

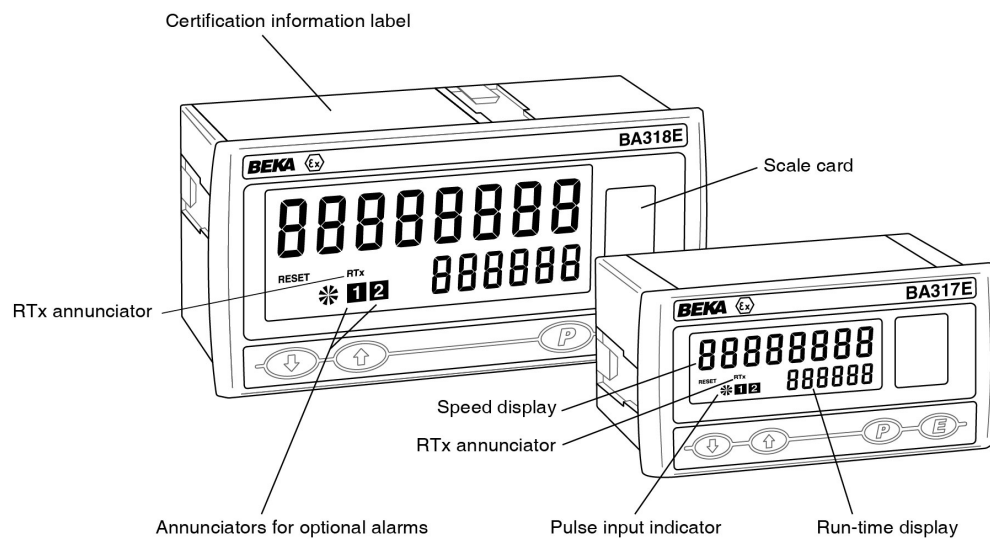
BA317E and BA318E

One input

Intrinsically safe

Tachometers

Issue 6



CONTENTS

1. Description

2. Operation

- 2.1 Initialisation
- 2.2 Controls
- 2.3 Displays

3. Intrinsic Safety Certification

- 3.1 ATEX & UKEX gas certification
- 3.2 Zones, gas groups & T rating
- 3.3 Special conditions for safe use
- 3.4 Power supply
- 3.5 Pulse input terminals
 - 3.5.1 sensors that do not require energising.
 - 3.5.2 sensors that require energising
- 3.6 Remote reset terminals
- 3.7 Certification label information

4. System Design for Hazardous Areas

- 4.1 Use with Zener barriers
 - 4.1.1 Power supply
 - 4.1.2 Pulse input
 - 4.1.3 Switch contact input
 - 4.1.4 Open Collector input
 - 4.1.5 2-wire proximity detector input
 - 4.1.6 Magnetic pick-off input
 - 4.1.7 Voltage pulse input
 - 4.1.8 Remote reset
- 4.2 Use with galvanic isolators
 - 4.2.1 Power supply
 - 4.2.2 Pulse input
 - 4.2.3 Switch contact input
 - 4.2.4 2-wire proximity detector input
 - 4.2.5 Magnetic pick-off input
 - 4.2.6 Voltage pulse input
 - 4.2.7 Remote reset

5. Installation

- 5.1 Location
- 5.2 EMC
- 5.3 Installation procedure
- 5.4 Scale card

6. Configuration and Calibration

- 6.1 Calibration structure
- 6.2 Accessing configuration functions
- 6.3 Summary of configuration functions
- 6.4 Input: input
- 6.5 Input type: input type
- 6.6 Debounce: debounce
- 6.7 Display update interval: update interval
- 6.8 Run-time display: display
- 6.9 Position of the decimal points: decimal
- 6.10 Speed scale factor: scale factor
- 6.11 Timebase: timebase
- 6.12 Display filter: filter
- 6.13 Clip-off: clip-off
- 6.14 Local reset: local reset
- 6.15 Local run-time reset: $\text{local run-time reset}$
- 6.16 Local grand total run-time reset: $\text{local grand total run-time reset}$
- 6.17 Grand total run-time reset from within the configuration menu: $\text{grand total run-time reset}$
- 6.18 Security code: security code
- 6.19 Reset configuration to factory defaults: reset to defaults

7. Configuration example

- 7.1 Configuration procedure

8. Maintenance

- 8.1 Fault finding during commissioning
- 8.2 Fault finding after commissioning
- 8.3 Servicing
- 8.4 Routine maintenance
- 8.5 Guarantee
- 8.6 Customer comments

The BA317E and BA318E are CE marked to show compliance with the European Explosive Atmospheres Directive 2014/34/EU and the European EMC Directive 2014/30/EU.

They are also UKCA marked to show compliance with UK statutory requirements Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations UKSI 2016:1107 (as amended) and with the Electromagnetic Compatibility Regulations UKSI 2016:1091 (as amended).

CONTENTS CONTINUED

9. Accessories

9.1 Scale card

9.2 Tag information

9.3 Display backlight

9.4 Alarms

- 9.4.1 Solid state output
- 9.4.2 Intrinsic safety
- 9.4.3 Configuration & adjustment
- 9.4.4 Alarm enable: *EnbL*
- 9.4.5 Type of alarm: *TYPE*
- 9.4.6 Setpoint adjustment: *SP1x & SP2x*
- 9.4.7 Alarm function: *HiLo*
- 9.4.8 Alarm output status: *no.nL*
- 9.4.9 Hysteresis: *HStL*
- 9.4.10 Alarm delay: *dELR*
- 9.4.11 Alarm silence time: *SiL*
- 9.4.12 Flash display when alarm occurs:
FLSH
- 9.4.13 Access Setpoint: *RESP*
- 9.4.14 Adjusting alarm setpoints
from display mode.

9.5 Pulse Output

- 9.5.1 Intrinsic safety
- 9.5.2 System design
- 9.5.3 Configuration
- 9.5.4 Access Pulse output sub-menu:
PULSE.oP
- 9.5.5 Enable pulse output: *EnbL*
- 9.5.6 Source of output pulse: *SourceE*
- 9.5.7 Divide output pulse frequency:
diUdE
- 9.5.8 Define output pulse width: *durRt, on*
- 9.5.9 Pulse storage

9.6 4/20mA output

- 9.6.1 Intrinsic safety
- 9.6.2 System design
- 9.6.3 Configuration & calibration
- 9.6.4 Access 4/20mA output sub-menu:
4-20.oP
- 9.6.5 Display which corresponds to 4mA
output: *4.0000*
- 9.6.6 Display which corresponds to 20mA
output: *20.0000*

Appendix 1 IECEx certification

Appendix 2 ETL & cETL certification

1. DESCRIPTION

These intrinsically safe, single input Tachometers are primarily intended for measuring rotational speed within hazardous areas. To assist with routine maintenance, they also include a run-time clock that records the number of hours that the monitored machinery has been operating.

The two models are electrically similar, but have different size displays and enclosures. The available factory fitted accessories also vary.

Model	Displays	Bezel size
BA317E	Speed 8 digits 9mm high Run-time 6 digits 6mm high	96 x 48mm
BA318E	Speed 8 digits 18mm high Run-time 6 digits 12mm high	144 x 72mm

This instruction manual supplements the abbreviated instruction sheet supplied with each instrument.

Both models have ATEX & UKCA intrinsic safety certification for use in gas hazardous areas.

For international applications both models also have IECEx certification which is described in Appendix 1.

For applications in the USA or Canada, both models also have ETL and cETL certification which is described in Appendix 2.

2. OPERATION

Fig 1 shows a simplified block diagram of the BA317E and BA318E Tachometers. The instruments can accept pulses from most types of sensor and display speed per second, minute or per hour, plus run-time in hours on a separate display.

The BA317E and BA318E have a single pair of input terminals for connection to all types of sensor. When connected to 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 connects power to the sensor input terminals.

Factory fitted accessories include an internally powered display backlight, dual alarms and an isolated 4/20mA output which may be configured to retransmit any part of the speed display.

The larger BA318E Tachometer is always supplied with an isolated pulse output which can be configured to synchronously retransmit the pulse input, or a frequency divided and widened output. This pulse output is only available on the smaller BA317E Tachometer as an option.

Factory fitted optional accessories for the two models are shown below:

BA317E 96 x 48mm	BA318E 144 x 72mm
Backlight	Backlight
Isolated dual alarms*	Isolated dual alarms
or	
Isolated 4/20mA output*	Isolated 4/20mA output
or	
Isolated pulse output*	
<i>*Only one output option may be fitted to BA317E</i>	<i>Isolated pulse output always fitted to BA318E</i>

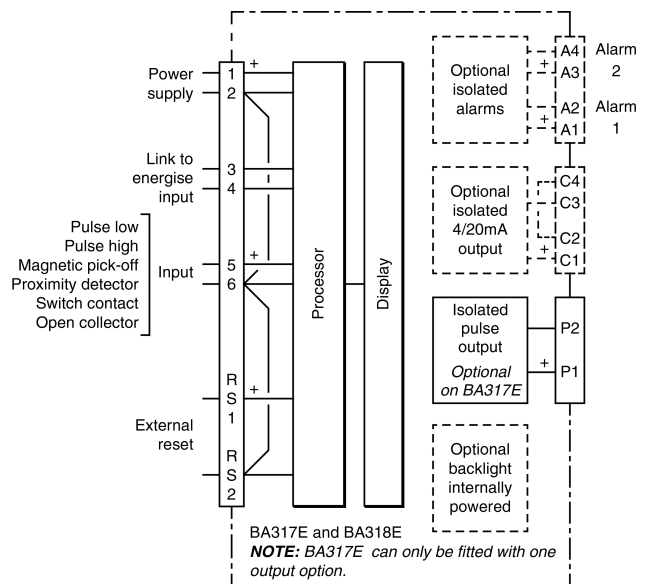


Fig 1 BA317E and BA318E block diagram

2.1 Initialisation

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









All segments of the display are activated



Tachometer starts functioning, using the configuration information stored in the instrument's permanent memory. Unless the run-time display has been reset to zero, new elapsed time will be added to the existing run-time total.

2.2 Controls

The BA317E and BA318E are controlled and configured via four front panel push buttons. In the display mode i.e. when the instrument is displaying speed the push button functions are:

Push Button Functions

-  +  To reset run-time to zero press buttons simultaneously for three seconds or longer. This is a configurable function. See 6.15
-  +  To reset grand total run-time to zero press buttons simultaneously for ten seconds or longer. This is a configurable function. See 6.16
-  +  Shows in succession, firmware version number, instrument function FREQ and any output accessories that are fitted:
- R Dual alarm outputs
 - P Pulse output
(Fitted to all BA318E)
 - I 4/20mA output
-  +  Access to configuration menu

Note: When optional alarms are fitted, the Tachometer may be configured to provide direct access to the alarm setpoints from the display mode when the  +  buttons are operated. See 9.4.13 and 9.4.14

2.3 Displays

The BA317E and BA318E have two digital displays and associated annunciators, plus a pulse input indicator as shown on page 1.

Speed display

On larger eight digit display

Run-time display

On smaller six digit display. Shows time in hours, with a resolution of 0.1 hours, that monitored machinery has been operating. May be turned off. See 6.8

Pulse input 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 at which the run-time timer stops functioning.

Reset annunciator

Activated while run-time display is being reset to zero.

Grand total annunciator

Activated while run-time grand total which is shown in hours is being displayed.

RTx annunciator

Retransmitted pulse annunciator. Depends upon the setting of SOURCE in the pulse output configuration menu.

SCALE#

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

dr FEE

Annunciator continuously activated.

3. INTRINSIC SAFETY CERTIFICATION

The BA317E and the BA318E Tachometer have IECEx, ATEX and UKEX gas certification. This section of the instruction manual describes ATEX & UKEX gas certification. IECEx and other approvals are each described in separate appendixes to this manual.

3.1 ATEX & UKEX gas certification

The BA317E and the BA318E comply with the European ATEX Directive and UK statutory requirements for Group II, Category 1G equipment. The Tachometers carry both the EU community CE mark and the UKCA mark. Subject to local codes of practice they may be installed in any of the European Economic Area (EEA) member countries and in the UK.

This section of the instruction manual describes ATEX & UKEX installations in explosive gas atmospheres conforming with EN60079-14 *Electrical installation design, selection and erection*. When designing systems the local Code of Practice should be consulted.

3.2 Zones, gas groups and T rating

The BA317E and BA318E Tachometer have been certified Ex ia IIC T5 Ga. When connected to a suitable system they 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.

Note: The specified operating temperature of the BA317E and the BA318E is -40 to +70°C. At temperatures below -20°C the display digits will change more slowly and the contrast will be reduced, but the instruments will continue to function

This allows the Tachometer 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 Special conditions for safe use

The ATEX & UKCA certificates have an 'X' suffix indicating that special conditions apply to prevent an electrostatic charge developing on the outside of the instrument enclosure.

CAUTION

To avoid an electrostatic charge being generated instrument enclosure should only be cleaned with a damp cloth.

3.4 Power supply

When installed in a hazardous area the BA317E and the BA318E must be powered via a certified Zener barrier or galvanic isolator from a dc supply located in the safe area.

The input safety parameters of terminals 1 and 2 are:

U _i	=	28V dc
I _i	=	200mA dc
P _i	=	0.84W

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

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

C _i	=	2nF
L _i	=	4μH

To determine the maximum permissible cable parameters the above figures, which are small and may be ignored in many applications, should be subtracted from the maximum permitted cable parameters specified for the Zener barrier or galvanic isolator powering the BA317E or BA318E Tachometer.

3.5 Pulse input terminals

The BA317E and BA318E Tachometer have a single pair of pulse input terminals 5 and 6 that are used for connecting all types of sensor to the instrument. For sensors that require energising, such as a switch contact or a 2-wire proximity detector, fitting an external link between tachometer terminals 3 & 4 connects an internal 7V, 6mA supply to the input terminals. This link is not required when the Tachometer is connected to a sensor with a voltage output such as a magnetic pick-off.

The table below shows which types of sensor require a link fitting and the resulting intrinsic safety output parameters of the input terminals 5 and 6.

Type of input	Link 3 & 4	Pulse input terminals 5 & 6 safety description		
		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	1V	0.5mA	0.2mW
Voltage input (low)	No	1V	0.5mA	0.2mW
Voltage input (high)	No	1V	0.5mA	0.2mW

3.5.1 Sensors that don't require energising

For intrinsic safety purposes, sources of energy with output parameters less than 1.5V; 100mA and 25mW are considered to be *simple apparatus* (EN60079-11), which allows them to be ignored when designing most intrinsically safe systems.

When terminals 3 and 4 are not linked, the output parameters of the Tachometer's input terminals 5 and 6 comply with the requirements for *simple apparatus* which allows these output parameters to be ignored when considering the safety of the circuit connected to the input of the Tachometer.

Any certified intrinsically safe apparatus or circuit may be safely connected to the Tachometer input terminals 5 and 6 providing that the output parameters of the apparatus or circuit are equal to or less than:

$$\begin{aligned} U_o &\leq 28V \text{ dc} \\ I_o &\leq 200mA \text{ dc} \\ P_o &\leq 0.84W \end{aligned}$$

This allows a certified intrinsically safe voltage pulse output sensor, or a certified intrinsically safe magnetic pick-off to be directly connected to the Tachometer input terminals providing:

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

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

The BA317E and BA318E intrinsic safety certificates specifies that the equivalent capacitance and inductance between the two pulse input terminals 5 and 6 is:

$$\begin{aligned} C_i &= 2nF \\ L_i &= 4\mu H \end{aligned}$$

To determine the maximum permissible cable parameters these figures should be subtracted from the maximum permitted cable parameters specified for the sensor connected to the input terminals of the Tachometer. The Tachometer input parameters are very small and are unlikely to make any significant difference to the allowable cable parameters.

3.5.2 sensors that do require energising

Sensors with a switch contact, proximity detector or open collector output require energising which is achieved by linking Tachometer terminals 3 and 4 together as described in section 3.5. When energised, the output parameters of the Tachometer pulse input terminals 5 and 6 are:

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

These parameters do not comply with the requirements for *simple apparatus* and should be included when considering the safety of the circuit connected to the input of the Tachometer.

Any certified intrinsically safe sensor may be connected to a BA317E or BA318E energised input providing that:

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

$$\begin{aligned} U_i &\geq 10.5V \text{ dc} \\ I_i &\geq 9.2mA \text{ dc} \\ P_i &\geq 24mW \end{aligned}$$

or complies with the requirements for *simple apparatus*.

- The sensor and associated wiring can withstand a 500V rms insulation test to earth.
- The sensor is located in the same hazardous area as the BA317E or BA318E.
- Minimum sensor operating voltage 7.5V (2-wire proximity detector).

This is not restrictive and most sensors will comply.

This allows a mechanically operated switch, open collector transistor or a certified intrinsically safe NAMUR proximity detector to be directly connected to the Tachometer input terminals.

The maximum capacitance and inductance that may be safely connected between the two pulse input terminals 5 and 6 is:

$$\begin{aligned}C_o &= 2.4\mu\text{F} \\L_o &= 200\text{mH}\end{aligned}$$

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

3.6 Remote reset terminals

The BA317E and BA318E run-time display may be reset to zero by connecting the reset terminals RS1 and RS2 together for more than one second. These two terminals have the following input and output safety parameters:

$$\begin{aligned}U_o &= 3.8\text{V dc} \\I_o &= 1\text{mA} \\P_o &= 1\text{mW} \\U_i &= 28\text{V dc} \\I_i &= 200\text{mA} \\P_i &= 0.84\text{W}\end{aligned}$$

The equivalent capacitance and inductance between them is:

$$\begin{aligned}C_i &= 0 \\L_i &= 0\end{aligned}$$

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

$$\begin{aligned}C_o &= 40\mu\text{F} \\L_o &= 1\text{H}\end{aligned}$$

The reset terminals may be directly connected to any mechanically operated switch located within the same hazardous area as the BA317E or BA318E Tachometer. The switch and associated wiring should be able to withstand a 500V rms insulation test to earth.

The run-time display may be reset to zero from within the hazardous area by any mechanically operated switch connected directly to terminals RS1 and RS2. To reset the run-time display from the safe area a Zener barrier or intrinsically safe relay is required to transfer the contact closure into the hazardous area. Almost any intrinsically safe relay with certification permitting the contacts to be connected to equipment in the hazardous area may be used. A positive diode return Zener barrier may also be used as shown in Fig 2.

Alternatively, the BA317E or BA318E may be configured so that the run-time display is reset to zero when the ▼ and ▲ push buttons are operated simultaneously for more than two seconds. See 6.15

3.7 Certification label information

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



BA317E Certification information label

4. SYSTEM DESIGN FOR 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 BA317E or BA318E.

Terminals 2, 6 and RS2 of the BA317E and BA318E Tachometer 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 certified Zener barrier may be used with the BA317E and BA318E providing their output parameters do not exceed the input parameters of the terminals to which they are connected. Only one polarity of Zener barrier i.e. positive or negative, may be used in a Tachometer system.

Fig 2 illustrates the basic circuit that is used for all BA317E and BA318E installations protected by Zener barriers. For simplicity, connections for the pulse output and optional alarms and 4/20mA output are shown separately in section 9 this manual.

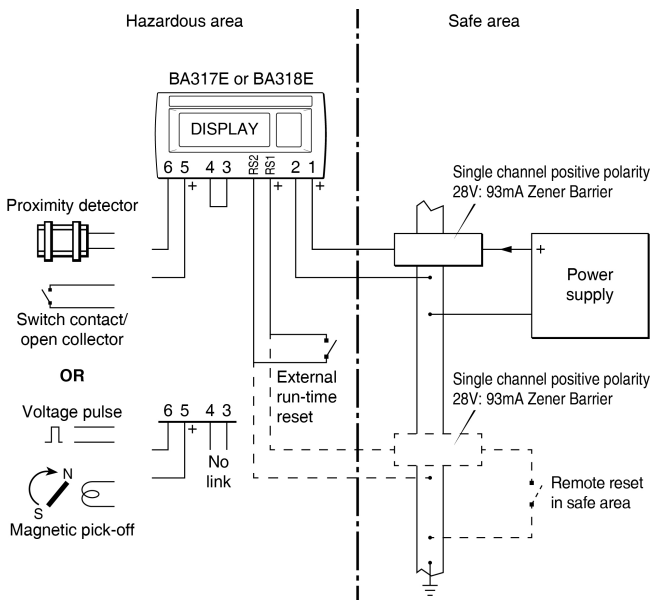


Fig 2 BA317E or BA318E used with Zener barriers

Alternatively the pulse source may be located in the safe area. Fig 3 shows how an additional Zener barrier is used to transfer the pulse input to the Tachometer 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 BA317E and the BA318E. See Fig 1.

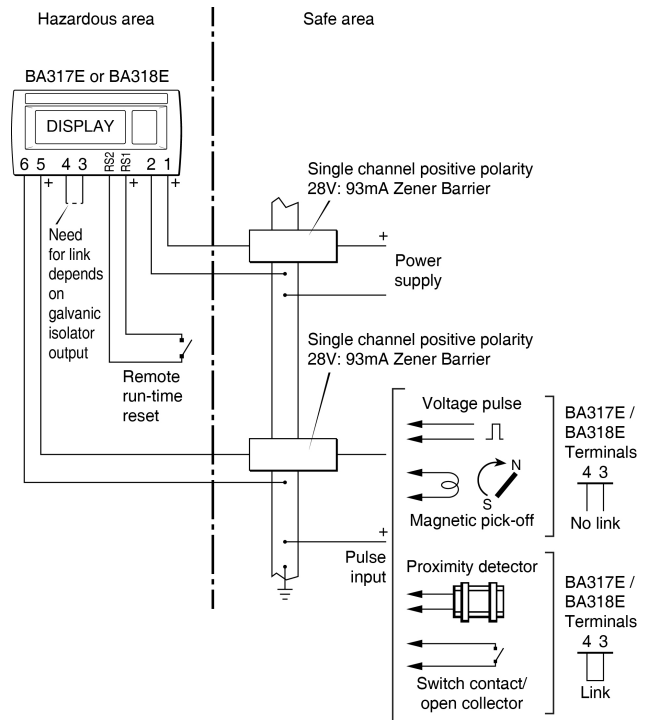


Fig 3 BA317E or BA318E used with Zener barriers pulse source in safe area.

4.1.1 Power supply

The BA317E and the BA318E Tachometers require 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 BA317E or BA318E Tachometer providing the output safety parameters of the barrier are equal to or less than the input safety parameters of terminals 1 & 2 of the Tachometer.

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 increase the instrument's current consumption and therefore increases the minimum safe area operating voltage, see section 9.3 for details.

4.1.2 Pulse input

As shown in Figs 2 and 3 the BA317E and the BA318E can display the speed and total run-time from sensors 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 sensor is located within the same hazardous area as the Tachometer.

The following table shows the Tachometer's input switching thresholds when conditioned for use with sensors having different outputs. For reliable operation the Tachometer's pulse input must fall below the lower threshold and rise above the upper threshold.

Input sensor	Switching thresholds	
	Lower	Upper
Open collector	2k Ω	10k Ω
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	100 Ω	1000 Ω

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

4.1.3 Switch contact input

Any sensor with a mechanically or magnetically activated switch contact located in the hazardous area may be directly connected to pulse input terminals 5 and 6, providing the sensor and associated wiring can withstand a 500V rms insulation test to earth. Most magnetically activated reed relays comply with these requirements. The BA317E and the BA318E contain a configurable debounce circuit to prevent contact bounce being counted. See section 6.6.

4.1.4 Open collector input

Certified intrinsically safe sensors with an open collector output may be directly connected to input terminals 5 & 6 providing the sensor is located in the same hazardous area as the Tachometer and the associated wiring can withstand a 500V rms insulation test to earth.

The BA317E and BA318E contain a configurable debounce circuit to prevent false triggering. Three levels of de-bounce protection are independently available. See section 6.6.

4.1.5 2-wire proximity detector input

Most certified intrinsically safe sensors incorporating a NAMUR 2-wire proximity detector may be directly connected to the input of a BA317E or BA318E, providing the input safety parameters of the sensor (proximity detector) are equal to, or greater than, the output safety parameters of Tachometer's pulse input. i.e.

$$\begin{aligned} U_i &\geq 10.5V \text{ dc} \\ I_i &\geq 8.2mA \text{ dc} \\ P_i &\geq 25mW \end{aligned}$$

The minimum operating voltage of the sensor (proximity detector) is less than 7.5V. The sensor must be located in the same hazardous area as the BA317E or BA318E and with the associated wiring be able to withstand a 500V rms insulation test to earth.

The Tachometer contains a configurable debounce circuit to prevent false triggering. Three levels of debounce protection are independently available for each input. See section 6.6.

4.1.6 Magnetic pick-off input

sensors incorporating a magnetic pick-off to sense rotation will have a low level voltage output unless the sensor incorporates an amplifier. $[0, L]$ in the BA317E and BA318E input configuration menu is a low level voltage pulse input intended for use with an intrinsically safe magnetic pick-off. When a Tachometer is configured for $[0, L]$ the input terminals comply with the requirements for *simple apparatus* allowing connection to any certified intrinsically safe magnetic sensor having output parameters equal to or less than:

$$\begin{aligned} U_o &\leq 28V \text{ dc} \\ I_o &\leq 200mA \text{ dc} \\ P_o &\leq 0.84W \end{aligned}$$

The maximum permitted cable parameters will be the magnetic pick-off's C_o and L_o specified on it's intrinsic safety certificate, less the Tachometers pulse input parameters C_i and L_i which are small and can often be ignored.

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

Both Tachometers contain a configurable debounce circuit to prevent false triggering of the instrument. See section 6.6.

4.1.7 Voltage pulse input

Two voltage pulse input ranges are selectable in the BA317E and BA318E Tachometer configuration menu, $U_{oLLE5\ L}$ and $U_{oLLE5\ H}$. When configured for either of the voltage pulse ranges, the input terminals 5 & 6 comply with the requirements for *simple apparatus*. This allows the inputs to be connected to any certified intrinsically safe sensor with a voltage output located in the same hazardous area as the Tachometer having output parameters equal to or less than:

$$\begin{aligned} U_o &\leq 28\text{V dc} \\ I_o &\leq 200\text{mA dc} \\ P_o &\leq 0.84\text{W} \end{aligned}$$

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



The maximum permitted cable parameters will be defined by the intrinsic safety certification of the sensor less the Tachometer's input parameters C_i and L_i which are small and can often be ignored.

The Tachometer contains a configurable debounce circuit to prevent false triggering of the instrument. Three levels of de-bounce protection are independently available for each input. See section 6.6.

4.1.8 Remote reset

The BA317E and the BA318E run-time display may be remotely reset to zero by connecting terminals RS1 & RS2 together for more than one second. Permanent interconnection inhibits the run-time clock. Remote resetting may be accomplished by any mechanically operated switch located in the same hazardous area as the Tachometer providing it and the associated wiring can withstand a 500V rms insulation test to earth. No Zener barrier or galvanic isolator is required.

A BA317E or BA318E run-time display may also be remotely reset to zero from the safe area. Any switch may be used but a Zener barrier is required to transfer the contact closure into the hazardous area 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 the BA317E or a BA318E may be reset from both the safe and the hazardous area.

Note: The BA317E and the BA318E can be configured to reset the run-time display to zero when the  and  push buttons are operated simultaneously for more than two seconds - see 6.15.

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 certified galvanic isolator with output parameters equal to or less than the input parameters of the BA317E and BA318E having the correct function may be used.

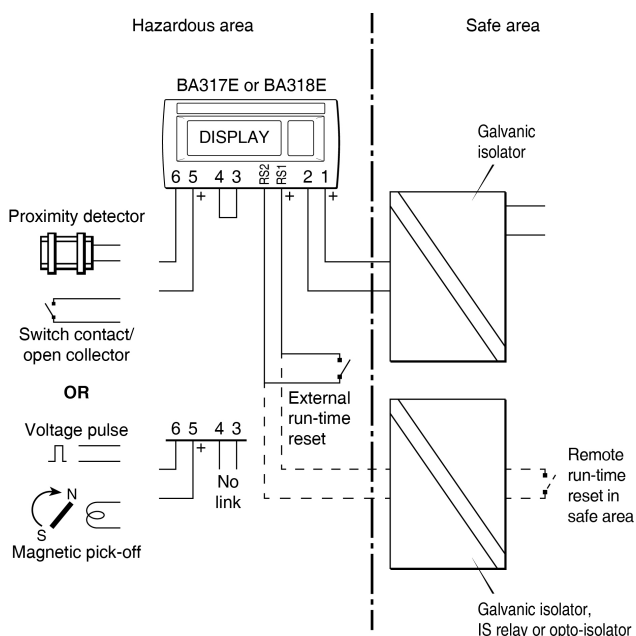


Fig 4 BA317E or BA318E used with galvanic isolators.

Fig 4 illustrates the basic circuit that is used for all BA317E and BA318E installations protected by galvanic isolators. For simplicity, connections for the optional pulse output, 4/20mA output and alarms are shown separately in section 9 of this manual.

Alternatively the pulse source may be located in the safe area. Fig 5 shows how an additional galvanic isolator is used to transfer the signal to the Tachometer in the hazardous area, although it may be difficult to find isolators for use with some types of sensor.

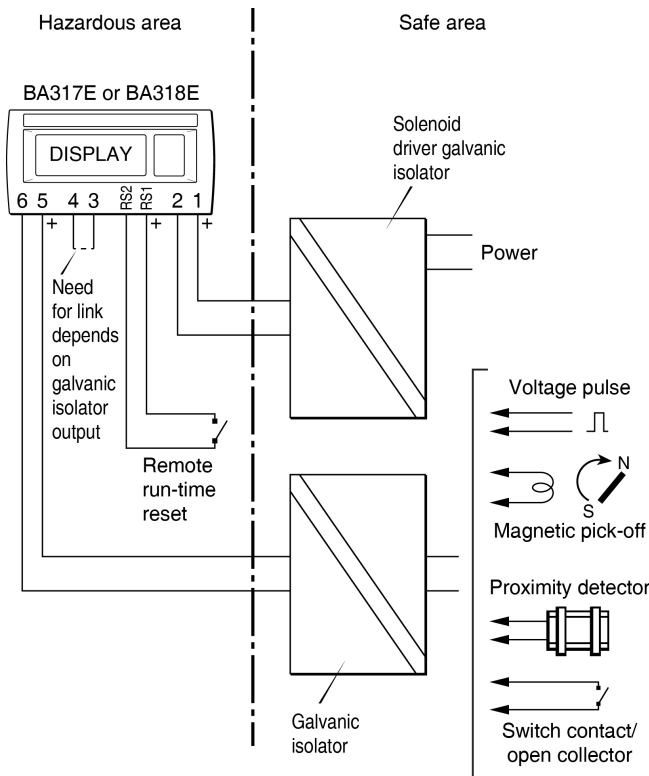


Fig 5 Pulse source in safe area

4.2.1 Power supply

The BA317E and the BA318E Tachometers consume 10mA plus 6mA sensor current when terminals 3 and 4 are joined together. They require a minimum operating voltage of 10V between terminals 1 and 2. Any certified galvanic isolator may be used to power a BA317E or BA318E Tachometer providing the output safety parameters of the isolator are equal to or less than the input safety parameters of terminals 1 & 2. These requirements are not restrictive and allow a wide range of galvanic isolators, such as solenoid drivers, to be used.

Note: The optional factory fitted display backlight increase the instrument's current consumption. See section 9.3 for details.

4.2.2 Pulse input

As shown in Fig 4 the BA317E and the BA318E can accept pulses from a wide variety of sensors in the hazardous area, or from the safe area as shown in Fig 5.

No galvanic isolator is required in series with the input if the intrinsically safe pulse sensor is located within the same hazardous area as the Tachometer.

The following table shows the Tachometer switching thresholds when configured for various sensors. For reliable counting the input signal must fall below the lower threshold and rise above the upper threshold.

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

4.2.3 Switch contact input

Any mechanically activated switch contact located in the hazardous area may be directly connected to pulse input terminals 5 and 6 providing the switch and associated wiring can withstand a 500V rms insulation test to earth. Most magnetically activated reed relays used comply with these requirements. The BA317E and the BA318E contain a configurable debounce circuit to prevent contact bounce being counted.

See section 6.6 for details of the maximum counting frequency.

4.2.4 2-wire proximity detector input

Most sensors incorporating a certified intrinsically safe 2-wire proximity detector complying with the NAMUR switching thresholds may be used, providing the input safety parameters of the sensor are equal to or greater than the output safety parameters of terminals 5 and 6 of the Tachometer. i.e.

$$\begin{aligned}
 U_i &\geq 10.5V \text{ dc} \\
 I_i &\geq 9.2mA \text{ dc} \\
 P_i &\geq 24mW
 \end{aligned}$$

and the minimum operating voltage of the sensor is less than 7.5V.

See section 6.6 for details of the maximum counting frequency.

4.2.5 Magnetic pick-off input

U₀ L in the Tachometer input configuration menu is a low level voltage pulse input intended for use with magnetic pick-off sensors producing an ac output. For a U₀ L input the pulse input terminals 5 and 6 of the Tachometer comply with the requirements for *simple apparatus* allowing connection to any certified intrinsically safe magnetic pick-off within the hazardous area having output parameters equal to or less than:

$$\begin{array}{lcl} U_0 & \leq & 28\text{V dc} \\ I_0 & \leq & 200\text{mA dc} \\ P_0 & \leq & 0.84\text{W} \end{array}$$

The maximum permitted cable parameters will be defined by the magnetic pick-off's intrinsic safety certificate, less the Tachometer input parameters which are small and can usually be ignored,

See section 6.6 for details of the maximum counting frequency.

4.2.6 Voltage pulse input

Two voltage pulse input ranges are selectable in the configuration menu, U₀Lt5 L and U₀Lt5 H. When configured for either voltage pulse ranges the pulse input terminals 5 and 6 of the Tachometer comply with the requirements for *simple apparatus*. This allows the Tachometer input terminals to be connected to any certified intrinsically safe voltage source within the hazardous area having output parameters equal to or less than:

$$\begin{array}{lcl} U_0 & \leq & 28\text{V dc} \\ I_0 & \leq & 200\text{mA dc} \\ P_0 & \leq & 0.84\text{W} \end{array}$$

The BA317E and the BA318E Tachometer may therefore be connected directly to most certified intrinsically safe sensors with a high level voltage pulse output.

The maximum permitted cable parameters will be defined by the sensor's intrinsic safety certificate, less the Tachometer's input parameters which are small and can usually be ignored.

See section 6.6 for details of the maximum counting frequency.

4.2.7 Remote reset

The BA317E and the BA318E run-time display may be remotely reset to zero by connecting terminals RS1 & RS2 together for more than one second. Permanent interconnection inhibits the run-time clock. Remote resetting may be accomplished by any mechanically operated switch located in the same hazardous area as the Tachometer providing it and the associated wiring can withstand a 500V rms insulation test to earth. No galvanic isolator is required.

A BA317E or BA318E run-time display may also be remotely reset to zero from the safe area. Any switch may be used but a galvanic isolator or IS relay is required to transfer the contact closure into the hazardous area. Almost any device with a contact that may be connected to equipment in the hazardous area may be used for this application. Fig 4 illustrates how the BA317E and the BA318E may be reset from both the safe and the hazardous area.

Note: The BA317E and the BA318E can be configured to reset the run-time display to zero when the ▼ and ▲ push buttons are operated simultaneously for more than two seconds - see section 6.15.

5. INSTALLATION

5.1 Location

Both models have a robust glass reinforced modified PPO enclosure with a toughened glass window. The fronts of both Tachometers have IP66 ingress protection and a gasket seals the joint between the instrument enclosure and the panel. The rear of both Tachometers have IP20 ingress protection.

The Tachometer may be installed in any panel providing that the operating temperature is between -40°C and $+70^{\circ}\text{C}$ and the intrinsic safety requirements are complied with. At temperatures below -20°C the display digits will change more slowly and the contrast will be reduced, but the instruments will continue to function i.e. run-time hours will be counted, retransmitted outputs will continue to operate and alarms will function.

Figs 6A and 6B show the overall dimensions of the 96 x 48mm BA317E and the 144 x 72mm BA318E together with the recommended panel cut-out dimensions. To achieve an IP66 seal between the instrument enclosure and the instrument panel the smaller tolerance aperture must be used, and the BA318E must be secured with four panel mounting clamps.

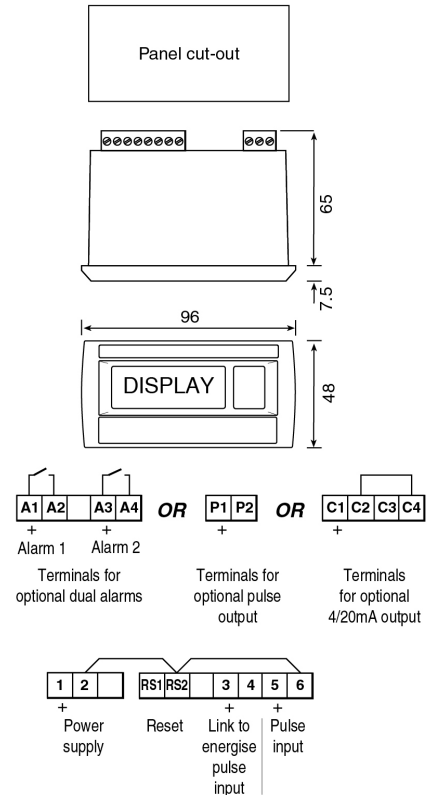
Cut-out dimensions

Recommended for all installations.

Mandatory to achieve an IP66 seal between the instrument and the panel
 $90 +0.5/-0.0 \times 43.5 +0.5/-0.0$

DIN 43 700

$92.0 +0.8/-0.0 \times 45 +0.6 -0.0$



Support panel wiring to prevent vibration damage

Note: Optional backlight is internally powered

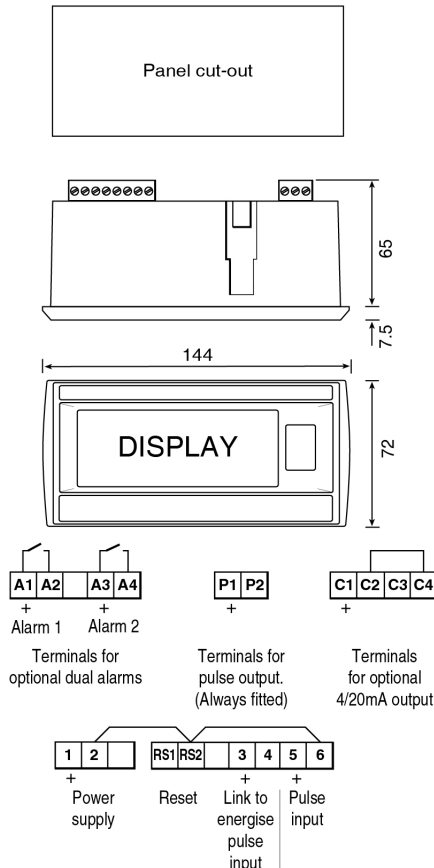
Fig 6A BA317E dimensions & terminals

Cut-out dimensions

Recommended for all installations.
Mandatory to achieve an IP66 seal
between the instrument and the panel
 $136.0 +0.5/-0.0 \times 66.2 +0.5/-0.0$

DIN 43 700

$138.0 +1.0/-0.0 \times 68.0 +0.7/-0.0$



Support panel wiring to prevent vibration damage

Note: Optional backlight is internally powered

Fig 6B BA318E dimensions & terminals

CAUTION

Although both Tachometers have IP66 front protection, the front of the instrument should be shielded from continuous direct sunlight and severe weather conditions.

5.2 EMC

The BA317E and BA318E are compliant with the European EMC Directive and the UK EMC statutory requirements. For specified immunity all wiring should be in screened twisted pairs, with the screens earthed at one point within the safe area.

5.3 Installation Procedure

- Cut the specified aperture in the panel. To achieve an IP66 seal between the instrument enclosure and the instrument panel the aperture must have the tighter tolerances specified in Figs 6A and 6B.
- Slide the gasket over the body of the Tachometer before inserting the instrument into the panel aperture.
- Firstly ensure that all the panel mounting clamps are closed by turning the knurled screws fully anti clockwise until the two pips in the clamp foot align with holes in the clamp body.
- Place a clamp in the recess on each side of the Tachometer, pulling gently to slide it onto the dovetail as shown in Fig 7. Push the knurled screw slightly forward to engage the thread and tighten by turning clockwise until it is just finger tight. When all clamps are fitted ensure that the gasket behind the front panel bezel is correctly positioned before fully tightening the clamps to secure the instrument. The maximum recommended clamp tightening torque is 22cNm (1.95 lbf in) which is approximately equivalent to finger-tight plus one half turn. **Do not over tighten.**
- Four panel mounting clamps are required to achieve an IP66 seal between a BA318E and the instrument panel.
- Connect the panel wiring to the rear terminal block(s) as shown in Figs 6A and 6B. To simplify installation, the terminals are removable so that the panel wiring can be completed before the instrument is installed. To prevent vibration damage **ensure panel wiring is supported.**

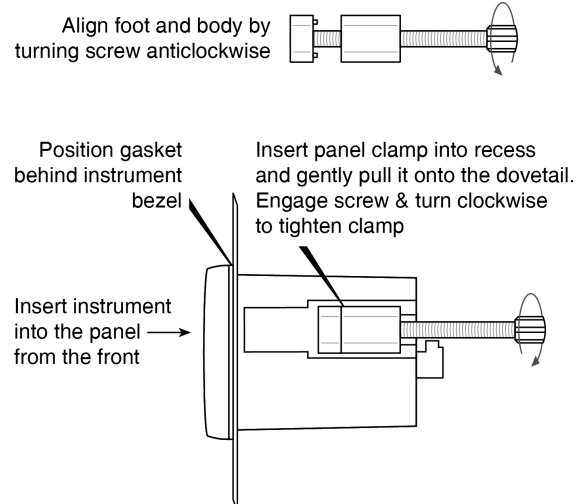


Fig 7 Fitting panel mounting clamps

5.4 Scale card

The Tachometer's units of measurement are shown on a printed scale card in a window at the right hand side of the display. The scale card is mounted on a flexible strip that is inserted into a slot at the rear of the instrument as shown in Fig 8. Thus the scale card can easily be changed without removing the Tachometer from the panel or opening the instrument enclosure.

New Tachometers are supplied with a printed scale card showing the requested units of measurement, if this information is not supplied when the instrument is ordered a blank card will be fitted.

A pack of self-adhesive scale cards printed with common units of measurement is available as an accessory from BEKA associates. Custom printed scale cards can also be supplied.

To change a scale card, unclip the tapered end of the flexible strip at the rear of the instrument by gently pushing it upwards and pulling it out of the enclosure. Peel the existing scale card from the flexible strip and replace it with a new printed card, which should be aligned as shown below. Do not fit a new scale card on top of an existing card.

Install the new scale card by gently pushing the flexible strip into the slot at the rear of the Tachometer, when it reaches the internal end-stop secure it by pushing the end of the flexible strip downwards so that the tapered section is held by the rear panel.

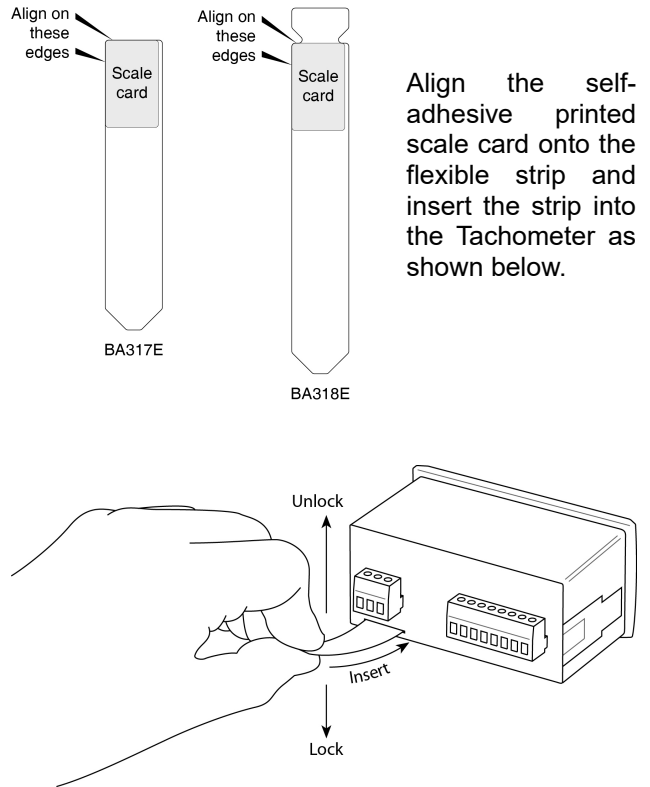


Fig 8 Inserting the flexible strip carrying the scale card into slot at the rear of Tachometer.

6.0 CONFIGURATION & CALIBRATION

The BA317E and BA318E Tachometers are 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.

When factory fitted optional alarms, pulse and 4/20mA outputs are included, additional functions appear in the configuration menu, which are described separately in section 9.

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

Function	Display	Default
Input	\div nP.tYPE	aP.CaL
Debounce	dEbouNCE	dEFRAULt
Update	uPdARE	0.5
Run-time display	dI SP-2	on
Decimal point (speed)	dP	0000.0
Speed scale factor	SCALE.S	001.00
Timebase	t-bRSE	t6-60
Filter	F, LEEr	24
Clip-off	CLP-oFF	0000.0
Local run-time reset	CLr t0t	aFF
Local grand total run-time reset.	CLr Gt0t	aFF
Security code	Code	0000

6.1 Calibration structure

Fig 9 shows the BA317E and BA318E calibration structure.

The pulse input is divided by SCALE.S to provide the required Tachometer speed display in engineering units. e.g. if a sensor monitoring a rotating shaft generates 18 pulses per revolution, to produce a display in revolutions SCALE.S should be set to 18.0.

The timebase t-bRSE is a multiplying factor that determines whether the Tachometer displays speed per second, per minute or per hour.

The Tachometer incorporates a run-time counter that displays the time in hours that the speed of the monitored machinery has been equal to or greater than the Clip-off value.

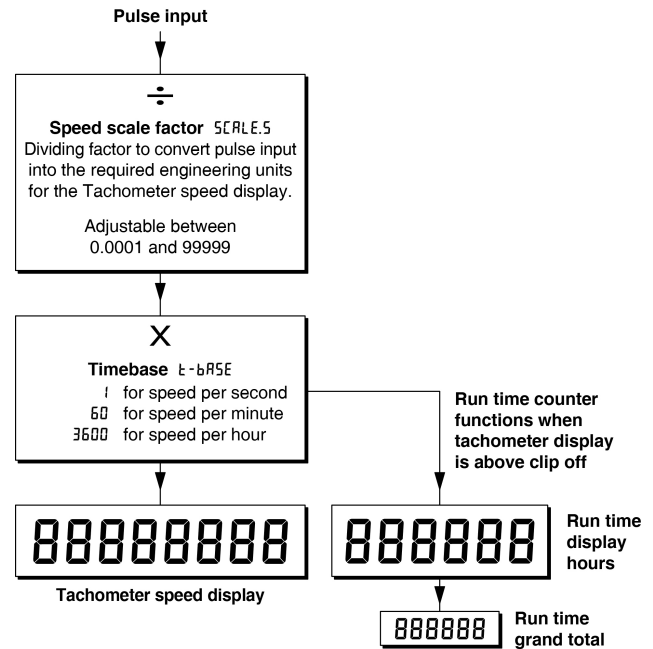


Fig 9 Calibration structure

6.2 Accessing configuration functions

Throughout this manual push buttons are shown as ∇ , \blacktriangle , P and E . Legends displayed by the instruments are shown in a seven segment font as they appear on the Tachometers e.g. nPULt and uPdARE.

Access to the configuration menu is obtained by operating the P + E push buttons simultaneously. If the instrument is not protected by a security code the first parameter nPULt 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 \blacktriangle push button to adjust the flashing 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 nPULt to be displayed. If an incorrect code is entered, or a push button is not operated within ten seconds, the instrument will automatically return to the display mode.

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





Once within the configuration menu the required parameter can be selected by scrolling through the menu using the ∇ or \blacktriangle push buttons. The configuration menu is shown diagrammatically in Fig 10.

When returning to the display mode following reconfiguration, the Tachometer will display dARE followed by SUE 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 Tachometer. If more detail is required, each section contains a reference to a full description of the function.

Display	Summary of function	Display	Summary of function
Input	<p>Input Contains sub-menu with two functions:</p> <p>InputType Select Input type</p> <p>Debounce Set debounce</p> <p>See section 6.4</p> <p>InputType Configures the Tachometer to accept one of six types of input:</p> <p>OpenCol Open collector *</p> <p>Voltage L Voltage pulse <1 >3V</p> <p>Voltage H Voltage pulse <3 >10V</p> <p>Magnetic Magnetic pick-off</p> <p>Proximity Proximity detector *</p> <p>Switch Switch contact *</p> <p>* Link terminals 3 & 4</p> <p>See section 6.5</p> <p>Debounce Defines level of input debounce applied to the pulse input to prevent false counting, three levels are selectable:</p> <p>Default</p> <p>Heavy</p> <p>Light</p> <p>See section 6.6</p>	dP	<p>Decimal points Defines the position of the decimal point in the Tachometer speed display.</p> <p>See section 6.9</p>
Update	<p>Display update interval Defines the interval between display updates from 0.5 to 5 seconds.</p> <p>See section 6.7</p>	SCALE.5	<p>Speed scale factor SCALE.5 is a dividing factor, adjustable between 0.0001 and 99999, that converts the pulse input into the required Tachometer speed display.. e.g. If a sensor monitoring a rotating shaft generates 18 pulses per revolution, to produce a Tachometer speed display in revolutions SCALE.5 should be set to 18.0.</p> <p>See section 6.10</p>
Update		Timebase	<p>Timebase Selectable multiplier allowing Tachometer speed display to be in units per second, per minute or per hour.</p> <p>Select:</p> <p>1 per second</p> <p>60 per minute</p> <p>3600 per hour</p> <p>See section 6.11</p>
5P-2	<p>Run-time display Turns the lower display, which shows run-time in hours, on or off.</p> <p>See section 6.8</p>	Filter	<p>Display filter Adjustable digital filter that reduces the noise on the Tachometer speed display, comprising two parameters each adjustable between 0 and 9. The first digit defines the amount of filtering applied to the display, the second the deviation from the displayed value at which the filter will be overridden and the Tachometer display will move rapidly to the new value.</p> <p>See section 6.12</p>
		Clip-off	<p>Clip-off Clip-off is the Tachometer speed display threshold below which the run-time clock is inhibited.</p> <p>See section 6.13</p>

Display	Summary of function	Display	Summary of function
LoL LLr	<p>Local reset</p> <p>Contains sub-menu with two functions enabling the run-time display and grand total run-time to be reset to zero via the front panel push buttons when the Tachometer is in the display mode.</p> <p>See section 6.14</p> <p>LLr tot</p> <p>When 'on' is selected, operating the  and  buttons simultaneously for more than three seconds in the display mode resets the run-time display to zero.</p> <p>See section 6.15</p> <p>LLr Gtot</p> <p>When on is selected, operating the  and  buttons simultaneously for more than 10 seconds in the display mode resets the run-time grand total to zero.</p> <p>See section 6.16</p>	<p>LLr Gtot</p> <p>Resets grand total run-time to zero.</p> <p>This function resets the grand total run-time to zero from within the configuration menu when LLr YEE is selected, and SurE is entered to confirm the instruction.</p> <p>Note: Once reset, the original grand total can not be recovered.</p> <p>See section 6.17</p> <p>Code</p> <p>Security code</p> <p>Defines a four digit alphanumeric code that 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.</p> <p>See section 6.18</p> <p>rSEt dEF</p> <p>Reset to factory defaults</p> <p>Returns the Tachometer to the factory defaults shown in section 6.0 To prevent accidental use the request must be confirmed by entering SurE before the reset will be executed.</p> <p>See section 6.19</p>	

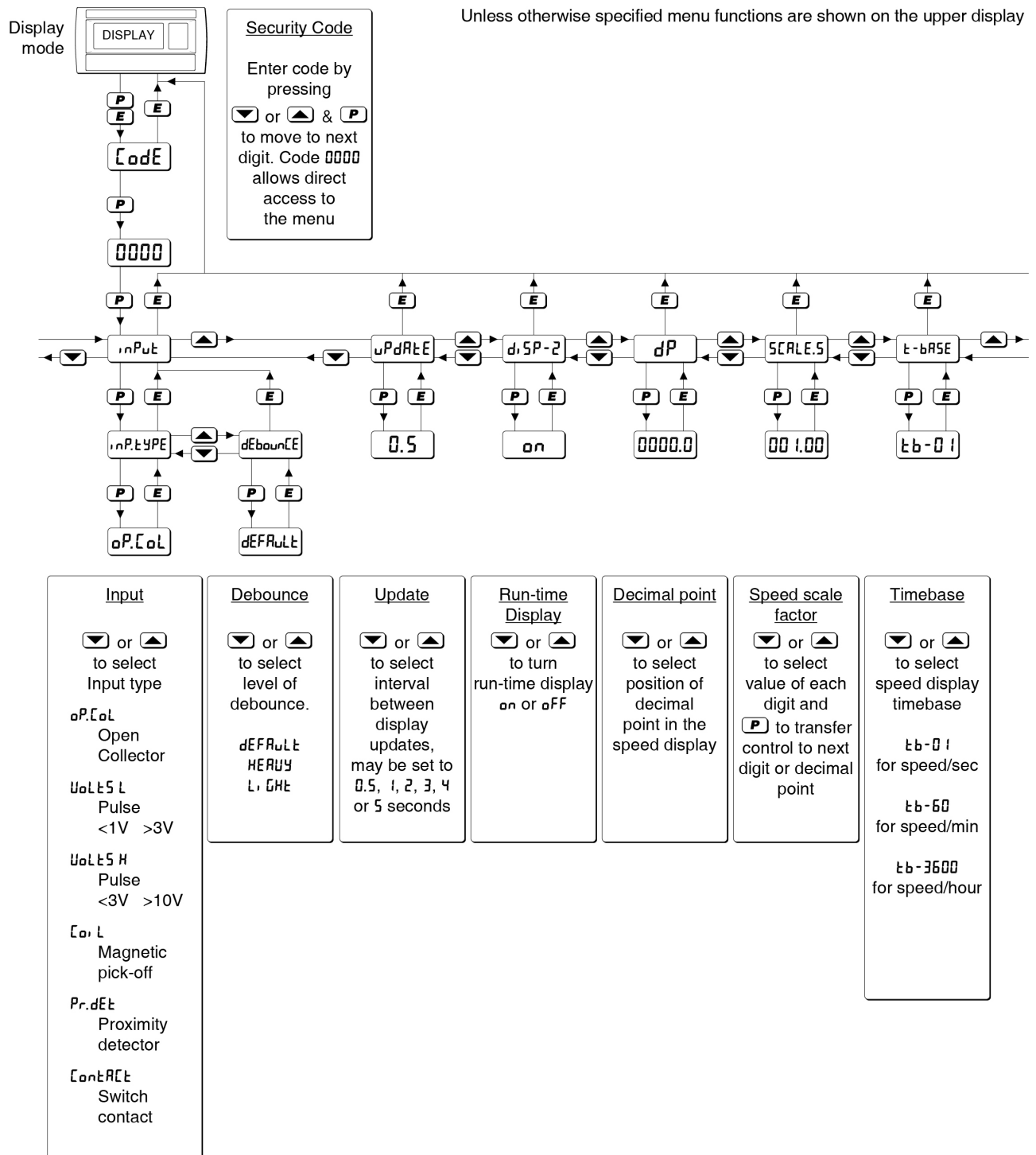
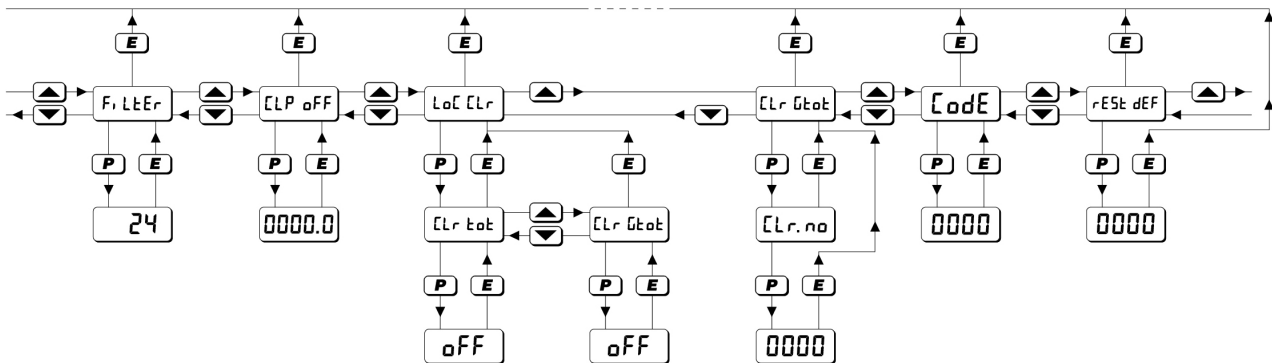


Fig 10 Configuration menu

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



<p>Filter</p> <p>▼ or ▲ to adjust value of each digit and P to transfer control to other digit</p> <p>First digit: filter magnitude</p> <p>second digit: step response</p> <p>Note: While making adjustments the filtered rate display is shown on lower display so stability can be assured</p>	<p>Clip off</p> <p>Tachometer display below which run-time timer is inhibited</p> <p>▼ or ▲ to adjust value and P to move to next digit</p>	<p>Local run-time reset</p> <p>▼ or ▲ to turn the local run-time reset function on or off. When on, run-time display is reset to zero when ▼ and ▲ are operated simultaneously in display mode for more than 3 seconds</p>	<p>Local run-time grand total reset</p> <p>▼ or ▲ to turn the local grand total run-time reset function on or off. When on, grand total run-time may be reset to zero when E and ▲ are operated simultaneously in display mode for more than 10 seconds</p>	<p>Reset run-time grand total</p> <p>Press ▼ or ▲ to select YES to reset grand total to zero</p> <p>Confirm instruction by entering SurE. Press ▼ or ▲ to adjust each digit and P to move to next digit</p>	<p>Define Security Code</p> <p>Enter by pressing ▼ or ▲ and P to move to next digit</p>	<p>Reset configuration to factory defaults</p> <p>Confirm instruction by entering SurE. Press ▼ or ▲ to adjust each digit and P to move to next digit</p>
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6.4 Input: **Input**

The Input function contains two sub-functions **InputType** and **Debounce** which configure the Tachometer input and define the amount of input noise rejection.

6.5 Input type: **InputType**

InputType is a sub-menu in the **Input** function which defines the type of input sensor or input pulse with which the Tachometer will function. To check or change the type of input, select **Input** in the main configuration menu and press **[P]** which will reveal the **InputType** prompt, pressing **[P]** again will show the present type of input. If set as required press **[E]** twice to return to the configuration menu, or repeatedly press the **[V]** or **[A]** button until the required type of input is displayed and then press **[E]** twice to return to the configuration menu.

One of following six types of input may be selected:

		Switching thresholds	
		Low	High
Open	Open collector ²	2	10kΩ
Voltage pulse low	Voltage pulse low ¹	1	3V
Voltage pulse high	Voltage pulse high ¹	3	10V
Magnetic pick-off	Magnetic pick-off	0	40mV
Proximity detector	Proximity detector ²	1.2	2.1mA
Switch contact	Switch contact ²	100	1000Ω

Notes:

- 1 Maximum voltage input +30V.
- 2 For sensors that require energising i.e. proximity detectors, switch contacts and open collectors, terminals 3 & 4 of the Tachometer 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 6.6 for maximum operating frequency.

6.6 Debounce: **Debounce**

Debounce is an adjustable sub-menu in the **Input** function which prevents the Tachometer 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 Tachometer input that has been selected in the **InputType** 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 Tachometer processes the input pulse. Input switching thresholds are shown in section 6.5.

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

The Tachometer'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 operating 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		
Debounce level	Max counting frequency	
	Type of input	
	Contact	All others
Default	250Hz	12kHz
Heavy	120Hz	2kHz
Light	1000Hz	100kHz

The minimum input 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 **InputType** prompt, press the **[V]** or **[A]** button to select **Debounce** followed by **[P]** to reveal the existing setting. Pressing the **[V]** or **[A]** 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.

6.7 Display update interval: $\mu P d R E$

If the Tachometer display is likely to change rapidly, a longer interval between display updates may simplify reading the 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 $\mu P d R E$ from the configuration menu and press \boxed{P} to reveal the current time. Pressing the \blacktriangledown or \blacktriangle button will scroll through the six times. When the required interval has been selected press \boxed{E} to enter the selection and return to the configuration menu.

6.8 Run-time display: $d, 5P-2$

This function turns the run-time display *on* or *off*, although the run-time timer continues to function when the display is off.

To check the status of the run-time display, select $d, 5P-2$ from the configuration menu and press \boxed{P} that will reveal if the run-time display is *on* or *off*. The setting may be changed by pressing the \blacktriangledown or \blacktriangle button followed by the \boxed{E} button to enter the selection and return to the configuration menu.

6.9 Position of the decimal points: dP

This function positions the decimal point in the Tachometer speed display. To adjust select dP from the configuration menu and press \boxed{P} . The Tachometer display will be activated and identified by the display annunciator as RATE. The decimal point, which may be positioned between any of the digits or may be absent is positioned by operating the \blacktriangledown or \blacktriangle push button. When set as required enter the setting and return to the configuration menu by operating the \boxed{E} button.

6.10 Speed scale factor: $5C R L E . 5$

$5C R L E . 5$ is a dividing factor adjustable between 0.0001 and 99999 that enables the Tachometer speed display to be in the required engineering units. e.g. If a sensor monitoring a rotating shaft generates 18 pulses per revolution, to produce a Tachometer speed display in revolutions $5C R L E . 5$ should be set to 18.0.

The units of the Tachometer speed display are pulses per unit of time. The unit of time is the timebase of the instrument which is determined by $t-b R 5 E$ which is described in section 6.11.

To check or change the speed scale factor select $5C R L E . 5$ from the configuration menu and press \boxed{P} which will reveal the existing value with one digit flashing. The value of the flashing digit may be changed by pressing the \blacktriangledown or \blacktriangle button.

When this digit has been adjusted as required, pressing \boxed{P} will transfer control to the next digit. When all the digits have been adjusted pressing \boxed{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 speed scale factor has been entered, press \boxed{E} to return to the $5C R L E . 5$ prompt in the configuration menu.

6.11 Timebase: $t-b R 5 E$

The timebase multiplies the Tachometer speed display by 1, 60 or 3,600 depending upon whether the Tachometer is required to display speed per second, per minute or per hour. e.g. RPS, RPM or RPH. See Fig 9.

To check or change the timebase, select $t-b R 5 E$ from the configuration menu and press \boxed{P} which will reveal the current setting. Pressing the \blacktriangledown or \blacktriangle button will scroll through the three options:

$t b - 1$	speed per second
$t b - 60$	speed per minute
$t b - 3600$	speed per hour

When the required multiplier is displayed press \boxed{E} to return to the $t-b R 5 E$ prompt in the configuration menu.

6.12 Display filter: $F, L E E r$

The digital display filter has two independent adjustable parameters enabling the Tachometer speed 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 speed at which the filtering defined by the first digit will be overridden and the Tachometer speed display will move rapidly to the new value.

Second digit	Magnitude of input step change which will override the filter and move the speed display rapidly to the new value..
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 recommended that initially the second digit is set to 0 (off) and the first digit is adjusted to provide an acceptable Tachometer display stability. The second digit should then be increased until the selected step size is greater than the noise on the display, at which setting the Tachometer speed display will become stable. These will be the optimum filter parameters for acceptable Tachometer speed display stability and a fast response to a large speed change of the monitored machinery.

To check or change the filter select **FILTEr** in the configuration menu and press **P** which will reveal the current 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 Tachometer display is shown on the lower display in place of run-time 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.

6.13 Clip-off: CLP OFF

Clip-off determines the displayed speed at which the run-time counter starts to function, below this threshold the run-time counter does not function. If the run-time counter is required to operate whenever the Tachometer is powered, clip-off should be set to zero.

If the run-time display is not being used it is not necessary to enter a clip-off value - see 6.8.

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 Tachometer speed display with one digit flashing. The value of the flashing digit may be adjusted by pressing the **▼** or **▲** button, when set as required pressing **P** will transfer control to the next digit. When all the digits have been adjusted, press the **E** button to enter the revised threshold and return to the **CLP OFF** prompt in the configuration menu.

When the Tachometer speed display falls below the clip-off threshold, the HOLD annunciator will be activated and the run-time clock will be stopped.

Note:

To avoid confusion, when the speed scale factor **SCALE.5**, timebase **t-base**, or the position of the speed display decimal point **dP** are changed, clip-off will automatically be reset to zero. A new clip-off threshold must be entered after any of these changes have been made.

6.14 Local reset: LoC CLR

The Local reset function contains two sub-functions **CLR EOE** and **CLR GTOE** which when enabled allow the run-time display and grand total run-time to be reset to zero via the instrument push buttons while the Tachometer is in the display mode.

6.15 Local run-time reset: CLR EOE

CLR EOE is a sub-menu in the **LoC CLR** function which when activated allows an operator to reset the run-time display to zero while the Tachometer is in the display mode by operating the **▼** & **▲** push buttons simultaneously for more than three seconds.

Select **LoC CLR** in the configuration menu and press **P** which will reveal the **CLR EOE** prompt, operate **P** again which will show if the local run-time 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 run-time display may also be reset to zero remotely by connecting terminals RS1 and RS2 together for more than one second. See sections 3.6; 4.1.8 and 4.2.7 of this manual.

6.16 Local grand total run-time reset: $\llcorner \llcorner \llcorner \llcorner$

The grand total run-time is a separate timer that functions in parallel with the run-time display, but is not zeroed when the run-time display is reset to zero. The run-time grand total may be viewed in the display mode by pressing the \llcorner and \llcorner buttons simultaneously.

$\llcorner \llcorner \llcorner \llcorner$ is a sub-menu in the $\llcorner \llcorner \llcorner \llcorner$ function which when activated allows an operator to reset the grand total run-time to zero while the Tachometer is in the display mode by operating the \llcorner and \llcorner push buttons simultaneously for more than ten seconds. See section 2.2

To check or change the function select $\llcorner \llcorner \llcorner \llcorner$ in the configuration menu and press \llcorner which will reveal the $\llcorner \llcorner \llcorner \llcorner$ prompt. Using the \llcorner or \llcorner button select $\llcorner \llcorner \llcorner \llcorner$ and press \llcorner which will show if the local grand total reset is on or off . If set as required operate the \llcorner button twice to return to the configuration menu, or the \llcorner or \llcorner button to change the setting followed by the \llcorner button twice to enter the change and return to the $\llcorner \llcorner \llcorner \llcorner$ prompt in the configuration menu.

Note:

Once reset, the grand total run-time can not be recovered.

6.17 Grand total run-time reset from within the configuration menu: $\llcorner \llcorner \llcorner \llcorner$

The grand total run-time is a separate timer that is incremented in parallel with the run-time display, but is not zeroed when the run-time display is reset to zero. The grand total may be viewed in the display mode by pressing the \llcorner and \llcorner buttons simultaneously.

The grand total can be reset to zero from within the configuration menu using this $\llcorner \llcorner \llcorner \llcorner$ function.

To zero the grand total from within the configuration menu select $\llcorner \llcorner \llcorner \llcorner$ and press \llcorner which will cause the instrument to display $\llcorner \llcorner . \text{no}$ with no flashing. Press the \llcorner or \llcorner push button until $\llcorner \llcorner . \text{YES}$ is displayed and then press \llcorner which will result in a $\llcorner \llcorner \llcorner \llcorner$ prompt being displayed with the first digit flashing. This is a request for the instruction to be confirmed by entering 5urE using the \llcorner or \llcorner button to adjust the flashing digit and the \llcorner button to move control to the next digit. Pressing \llcorner will then reset the grand total to zero and return the Tachometer to the configuration menu.

Note:

Once reset, the grand total can not be recovered.

6.18 Security code: $\llcorner \text{odE}$

Access to the instrument's 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 $\llcorner \llcorner \llcorner \llcorner$ which allows unrestricted access to all configuration functions.

To enter a new security code select $\llcorner \text{odE}$ from the configuration menu and press \llcorner which will cause the Tachometer to display $\llcorner \llcorner \llcorner \llcorner$ with one digit flashing. The flashing digit may be adjusted using the \llcorner or \llcorner push button and the \llcorner button to transfer control to the next digit. When all the digits have been adjusted press \llcorner to return to the $\llcorner \text{odE}$ prompt. The revised security code will be activated when the Tachometer is returned to the display mode.

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

6.19 Reset configuration to factory defaults:

$\llcorner \text{5EE dEF}$

$\llcorner \text{5EE dEF}$ resets the Tachometer configuration to the factory default configurations shown in sections 6.0.

To reset the Tachometer to the factory default configurations select $\llcorner \text{5EE dEF}$ from the configuration menu and press \llcorner which will result in the instrument displaying $\llcorner \llcorner \llcorner \llcorner$ with the first digit flashing. To confirm the instruction 5urE should be entered. Using the \llcorner or \llcorner button set the first flashing digit to 5 and press \llcorner which will transfer control to the second digit which should be set to u . When 5urE has been entered pressing the \llcorner button will reset all the configuration functions and return the instrument to the display mode.

7. CONFIGURATION EXAMPLE

In this example a BA317E Tachometer is connected to a proximity detector producing 105 pulses per revolution.

The BA317E is required to display rotational speed in RPM with a resolution of one RPM. The run-time clock is to operate when the shaft speed exceeds 5 RPM. The display is to be updated twice per second.

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

7.1 Configuration procedure

The BA317E Tachometer may be configured on-site without disconnection from the power supply or from the proximity detector.

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 **INPUL** which is the first function in the configuration menu. See Fig 10.

Step 2 Select the type of input & debounce

With **INPUL** displayed press **[P]** which will reveal the sub-menu. Using the **[▼]** or **[▲]** button select **INP.TYPE** and press **[P]** to reveal the current input. The Tachometer is required to work with a proximity detector so again using the **[▼]** or **[▲]** button select **Pr. dEt** followed by **[E]** to return to the **INP.TYPE** prompt in the sub-menu.

Using the **[▼]** or **[▲]** button select **dEBOUNEE** from the sub-menu and press **[P]**. Using the **[▼]** or **[▲]** button select **dEFRUL** which will provide moderate pulse edge noise protection. If the Tachometer is subsequently found to miscount the noise rejection can be increased. Enter the selection and return to the **INPUL** prompt in the configuration menu by pressing the **[E]** button twice.

See 6.4, 6.5 and 6.6

Step 3 Select the interval between display updates

Using the **[▼]** or **[▲]** button select **UPdRLE** in the configuration menu and press **[P]** to reveal how frequently the Tachometer 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 **UPdRLE** prompt in the configuration menu by pressing the **[E]** button.

See 6.7

Step 4 Run-time display

Using the **[▼]** or **[▲]** button select **d, 5P-2** in the configuration menu and press **[P]** to select if the run-time display is **on** or **off**. The Tachometer is required to display run-time therefore using the **[▼]** or **[▲]** button select **on** and press **[E]** to enter the selection and return to the **d, 5P-2** prompt in the configuration menu. See 6.8

Step 5 Position of decimal point in speed display.

Select **dP** from the configuration menu and press **[P]**. The speed display will be activated and identified by the Rate annunciator. Using the **[▼]** or **[▲]** push button position the decimal point to the right of the least significant digit to give a total display resolution of 1.

Finally press the **[E]** button to enter the selection and return to the **dP** prompt in the configuration menu.

See 6.9

Step 6 Enter the speed scale factor







SCALE5 is a dividing factor adjustable between 0.0001 and 99999 that enables the Tachometer to display speed in the required engineering units. The speed display timebase is determined by **t-bR5E** that is adjusted in Step 7.

In this example the Tachometer speed display is required in revolutions per minute. The proximity detector produces 105 pulses per revolution therefore **SCALE5** should therefore be adjusted to 105.0.

Using the **[▼]** or **[▲]** push button select **SCALE5** from the configuration menu and press **[P]** to reveal the existing value with one digit flashing. This should be changed to 105.0 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, enter the new value and return to the **SCALE5** prompt in the configuration menu by pressing **[E]**. See 6.10

Step 7 Enter the speed timebase

The speed timebase determines if the Tachometer displays speed per second, per minute or per hour. In this example revolutions per minute are required.

Using the  or  push button select `t-bR5E` from the configuration menu and press . Again using the  or  push button select `t-b-60` from the three options which will multiply the speed display by 60. Enter the selection and return to the `t-bR5E` prompt in the configuration menu by pressing .

See 6.11








Step 8 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 defines the deviation from the displayed speed at which the filtering, defined by the first digit, will be overridden and the Tachometer speed display will move rapidly to the new value. It is recommended that the second digit is initially set to 0.

After configuration both parameters may require further adjustment to provide a stable display with an acceptable step response.








To allow the effect of filter changes to be seen immediately, the live speed display is shown on the lower display in place of run-time while the filter parameters are shown and being adjusted on the upper display.

Using the  or  push button select `F.LtEr` from the configuration menu and press . The first digit, which controls the filter time constant, will be flashing and should be set to 2 using the  or  push buttons. The  button will transfer control to the second digit, which controls the step response and should be set to 0 in the same way. Finally, enter the selection and return to the `F.LtEr` prompt in the configuration menu by pressing .

See 6.12

Step 9 Define clip-off

In this example the run-time clock is required to operate when the display speed equals or exceeds 5 RPM. The clip-off threshold should therefore be set to 5.










Using the  or  push button select `CLP oFF` from the configuration menu. Press  which will reveal the current clip-off threshold in RPM i.e. the same units already selected for the speed display. Adjust the display to 00005 using the  or  push buttons to adjust the flashing digit and the  button to transfer control to the next digit. Finally, enter the new clip-off threshold and return to the `CLP-oFF` prompt in the configuration menu by pressing .







See 6.13

Step 13 Local reset of total and grand total

Two separate functions in the `LdC CLr` sub-menu may be individually activated to allow the operator to reset the run-time display and grand total run-time from the display mode without entering the configuration menu.











In this example the operator is required to reset the run-time display but not the grand total run-time when the BA317E Tachometer is in the display mode.

Using the  or  button select `LdC CLr` in the configuration menu and press  which will reveal the sub-menu. Again using the  or  button select the local total reset function `CLr tOt` and press . This is required therefore using the  or  button select `on` followed by  to return to the `CLr tOt` prompt in the sub-menu.








Using the  or  button select the local grand total run-time reset function `CLr tTtOt` and press . This is not required therefore using the  or  button select `oFF`. Enter the selection and return to the `LdC CLr` prompt in the configuration menu by pressing the  button twice.

See 6.15 and 6.16


Step 14 Reset the grand total to zero

Before completing configuration the run-time grand total should be reset to zero. Using the  or  button select `ELr.Gt0t` in the configuration menu and press  which will cause `ELr.no` to be displayed. Again using the  or  button select `ELr.YE5` and press  which will result in a `0000` display with one digit flashing. This is a request for the instruction to be confirmed by entering `5urE` using the  or  buttons to set each digit and the  button to move control to the next digit. Pressing  will then reset the run-time grand total to zero and return the instrument to the `ELr.Gt0t` prompt in the configuration menu.
See 6.17.

Step 15 Define the security code

Defining a security code prevents unauthorised access to the configuration menu. Using the  or  button select `Ed0E` from the configuration menu and press  which will reveal `0000` with the first digit flashing. This example requires the security code to be 1209, using the  or  button set the flashing digit to 1 and press  to transfer control to the second digit. When all have been entered press  to return to the main configuration menu.
See 6.18.

Step 16 Return to the display mode

Configuration of the BA317E is now complete. Pressing the  button will save the new configuration and return the Tachometer to the display mode. The BA317E will display `dRtR` followed by `5RUE` while the new information is stored in permanent memory, which will be protected from unauthorised adjustment by the security code.

To obtain a stable display it may be necessary to adjust the two filter parameters and the level of debounce during commissioning of the Tachometer.

8. MAINTENANCE

8.1 Fault finding during commissioning

If a BA317E or a BA318E 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.
Tachometer is receiving power but pulse input 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.
Pulse input indicator rotating, but incorrect speed display	Incorrect speed display calibration.	SCALE 5 E-6R5E
Pulse input indicator rotating but missing or incorrect run-time display.	Run-time display is not activated. Tachometer speed display is less than clip-off value. Remote reset switch contacts closed.	d, 5P-2 is activated See 6.8 If HOLD annunciator is activated, enter smaller CLIP-OFF value. See 6.13 That 'RESET' annunciator is not activated. If it is, check reset wiring and switch.
Unstable Tachometer display.	Noisy pulse input signal.	Eliminate source of electrical noise. Increase debounce and/or display filter. See 6.12
Unable to enter configuration menu.	Incorrect security code.	That the correct security code is being used. See 6.18 Contact BEKA if code is lost.
Clip-off does not function.	Clip-off has automatically been reset to zero following calibration change.	Reconfigure clip-off. See 6.13
Alarms do not function.	Alarms have been disabled following calibration change.	Re-enable both alarms. See 9.4.4

8.2 Fault finding after commissioning

ENSURE PLANT SAFETY BEFORE STARTING MAINTENANCE

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

If a BA317E or a BA318E Tachometer 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.
Pulse input indicator not rotating.	No input pulses.	Output from sensor. Wiring between sensor and Tachometer.
Pulse input indicator rotating, run-time display not functioning. HOLD annunciator activated.	Input below clip-off threshold.	Adjust CLIP-OFF threshold.
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.

8.3 Servicing

We recommend that faulty BA317E and BA318E Tachometers are returned to BEKA associates or to our local agent for repair.

8.4 Routine maintenance

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

8.5 Guarantee

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

8.6 Customer comments

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

9. ACCESSORIES

Accessories for the two models differ as shown below, all except the scale card, are factory fitted and should be specified when the instrument is ordered:

BA317E 96 x 48mm	BA318E 144 x 72mm
Scale card	Scale card
Tag number	Tag number
Backlight ¹	Backlight ¹
Isolated dual alarms ² or Isolated 4/20mA output ² or Isolated pulse output ²	Isolated dual alarms Isolated 4/20mA output See note 3

Notes:

1. Internally powered
2. Only one of the three output options may be fitted to a BA317E.
3. All BA318E Rate Tachometers are fitted with an isolated pulse output.

9.1 Scale card

Both models have a window on the right hand side of the display through which to view a scale card showing the units of measurement such as RPM. New Tachometers are fitted with a scale card showing the units of measurement specified when the instrument was ordered, if the units are not specified a blank scale card will be fitted. A pack of scale cards pre-printed with common units of measurement is available as an accessory. These can easily be fitted on-site to the Tachometer without opening the instrument enclosure or removing it from the panel, See section 5.4 of this instruction manual.

Custom scale cards for applications requiring less common units of measurement are also available.

9.2 Tag information

Both models can be supplied with a tag number or application information thermally printed onto the rear panel adjacent to the terminals. This information is not visible from the front of the instrument after installation.

9.3 Display backlight

The BA317E and the BA318E Tachometers can be supplied with a factory fitted backlight that produce green illumination enhancing display contrast and enabling the display to be read at night or in poor

lighting conditions. The optional backlight in both models is internally powered from the instrument power supply so that no additional wiring or intrinsically safe interface is required, but the supply current increases.

	Current consumption	
	BA317E	BA318E
Without backlight		10.0mA
10.0mA		
Addition for backlight	22.5mA	16.0mA
Addition with terminals 3 & 4 linked	6.0mA	6.0mA
Total current	38.5mA	32.0mA

9.4 Alarms

The BA317E and BA318E can be supplied with factory fitted dual isolated solid state single pole alarm outputs that may be independently configured.

Each may be configured as a speed or run-time alarm with a high or low function having a normally open or closed output. An alarm delay and alarm silence time can be included and hysteresis may be applied to speed alarms.

CAUTION

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

When the BA317E or BA318E 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 BA317E and BA318E internal counters are updated 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 speed or run-time has exceeded the alarm setpoint.

9.4.1 Solid state output

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

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

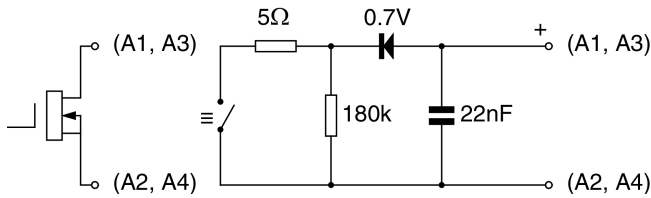


Fig 11 Equivalent circuit of each alarm output

9.4.2 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
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 12.

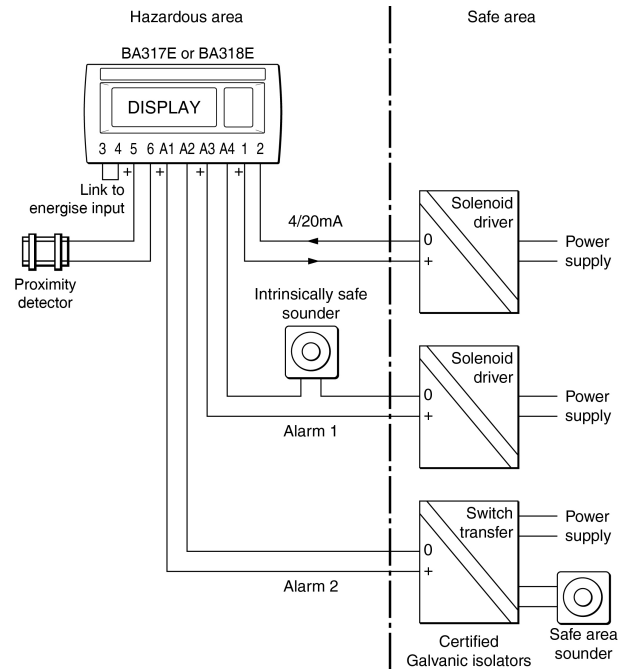


Fig 12 Typical alarm application

9.4.3 Configuration and adjustment

When a BA317E or BA318E is supplied with alarms the configuration menu is extended as shown in Fig 13 which for simplicity only shows alarm AL1 configured to operate as a speed alarm. The run-time options are identical except that a run-time alarm can not have hysteresis. Alarm AL2 functions are identical to alarm AL1.

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

Display	Summary of function	Display	Summary of function
EnbL	Alarm enable Enables or disables the alarm without changing the alarm parameters. See section 9.4.4	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 9.4.8
TYPE	Type of alarm Defines whether the alarm operates on the speed or run-time display. See section 9.4.5	HSEr	Hysteresis Adjusts the alarm hysteresis. Only available on a speed alarm. See section 9.4.9
SP ISPEEd or SP HOurS	Alarm setpoint 1 Adjusts the alarm setpoint. The alarm is activated when the speed or run-time display equals the setpoint. Note: SP IS is displayed for a speed alarm and SP IH for a run-time alarm. See section 9.4.6	dELd	Alarm delay time Adjusts the delay between the display equalling the setpoint and the alarm output being activated. See section 9.4.10
Hi .Lo	Alarm function Defines whether the alarm has a high or low function. See section 9.4.7	S. L	Alarm silence time Defines the time that the alarm output remains in the non-alarm condition following acceptance of an alarm. See section 9.4.11
		FLSH	Flash display when alarm occurs When enabled, alternates the speed or run-time display between the value and alarm reference RL1 or RL2 when an alarm output is activated. See section 9.4.12
		RCSP	Access setpoint Sub-menu that enables direct access to the alarm setpoints from the display mode and defines a separate security code. See section 9.4.13

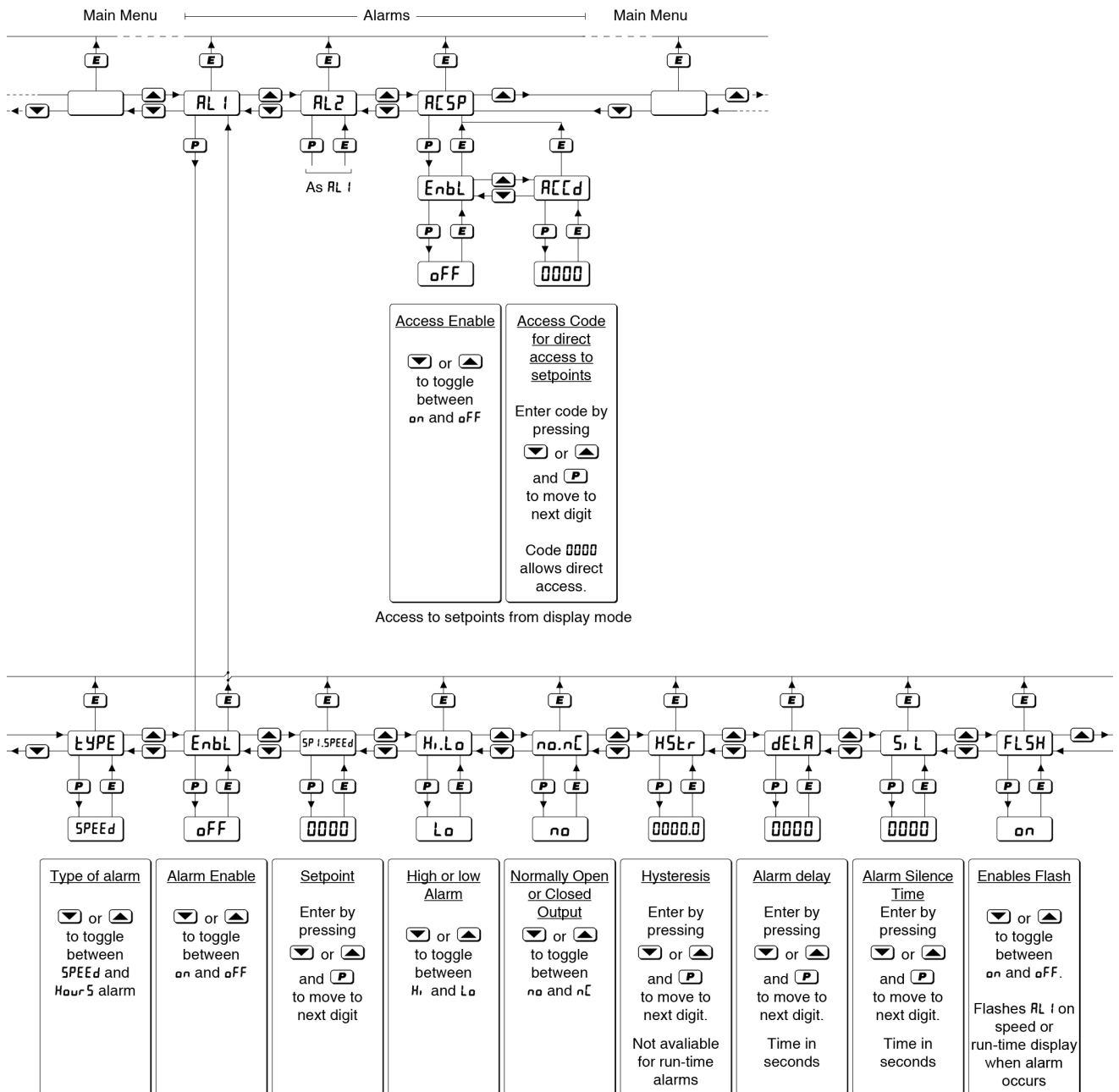

















Fig 13 Alarm menu structure

9.4.4 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 **RL1** or **RL2** from the configuration menu and press  to access the alarm sub-menu. Press the  or  button until **EnbL** is displayed followed by  which will reveal if the function is **on** or **off**. The setting can be changed by pressing the  or  push button followed by the  button to return to the alarm sub-menu.

9.4.5 Type of alarm: **LYPE**








Alarm 1 and Alarm 2 are totally independent, both may be speed or run-time alarms, or one may be conditioned for speed and the other for run-time.

Using the  or  push button select **LYPE** from the selected alarm sub-menu and press  to check or change the function. The  or  push button will toggle the selection between **SPEED** and **Hour5**, when set as required press the  button to return to the alarm sub-menu.

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







9.4.6 Setpoint adjustment: **SP1x & SP2x**

The speed alarm setpoints **SP1SPEED** and **SP2SPEED** may be positioned anywhere between 0000000 and 9999999, and the run-time alarm setpoint **SP1Hour5** and **SP2Hour5** anywhere between 00000 and 99999 hours.

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 speed display. Using the  or  push button select **SP1SPEED** in the **RL1** sub-menu and press  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  button to transfer control to the next digit. When set as required press  to enter the value and return to the **SP1SPEED** prompt in the alarm 1 sub-menu.







9.4.7 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  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  button to return to the **Hi.Lo** prompt in the alarm sub-menu.








9.4.8 Alarm output status: **no.nL**

Each single pole alarm output may be open or closed in the non-alarm condition. When the BA317E or BA318E 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 **nL** 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.nL** from the selected alarm sub-menu and press  to check or change the function. The  or  push button will toggle the contact status between **no** and **nL**, when set as required, press the  button to return to the **no.nL** prompt in the alarm sub-menu

9.4.9 Hysteresis: **H5Lr**

Hysteresis is only available on speed alarms so the **H5Lr** function only appears in the configuration sub-menu when alarm **LYPE** has been set to **SPEED**. During configuration hysteresis is shown in the units of **SPEED** previously configured for the Tachometer display.








Using the  or  push button select **H5Lr** in the selected alarm sub-menu and press  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  button to transfer control to the next digit. When set as required press  to enter the value and return to the **H5Lr** prompt in the alarm sub-menu.

e.g. A Tachometer configured to display a rotational speed of 0 to 500 RPM, with a high alarm set at 400 RPM and hysteresis of 10 RPM will perform as follows:

The high alarm will be activated when speed equals or exceeds 400 RPM, but will not reset until the speed falls below 390 RPM.

9.4.10 Alarm delay: **dELR**

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 **dELR** using the  or  push button in the selected alarm sub-menu and press  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  button to transfer control to the next digit. When set as required press  to enter the value and return to the **dELR** prompt in the alarm sub-menu.

The 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.

9.4.11 Alarm silence time: 5, L

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

To adjust the alarm silence time select 5, L 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 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 5, L prompt in the alarm sub-menu.

9.4.12 Flash display when alarm occurs: FL5H

In addition to the two alarm annunciators at the bottom left hand side of the Tachometer 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 speed or run-time display between the numerical value and the alarm identification AL1 or AL2 when an alarm occurs.

Using the **[▼]** or **[▲]** push button select FL5H 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 FL5H prompt in the alarm sub-menu.

9.4.13 Access Setpoint: RESP

This function activates a separate menu that provides direct access to the alarm setpoints when the Tachometer is in the display 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 RESP 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 REED function which can be selected using the **[▼]** or **[▲]** push button.

To enter a new security code select REED from the sub-menu and press **[P]** which will cause the Tachometer to display 0000 with one digit flashing. The flashing digit may be adjusted using the **[▼]** and **[▲]** 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]** to return to the REED prompt. The revised security code will be activated when the Tachometer is returned to the display mode. Default security access code 0000 will disable the security code allowing direct access to the setpoints in the display mode by pressing the **[P]** and **[▲]** buttons simultaneously.

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

9.4.14 Adjusting alarm setpoints from the display mode

Access to the two alarm setpoints from the Tachometer display mode is obtained by operating the **[P]** and **[▲]** push buttons simultaneously as shown in Fig 14. If the setpoints are not protected by a security code the alarm setpoint prompt SP1SPEED or SP1HOURS will be displayed depending upon whether a speed or run-time alarm has been configured. If the setpoints are protected by a security code, CODE will be displayed first. Pressing **[P]** again will allow the alarm setpoint security access code to be entered digit by digit using the **[▼]** or **[▲]** buttons to adjust the flashing digit and the **[P]** push button to move control to the next digit. If the correct code is entered pressing **[E]** will then cause alarm setpoint prompt SP1SPEED or SP1HOURS to be displayed. If an incorrect security code is entered, or a button is not pressed within ten seconds, the instrument will automatically return to the display mode. Once within the menu pressing the **[▼]** or **[▲]** buttons will toggle the display between the two alarm setpoint prompts SP1x and SP2x.

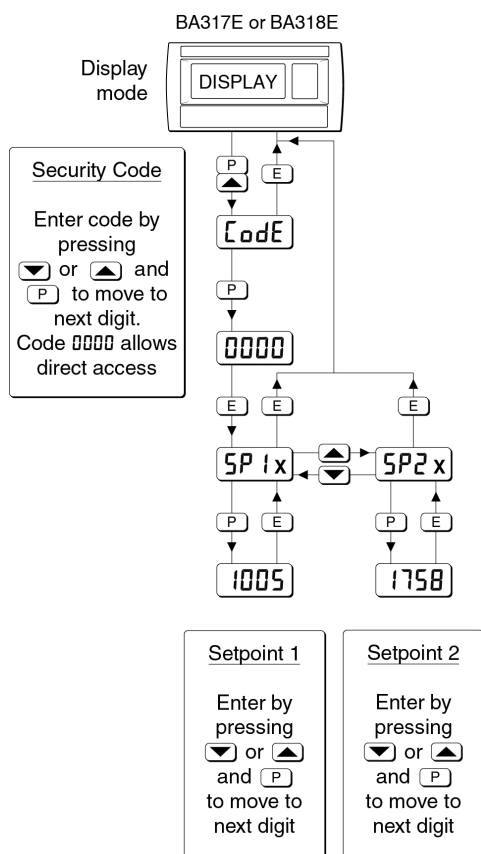


Fig 14 Setpoint adjustment from the display mode

To adjust an alarm setpoint select $5P1x$ or $5P2x$ and press **P** which will reveal the current setting. The flashing digit of the setpoint may be adjusted using the **▼** or **▲** push button and the **P** button to transfer control to the next digit. When the required setpoint has been entered, pressing **E** will return the display to the $5P1x$ or $5P2x$ prompt from which the other setpoint may be selected, or the instrument may be returned to the display mode by pressing **E** again.

Note: Direct access to the alarm setpoints is only available when the menu is enabled - see section 9.4.13

9.5 Pulse output

All BA318E Tachometers are supplied with an isolated pulse output. The pulse output is available as a factory fitted option on the smaller BA317E Tachometer, but only one output option can be fitted to this model. The pulse output is an open collector having the following parameters:

R_{on}	=	$60\Omega + 3V$
R_{off}	=	1M
I_{max}	=	10mA

The output pulse may be a synchronous duplicate of the input pulse or may be scaled and the pulse length extended.

The retransmitted RTx annunciator on the instrument display shows the status of the retransmitted pulse output. Annunciator activation depends upon the setting of $5aurEE$ in the pulse output configuration menu.

SCALEd

Annunciator activated each time pulse output open collector is *on*, i.e. R_{on} is less than $60\Omega + 3V$.

drEEk

Annunciator continuously activated

9.5.1 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:

U_o	=	28V dc
I_o	=	200mA
P_o	=	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.

9.5.2 System design

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

Fig 15 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 tachometer. The positive terminal of the pulse output circuit P1 is connected to the BA317E or BA318E Tachometer's positive supply terminal 1 at the instrument. When an output pulse occurs and the open collector 'closes', P2 is connected to P1 and a pulse output current flows through the diode return barrier to resistor R1 in the safe area. The current flowing in the circuit is determined by resistor R1 which should be chosen to limit the output current to less than 10mA. For a 24V supply R1 should therefore be greater than 2,200Ω

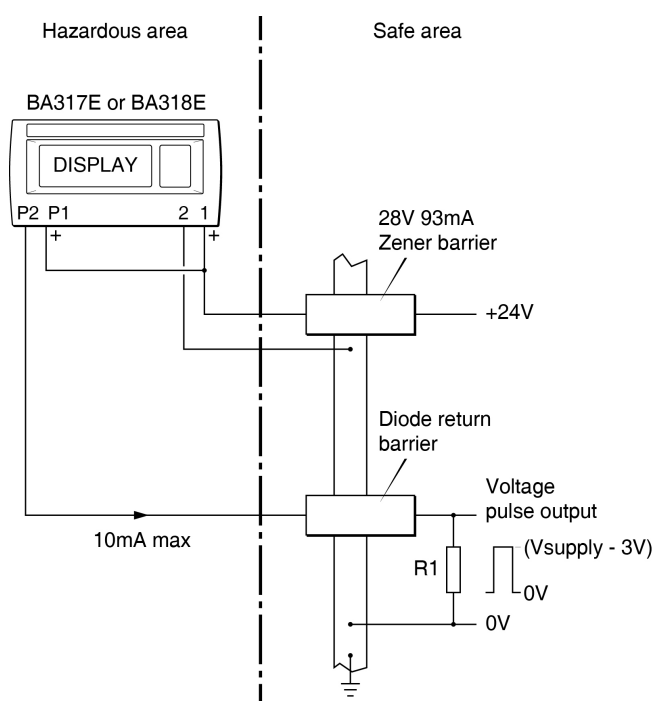


Fig 15 Transferring pulse output to safe area using Zener barriers

9.5.3 Configuration

All BA318E Tachometers are fitted with an opto-isolated pulse output and the pulse output is available as a factory fitted option on the smaller BA317E Tachometer. The Tachometer configuration menu is extended as shown in Fig 16 to include the pulse output sub-menu **PuL5E.oP**.

The pulse output sub-menu allows the source of the output pulse to be selected in the **5oUrEE** sub-function. For re-transmission applications the output pulse may be a synchronous duplicate of the input pulse by selecting **d,rEEt** in the **5oUrEE** sub-function. When **5rLEd** is selected, two additional functions, **d,U,dE** and **durRt,on** are introduced enabling the input pulse frequency to be divided to produce the output pulse frequency, and the output pulse width (duration) to be lengthened.

9.5.4 Access Pulse output sub-menu: **PuL5E.oP**

Access the Tachometer configuration menu as described in section 6.2. Using the ▼ and ▲ push buttons scroll through the menu until **PuL5E.oP** is displayed, pressing **P** will then access the pulse output sub-menu which is shown in Fig 16.

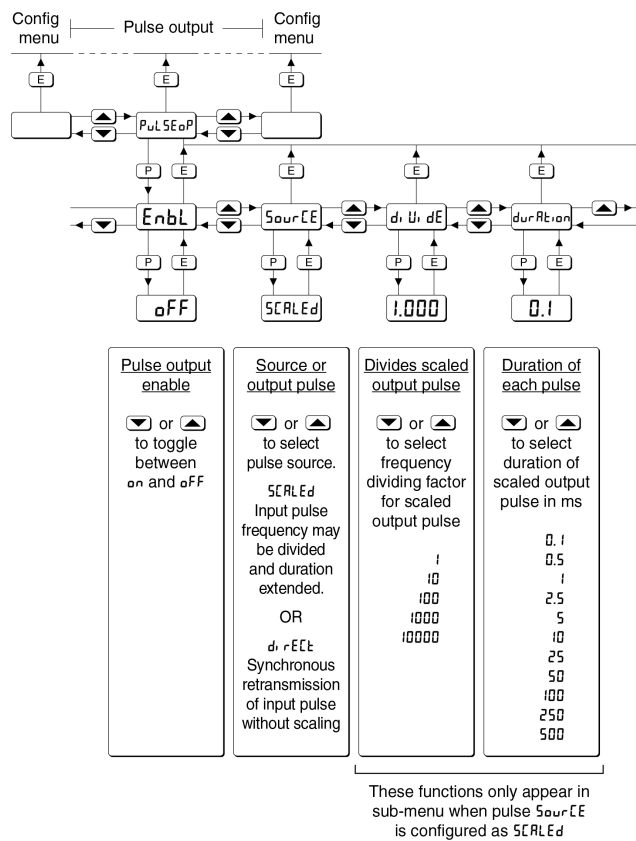


Fig 16 Pulse output configuration sub-menu

9.5.5 Enable pulse output: Enbl

This function allows the pulse output to be disabled or enabled without altering any of the pulse output parameters. Using the ▼ or ▲ push button select Enbl in the pulse output 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.

9.5.6 Source of output pulse: SaurEE

The output pulse may be derived from:

- d, rEEt** Synchronously re-transmitted input pulse.
Output pulse is a duplicate of the Tachometer input pulse.
- SCALed** Input pulse scaled prior to re-transmission.
Input pulse frequency may be divided to produce output pulse with defined duration by the d, U, dE and durRtion, on functions.

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

9.5.7 Divide output pulse frequency: d, U, dE

When SCALed is selected in the SaurEE function described in section 9.5.6, the output pulse frequency is the Tachometer input pulse frequency divided by one the following:

- 1
- 10
- 100
- 1000
- 10000

Using the ▼ or ▲ push button select d, U, dE in the pulse output sub-menu and press P to reveal the existing divisor. The value can be changed by pressing the ▼ or ▲ push button to select the required value followed by the E button to return to d, U, dE prompt.

Note: This function only appears in the pulse output sub-menu when SCALed is selected in the SaurEE function.

9.5.8 Define output pulse width: *durPulseOn*

When *SCALEd* is selected in the *Source* function as described in section 9.5.6, the output pulse width in milliseconds is defined by this function. One of 11 pulse widths may be selected:

0.1
0.5
1
2.5
5
10
25
50
100
250
500

Using the \blacktriangledown or \blacktriangle push button select *durPulseOn* in the pulse output sub-menu and press \rightarrow to reveal the existing pulse duration. The value can be changed by pressing the \blacktriangledown or \blacktriangle push button to select the required value followed by the \rightarrow button to return to *durPulseOn* prompt.

Note: This function only appears in the pulse output sub-menu when *SCALEd* is selected in the *Source* function.

9.5.9 Pulse storage

If the *diUdE* and *durPulseOn* functions are configured such that the output pulse frequency with the specified pulse width can not be output in real time, the generated 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 Tachometer is disconnected or turned off, any stored pulses will not be retained.

9.6 4/20mA output

The BA317E and BA318E Tachometer can be supplied with a factory fitted galvanically isolated 4/20mA output which may be conditioned to represent any part of the Tachometer speed display.

9.6.1 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:

$U_o = 28V$ dc
 $I_o = 200mA$
 $P_o = 0.84W$

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

$C_i = 2.2nF$
 $L_i = 4\mu H$

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.

9.6.2 System design

The Tachometer 4/20mA output is a passive current sink i.e. not powered, but it is totally isolated from all other Tachometer circuits. It is effectively a 2-wire 4/20mA transmitter requiring a minimum supply of 10V with its current being controlled by the Tachometer speed display. 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 17 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.

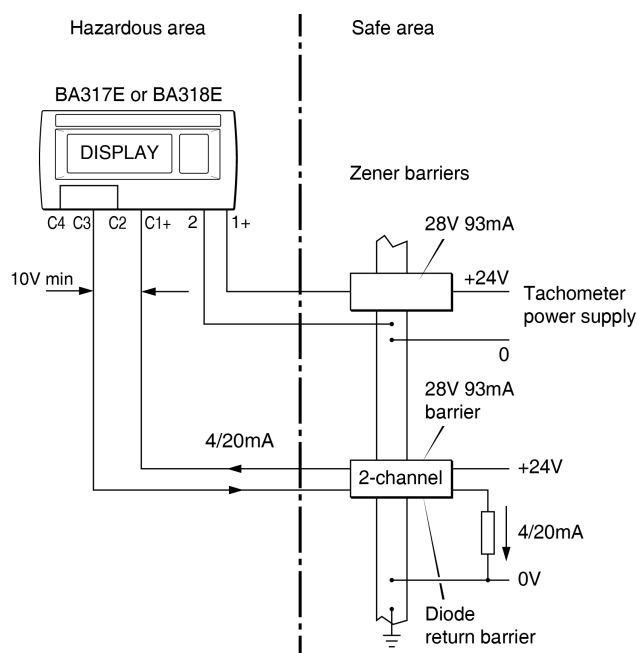


Fig 17 Application of 4/20mA output

9.6.3 Configuration and calibration

When a Tachometer is supplied with an optional 4/20mA output the configuration menu is extended as shown in Fig 18. The 4/20mA output sub-menu is accessed via the 4-20 mA function that is located before the $\text{CLr.}\text{Gt}\text{aP}$ function.

The 4/20mA output is controlled by the Tachometer speed display, the speeds corresponding to 4 and 20mA output are defined in the sub-menu.

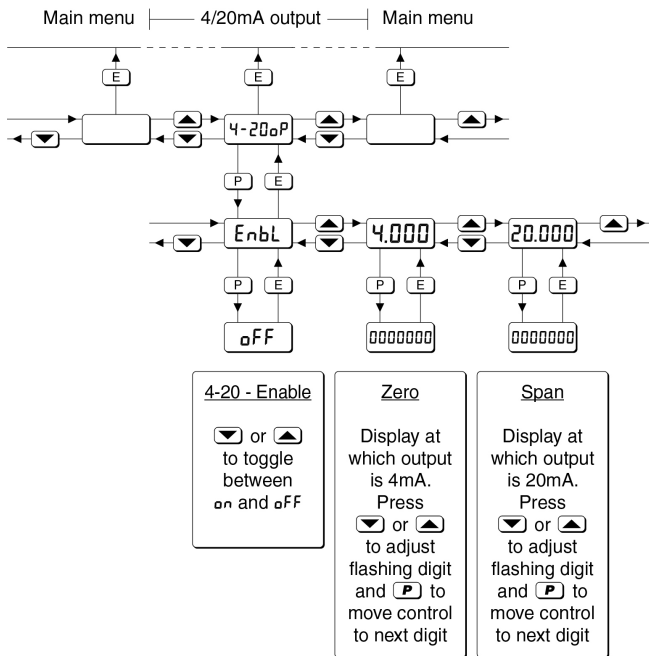


Fig 18 4/20mA output configuration sub-menu

9.6.4 Access 4/20mA output sub-menu: 4-20 mA

Access the Tachometer configuration menu as described in section 6.2. Using the ▼ and ▲ push buttons scroll through the menu until 4-20 mA is displayed, pressing P will then access the 4/20mA output sub-menu which is shown in Fig 18.

9.6.5 Display which corresponds to 4mA output: 4.0000

The Tachometer speed display which corresponds to a 4.000mA output current is defined by this function. Using the ▼ or ▲ push button select 4.0000 in the 4/20mA output sub-menu and press P to reveal the existing speed 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 4.0000 prompt in the 4/20mA output sub-menu.

9.6.6 Display which corresponds to 20mA output: 20.0000

The Tachometer speed display which corresponds to a 20.000mA output current is defined by this function. Using the ▼ or ▲ push button select 20.0000 in the 4/20mA output sub-menu and press P to reveal the existing speed 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 20.0000 prompt in the 4/20mA output sub-menu.

Notes:

1. If the Tachometer calibration is changed the 4/20mA output will automatically be set to 3.5mA irrespective of the speed display. The 4/20mA output should always be reconfigured following changes to the Tachometer configuration.
2. If the Tachometer and the 4/20mA current sink output are powered from separate supplies, the 4/20mA output current will continue to flow when the Tachometer supply fails or is turned off. Powering both from a common supply eliminates this effect.

Appendix 1 IECEx certification

A1.0 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

A1.1 IECEx Certificate of Conformity

The BA317E or BA318E Tachometers have been issued with an IECEx Certificate of Conformity number IECEx ITS 16.0004X which specifies the following certification code:

Ex ia IIC T5 Ga
-40°C ≤ Ta ≤ +70°C

The IECEx certificate may be downloaded from www.beka.co.uk, www.iecex.com or requested from the BEKA sales office.

A1.2 Installation

The IECEx intrinsic safety parameters are identical to the ATEX safety parameters described in the main section of this manual and both refer to the same standards. Therefore the ATEX and UKEX installation requirements specified in sections 3 & 5 of this manual may be used for IECEx installations, but the local code of practice should also be consulted.

A1.3 Special conditions for safe use

The IECEx Certificate of Conformity number has an 'X' suffix indicating that special conditions apply to prevent an electrostatic charge developing on the outside of the instrument enclosure.

CAUTION

To avoid an electrostatic charge being generated instrument enclosure should only be cleaned with a damp cloth.

Appendix 2 ETL & cETL certification for installations in USA and Canada

A2.0 cETL Mark

For installations in the USA and Canada, the BA317E and the BA318E Tachometers have ETL and cETL intrinsic safety and nonincendive approval, Control Number 4008610. Copies of the Authorisation to Mark are available from the BEKA associates sales office and www.beka.co.uk

A2.1 Intrinsic safety approval

The US and Canadian standards used for assessment and certification of the BA317E and BA318E 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 local codes of practice.

ETL and cETL intrinsic safety codes

CL I Div 1 Groups A, B, C, D T5 (US IS gas, Div cert)
CL II Div 1 Groups E, F, G. CL III (US IS dust, Div cert)

CL I Zone 0 AEx ia IIC T5 Ga (US IS gas, Zone cert)
Ex ia IIC T5 Ga (Canadian IS gas, Zone cert)

$-40^{\circ}\text{C} \leq T_a \leq 70^{\circ}\text{C}$

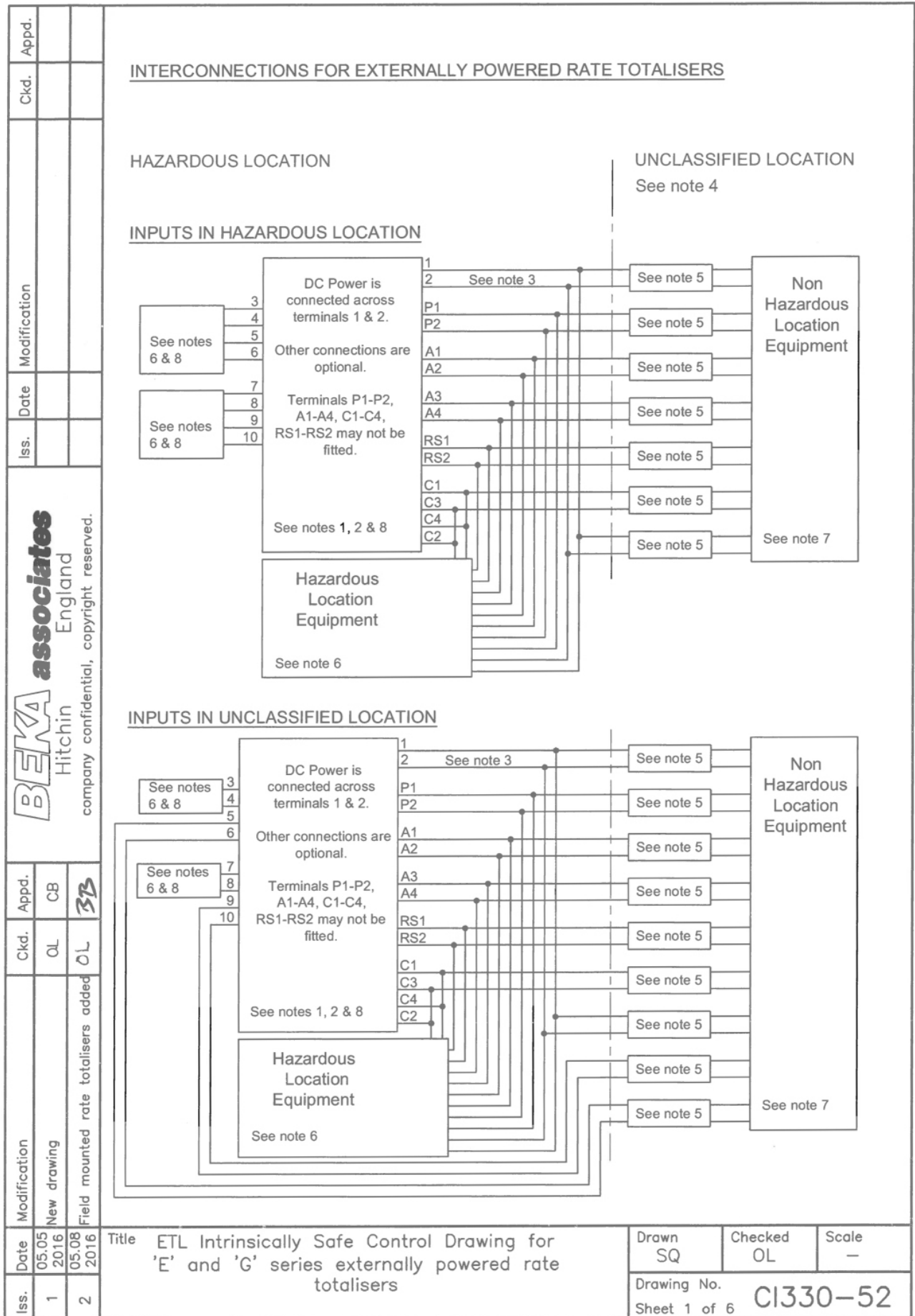
A2.2 Nonincendive approval

The BA317E and BA318E Tachometers also have 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 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
 $-40^{\circ}\text{C} \leq T_a \leq 70^{\circ}\text{C}$



Iss.	1	2	Date	05.05 2016	05.08 2016	Modification	New drawing	Field mounted rate totalisers added	Ckd.	QL	DL	Appd.	CB	B.B	Iss.	Date	Modification	Ckd.	Appd.
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INTERCONNECTIONS FOR EXTERNALLY POWERED RATE TOTALISERS

HAZARDOUS LOCATION

INPUTS IN HAZARDOUS AND UNCLASSIFIED LOCATIONS

UNCLASSIFIED LOCATION
See note 4

INPUTS IN HAZARDOUS AND UNCLASSIFIED LOCATIONS

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.	1	Date	05.05.2016	Modification	New drawing	Ckd.	QL	Appd.	CB
Iss.	2	Date	05.08.2016	Modification	Field mounted rate totalisers added	Ckd.	OL	Appd.	33

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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 SQ


Checked OL

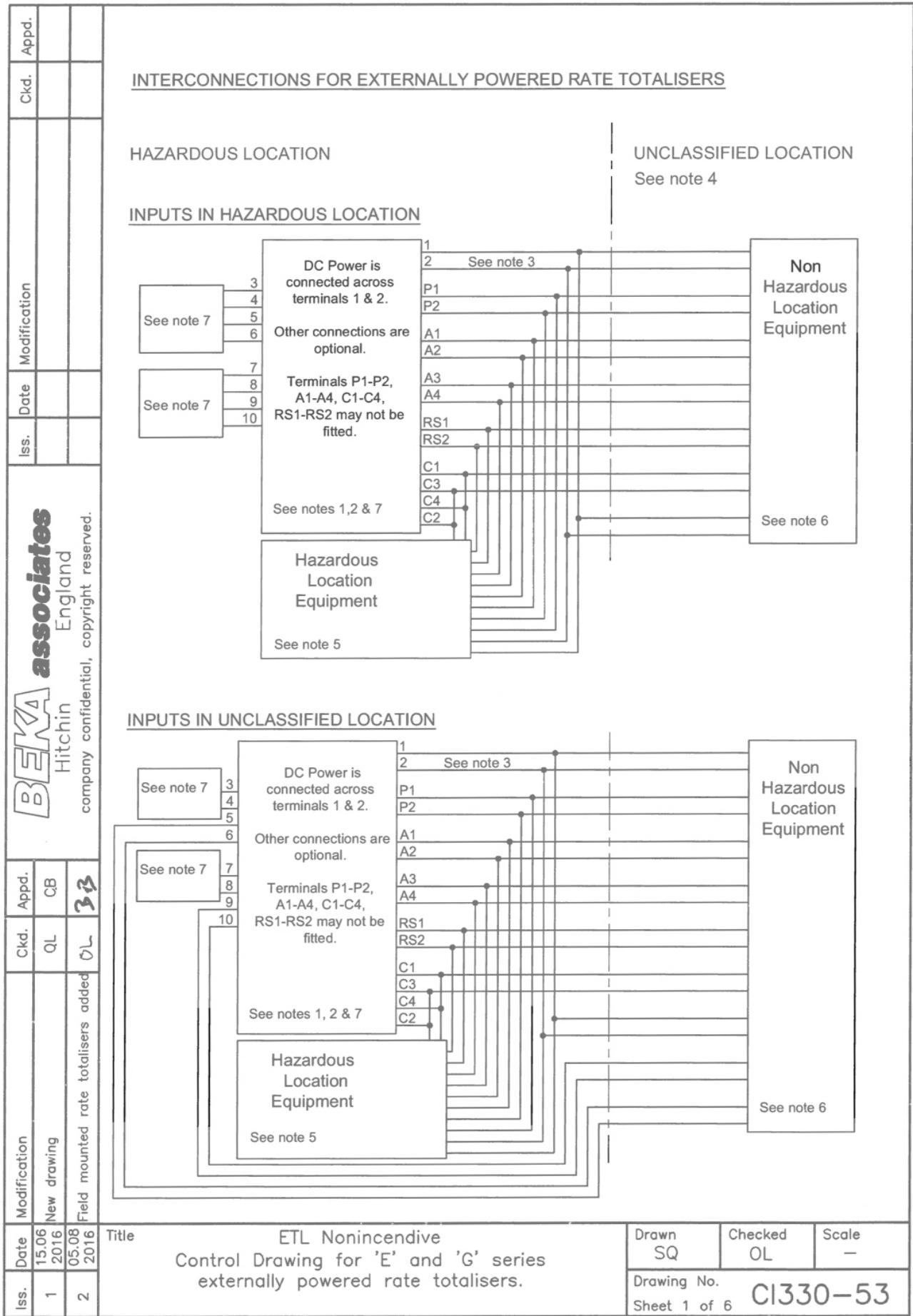
Scale —

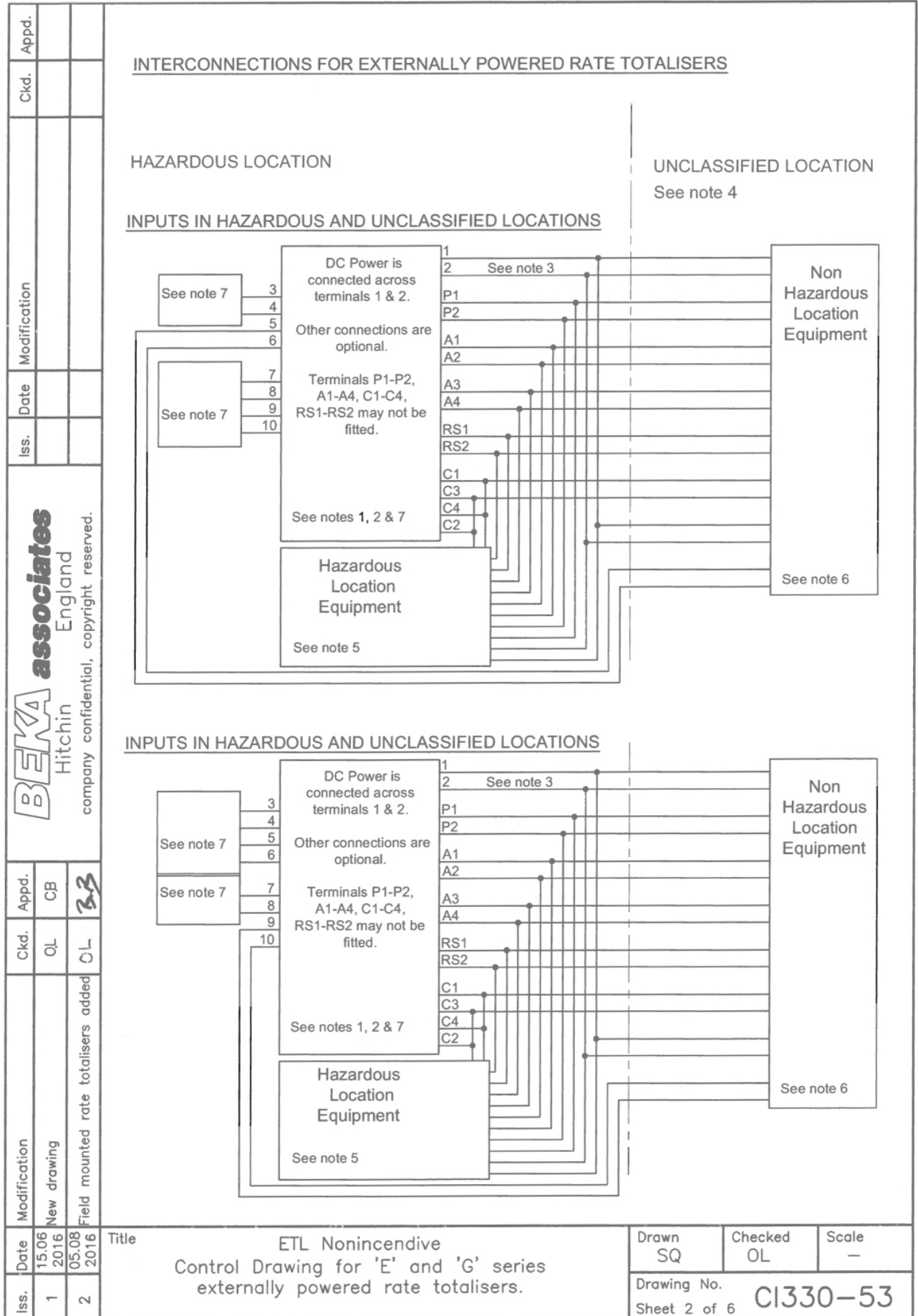
Drawing No. **CI330-52**


Sheet 3 of 6

Iss.		Date		Modification		Ckd.	Appd.																														
1		05.05.2016		New drawing																																	
2		05.08.2016		Field mounted rate totalisers added																																	
<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: center;">  <p>BEKA associates Hitchin England company confidential, copyright reserved.</p> </div> <div> <p>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.</p> <p>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.</p> <p>5. One single channel or one two channel associated protective barrier or galvanic isolator with entity parameters complying with the following requirements:</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 15%;">Uo</td> <td style="width: 35%;">equal or less than</td> <td style="width: 50%;">the lowest Ui of the NRTL or CSA approved apparatus installed in the loop.</td> </tr> <tr> <td>Io</td> <td>equal or less than</td> <td>the lowest Li of the NRTL or CSA approved apparatus installed in the loop.</td> </tr> <tr> <td>Po</td> <td>equal or less than</td> <td>the lowest Pi of the NRTL or CSA approved apparatus installed in the loop.</td> </tr> <tr> <td>Lo</td> <td>equal or greater than</td> <td>the sum of the cable inductances and the internal inductances Li of each NRTL or CSA approved apparatus in the loop.</td> </tr> <tr> <td>Co</td> <td>equal or greater than</td> <td>the sum of the cable capacitance and the internal capacitance Ci of each NRTL or CSA approved apparatus in the loop.</td> </tr> </table> <p>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:</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 15%;">Ui</td> <td style="width: 35%;">equal or greater than</td> <td style="width: 50%;">the highest Uo of the NRTL or CSA approved apparatus powering the loop.</td> </tr> <tr> <td>li</td> <td>equal or greater than</td> <td>the highest Io of the NRTL or CSA approved apparatus powering the loop.</td> </tr> <tr> <td>Pi</td> <td>equal or greater than</td> <td>the highest Po of the NRTL or CSA approved apparatus powering the loop.</td> </tr> <tr> <td>Lo</td> <td>of the NRTL or CSA approved apparatus powering the loop equal or greater than</td> <td>the sum of the cable inductances and the internal inductances Li of each NRTL or CSA approved apparatus in the loop.</td> </tr> <tr> <td>Co</td> <td>of the NRTL or CSA approved apparatus powering the loop equal or greater than</td> <td>the sum of the cable capacitances and the internal capacitances Ci of each NRTL or CSA approved apparatus in the loop.</td> </tr> </table> </div> </div>								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 Li 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.	Ui	equal or greater than	the highest Uo of the NRTL or CSA approved apparatus powering the loop.	li	equal or greater than	the highest Io of the NRTL or CSA approved apparatus powering the loop.	Pi	equal or greater than	the highest Po of the NRTL or CSA approved apparatus powering the loop.	Lo	of the NRTL or CSA approved apparatus powering the loop 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	of the NRTL or CSA approved apparatus powering the loop equal or greater than	the sum of the cable capacitances and the internal capacitances Ci of each NRTL or CSA approved apparatus in the loop.
Uo	equal or less than	the lowest Ui of the NRTL or CSA approved apparatus installed in the loop.																																			
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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 4 of 6																															

Iss.	1	Date	05.05.2016	Modification	New drawing	Ckd.	OL	Appd.	CB
Iss.	2	Date	05.08.2016	Modification	Field mounted rate totalisers added	Ckd.	OL	Appd.	3.3
<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: center;">  <p>BEKA Hitchin company confidential, copyright reserved.</p> </div> <div style="text-align: center;"> <p>associates England</p> </div> </div>									
<p>7. The unclassified location equipment shall not use or generate more than 250V rms or 250V dc.</p> <p>8. Safety parameters</p> <div style="display: flex; justify-content: space-between;"> <div style="width: 48%;"> <p>DC Power terminals 1 & 2</p> <p> $U_i = 28V$ $U_o = 0$ $I_i = 200mA$ $I_o = 0$ $P_i = 0.84W$ $C_i = 2nF$ $L_i = 4\mu H$ </p> <p>Terminals 4,5,6 (input A for models in notes 6 and 7), terminals 8,9,10 (input b for models in note 7).</p> <p> $U_i = 28V$ $U_o = 1.1V$ $I_i = 200mA$ $I_o = 0.5mA$ $P_i = 0.84W$ $P_o = 0.2mW$ $C_i = 2nF$ $L_i = 4\mu H$ </p> <p>Optional pulse output terminals P1 & P2</p> <p> $U_i = 28V$ $U_o = 0$ $I_i = 200mA$ $I_o = 0$ $P_i = 0.84W$ $C_i = 0$ $L_i = 0$ </p> <p>Optional alarm output terminals A1, A2, A3 and A4</p> <p> $U_i = 28V$ $U_o = 1.47V$ $I_i = 200mA$ $I_o = 1\mu A$ $P_i = 0.84W$ $P_o = 2\mu W$ $C_i = 22nF$ $L_i = 4\mu H$ </p> </div> <div style="width: 48%;"> <p>Terminals RS1-RS2, (optional reset input)</p> <p> $U_i = 28V$ $U_o = 3.8V$ $I_i = 200mA$ $I_o = 1mA$ $P_i = 0.84W$ $P_o = 1mW$ $C_i = 0$ $L_i = 0$ </p> <p>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).</p> <p> $U_i = 14V$ $U_o = 10.5V$ $I_i = 200mA$ $I_o = 9.2mA$ $P_i = 0.7W$ $P_o = 24mW$ $C_i = 2nF$ $L_i = 4\mu H$ </p> <p>Optional 4-20mA output terminals C1, C2, C3 and C4</p> <p> $U_i = 28V$ $U_o = 0$ $I_i = 200mA$ $I_o = 0$ $P_i = 0.84W$ $C_i = 2.2nF$ $L_i = 4\mu H$ </p> </div> </div> <p>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: $-40^{\circ}C \leq T_a \leq +70^{\circ}C$.</p>									
<p>Title ETL Intrinsically Safe Control Drawing for 'E' and 'G' series externally powered rate totalisers.</p>						<p>Drawn SQ</p>	<p>Checked OL</p>	<p>Scale —</p>	
<p>Drawing No. CI330-52</p> <p>Sheet 5 of 6</p>									





Iss.	1	2	Date	05.05 2016	05.08 2016	Modification	New drawing	Field mounted rate totalisers added	Appd.	Ckd.	Appd.				
 BEKA associates England Hitchin company confidential, copyright reserved.															
<p>Notes</p> <p>1. 1 and 2 input externally powered rate totalisers with model numbers and coding as shown in the following tables.</p>															
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							
<p>Title</p> <p style="text-align: center;">ETL Nonincendive Control Drawing for 'E' and 'G' series externally powered rate totalisers.</p>										<p>Drawn SQ</p>		<p>Checked OL</p>		<p>Scale —</p>	
<p>Drawing No.</p> <p style="text-align: center;">CI330-53</p>										<p>Sheet 3 of 6</p>					

Iss.		Date	Modification	Ckd.	Appd.	<p>BEKA associates Hitchin England company confidential, copyright reserved.</p>	Iss.	Date	Modification	Ckd.	Appd.	
1	15.06.2016	New drawing										
2	05.08.2016	Field mounted rate totalisers added										
						<p>2. Terminals 7, 8, 9 and 10 only exist on 2 input instruments.</p> <p>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.</p> <p>4. Classified location equipment shall be 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.</p> <p>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.</p> <p>6. The unclassified location equipment shall not use or generate more than 250V rms or 250V dc.</p>						
<p>Title</p> <p>ETL Nonincendive Control Drawing for 'E' and 'G' series externally powered rate totalisers.</p>						<p>Drawn SQ</p>		<p>Checked OL</p>		<p>Scale —</p>		
						<p>Drawing No. C1330-53 Sheet 4 of 6</p>						

Iss.	Date	Modification	Ckd.	Appd.
1	15.06.2016	New drawing		
2	05.08.2016	Field mounted rate totalisers added		

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Iss.	Date	Modification	Ckd.	Appd.

Title ETL Nonincendive Control Drawing for 'E' and 'G' series externally powered rate totalisers.		Drawn SQ	Checked OL	Scale —
		Drawing No. C1330-53 Sheet 5 of 6		

7. Safety parameters DC Power terminals 1 & 2 $U_i = 30V$ $I_i = 100mA$ Terminals 4,5,6 (input A for models in notes 5 and 6), terminals 8,9,10 (input b for models in note 6). $U_i = 30V$ $U_o = 1.1V$ $I_o = 0.5mA$ Optional pulse output terminals P1 & P2 $U_i = 30V$ $I_i = 100mA$ $U_o = 0$ $I_o = 0$ Optional alarm output terminals A1, A2, A3 and A4 $U_i = 30V$ $I_i = 200mA$ $U_o = 1.47V$ $I_o = 1\mu A$		Terminals RS1-RS2, (optional reset input) $U_i = 30V$ $U_o = 3.8V$ $I_o = 1mA$ 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). $U_i = 15V$ $U_o = 10.5V$ $I_o = 9.2mA$ Optional 4-20mA output terminals C1, C2, C3 and C4 $U_i = 30V$ $U_o = 0$ $I_o = 0$
--	--	--

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: $-40^{\circ}C \leq T_a \leq +70^{\circ}C$.

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

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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.	Title	Drawn SQ	Checked OL	Scale —
					ETL Nonincendive Control Drawing for 'E' and 'G' series externally powered rate totalisers.	Drawing No. CI330-53 Sheet 6 of 6		