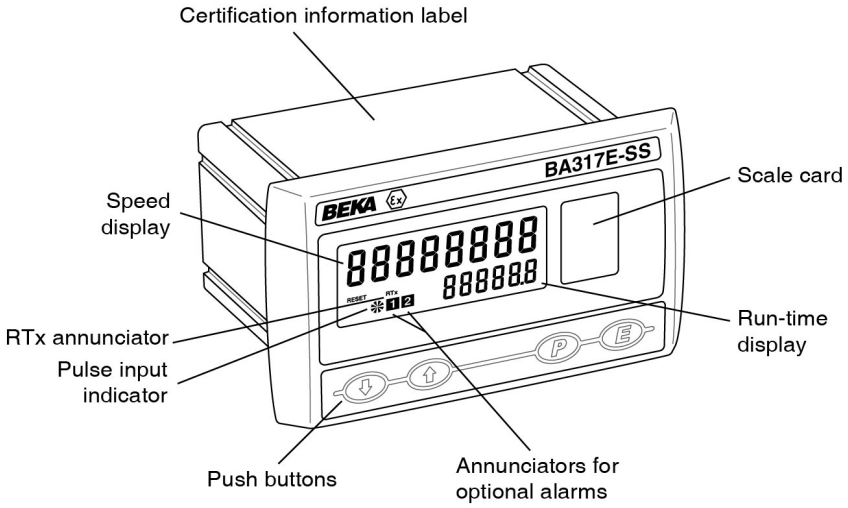
BA317E-SS
Rugged one input Intrinsically safe Tachometer

Issue 6



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The BA317E-SS is CE marked to show compliance with the European Explosive Atmospheres Directive 2014/34/EU and the European EMC Directive 2014/30/EU

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1. DESCRIPTION

This rugged intrinsically safe, one input Tachometer is primarily intended for measuring rotational speed within a hazardous area. To assist with routine maintenance, it also includes a run-time clock that records the number of hours that the monitored machinery has been operating.

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

The BA317E-SS has been certified intrinsically safe for use in gas and dust hazardous areas by Notified Body Intertek Testing and Certification Ltd and complies with the European ATEX Directive 2014/34/EU. It has a rugged stainless steel enclosure and an impact resistant glass window. In addition to normal intrinsically safe applications, the certification allows it to be installed in an Ex e, Ex n, Ex p or Ex t panel enclosure without invalidating the enclosure's certification.

For international applications the BA317E-SS also has IECEx certification which is described in Appendix 2.

For applications in the USA and Canada the BA317E-SS has ETL and cETL certification which is described in Appendix 3.

2. OPERATION

Fig 1 shows a simplified block diagram of the BA317E-SS Tachometer. 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-SS has 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 optional accessories are shown below:

Backlight

Isolated dual alarms
or
Isolated 4/20mA output
or
Isolated pulse output

Only one output option may be fitted

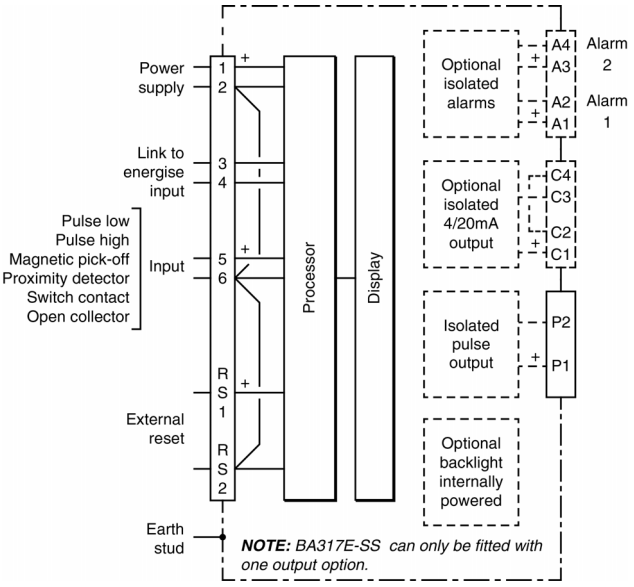


Fig 1 BA317E-SS

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-SS is 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

E + ▲ To reset grand total run-time to zero press buttons simultaneously for ten seconds or longer. This is a configurable function. See 6.16

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

- A Dual alarm outputs
- P Pulse output
- C 4/20mA output

P + E 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 P + ▲ buttons are operated.
See 9.4.13 and 9.4.14

2.3 Displays

The BA317E-SS has two digital displays and associated annunciators, plus a pulse input indicator as shown on front cover of this manual.

Speed display On upper eight digit display

Run-time display On lower 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.

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

dirECt:
Annunciator continuously activated.

3. INTRINSIC SAFETY CERTIFICATION

The BA317E-SS Tachometer has ATEX and IECEx gas and dust certification. This section of the instruction manual describes ATEX gas certification. Dust, IECEx and other approvals are each described in separate appendixes to this manual.

3.1 ATEX gas certification

Notified Body Intertek Testing and Certification Ltd have issued the BA317E-SS with an EC-Type Examination Certificate number ITS16ATEX28408X. This confirms compliance with harmonised European standards and it has been used to confirm compliance with the European ATEX Directive for Group II, Category 1G equipment. The Tachometer carries the community mark and subject to local codes of practice may be installed in any of the European Economic Area (EEA) member countries. ATEX certificates are also acceptable for installations in Switzerland.

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

3.2 Zones, gas groups and T rating

The BA317E-SS Tachometer has been certified Ex ia IIC T5. 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 to +60°C	When installed as an intrinsically safe Ex i instrument in an Ex e, Ex n, Ex p or Ex t enclosure.
-40 to +70°C	When used as an intrinsically safe Ex i instrument **not** in an Ex e, Ex n, Ex p or Ex t enclosure.

3.3 Special conditions for safe use

The ATEX intrinsic safety certificate number has an 'X' suffix indicating that for some applications special conditions apply for safe use.

> *When installed in an Ex e, Ex n, Ex p or Ex t panel enclosure all connections to the BA317E-SS must be made by appropriately rated Zener barriers or galvanic isolators.*

This means that when installed in an Ex e, Ex n, Ex p or Ex t panel enclosure the BA317E-SS remains an intrinsically safe instrument and must comply with the installation requirements shown in this manual.

The certificate also states:

> *The front of the stainless steel enclosure complies with the requirements for Ex e, Ex n Ex p & Ex t type of protection.*

Therefore when correctly installed the BA317E-SS Tachometer will not invalidate the Ex e, Ex n, Ex p or Ex t panel enclosure certification.

Note: At temperatures below -20°C the instrument will continue to function, but the display response will become slower and the contrast will be reduced.

3.4 Power supply

When installed in a hazardous area the BA317E-SS 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:

Ui = 28V dc
Ii = 200mA dc
Pi = 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:

Ci = 2nF
Li = 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-SS Tachometer.

3.5 Pulse input terminals

The BA317E-SS Tachometer has 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.

		Pulse input terminals 5 & 6 safety description		
Type of input	**Link 3 & 4**	**Uo**	**Io**	**Po**
Switch contact	Yes	10.5V	8.2mA	25mW
Proximity detector	Yes	10.5V	8.2mA	25mW
Open collector	Yes	10.5V	8.2mA	25mW
Magnetic pick-off	No	1V	11µA	3µW
Voltage input (low)	No	1V	11µA	3µW
Voltage input (high)	No	1V	11µA	3µW

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* (Clause 5.7 of EN60079-11), which allows them to be ignored when designing an intrinsically safe system.

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:

Uo ≤ 28V dc
Io ≤ 200mA dc
Po ≤ 0.84W

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:

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

b. The device can withstand a 500V rms insulation test to earth.The BA317E-SS EC-Type Examination Certificate specifies that the equivalent capacitance and inductance between the two pulse input terminals 5 and 6 is:

   Ci = 2nF
   Li = 8µH

   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.

c. The sensor is located in the same hazardous area as the BA317E-SS.

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:

Uo = 10.5V dc
Io = 8.2mA dc
Po = 25mW

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-SS energised input providing that:

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

   Ui ≥ 10.5V dc
   Ii ≥ 8.2mA dc
   Pi ≥ 25mW

   or complies with the requirements for *simple apparatus.*

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

c. The sensor is located in the same hazardous area as the BA317E-SS.

d. Minimum sensor operating voltage is less than 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:

Co = 2.4µF
Lo = 200mH

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

3.6 Remote reset terminals

The BA317E-SS 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:

Uo = 3.8V dc
Io = 1.6mA dc
Po = 2.0mW

Ui = 28V dc
Ii = 200mA dc
Pi = 0.84W

The equivalent capacitance and inductance between them is:

Ci = 0
Li = 0

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

Co = 40µF
Lo = 1H

The reset terminals may be directly connected to any mechanically operated switch located within the same hazardous area as the BA317E-SS 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 as shown in Fig 2. A diode return Zener barrier is not suitable for this application. Alternatively, the BA317E-SS 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 ATEX and IECEx certification information plus BEKA associates name and location. Non European certification information may also be included.

BA317E-SS 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-SS.

Terminals 2, 6 and RS2 of the BA317E-SS 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-SS 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-SS installations protected by Zener barriers. For simplicity, connections for the optional pulse output, alarms and 4/20mA output are shown separately in section 9 this manual.

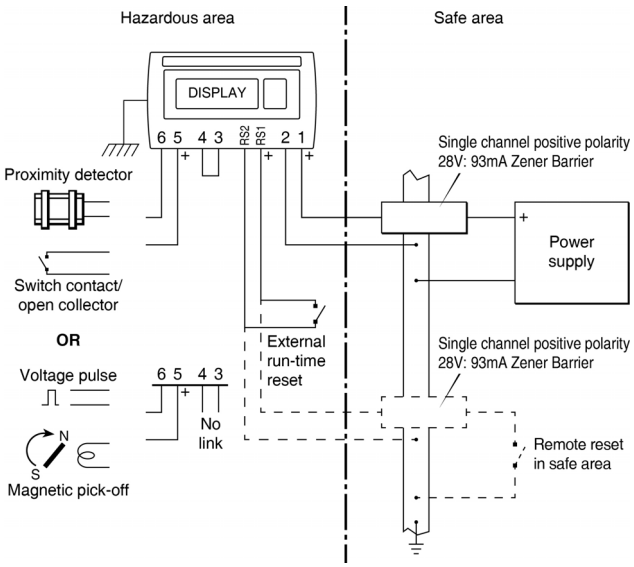


Fig 2 BA317E-SS used with Zener barriers

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-SS See Fig 1.

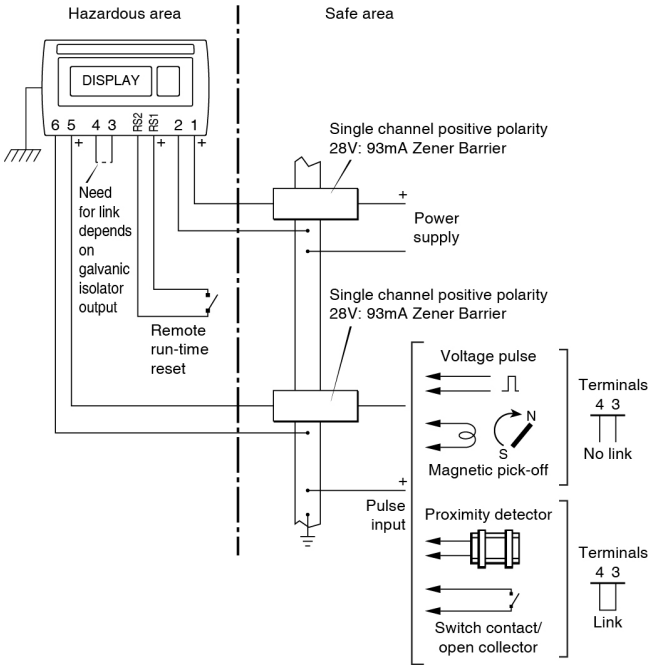


Fig 3 BA317E-SS used with Zener barriers pulse source in safe area.

4.1.1 Power supply

The BA317E-SS Tachometer requires a minimum of 10V between terminal 1 & 2 and consumes:

Without backlight	10.0mA
Addition for backlight	22.5mA
Addition with terminals 3 & 4 linked	6.0mA
Total current	38.5mA

Any certified Zener barrier may be used to power a BA317E-SS 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-SS 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	2kΩ	10kΩ
Voltage pulse low	1.0V	3.0V
Voltage pulse high	3.0V	10.0V
Magnetic pick-off	0mV	40mV peak
Proximity detector	1.2mA	2.1mA
Switch	100Ω	1000Ω

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-SS 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-SS contains 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-SS, 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.

Ui	≥	10.5V dc
Ii	≥	8.2mA dc
Pi	≥	25mW

The minimum operating voltage of the sensor (proximity detector) must be less than 7.5V. The sensor must be located in the same hazardous area as the BA317E-SS 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. CoiL in the BA317E-SS input configuration menu is a low level voltage pulse input intended for use with an intrinsically safe magnetic pick-off. When a BA317E-SS Tachometer is configured for CoiL and terminals 3 and 4 are not linked, the input complies with the requirements for *simple apparatus* allowing connection to any certified intrinsically safe magnetic sensor having output parameters equal to or less than:

Uo	≤	28V dc
Io	≤	200mA dc
Po	≤	0.84W

The maximum permitted cable parameters will be the magnetic pick-off's Co and Lo specified on it's intrinsic safety certificate, less the Tachometer's pulse input parameters Ci and Li 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.

The BA317E-SS contains 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-SS Tachometer configuration menu, UoLt5 L and UoLt5 H. When configured for either of the voltage pulse ranges and terminals 3 and 4 are not linked, the input terminals 5 & 6 comply with the requirements for *simple apparatus*. This allows the input to be connected to any certified intrinsically safe sensor with a voltage output located in the same hazardous area as the Tachometer having output parameters equal to or less than:

Uo	≤	28V dc
Io	≤	200mA dc
Po	≤	0.84W

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 Ci and Li 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-SS 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-SS 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-SS may be reset from both the safe and the hazardous area.

Note: The BA317E-SS 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-SS having the correct function may be used.

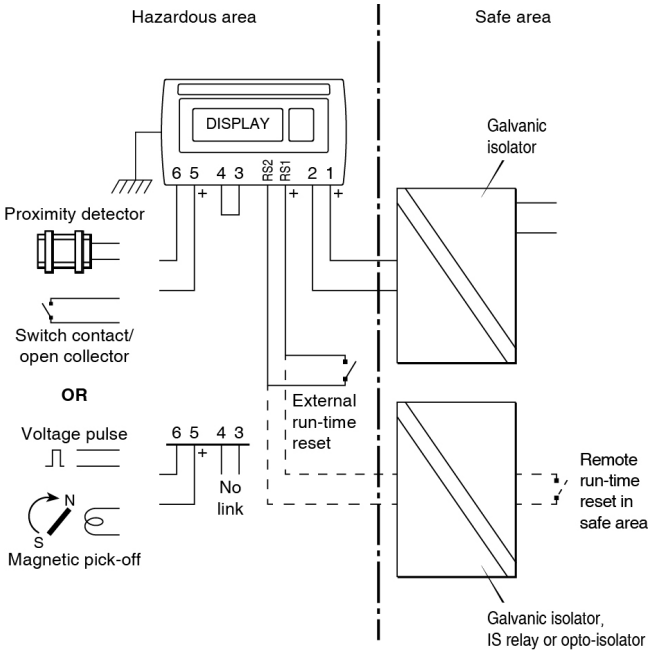


Fig 4 BA317E-SS used with galvanic isolators.

Fig 4 illustrates the basic circuit that is used for all BA317E-SS 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.

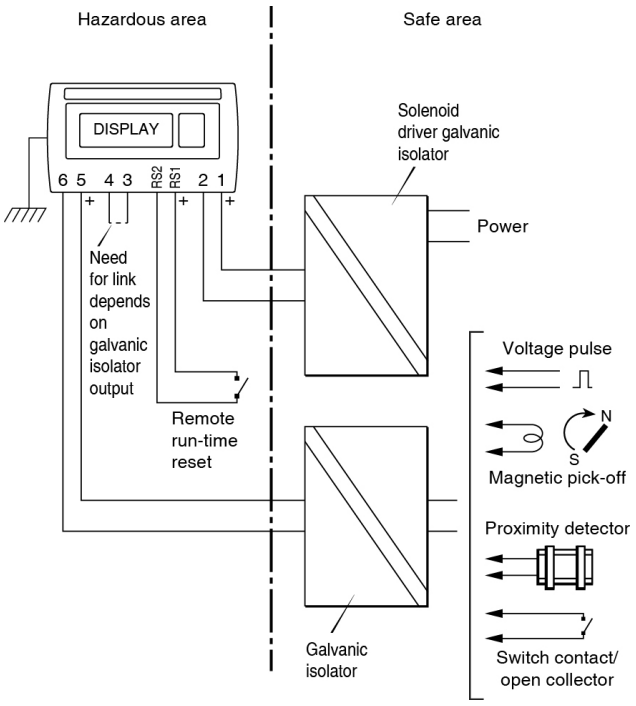


Fig 5 Pulse source in safe area

4.2.1 Power supply

The BA317E-SS Tachometer requires a minimum of 10V between terminal 1 & 2 and consumes:

Without backlight	10.0mA
Addition for backlight	22.5mA
Addition with terminals 3 & 4 linked	6.0mA
Total current	38.5mA

Any certified galvanic isolator may be used to power a BA317E-SS 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.

4.2.2 Pulse input

As shown in Fig 4 the BA317E-SS 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 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-SS contains a configurable debounce circuit to prevent contact bounce being counted.

See section 6.6 for details of the maximum counting frequency.

4.2.4 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-SS contain a configurable debounce circuit to prevent false triggering. Three levels of de-bounce protection are independently available. See section 6.6.

4.2.5 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.

Ui	≥	10.5V dc
Ii	≥	8.2mA dc
Pi	≥	25mW

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

See section 6.6 for details of the maximum counting frequency.

4.2.6 Magnetic pick-off input

[oiL 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 [oiL 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:

Uo	≤	28V dc
Io	≤	200mA dc
Po	≤	0.84W

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.

4.2.7 Voltage pulse input

Two voltage pulse input ranges are selectable in the configuration menu, UoLt5 L and UoLt5 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:

Uo	≤	28V dc
Io	≤	200mA dc
Po	≤	0.84W

The BA317E-SS 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.

4.2.8 Remote reset

The BA317E-SS 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-SS 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-SS may be reset from both the safe and the hazardous area.

Note: The BA317E-SS 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.

4.3 Use in an Ex e or Ex p panel enclosure located in Zone 1 or Zone 2.

The BA317E-SS ATEX EC-Type Examination Certificate allows the Tachometer to be installed in an Ex e IIC Gb increased safety panel enclosure located in Zone 1 or 2, or in an Ex p IIC Gb pressurised panel enclosure located in a Zone 1 or 2 hazardous area. The BA317E-SS may also be installed in an Ex n enclosure located in Zone 2.

When installed in a certified panel enclosure the BA317E-SS Tachometer remains intrinsically safe and must be protected by a Zener barrier or galvanic isolator as described in sections 4.1 and 4.2. However when correctly installed, the Tachometer does not invalidate the certification of the Ex e, Ex n or Ex p panel enclosure allowing installation with higher power control equipment.

4.3.1 Installation in an Ex e panel enclosure

Installation of a BA317E-SS Tachometer in an Ex e IIC Gb increased safety panel enclosure does not invalidate the Ex e panel's ingress and impact protection as the front of the BA317E-SS complies with Ex e impact and ingress requirements. Although mounted in an Ex e panel enclosure, the BA317E-SS remains Group II Category 1G Ex ia IIC T5 Ga intrinsically safe apparatus and therefore it must be powered via a Zener barrier or galvanic isolator as described in section 4.1 and 4.2 of this manual.

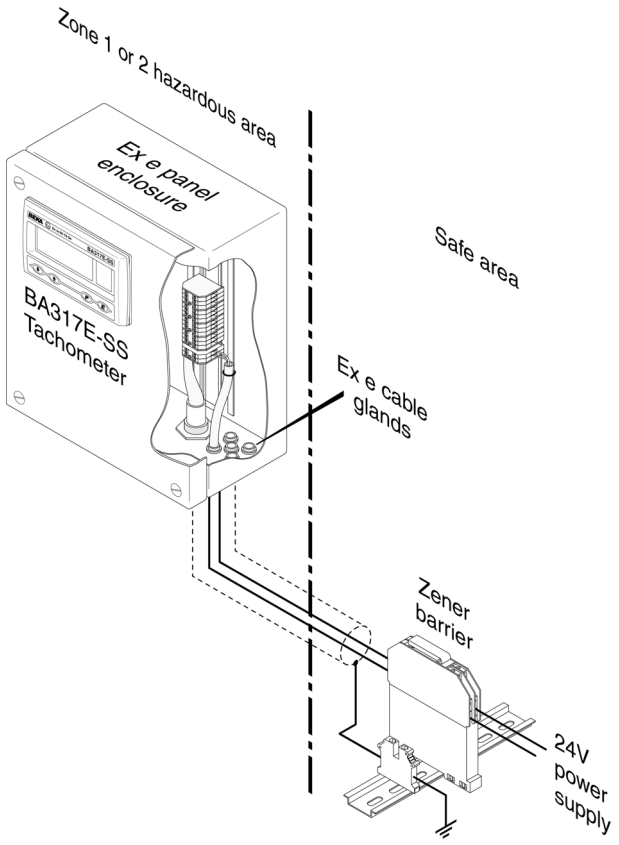


Fig 6 Typical installation in Ex e panel enclosure

Some Zener barriers and galvanic isolators are certified for mounting within a protective enclosure located in Zone 2 which may permit them to be mounted in the same Ex e enclosure as the BA317E-SS Tachometer. Zener barriers and galvanic isolators are not permitted in Ex e enclosures located in Zone 1.

The Tachometer terminals, the wiring to the Tachometer and the intrinsically safe interface, if mounted within the enclosure, should be segregated from all other non-intrinsically safe wiring and equipment within the panel enclosure as required by EN 60079-11 *Equipment protected by intrinsic safety* and EN 60079-14 *Electrical installations design, selection and erection*.

The Ex e panel enclosure should be fitted with a warning label saying 'Do not open when non-intrinsically safe circuits are energised', alternatively all bare live non-intrinsically safe parts within the panel enclosure should have an IP30 cover carrying a warning label 'Do not open when energised'.

The power dissipation within an BA317E-SS fitted with operational alarms and a backlight is normally about 350mW. In the very unlikely event that all three circuits fail to the worst case condition at the same time, the total power dissipation rises to 2.5W which could raise the internal temperature of a small thermally well insulated panel enclosure.

4.3.2 Installation in Ex p panel enclosure

Installation of a BA317E-SS Tachometer in an Ex p IIC Gb or Ex p IIC Gc pressurised panel enclosure does not invalidate the Ex p panel's impact and ingress protection as the front of the Tachometer complies with Ex p impact and ingress requirements. Although mounted in an Ex p panel enclosure, the BA317E-SS remains Group II Category 1G Ex ia IIC T5 Ga intrinsically safe apparatus and must therefore be powered via a Zener barrier or galvanic isolator as described in section 4.1 and 4.2 of this manual to ensure that the instrument's front panel push button switches are nonincendive.

When installed in an Ex p panel enclosure the four vents at the rear of the Tachometer which are shown in Fig 10 should not be obstructed.

Zener barriers and galvanic isolators may be installed in the same Ex p enclosure as the BA317E-SS. All may be mounted in an Ex px enclosure installed in Zones 1 or 2, or in an Ex pz enclosure installed in Zone 2, both of which have a non-hazardous interior. Some Zener barriers and galvanic isolators may have certification permitting installation within an Ex py enclosure which has a Zone 2 interior.

The Tachometer's terminals, the wiring to the Tachometer and the intrinsically safe interface, if mounted within the enclosure, should be segregated from all other non-intrinsically safe wiring and equipment within the panel enclosure as required by EN 60079-11 *Equipment protected by intrinsic safety* and EN 60079-14 *Electrical installations design, selection and erection*.

If live maintenance is anticipated, it is recommended that the Ex p panel enclosure should be fitted with a warning label saying 'Do not open when non-intrinsically safe circuits are energised', alternatively all bare live non-intrinsically safe parts within the panel enclosure should have an IP30 cover carrying a warning label 'Do not open when energised'.

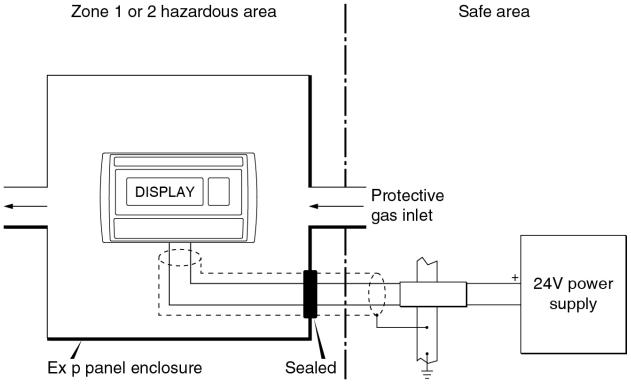


Fig 7 Typical installation in Ex p panel enclosure

5. INSTALLATION

5.1 Location

The BA317E-SS has a stainless steel case with a 10mm thick toughened glass window. The case provides 7J and the window 4J front of panel impact protection. The captive silicone gasket, which seals the joint between the instrument and the panel enclosure, ensures IP66 front of panel ingress protection. The rear of the Tachometer has IP20 protection.

Although the front of the BA317E-SS has IP66 protection, it should be shielded from continuous direct sunlight and severe weather conditions.

Installation in an Ex e or Ex p panel enclosure is described in sections 4.3.1 and 4.3.2.

Fig 8 show the overall dimensions of the BA317E-SS together with the recommended panel enclosure cut-out dimensions. Figs 8 & 10 shows the location of the terminals for field wiring.

5.2 Installation Procedure

a. Cut the aperture specified in Fig 8 in the panel enclosure. Ensure that the edges of aperture are de-burred.

b. Inspect the Tachometer's captive gasket and ensure that it is not damaged before inserting the Tachometer into the panel enclosure aperture.

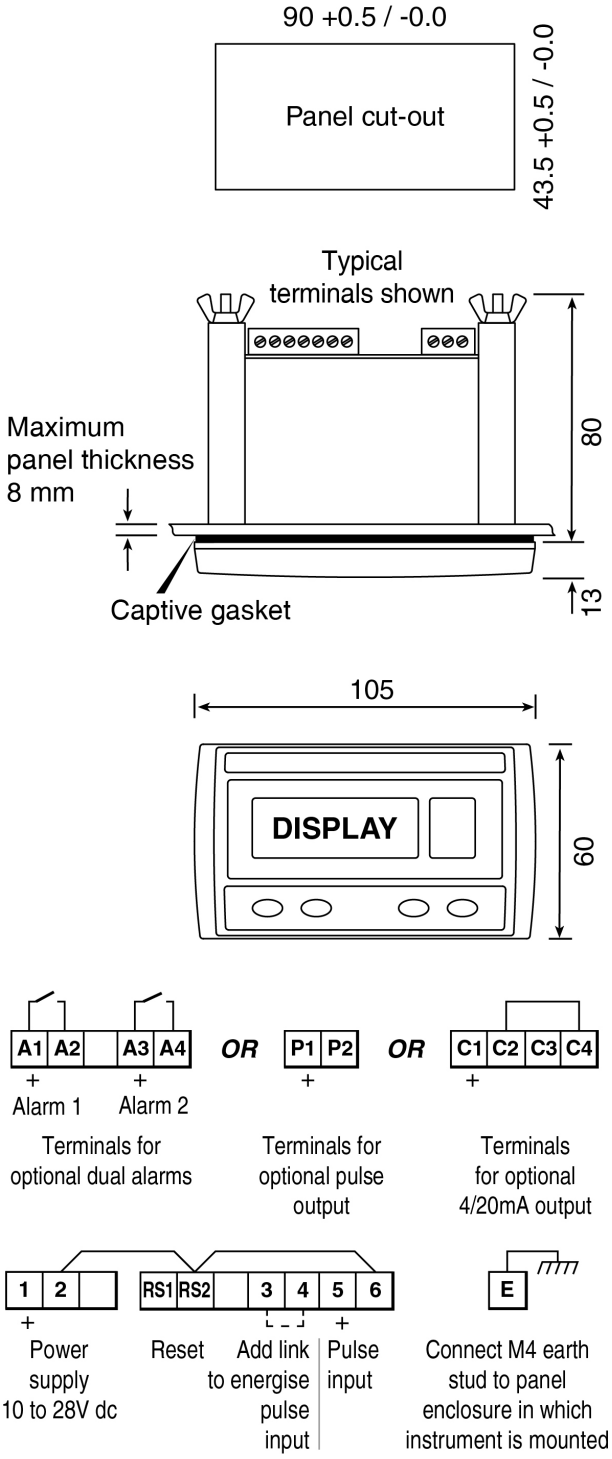
c. If the enclosure panel is less than 1.0mm thick, or is non-metallic, an optional BEKA stainless steel support plate should be slid over the rear of the Tachometer before the panel clamps are fitted to evenly distribute the clamping force and prevent the enclosure panel being distorted or creeping.

d. Slide a panel clamp into the two grooves at each corner of the indicator housing with the M3 stud protruding through the hole at the rear of the clamp. Fit the stainless steel spring washer over the stud and secure with the stainless steel wing nut.

e. Evenly tighten the four clamps to secure the instrument. The recommended minimum tightening torque for each wing nut is 22cNm (1.95 lbf in).

f. Connect the panel enclosure wiring to the rear terminal blocks. To simplify installation, the terminals are removable so that wiring can be completed before the instrument is installed. Cables should be mechanically secured to ensure terminals are not damaged by vibration.

g. Finally, fit a silicone rubber push-on cap to the end of each M3 threaded rod.



Support panel wiring to prevent vibration damage

Note: Optional backlight is internally powered

Fig 8 Dimensions and terminals

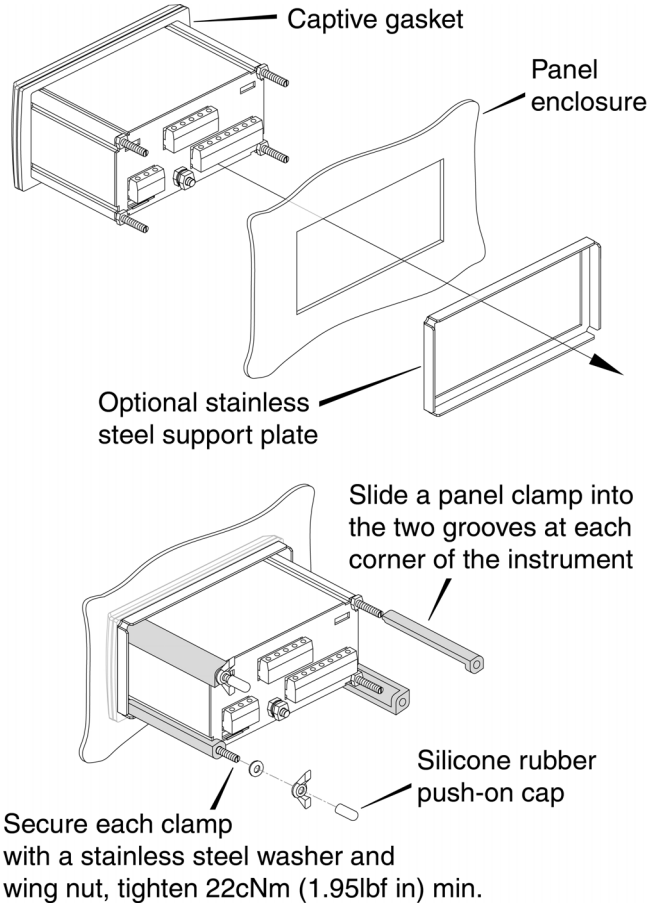


Fig 9 Installation procedure

5.3 EMC

The BA317E-SS complies with the requirements of the European EMC Directive 2014/30/EU. For specified immunity all wiring should be in screened twisted pairs, with the screens earthed at one point within the safe area.

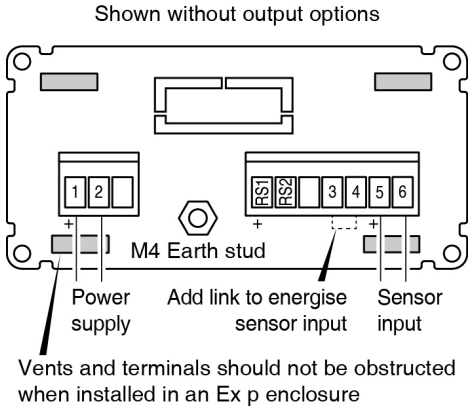


Fig 10 Terminals for field wiring

5.4 Tachometer earthing

The BA317E-SS has an M4 earth stud on the rear panel which should be electrically connected to the panel enclosure in which the Tachometer is mounted, or to the plant equipotential conductor.

5.5 Scale card

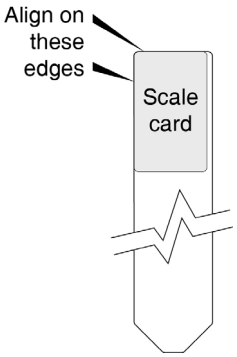
The Tachometer's units of measurement are shown on a printed scale card in a window at the right hand side of the display. The scale card is mounted on a flexible strip that is inserted into a slot at the rear of the instrument as shown in Fig 11. Thus the scale card can easily be changed without removing 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 flow 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.



Align the self-adhesive printed scale card onto the flexible strip and insert the strip into the indicator as shown below.

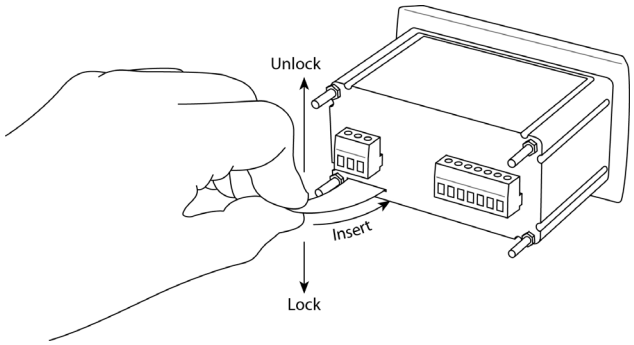


Fig 11 Inserting flexible strip carrying scale card into slot at the rear of the Tachometer.

6.0 CONFIGURATION & CALIBRATION

The BA317E-SS Tachometer is configured and calibrated via four front panel push buttons. All the configuration functions are contained in an easy to use intuitive menu that is shown diagrammatically in Fig 13.

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 output or 4/20mA output 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	inP.tYPE	oP.CoL
Debounce	dEbounCE	dEFAuLt
Update	uPdAtE	0.5
Run-time display	di SP-2	on
Decimal point (speed)	dP	0000.0
Speed scale factor	SCALE.S	001.00
Timebase	t-bASE	tb-60
Filter	FiLtEr	24
Clip-off	CLP-oFF	0000.0
Local run-time reset	CLr tot	oFF
Local grand total run-time reset.	CLr Gtot	oFF
Security code	CodE	0000

6.1 Calibration structure

Fig 12 shows the BA317E-SS 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-bASE 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.

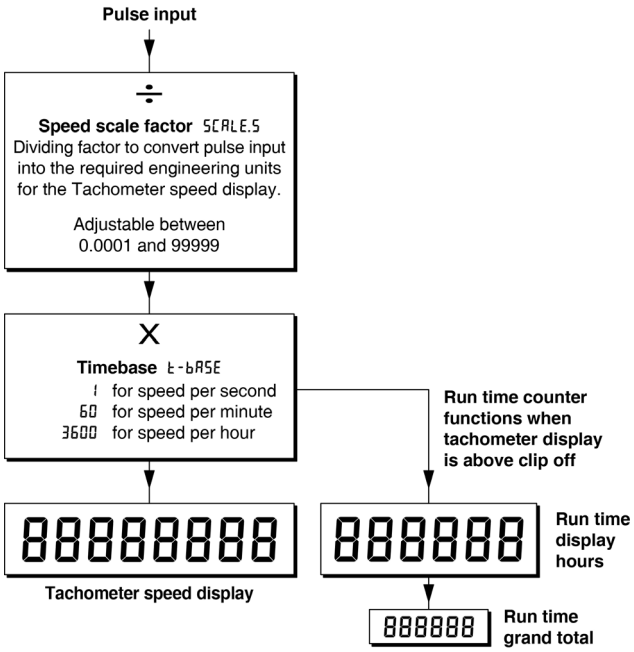


Fig 12 Calibration structure

6.2 Accessing configuration functions

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

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 inPut will be displayed. If a security code other than the default code 0000 has already been entered, the instrument will display CodE. Press P to clear this prompt and enter the security code for the instrument using the ▼ or ▲ push button to adjust 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 inPut 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 ▲ push buttons. The configuration menu is shown diagrammatically in Fig 13.

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

6.3 Summary of configuration functions

This section summarises all the configuration functions. When read in conjunction with Fig 11 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
inPut	**Input** Contains sub-menu with two functions: inP.tYPE Select Input type dEbounCE Set debounce **See section 6.4**
	inP.tYPE Configures the Tachometer to accept one of six types of input: oP.Col Open collector * VoLtS L Voltage pulse <1 >3V VoLtS H Voltage pulse <3 >10V Coil Magnetic pick-off Pr.dEt Proximity detector * ContACt Switch contact * * Link terminals 3 & 4 **See section 6.5**
	dEbounCE Defines level of input debounce applied to the pulse input to prevent false counting, three levels are selectable: dEFAuLt HEAVY LiGHt **See section 6.6**
uPdAtE	**Display update interval** Defines the interval between display updates from 0.5 to 5 seconds. **See section 6.7**
di SP-2	**Run-time display** Turns the lower display, which shows run-time in hours, on or oFF. **See section 6.8**

Display	Summary of function
dP	**Decimal points** Defines the position of the decimal point in the Tachometer speed display. **See section 6.9**
SCALE.S	**Speed scale factor** SCALE.S 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.S should be set to 18.0. **See section 6.10**
t-bASE	**Timebase** Selectable multiplier allowing Tachometer speed display to be in units per second, per minute or per hour. Select: tb-01 per second tb-60 per minute tb-3600 per hour **See section 6.11**
FiLtEr	**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. **See section 6.12**
CLP-oFF	**Clip-off** Clip-off is the Tachometer speed display threshold below which the run-time clock is inhibited. **See section 6.13**

Display	Summary of function
LoC CLr	**Local reset** 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. **See section 6.14** CLr tot 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. **See section 6.15** CLr Gtot When on is selected, operating the E and ▲ buttons simultaneously for more than 10 seconds in the display mode resets the run-time grand total to zero. **See section 6.16**
CLr Gtot	**Resets grand total run-time to zero.** This function resets the grand total run-time to zero from within the configuration menu when CLr YES is selected, and SurE is entered to confirm the instruction. **Note**: Once reset, the original grand total can not be recovered. **See section 6.17**
CodE	**Security code** 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. **See section 6.18**
rSEt dEF	**Reset to factory defaults** 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. **See section 6.19**

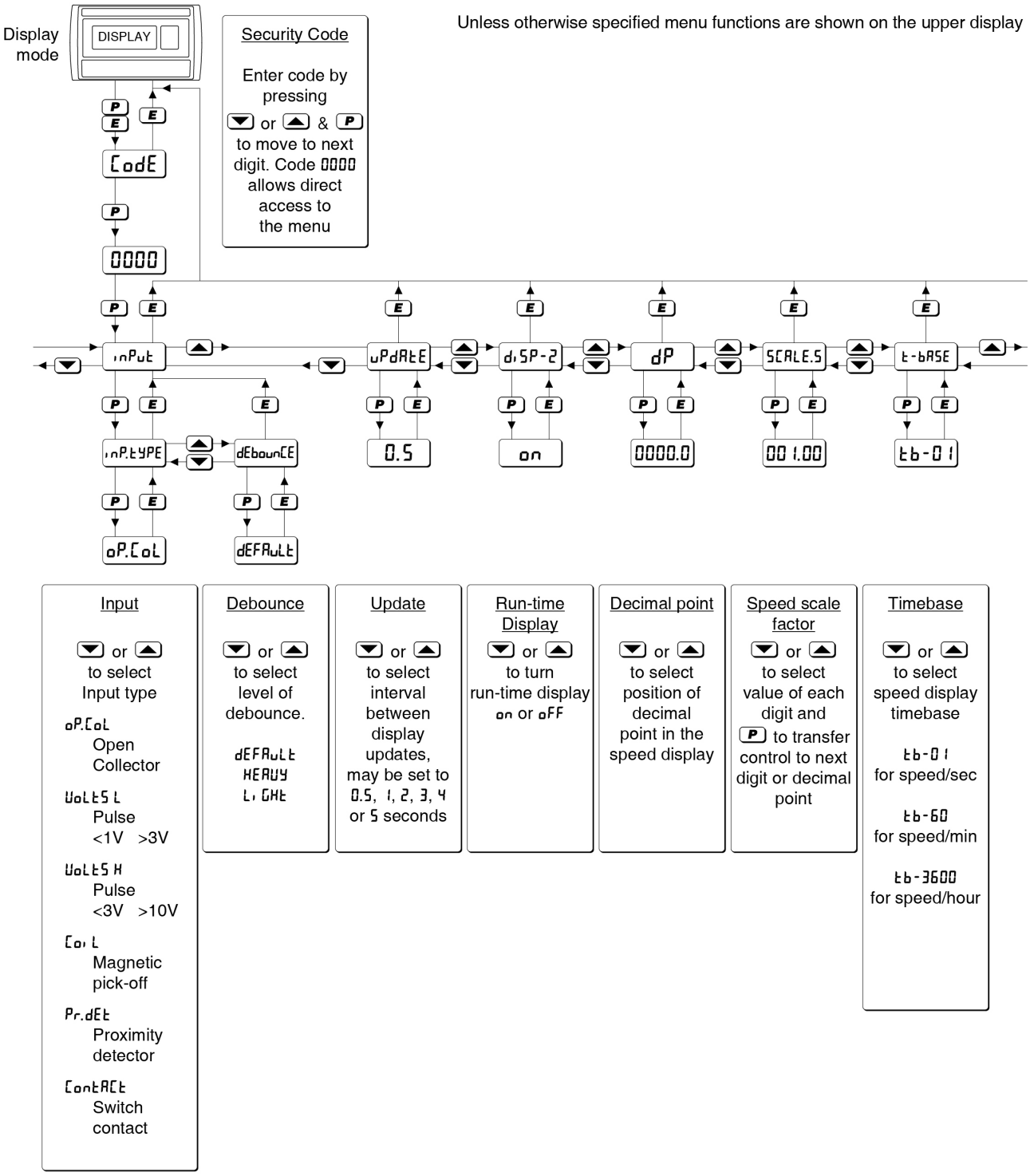
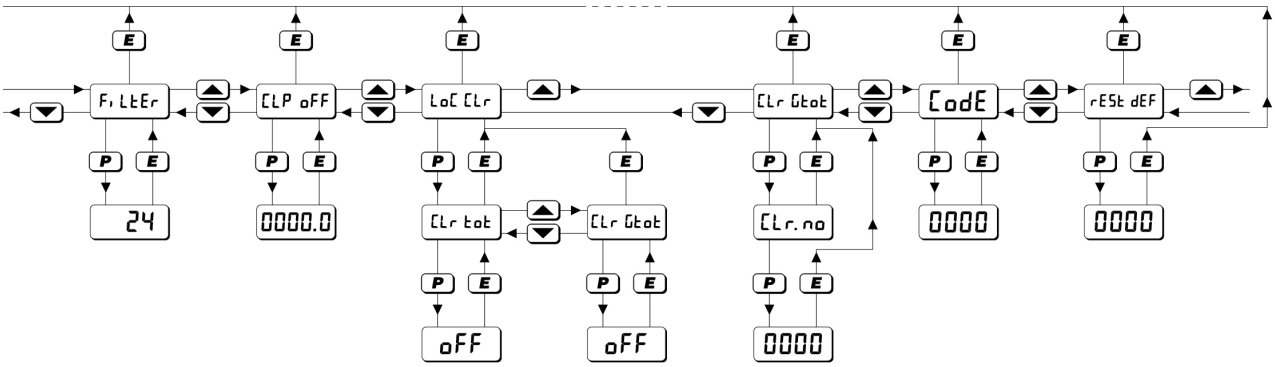


Fig 13 Configuration menu

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



Filter

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

First digit: filter magnitude

second digit: step response

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

Clip off

Tachometer display below which run-time timer is inhibited

▼ or ▲ to adjust value and P to move to next digit

Local run-time reset

▼ 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

Local run-time grand total reset

▼ 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

Reset run-time grand total

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

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

Define Security Code

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

Reset configuration to factory defaults

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

6.4 Input: inPut

The Input function contains two sub-functions inP.tYPE and dEbounCE which configure the Tachometer input and define the amount of input noise rejection.

6.5 Input type: inP.tYPE

inP.tYPE 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 inP.tYPE 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 ▼ or ▲ 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
oP.Col	Open collector [2]	2	10kΩ
VoLtSL	Voltage pulse low [1]	1	3V
VoLtSH	Voltage pulse high[1]	3	10V
Coil	Magnetic pick-off	0	40mV
Pr.dEt	Proximity detector [2]	1.2	2.1mA
ContACt	Switch contact [2]	100	1000Ω

Notes:

1 Maximum voltage input +28V.

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 inP.tYPE function.

The following table shows the minimum time that the input pulse must be continuously above the upper input switching threshold and continuously below the lower switching threshold to ensure that the 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 operating input frequency is 0.01Hz. Below this frequency the speed display will be forced to zero.

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

6.7 Display update interval: uPdAtE

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

6.8 Run-time display: di SP-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 di SP-2 from the configuration menu and press P that will reveal if the run-time display is on or oFF. The setting may be changed by pressing the ▼ or ▲ button followed by the E button to enter the selection and return to the configuration menu.

6.9 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 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 ▼ or ▲ push button. When set as required enter the setting and return to the configuration menu by operating the E button.

6.10 Speed scale factor: SCALE.S

SCALE.S 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 SCALE.S 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-bASE which is described in section 6.11.

To check or change the speed scale factor select SCALE . S from the configuration menu and press P which will reveal the existing value with one digit flashing. The value of the flashing digit may be changed by pressing the ▼ or ▲ button.

When this digit has been adjusted as required, pressing P will transfer control to the next digit. When all the digits have been adjusted pressing P will transfer control to the decimal point which may be positioned between any of the digits, or may be omitted by moving it to the right of the least significant digit. When the required speed scale factor has been entered, press E to return to the SCALE.S prompt in the configuration menu.

6.11 Timebase: t-bASE

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 12.

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

tb-1	speed per second
tb-60	speed per minute
tb-3600	speed per hour

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

6.12 Display filter: FiLtEr

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.S, 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 tot and CLr GtoT 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 tot

CLr tot 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 ▼ and ▲ push buttons simultaneously for more than three seconds.

Select LoC CLr in the configuration menu and press P which will reveal the CLr tot prompt, operate P again to 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 4.2.8 of this manual.

6.16 Local grand total run-time reset: CLr Gtot

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 E and ▲ buttons simultaneously.

CLr Gtot is a sub-menu in the LoC CLr 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 E and ▲ push buttons simultaneously for more than ten seconds. See section 2.2

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

Note:

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

6.17 Grand total run-time reset from within the configuration menu: CLr Gtot

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 E and ▲ buttons simultaneously.

The grand total can be reset to zero from within the configuration menu using this CLr Gtot function.

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

Note:

Once reset, the grand total can not be recovered.

6.18 Security code: CodE

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 0000 which allows unrestricted access to all configuration functions.

To enter a new security code select CodE from the configuration menu and press P which will cause the Tachometer to display 0000 with one digit flashing. The flashing digit may be adjusted using the ▼ or ▲ push button and the P button to transfer control to the next digit. When all the digits have been adjusted press E to return to the CodE prompt. The revised security code will be activated when the 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: rSEt dEF

rSEt 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 rSEt dEF from the configuration menu and press P which will result in the instrument displaying 0000 with the first digit flashing. To confirm the instruction SurE should be entered. Using the ▼ or ▲ button set the first flashing digit to S and press P which will transfer control to the second digit which should be set to u. When SurE has been entered pressing the E button will reset all the configuration functions and return the instrument to the display mode.

7. CONFIGURATION EXAMPLE

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

The BA317E-SS 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-SS 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 inPut which is the first function in the configuration menu. See Fig 13.

Step 2 Select the type of input & debounce

With inPut 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 dEbounCE from the sub-menu and press P. Using the ▼ or ▲ button select dEFAuLt 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 inPut 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 uPdAtE 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 uPdAtE prompt in the configuration menu by pressing the E button.

See 6.7

Step 4 Run-time display

Using the ▼ or ▲ button select di SP-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 di SP-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

SCALE.S 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-bASE 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 SCALE.S should therefore be adjusted to 105.0.

Using the ▼ or ▲ push button select SCALE.S 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 SCALE.S 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-bASE from the configuration menu and press P. Again using the ▼ or ▲ push button select tb-60 from the three options which will multiply the speed display by 60. Enter the selection and return to the t-bASE prompt in the configuration menu by pressing E.

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

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 P 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 P 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 E.

See 6.13

Step 13 Local reset of total and grand total

Two separate functions in the LoC 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-SS Tachometer is in the display mode.

Using the ▼ or ▲ button select LoC CLr in the configuration menu and press P which will reveal the sub-menu. Again using the ▼ or ▲ button select the local total reset function CLr tot and press P. This is required therefore using the ▼ or ▲ button select on followed by E to return to the CLr tot prompt in the sub-menu.

Using the ▼ or ▲ button select the local grand total run-time reset function CLr Gtot and press P. This is not required therefore using the ▼ or ▲ button select oFF. Enter the selection and return to the LoC CLr prompt in the configuration menu by pressing the E 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 CLr.GtoL in the configuration menu and press P which will cause CLr.no to be displayed. Again using the ▼ or ▲ button select CLr YES and press P which will result in a 0000 display with one digit flashing. This is a request for the instruction to be confirmed by entering SurE using the ▼ or ▲ buttons to set each digit and the P button to move control to the next digit. Pressing E will then reset the run-time grand total to zero and return the instrument to the CLr.GtoL 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 CodE from the configuration menu and press P 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 P to transfer control to the second digit. When all have been entered press E to return to the main configuration menu.
See 6.18.

Step 16 Return to the display mode

Configuration of the BA317E-SS is now complete. Pressing the E button will save the new configuration and return the Tachometer to the display mode. The BA317E-SS will display dAtA followed by SAVE 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-SS 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.S t-bASE
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.	di SP-2 is activated See 6.8 If HOLD annunciator is activated, enter smaller CLi P-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-SS 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 CLi P-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-SS 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 BA317E-SS Tachometer are shown below, all except the scale card are factory fitted and should be specified when the instrument is ordered:

Scale card

Tag number

Backlight [1]

Isolated pulse output [2]
or
Isolated 4/20mA output [2]
or
Isolated dual alarms [2]

Notes:

1. Internally powered
2. Only one of the three output options can be fitted to a BA317E-SS Tachometer.

9.1 Scale card

The BA317E-SS has 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 5.5 and Fig 11.

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

9.2 Tag information

The BA317E-SS can be supplied with a tag number or application information laser etched 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-SS Tachometer can be supplied with a factory fitted backlight that produce green illumination enhancing display contrast and enabling the display to be read at night and in poor lightng conditions. The optional backlight is internally powered from the instrument power supply so that no additional wiring or intrinsically safe interface is required, but the supply current increases as shown below:

Without backlight	10.0mA
Addition for backlight	22.5mA
Addition with terminals 3 & 4 linked	6.0mA
Total current	38.5mA

9.4 Alarms

The BA317E-SS can be factory fitted with 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-SS 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-SS internal counters are up-dated and compared with the alarm setpoint twice per second, irrespective of the display update time selected. This may result in an alarm being delayed for up to half a second after 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 14. 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

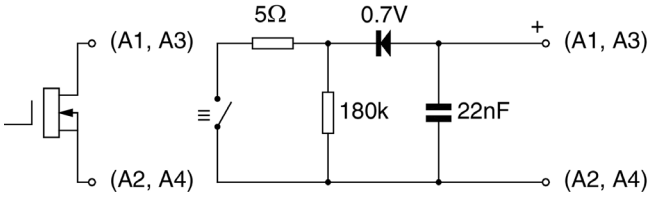


Fig 14 Equivalent circuit of each alarm output

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	=	8µH (Effectively 0)

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 15.

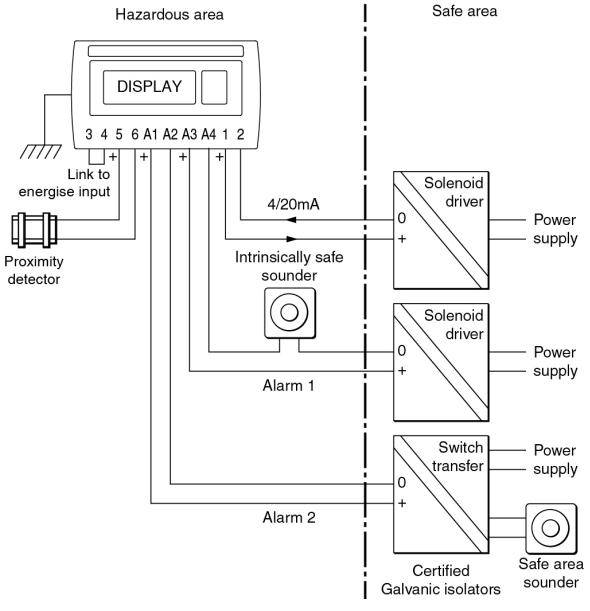


Fig 15 Typical alarm application

9.4.3 Configuration and adjustment

When a BA317E-SS is supplied with alarms the configuration menu is extended as shown in Fig 16 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
EnbL	**Alarm enable** Enables or disables the alarm without changing the alarm parameters. See section 9.4.4
tYPE	**Type of alarm** Defines whether the alarm operates on the speed or run-time display. See section 9.4.5
SP 1SPEEd or SP 1HourS	**Alarm setpoint 1** Adjusts the alarm setpoint. The alarm is activated when the speed or run-time display equals the setpoint. **Note:** SP 1S is displayed for a speed alarm and SP 1H for a run-time alarm. See section 9.4.6
Hi .Lo	**Alarm function** Defines whether the alarm has a high or low function. See section 9.4.7
no.nC	**Normally open or normally closed output.** Determines whether the single pole alarm output is open or closed in the non-alarm condition. See section 9.4.8
HSt r	**Hysteresis** Adjusts the alarm hysteresis. Only available on a speed alarm. See section 9.4.9
dELA	**Alarm delay time** Adjusts the delay between the display equalling the setpoint and the alarm output being activated. See section 9.4.10
Si L	**Alarm silence time** Defines the time that the alarm output remains in the non-alarm condition following acceptance of an alarm. See section 9.4.11

Display	Summary of function
FLSH	**Flash display when alarm occurs** When enabled, alternates the speed or run-time display between the value and alarm reference AL1 or AL2 when an alarm output is activated. See section 9.4.12
ACSP	**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

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 AL1 or AL2 from the configuration menu and press P to access the alarm sub-menu. Press the ▼ or ▲ button until EnbL is displayed followed by P which will reveal if the function is on or oFF. The setting can be changed by pressing the ▼ or ▲ push button followed by the E button to return to the alarm sub-menu.

9.4.5 Type of alarm: tYPE

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 tYPE from the selected alarm sub-menu and press P to check or change the function. The ▼ or ▲ push button will toggle the selection between SPEEd and HourS, when set as required press the E button to return to the alarm sub-menu.

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

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 SP1HourS and SP2HourS 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 AL1 sub-menu and press P which will reveal the existing setpoint with one digit flashing. The required setpoint can be entered using the ▼ or ▲ push button to adjust the flashing digit and the P button to transfer control to the next digit. When set as required press E to enter the value and return to the 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 P to check or change the function. The ▼ or ▲ push button will toggle the alarm function between Hi and Lo, when set as required, press the E button to return to the Hi.Lo' prompt in the alarm sub-menu.

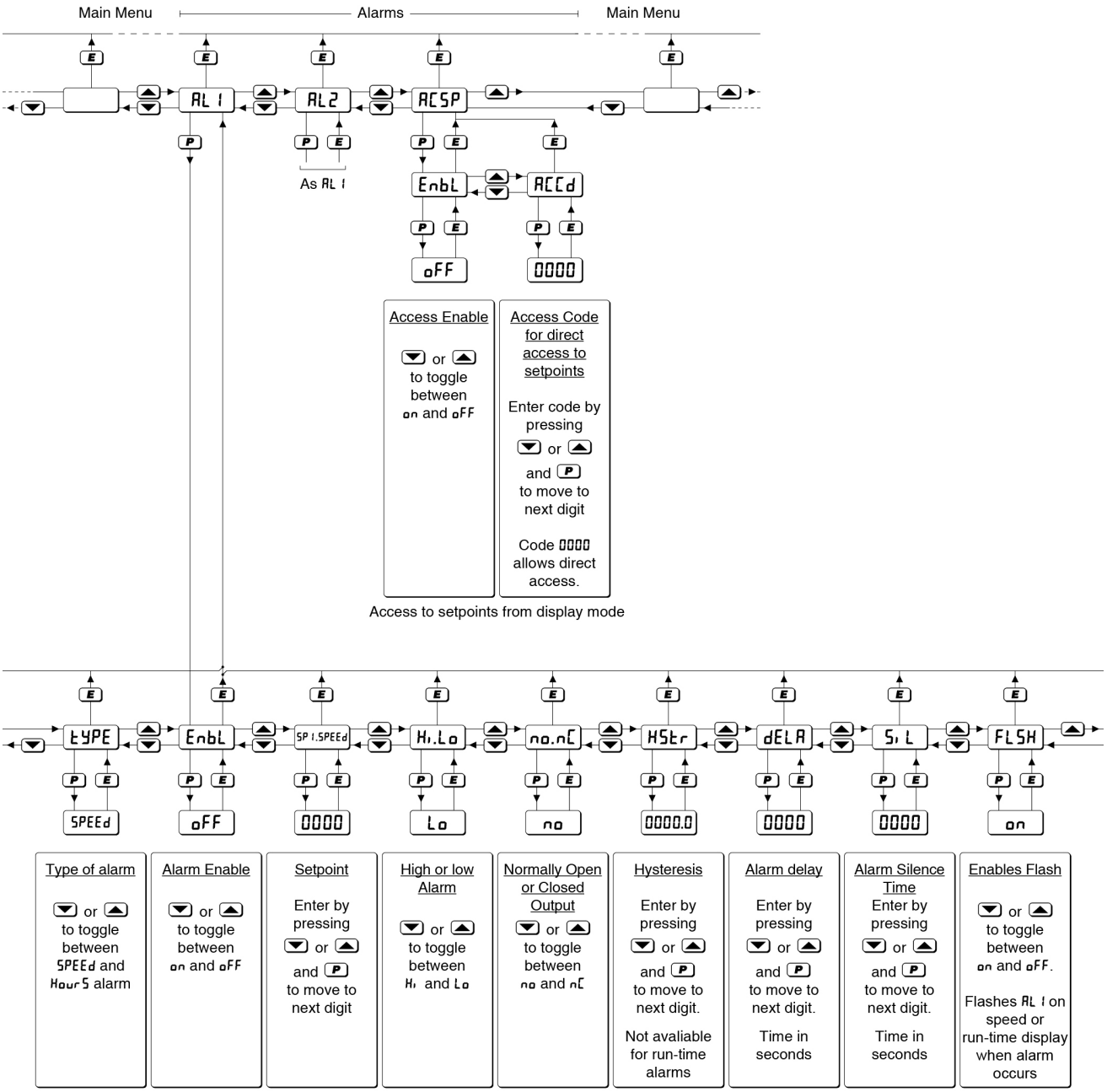


Fig 16 Alarm menu structure

9.4.8 Alarm output status: no.nC

Each single pole alarm output may be open or closed in the non-alarm condition. When the BA317E-SS power supply is turned off or disconnected, the alarm output(s) will open irrespective of whether normally open or normally closed outputs have been selected. Therefore, when designing an alarm system normally closed nC should be selected so that the output opens when an alarm occurs or if the power supply fails.

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

9.4.9 Hysteresis: HYSt

Hysteresis is only available on speed alarms so the HYSt function only appears in the configuration sub-menu when alarm tYPE 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 HYSt in the selected alarm sub-menu and press P which will reveal the existing hysteresis with one digit flashing. The required hysteresis can be entered using the ▼ or ▲ push button to adjust the flashing digit and the P button to transfer control to the next digit. When set as required press E to enter the value and return to the HYSt 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: dELA

This function enables activation of the alarm output to be delayed for a fixed time following the alarm condition occurring. The delay can be set in 1 second increments up to 3600 seconds. If a delay is not required zero should be entered.

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

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: SiL

The alarm silence function is primarily intended for use in small installations where the alarm output directly operates an annunciator such as a sounder. When the alarm silence time is set to any figure other than zero, the P push button becomes an alarm accept button.

After an alarm has occurred, operating the P button will cause the alarm output to revert to the non-alarm condition for the 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 SiL using the ▼ or ▲ push button in the selected alarm sub-menu and press P which will reveal the existing alarm silence time in seconds with one digit flashing. The required silence time can be entered using the ▼ or ▲ push button to adjust the flashing digit and the P button to transfer control to the next digit. When set as required press E to enter the value and return to the SiL prompt in the alarm sub-menu.

9.4.12 Flash display when alarm occurs: FLSH

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

9.4.13 Access Setpoint: ACSP

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 RCSP 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 RCCd function which can be selected using the ▼ or ▲ push button.

To enter a new security code select RCCd 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 RCCd 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 17. If the setpoints are not protected by a security code the alarm setpoint prompt SP 1SPEEd or SP 1Hour5 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 SP 1SPEEd or SP 1Hour5 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.

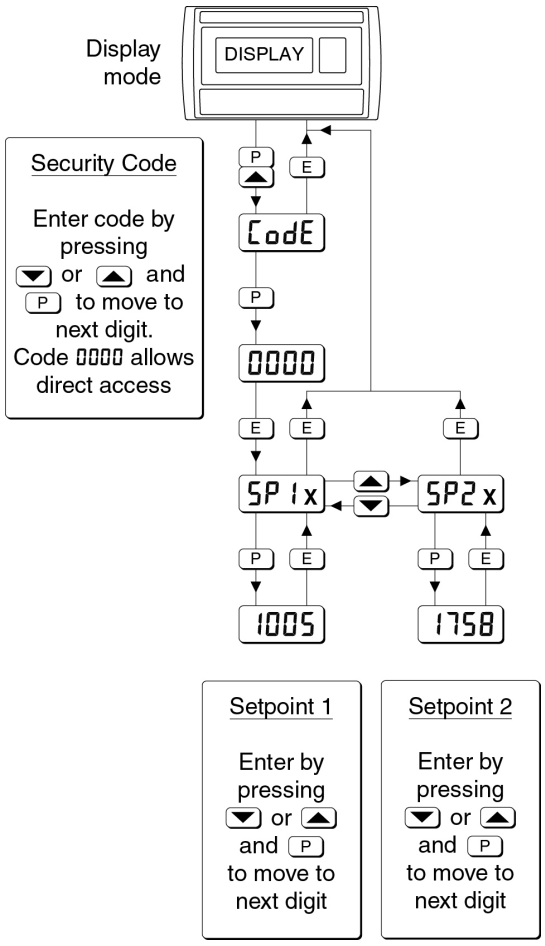


Fig 17 Setpoint adjustment from the display mode

Once within the menu pressing the ▼ or ▲ buttons will toggle the display between the two alarm setpoint prompts SP 1x and SP2x.

To adjust an alarm setpoint select SP 1x or SP2x 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 SP 1x or SP2x 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

A pulse output is available as a factory fitted option. Only one output option can be fitted to a BA317E-SS.

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

Ron	=	60Ω + 3V
Roff	=	1M
Imax	=	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 SourCE in the pulse output configuration menu.

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

dirECt:
Annunciator continuously activated

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:

Uo	=	28V dc
Io	=	200mA
Po	=	0.84W

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

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 18 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-SS 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

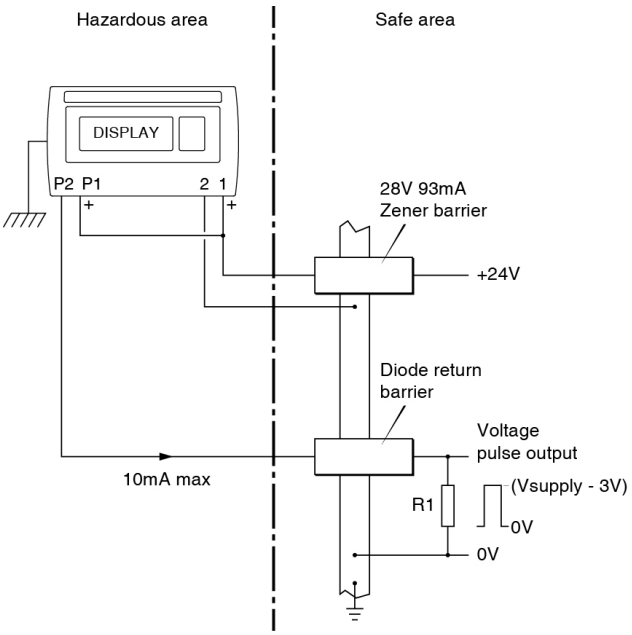


Fig 18 Transferring pulse output to safe area using Zener barriers

9.5.3 Configuration

When an optional pulse output is fitted to a BA317E-SS Tachometer the configuration menu is extended as shown in Fig 19 to include the pulse output sub-menu PuLSE.oP.

The pulse output sub-menu allows the source of the output pulse to be selected in the SourCE sub-function. For re-transmission applications the output pulse may be a synchronous duplicate of the input pulse by selecting dirECt in the SourCE sub-function. When SCALEd is selected, two additional functions, diVidE and durAtion are introduced enabling the input pulse frequency to be divided to produce the output pulse frequency, and the output pulse width (duration) to be defined.

9.5.4 Access Pulse output sub-menu: PuLSE.oP

Access the Tachometer configuration menu as described in section 6.2. Using the ▼ or ▲ push buttons scroll though the menu until PuLSE.oP is displayed, pressing P will then access the pulse output sub-menu which is shown in Fig 19.

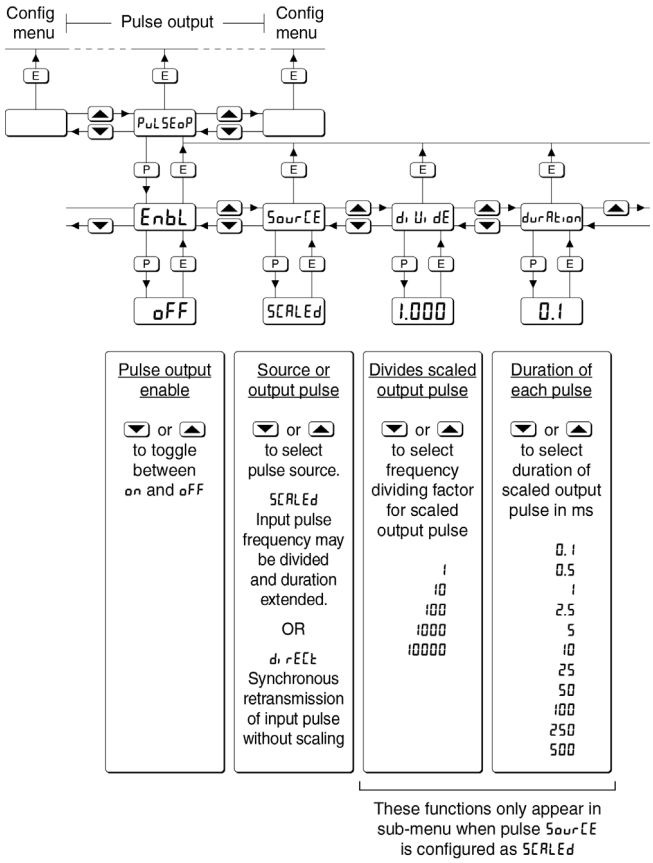


Fig 19 Pulse output configuration sub-menu

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: SourCE

The output pulse may be derived from:

di rECt **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 di Ui dE and durAti on functions.

Using the ▼ or ▲ push button select SourCE 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 SourCE prompt.

9.5.7 Divide output pulse frequency: di Ui dE

When SCALEd is selected in the SourCE function as 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 di Ui 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 di Ui dE prompt.

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

9.5.8 Define output pulse width: durAti on

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 ▼ or ▲ push button select durAti on in the pulse output sub-menu and press P to reveal the existing pulse duration. The value can be changed by pressing the ▼ or ▲ push button to select the required value followed by the E button to return to durAti on 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 dIvIdE and durAtIon functions are configured such that the output pulse frequency with the specified pulse width can not be output in real time, the 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-SS 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. Only one output option can be fitted to a BA317E-SS.

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:

Uo = 28V dc
Io = 200mA
Po = 0.84W

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

Ci = 13nF
Li = 8µH

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's 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 20 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.

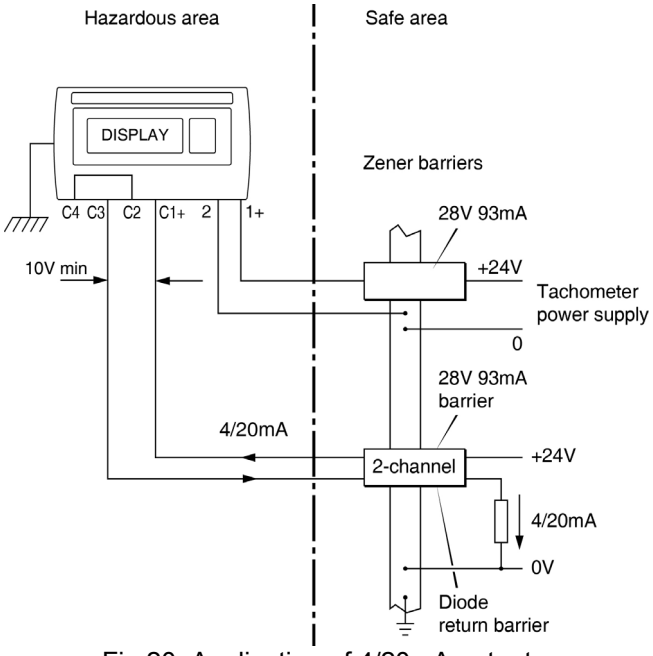


Fig 20 Application of 4/20mA output

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 21. The 4/20mA output sub-menu is accessed via the 4-20 oP function that is located before the CLr.Gtot 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.

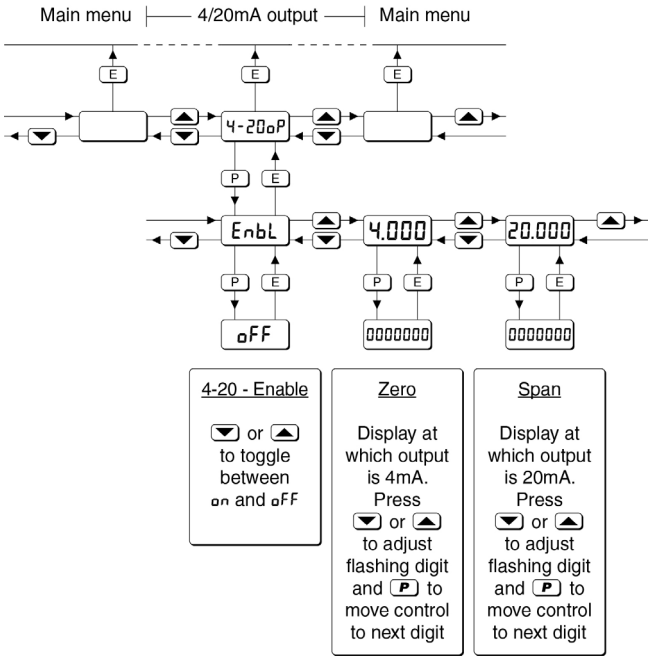


Fig 21 4/20mA output configuration sub-menu

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

Access the Tachometer configuration menu is described in section 6.2. Using the ▼ or ▲ push buttons scroll though the menu until 4-20 oP is displayed, pressing P will then access the 4/20mA output sub-menu which is shown in Fig 21.

9.6.5 Display corresponding to 4mA output: 4.000

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

9.6.6 Display corresponding to 20mA output: 20.000

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

A1.0 ATEX dust certification
In addition to ATEX certification permitting installation in explosive gas atmospheres which is described in the main section of this instruction manual, the BA317E-SS Tachometer has ATEX certification permitting installation in combustible dust atmospheres.

This appendix describes ATEX installations in explosive dust atmospheres conforming with EN 60079-14 *Electrical installations design, selection and erection*. When designing systems for installation outside the UK the local Code of Practice should be consulted.

The Tachometer's dust input and output safety parameters are identical to its gas parameters, therefore all the electrical circuits shown in the main section of this manual may also be used for dust applications. Intrinsically safe systems in dust atmospheres only have to comply with IIB requirements. Apparatus certificates for intrinsically safe interfaces usually specify Co and Lo for IIC gases, but for use with apparatus in dust atmospheres these may be increased to the IIB figures. For a IIC interface with a Uo of 28V and an Io of 93mA, Co increases from 83nF to 650nF and Lo increases by a factor of 4 for IIB.

A1.1 Zones, and Maximum Surface Temperature
The BA317E-SS has been ATEX dust certified

Group II, Category 1D
Ex ia IIIC T80ºC Da -40 ≤ Ta ≤ 60°C

When connected to a suitable system the Tachometer may be installed in:

Zone 20 explosive atmosphere in the form of a cloud of combustible dust in air is continuously present, or for long periods or frequently.

Zone 21 explosive atmosphere in the form of a cloud of combustible dust in air is likely to occur occasionally in normal operation.

Zone 22 explosive atmosphere in the form of a cloud of combustible dust in air is not likely to occur in normal operation, but if it does occur, will only persist for a short period.

Be used with dust in subdivisions:

IIIA combustible flyings

IIIB non-conductive dust

IIIC conductive dust
(For use with IIIC conductive dusts special conditions for safe use apply – see section A1.4)

Having a Minimum Ignition Temperature of:

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

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

A1.3 Maintenance

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.

The BA317E-SS has IP66 front of panel protection and a gasket is provided to seal the joint between the instrument and the mounting panel thus preventing dust ingress from the outside. The rear of the instrument has IP20 protection therefore when used in any dust application the panel enclosure in which the instrument is mounted should provide at least IP54 ingress protection. For applications in IIIC conductive dusts, IP6X protection is required.

A1.4 Special conditions for safe use
The ATEX certificate has an 'X' suffix indicating that special conditions for safe use are required for installation dust atmospheres, the certificate states:

- For use in group III explosive dust atmospheres the BA317E-SS shall be mounted such that the rear of the instrument has at least IP54 protection.

- For use in group IIIC conductive explosive dust atmospheres the BA317E-SS shall be mounted such that the rear terminals have at least IP6X protection.

A1.5 Installation in an Ex t panel enclosure within Zone 21 or Zone 22.

Installation of a BA317E-SS Tachometer in an Ex t panel enclosure does not invalidate the Ex t panel's certification as the front of BA317E-SS complies with Ex t impact and ingress requirements. Although mounted in an Ex t panel enclosure, the BA317E-SS remains Group II, Category 1D Ex ia IIIC T80ºC Da intrinsically safe apparatus and therefore should be powered via a Zener barrier or galvanic isolator as described in section 4.1 and 4.2 of this manual.

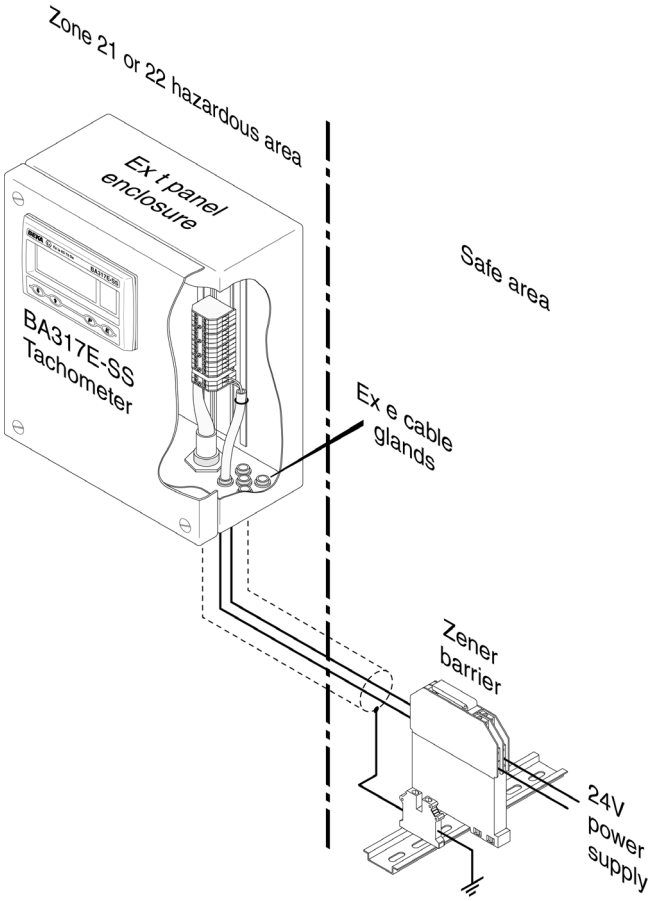


Fig 22 Typical installation in Ex t panel enclosure

The Zener barrier, galvanic isolator or associated apparatus is usually installed in the safe area, but if suitably certified may be mounted in the same Ex t panel enclosure as the Tachometer for Zone 22 applications providing the surface temperature of the enclosure is not exceeded.

The Tachometer terminals, the wiring to the Tachometer and the intrinsically safe interface, if mounted within the enclosure, should be segregated from all other non-intrinsically safe wiring and equipment within the panel enclosure as required by EN 60079-11 *Equipment protected by intrinsic safety* and EN 60079-14 *Electrical installations design, selection and erection*.

If live maintenance is anticipated, it is recommended that the Ex t panel enclosure should be fitted with a warning label saying 'Do not open when non-intrinsically safe circuits are energised', alternatively all bare live non-intrinsically safe parts within the panel enclosure should have an IP30 cover carrying a warning label 'Do not open when energised'.

Appendix 2 IECEx certification

A2.0 The IECEx Certification Scheme

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

A2.1 IECEx Certificate of Conformity

The BA317E-SS Tachometer has been issued with an IECEx Certificate of Conformity number IECEx ITS 16.0004X which specifies the following certification code:

Ex ia IIC T5 Ga
Ex ia IIIC T 80ºC Da
-40ºC ≤ Ta ≤ +60ºC

When installed as purely intrinsically safe apparatus i.e. when not relying upon ingress and impact resistance of the Tachometer front in an Ex e, Ex p, Ex n or Ex t panel enclosure the ambient temperature range is increased to -40ºC ≤ Ta ≤ +70ºC.

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

A2.2 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 installation requirements specified in sections 3, 5 and Appendix 1 of this manual may be used for IECEx installations, but the local code of practice should also be consulted.

A2.3 Special conditions for safe use

The IECEx intrinsic safety certificate number has an 'X' suffix indicating that for some applications special conditions apply for safe use.

- For use in group III explosive dust atmospheres the BA317E-SS shall be mounted such that the rear of the instrument has at least IP54 protection.

- For use in group IIIC conductive explosive dust atmospheres the BA317E-SS shall be mounted such that the rear terminals have at least IP6X protection.

This means that when installed in an Ex e, Ex n, Ex p or Ex t panel enclosure the BA317E-SS remains an intrinsically safe instrument and must comply with the installation requirements shown in this manual.

The certificate also states:

The front of the stainless steel enclosure complies with the requirements for Ex e, Ex n Ex p & Ex t type of protection.

Therefore when correctly installed in a certified panel enclosure the BA317E-SS Tachometer will not invalidate the Ex e, Ex n, Ex p or Ex t panel enclosure certification.

Appendix 3 ETL & cETL certification for installations in USA and Canada

A3.0 cETL Mark

For installations in the USA and Canada, the BA317E-SS rugged Tachometer has 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

A3.1 Intrinsic safety approval

The US and Canadian standards used for assessment and certification of the BA317E-SS 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 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)

Class I Zone 0 AEx ia IIC T5 Ga (US IS gas, Zone cert)
Zone 20 AEx ia IIIC T80ºC Da (US IS dust, Zone cert)

Ex ia IIC T5 Ga (Canadian IS gas, Zone cert)
Ex ia IIIC T80ºC Da (Canadian IS dust, Zone cert)

-40ºC ≤ Ta ≤ 60ºC

A3.2 Nonincendive approval

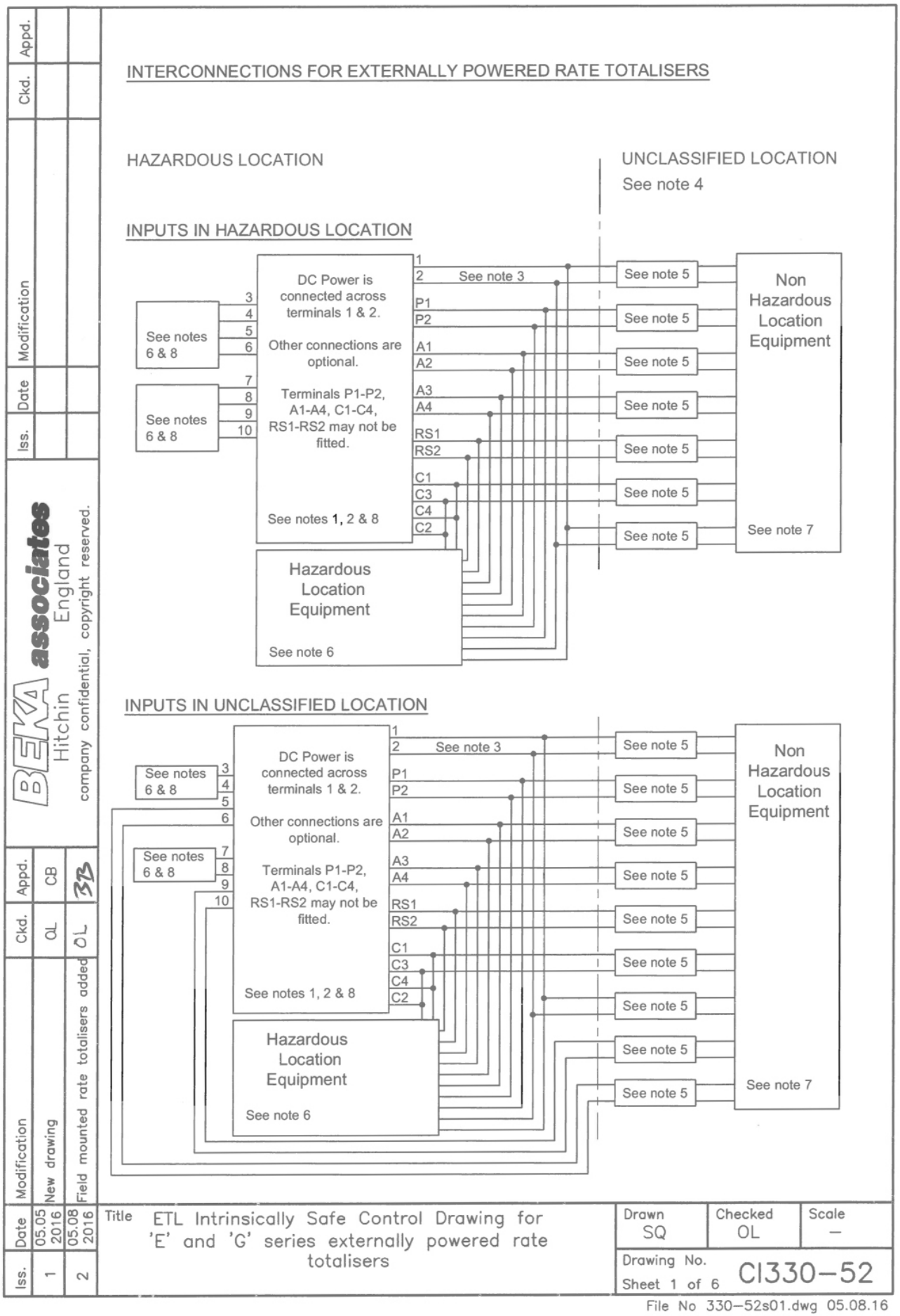
The BA317E-SS rugged Tachometer also has ETL and cETL nonincendive approval allowing installation in Division 2 hazardous (classified) locations without the need for Zener barriers or galvanic isolators.

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
-40ºC ≤ Ta ≤ 70ºC

INTERCONNECTIONS FOR EXTERNALLY POWERED RATE TtotalISERS



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

BEKA associates Hitchin England

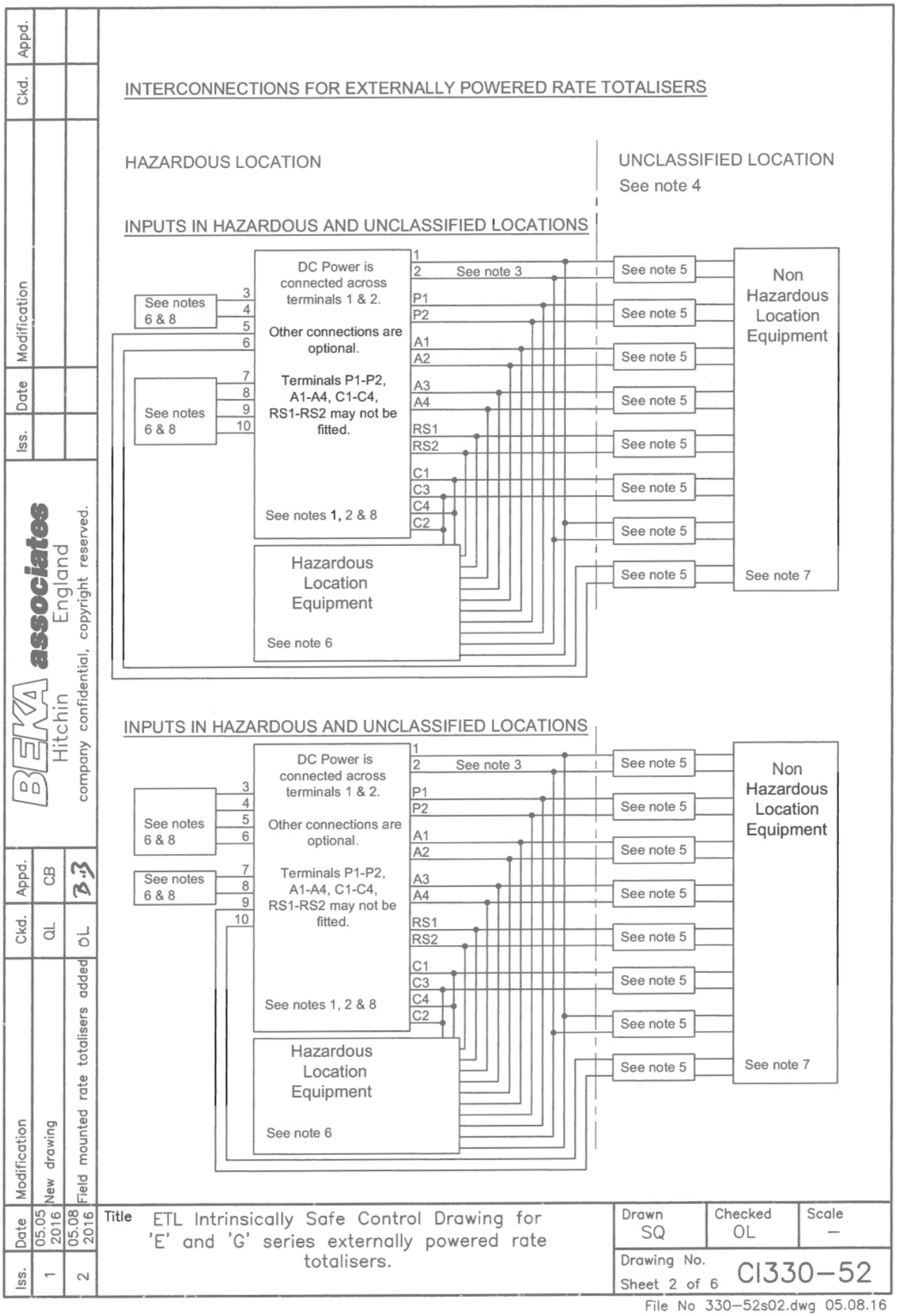
Title: ETL Intrinsically Safe Control Drawing for 'E' and 'G' series externally powered rate totalisers

Drawn	Checked	Scale
SQ	OL	—

Drawing No. CI330–52

Sheet 1 of 6

File No 330–52s01.dwg 05.08.16


INTERCONNECTIONS FOR EXTERNALLY POWERED RATE TOTALISERS
HAZARDOUS LOCATION
UNCLASSIFIED LOCATION
See note 4
INPUTS IN HAZARDOUS AND UNCLASSIFIED LOCATIONS
DC Power is connected across terminals 1 & 2.
Other connections are optional.
Terminals P1-P2, A1-A4, C1-C4, RS1-RS2 may not be fitted.
See notes 1, 2 & 8
See notes 6 & 8
See notes 6 & 8
Hazardous Location Equipment
See note 6
1
2
See note 3
P1
P2
A1
A2
A3
A4
RS1
RS2
C1
C3
C4
C2
3
4
5
6
7
8
9
10
See note 5
Non Hazardous Location Equipment
See note 7
INPUTS IN HAZARDOUS AND UNCLASSIFIED LOCATIONS
DC Power is connected across terminals 1 & 2.
Other connections are optional.
Terminals P1-P2, A1-A4, C1-C4, RS1-RS2 may not be fitted.
See notes 1, 2 & 8
See notes 6 & 8
See notes 6 & 8
Hazardous Location Equipment
See note 6
Non Hazardous Location Equipment
See note 7
BEKA associates
Hitchin England
company confidential, copyright reserved.
Appd.
Ckd.
Modification
Date
Iss.
CB
QL
QL
3.3
Field mounted rate totalisers added
New drawing
05.08 2016
05.05 2016
1
2
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

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.

BEKA associates Hitchin England

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

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

Drawn	Checked	Scale
SQ	OL	—

Drawing No. CI330–52
Sheet 3 of 6

File No 330–52s03.dwg 05.08.16

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

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

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

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

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

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

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

BEKA associates Hitchin England

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

Drawn	Checked	Scale
SQ	OL	–

Drawing No. CI330–52
Sheet 4 of 6

File No 330–52s07.dwg 05.08.16

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

8. Safety parameters

DC Power terminals 1 & 2

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

Terminals RS1-RS2, (optional reset input)

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

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

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

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

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

Optional pulse output terminals P1 & P2

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

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

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

Optional alarm output terminals A1, A2, A3 and A4

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

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

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

BEKA associates Hitchin England

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

Drawn	Checked	Scale
SQ	OL	—

Drawing No. CI330–52

Sheet 5 of 6

File No 330–52s08.dwg 05.08.16

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

WARNING
Potential electrostatic charging hazard clean only with a damp cloth

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

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

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

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

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

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

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

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

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

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

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

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

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

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

BEKA associates Hitchin England

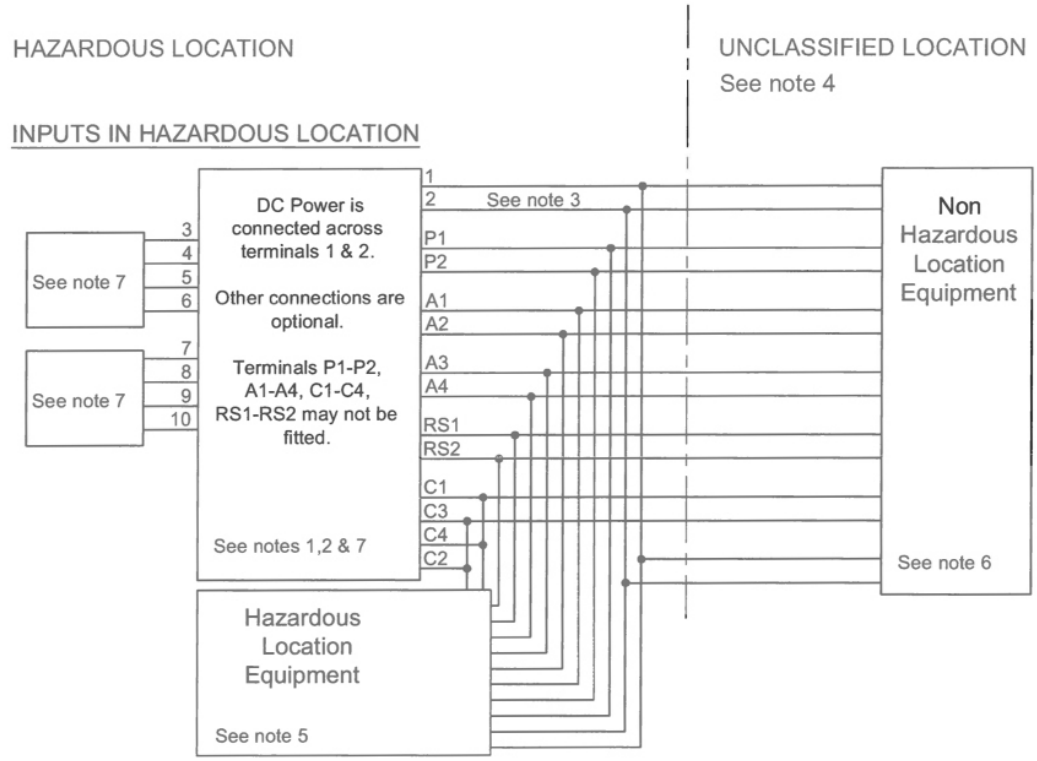
Title: ETL Intrinsically Safe Control Drawing for 'E' and 'G' series externally powered rate totalisers.

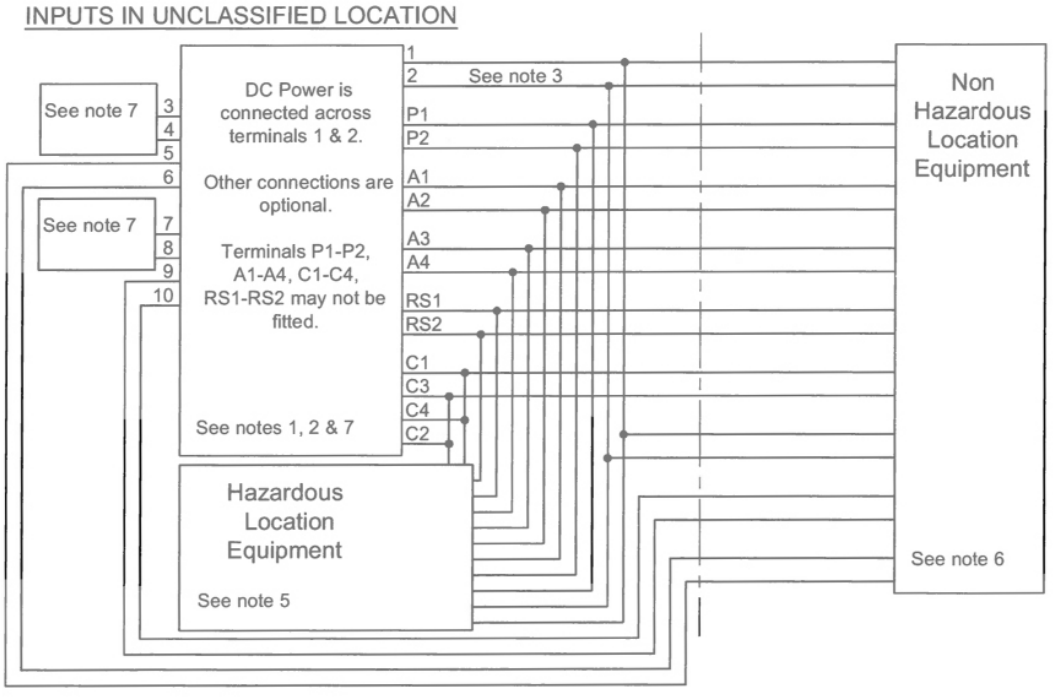
Drawn	Checked	Scale
SQ	OL	–

Drawing No. CI330–52
Sheet 6 of 6

File No 330–52s06.dwg 05.08.16

INTERCONNECTIONS FOR EXTERNALLY POWERED RATE TOTALISERS





Iss.	Date	Modification	Appd.	Ckd.	Appd.
1	15.06 2016	New drawing			
2	05.08 2016	Field mounted rate totalisers added	CB	OL	33

BEKA associates Hitchin England

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

Drawn	Checked	Scale
SQ	OL	—

Drawing No. CI330–53
Sheet 1 of 6

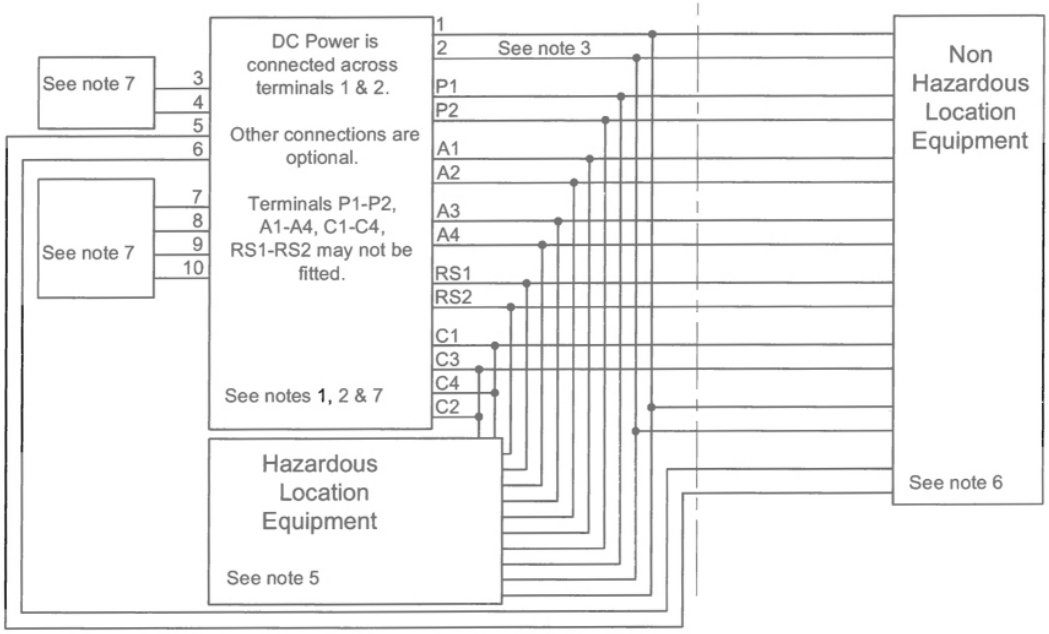
File No 330–53s01.dwg 05.08.16

INTERCONNECTIONS FOR EXTERNALLY POWERED RATE TOTALISERS

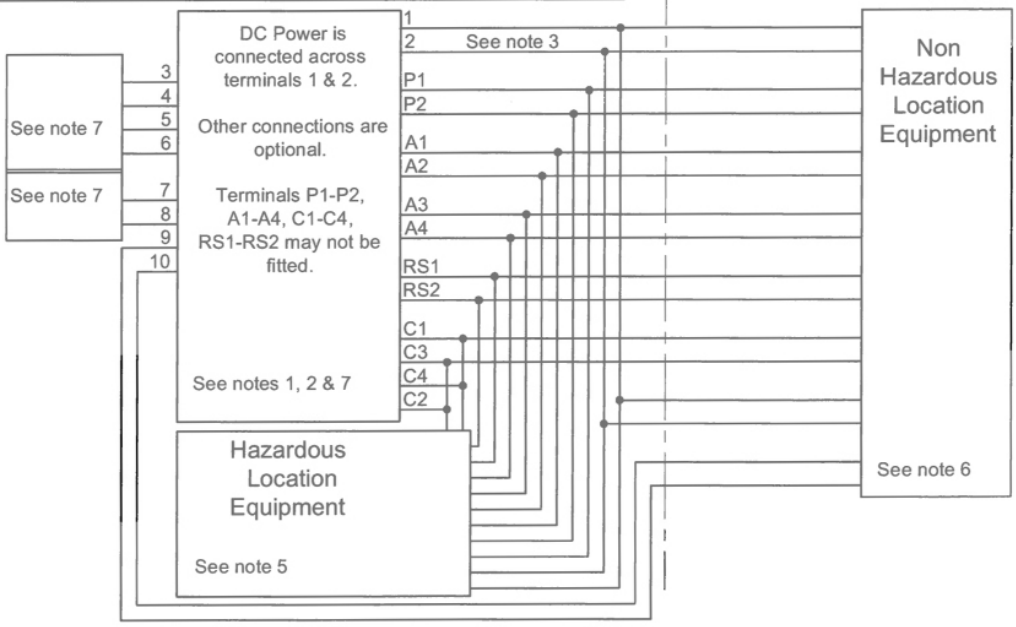
HAZARDOUS LOCATION

UNCLASSIFIED LOCATION
See note 4

INPUTS IN HAZARDOUS AND UNCLASSIFIED LOCATIONS



INPUTS IN HAZARDOUS AND UNCLASSIFIED LOCATIONS



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

BEKA associates Hitchin England

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

Drawn	Checked	Scale
SQ	OL	—

Drawing No. CI330–53
Sheet 2 of 6

File No 330–53s02.dwg 05.08.16

Notes

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

NE PANEL MOUNTING INSTRUMENTS

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

E PANEL MOUNTING INSTRUMENTS

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

E–SS PANEL MOUNTING INSTRUMENTS

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

NG FIELD MOUNTING INSTRUMENTS

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

G FIELD MOUNTING INSTRUMENTS

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

E FIELD MOUNTING INSTRUMENTS

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

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

BEKA associates Hitchin England

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

Drawn	Checked	Scale
SQ	OL	—

Drawing No. CI330–53

Sheet 3 of 6

File No 330–53s03.dwg 05.08.16

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

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

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

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

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

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

BEKA associates Hitchin England

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

Drawn	Checked	Scale
SQ	OL	—

Drawing No. CI330–53

Sheet 4 of 6

File No 330–53s04.dwg 05.08.16

7. Safety parameters

DC Power terminals 1 & 2

Ui = 30V
Ii = 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).

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

Optional pulse output terminals P1 & P2

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

Optional alarm output terminals A1, A2, A3 and A4

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

Terminals RS1-RS2, (optional reset input)

Ui = 30V
Uo = 3.8V
Io = 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).

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

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

Ui = 30V
Uo = 0
Io = 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°C ≤ Ta ≤ +70°C.

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

BEKA associates Hitchin England

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

Drawn	Checked	Scale
SQ	OL	—

Drawing No. CI330-53
Sheet 5 of 6

File No 330-53s05.dwg 05.08.16

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

WARNING
Potential electrostatic charging hazard clean only with a damp cloth

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

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

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

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

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

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

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

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

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

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

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

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

BEKA associates Hitchin England

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

Drawn	Checked	Scale
SQ	OL	—

Drawing No. CI330–53
Sheet 6 of 6

File No 330–53s06.dwg 05.08.16