments, may be calibrated to compensate for flowmeter non-linearity.

The BA334G has a single pair of input terminals for connection to all types of sensor. When counting pulses from a sensor requiring energising, such as a switch contact, open collector or a two wire proximity detector, an external link between terminals 3 and 4 supplies power to the transducer.

Factory fitted accessories include an internally powered display backlight, dual alarms and an isolated 4/20mA output which may be configured to retransmit the rate or total display.

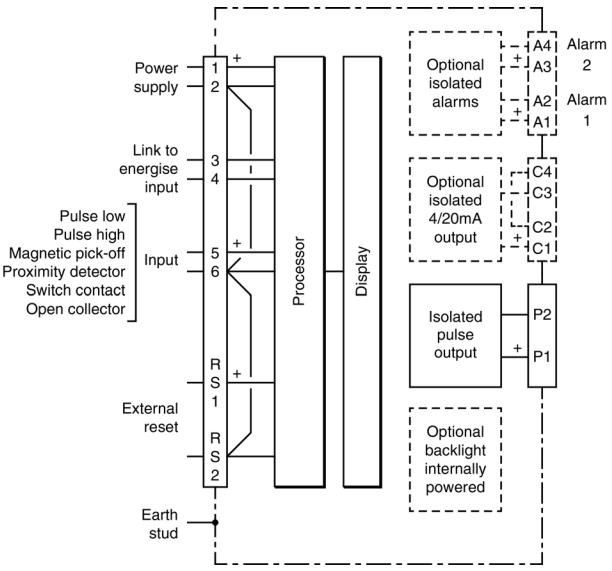


Fig 1 BA334G block diagram

2.1 Initialisation

Each time power is applied to the Rate Totaliser initialisation is performed. After a short delay the following display sequence occurs:

All segments of the display are activated

Instrument starts functioning using the configuration information stored in permanent memory. Unless total and grand total displays have been reset to zero, new flow will be added to the existing totals.

2.2 Controls

The BA334G is controlled and configured via four front panel push buttons. In the totalisation mode i.e. when the instrument is displaying rate and total flow the push button functions are:

Push Button Functions

E + ▼ Grand total - shows Lo followed by least significant 8 digits of the 16 digit grand total.

E + ▲ Grand total - shows Hi followed by the most significant 8 digits of the 16 digit grand total.
If Local Grand Total Reset CLr Gtot in the instrument configuration menu has been activated, operating the E and ▲ buttons for ten seconds will result in CLr.no being displayed with the no flashing. Operating the ▼ or ▲ button will change the display to CLr . YES, the E button will then reset the grand total to zero which will be confirmed by a brief display of Gt CLrd.
See 6.20

▼ + ▲ If Local Total Reset CLr tot in the instrument configuration menu has been activated, operating the ▼ and ▲ buttons for three seconds will reset the total display to zero and clear any pulses stored in the optional pulse output.
The Grand Total is not reset.
See 6.19

P + ▼ Shows in succession, firmware version number, instrument function totALi SE and any output accessories that are fitted:

- A Dual alarm outputs
- P Pulse output (always fitted)
- C 4/20mA output

P + ▲ Provides direct access to the alarm setpoints when the Rate Totaliser is fitted with optional alarms and the ACSP setpoints function has been enabled.
See 10.3.13

P + E Access to configuration menu

2.3 Displays

The BA334G has two digital displays and associated annunciators, plus a flow indicator as shown on front cover.

Total display — Shows the total flow on the upper eight digit display. May be reset to zero via front panel push buttons or by a remote reset switch.

Rate Display — Shows the flow rate on the lower six digit display.

Flow indicator — This disc in the lower left hand corner of the display 'rotates' for two seconds each time an input pulse is received. Appears to rotate continuously when input frequency exceeds 0.5Hz.

Hold annunciator — Activated when input frequency is below the clip-off threshold.

Reset annunciator — Activated while instrument is being reset via the front panel push buttons, or the external reset terminals.

Rate annunciator — Identifies rate display

Total annunciator — Identifies total display

RTx annunciator — Retransmitted pulse annunciator.
Depends upon the setting of SourCE in the pulse output configuration menu.

SCALEd
Annunciator activated each time pulse output open collector is *on*, i.e. Ron is less than 60Ω + 3V.

dirECt:
Annunciator continuously activated.

2.4 Display over-range

Over-range of the upper eight digit display or the lower six digit display is indicated by all the digits displaying 9 and all the decimal points flashing.

3. INTRINSIC SAFETY CERTIFICATION

The BA334G has ATEX and IECEx gas and dust certification. This section of the instruction manual describes ATEX gas certification. ATEX dust and IECEx approvals are described in Appendixes 1 and 2.

3.1 ATEX gas certification

Notified Body Intertek Testing and Certification Ltd have issued the BA334G with an EU-Type Examination Certificate number ITS16ATEX28408X. This confirms compliance with harmonised European standards and it has been used to confirm compliance with the European ATEX Directive for Group II, Category 1G equipment, Ex ia IIC T5 Ga equipment. The Rate Totaliser carries 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 section of the instruction manual describes ATEX installations in explosive gas atmospheres conforming with EN 60079-14 *Electrical installations design, selection and erection*. When designing systems for installation outside the UK the local Code of Practice should be consulted.

3.2 Zones, gas groups and T rating

The BA334G Rate Totaliser has been certified Ex ia IIC T5 Ga. When connected to a suitable system it 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

In gases that may be used with equipment having a temperature classification of:

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

At ambient temperatures between -40 and +70°C.

CAUTION installation in Zone 0

When installed in a Zone 0 potentially explosive atmosphere requiring EPL Ga apparatus, the instrument shall be installed such that even in the event of rare incidents, an ignition source due to impact or friction between the aluminium label and iron/steel is excluded.

No special conditions apply when the BA334G Rate Totaliser is installed in Zone 1 or in Zone 2. This allows the BA334G to be installed in all gas Zones and to be used with most common industrial gases except carbon disulphide and ethyl nitrite which have an ignition temperature of 95°C.

3.3 Power supply

When installed in a hazardous area the BA334G should be powered from a certified Zener barrier, galvanic isolator or associated apparatus with an intrinsically safe voltage output.

The safety parameters of terminals 1 and 2 are:

Ui	=	28V dc
Ii	=	200mA dc
Pi	=	0.84W
Uo	=	0
Io	=	0

Any certified Zener barrier, galvanic isolator or associated apparatus with output safety parameters equal to or less than these input limits may be used.

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

Ci	=	2nF
Li	=	4µH

To determine the maximum permissible cable parameters the above figures, which are small and may be ignored in some applications, should be subtracted from the maximum permitted cable parameters specified for the Zener barrier, galvanic isolator or associated apparatus powering the BA334G Rate Totaliser.

3.4 Pulse input terminals

The BA334G Rate Totaliser has a single pair of pulse input terminals 5 and 6 that may be configured for use with different types of flowmeter.

For flowmeters with transducers that require energising to determine their state, such as switch contacts or a 2-wire proximity detector in a turbine flowmeter, an external link between terminals 3 & 4 of the BA334G connects an internal 7V, 6mA supply to the input. Energising is not required when the Rate Totaliser's input is connected to a voltage pulse source.

Fitting an external link between terminals 3 & 4 changes the output safety parameters of the Rate Totaliser input terminals 5 & 6 as shown in the following table. This table also shows the types of sensor requiring energising (link fitting).

		Output safety parameters		
Type of input	**Link 3 & 4**	**Uo**	**Io**	**Po**
Switch contact	Yes	10.5V	9.2mA	24mW
Proximity detector	Yes	10.5V	9.2mA	24mW
Open collector	Yes	10.5V	9.2mA	24mW
Magnetic pick-off	No	1.1V	0.5mA	0.2mW
Voltage input (low)	No	1.1V	0.5mA	0.2mW
Voltage input (high)	No	1.1V	0.5mA	0.2mW

3.4.1 Flowmeter sensors not require energising

Flowmeters employing magnetic pick-offs or voltage pulse sensors do not require energising, therefore terminals 3 & 4 should not be linked. When not energised i.e. without a link, the output parameters of the pulse input terminals comply with the requirements for *simple apparatus*. For intrinsic safety purposes, sources of energy with output parameters less than 1.5V; 100mA and 25mW are considered to be *simple apparatus* (Clause 5.7 of EN60079-11), which allows their output parameters Uo, Io & Po to be ignored when assessing the safety of an intrinsically safe system, thus simplifying loop assessment and documentation.

Almost any flowmeter with a voltage pulse output may be directly connected to the BA334G input in a hazardous area providing that:

a. The flowmeter is a certified intrinsically safe device having output parameters equal to or less than:

Uo	≤	28V dc
Io	≤	200mA dc
Po	≤	0.84W

or complies with requirements for *simple apparatus.*

b. The flowmeter and associated wiring can withstand a 500V rms insulation test to earth.

c. The flowmeter is located in the same hazardous area as the BA334G. The BA334G EU-Type Examination Certificate specifies that the equivalent capacitance and inductance of pulse input is:

Ci	=	2nF
Li	=	4µH

To determine the maximum permissible cable parameters these figures should be subtracted from the maximum permitted output parameters Lo and Co specified by the certificate for the flowmeter connected to the totaliser's pulse input terminals. The totalisers pulse input equivalent capacitance and inductance are small and unlikely to make a significant difference to the allowable cable parameters.

3.4.2 Flowmeter sensors requiring energising

Flowmeters with switch contacts, proximity detector or open collector outputs require energising which is achieved by linking Rate Totaliser terminals 3 and 4 together as described in section 3.4. When energised, the output parameters of the pulse input terminals 5 and 6 are:

Uo	=	10.5V dc
Io	=	9.2mA dc
Po	=	24mW

These output parameters do not comply with the requirements for *simple apparatus* and should be considered when assessing the safety of the flowmeter connected to the totaliser pulse input.

Any certified intrinsically safe flowmeter may be connected to a BA334G energised input providing that:

a. The flowmeter is a certified intrinsically safe device having input parameters equal to or greater than:

Uo	≥	10.5V dc
Io	≥	9.2mA dc
Po	≥	24mW

or complies with the requirements for *simple apparatus.*

b. The flowmeter and associated wiring can withstand a 500V rms insulation test to earth.

c. The flowmeter is located in the same hazardous area as the BA334G.

d. Minimum operating voltage of a flowmeter incorporating a proximity detector is less than 7.5V.

e. The maximum capacitance and inductance that may be safely connected to the energised pulse input terminals 5 & 6 (terminals 3 & 4 linked) is:

Co	=	2.4µF
Lo	=	200mH

This is not restrictive as the combined capacitance and inductance of most sensors and the connecting cable will be less than this.

3.5 Remote reset terminals

The BA334G total display may be reset to zero by connecting the external reset terminals RS1 and RS2 together for more than one second. The two reset terminals have the following input and output safety parameters:

Uo	=	3.8V dc
Io	=	1mA
Po	=	1mW
Ui	=	28V dc
Ii	=	200mA dc
Pi	=	0.84W

The equivalent capacitance and inductance between them is:

Ci	=	0
Li	=	0

The maximum cable capacitance and inductance that may be safely connected between the reset terminals RS1 and RS2 is:

Co	=	40µF
Lo	=	1H

The reset terminals may be directly connected to any mechanically operated switch located within the same hazardous area as the BA334G Rate Totaliser. The switch and associated wiring should be able to withstand a 500V rms insulation test to earth.

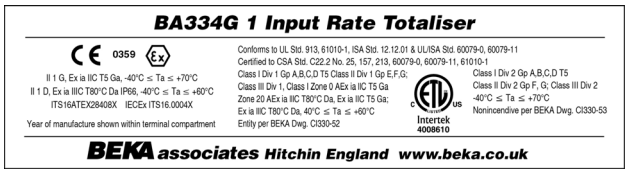
If the reset switch is required in the safe area a Zener barrier or intrinsically safe relay is required to transfer the contact closure into the hazardous area. Almost any intrinsically safe relay with certification permitting the contacts to be connected to equipment in the hazardous area may be used.

A diode return Zener barrier is not suitable for this application.

Alternatively the BA334G may be configured so that the total display is reset to zero when the ▼ and ▲ push buttons are operated simultaneously for more than three seconds. See 6.19

3.6 Certification label information

The Rate Totaliser certification information label is fitted in a recess on the top outer surface of the enclosure. It shows the ATEX and IECEx certification information plus BEKA associates name, location, year of manufacture and the instrument serial number. Non European certification information may also be included.



BA334G Certification information label

4. SYSTEM DESIGN FOR GAS HAZARDOUS AREAS.

4.1 Use with Zener barriers

Zener barriers are the least expensive intrinsically safe interface between a safe and hazardous area. However they require a high integrity earth connection that may be expensive to install and they do not provide isolation. When a high integrity earth connection is not already available, it may be less expensive and complicated to use galvanic isolators for the installation of a single BA334G.
Terminals 2, 6 and RS2 of the BA334G Rate Totaliser are internally connected together. If any of these terminals are earthed, as shown in Figs 2 & 3, the other common terminals should only be connected to the same earth, i.e. the barrier busbar, or to circuits that have 500V rms insulation to earth.

Any Zener barrier may be used with the BA334G providing it's certification is for use with apparatus in the required Zone and gas group, and it's output parameters do not exceed the input parameters of the Rate Totaliser terminals to which it is connected. Only one polarity of Zener barrier i.e. positive or negative, may be used in a Rate Totaliser system.

Fig 2 illustrates the basic circuit that is used for all BA334G installations protected by Zener barriers. For simplicity, connections for the pulse output and optional alarms and 4/20mA output are shown separately in sections 6.24 and 10 of this manual.

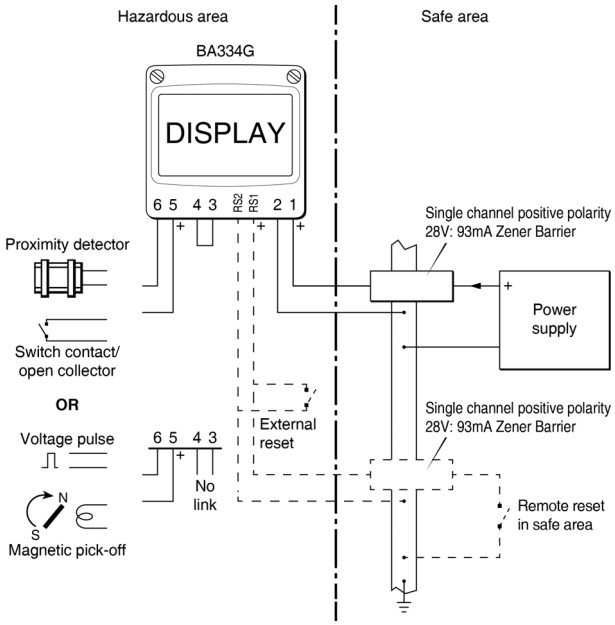


Fig 2 BA334G used with Zener barriers

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.

When designing a system it is important to remember that terminals 2, 6 and RS2 are interconnected within the BA334G See Fig 1.

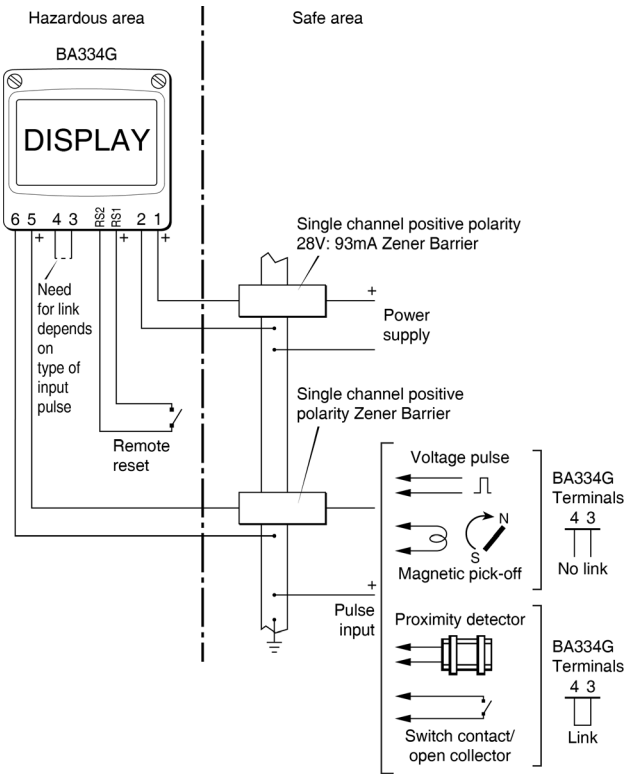


Fig 3 BA334G used with Zener barriers pulse source in the safe area.

4.1.1 Power supply

The BA334G Rate Totaliser requires a minimum of 10V between terminal 1 & 2 and consume:

	10mA	without optional backlight
plus	6mA	when terminals 3 & 4 are linked

Any certified Zener barrier may be used to power a BA334G Rate Totaliser providing the output safety parameters of the barrier are equal to or less than the input safety parameters of terminals 1 & 2 of the Rate Totaliser.

Although this allows a wide variety of barriers to be used, a positive polarity 28V; 93mA; 300Ω Zener barrier, which has an end-to-end resistance of about 340Ω, is an industry standard device which is frequently used. With this barrier the supply voltage in the safe area must be between 15.5V and the maximum working voltage of the Zener barrier which, depending upon manufacturer, will be approximately 26V.

Note: The optional factory fitted display backlight increases the instrument's current consumption to 32mA and therefore increases the minimum safe area operating voltage, see section 10.2 for details.

4.1.2 Pulse input

As shown in Figs 2 and 3 the BA334G can display the rate and total flow from flowmeters with a wide variety of pulse outputs located in safe and hazardous areas.
No Zener barrier is required in series with the input if the intrinsically safe flowmeter is located within the same hazardous area as the Rate Totaliser.

The following table shows the Rate Totaliser's input switching thresholds when conditioned for use with flowmeters having different outputs, For reliable totalisation the Rate Totaliser pulse input must fall below the lower threshold and rise above the upper threshold.

Input transducer	Switching thresholds	
	Lower	Upper
Open collector	2kΩ	10kΩ
Voltage pulse low	1.0V	3.0V
Voltage pulse high	3.0V	10.0V
Magnetic pick-off	0	40mV peak
Proximity detector	1.2mA	2.1mA
Switch	100Ω	1000Ω

Flowmeters with a switch contact, proximity detector or an open collector output require energising which is achieved by linking Rate Totaliser terminals 3 and 4.

4.1.3 Switch contact input
Any flowmeter with a mechanically or magnetically activated switch contact located in the same hazardous area as the Rate Totaliser may be directly connected to pulse input terminals 5 and 6, providing the flowmeter and associated wiring can withstand a 500V rms insulation test to earth. Most magnetically activated reed relays used in turbine flowmeters comply with these requirements and the requirements for *simple apparatus*. The BA334G contains a configurable debounce circuit to prevent false triggering. Three levels of de-bounce protection are independently available.
See section 6.7.

4.1.4 Open collector input
Most certified intrinsically safe flowmeters with an open collector output may be directly connected to a BA334G input terminals 5 & 6, providing the input safety parameters of the flowmeter (open collector) are equal to or greater than the output safety parameters of Rate Totaliser's pulse input. i.e.

Ui ≥ 10.5V dc
Ii ≥ 8.2mA dc
Pi ≥ 24mW

The flowmeter must be located in the same hazardous area as the BA334G and the associated wiring should be able to withstand a 500V rms insulation test to earth.

The BA334G contains a configurable debounce circuit to prevent false triggering. Three levels of de-bounce protection are independently available. See section 6.7.

4.1.5 2-wire proximity detector input
Most certified intrinsically safe flowmeters incorporating a NAMUR 2-wire proximity detector may be directly connected to a BA334G input, providing the input safety parameters of the flowmeter (proximity detector) are equal to or greater than the output safety parameters of Rate Totaliser's pulse input. i.e.

Ui ≥ 10.5V dc
Ii ≥ 8.2mA dc
Pi ≥ 24mW

The minimum operating voltage of the flowmeter (proximity detector) should be less than 7.5V. The flowmeter must be located in the same hazardous area as the BA334G and the associated wiring should be able to withstand a 500V rms insulation test to earth.

The Rate Totalisers contain a configurable debounce circuit to prevent false triggering. Three levels of debounce protection are independently available. See section 6.7.

4.1.6 Magnetic pick-off input
Flowmeters incorporating a magnetic pick-off to sense flow will have a low level voltage output unless the flowmeter incorporates an amplifier. CoiL in the BA334G input configuration menu is a low level voltage pulse input intended for use with an intrinsically safe magnetic pick-off. When a Rate Totaliser is configured for CoiL and terminals 3 & 4 are not linked, the input terminals 5 & 6 comply with the requirements for *simple apparatus* allowing connection to any certified intrinsically safe magnetic sensor having output parameters equal to or less than:

Uo ≤ 28V dc
Io ≤ 200mA dc
Po ≤ 0.84W

The maximum permitted cable parameters will be the magnetic pick-off's Co and Lo specified on it's intrinsic safety certificate, less the Rate Totalisers pulse input parameters Ci and Li which are small and can often be ignored.

The flowmeter must be located within the same hazardous area as the Rate Totaliser and with the associated wiring be able to withstand a 500V rms insulation test to earth.

The Rate Totalisers contain a configurable debounce circuit to prevent false triggering of the instrument. Three levels of de-bounce protection are independently available. See section 6.7.

4.1.7 Voltage pulse input
Two voltage pulse input ranges are selectable in the BA334G Rate Totaliser configuration menu, UoLt5 L and UoLt5 H. When configured for either of the voltage pulse ranges and terminals 3 & 4 are not linked, the input terminals 5 & 6 comply with the requirements for *simple apparatus*. This allows the input to be connected to any certified intrinsically safe flowmeter with a voltage output located in the same hazardous area as the Rate Totaliser having output parameters equal to or less than:

Uo ≤ 28V dc
Io ≤ 200mA dc
Po ≤ 0.84W

The Rate Totaliser input may therefore be directly connected to most certified intrinsically safe flowmeters with a high level voltage pulse output.

The maximum permitted cable parameters will be defined by the intrinsic safety certification of the flowmeter less the Rate Totalisers input parameters Ci & Li which are small and can often be ignored.

The Rate Totalisers contain a configurable debounce circuit to prevent false triggering of the instrument. Three levels of de-bounce protection are independently available. See section 6.7.

4.1.8 Remote reset

The Rate Totaliser's total display may be remotely reset to zero by connecting terminals RS1 and RS2 together for more than one second. Permanent interconnection inhibits totalisation. Remote resetting may be accomplished by any mechanically operated switch located in the same hazardous area as the Rate Totaliser providing the switch and the associated wiring can withstand a 500V rms insulation test to earth. No Zener barrier is required.

A BA334G may also be remotely reset from the safe area. Any switch may be used but a Zener barrier is required to transfer the contact closure into the hazardous area which may be combined with the supply barrier so that only one package is required. A diode return barrier is not suitable for this application. Fig 2 illustrates how a BA334G may be reset from both the safe and the hazardous area.

Note: The Rate Totaliser may be configured to reset the total display to zero by operating the ▼ and ▲ push buttons simultaneously for more than three seconds in the totalising mode i.e. when the instrument is displaying flow. See 6.19

4.2 Use with Galvanic Isolators

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

Any galvanic isolator may be used with the BA334G providing it's certification is for use with apparatus in the required Zone and gas group, and it's output parameters do not exceed the input parameters of the Rate Totaliser terminals to which it is connected. It must also have the correct function.

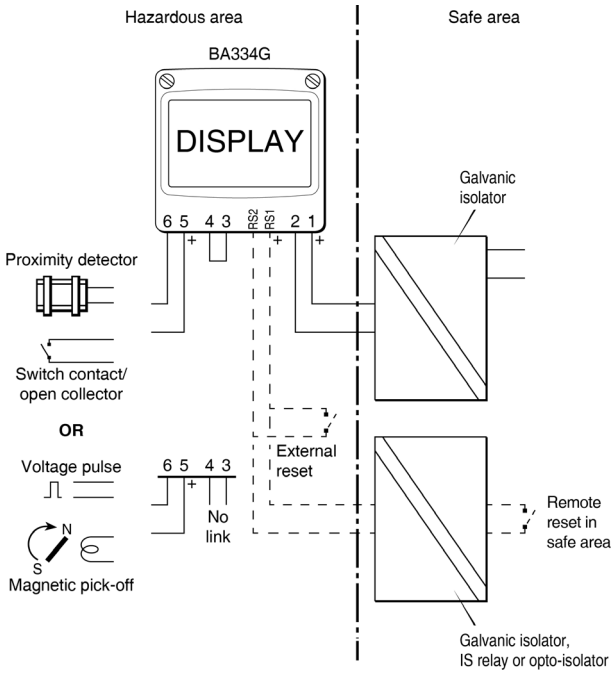


Fig 4 BA334G used with galvanic isolators.

Fig 4 illustrates the basic circuit that is used for all BA334G installations protected by galvanic isolators. For simplicity, connections for the pulse output, optional alarms and 4/20mA output are shown separately in sections 6.24 and 10 of this manual.

The totaliser pulse source may be located in the safe area as shown in Fig 5. An additional galvanic isolator is used to transfer the signal to the rate totaliser in the hazardous area, although it may be difficult to find isolators for transferring some flowmeter transducer outputs.

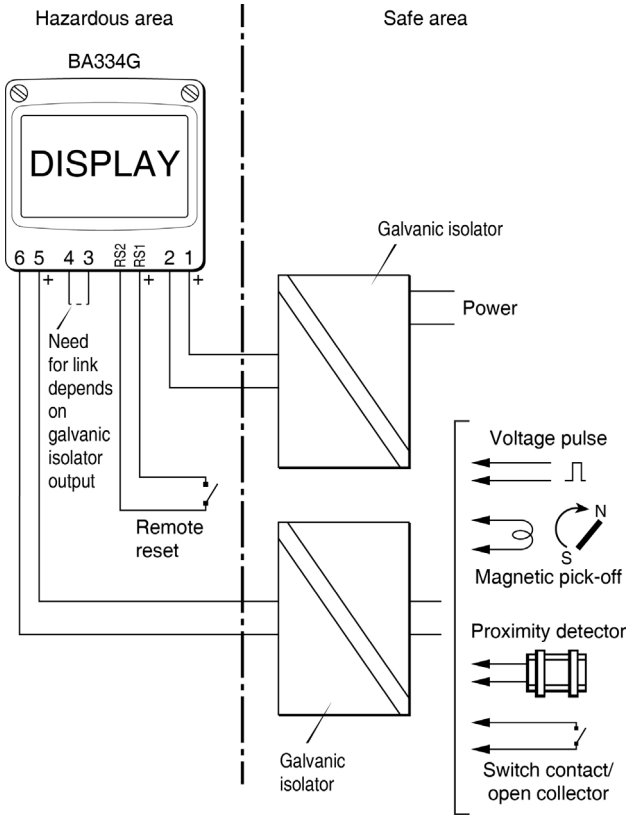


Fig 5 Pulse source in safe area

4.2.1 Power supply

The BA334G Rate Totaliser requires a minimum of 10V between terminal 1 & 2 and consumes:

	10mA	without optional backlight
plus	6mA	when terminals 3 & 4 are linked.

Total increases to 32mA when optional backlight is fitted. Any galvanic isolator certified for the gas group and Zone in which the BA334G is installed may be used to power the instrument. The output safety parameters of the isolator must be equal to or less than the input safety parameters of terminals 1 & 2 and the voltage at terminals 1 & 2 must be greater than 10V. These requirements are not restrictive and allow a wide range of galvanic isolators, such as solenoid drivers, to be used.

4.2.2 Pulse input

As shown in Figs 4 and 5 the BA334G inputs can be directly connected to hazardous area flowmeters, or to safe area flowmeters via isolators. Galvanic isolators are not required in series with the input if an intrinsically safe flowmeter is located within the same hazardous area as the Rate Totaliser.

The BA334G Rate Totaliser may be used with flowmeters having a wide variety of pulse outputs. The following table shows the switching thresholds for each type. For reliable operation the Rate Totalisers input signal must fall below the lower threshold and rise above the upper threshold.

Input transducer	Switching thresholds	
	Lower	Upper
Open collector	2kΩ	10kΩ
Voltage pulse low	1.0V	3.0V
Voltage pulse high	3.0V	10.0V
Magnetic pick-off	0mV	40mV peak
Proximity detector	1.2mA	2.1mA
Switch	100Ω	1000Ω

Switch contacts, proximity detectors and open collector sensors require energising which is achieved by linking terminals 3 and 4 together as shown in Figs 4 and 5.

4.2.3 Switch contact input

Any flowmeter with a mechanical or magnetically activated switch contact output may be directly connected to input terminals 5 & 6 providing the flowmeter is located in the same hazardous area as the Rate Totaliser and the flowmeter and associated wiring can withstand a 500V rms insulation test to earth. Most magnetically activated reed relays used in turbine flowmeters comply with these requirements. The BA334G contains a configurable debounce circuit to prevent contact bounce being counted. Three levels of de-bounce protection are independently available. See section 6.7.

4.2.4 Open collector input

Most certified intrinsically safe flowmeters with an open collector output may be directly connected to a BA334G input terminals 5 & 6, providing the input safety parameters of the flowmeter (open collector) are equal to or greater than the output safety parameters of Rate Totaliser's pulse input. i.e.

Ui	≥	10.5V dc
Ii	≥	8.2mA dc
Pi	≥	24mW

The flowmeter must be located in the same hazardous area as the BA334G and the associated wiring should be able to withstand a 500V rms insulation test to earth.

The BA334G contains a configurable debounce circuit to prevent false triggering. Three levels of de-bounce protection are independently available. See section 6.7.

4.2.5 2-wire proximity detector input

Most certified intrinsically safe flowmeters incorporating a NAMUR 2-wire proximity detector may be directly connected to a BA334G input, providing the input safety parameters of the proximity detector are equal to or greater than the output safety parameters of a BA334G input. The (flowmeter) proximity detector input safety parameters should be:

Ui	≥	10.5V dc
Ii	≥	8.2mA dc
Pi	≥	24mW

and the minimum operating voltage of the flowmeter (proximity detector) is less than 7.5V. The flowmeter must be located in the same hazardous area as the Rate Totaliser, and with the associated wiring, be able to withstand a 500V rms insulation test to earth.

The BA334G contain a configurable debounce circuit to prevent false triggering of the instrument. Three levels of de-bounce protection are available. See section 6.7.

4.2.6 Magnetic pick-off input

Flowmeters incorporating a magnetic pick-off to sense flow will have a low level voltage output unless the flowmeter incorporates an amplifier. [oiL in the BA334G input configuration menu is a low level voltage pulse input intended for use with an intrinsically safe magnetic pick-off. When a Rate Totaliser input is configured for [oiL and terminals 3 & 4 are not linked, input terminals 5 & 6 comply with the requirements for *simple apparatus* allowing connection to any certified intrinsically safe magnetic sensor having output parameters equal to or less than:

Uo	≤	28V dc
Io	≤	200mA dc
Po	≤	0.84W

The maximum permitted cable parameters will be be the flowmeter's Co and Lo specified on it's intrinsic safety certificate, less the Rate Totalisers pulse input parameters Ci and Li which are small and can often be ignored.

The flowmeter must be located within the same hazardous area as the BA334G and with the associated wiring must be able to withstand a 500V rms insulation test to earth.

The BA334G contain a configurable debounce circuit to prevent false triggering of the instrument. Three levels of de-bounce protection are independently available. See section 6.7.

4.2.7 Voltage pulse input

Two voltage pulse input ranges are independently selectable in the BA334G Rate Totalisers configuration menu, UoLt5 L and UoLt5 H. When configured for either of the voltage pulse ranges, and terminals 3 & 4 are not linked, the input terminals 5 & 6 comply with the requirements for *simple apparatus*. This allows the pulse input to be connected to any certified intrinsically safe flowmeter with a voltage output located within the same hazardous area as the Rate Totaliser providing it has output parameters equal to or less than:

Uo	≤	28V dc
Io	≤	200mA dc
Po	≤	0.84W

The BA334G Rate Totalisers may therefore be directly connected to most certified intrinsically safe flowmeters with a high level voltage output.

The maximum permitted cable parameters will be defined by the flowmeter's intrinsic safety Co and Lo less the Rate Totaliser's pulse input parameters Ci and Li which are small and can often be ignored.

The BA334G contains a configurable debounce circuit to prevent false triggering of the instrument. Three levels of de-bounce protection are available. See section 6.7.

4.2.8 Remote reset

The Rate Totaliser's total display may be remotely reset to zero by connecting terminals RS1 and RS2 together for more than one second. Permanent interconnection inhibits totalisation. Remote resetting may be accomplished by any mechanically operated switch located in the same hazardous area as the Rate Totaliser providing the switch and the associated wiring can withstand a 500V rms insulation test to earth. No galvanic isolator is required.

A BA334G may also be remotely reset 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 a BA334G may be reset from both the safe and the hazardous area.

Note: The BA334G Rate Totaliser may be configured to reset the total display to zero by operating the ▼ and ▲ push buttons simultaneously for more than three seconds in the totalising mode i.e. when the instrument is displaying flow. See 6.19

5. INSTALLATION

5.1 Location

The BA334G Rate Totaliser is housed in robust IP66 glass reinforced polyester (GRP) enclosure incorporating an armoured glass window and stainless steel fittings making it suitable for exterior mounting in most industrial on-shore and off-shore installations. The Rate Totaliser should be positioned where the display is not in continuous direct sunlight. Special conditions apply for Zone 0 installations, see section 3.2.

Field wiring terminals are located on the rear of the Rate Totaliser assembly as shown in Fig 7.

To ensure electrical continuity between the two conduit or cable entries, the enclosure is fitted with a bonding plate which includes an M4 earth stud. This may be mounted on the inside or outside of the enclosure. If the carbon loaded GRP enclosure is not bolted to an earthed post or structure, this earth stud should be connected to a local earth or the plant potential equalising conductor.

An insulated M4 stud is provided in the bottom right hand corner of the back-box for interconnecting cable screens.

The BA334G Rate Totaliser may be pipe mounted using a BA393G pipe mounting kit, or panel mounted using a BA394G or BA395G panel mounting kit.

5.2 Installation Procedure

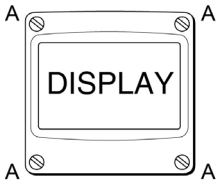
Fig 6 illustrates the instrument installation procedure.

A. Remove the Rate Totaliser assembly by unscrewing the four captive 'A' screws.

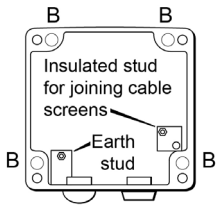
B. Mount the enclosure back-box on a flat surface and secure with screws or bolts through the four 'B' holes. Alternatively use one of the pipe or panel mounting kits which are available as accessories.

C. Remove the temporary hole plug and install an appropriate IP and temperature rated M20 x 1.5mm cable gland or conduit fitting. If two entries are required, the supplied IP66 stopping plug should be replaced with an appropriate IP and temperature rated M20 x 1.5mm cable gland or conduit fitting.

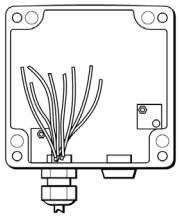
D. Connect the field wiring to the terminals as shown in Fig 7. Replace the instrument assembly on the back-box and evenly tighten the four 'A' screws.



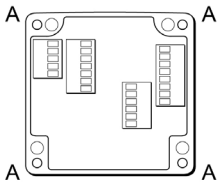
Step A
Unscrew the four captive 'A' screws and separate the indicator assembly and the back-box.



Step B
Secure the enclosure back-box to a flat surface with M6 screws through the four 'B' holes. Alternatively use a pipe mounting kit.

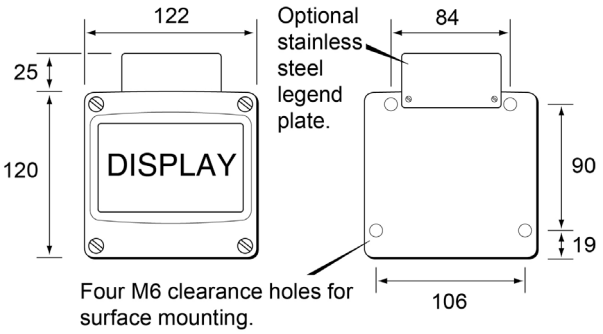


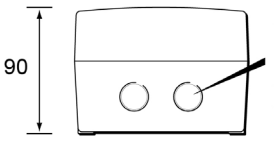
Step C
Remove the temporary hole plug and install an appropriate IP rated cable gland or conduit fitting. Feed the field wiring through the cable entry.



Step D
Terminate field wiring on the indicator assembly. Replace the indicator assembly on the enclosure back-box and tighten the four 'A' screws.

Fig 6 BA334G installation procedure





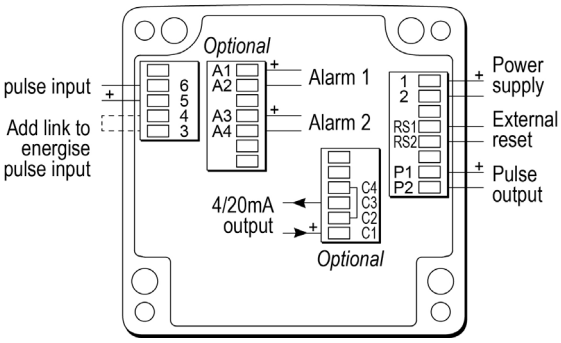


Fig 7 Dimensions and terminal connections

5.3 EMC

The BA334G complies with the requirements of the European EMC Directive 2014/30/EU. For specified immunity all wiring should be in screened twisted pairs, with the screens earthed at one point in the safe area.

5.4 Units of measurement and tag marking on scale card.

The Rate Totaliser's units of measurement and tag information are shown on a scale card which slides into the instrument.

New Rate Totalisers are supplied with a printed scale card showing the requested units of measurement and tag information. If this information is not supplied when the instrument is ordered, a blank scale card will be fitted which can easily be marked on-site with a dry transfer or a permanent marker. Custom printed scale cards are available from BEKA associates as an accessory.

To remove the scale card from a Rate Totaliser carefully pull the transparent tab at the rear of the instrument assembly away from the assembly as shown in Fig 8a.

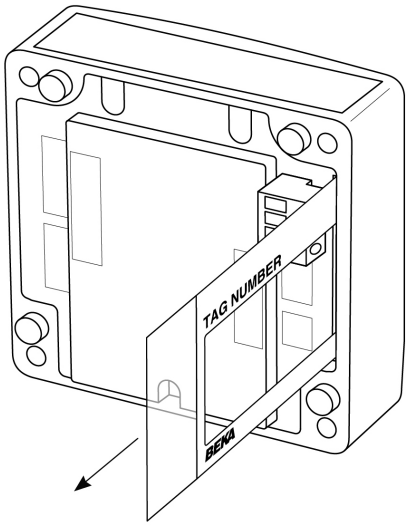


Fig 8a Removing scale card

To replace the scale card carefully insert it into the slot on the right hand side of the input terminals as shown in Fig 8b. Force should be applied evenly to both sides of the scale card to prevent it twisting. The card should be inserted until about 2mm of the transparent tab remains protruding.

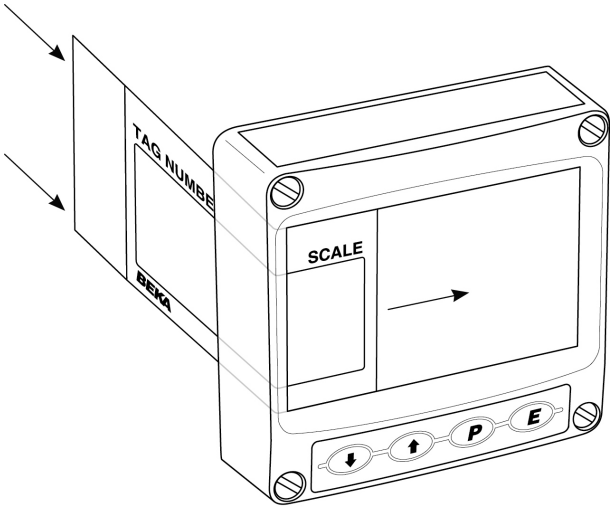


Fig 8b Inserting scale card into the instrument assembly.

6. CONFIGURATION AND CALIBRATION

The BA334G Rate Totaliser is configured and calibrated via four front panel push buttons. All the configuration functions are contained in an easy to use intuitive menu that is shown diagrammatically in Fig 10.

Each menu function is summarised in section 6.3 of this manual and each summary includes a reference to more detailed information. The sixteen segment lineariser is described separately in section 7.

Configuration of the isolated pulse output, which is fitted to all BA334G Rate Totalisers is described separately in section 6.24. The optional outputs which when fitted appear as additional functions in the configuration menu are described in section 10.

All new Rate Totalisers are supplied calibrated as requested at the time of ordering. If calibration is not requested, Rate Totalisers will have default configuration as shown in the following table, but can easily be re-configured on-site.

Function	Display	Default
Access code	CodE	0000
Function	FunCti on	Std
Input	inP.tYPE	oP.CoL
Debounce	dEbounCE	dEFAuLt
Update	uPdAtE	0.5
Upper display	di SP-1	totAL
Lower display	di SP-2	on
Decimal point	dP	Rate 0.0 Total 0
K Factor	FACtor	1.0
Total scale factor	SCALE.t	1.0
Rate scale factor	SCALE.r	1.0
Timebase	t-bASE	SEC
Filter	Fi LtEr	24
Clip-off	CLP-oFF	0
Local total reset	t-rESEt	oFF
Local grand total reset	Gt-rESEt	oFF
Security code	CodE	0000

Note: While the instrument is being configured totalisation continues so that any flow occurring during this time is recorded.

6.1 Configuration structure

Fig 9 shows the BA334G calibration structure. The rate and total display calibrations are independent which allows the displays to have different engineering units.

The rate totaliser pulse input is divided by FACtor which is usually set to the K-factor of the flowmeter, thus converting the flowmeter output into engineering units. When the 16 segment lineariser Lin is selected in the Function sub-menu, up to 16 values for FACtor may be entered each at a specified input pulse frequency to compensate for flowmeter nonlinearity. See section 7.

SCALE-r is a dividing factor that converts the output from FACtor into the required rate display in engineering units. e.g. if the output from FACtor is one pulse per litre and the rate display is required in gallons, SCALE-r should be set to 4 . 5461 which is the number of litres in an imperial gallon.

The timebase t-bASE is a multiplying factor that determines if the instrument displays flow per second, per minute or per hour.

The total flow display is independent of the rate display. SCALE-t is a dividing factor that converts the output from FACtor into the required total display engineering units. e.g. if the output from FACtor is one pulse per litre and the total display is required in thousands of gallons, SCALE-t should be set to 4546 . 1 which is the number of litres in 1,000 imperial gallons.

The BA334G uses 'real' decimal points. Moving the position of a decimal point in a scale factor will affect the instrument calibration.

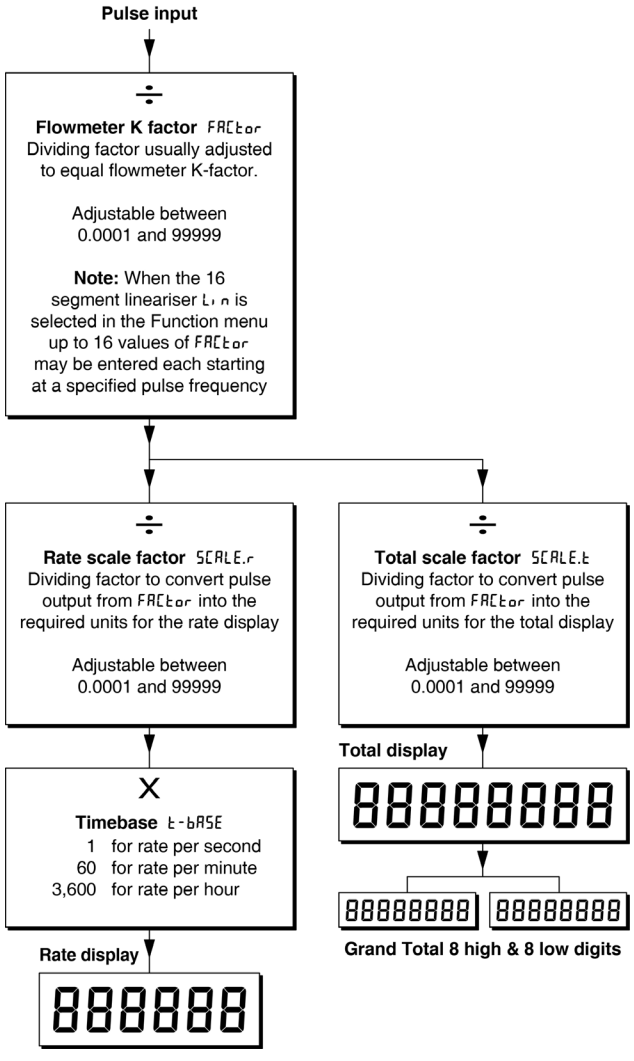


Fig 9 Calibration structure

6.2 Accessing configuration functions

Throughout this manual push buttons are shown as ▼, ▲, P and E and legends displayed by the instrument are shown in a seven segment font exactly as they appear on the instrument display e.g. inPut and uPdAtE.

Access to the configuration 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 FunCtion 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 ▼ or ▲ push button to adjust each digit, and the P push button to transfer control to the next digit. If the correct code has been entered pressing E will cause the first parameter FunCtion 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 totalisation mode.

All configuration functions and prompts are shown on the upper eight digit display.

Once within the main configuration menu the required parameter can be selected by scrolling through the menu using the ▼ or ▲ push button. The configuration menu is shown diagrammatically in Fig 10.

When returning to the totalisation mode following reconfiguration, the Rate Totaliser will display dAtA followed by SAVE while the new information is stored in permanent memory.

6.3 Summary of configuration functions

This section summarises all the configuration functions. When read in conjunction with Fig 10 it provides a quick aid for configuring the Rate Totaliser. If more detail is required, each section contains a reference to a full description of the function.

Display	Summary of function
FunCtion	**Rate Totaliser function** Defines the relationship between the pulse input and the Rate Totaliser display. May be set to: Std Standard linear relationship Lin 16 segment adjustable lineariser - see section 7. **See section 6.4**
inPut	**Input** Contains sub-menu with two functions inP.tYPE Select Input type dEbounCE Set debounce **See section 6.5**
inP.tYPE	Configures the Rate Totaliser to accept one of six types of input: oP Col Open collector * VoLt5 L Voltage pulse <1 >3V VoLt5 H Voltage pulse <3 >10V Coil Magnetic pick-off Pr.dEt Proximity detector * ContACt Switch contact * * Link terminals 3 & 4 **See section 6.6**
dEbounCE	Defines level of input debounce applied to the pulse input to prevent false counting: dEFAuLt HEAVY LiGHt **See section 6.7**
uPdAtE	**Display update interval** Define the interval between display updates between 0.5 and 5 seconds. **See section 6.8**

Display	Summary of function
di SP- 1	**Upper display** Defines whether rAtE or totAL is shown on the upper display. The other variable will be shown on the lower display, providing the lower display is on in function di SP-2. **See section 6.9**
di SP-2	**Lower display** Turns the lower display, which normally shows rate, on or oFF. **See section 6.10**
dP	**Decimal points** Defines the position of the decimal point in both the rate and total displays. **See section 6.11**
FACtor	**Flowmeter K-factor** The rate totaliser pulse input is divided by FACtor, which is usually set to the K-factor of the flowmeter, thus converting the flowmeter output into engineering units. FACtor may be adjusted between 0.0001 and 99999. When the 16 segment linearisers Lin is selected in the Function sub-menu, up to 16 values for FACtor may be entered, each at a specified input pulse frequency to compensate for flowmeter non-linearity. **See section 6.12**
SCALE.t	**Total Scale Factor** SCALE.t is a dividing factor that converts the pulse output from FACtor into the required total display in engineering units. e.g. if the output from FACtor is one pulse per litre and the total display is required in thousands of gallons, SCALE.t should be set to 4546 .1 which is the number of litres in 1,000 imperial gallons. SCALE.t may be adjusted between. 0.0001 and 99999. The total flow display is independent of the rate display. **See section 6.13**

Display	Summary of function
SCALE.r	**Rate scale factor** SCALE.r is a dividing factor that converts the pulse output from FACtor into the required rate display in engineering units. e.g. if the output from FACtor is one pulse per litre and the rate display is required in gallons, SCALE.r should be set to 4.5461 which is the number of litres in an imperial gallon. SCALE.r may be adjusted between 0.0001 and 99999. The flow rate display is independent of the total flow display. **See section 6.14**
t-bASE	**Timebase** Selectable multiplier allowing flow rate to be displayed in units per second, per minute or per hour. Select: tb-01 for flow / second tb-60 for flow / minute tb-3600 for flow / hour **See section 6.15**
FiLtEr	**Display filter** An adjustable digital filter to reduce noise on the rate display is controlled by two parameters each adjustable between 0 and 9. The first digit defines the amount of filtering applied to the display, the second deviation from the displayed rate at which the filter will be overridden and the rate display will move rapidly to the new value. **See section 6.16**
CLP-oFF	**Clip-off** To prevent totalisation of very low flow rates, clip-off enables the user to select a flow rate display below which totalisation is inhibited. **See section 6.17**

Display	Summary of function
LoC CLr	**Local reset** Contains sub-menu with two functions enabling total and grand total to be reset to zero via the front panel push buttons when the Rate Totaliser is in the totalisation mode. **See section 6.18**
	Local total reset CLr tot When on is selected total display is reset when ▼ and ▲ buttons are operated simultaneously for more than 3 seconds in the operating mode. **See section 6.19**
	Local grand total reset CLr Gtot When on is selected the grand total is reset when E and ▲ buttons are operated simultaneously for more than 10 seconds in the operating mode. **Note:** Once reset, the grand total can not be restored. **See section 6.20**

Display	Summary of function
CLr-Gtot	**Reset grand total from configuration menu.** This function resets the grand total to zero from within the configuration menu when CLr YES is selected, and SurE is entered to confirm the instruction. **Note**: Once reset, the grand total can not be recovered. **See section 6.21**
CodE	**Security code** Defines a four digit alphanumeric code which must be entered to gain access to the configuration menu. Default code 0000 disables the security function and allows unrestricted access to all configuration functions. **See section 6.22**
rSEt dEF	**Reset to factory defaults** Returns the Rate Totaliser configuration functions to the factory default shown in section 6. To prevent accidental use the request must be confirmed by entering SurE before the reset will be executed. **See section 6.23**

6.4 Rate Totaliser function: FunCti on

The Rate Totaliser contains an adjustable sixteen segment lineariser which may be used to compensate for flowmeter non-linearity. This function turns this lineariser on or oFF.

Std	Lineariser not activated
Lin	Lineariser activated

To reveal the existing Rate Totaliser function select FunCti on from the configuration menu and press P. If the function is set as required, press E to return to the configuration menu, or press the ▼ or ▲ button to change the setting, followed by the E button to return to the FunCti on prompt in the configuration menu.

Std **Linear**
Provides a linear relationship between the pulse input and the Rate Totaliser displays.

Lin **16 segment adjustable lineariser**
Enables a sixteen segment adjustable lineariser. When Lin is selected the FACtor function is expanded to allow up to 16 values to be entered for different input pulse frequencies. Detailed information about the lineariser including configuration is contained in section 7 of this instruction manual.

6.5 Input: inPut

The Input function contains two sub-functions inP.tYPE and dEbounCE which configure the Rate Totaliser input and input noise rejection.

6.6 Input type: inP.tYPE

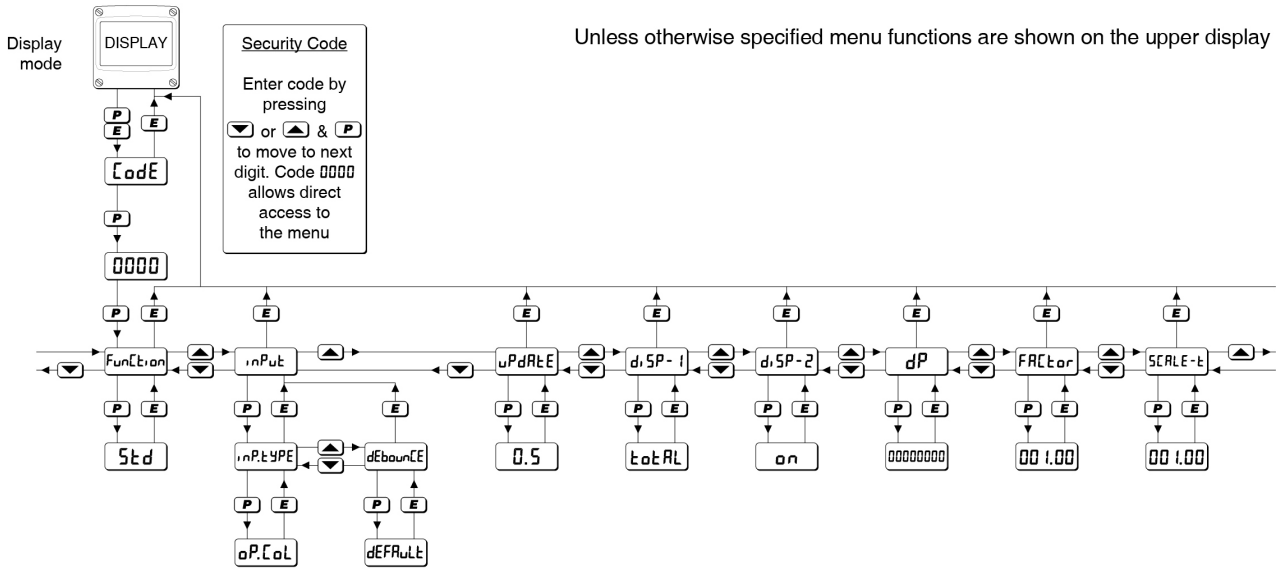
inP.tYPE is a sub-menu in the inPut function which defines the type of flowmeter or input pulse that the Rate Totaliser will count. To check or change the type of input, select inPut in the main configuration menu and press P which will reveal the inP.tYPE prompt, pressing P again will show the Rate Totaliser input. If set as required press E twice to return to the configuration menu, or repeatedly press the ▼ or ▲ button until the required type of input is displayed, then press E twice to return to the configuration menu.

One of following six types of input may be selected:

		Switching thresholds	
		Low	**High**
oP Col	Open collector [2]	2	10kΩ
Volts L	Voltage pulse low [1]	1	3V
Volts H	Voltage pulse high[1]	3	10V
Coil	Magnetic pick-off	0	40mV
Pr.dEt	Proximity detector [2]	1.2	2.1mA
ContACt	Switch contact [2]	100	1000Ω

Notes:

1. Maximum voltage input +30V.
2. For flowmeter transducers that require energising i.e. proximity detectors, switch contacts or open collectors, terminals 3 & 4 of the Rate Totaliser should be linked together.
3. To count correctly, the input pulse must fall below the lower switching threshold and rise above the higher switching threshold.
4. See section 6.7 for maximum counting frequency.



Function

▼ or ▲ to select Function of rate totaliser

`Std` Linear

`Lin` 16 segment lineariser

Input

▼ or ▲ to select Input type

`oP.CoL` Open Collector.

`VoLt5 L` Pulse <1V >3V

`VoLt5 H` Pulse <3V >10V

`Coil` Magnetic pick-off.

`Pr.dEt` Proximity detector.

`ContACt` Switch contact.

Debounce

▼ or ▲ to select level of debounce.

`dEFAuLt` `HEAVY` `LiGHt`

Update

▼ or ▲ to select interval between display updates, may be set to 0.5, 1, 2, 3, 4 or 5 seconds

Upper Display

▼ or ▲ to select whether `rAtE` or `totAL` is shown on the upper display

Lower Display

▼ or ▲ to turn lower display `on` or `oFF`

Decimal point

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

K-factor

▼ or ▲ to select value and P to move to next digit or decimal point

Note: When `Lin` is selected 16 values for `FACtor` may be entered

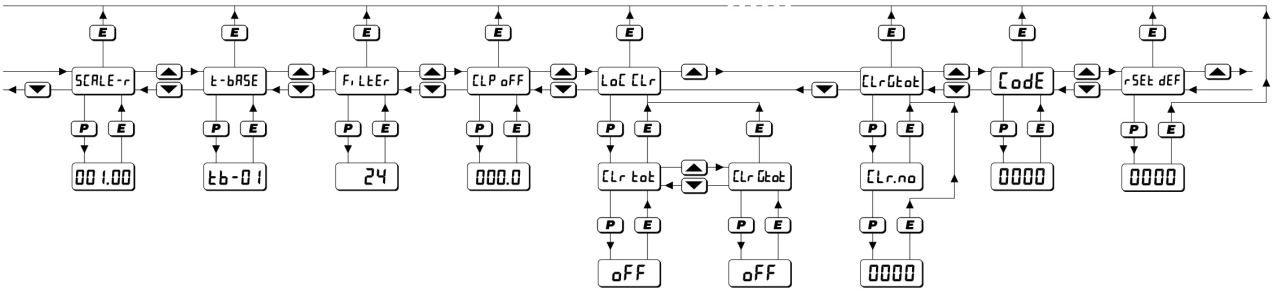
Total scale factor

Divides `FACtor` to produce total display

Press ▼ or ▲ to adjust value and P to move to next digit or decimal point

Fig 10 Configuration menu

When fitted optional alarms, pulse output and 4/20mA output functions appear here.



Rate scale factor

Divides FACtor to produce rate display

Press ▼ or ▲ to adjust value and P to move to next digit or decimal point

Timebase

▼ or ▲ to select rate display timebase

tb-01 for flow/sec

tb-60 for flow/min

tb-3600 for flow/hour

Filter

▼ or ▲ to adjust value of each digit and P to transfer control to other digit

First digit: filter magnitude

second digit: step response

Note: While making adjustments the filtered rate display is shown on lower display so stability can be assessed

Clip off

Rate display below which totalisation is inhibited

Press ▼ or ▲ to adjust value of each digit and P to move to next digit

Local total reset

▼ or ▲ to turn the local total reset function on or oFF. When on, total display is reset to zero when ▼ and ▲ are operated simultaneously in display mode for more than 3 seconds

Local grand total reset

▼ or ▲ to turn the local grand total reset function on or oFF. When on, grand total display may be reset to zero when E and ▲ are operated simultaneously in display mode for more than 10 seconds

Clear grand total

Press ▼ or ▲ to select YES to reset grand total to zero

Confirm instruction by entering SurE. Press ▼ or ▲ to adjust each digit and P to move to next digit

Define Security Code

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

Reset configuration to factory defaults

Confirm instruction by entering SurE. Press ▼ or ▲ to adjust each digit and P to move to next digit

6.7 Debounce: dEbouncE

dEbouncE is an adjustable sub-menu in the inPut function which prevents the Rate Totaliser miscounting when the input pulse has noisy edges, such as those resulting from a mechanical contact closing and bouncing. Three levels of protection may be selected and the amount of debounce applied depends upon the type of Rate Totaliser input that has been selected in the inP . tYPE function.

The following table shows the minimum time that the input pulse must be continuously above the upper input switching threshold and continuously below the lower switching threshold to ensure that the Rate Totaliser processes the input pulse. Input switching thresholds are shown in section 4.1.2.

De-bounce level	Min input pulse width	
	Type of Input	
	Contact	All others
Default	1600µs	40µs
Heavy	3200µs	350µs
Light	400µs	5µs

The Rate Totalier's maximum counting frequency depends upon the debounce level selected, the shape of the input pulse and its amplitude. The following table assumes a square wave input and is only for guidance. The maximum counting frequency will be lower if the input pulses have sloping edges and the pulse amplitude only slightly exceeds the input switching thresholds.

ONLY FOR GUIDANCE		
De-bounce level	Max counting frequency	
	Type of input	
	Contact	All others
Default	250Hz	12kHz
Heavy	120Hz	2kHz
Light	1000Hz	100kHz

The minimum counting frequency is 0.01Hz. Below this frequency the rate display will be forced to zero.

The dEbouncE function is a sub-menu located in the inPut function. Select inPut in the configuration menu and press P which will reveal the inP.tYPE prompt, press the ▼ or ▲ button to select dEbouncE followed by P to reveal the existing setting. Pressing the ▼ or ▲ button will scroll through the three levels. When the required level has been selected, pressing E twice will enter the selection and return the display to the inPut prompt in the configuration menu.

6.8 Display update interval: uPdAtE

If either the rate or the total display is likely to change rapidly, a longer interval between display updates may simplify reading the Rate Totaliser display. This function allows one of six different display intervals between 0.5 and 5 seconds to be selected. The selected display update interval does not affect the update time of any other instrument function.

To adjust the update interval select uPdAtE from the configuration menu and press P to reveal the existing time. Pressing the ▼ or ▲ button will scroll through the six times. When the required interval has been selected press E to enter the selection and return to the configuration menu.

6.9 Upper display: di SP-1

Usually total flow is shown on the larger upper eight digit display, but this function allows rate to be shown on the upper display and total on the smaller lower display which can show six positive digits.

To check the status of the upper display, select di SP-1 from the configuration menu and press P which will reveal if the display is showing rAtE or totAL. The setting can be changed by pressing the ▼ or ▲ button followed by the E button to enter the selection and return to the configuration menu.

6.10 Lower display: di SP-2

This function turns the lower display *on* or *off.* When turned *off*, the BA334G will only have one eight digit display which may be configured in the di SP-1 function to show total flow or rate of flow.

To check the status of the lower display, select di SP-2 from the configuration menu and press P to reveal if the lower display is on or oFF. The setting may be changed by pressing the ▼ or ▲ button followed by the E button to enter the selection and return to the configuration menu.

6.11 Position of the decimal points: dP

The upper and lower displays have eight and six digits respectively. This function enables the position of the decimal point on both displays to be independently positioned.

To adjust the position of the decimal points select dP from the configuration menu and press P. The upper display defined as the rate or total display by function d1 SP-1 (section 6.9) will be activated and identified by the display annunciator as Rate or Total. The decimal point is positioned by operating the ▼ or ▲ push button.

In the total display the ▼ button moves the position of the decimal point to the left and the ▲ button moves it to the right. It may be positioned between any of the six right hand digits or absent by moving it to the right of the least significant digit.

There are no restrictions on the position of the decimal point in the rate display.

When the decimal point in the upper display has been positioned pressing the P button will transfer control to the lower display variable, but it will be shown and annunciated on the larger upper display. The position of the decimal point may be positioned in the same way by operating the ▼ or ▲ push buttons. When set as required enter the settings and return to the configuration menu by operating the E button.

6.12 Flowmeter K-factor: FACtor

The rate totaliser pulse input is divided by FACtor, which is adjustable between 0.0001 and 99999, for flow applications FACtor should be set to the K-factor of the flowmeter. K-factor is the number of pulses that the flowmeter produces per unit volume of flow e.g. 20 pulses per litre, FACtor therefore converts the flowmeter output into engineering units ready for further scaling to produce the required rate and total flow displays. See Fig 9.

When the 16 segment lineariser Lin is selected in Function up to 16 values of FACtor may be entered, each at a specified input pulse frequency to compensate for flowmeter non-linearity. See section 7 of this manual.

To check or change the value select FACtor from the configuration menu and press P which will reveal the existing value with one digit flashing.

The flashing digit may be adjusted by pressing the ▼ or ▲ button. When this digit has been adjusted pressing P will transfer control to the next digit. When all the digits have been adjusted pressing P will transfer control to the decimal point that may be positioned between any of the digits, or may be omitted by moving it to the right of the least significant digit. When set as required, press E to return to the FACtor prompt in the configuration menu.

6.13 Total scale factor: SCALE.t

SCALE.t is a dividing factor adjustable between 0.0001 and 99999 that enables total flow to be displayed in the required engineering units. e.g. if the output from FACtor is one pulse per litre and the total display is required in thousands of gallons, SCALE.t should be set to 4546.1 which is the number of litres in 1,000 imperial gallons. The total flow display is independent of the rate display.

To check or change the total scale factor select SCALE.t from the configuration menu and press P which will reveal the existing value with one digit flashing. The value of the flashing digit may be changed by pressing the ▼ or ▲ button. When this digit has been adjusted as required, pressing P will transfer control to the next digit. When all the digits have been adjusted pressing P will transfer control to the decimal point that may be positioned between any of the digits, or may be omitted by moving it to the right of the least significant digit. When the required total scale factor has been entered, press E to return to the SCALE.t prompt in the configuration menu.

6.14 Rate scale factor: SCALE.r

SCALE.r is a dividing factor adjustable between 0.0001 and 99999 that enables the flow rate to be displayed in the required engineering units. e.g. if the output from FACtor is one pulse per litre and the rate display is required in gallons, SCALE.r should be set to 4.5461 which is the number of litres in an imperial gallon.

The units of the rate display are volume per unit of time. The unit of time is the timebase of the instrument which is determined by t-bASE described in section 6.15.

To check or change the rate scale factor select SCALE.r from the configuration menu and press P which will reveal the existing value with one digit flashing. The value of the flashing digit may be changed by pressing the ▼ or ▲ button. When this digit has been adjusted as required, pressing P will transfer control to the next digit. When all the digits have been adjusted pressing P will transfer control to the decimal point which may be positioned between any of the digits, or may be omitted by moving it to the right of the least significant digit. When the required rate scale factor has been entered, press E to return to the SCALE.r prompt in the configuration menu.

6.15 Timebase: t-bASE

The timebase multiplies the rate display by 1, 60 or 3,600 depending upon whether the Rate Totaliser is required to display rate per second, per minute or per hour. See Fig 9.

To check or change the timebase, select t-bASE from the configuration menu and press P which will reveal the existing setting. Pressing the ▼ or ▲ button will scroll through the three options:

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

When the required multiplier is displayed press E to return to the t-bASE prompt in the configuration menu.

6.16 Display filter: FiLtEr

The digital display filter has two independent adjustable parameters enabling the rate display 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 input step 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 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 in the configuration menu and press P which will reveal the existing settings with the first digit flashing. Pressing the ▼ or ▲ 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 while adjustments are being made. When set as required, press the E button to enter the revised parameters and return to the FiLtEr prompt in the configuration menu.

6.17 Clip-off: CLP oFF

To prevent totalisation of very low flow rates that over long periods may result in significant totalisation errors, the BA334G may be configured to stop totalising when the flow rate falls below an adjustable threshold.

To check or change the clip-off threshold select CLP oFF from the configuration 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 ▼ or ▲ button. 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 CLP oFF prompt in the configuration menu.

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

Note:
To avoid confusion, when the K-factor FACtor, rate scale factor SCALE.r, timebase t-bASE, or the position of the rate display decimal point are changed, clip-off will automatically be reset to zero. A new clip-off threshold must therefore be entered after any of these functions have been adjusted.

6.18 Local reset: LoC CLr

The Local reset function contains two sub-functions CLr tot and CLr GtoT which when enabled allow the total display and grand total to be reset to zero via the instrument push buttons while the Rate Totaliser is in the totalisation mode.

6.19 Local total reset: CLr tot

CLr tot is a sub-menu in the LoC CLr function which when activated allows an operator to reset the total display to zero while in the totalisation mode by operating the ▼ and ▲ push buttons simultaneously for more than three seconds.

Select LoC CLr in the configuration menu and press P which will reveal the CLr tot prompt then operate P again which will show if the local total reset is on or oFF. If set as required operate the E button twice to return to the configuration menu, or the ▼ or ▲ button to change the setting followed by the E button twice to enter the change and return to the LoC CLr prompt in the configuration menu.

Note:
The total display may also be reset to zero remotely by connecting terminals RS1 and RS2 together for more than one second. See sections 3.5; 4.1.8 and 4.2.8 of this manual.

6.20 Local grand total reset: CLr GtoT

The grand total is a separate sixteen digit counter which is incremented in parallel with the total display, but is not zeroed when the total display is reset to zero. The grand total may be viewed in the totalisation mode in two eight digit sections as described in section 2.2 of this manual.

CLr GtoT is a sub-menu in the LoC CLr function which when activated allows the operator to reset the grand total display to zero in the totalisation mode by operating the E and ▲ push buttons simultaneously for more than ten seconds.

Select LoC CLr in the configuration menu and press P which will reveal CLr tot. Using the ▼ or ▲ button to select CLr GtoT and press P which will show if local grand total reset is on or oFF. If set as required operate the E button twice to return to the configuration menu, or the ▼ or ▲ button to change the setting followed by the E button twice to enter the change and return to the LoC CLr prompt in the configuration menu.

6.21 Grand total reset from configuration menu: CLr GtoT

The grand total is a separate sixteen digit counter which is incremented in parallel with the total display, but is not zeroed when the total display is reset to zero. The grand total may be viewed in the totalisation mode in two eight digit sections as described in section 2.2 of this manual.

The grand total can be reset to zero from within the configuration menu using this CLr.GtoT function, or from the totalisation mode if sub-function CLr GtoT in the LoC CLr function is activated - see 6.20.

To zero the grand total from within the configuration menu select CLr GtoT and press P which will cause the instrument to display CLr.no with no flashing. Press the ▼ or ▲ push button until CLr.YES is displayed and then press P which will result in a 0000 prompt being displayed with the first digit flashing. This is a request for the instruction to be confirmed by entering SurE using the ▼ or ▲ buttons and the P button to move control to the next digit. Pressing E will then reset the grand total to zero and return the Rate Totaliser to the configuration menu.

Note:
Once reset, the grand total can not be recovered.

6.22 Security code: CodE

Access to the instrument configuration menu may be protected by a four digit security code which must be entered to gain access. New instruments are configured with the default security code 0000 which allows unrestricted access to all configuration functions.

To enter a new security code select CodE from the configuration menu and press P which will cause the Rate Totaliser to display 0000 with one digit flashing. The flashing digit may be adjusted using the ▼ or ▲ push buttons, when set as required operating the P button will transfer control to the next digit. When all the digits have been adjusted press E to return to the CodE prompt. The revised security code will be activated when the Rate Totaliser is returned to the totalisation mode.

Please contact BEKA associates sales department if the security code is lost.

6.23 Reset configuration to factory defaults
rSEt dEF

This function resets the Rate Totaliser including the lineariser, to the factory default configurations which are shown in section 6.0

To reset the Rate Totaliser to the factory default configurations select rSEt dEF from the configuration menu and press P which will result in a 0000 display with the first digit flashing. This is a request to confirm the reset to factory default instruction by entering SurE. Using the ▼ or ▲ button set the flashing digit to S and press P to transfer control to the second digit which should be set to u. When SurE has been entered, pressing the E button will reset the BA334G to the factory defaults and return the instrument to the totalising mode.

6.24 Pulse output
All BA334G Rate Totalisers have an opto-isolated pulse output.

The pulse output is an open collector having the following parameters:

Ron	=	60Ω + 3V
Roff	=	1M
I max	=	10mA

The output pulse may be a duplicate of the input pulse for re-transmission applications, or it may be derived from the least significant digit of the total display. When derived from the total display the output pulse frequency may be divided and the output pulse width defined.

The retransmitted RTx annunciator on the instrument display shows the status of the retransmitted pulse output. Annunciator activation depends upon the setting of SourCE in the pulse output configuration menu.

SCALEd
: Annunciator activated each time pulse output open collector is *on*, i.e. Ron is less than 60Ω + 3V.

dirECt:
: Annunciator continuously activated

6.24.1 Intrinsic safety
The pulse output is an optically isolated separate intrinsically safe circuit that has zero output safety parameters. The output therefore complies with the requirements *for simple apparatus*. This allows pulse output 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:

Uo	≤	28V dc
Io	≤	200mA dc
Po	≤	0.84W

The equivalent capacitance and inductance of the pulse output are both zero which allows the maximum permissible cable parameters specified by the certificate for the Zener barrier or galvanic isolator powering the pulse output circuit to be used.

6.24.2 System design
The Rate Totalisers pulse output is a passive circuit i.e. not powered, but it is totally isolated from all other Rate Totaliser circuits. Subject to complying with intrinsic safety interconnection requirements, the terminals P1 and P2 may be connected to another instrument with an open collector input. The pulse output may also be transferred to the safe area via a galvanic isolator or a Zener barrier.

Fig 11 shows how a 2-channel Zener barrier may be used to produce a voltage pulse in the safe area that could be used to drive a safe area counter. The positive terminal of the pulse output circuit P1 is connected to the Rate totaliser's positive supply terminal 1. When an output pulse occurs and the open collector output 'closes', P2 is connected to P1 and the pulse current flows through the diode return barrier to resistor R1 in the safe area. The current flowing in the circuit is determined by R1 which should be chosen to limit the pulse output current to less than 10mA. For a 24V supply R1 should be greater than 2,200Ω.

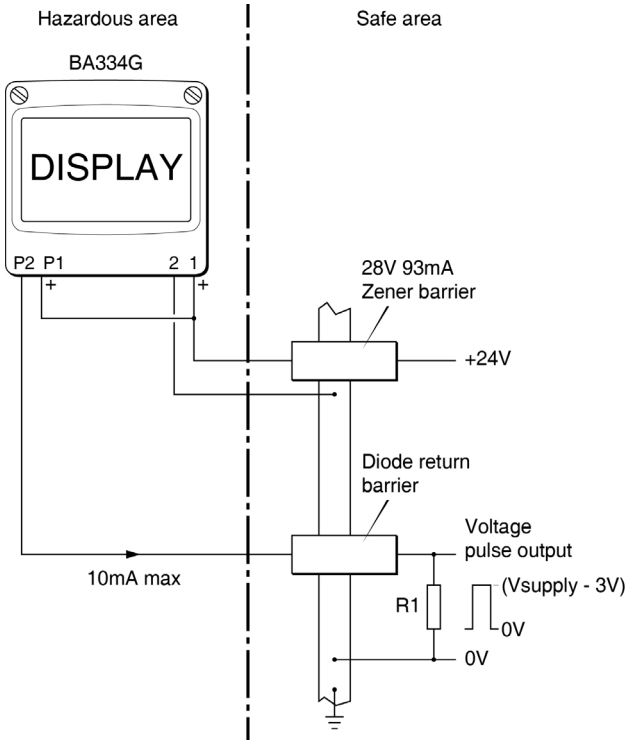


Fig 11 Transferring pulse output to the safe area using Zener barriers

6.24.3 Configuration

The pulse output menu shown in Fig 12 is in the BA334G configuration menu. The output pulse may be a duplicate of the input pulse by selecting dIrECt in the SourCE sub-function. Alternatively, selecting SCALEd derives the output pulse from incrementation of the least significant digit of the total display. When SCALEd is selected two additional functions, dIvIdE and durAtIon are added to the sub-menu allowing the output pulse frequency to be divided and the output pulse width (duration) to be defined.

6.24.4 Pulse output: PuLSE oP

The pulse output is configured in a sub-menu contained in the PuLSE oP function.

Using the ▼ or ▲ push button scroll though the configuration menu until PuLSE oP is displayed, pressing P will then access the pulse output sub-menu which is shown in Fig 12.

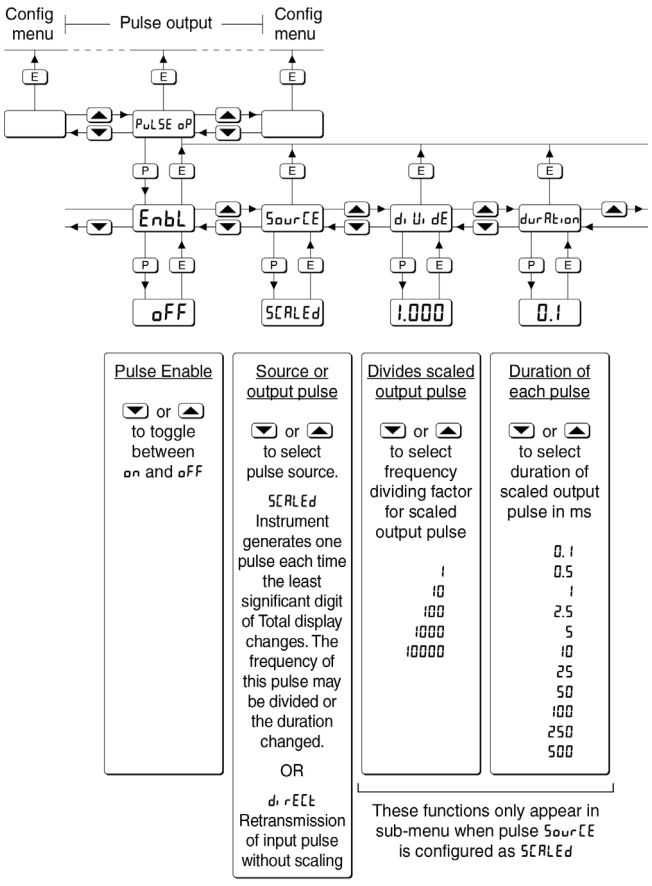


Fig 12 Pulse output configuration sub-menu

6.24.5 Enable pulse output: EnbL

This function allows the pulse output to be enabled or disabled without altering any of the pulse output parameters. Using the ▼ or ▲ push button select EnbL in the pulse output sub-menu and press P which will reveal the existing setting on or oFF. The function can be changed by pressing the ▼ or ▲ push button followed by the E button to return to EnbL prompt in the sub-menu.

6.24.6 Source of output pulse: SourCE

The output pulse may be derived from:

SCALEd	Incrementation of least significant digit of the total display. May be divided and width defined by the diVidE and durAtion functions to generate the required output pulse.
dirECt	Output is synchronous duplicate of the Rate Totaliser input pulse.

Using the ▼ or ▲ push button select SourCE in the pulse output sub-menu and press P to reveal the existing pulse source. The function can be changed by pressing the ▼ or ▲ push button followed by the E button to return to SourCE prompt in the sub-menu.

6.24.7 Divide output pulse frequency: diVidE

When SCALEd is selected in the SourCE sub-function (6.24.6) the output pulse is derived from incrementation of the least significant digit of the total display divided by one of the following five factors to produce the output pulse:

1
10
100
1000
10000

Using the ▼ or ▲ push button select diVidE in the pulse output sub-menu and press P which will reveal the existing divisor. The selected divisor can be changed by pressing the ▼ or ▲ push button followed by the E button to return to diVidE prompt in the sub-menu.

Note: This function only appears in the pulse output sub-menu when the SCALEd is selected in the SourCE sub-function (6.24.6).

6.24.8 Output pulse width: durAtion

When SCALEd is selected in the SourCE sub-function (6.24.6) the output pulse width is defined by this function. One of following millisecond pulse widths may be selected:

0.1
0.5
1
2.5
5
10
25
50
100
250
500

Using the ▼ or ▲ push button select durAtion in the pulse output sub-menu and press P which will reveal the existing pulse duration. The value can be changed by pressing the ▼ or ▲ push button to select the required value followed by the E button to return to durAtion prompt in the sub-menu.

Note: This function only appears in the pulse output sub-menu when SCALEd is selected in the SourCE sub-function (6.24.6).

6.24.9 Pulse storage

If the diVidE and durAtion functions are configured such that the output pulse frequency with the specified pulse width can not be output in real time, the number of pulses will be stored and transmitted at the maximum possible speed.

When the total display is reset to zero or the power supply to the Rate Totaliser is disconnected or turned off, any stored pulses will not be retained.

7. LINEARISER

The BA334G Rate Totaliser can produce accurate results when used with a flowmeter having a K-factor that varies with the flow rate, such as a turbine meter used over a wide range of flows. The instrument includes a sixteen segment straight-line lineariser that may be adjusted to compensate for flowmeter non-linearity.

The lineariser is enabled by selecting Lin in the Function section of the configuration menu. The configuration menu shown in Fig 10 remains basically unchanged, except that up to 16 values of the flowmeter K-factor can be entered as L-FACtor, together with PuLSE Fr the corresponding input frequency at which each starts.

Fig 14 shows how the Rate Totaliser configuration function FACtor is extended when the lineariser is activated by selecting Lin in the Function menu.

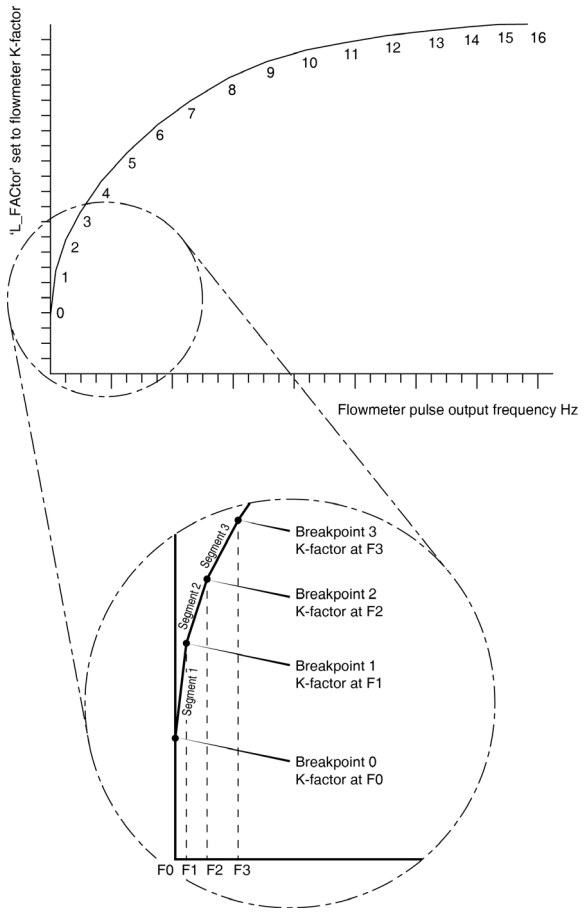


Fig 13 shows a typical linearising characteristic

The lineariser configuration is retained irrespective of how Function in the Rate Totaliser configuration menu is subsequently changed. It is therefore possible to select and deselect the lineariser without having to reconfigure it.

7.1 Flowmeter specification

Flowmeters are usually supplied with a calibration certificate specifying the average K-factor and the flow range over which it applies. For use over extended flow ranges and for non-linear devices, multiple K-factors will be specified, often in a table similar to the one shown below.

Flow Rate Litres/min	**K-factor** Pulses/litre
5	200
10	230
15	239
20	242

From this calibration certificate information the output frequency of the flowmeter, which is required for conditioning the Rate Totaliser lineariser, can be calculated.

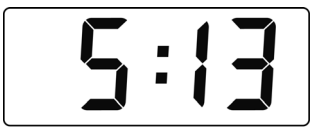
$$\text{Output frequency Hz} = \frac{(\text{Flow rate per min}) \times (\text{K-factor})}{60}$$

Flow Rate Litres/min	**K-factor** Pulses/litre	**Output frequency** Hz
0	0	0
5	200	16.666
10	230	38.333
15	239	59.750
20	242	80.666

7.2 Summary of lineariser configuration Functions.

This section summarises the lineariser configuration functions. When read in conjunction with Fig 14 it provides a quick aid for configuring the lineariser. If more detail is required, each section contains a reference to a full description of the function.

The number of straight-line lineariser segments required should first be entered using the Add and dEL functions. In both of these sub-functions the Rate Totaliser displays the current segment and the total number of segments being used as shown below.



current breakpoint total number of breakpoints

Increasing the number of segments will provide a more accurate approximation of the flowmeter characteristic and increase totalisation accuracy.

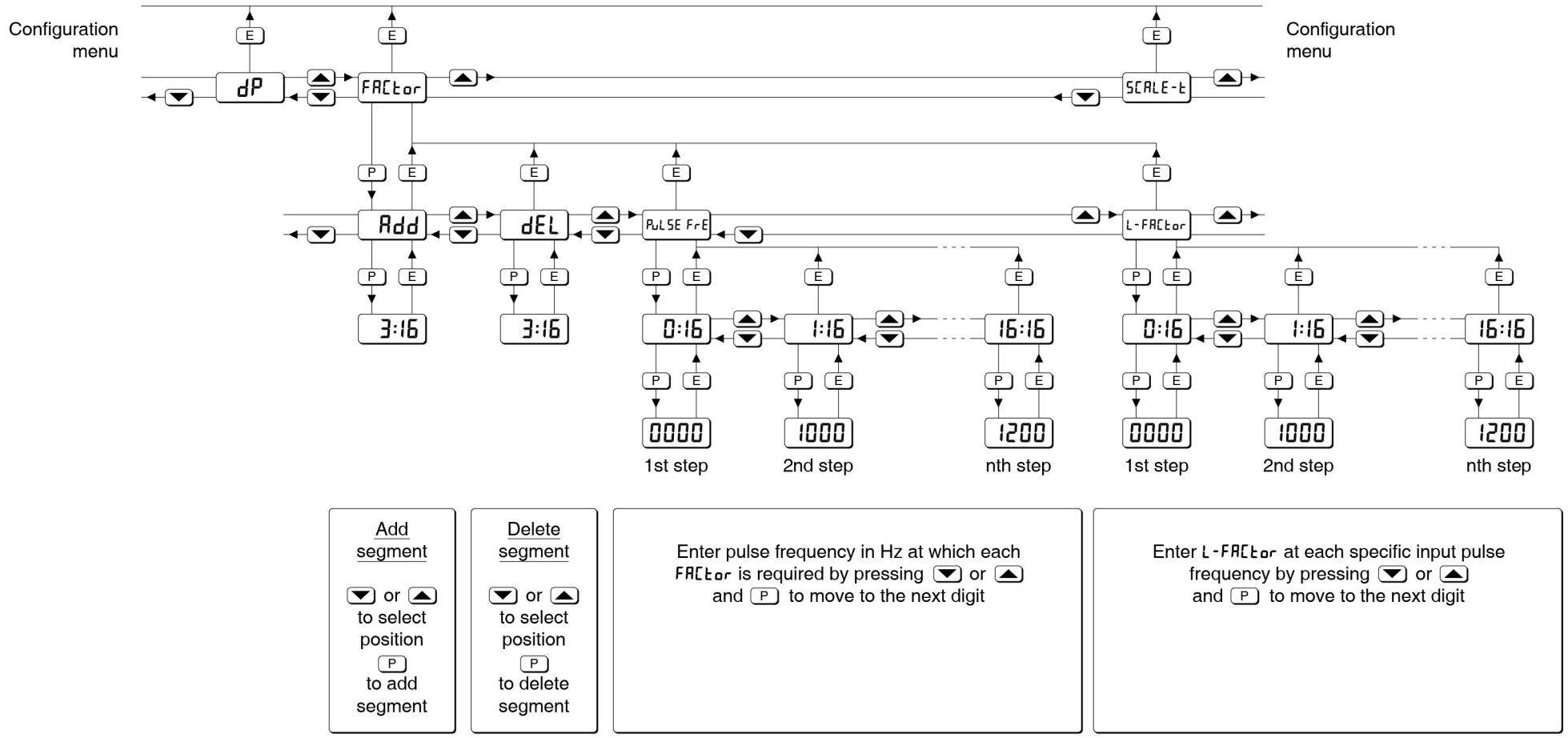


Fig 14 Lineariser configuration menu

For each segment an input pulse frequency in Hz PuLSE Fr and a corresponding flowmeter K-factor L-FACtor are required. See section 7.1

Lineariser factory defaults are shown below:

Break point	PuLSEFrE	L-FACtor
0.	10Hz	1.00
1.	15000Hz	1.00

Display	Summary of function
Add	**Add a segment** Adds a new segment before the displayed segment. The calibration of existing segments is not changed, but the identification number of all subsequent segments is increased by one. See section 7.3
dEL	**Remove a segment** Removes the displayed segment, the identification number of all subsequent segments is decreased by one. See section 7.4
PuLSE Fr	**Pulse input frequency** Defines the input frequency in Hz at which the selected lineariser segments starts. See section 7.5
L-FACtor	**Flowmeter K-factor** The rate totaliser pulse input is divided by L-FACtor, which is usually set to the K-factor of the flowmeter, thus converting the flowmeter output into engineering units. L-FACtor may be adjusted between 0.0001 and 99999. Up to 16 values for L-FACtor may be entered, each starting at a specified input pulse frequency PuLSE Fr. See section 7.6

7.3 Add a segment: Add

Add is a sub-menu in the FACtor function that enables a straight-line segment to be added to the lineariser at any point. Select FACtor in the configuration menu and press P, which will reveal one of four sub-functions. If Add is not displayed repeatedly press the ▼ or ▲ button to select Add followed by P which will cause the current segment and the total number of linearisers segments to be displayed as shown below:

current breakpoint — total number of breakpoints

Each time the P push button is operated a segment will be added to the lineariser. If configuring the lineariser for the first time, repeatedly press P until the required total number of segments is shown on the right hand side of the display. Any number between 1 and 16 may be selected.

If adding an additional segment to an already configured lineariser, the insertion position, which is shown on the left hand side of the display, can be selected using the ▼ or ▲ push button. When inserting an additional segment, the identification numbers of all segments equal to and above the insertion point are increased by one.

Press E to return to the Add prompt in the FACtor sub-menu.

7.4 Remove a segment: dEL

dEL is a sub-menu in the FACtor function that enables any segment to be removed from the lineariser configuration. Select FACtor in the configuration menu and press P, which will reveal one of four sub-functions. If dEL is not displayed repeatedly press the ▼ or ▲ button to select dEL followed by P which will cause the current segment with the total number of segments to be displayed as shown below:

current breakpoint — total number of breakpoints

Each time the P push button is operated the current segment will be deleted from the lineariser. If configuring the lineariser for the first time, repeatedly press P until the total number of segments is reduced to the required number.

If removing a segment from a configured lineariser, the segment to be deleted, which is shown on the left hand side of the display, can be selected using the ▼ or ▲ push button. When a segment is deleted, the identification numbers of all segments above the deleted segment are decreased by one.

Press E to return to the dEL prompt in the lineariser sub-menu.

7.5 Input frequency: PuLSE Fr

PuLSE Fr is a sub-menu in the FACtor function for entering the pulse input frequency at which each of the lineariser segments starts, see Fig 13.

To enter the input pulse frequency at which one or more lineariser segments start, select FACtor in the configuration menu and press P which will reveal one of four sub-functions. If PuLSE Fr is not displayed repeatedly press the ▼ or ▲ button to select PuLSE Fr followed by P to display the current segment for which the start frequency will be entered and the total number of segments that have already been defined using the Add and dEL functions, see below.

current breakpoint | total number of breakpoints

The required segment, which is shown on the left hand side of the display, can be selected using the ▼ or ▲ push button. When selected press P which will reveal the current input frequency with one digit flashing. The value of the flashing digit may be changed by pressing the ▼ or ▲ button. When this digit is correct pressing P will transfer control to the next digit. When the input frequency for this lineariser segment is set as required, press the E button to return to the segment identification display from which the next segment may be selected using ▼ or ▲ push button.

When the input frequency for all of the segments has been entered, return to the FACtor prompt in the configuration menu by operating the E push button.

7.6 Flowmeter K-factor L-FACtor

L-FACtor is a sub-menu in the FACtor function for entering the flowmeter K-factor for each of the lineariser segments, see Fig 13.

The rate totaliser pulse input is divided by L-FACtor, which is adjustable between 0.0001 and 99999; for flow applications it should be set to the K-factor of the flowmeter. K-factor is the number of pulses that the flowmeter produces per unit volume of flow e.g. 20 pulses per litre, L-FACtor therefore converts the flowmeter output into engineering units ready for further scaling to produce the required rate and total flow displays.

To enter the flowmeter K-factor for one or more segments, select FACtor in the configuration menu and press P, which will reveal one of four sub-functions. If L-FACtor is not displayed in the sub-menu repeatedly press the ▼ or ▲ button to select L-FACtor followed by P to display the current segment for which L-FACtor will be entered and the total number of segments that have already been defined using the Add and dEL functions.

The required segment, which is shown on the left hand side of the display, can be selected using the ▼ or ▲ push button, see below.

current breakpoint | total number of breakpoints

When selected, press P which will reveal the current L-FACtor for the selected segment with one digit flashing. The value of the flashing digit may be changed by pressing the ▼ or ▲ button. When this digit has been adjusted as required, pressing P will transfer control to the next digit. When all the digits have been adjusted pressing P will transfer control to the decimal point that may be positioned between any of the digits, or may be omitted by moving it to the right of the least significant digit.

When L-FACtor for this lineariser segment is set as required, press the E button to return to the segment identification display from which the next segment may be selected using ▼ or ▲ push button. When L-FACtor for all of the segments has been entered, return to the FACtor prompt in the configuration menu by operating the E push button twice.

7.7 Lineariser error message

If an attempt is made to position a segment at an input frequency which is not greater than the frequency of the preceding segment, or at an input frequency which is not less than the frequency of the following segment, the error message VALuEErr will be displayed.

8. CONFIGURATION EXAMPLE

In this example a BA334G Rate Totaliser is connected to a turbine flowmeter having a K-factor of 105 pulses per litre with a magnetic pick-off.

The BA334G is required to display rate of flow in imperial gallons per hour with a resolution of one gallon and total flow in cubic metres with a maximum total of 100000 and a resolution of 0.01 cubic metres. Linearisation is not required. Totalisation is to stop when the flow rate falls below 10 gallons per hour. The display is to be updated twice per second.

For this application the operator needs to reset the total display to zero from the totalisation mode, but should not be able to reset the grand total. To prevent tampering the instrument configuration menu is to be protected by security code of 1209

8.1 Configuration procedure

The BA334G Rate Totaliser may be configured on-site without disconnection from the power supply or from the flowmeter.

Step 1 **Enter the configuration menu**
Enter the configuration menu by simultaneously pressing P and E. Assuming a security code has not already been entered the instrument will respond by displaying FunCt, on which is the first function in the configuration menu. See Fig 10.

Step 2 **Select a linear function**
With FunCt, on displayed press P to reveal the function of the Rate Totaliser. Using the ▼ or ▲ button select Std to switch off the linearliser and provide a linear function. Press E to enter the selection. See 6.4

Step 3 **Select the type of input & debounce**
Using the ▼ or ▲ button select , nPut in the configuration menu and press P which will reveal the sub-menu. Again using the ▼ or ▲ button select , nP . tYPE and press P to reveal the existing input. The Rate Totaliser is required to work with a magnetic pick-off therefore using the ▼ or ▲ button select Coil followed by E to return to the , nP.tYPE prompt in the sub-menu.
Using the ▼ or ▲ button select dEbounCE from the sub-menu and press P. Using the ▼ or ▲ button select dEFAuLt which will provide moderate pulse edge noise protection. If the Rate Totaliser is subsequently found to miscount the noise rejection can be increased. Enter the selection and return to the , nPut prompt in the configuration menu by pressing the E button twice. See 6.6 and 6.7

Step 4 **Select the interval between display updates**
Using the ▼ or ▲ button select uPdAtE in the configuration menu and press P to reveal how frequently the Rate Totaliser display is updated. Using the ▼ or ▲ push button select 0.5 (0.5 seconds i.e. 2 display updates per second). Enter the selection and return to the uPdAtE prompt in the configuration menu by pressing the E button.
See 6.8

Step 5 **Upper display**
Using the ▼ or ▲ button select d, SP-1 in the configuration menu and press P to select whether flow rate or total flow is shown on the upper 8 digit display. The required maximum total of 100000 with 0.01 resolution can only be accommodated on the top display. Therefore using the ▼ or ▲ button select totAL and press E to enter the selection and return to the d, SP-1 prompt in the configuration menu.
See 6.9

Step 6 **Lower display**
Using the ▼ or ▲ button select d, SP-2 in the configuration menu and press P which will show if the lower display is on or oFF. The Rate Totaliser is required to display both total flow and the rate of flow so the lower display is required. Using the ▼ or ▲ button select on and press E to enter the selection and return to the d, SP-2 prompt in the configuration menu.
See 6.10

Step 7 **Position rate & total decimal points**
Select dP from the configuration menu and press P. The upper display already defined as the total display by function d, SP-1 will be activated and identified by the Total annunciator. Using the ▼ or ▲ push button position the decimal point in front of the second least significant digit to give a total display resolution of 0.00.

Pressing the P button will show the rate display, but in the upper display position with the Rate annunciator activated. Using the ▼ or ▲ push button position the decimal point to the right of the least significant digit so that it is not visible to give a total display resolution of 1. Finally press the E button to enter the selections and return to the dP prompt in the configuration menu. See 6.11

Step 8 Enter the flowmeter K-factor

K-factor is the number of pulses that a flowmeter produces per unit volume of flow. The Rate Totaliser pulse input is divided by FACtor, which is adjustable between 0.0001 and 99999. When set to the K-factor of the flowmeter FACtor converts the flowmeter output into engineering units ready for further scaling to produce the required rate and total flow displays.

Using the ▼ or ▲ push button select FACtor from the configuration menu and press P to show the existing value with one digit flashing. Enter 105 using the ▼ or ▲ push button to adjust the flashing digit and the P button to transfer control to the next digit and to position the decimal point. Finally return to the FACtor prompt in the configuration menu by pressing E. The output from FACtor will now be in litres which may be scaled to produce required rate and total displays.
See 6.12

Step 9 Enter the total scale factor

The Total Scale Factor SCALE.t is a dividing factor adjustable between 0.0001 and 99999 that enables total flow to be displayed in the required engineering units. In this example the total flow display is required in cubic metres. There are 1,000 litres in a cubic metre so SCALE-t should be set to 1000.

Using the ▼ or ▲ push button select SCALE.t from the configuration menu and press P to reveal the existing value with one digit flashing. Enter 1000 using the ▼ or ▲ push button to adjust the flashing digit and the P button to transfer control to the next digit and to position the decimal point. Finally, return to the SCALE.t prompt in the configuration menu by pressing E. The total flow display is independent of the rate display. See 6.13

Step 10 Enter the rate scale factor

SCALE.r is a dividing factor adjustable between 0.0001 and 99999 that enables the flow rate to be displayed in the required engineering units. The rate display timebase is determined by t-bASE that is adjusted in Step 11.

In this example the rate of flow display is required in imperial gallons. FACtor, which was adjusted in Step 8 of this example produces an output in Litres that must be converted to imperial gallons. There are 4.5461 Litres in an imperial gallon so SCALE.r should be adjusted to 4.5461

Using the ▼ or ▲ push button select SCALE.r from the configuration menu and press P to reveal the existing value with one digit flashing. Enter 4.5461 using the ▼ or ▲ push button to adjust the flashing digit and the P button to transfer control to the next digit and to position the decimal point. Finally return to the SCALE.r prompt in the configuration menu by pressing E. The flow rate display is independent of the total flow display.
See 6.14

Step 11 Enter the rate timebase

The rate timebase determines whether flow rate is displayed per second, per minute or per hour. In this example gallons per hour are required.
Using the ▼ or ▲ push button select t-bASE from the configuration menu and press P. Again using the ▼ or ▲ push button select tb-3600 from the three options which will multiply the rate display by 3600. Return to the t-bASE prompt in the configuration menu by pressing E.
See 6.15

Step 12 Adjust the display filter

The digital display filter has two independent adjustable parameters enabling the rate display 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, for initial configuration it is recommended it is set to 2 which is a time constant of 4.3 seconds. The second digit controls jump-out following a step input change and it is recommended that this is initially set to 0.

After configuration during commissioning both parameters should be adjusted experimentally to provide a stable display with an acceptable step response.

To allow the effect of filter changes to be seen immediately, the live rate display is shown on the lower display while the filter parameters are shown and may be adjusted on the upper display.

Using the ▼ or ▲ push button select FiLtEr from the configuration menu and press P.

The first digit, which controls the filter time constant, will be flashing and should be set to 2 using the ▼ or ▲ push button. The P button will transfer control to the second digit, which controls the step response and should be set to 0 in the same way. When entered return to the FiLtEr prompt in the configuration menu by pressing E.
See 6.16

Step 13 Define clip-off

To prevent totalisation of low flow rates clip-off defines a flow rate threshold below which totalisation is inhibited. In this example it is required that totalisation does not occur at flow rates below 10 gallons per hour.

Using the ▼ or ▲ push button select CLP oFF from the configuration menu. Press P which will reveal the current clip-off threshold in gallons per hour i.e. the same units already selected for the rate display. Enter 10 using the ▼ or ▲ push button to adjust the flashing digit and the P button to transfer control to the next digit. Finally, store the new clip-off threshold and return to the CLP oFF prompt in the configuration menu by pressing E.
See 6.17

Step 14 Local reset of total and grand total

Two separate functions in the LoC CLr sub-menu may be individually activated to enable the operator to reset the total and grand total displays from the totalisation mode without entering the configuration menu.

In this example the operator is required to be able to reset the total display but not the grand total display when the BA334G Rate Totaliser is in the totalisation mode.

Using the ▼ or ▲ button select LoC CLr in the configuration menu and press P which will reveal the sub-menu. Again using the ▼ or ▲ button select the local total reset function CLr tot and press P. This function is required so using the ▼ or ▲ button select on followed by E to return to the CLr tot prompt in the sub-menu. Using the ▼ or ▲ button select the local grand total reset function CLr Gtot and press P. This function is not required so using the ▼ or ▲ button select oFF. Finally return to the LoC CLr prompt in the configuration menu by pressing the E button twice.
See 6.18, 6.19 and 6.20.

Step 15 Reset the grand total to zero

Before completing configuration the Rate Totaliser's grand total should be reset to zero. Using the ▼ or ▲ button select CLr Gtot in the configuration menu and press P which will cause CLr. no to be displayed with no flashing. Again using the ▼ or ▲ button select CLr. YES with YES flashing. Press P which will result in 0000 being displayed with one digit flashing. This is a request for the instruction to be confirmed by entering SurE using the ▼ or ▲ button to set each digit and the P button to move control to the next digit.
Pressing E will then reset the grand total to zero and return the instrument to the CLr Gtot prompt in the configuration menu.
See 6.21.

Step 16 Define the security code

Defining a security code prevents unauthorised access to the configuration menu. Using the ▼ or ▲ buttons select CodE from the configuration menu and press P which will result in 0000 being displayed with the first digit flashing. This example requires the security code to be 1209, using the ▼ or ▲ buttons set the flashing digit to 1 and press P to transfer control to the second digit. When all the digits of the new code have been entered press E to store the code and return to the main configuration menu.
See 6.22.

Step 17 Return to the totalisation mode

Configuration of the BA334G is now complete. Pressing the E button will save the new configuration and return the Rate Totaliser to the totalisation mode. The BA334G will display dAtA followed by SAVE while the new information is being stored in permanent memory.

9. MAINTENANCE

9.1 Fault finding during commissioning

If a BA334G fails to function during commissioning the following procedure should be followed:

Symptom	Cause	Check:
No display	No power supply, or incorrect wiring. Note: Terminals 2, 6 & RS2 are interconnected within the instrument.	That there is between 10 and 28V on terminals 1 & 2 with terminal 1 positive.
Rate Totaliser is receiving power but flow indicator not rotating	No input pulses, incorrect input configuration, incorrect linking of terminals 3 & 4	Input configuration. Linking of terminals 3 & 4. That input signal polarity is correct.
Flow indicator rotating but incorrect rate display	Incorrect rate display calibration	FACtor SCALE.r t-bASE
Flow indicator rotating but incorrect total display	Incorrect total display calibration. Remote reset switch contacts closed	FACtor SCALE.t That RESET annunciator is not activated. If it is, check reset wiring and switch.
Flow indicator rotating, but zero rate display, no totalisation and HOLD annunciator activated.	CL, P oFF is activated	CLP oFF and if necessary adjust threshold.
Unstable rate display	Noisy pulse input signal	Eliminate source of electrical noise. Increase debounce and/or display filter.
Unable to enter configuration menu.	Incorrect security code	That the correct security code is being used. Contact BEKA if code is lost.
Clip-off does not function	Clip-off has automatically reset to zero following change of rate display calibration.	Reconfigure CL, P oFF
Alarms do not function	Alarms have been disabled following calibration change	Re-enable both alarms.

9.2 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 BA334G 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 Rate Totaliser.
Flow indicator rotating, rate display is zero and totalisation. HOLD annunciator is not activated.	Input below clip-off threshold.	Clip off threshold and if necessary adjust.
Unstable rate display	Noisy pulse input signal	Locate source of electrical noise, or increase debounce and rate display filter.

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

9.3 Servicing

We recommend that faulty BA334G Rate Totalisers are returned to BEKA associates or to your local BEKA agent for repair.

9.4 Routine maintenance

The mechanical and electrical condition of the instrument should be regularly checked. Inspection frequency should be adjusted to suit the environmental conditions.

9.5 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.

9.6 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.

10. ACCESSORIES

10.1 Units of measurement & instrument identification.

New BA334G Rate Totalisers are supplied with a printed scale card showing the units of measurement and tag information specified when the instrument was ordered. If this information was not supplied a blank scale card will be fitted which can easily be marked with a dry transfer or a permanent marker on-site.

Custom printed scale cards are available as accessories and may be easily fitted as shown in section 5.4 of this manual.

The BA334G can also be supplied with a blank or custom laser engraved stainless steel legend plate - see Fig 7. The plate, which after installation is visable from the front of the instrument, is supplied loose with two fixing screws for securing it to the rear of the instrument's back-box. This plate can typically accommodate:

1 row of 5 alphanumeric characters 10mm high

or 1 row of 6 alphanumeric characters 7mm high

or 2 rows of 10 alphanumeric characters 5mm high

10.2 Backlight

The BA334G Rate Totaliser can be supplied with a factory fitted backlight that produces green illumination enhancing display contrast and enabling it to be read at night or in poor lighting conditions. The backlight is internally powered from the instrument so that no additional wiring or intrinsically safe interface is required, but the instrument supply current increases to 32mA.

10.3 Alarms

The BA334G can be supplied with factory fitted dual solid state single pole alarm outputs that may be independently programmed as high or low, rate or total alarms with normally open or normally closed outputs.

Configurable functions for each alarm include adjustable setpoint, alarm delay time and alarm silence time. Hysteresis may be applied to rate alarms.

CAUTION

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

When the BA334G power supply is turned off or disconnected, 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 chosen for the alarm condition.

Alarm annunciators on the instrument display indicate the status of each alarm. If an alarm delay or silence time has been selected the annunciator will flash during the delay or silence period.

The BA334G internal counters are up-dated and compared with the alarm setpoint twice per second, irrespective of the display update time selected. This may result in an alarm being delayed for up to half a second after the rate or total has exceeded the setpoint.

10.3.1 Solid state output

Each alarm has a galvanically isolated single pole solid state switch output as shown in Fig 15. 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.

Ron = less than 5Ω + 0.7V
Roff = greater than 1MΩ

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

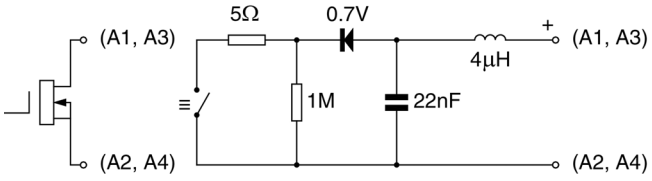


Fig 15 Equivalent circuit of each alarm output

10.3.2 Intrinsic safety

Each alarm output is a separate galvanically isolated intrinsically safe circuit with output safety parameters complying with the requirements for *simple apparatus*. This allows the alarm output terminals A1 & A2 and A3 & A4 to be connected to almost any intrinsically safe circuit protected by a Zener barrier or galvanic isolator providing the output parameters of the circuit do not exceed:

Uo ≤ 28V dc
Io ≤ 200mA dc
Po ≤ 0.84W

The maximum equivalent capacitance and inductance between each set of alarm terminals is:

Ci = 22nF
Li = 4µH

To determine the maximum permissible cable

parameters Ci should be subtracted from the maximum permitted external capacitance Co specified by the certificate for the intrinsically safe interface powering the alarm circuit, such as the solenoid driver and switch transfer galvanic isolators shown in Fig 16.

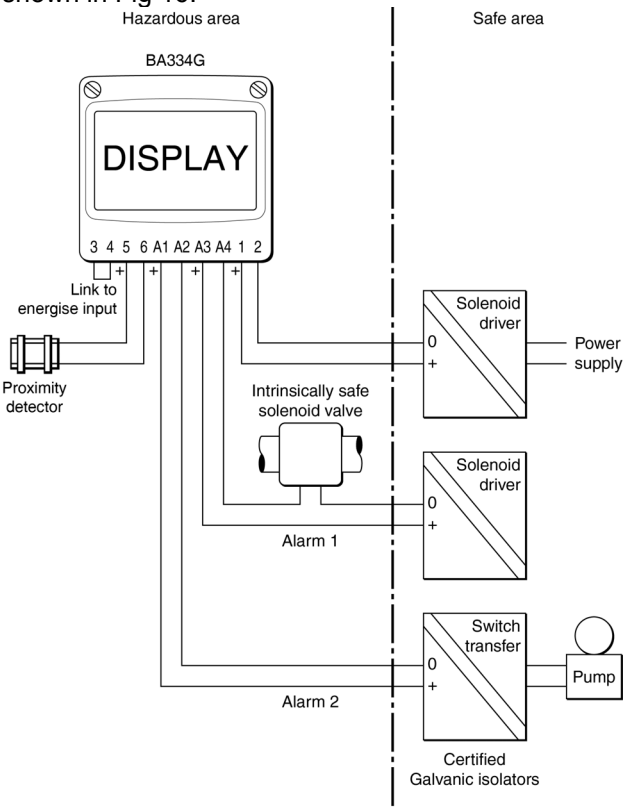


Fig 16 Typical alarm application

10.3.3 Configuration and adjustment

When a BA334G Rate Totaliser is fitted with alarms the configuration menu is extended as shown in Fig 17. The alarm functions appear after CLr Ctot and each alarm may be configured to operate on the rate or total display.

For simplicity Fig 17 only shows the configurable functions on the rate option of alarm AL 1, the total options is identical except that total alarms do not have hysteresis. Alarm AL2 is identical to alarm AL 1.

The following table summarises each of the alarm configuration functions and includes a cross reference to more detailed information. Again only alarm AL 1 functions are listed.

Display	Summary of function
EnbL	**Alarm enable** Enables or disables the alarm without changing the alarm parameters. See section 10.3.4
tYPE	**Type of alarm** Defines whether the alarm operates on the rate or total display. See section 10.3.5
SP 1r or SP 1t	**Alarm setpoint 1** Adjusts the alarm setpoint. The alarm is activated when the rate or total display equals the setpoint. **Note:** SP 1r is displayed for a rate alarm and SP 1t for a total alarm. See section 10.3.6
Hi.Lo	**Alarm function** Defines whether the alarm has a high or low function. See section 10.3.7
no.nC	**Normally open or normally closed output.** Determines whether the single pole alarm output is open or closed in the non-alarm condition. See section 10.3.8
HSt r	**Hysteresis** Adjusts the alarm hysteresis. Only available on a rate alarm. See section 10.3.9
dELA	**Alarm delay time** Adjusts the delay between the display equaling the setpoint and the alarm output being activated. See section 10.3.10
Si L	**Alarm silence time** Defines the time that the alarm output remains in the non-alarm condition following acceptance of an alarm. See section 10.3.11
FLSH	**Flash display when alarm occurs** When enabled, alternates the rate or total display between process value and alarm reference AL 1 or AL2 when an alarm output is activated. See section 10.3.12
ACSP	**Access setpoint** Sub-menu that enables direct access to the alarm setpoints from the totalisation mode and defines a separate security code. See section 10.3.13

10.3.4 Alarm enable: EnbL

This function allows the alarm to be enabled or disabled without altering any of the alarm parameters. Using the ▼ or ▲ push button select AL1 or AL2 from the configuration menu and press P to access the alarm sub-menu. Press the ▼ or ▲ button until EnbL is displayed followed by P which will reveal if the function is on or oFF. The setting can be changed by pressing the ▼ or ▲ push button followed by the E button to return to the alarm sub-menu.

10.3.5 Type of alarm: tYPE

Alarm 1 and Alarm 2 are totally independent, both may be rate or total alarms, or one may be conditioned for rate and the other for total.
Using the ▼ or ▲ push button select tYPE from the selected alarm sub-menu and press P to check or change the function. The ▼ or ▲ push button will toggle the selection between rAtE and totAL, when set as required press the E button to return to the alarm sub-menu.

Note: When tYPE is changed, the alarm configuration is automatically reset to the default values and the alarm is disabled. It must therefore be reconfigured before use.

10.3.6 Setpoint adjustment: SP1 & SP2

The rate alarm setpoints SP1r and SP2r may be positioned anywhere between 000000 and 999999 and the total alarm setpoint SP1t and SP2t anywhere between 00000000 and 99999999.

All the setpoints are adjusted in the same way, for example to adjust the setpoint of Alarm 1 which has been configured to operate on the rate display. Using the ▼ or ▲ push button select SP1r in the AL1 sub-menu and press P which will reveal the existing setpoint with one digit flashing. The required setpoint can be entered using the ▼ or ▲ push button to adjust the flashing digit and the P button to transfer control to the next digit. When set as required press E to enter the value and return to the SP1r prompt in the alarm 1 sub-menu.

10.3.7 Alarm function: Hi.Lo

Alarm 1 and Alarm 2 are totally independent, both may be Hi or Lo, or one may be conditioned as a Hi alarm and the other as a Lo alarm.
Using the ▼ or ▲ push button select Hi. Lo from the selected alarm sub-menu and press P to check or change the function. The ▼ or ▲ push button will toggle the alarm function between Hi and Lo, when set as required, press the E button to return to the Hi.Lo prompt in the alarm sub-menu.

10.3.8 Alarm output status: no.nC

Each single pole alarm output may be open or closed in the non-alarm condition. When the BA334G power supply is turned off or disconnected, the alarm output(s) 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.

Using the ▼ or ▲ push button select no nC from the selected alarm sub-menu and press P to check or change the function. The ▼ or ▲ push button will toggle the contact status between no and nC, when set as required, press the E button to return to the no nC prompt in the alarm sub-menu.

10.3.9 Hysteresis: HStr

Hysteresis is only available on rate alarms so the HStr function only appears in the configuration sub-menu when alarm tYPE has been set to rAtE. During configuration hysteresis is shown in the units of rate previously configured for the rate display.

Using the ▼ or ▲ push button select HStr in the selected alarm sub-menu and press P which will reveal the existing hysteresis with one digit flashing. The required hysteresis can be entered using the ▼ or ▲ push button to adjust the flashing digit and the P button to transfer control to the next digit. When set as required press E to enter the value and return to the HStr prompt in the alarm sub-menu.

e.g. A Rate Totaliser configured 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.

10.3.10 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 set in 1 second increments up to 3600 seconds. If a delay is not required zero should be entered.

To adjust the delay select dELA using the ▼ or ▲ push button in the selected alarm sub-menu and press P which will reveal the existing delay time in seconds with one digit flashing. The required delay time can be entered using the ▼ or ▲ push button to adjust the flashing digit and the P button to transfer control to the next digit. When set as required press E to enter the value and return to the dELA prompt in the alarm sub-menu.

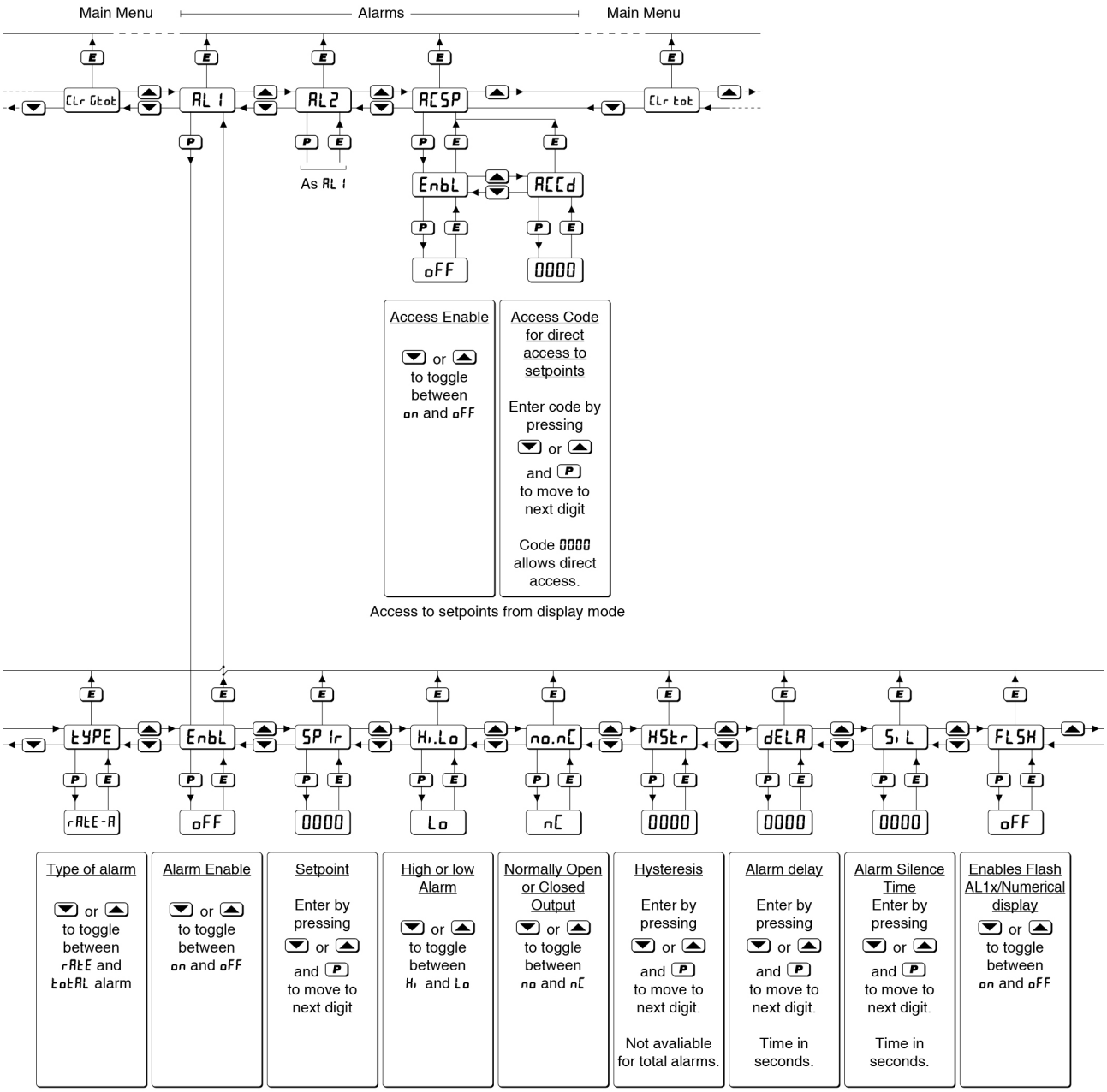


Fig 17 Alarm menu structure

The Rate Totaliser's alarm annunciator will start flashing immediately an alarm condition occurs and will continue for the delay time, after which the alarm output will be activated and the alarm annunciator will be permanently activated.

10.3.11 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 by operating the P push button, the Rate Totaliser's alarm annunciator will flash until the silence time expires.

To adjust the alarm silence time select SiL using the ▼ or ▲ push button in the selected alarm sub-menu and press P which will reveal the existing alarm silence time in seconds with one digit flashing. The required silence time can be entered using the ▼ or ▲ push button to adjust the flashing digit and the P button to transfer control to the next digit. When set as required press E to enter the value and return to the SiL prompt in the alarm sub-menu.

10.3.12 Flash display when alarm occurs: FLSH

In addition to the two alarm annunciators on the left hand side of the Rate Totaliser display which show the status of both alarms, this function provides an even more conspicuous indication that an alarm condition has occurred.

When enabled, this function alternates the rate or total display between the numerical value and the alarm identification AL1 or AL2 when an alarm occurs.

Using the ▼ or ▲ push button select FLSH from the selected alarm sub-menu and press P to check or change the function. The ▼ or ▲ push button will toggle the function between oFF and on, when set as required, press the E button to return to the FLSH prompt in the alarm sub-menu.

10.3.13 Access Setpoint: ACSP

This function activates a separate menu that provides direct access to the alarm setpoints from the totalisation mode by simultaneously operating the P and ▲ buttons. An operator can therefore adjust the alarm setpoints without having access to the configuration and alarm sub-menus. Protection against unauthorised or accidental adjustment is provided by a separate security access code.

Using the ▼ or ▲ push button select ACSP from the configuration menu and press P to reach the enable function EnbL. Pressing P will reveal the existing setting which can be toggled between on and oFF by pressing the ▼ or ▲ push button. When set as required, press the E button to return to the EnbL prompt from which a separate security access code can be entered using the ACCd function which can be selected using the ▼ or ▲ push button.

To enter a new security code select ACCd from the ACSP sub-menu and press P which will cause the Rate Totaliser to display 0000 with one digit flashing. The flashing digit may be adjusted using the ▼ or ▲ push button, when set as required operating the P button will transfer control to the next digit. When all the digits have been adjusted press E twice to return to the ACSP prompt in the configuration menu. The revised security code will be activated when the Rate Totaliser is returned to the totalisation mode. Default security access code 0000 will disable the security code allowing direct access to the setpoints from the totalisation mode by pressing the P and ▲ buttons simultaneously.

Please contact BEKA associates sales department if the security code is lost.

10.3.14 Adjusting alarm setpoints from the totalisation mode

Access to the two alarm setpoints from the Rate Totaliser totalisation mode is obtained by operating the P and ▲ push buttons simultaneously as shown in Fig 18. If the setpoints are not protected by a security code the alarm setpoint prompt SP1r or SP1t will be displayed depending upon whether a rate or total alarm has been conditioned. If access to the setpoints is protected by a security code, CodE will be displayed first. Pressing P again will allow the alarm setpoint security code to be entered digit by digit using the ▼ or ▲ button 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 result in the alarm setpoint prompt SP1x being displayed. If an incorrect security code is entered, or a button is not pressed within ten seconds, the instrument will automatically return to the totalisation mode.

Once within the menu pressing the ▼ or ▲ button will toggle the display between the two alarm setpoint prompts SP1x and SP2x.

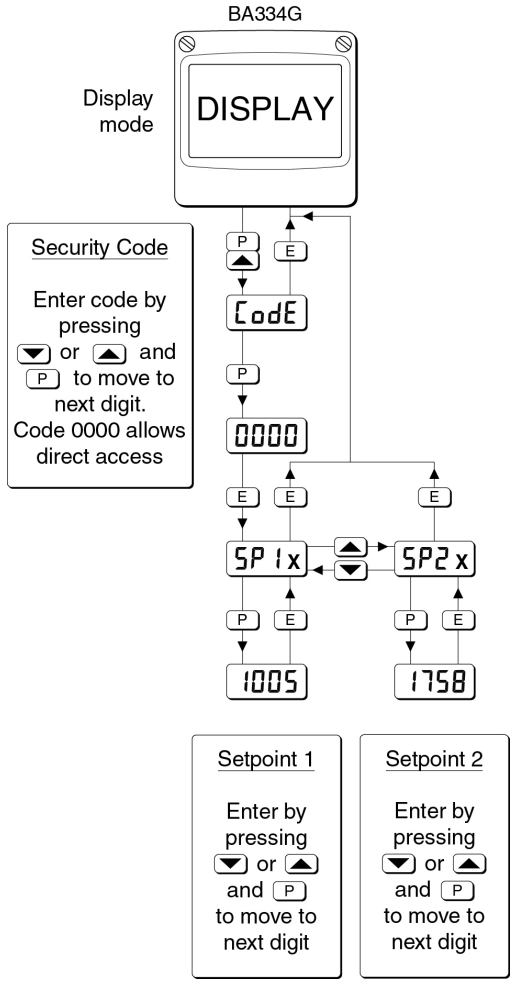


Fig 18 Setpoint adjustment from the totalisation mode

To adjust an alarm setpoint select SP 1x or SP2x and press P which will reveal the existing value. The flashing digit of the setpoint may be adjusted using the ▼ or ▲ push button 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 SP 1x or SP2x prompt from which the other setpoint may be selected, or the instrument may be returned to the totalisation mode by pressing E again.

Note: Direct access to the alarm setpoints is only available when the menu is enabled - see section 10.3.13

10.4 4/20mA output

The BA334G Rate Totaliser can be supplied with a factory fitted galvanically isolated 4/20mA output which may be configured to represent the rate or total display.

10.4.1 Intrinsic safety

The 4/20mA output has been certified as a separate galvanically isolated intrinsically safe circuit complying with the requirements for *simple apparatus.* This allows terminals C1 and C3 to be connected to any intrinsically safe circuit protected by a certified Zener barrier or galvanic isolator providing the output parameters do not exceed:

Uo ≤ 28V dc
Io ≤ 200mA dc
Po ≤ 0.84W

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

Ci = 2.2nF
Li = 4µH

To determine the maximum permissible cable parameters, these figures should be subtracted from the maximum cable capacitance and inductance specified by the certificate for the Zener barrier or galvanic isolator powering the 4/20mA output circuit.

10.4.2 System design

The Rate Totalisers 4/20mA output is a galvanically isolated passive current sink i.e. not powered, but it is totally isolated from all other Rate Totaliser circuits. It is effectively a 2-wire 4/20mA transmitter requiring a minimum supply of 5V with its current being controlled by the Rate Totaliser. Subject to complying with intrinsic safety interconnection requirements, the terminals C1 and C3 may be connected to another instrument, which will accept a 4/20mA transmitter input. The 4/20mA current output may also be transferred to the safe area via a galvanic isolator or Zener barriers. Terminals C2 and C4 are internally linked and may be used for joining a return 4/20mA wire.

Fig 19 shows how a 2-channel Zener barrier may be used to transfer the 4/20mA current output into the safe area, alternatively a galvanic isolator may be used.

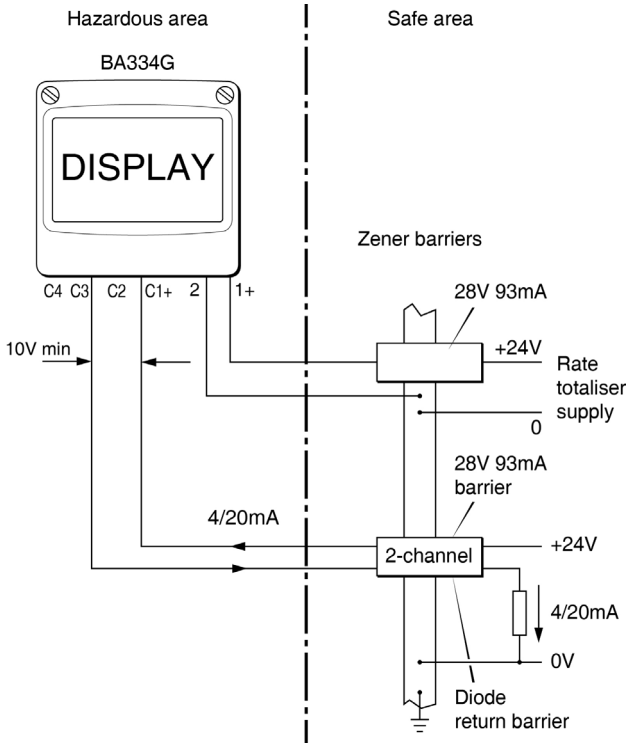


Fig 19 Application of 4/20mA output

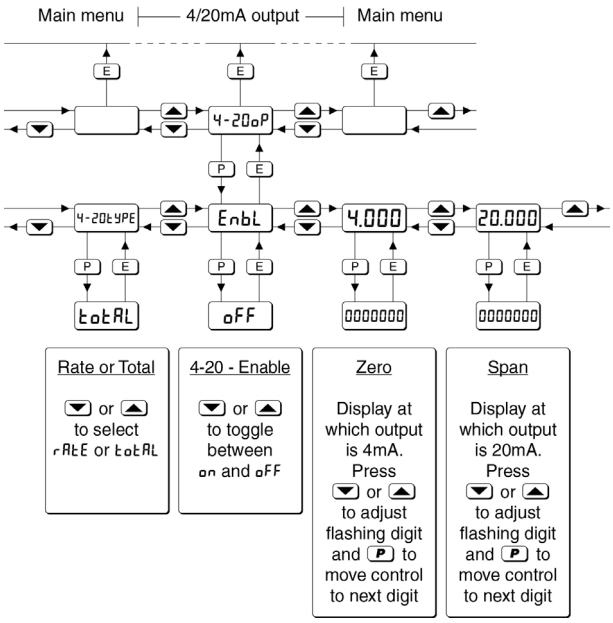


Fig 20 4/20mA output configuration sub-menu

10.4.3 Configuration

When a Rate Totaliser is supplied with an optional 4/20mA output the configuration menu is extended as shown in Fig 20. The 4/20mA output sub-menu is accessed via the 4-20 oP function. Using the ▼ or ▲ push buttons scroll though the menu until 4-20 oP is displayed, pressing P will then access the 4/20mA output sub-menu.

The 4/20mA output sub-menu allows the 4/20mA output to be controlled by the rate or the total display and to be scaled.

10.4.4 Enable 4/20mA output: EnbL

This function allows the 4/20mA current output to be disabled or enabled without altering the calibration. Using the ▼ or ▲ push button select EnbL in the 4-20 oP sub-menu and press P to reveal the existing setting on or oFF. The function can be changed by pressing the ▼ or ▲ push button followed by the E button to return to EnbL prompt in the sub-menu.

10.4.5 Select rate or total source: 4-20tYPE

The 4/20mA output current can represent the Rate Totaliser's rate or total display, this should be defined before any other current output functions are adjusted.

Using the ▼ or ▲ push button select 4-20tYPE in the 4-20 oP output sub-menu and press P to reveal the existing setting totAL or rAtE. The function can be changed by pressing the ▼ or ▲ push button followed by the E button to return to the 4-20tYPE prompt in the sub-menu.

10.4.6 Display which corresponds to 4mA output: 4.000

The Rate Totaliser display which corresponds to a 4.000mA output current is defined by this function. Using the ▼ or ▲ push button select 4.000 in the 4/20mA output sub-menu and press P which will reveal the existing rate or total display with one digit flashing. The required display can be entered using the ▼ or ▲ push button to adjust the flashing digit and the P button to transfer control to the next digit. When set as required press E to enter the value and return to the 4.000 prompt in the 4/20mA output sub-menu.

10.4.7 Display which corresponds to 20mA output: 20.000

The Rate Totaliser display which corresponds to a 20.000mA output current is defined by this function. Using the ▼ or ▲ push button select 20.000 in the 4/20mA output sub-menu and press P which will reveal the existing rate or total display with one digit flashing. The required display can be entered using the ▼ or ▲ push button to adjust the flashing digit and the P button to transfer control to the next digit. When set as required press E to enter the value and return to the 20.000 prompt in the 4/20mA output sub-menu 4-20 oP.

Notes:

1. If the calibration of the rate or total display defined as the source for the 4/20mA output is changed, the 4/20mA output will automatically be set to give a constant 3.5mA output irrespective of the display. The 4/20mA output should always be reconfigured following reconfiguration of the source display.

2. If the Rate Totaliser and the 4/20mA current sink output are powered from separate supplies, the 4/20mA output current will continue to flow when the Rate Totaliser supply fails or is turned off. Powering both from a common supply eliminates this effect.

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 BA334G also has ATEX dust certification.

A1.1 Zones, and Maximum Surface Temperature.

The BA334G has been certified Group II Category 1D Ex ia IIIC T80°C Da, Ta = -40º to 60ºC. When connected to a suitable system it 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 dust in subdivisions:

IIIA	combustible flyings
IIIB	non-conductive dust
IIIC	conductive dust

Having a Minimum Ignition Temperature of:

Dust cloud	120°C
Dust layer on Rate Totaliser up to 5mm thick	155°C
Dust layer on Rate Totaliser over 5mm thick.	Refer to EN 60079-14

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

A1.2 Installation and maintenance

The installation requirements described in this manual for use in a potentially explosive gas atmosphere also apply when the Rate totaliser is installed in a potentially explosive dust atmosphere.

The instrument assembly should only be removed from the enclosure back-box when dust can not enter the instrument enclosure. Before replacing the instrument assembly the sealing gasket should be inspected to ensure that it is undamaged and free from foreign bodies.

It is good practice to prevent dust accumulating on the Rate Totaliser enclosure. If this can not be avoided, care should be taken to ensure that the layer thickness does not exceed 5mm for dusts having a minimum ignition temperature of 155°C.

APPENDIX 2

IECEx certification

A2.0 The IECEx Certification Scheme

IECEx is a global certification scheme for explosion protected products which aims to harmonise international certification standards. For additional information about the IECEx certification scheme and to view the BEKA associate certificates, please visit www.iecex.com

A2.1 IECEx Certificate of Conformity

The BA334G Rate Totaliser and the optional accessories have been issued with an IECEx Certificate of Conformity number IECEx ITS 16.0004X which specifies the following certification codes:

Ex ia IIC T5 Ga
Ta = -40°C to 70°C
Ex ia IIIC T80°C IP66 Da
Ta = -40°C to 60°C

The specified IECEx gas and dust intrinsic safety parameters are identical to the ATEX safety parameters described in the main section and Appendix 1 of this manual.

The IECEx certificate may be downloaded from the BEKA associates or the IECEx website, or may be requested from the BEKA sales office.

A2.2 Installation

The IECEx and ATEX certificates specify identical safety parameters and installation requirements for both approvals as defined by IEC 60079-14. The ATEX installation requirements specified in the main section and Appendix 1 of this manual may therefore be used for IECEx installations, but the local code of practice should also be consulted.

APPENDIX 3

ETL & cETL certification for installations in USA and Canada.

A3.0 cETL Mark
For installations in the USA and Canada, the BA334G Rate Totaliser has ETL and cETL intrinsic safety and nonincendive approval, Control Number 4008610. Copies of the Authorisation to Mark may be downloaded from the BEKA associates website www.beka.co.uk or requested from the BEKA associates sales office

A3.1 Intrinsic safety approval
The US and Canadian standards used for assessment and certification of the BA334G are listed on the cETL Authorisation to Mark.

Installations must comply with BEKA associates Control Drawing CI330-52, which is attached to this appendix.

The ETL safety parameters are the same as the ATEX and IECEx parameters, the systems shown in sections 3 and 4 of this manual may therefore also be used for US and Canadian installations subject to compliance with the local codes of practice.

ETL and cETL intrinsic safety codes

USA & Canada
CL I Div 1 Groups A, B, C, D T5
CL II Div 1 Groups E, F, G. CL III
-40ºC < Ta < 70ºC

USA
CL I Zone 0 AEx ia IIC T5 Ga
Zone 20 AEx ia IIIC T80ºC Da
-40ºC < Ta < 70ºC

Canada
Ex ia IIC T5 Ga
Ex ia IIIC T80ºC Da
-40ºC < Ta < 70ºC

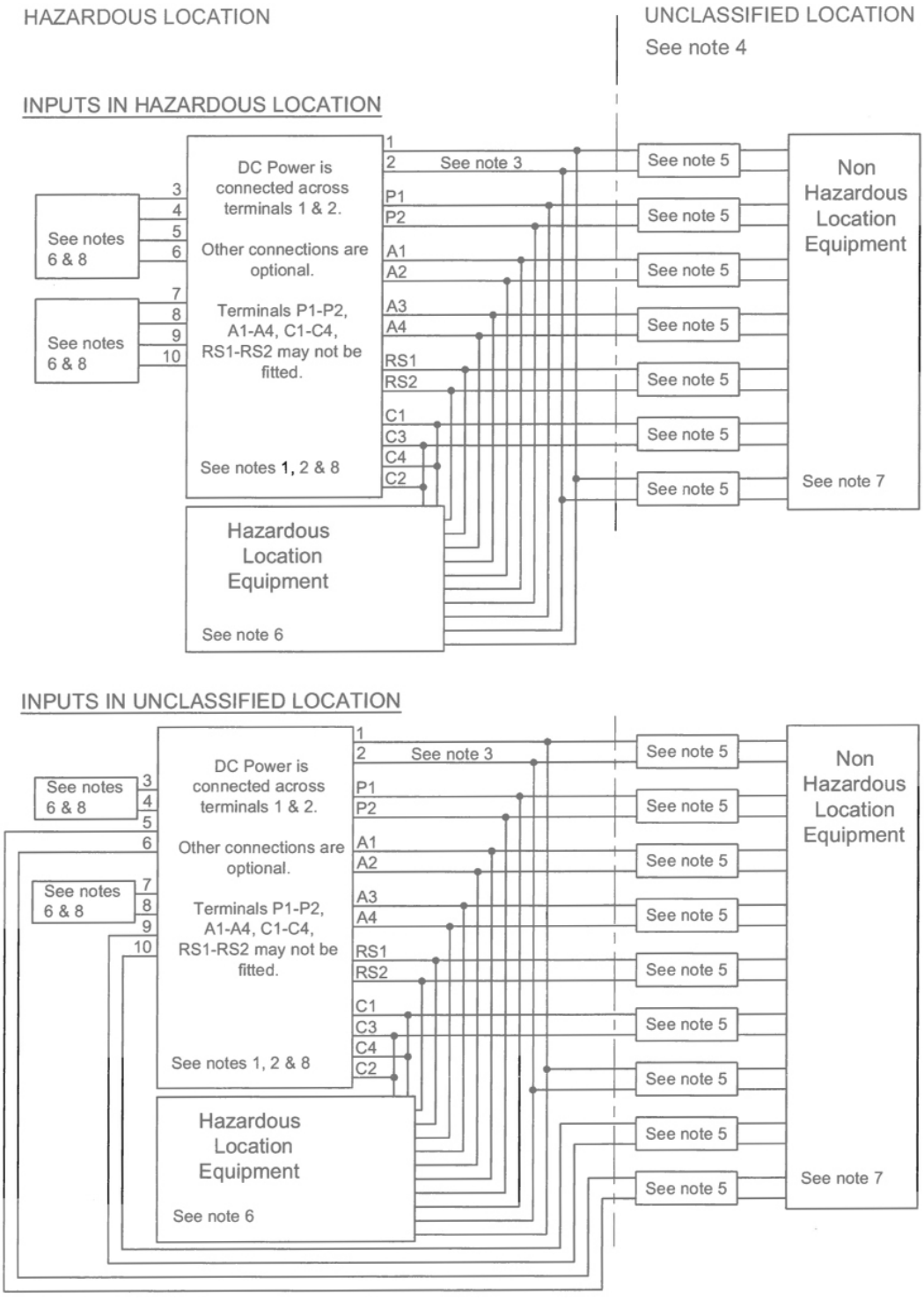
A3.2 Nonincendive approval
The BA334G Rate Totaliser also has ETL nonincendive approval allowing installation in Division 2 hazardous (classified) locations without the need for Zener barriers or galvanic isolators.

Installations must comply with BEKA associates Control Drawing CI330-53, which is attached to this appendix, and with the local codes of practice.

ETL and cETL nonincendive codes US & Canada

CL I Div 2 Groups A, B, C, D T5
CL II Div 2 Groups F, G
CL III Div 2
-40ºC < Ta < 70ºC

INTERCONNECTIONS FOR EXTERNALLY POWERED RATE TOTALISERS



Iss.	Date	Modification	Ckd.	Appd.
1	05.05 2016	New drawing	OL	CB
2	05.08 2016	Field mounted rate totalisers added	OL	BB

BEKA associates Hitchin England

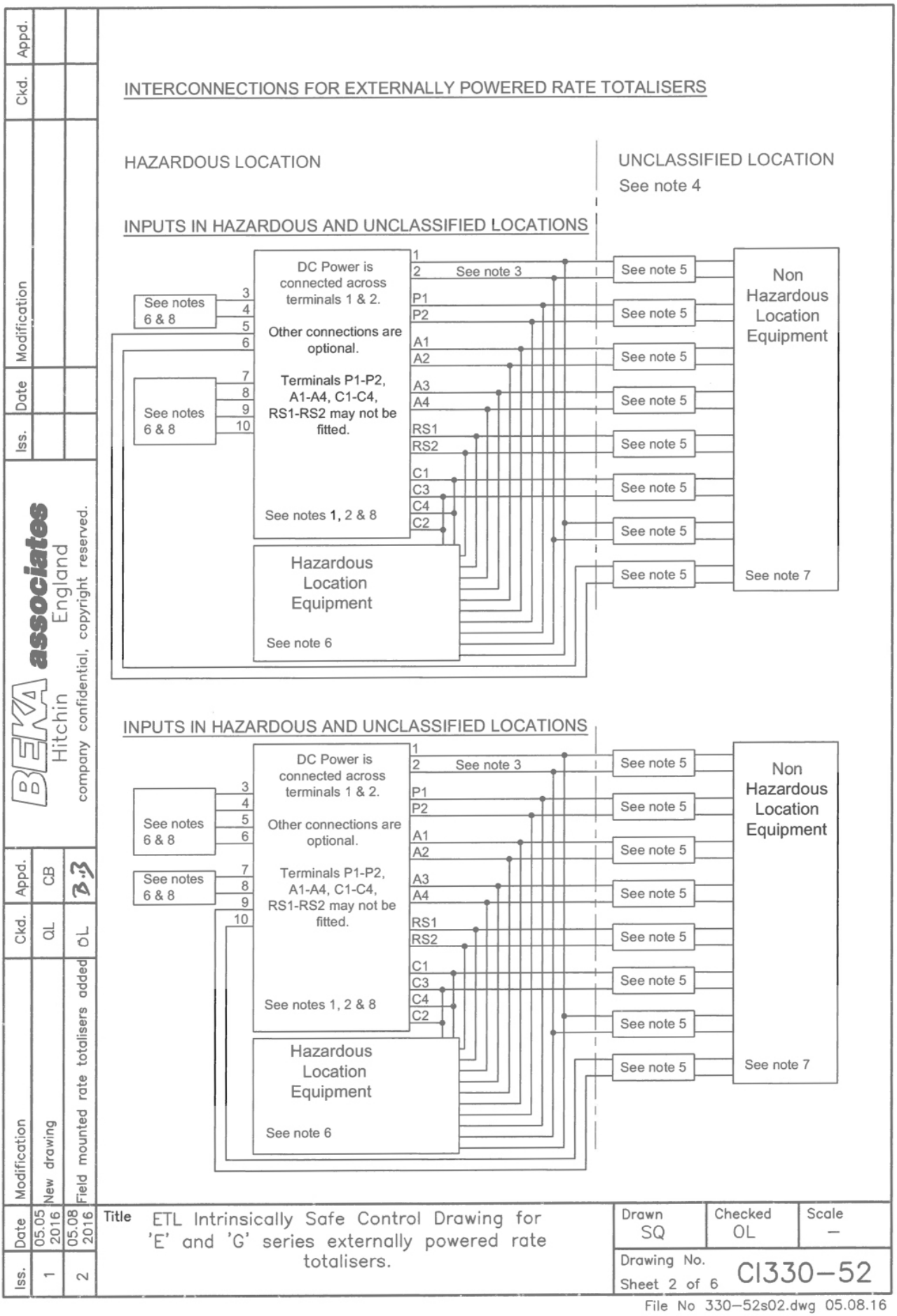
Title: ETL Intrinsically Safe Control Drawing for 'E' and 'G' series externally powered rate totalisers

Drawn	Checked	Scale
SQ	OL	–

Drawing No. CI330–52

Sheet 1 of 6

File No 330–52s01.dwg 05.08.16


INTERCONNECTIONS FOR EXTERNALLY POWERED RATE TOTALISERS
HAZARDOUS LOCATION
UNCLASSIFIED LOCATION
See note 4
INPUTS IN HAZARDOUS AND UNCLASSIFIED LOCATIONS
DC Power is connected across terminals 1 & 2.
Other connections are optional.
Terminals P1-P2, A1-A4, C1-C4, RS1-RS2 may not be fitted.
See notes 1, 2 & 8
See notes 6 & 8
See note 3
See note 5
Non Hazardous Location Equipment
See note 7
Hazardous Location Equipment
See note 6
INPUTS IN HAZARDOUS AND UNCLASSIFIED LOCATIONS
DC Power is connected across terminals 1 & 2.
Other connections are optional.
Terminals P1-P2, A1-A4, C1-C4, RS1-RS2 may not be fitted.
See notes 1, 2 & 8
See notes 6 & 8
See note 3
See note 5
Non Hazardous Location Equipment
See note 7
Hazardous Location Equipment
See note 6
BEKA associates
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company confidential, copyright reserved.
Appd. CB B.3
Ckd. QL OL
Modification Field mounted rate totalisers added
Date 05.08 2016
Iss. 2
Modification New drawing
Date 05.05 2016
Iss. 1
Title ETL Intrinsically Safe Control Drawing for 'E' and 'G' series externally powered rate totalisers.
Drawn SQ
Checked OL
Scale —
Drawing No. CI330-52
Sheet 2 of 6
File No 330-52s02.dwg 05.08.16

Iss.	Date	Modification	Ckd.	Appd.
1	05.05 2016	New drawing	QL	CB
2	05.08 2016	Field mounted rate totalisers added	OL	BB

BEKA associates Hitchin England

Notes

1. 1 and 2 input externally powered rate totalisers with model numbers and coding as shown in the following tables.

E PANEL MOUNTING INSTRUMENTS

Type	Model Nos.	Division Marking	Zonal Marking	Ambient Temp.
1 input tachometer 1 input rate totaliser 2 input rate totaliser 1 input counter 2 input counter 1 input timer 2 input timer	BA317E BA318E BA337E BA338E BA388E BA367E BA368E BA377E BA378E	Class I Division 1 Groups A, B, C & D T5 Class II Division 1 Groups E, F & G Class III Division 1	Zone 0 AEx ia IIC T5 Ga	−40°C to +70°C

E−SS PANEL MOUNTING INSTRUMENTS

Type	Model Nos.	Division Marking	Zonal Marking	Ambient Temp. (see note 9)
1 input tachometer 1 input rate totaliser 1 input counter 1 input timer	BA317E−SS BA337E−SS BA367E−SS BA377E−SS	Class I Division 1 Groups A, B, C & D T5 Class II Division 1 Groups E, F & G Class III Division 1	Zone 0 AEx ia IIC T5 Ga Zone 20 AEx ia IIIC T80°C Da	−40°C to +60°C

G FIELD MOUNTING INSTRUMENTS

Type	Model Nos.	Division Marking	Zonal Marking	Ambient Temp. (see note 9)
1 input tachometer 1 input rate totaliser 2 input rate totaliser 2 input counter 2 input timer	BA314G BA334G BA384G BA364G BA374G	Class I Division 1 Groups A, B, C & D T5 Class II Division 1 Groups E, F & G Class III Division 1	Zone 0 AEx ia IIC T5 Ga Zone 20 AEx ia IIIC T80°C Da	−40°C to +60°C

E FIELD MOUNTING INSTRUMENTS

Type	Model Nos.	Division Marking	Zonal Marking	Ambient Temp.
1 input tachometer 1 input rate totaliser 2 input rate totaliser 2 input counter 2 input timer	BA314E BA334E BA384E BA364E BA374E	Class I Division 1 Groups A, B, C & D T5 Class II Division 1 Groups E, F & G Class III Division 1	Zone 0 AEx ia IIC T5 Ga	−40°C to +70°C

2. Terminals 7, 8, 9 and 10 only exist on 2 input instruments.

Title: ETL Intrinsically Safe Control Drawing for 'E' and 'G' series externally powered rate totalisers.

Drawn	Checked	Scale
SQ	OL	—

Drawing No. CI330−52
Sheet 3 of 6

File No 330−52s03.dwg 05.08.16

3. Installations shall be in accordance with ANSI/ISA RP 12.06.01 'Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations' and the National Electrical Code ANSI/NFPA 70. Installations in Canada shall be in accordance with the Canadian Electrical Code C22.2.

4. The associated protective barriers and galvanic isolators shall be NRTL approved and the manufacturers instructions shall be followed when installing this equipment.
For installations in Canada the associated protective barriers and galvanic isolators shall be NRTL or CSA approved and the manufacturers installation drawings shall be followed when installing this equipment.

5. One single channel or one two channel associated protective barrier or galvanic isolator with entity parameters complying with the following requirements:

Uo	equal or less than	the lowest Ui of the NRTL or CSA approved apparatus installed in the loop.
Io	equal or less than	the lowest Ii of the NRTL or CSA approved apparatus installed in the loop.
Po	equal or less than	the lowest Pi of the NRTL or CSA approved apparatus installed in the loop.
Lo	equal or greater than	the sum of the cable inductances and the internal inductances Li of each NRTL or CSA approved apparatus in the loop.
Co	equal or greater than	the sum of the cable capacitance and the internal capacitance Ci of each NRTL or CSA approved apparatus in the loop.

6. Simple Apparatus as defined in the National Electrical Code ANSI/NFPA 70, or for installations in Canada by the Canadian Electrical Code C22.2 OR:

Ui	equal or greater than	the highest Uo of the NTRL or CSA approved apparatus powering the loop.
Ii	equal or greater than	the highest Io of the NTRL or CSA approved apparatus powering the loop.
Pi	equal or greater than	the highest Po of the NTRL or CSA approved apparatus powering the loop.
Lo	of the NTRL or CSA approved apparatus powering the loop equal or greater than	the sum of the cable inductances and the internal inductances Li of each NTRL or CSA approved apparatus in the loop.
Co	of the NTRL or CSA approved apparatus powering the loop equal or greater than	the sum of the cable capacitances and the internal capacitances Ci of each NTRL or CSA approved apparatus in the loop.

Iss.	Date	Modification	Ckd.	Appd.
1	05.05 2016	New drawing	OL	CB
2	05.08 2016	Field mounted rate totalisers added	OL	BB

BEKA associates Hitchin England

Title: ETL Intrinsically Safe Control Drawing for 'E' and 'G' series externally powered rate totalisers.

Drawn	Checked	Scale
SQ	OL	–

Drawing No. CI330–52
Sheet 4 of 6

File No 330–52s07.dwg 05.08.16

7. The unclassified location equipment shall not use or generate more than 250V rms or 250V dc.

8. Safety parameters

DC Power terminals 1 & 2

Ui	=	28V	Uo = 0
Ii	=	200mA	Io = 0
Pi	=	0.84W	
Ci	=	2nF	
Li	=	4µH	

Terminals RS1-RS2, (optional reset input)

Ui	=	28V	Uo = 3.8V
Ii	=	200mA	Io = 1mA
Pi	=	0.84W	Po = 1mW
Ci	=	0	
Li	=	0	

Terminals 4,5,6 (input A for models in notes 6 and 7), terminals 8,9,10 (input b for models in note 7).

Ui	=	28V	Uo = 1.1V
Ii	=	200mA	Io = 0.5mA
Pi	=	0.84W	Po = 0.2mW
Ci	=	2nF	
Li	=	4µH	

Terminal 3,4,5,6 (input A for models in notes 6 and 7), terminals 7,8,9,10 (input b for models in note 7).

Ui	=	14V	Uo = 10.5V
Ii	=	200mA	Io = 9.2mA
Pi	=	0.7W	Po = 24mW
Ci	=	2nF	
Li	=	4µH	

Optional pulse output terminals P1 & P2

Ui	=	28V	Uo = 0
Ii	=	200mA	Io = 0
Pi	=	0.84W	
Ci	=	0	
Li	=	0	

Optional 4-20mA output terminals C1, C2, C3 and C4

Ui	=	28V	Uo = 0
Ii	=	200mA	Io = 0
Pi	=	0.84W	
Ci	=	2.2nF	
Li	=	4µH	

Optional alarm output terminals A1, A2, A3 and A4

Ui	=	28V	Uo = 1.47V
Ii	=	200mA	Io = 1µA
Pi	=	0.84W	Po = 2µW
Ci	=	22nF	
Li	=	4µH	

9. When installed purely as intrinsically safe equipment in division 1, division 2, zone 0, zone 1 or zone 2, the ambient temperature range of the BA317E-SS, BA337E-SS, BA367E-SS, BA377E-SS, BA314G, BA334G, BA364G, BA374G and BA384G is: -40°C ≤ Ta ≤ +70°C.

Iss.	Date	Modification	Ckd.	Appd.
1	05.05 2016	New drawing	OL	CB
2	05.08 2016	Field mounted rate totalisers added	OL	B.J

BEKA associates Hitchin England

Title: ETL Intrinsically Safe Control Drawing for 'E' and 'G' series externally powered rate totalisers.

Drawn	Checked	Scale
SQ	OL	—

Drawing No. CI330-52

Sheet 5 of 6

File No 330-52s08.dwg 05.08.16

10. **CAUTION** Aluminium and stainless steel certification labels that are mounted on the BA317E, BA318E, BA337E, BA338E, BA367E, BA368E, BA377E, BA378E and BA388E externally powered rate totaliser enclosures may be marked with their maximum capacitance (8pF). The BA317E, BA318E, BA337E, BA338E, BA367E, BA368E, BA377E, BA378E and BA388E enclosures may also carry the following potential electrostatic warning:

WARNING
Potential electrostatic charging hazard clean only with a damp cloth

AVERTISSEMENT
Risque potentiel de charge électrostatique Nettoyer uniquement avec un chiffon humide

Alternatively, the enclosures may be manufactured from a conducting plastic per Article 250 of the National Electrical Code.

11. When mounting the BA317E, BA318E, BA337E, BA338E, BA367E, BA368E, BA377E, BA378E and the BA388E panel mounting externally powered rate totalisers in an enclosure to maintain Type 4 front panel rating:

Minimum panel thickness should be 2mm (0.08inches) Steel
3mm (0.12inches) Aluminium

Outside panel finish should be smooth, free from particles, inclusions, runs or build-ups around cut-out.

Panel cut-out for BA317E, BA327E, BS367E and BA377E shall be:
90.0 x 43.5mm -0.0 +0.5mm (3.54 x 1.71 inches –0.00 +0.02)

Two panel mounting clips are required and each shall be tightened to between: 20 & 22cNm (1.77 to 1.95inLb)

Panel cut-out for BA318E, BA338E, BA368E, BA378E and BA388E shall be:
66.2 x 136.0mm-0.0 +0.5mm (2.60 x 5.35 inches –0.00 +0.02)

Four panel mounting clips are required and each shall be tightened to between: 20 & 22cNm (1.77 to 1.95inLb)

12. When mounting the BA317E-SS, BA337E-SS, BA367E-SS, and BA377E-SS panel mounting externally powered rate totalisers in an AEx e, AEx n, AEx p or AEx t certified enclosure, or an enclosure to maintain IP66 front panel rating, the panel cut-out shall be:

92.0 +0.8/-0.0 x 45.0 +0.6/-0.0mm (3.62 +0.03/-0.0 x 1.77 +0.02/-0.0 inches)

4 panel mounting clamps are required and each shall be tightened to a minimum of 22cNm (1.95inLb).

When correctly installed, the BA317E-SS, BA337E-SS, BA367E-SS and BA377E-SS will not invalidate the certification of an AEx e, AEx n, AEx p or AEx t panel enclosure.

Iss.	Date	Modification	Ckd.	Appd.
1	05.05 2016	New drawing	QL	CB
2	05.08 2016	Field mounted rate totalisers added	OL	3.3

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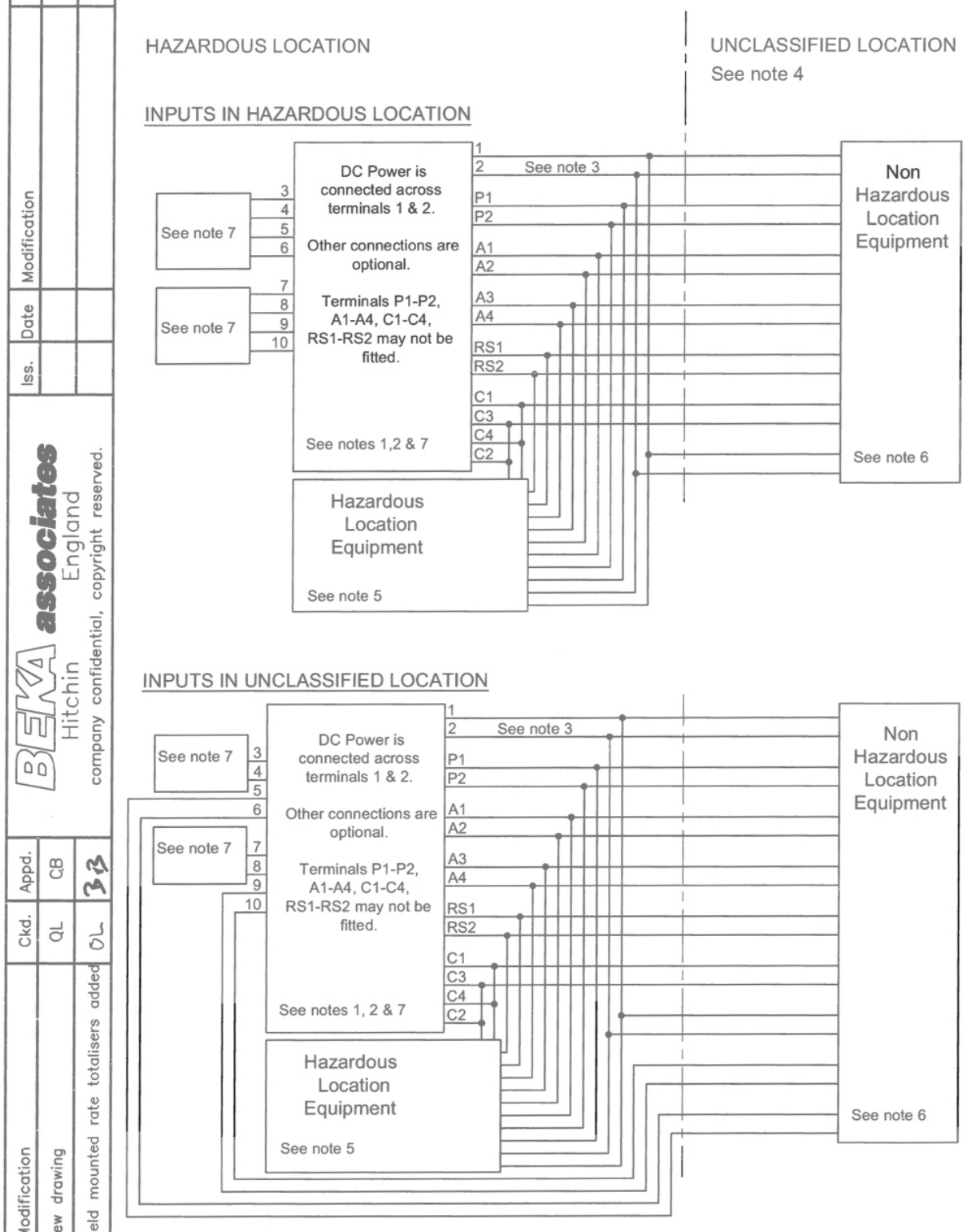
Title: ETL Intrinsically Safe Control Drawing for 'E' and 'G' series externally powered rate totalisers.

Drawn	Checked	Scale
SQ	OL	–

Drawing No. CI330–52
Sheet 6 of 6

File No 330–52s06.dwg 05.08.16

INTERCONNECTIONS FOR EXTERNALLY POWERED RATE TOTALISERS



Iss.	Date	Modification	Ckd.	Appd.
1	15.06 2016	New drawing	QL	CB
2	05.08 2016	Field mounted rate totalisers added	OL	JB

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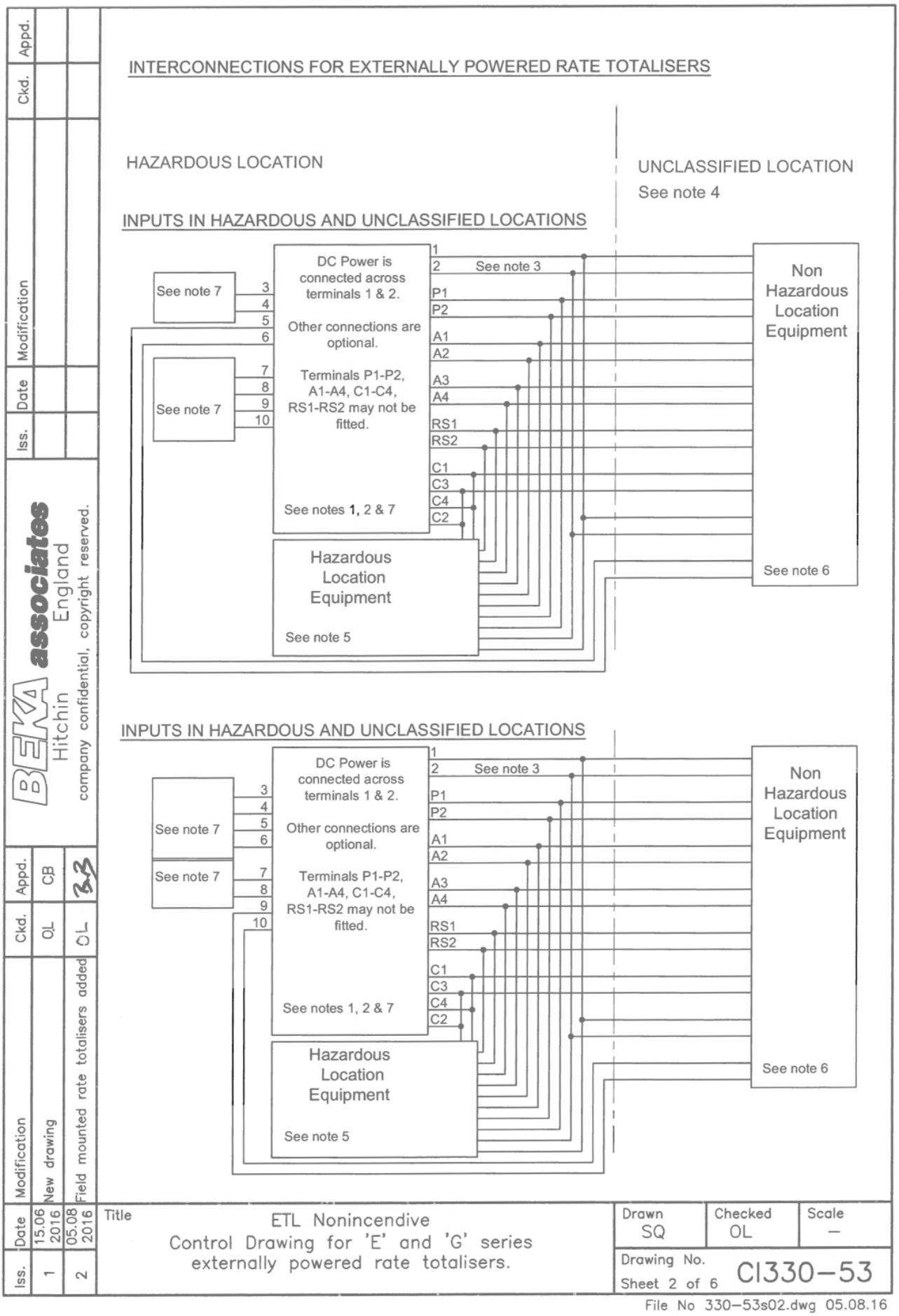
Title: ETL Nonincendive Control Drawing for 'E' and 'G' series externally powered rate totalisers.

Drawn	Checked	Scale
SQ	OL	–

Drawing No. CI330–53

Sheet 1 of 6

File No 330–53s01.dwg 05.08.16


INTERCONNECTIONS FOR EXTERNALLY POWERED RATE TOTALISERS
HAZARDOUS LOCATION
UNCLASSIFIED LOCATION
See note 4
INPUTS IN HAZARDOUS AND UNCLASSIFIED LOCATIONS
See note 7
See note 7
DC Power is connected across terminals 1 & 2.
Other connections are optional.
Terminals P1-P2, A1-A4, C1-C4, RS1-RS2 may not be fitted.
See notes 1, 2 & 7
See note 3
Hazardous Location Equipment
See note 5
Non Hazardous Location Equipment
See note 6
1
2
3
4
5
6
7
8
9
10
P1
P2
A1
A2
A3
A4
RS1
RS2
C1
C3
C4
C2
INPUTS IN HAZARDOUS AND UNCLASSIFIED LOCATIONS
See note 7
See note 7
DC Power is connected across terminals 1 & 2.
Other connections are optional.
Terminals P1-P2, A1-A4, C1-C4, RS1-RS2 may not be fitted.
See notes 1, 2 & 7
See note 3
Hazardous Location Equipment
See note 5
Non Hazardous Location Equipment
See note 6
Appd.
Ckd.
Modification
Date
Iss.
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CB
OL
CL
33
1 New drawing 15.06 2016
2 Field mounted rate totalisers added 05.08 2016
Title
ETL Nonincendive
Control Drawing for 'E' and 'G' series
externally powered rate totalisers.
Drawn SQ
Checked OL
Scale —
Drawing No. CI330–53
Sheet 2 of 6
File No 330–53s02.dwg 05.08.16

Notes

1. 1 and 2 input externally powered rate totalisers with model numbers and coding as shown in the following tables.

NE PANEL MOUNTING INSTRUMENTS

Type	Model Nos.	Division Marking	Zonal Marking (see note 8)	Ambient Temp. (see note 9)
1 input tachometer 1 input rate totaliser 1 input counter 1 input timer	BA317NE BA337NE BA367NE BA377NE	Class I Division 2 Groups A, B, C & D T5 Class II Division 2 Groups F & G Class III Division 2	Zone 2 AEx nA ic IIC T5 Gc Zone 22 AEx ic tc IIIC T80°C Dc	−40°C to +60°C

E PANEL MOUNTING INSTRUMENTS

Type	Model Nos.	Division Marking	Zonal Marking	Ambient Temp.
1 input tachometer 1 input rate totaliser 2 input rate totaliser 1 input counter 2 input counter 1 input timer 2 input timer	BA317E BA318E BA337E BA338E BA388E BA367E BA368E BA377E BA378E	Class I Division 2 Groups A, B, C & D T5 Class II Division 2 Groups F & G Class III Division 2	None	−40°C to +70°C

E–SS PANEL MOUNTING INSTRUMENTS

Type	Model Nos.	Division Marking	Zonal Marking	Ambient Temp.
1 input tachometer 1 input rate totaliser 1 input counter 1 input timer	BA317E–SS BA337E–SS BA367E–SS BA377E–SS	Class I Division 2 Groups A, B, C & D T5 Class II Division 2 Groups F & G Class III Division 2	None	−40°C to +70°C

NG FIELD MOUNTING INSTRUMENTS

Type	Model Nos.	Division Marking	Zonal Marking (see note 8)	Ambient Temp. (see note 9)
1 input tachometer 1 input rate totaliser 2 input rate totaliser 2 input counter 2 input timer	BA314NG BA334NG BA384NG BA364NG BA374NG	Class I Division 2 Groups A, B, C & D T5 Class II Division 2 Groups F & G Class III Division 2	Zone 2 AEx nA ic IIC T5 Gc Zone 22 AEx ic tc IIIC T80°C Dc	−40°C to +60°C

G FIELD MOUNTING INSTRUMENTS

Type	Model Nos.	Division Marking	Zonal Marking	Ambient Temp.
1 input tachometer 1 input rate totaliser 2 input rate totaliser 2 input counter 2 input timer	BA314G BA334G BA384G BA364G BA374G	Class I Division 2 Groups A, B, C & D T5 Class II Division 2 Groups F & G Class III Division 2	None	−40°C to +70°C

E FIELD MOUNTING INSTRUMENTS

Type	Model Nos.	Division Marking	Zonal Marking	Ambient Temp.
1 input tachometer 1 input rate totaliser 2 input rate totaliser 2 input counter 2 input timer	BA314E BA334E BA384E BA364E BA374E	Class I Division 2 Groups A, B, C & D T5 Class II Division 2 Groups F & G Class III Division 2	None	−40°C to +70°C

Iss.	Date	Modification	Ckd.	Appd.
1	05.05 2016	New drawing	QL	CB
2	05.08 2016	Field mounted rate totalisers added	OL	3.3

BEKA associates Hitchin England

Title: ETL Nonincendive Control Drawing for 'E' and 'G' series externally powered rate totalisers.

Drawn	Checked	Scale
SQ	OL	–

Drawing No. CI330–53
Sheet 3 of 6

File No 330–53s03.dwg 05.08.16

2. Terminals 7, 8, 9 and 10 only exist on 2 input instruments.

3. Nonincendive field wiring installations shall be in accordance with the National Electrical Code ANSI/NFPA 70. The Nonincendive Field Wiring concept allows interconnection of Nonincendive Field Apparatus with Associated Nonincendive Field Wiring Apparatus using any of the wiring methods permitted for unclassified locations. Installations in Canada shall be in accordance with the Canadian Electrical Code C22.2.

4. Classified location equipment shall br NRTL Approved Nonincendive Field Wiring Apparatus or simple apparatus as defined in ANSI/NFPA70. For Canadian installations classified location equipment shall be NRTL or CSA Approved Nonincendive Field Wiring Apparatus.

5. Simple Apparatus as defined in the National Electrical Code ANSI/NFPA 70, 3r for installations in Canada by the Canadian Electrical Code C22.2 or as defined in note 2.

6. The unclassified location equipment shall not use or generate more than 250V rms or 250V dc.

Iss.	Date	Modification	Ckd.	Appd.
1	15.06 2016	New drawing	OL	CB
2	05.08 2016	Field mounted rate totalisers added	OL	2.3

BEKA associates Hitchin England

Iss.	Date	Modification	Ckd.	Appd.

Title: ETL Nonincendive Control Drawing for 'E' and 'G' series externally powered rate totalisers.

Drawn	Checked	Scale
SQ	OL	—

Drawing No. CI330-53

Sheet 4 of 6

File No 330-53s04.dwg 05.08.16

Iss.	Date	Modification	Ckd.	Appd.
1	15.06 2016	New drawing	OL	CB
2	05.08 2016	Field mounted rate totalisers added	OL	BB

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7. Safety parameters

DC Power terminals 1 & 2

Ui = 30V
Ii = 100mA

Terminals RS1-RS2, (optional reset input)

Ui = 30V
Uo = 3.8V
Io = 1mA

Terminals 4,5,6 (input A for models in notes 5 and 6), terminals 8,9,10 (input b for models in note 6).

Ui = 30V
Uo = 1.1V
Io = 0.5mA

Terminal 3,4,5,6 (for models in notes 5 and 6), terminals 7,8,9,10 (input b with terminals for models in note 6).

Ui = 15V
Uo = 10.5V
Io = 9.2mA

Optional pulse output terminals P1 & P2

Ui = 30V
Ii = 100mA
Uo = 0
Io = 0

Optional 4-20mA output terminals C1, C2, C3 and C4

Ui = 30V
Uo = 0
Io = 0

Optional alarm output terminals A1, A2, A3 and A4

Ui = 30V
Ii = 200mA
Uo = 1.47V
Io = 1µA

8. The 'AEx ic' in codes refers to instrument push button contacts which are nonincendive.

9. When installed purely as non-incendive equipment, the ambient temperature range of the BA317NE, BA337NE, BA367NE, BA377NE, BA314NG, BA334NG, BA364NG, BA374NG, and BA384NG is: -40°C ≤ Ta ≤ +70°C.

Title: ETL Nonincendive Control Drawing for 'E' and 'G' series externally powered rate totalisers.

Drawn	Checked	Scale
SQ	OL	–

Drawing No. CI330–53
Sheet 5 of 6

File No 330–53s05.dwg 05.08.16

10. **CAUTION** The BA317E, BA318E, BA337E, BA338E, BA367E, BA368E, BA377E, BA378E and the BA388E Externally Powered rate totaliser enclosures may carry the following potential electrostatic warning:

WARNING
Potential electrostatic charging hazard clean only with a damp cloth

AVERTISSEMENT
Risque potentiel de charge
électrostatique Nettoyer uniquement
avec un chiffon humide

Alternatively, the enclosures may be manufactured from a conducting plastic per Article 250 of the National Electrical Code.

11. When mounting the BA317E, BA318E, BA337E, BA338E, BA367E, BA368E, BA377E, BA378E, BA388E, BA317E-SS, BA337E-SS, BA367E-SS, BA377E-SS, BA317NE, BA337NE, BA367NE & BA377NE panel mounting Externally Powered Rate Totalisers in an enclosure to maintain Type 4 front panel rating:

Minimum panel thickness should be 2mm (0.08inches) Steel
3mm (0.12inches) Aluminium

Outside panel finish should be smooth, free from particles, inclusions, runs or build-ups around cut-out.

Panel cut-out for BA317E, BA337E, BA367E, and BA377E shall be:
90.0 x 43.5mm -0.0 +0.5mm (3.54 x 1.71 inches -0.00 +0.02)

Two panel mounting clips are required for BA317E, BA337E, BA367E, and BA377E and each shall be tightened to between: 20 & 22cNm (1.77 to 1.95inLb)

Panel cut-out for BA318E, BA338E, BA368E, BA378E, and BA388E shall be:
136.0 x 66.2mm -0.0 +0.5mm (5.35 x 2.60 inches -0.00 +0.02)

Four panel mounting clips are required for BA318E, BA338E, BA368E, BA378E, and BA388E and each shall be tightened to between: 20 & 22cNm (1.77 to 1.95inLb)

Panel cut-out for BA317E-SS, BA337E-SS, BA367E-SS, BA377E-SS, BA317NE, BA337NE, BA367NE & BA377NE shall be:
(92.0mm -0.0 +0.8) x (45.0mm -0.0 +0.6)
(3.62 inches -0.00 +0.03) x (1.77 inches - 0.00 +0.02)

Four panel mounting clips are required for BA317E-SS, BA337E-SS, BA367E-SS, BA377E-SS, BA317NE, BA337NE, BA367NE & BA377NE and each shall be tightened to at least: 22cNm (1.95inLb)

Iss.	Date	Modification	Ckd.	Appd.
1	15.06 2016	New drawing	OL	CB
2	05.08 2016	Field mounted rate totalisers added	OL	B.B

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Title: ETL Nonincendive Control Drawing for 'E' and 'G' series externally powered rate totalisers.

Drawn	Checked	Scale
SQ	OL	–

Drawing No. CI330–53
Sheet 6 of 6

File No 330–53s06.dwg 05.08.16

APPENDIX 4

BA334E Rate Totaliser

The BA334E Rate Totaliser is functionally identical to the BA334G Rate Totalisers described in the main sections of this manual, but differs in mechanical construction, certification and factory fitted options.

All BA334E Rate Totalisers are fitted with:

A Green internally powered display backlight

Dual galvanically isolated alarms

An isolated 4/20mA current sink output

These are only available as factory fited options for the BA334G Rate Totaliser.

A4.1 Mechanical construction

The BA334E is housed in a robust GRP IP66 enclosure with a separate terminal compartment. Section A4.5 of this appendix describes the enclosure and installation procedure.

A4.2 Certification

The BA334E has the same ATEX, IECEx and ETL intrinsic safety certification as the BA334G, but the **BA334E does not have ATEX and IECEx dust certification**.

The safety parameters and certification numbers specified in this manual for the BA334G Rate Totalisers also apply to the BA334E Rate Totaliser. Therefore all of the systems described for the BA334G in the main section of this manual may also be used for the BA334E.

A4.3 Location

The BA334E 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 installations, including off-shore and waste water treatment sites. The Rate Totaliser should be positioned where the display is not in continuous direct sunlight.

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 enclosure is fitted with a bonding plate to ensure electrical continuity between the three conduit / cable entries.

A4.4 BA334E Accessories

A4.4.1 Units measurement & instrument identification.

The BA334E is fitted with a blank escutcheon around the liquid crystal display. This can be supplied printed with any units of measurement and tag information specified at the time of ordering. Alternatively, the information may be added on-site via an embossed strip, dry transfer or a permanent marker.

To gain access to the escutcheon remove the terminal cover by unscrewing the two 'A' screws which will reveal two concealed 'D' screws. Remove the push buttons by unscrewing the two 'C' screws and un-plug the five way connector. Finally, unscrew all four 'D' screws and carefully lift off the front of the instrument. The location of all the screws is shown in Fig A4.1.

Add the required legend to the display escutcheon, or stick a new pre-printed self-adhesive escutcheon, which is available from BEKA associates, on top of the existing escutcheon. Do not remove the original escutcheon.

The BA334E can also be supplied with a blank or custom laser engraved stainless steel plate secured by two screws to the front of the instrument enclosure. This plate can typically 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.

A4.4.2 Pipe mounting kits

The BA334E Rate Totaliser is surface mounting, but may be pipe mounted using the BA392D or the BA393 pipe mounting kit.

A4.5 Installation Procedure

Fig A4.1 illustrates the instrument installation procedure.

a. Remove the instrument terminal cover by unscrewing the two captive 'A' screws.

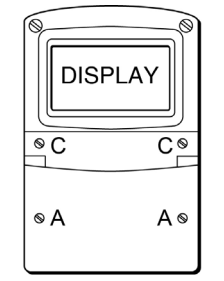
b. Mount the instrument on a flat surface and secure with screws or bolts through the two 'B' holes. Alternatively secure to a vertical or horizontal pipe using a BA392D or BA393 pipe mounting kit.

c. Remove the temporary hole plug and install an appropriate IP rated cable gland or conduit fitting. If more than one entry is required, one or both of the IP66 stopping plugs may be replaced with an appropriate IP rated cable gland or conduit fitting.

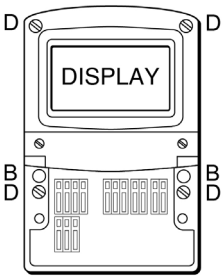
d. Connect the field wiring to the terminals as shown in Fig A4.2.

e. Replace the instrument terminal cover and evenly tighten the two 'A' screws.

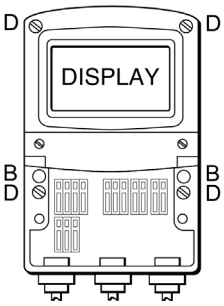
If the BA334E is not bolted to an earthed post or structure, the earth terminal should be connected to the plant potential equalising conductor.



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



Step B
Secure the instrument to a flat surface with M6 screws through the two 'B' holes. Alternatively use a pipe mounting kit.



Step C and D
Remove the temporary hole plug and install an appropriate IP rated cable gland or conduit fitting and terminate field wiring. Finally replace the terminal cover and tighten the two 'A' screws.

Fig A4.1 BA334E installation procedure

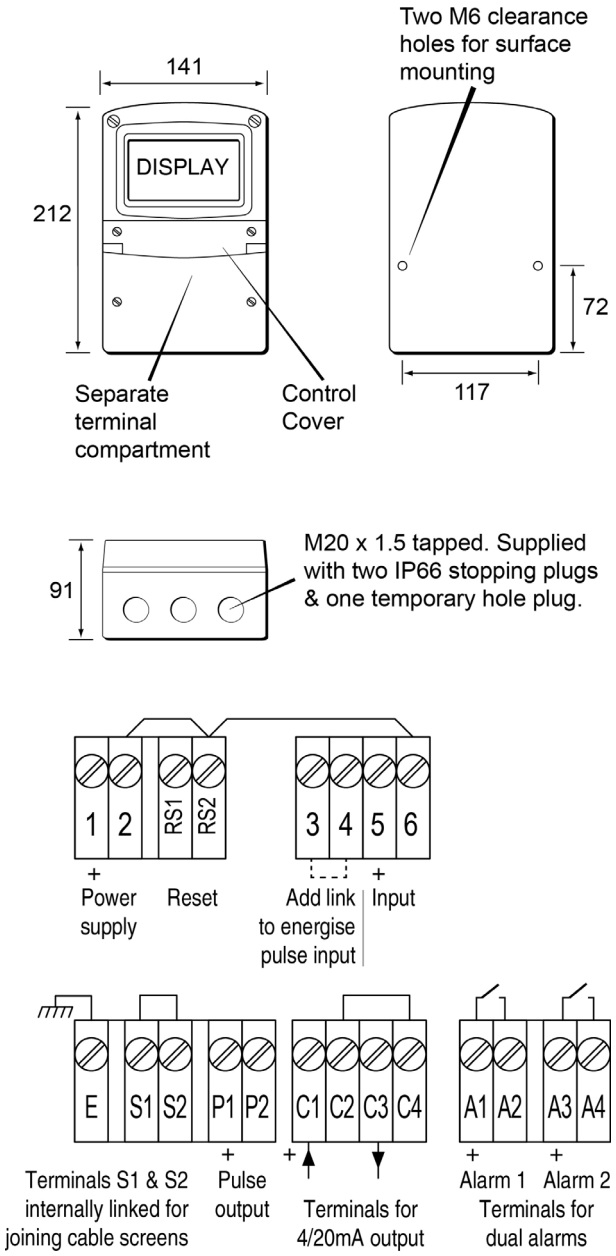


Fig A4.2 Dimensions and terminal connections

A4.6 EMC

The BA334E complies with the requirements of the European EMC Directive 2014/30/EU. For specified immunity all wiring should be in screened twisted pairs, with the screens earthed in the safe area.