APPLICATION GUIDE AG364

Externally powered pulse input Counters

For models with an 'E' or 'G' suffix

Contents

Externally powered pulse input Counters

1. Introduction

This Application Guide is intended to aid the selection of a pulse input Counter from the extensive range of models manufactured by BEKA associates. The guide also contains configuration examples.

The guide does not contain detailed system design or step-by-step configuration information which is contained in the instruction manual for each model. Detailed installation and certification information for use in hazardous areas is also contained in the instruction manual for each model which can be viewed on the BEKA website at www.beka.co.uk.

2. Description

The BEKA range of pulse input Counters includes field and panel mounting models for general purpose applications and for use in gas and dust hazardous areas. All models can be supplied with a wide range of factory fitted options including a display backlight, alarm outputs and isolated pulse and current outputs for retransmission applications.

All models have separate total and rate displays. These can be independently scaled to show the engineering units represented by the total number of input pulses and their rate in the same, or in different engineering units of measurement.

Counter input(s) will function with most types of active and passive pulse sources including, voltages, contact closures, magnetic pick-offs and 2-wire proximity detectors.

The two input models can calculate the sum or difference of the number of pulses received at each input and display the total and rate in engineering units. Two input Counters also include a quadrature decoder allowing them to display position, speed and direction of movement.

All models are configured and calibrated via four push buttons using a common configuration menu. Although easy to configure on-site without the need for test equipment, Counters can be supplied configured and ready for installation with a printed slide-in scale card showing customer specified information for no additional charge.

Model	**BA364E**	**BA364G**
Some shown with optional backlight		
Enclosure material, size and IP rating	Field GRP 141 x 212mm IP66	Field GRP 122 x 120mm IP66
Number of M20 cable entries	3	2
Separate terminal compartment	Yes	No
Display	Primary: 8 digits 18mm high Secondary: 6 digits 12mm high	
Number of inputs	2	
Certification International IECEx **Gas** **Dust**	Ex ia IIC T5 Ga -40°C ≤ Ta ≤ +70°C N/A	Ex ia IIC T5 Ga -40°C ≤ Ta ≤ +70°C Ex ia IIIC T80°C Da -40°C ≤ Ta ≤ +60°C
Certification Europe ATEX **Gas** **Dust**	Group II Category 1G Ex ia IIC T5 Ga -40°C ≤ Ta ≤ +70°C N/A	Group II Category 1G Ex ia IIC T5 Ga -40°C ≤ Ta ≤ +70°C Group II Category 1D Ex ia IIIC T80°C Da -40°C ≤ Ta ≤ +60°C
Certification USA ETL	Class I Div 1 Gp A, B, C, D T5 Class II Div 1 Gp E, F, G. Class III Div 1 Class I Zone 0 AEx ia IIC T5 Ga -40°C ≤ Ta ≤ 70°C	
Certification Canada cETL	Class I Div 1 Gp A, B, C, D T5 Class II Div 1 Gp E, F, G. Class III Div 1 Ex ia IIC T5 Ga -40°C ≤ Ta ≤ 70°C	
Options - *must be specified when indicator is ordered*		
Backlight Alarms 4/20mA output Pulse output	Included Included Included Included	Yes Yes Yes Included
Accessories		
Pipe mounting kit Panel mounting kit Unsealed Sealed	BA393 N/A N/A	BA393G BA394G BA494G

BA364NG	BA564G
	
Field GRP 122 x 120mm IP66	Field GRP 122 x 120mm IP66
2	
No	No
Primary: 8 digits 18mm high Secondary: 6 digits 12mm high	
2	2
Ex nA ic IIC T5 Gc -40°C ≤ Ta ≤ +60°C Ex ic tc IIIC T80°C Dc -40°C ≤ Ta ≤ +60°C *Ex ic codes only refer to push button contacts*	Not Certified General purpose applications only
Group II Category 3G Ex nA ic IIC T5 Gc -40°C ≤ Ta ≤ +60°C Group II Category 3D Ex ic tc IIIC T80°C Dc -40°C ≤ Ta ≤ +60°C *Ex ic codes only refer to push button contacts*	
Class I Zone 2 AEx nA ic IIC T5 Gc Zone 22 AEx ic tc IIIC T80°C Dc -40°C ≤ Ta ≤ 60°C *Ex ic codes only refer to push button contacts*	
Ex nA ic IIC T5 Gc Ex n IIC T5 Gc Ex ic tc IIIC T80°C Dc Class III Div 2 Class II Div 2 Gp F, G -40°C ≤ Ta ≤ 60°C *Ex ic codes only refer to push button contacts*	
Yes Yes Yes Included	Yes Yes Yes Included
BA393G BA394G N/A	BA393G BA394G BA494G

Table 1 Field mounting counters

Model	BA367E	BA368E	BA367E-SS
Some shown with optional backlight			
Enclosure material & size	Panel Noryl 96 x 48 mm	Panel Noryl 144 x 72 mm	Rugged panel 316 S/steel 105 x 60 mm
Protection	Front IP66, rear IP20		
Display	Primary: 8 digits 9mm high Secondary: 6 digits 6mm high	Primary: 8 digits 18mm high Secondary: 6 digits 12mm high	Primary: 8 digits 9mm high Secondary: 6 digits 6mm high
Number of inputs	1	2	1
Certification International IECEx **Gas**	Ex ia IIC T5 Ga -40°C ≤ Ta ≤ +70°C		Ex ia IIC T5 Ga -40°C ≤ Ta ≤ +60°C *
Dust	N/A		Ex ia IIIC T80°C Da -40°C ≤ Ta ≤ +60°C *
Certification Europe ATEX **Gas**	Group II Category 1G Ex ia IIC T5 Ga -40°C ≤ Ta ≤ +70°C		Group II Category 1G Ex ia IIC T5 Ga -40°C ≤ Ta ≤ +60°C *
Dust	N/A		Group II Category 1D Ex ia IIIC T80°C Da -40°C ≤ Ta ≤ +60°C *
Certification USA ETL	Class I Div 1 Gp A, B, C, D T5 Class II Div 1 Gp E, F, G. Class III Div 1 Class I Zone 0 AEx ia IIC T5 Ga -40°C ≤ Ta ≤ 70°C		Zone 20 AEx ia IIIC T80°C Da -40°C ≤ Ta ≤ 60°C *
Certification Canada cETL	Class I Div 1 Gp A, B, C, D T5 Class II Div 1 Gp E, F, G. Class III Div 1 Ex ia IIC T5 Ga -40°C ≤ Ta ≤ 70°C		Ex ia IIIC T80°C Da -40°C ≤ Ta ≤ 60°C *
Options - *must be specified when indicator is ordered*			
Backlight	Yes	Yes	Yes
Alarms	Yes	Yes	Yes
4/20mA output	Yes #	Yes	Yes #
Pulse output	Yes	Included	Yes
Accessories			
Rear sealing kit	BA495	N/A	BA495

** May be installed in an Ex e, Ex p, Ex n or Ex t panel enclosure without invalidating enclosure certification.*

BA367NE	BA567E	BA568E	BA567E-SS
			
Rugged panel 316 S/steel 105 x 60 mm	Panel Noryl 96 x 48 mm	Panel Noryl 144 x 72 mm	Rugged panel 316 S/steel 105 x 60 mm
Front IP66, rear IP20	Front IP66, rear IP20		
Primary: 8 digits 9mm high Secondary: 6 digits 6mm high	Primary: 8 digits 9mm high Secondary: 6 digits 6mm high	Primary: 8 digits 18mm high Secondary: 6 digits 12mm high	Primary: 8 digits 9mm high Secondary: 6 digits 6mm high
1	1	2	1
Ex nA ic IIC T5 Gc -40°C ≤ Ta ≤ +60°C Ex ic tc IIIC T80°C Dc IP66 -40°C ≤ Ta ≤ +60°C *Ex ic codes only refer to push button contacts*	Not Certified General purpose applications only		
Group II Category 3G Ex nA ic IIC T5 Gc -40°C ≤ Ta ≤ +60°C Group II Category 3D Ex ic tc IIIC T80°C Dc -40°C ≤ Ta ≤ +60°C *Ex ic codes only refer to push button contacts*			
Class I Zone 2 AEx nA ic IIC T5 Gc Zone 22 AEx ic tc IIIC T80°C Dc -40°C ≤ Ta ≤ 60°C *Ex ic codes only refer to push button contacts*			
Ex nA ic IIC T5 Gc Ex n IIC T5 Gc -40°C ≤ Ta ≤ 60°C *Ex ic codes only refer to push button contacts*			
Yes Yes Yes Yes #	Yes Yes Yes Yes #	Yes Yes Yes Included	Yes Yes Yes Yes #
BA495	BA495	N/A	BA495

 # Only one may be fitted

Table 2 Panel mounting counters

3. Selecting a model

When selecting a model the following requirements should be considered:

Mounting	Field or Panel
Location	Safe area Gas Hazardous area Zone 0, 1 or 2 Type of protection Certification authority Dust hazardous area Zone 20, 21 or 22 Type of protection Certification authority
Number of inputs	1 pulse input 2 pulse inputs
Options	Display backlight Dual alarm outputs Pulse output 4/20mA output

To simplify selection Table 1 summarises the specifications of all the field mounting Counters and Table 2 contains similar information for the panel mounting models. Datasheets including specifications, instruction manuals and third party safety and ingress certificates for each model are available from the BEKA website www.beka.co.uk.

3.1 Mounting

The BEKA range of pulse input Counters includes models for field and panel mounting.

3.1.1 Field mounting

Field mounting Counters with a 'G' model number suffix have a robust glass reinforced polyester (GRP) enclosure with an 8mm thick toughened glass window. The enclosure has IP66 ingress protection which will not be degraded by 7J impacts to the GRP case or 4J impacts to the window at temperatures between -40°C and +70°C. The enclosure's ingress and impact protection has been independently assessed by a third party UKAS accredited test house. The resulting test certificate is shown on the BEKA website.

The enclosure material is carbon loaded to prevent the accumulation of static charges. GRP is very strong and will not corrode or degrade when used for Counter installations in marine and waste water environments. For installations in hazardous areas, GRP overcomes the restrictions limiting the use of aluminium in potentially explosive atmospheres.

Field mounting instruments with a 'G' model number suffix have two M20 x 1.5 threaded cable entries. To maintain the integrity of the Counter enclosure both cable entries should be fitted with impact resistant M20 x 1.5 IP66 glands, conduit entries or blanking plugs.

The instrument's units of measurement and tag information can be marked onto a slide-in scale card clearly visible above and below the display. Although easy to configure on-site, Counters can be supplied configured and calibrated with this scale card printed with customer specified units of measurement for no additional charge.

A 316 stainless steel legend plate which can be supplied laser engraved with customer specified information is available as an option.

Field mounting Counters are surface mounting, but can be pipe or panel mounted using one of the BEKA accessory kits.

BA393G 316 stainless steel pipe mounting kit, attaches instrument to any vertical or horizontal pipe with outside diameter between 40 and 73mm.

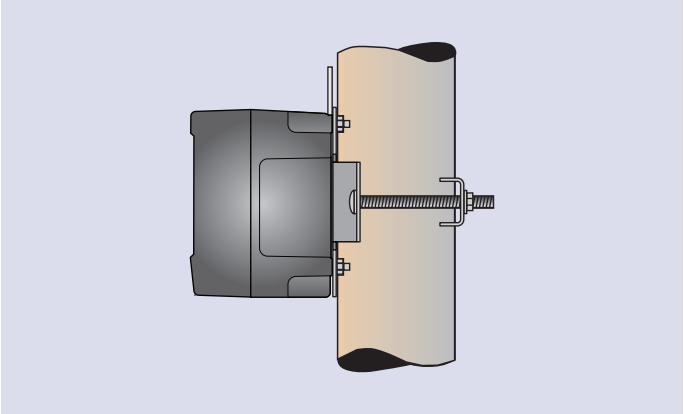

Fig 1 BA393G Pipe mounting kit

BA394G 316 stainless steel panel mounting kit secures field mounting instrument into a panel aperture, but does not seal panel aperture.

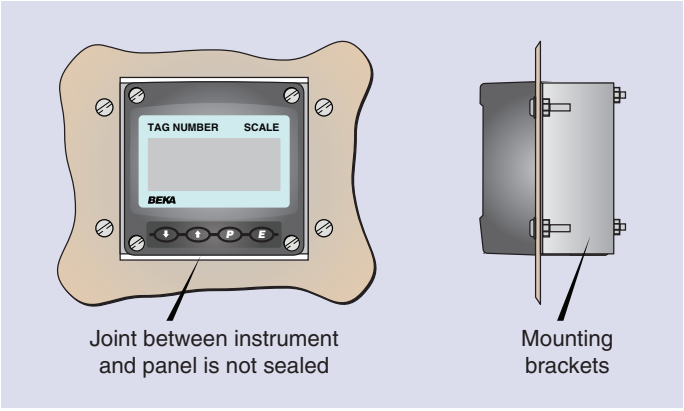

Fig 2 BA394G Panel mounting kit

BA494G GRP panel mounting kit secures field mounting instrument into a panel aperture and provides an IP66 seal between the front and rear of the panel. Not certified for field mounting instruments with an 'NG' suffix

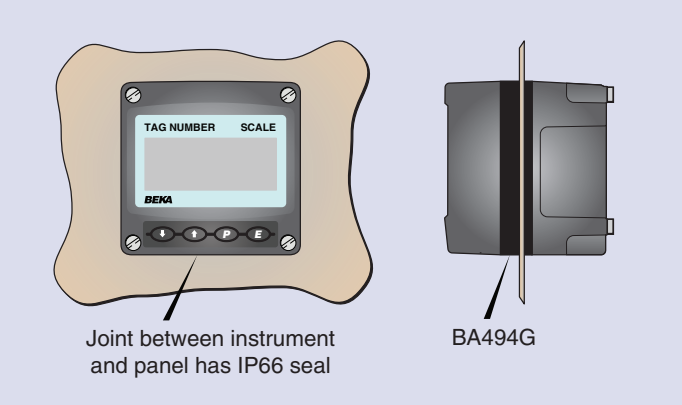

Fig 3 BA494G Sealed panel mounting kit

In addition to the 'G' suffix intrinsically safe field mounting model, the 'E' suffix intrinsically safe Counter is also available which has a separate field terminal enclosure with three tapped M20 x 1.5 cable entries. This model is supplied with a display backlight, dual alarms plus isolated pulse and 4/20mA outputs.

Options include a printed internal display escutcheon showing customer specified units of measurement and tag information. An external stainless steel legend plate which can be supplied laser engraved with customer specified information is also available.

The 'E' suffix Counter is surface mounting, but can be pipe mounted using a BA393 stainless steel pipe mounting kit.

3.1.2 Panel mounting

Panel mounting Counters are available in 96 x 48mm and 144 x 72mm glass loaded Noryl (modified PPE) DIN enclosures with a toughened scratch resistant glass display window. The enclosure size depends upon the display size and the number of pulse inputs. Both enclosures have IP66 front of panel ingress protection, and when correctly installed provide an IP66 seal between the instrument and the instrument panel. The ingress protection of the enclosures have been independently assessed at temperatures between -40°C and +70°C by a third party UKAS accredited test house. The resulting test certificate is shown on the BEKA website.

The instrument's units of measurement can be marked onto a slide-in scale card clearly visible at the right hand side of the display. The scale card can be fitted without opening the instrument enclosure or removing the Counter from the instrument panel. Although easy to configure on-site, Counters can be supplied configured with the scale card printed with customer specified units of measurement for no additional charge.

For panel mounting applications in marine environments, or where the front of the instrument is likely to be impacted, single input rugged models are available in a 316 stainless steel enclosure. These models, which are identified by an '-SS' model number suffix, have identical features as the other models including the slide-in scale card.

The stainless steel enclosure has IP66 front of panel ingress protection, and when correctly installed provide an IP66 seal between the instrument and the instrument panel. The ingress protection of the enclosure has been independently assessed at temperatures between -40°C and +70°C by a third party UKAS accredited test house. The resulting test certificate is shown on the BEKA website.

The intrinsically safe BA367E-SS Counter has been certified for installation in Ex e and Ex p enclosures without invalidating the certification of the panel enclosure in which it is mounted.

For applications in Zone 2 or 22 without the need for Zener barriers or galvanic isolators, the BA367NE Counter has Ex nA non-sparking and Ex tc dust ignition protection by enclosure. Please see BEKA Application Guide AG310 for more information on how to install this Counter.

The rear of panel ingress protection of all 96 x 48mm and 105x60 rugged stainless steel Counters can be increased to IP66 with a BA495 rear cover sealing kit. Manufactured from 316 stainless steel the cover incorporates two M20 unthreaded entries for cable glands, allowing these Counters to be installed in open panels.

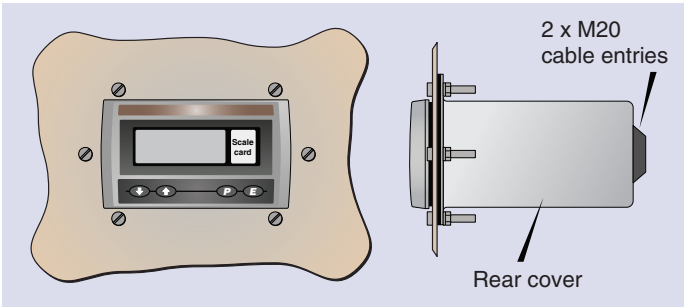

Fig 4 BA495 rear cover

3.2 Location

Having decided how the Counter is to be mounted, the location of the installation will help to determine the required model.

3.2.1 General purpose application

If the Counter is to be installed in an area which does not have a flammable gas or combustible dust hazard, the following general purpose two input Counter should be selected.

Field mounting

BA564G 2 input

Panel mounting models are available in two alternative DIN enclosure sizes plus a rugged impact resistant instrument in a 316 stainless steel enclosure. See Table 2.

Panel mounting

BA567E	1 input	96 x 48mm
BA568E	2 input	144 x 72mm
BA567E-SS	1 input	Rugged 105 x 60mm

3.2.2 Explosive atmosphere applications

To select a Counter for a hazardous area installation, the Zone or Division in which it is to be installed and the hazard must be known, together with the required certification authority i.e. IECEx, ATEX or ETL.

The Counter range includes intrinsically safe Ex ia models for installation in most gas and dust Zones. For installations in Zone 2 or 22 without the need for Zener barriers or galvanic isolators, models with non-sparking Ex nA certification for gas hazards and dust ignition protection by enclosure Ex tc are included.

Field mounting see Table 1

BA364E	2 input	1G	Ex ia	*Separate terminal compartment.*
BA364G	2 input	1GD	Ex ia	
BA364NG	2 input	3GD	Ex nA and Ex tc	

Panel mounting see Table 2

BA367E	1 input	96 x 48mm	1GD Ex ia
BA368E	2 input	144 x 72mm	1GD Ex ia
BA367E-SS	1 input	Rugged 105 x 60mm	1GD Ex ia
BA367NE	1 input	Rugged 105 x 60mm	3GD Ex nA and Ex tc

When selecting a Counter for installation in a hazardous area, the instrument's apparatus certificate should be consulted to ensure that the instrument has approval for the required area, hazard and temperature range.

3.3 Operating temperature

All the field and panel mounting Counters, except models with an 'E-SS' and 'NG' suffix, have a specified operating temperature of -40°C to +70°C. Between these temperatures the Counters will function normally, however at temperatures below -20°C the display digits will gradually change more slowly and contrast will be reduced. At some temperature below -20°C the display will stop functioning, but counting will continue normally and the instrument will not be damaged.

Models with an 'E-SS' and 'NG' suffix have a maximum certification temperature of +60°C but performance is the same as other models at low temperatures.

4. Counter function

All BEKA externally powered pulse input Counters have similar functions, although the number of inputs and the output options may differ. Fig 5 shows a simplified block diagram of a one input instrument. Each input pulse updates a counter which is scaled to produce a live total display of what the input pulses represent. e.g. number of item or liquid flow. This register may be reset via the instrument's push buttons or remotely.

A separate display shows the rate at which the input pulses arrive. Again this is scaled to show, in the same or different engineering units, what the input pulses represent.

All models can function with most types of active and passive pulse sources. To count pulses from sensors which have to be powered such as a switch contact, open collector transistor or a two wire proximity detector, an external link between two of the Counter's field terminals energises the input circuit.

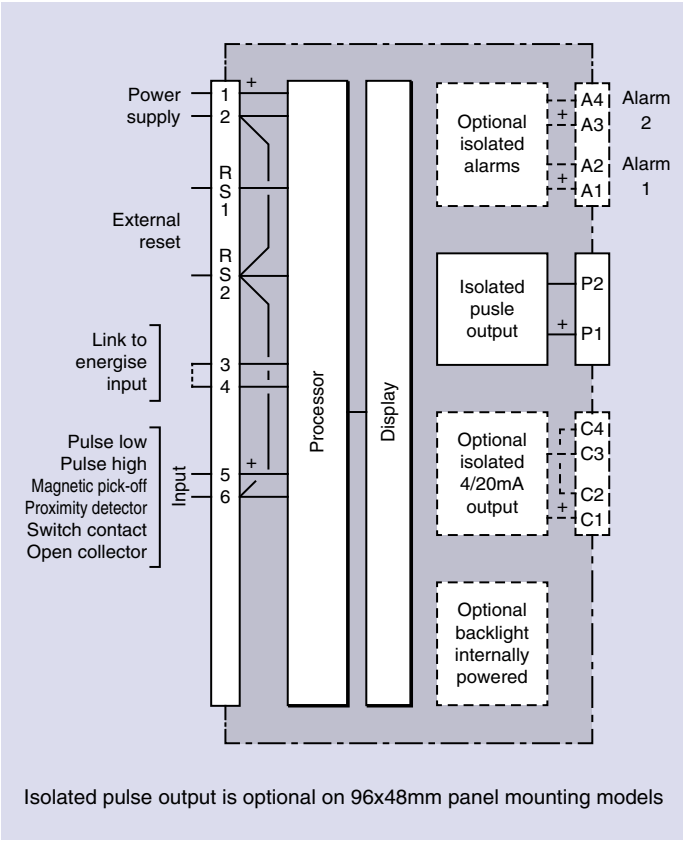

Fig 5 Simplified diagram of single input Counter

All models have separate rate and total displays as shown in Fig 6 with independent calibration allowing rate and total to be displayed in different units of measurement. e.g. total in Tonnes and rate in metres per minute.

The display digit size depends upon the model as shown below.

	Display size	
	6 digits	8 digits
Field mounting		
All models	12mm	18mm
Panel mounting		
96 x 48mm	6mm	9mm
144 x 72mm	12mm	18mm
Rugged 105 x 60mm	6mm	9mm

Rate and total may be shown on either the 6 or 8 digit displays. If only one variable is required, the lower six digit display may be disabled.

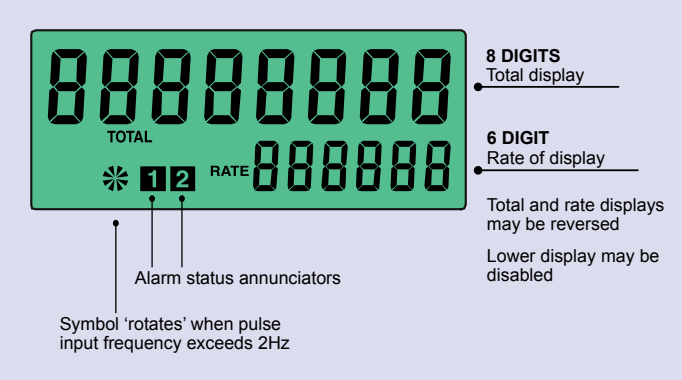

Fig 6 Counter display

The total display may be reset to zero by simultaneously operating two of the Counter's push buttons, or remotely by connecting the instruments external reset terminals together for more than one second.

The Counter also maintains a protected Grand Total which is not reset when the total display is zeroed. Both the total display and the grand total are retained when the Counter is not powered.

4.1 Input frequency range

The maximum input counting frequency of all models depends upon the type of input, and the debounce level selected. The shape of the input pulse and its amplitude also affect the maximum counting frequency. The input frequency specification is shown on the instrument datasheet and is fully explained in the instruction manual for each model, both of which are available on the BEKA website www.beka.co.uk.

The minimum input counting frequency is 0.01Hz, i.e. 1 pulse every 100 seconds. At lower input frequencies the instrument rate display will show zero.

5. Counter Configuration

All models are configured and calibrated using a common intuitive menu structured in the same way as all BEKA instruments. The menu is accessed via the four instrument push buttons and can be protected by a user defined four digit access code. The configuration structure of all one and two input Counters is shown in Fig 7. This allows a Counter to be configured and calibrated on-site without the need for external test equipment.

The configuration menu uses English language names to describe functions and variables such as CodE and dEbounCE. When the function name has more than eight characters a simple abbreviation is used such as d, SP- 1 (Display 1) and t-rESEt (Total reset). In this Application Guide these function and variable names are shown in a seven segment font, exactly as they appear on the Counter's display.

BEKA Counters are easy to calibrate as there are only three basic variables to adjust.

Total scale factor	SCALE.t
Rate scale factor	SCALE.r
Timebase	t-bASE

The first two variables SCALE.t and SCALE.r divide the number of input pulses to convert them to meaningful engineering units, such as tonnes or litres. As shown in Fig 7 these are arranged so that the total and the rate can be displayed in different engineering units. SCALE.t and SCALE.r are described separately in the following sections.

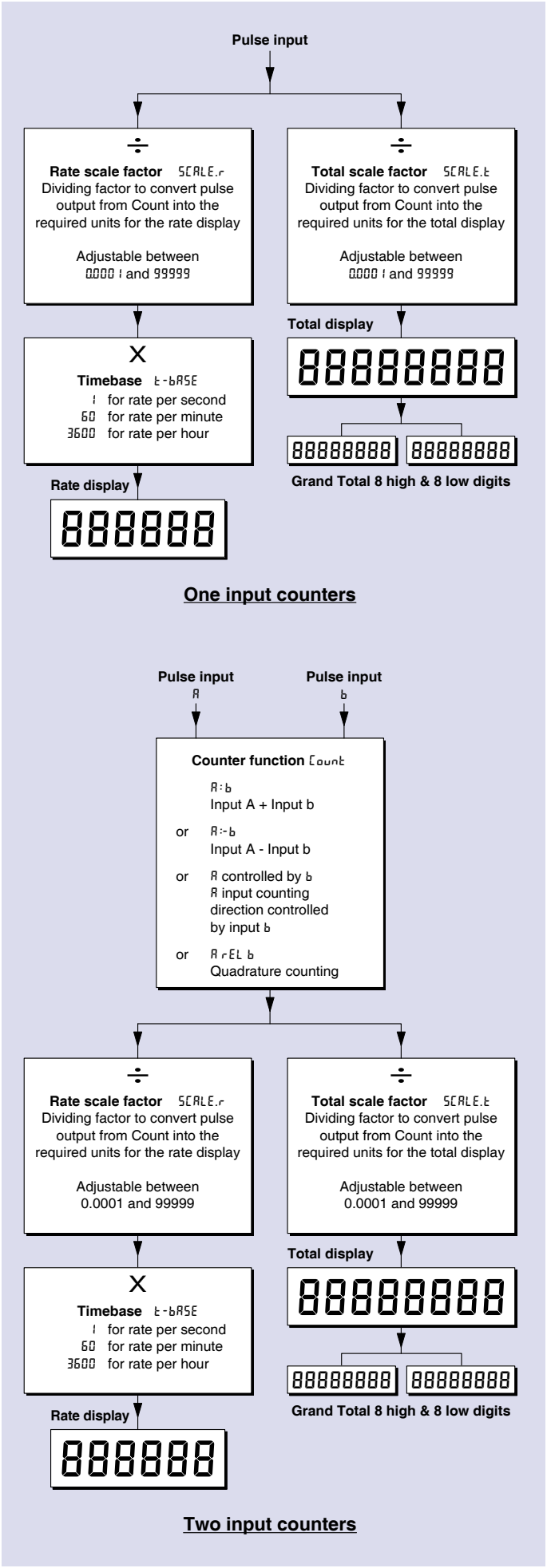

Fig 7 Configuration structure

5.1 Total Scale Factor SCALE.t

SCALE.t is a dividing factor adjustable between 0.0001 and 99999 that scales the number of pulses received to produce a total display in the required engineering units.

For example if the Counter input is connected to a sensor on a positive-displacement pump that produces 2 pulse for each stroke and each stroke displaces 1.75 litres of liquid. To produce the required total display in cubic metres the number of input pulses has to be divided by:

2	to count the number of pump strokes
1/1.75	to convert to litres pumped
1000	to convert litres to cubic metres

SCALE.t should therefore be set to

2 x 1/1.75 x 1000 = 1142.9

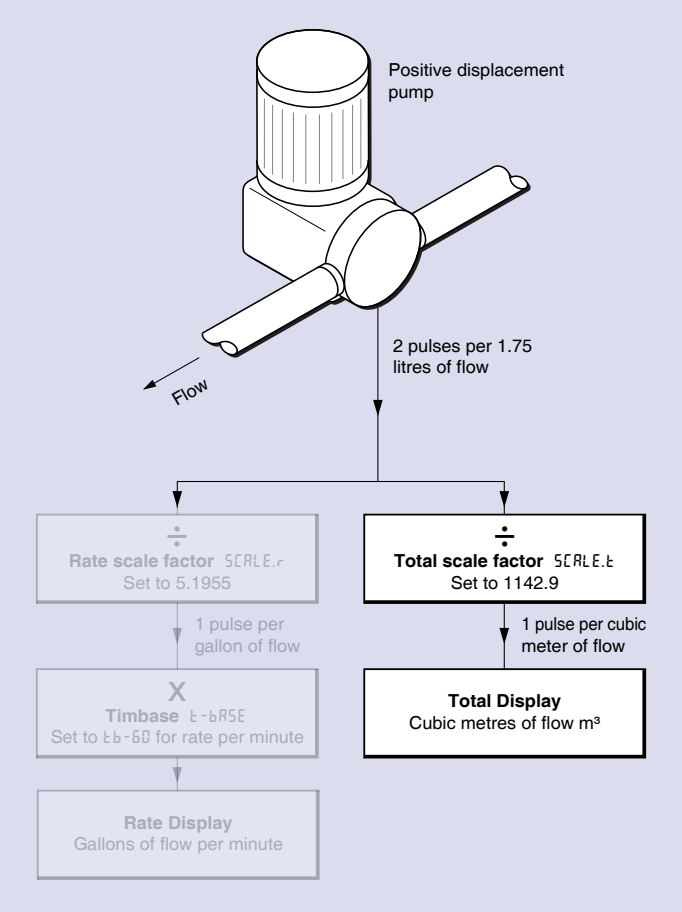

Fig 8 SCALE.t set to 1142.9 to produce total display in cubic metres m³

5.2 Rate scale factor SCALE.r

Function SCALE.r is a dividing factor adjustable between 0.0001 and 99999 that enables the input pulse rate to be displayed in the required engineering units. It is used in conjunction with the Counter's timebase t-bASE which determines whether the input pulse rate is displayed per second, per minute or per hour.

Functions SCALE.r and SCALE.t are independently adjustable which enables the Counter to have rate and total displays with different units of measurement.

Continuing the example shown in section 5.1. Assuming that the rate display is required in imperial gallons per minute.

The Counter input is connected to a sensor on a positive-displacement pump that produces 2 pulse for each stroke and each stroke displaces 1.75 litres of liquid. To produce the required rate display in cubic gallons the number of input pulses has to be divided by:

2	to count the number of pump strokes
1/1.75	to convert to litres pumped
4.5461	to convert litres to gallon (there are 4.5461 litres in an imperial gallon)

SCALE.r should therefore be set to:

2 x 1/1.75 x 4.5461 = 5.1955.

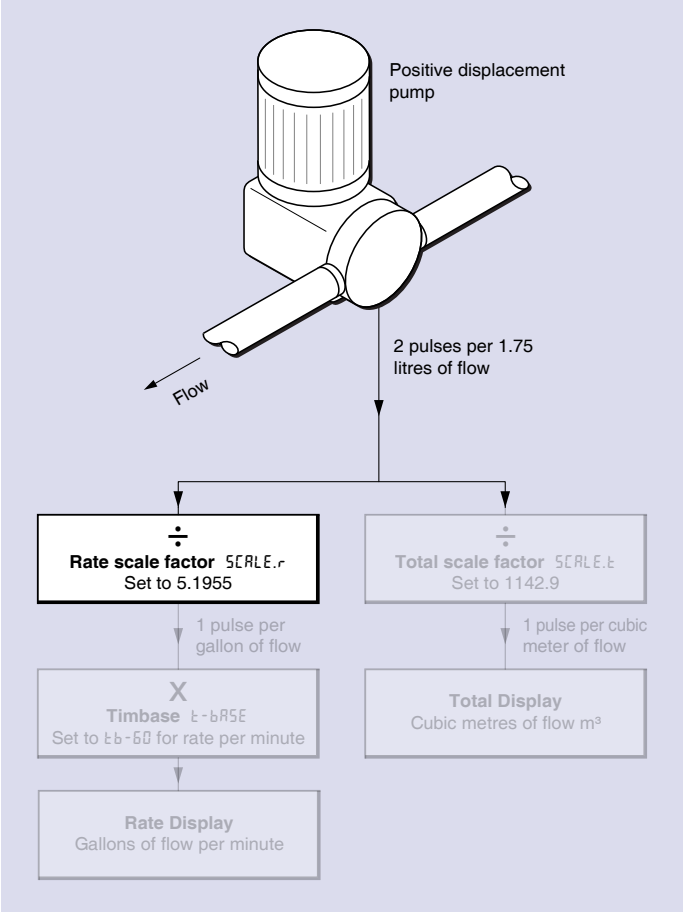

Fig 9 Illustrates how SCALE.r is set to produce a rate display in gallons

5.3 Timebase: t-bASE

As described in section 5.2, the rate scale factor SCALE.r defines the engineering units of the rate display.

The Counter's timebase t-bASE enables the output from SCALEr to be multiplied by 1, 60 or 3,600 to produce a rate display per second, per minute or per hour as shown below:

t-bASE menu options	
tb-1	x 1 for flow / second
tb-60	x 60 for flow / minute
tb-3600	x 3600 for flow / hour

Continuing the example in section 5.3, the rate display is required in gallons per minute, therefore t-bASE is set to tb-60 as shown in Fig 10.

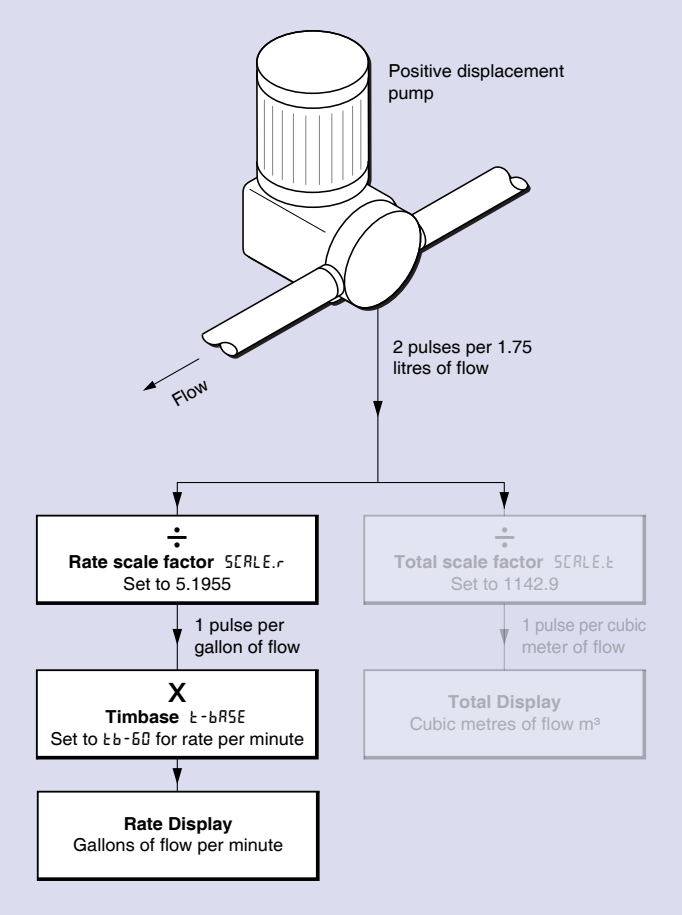

Fig 10 SCALE.r and t-bASE set to provide a Rate Display in Gallons / minute

6. Two input Counters

The two input Counters, BA364E, BA364G, BA364NG, BA564G, BA368E and BA568E have two inputs which can be individually configurable to operate with a wide range of pulse sources. The relationship between the two input is defined by the Count function which greatly expands the applications for these instruments.

One of the following four Count modes may be selected:

A:b	Pulses at input A added to pulses at input b.
A:-b	Pulses at input b subtracted from pulses at input A.
A Con b	Input b controls count direction of input A

Input b	Input A
Low	Up counter
High	Down counter

A rEL b	Quadrature input with sensors electrically 90° apart. Provides position display.

Two input models may be operated as a single input counter when configured for A:b or A Con b operation with the input b terminals connected together.

6.1 Input A + b and input A-b: A:b and A:-b

Fig 11a shows the voltage waveforms at the two inputs and the resulting total display when a two input Counter is configured for input A + b or input A - b. The diagrams are drawn with the instrument configured as an up-counter operating on the rising edge of a voltage input pulse.

If the sum of three or more pulse sources is required, multiple Counters can be linked using the instrument's synchronous pulse output - see section 7. The input of the second instrument connected to the Counter's pulse output should be configured for an open collector input.

Two input models may be operated as a single input counter when configured for A:b operation with the input b terminals connected together.

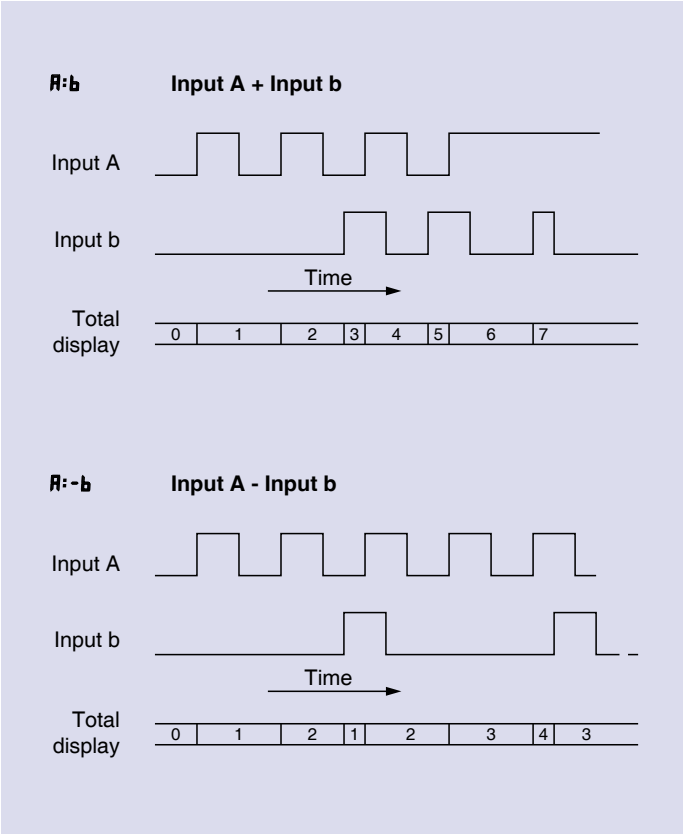

Fig 11a Input counting waveforms for input A + b and input A - b.

6.2 Input A controlled by input b: A Con b

With this configuration the instrument performs as a single input Counter from input A with the direction of counting controlled by input b. Fig 11b shows the voltage waveforms at both inputs and the resulting total display.

This configuration is useful when a single pulse output transducer monitors both filling and empting of a vessel. By entering the direction of flow on input b the Counter will monitor the total content of the vessel.

Two input models may be operated as a single input counter when configured for A Con b operation with the input b terminals connected together.

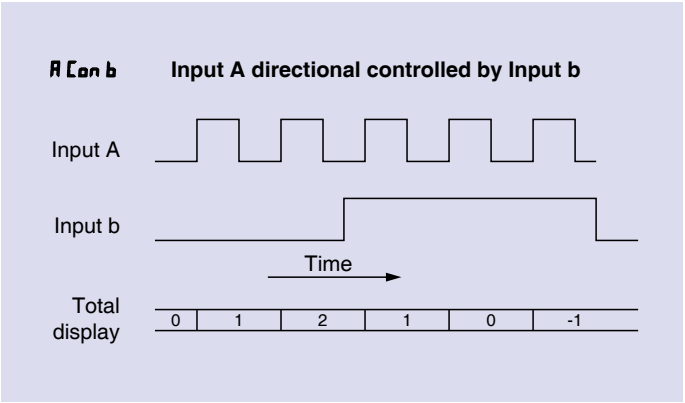

Fig 11b Input counting waveforms for input A controlled by input b.

6.3 Quadrature input: A rEL b

This configuration enables a two input Counter to decode the output from a quadrature encoder. The Counter can be configured to display position and rate including direction of movement in engineering units. Fig 11c shows the voltage waveforms at both Counter inputs and the resulting total display.

The two input transducers have to be positioned so that their outputs are electrically 90° apart for each target on the monitored device. To obtain acceptable resolution, multiple, equally spaced targets should be used. The two pulse inputs do not require equal mark and spaces to achieve reliable counting.

This configuration is ideal for measuring and displaying angular position and speed of any shaft and for displaying the position and speed of a winch cable passing over a monitored pulley.

It is also possible to monitor a linear movement providing that there are enough targets to obtain the required resolution.

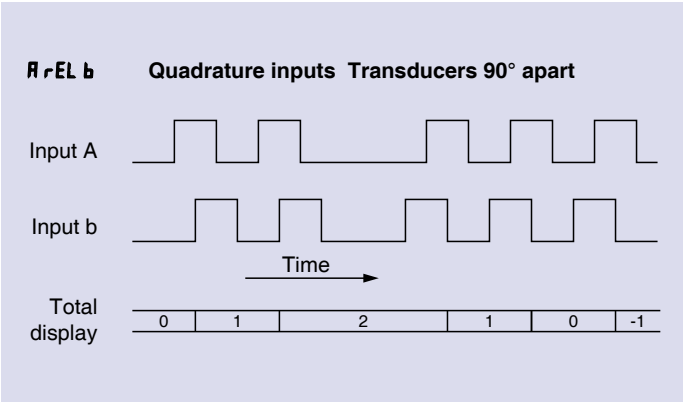

Fig 11c Input counting waveforms for quadrature input A relative to input b

7. Pulse output

All field mounting BEKA Counters and the larger 144 x 72mm panel mounting models have an optically isolated open collector pulse output. This pulse output is also available as a factory fitted option for the smaller 96 x 48mm and the rugged 105 x 60mm panel mounting models.

The pulse output is a passive output which means that it must always be powered, or connected to an instrument with a switch contact or an open collector input. When connecting the pulse output from a Counter to another BEKA Counter or Timer, the second instrument should be configured for an open collector input.

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

Selecting dirECt in the pulse output configuration menu produces a synchronous duplicate of the Counter input pulse at frequencies up to 5kHz. For two input counters the synchronous pulse output may be linked to either input A or to input b. This synchronous output is intended for retransmission to other instruments.

When SCALEd is selected in the pulse output configuration menu, the pulse output is derived from the incrementation of the least significant digit of the total display, irrespective of the position of the displayed decimal point. When a SCALEd output is selected the pulse output frequency may be divided by:

1
10
100
1000
10000

and the pulse output width (duration) may be selected from eleven options:

0.1 ms
0.5 ms
1 ms
2.5 ms
5 ms
10 ms
25 ms
50 ms
100 ms
250 ms
500 ms

If configured such that the output pulse frequency with the specified pulse width can not be output in real time, the number of pulses will be stored and transmitted at the maximum possible speed. If the Counter is reset or power to the Counter is removed, stored pulsed will be lost.

For two input Counters, the output pulse derived from the least significant digit of the total display, is only available when A:b (input A + input b) is selected in the Count function. A synchronous pulse output linked to either input A or to input b is available for all Count functions.

8. Optional 4/20mA output

All BEKA Counters can be supplied with a factory fitted galvanically isolated, 4/20mA current sink output which may be used for retransmission to other instrumentation. The output can be configured to represent any part of the instrument's rate or total display.

The output is passive, appearing as a 4/20mA loop powered transmitter requiring an external power supply between 5 and 28V. The output may be directly connected to any instrument with an input that will accept a loop powered 4/20mA transmitter.

9. Optional dual Alarm outputs

All BEKA Counters can be supplied with factory fitted dual alarms. Each alarm has a galvanically isolated, solid state single pole, voltage free output that may be independently configured as a high or low, rate or total alarm with a normally open or normally closed output.

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

When the Counter's 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 it is therefore recommended that an open output should be selected 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 outputs can switch any low voltage and power dc circuit such as a sounder or beacon, or they may be used as part of an on / off control system.

10. Configuration examples

This section contains some examples of Counter configurations requested by BEKA customers. Step-by-step instructions are not included nor are non-calibration configuration functions.

Example 1

A user required a BEKA Counter to display the total number of revolutions of a stirrer in a mixing vessel and its speed in revolutions per minute. An output pulse was required each time the stirrer completed 1000 revolutions. A proximity detector adjacent to the stirrer produced an output of 8 pules per revolution.

Summary

Sensor output	8 pulses / revolution
Required total display	0 revolutions
Required rate display	0 revolutions / minute
Pulse output	1 pulse for every 1000 revolutions.

Counter Configuration

Total display

SCALE.t 8.0
dP totAL 0

Display is required in revolutions and the proximity detector outputs 8 pulses per revolution of the stirrer. Therefore SCALE.t is set to 8. Total display resolution of 1 revolution is required, hence decimal point is positioned after the least significant digit where it is automatically suppressed and not visible.

Rate display

SCALE.r 8.0
dP rAtE 0
t-bASE tb-60

Display is required in revolutions per minute and the proximity detector outputs 8 pulses per revolution of the stirrer. Therefore SCALE.r is set to 8. Rate display resolution of 1 revolution is required, hence decimal point is positioned after the least significant display digit where it is automatically suppressed and not visible.
Selecting a timebase of tb-60 multiplies the rate display by 60 to show the stirrers rotational speed in revolutions per minute.

Pulse output

SourCE SCALEd
diVidE 1000

The Counter outputs a pulse each time the least significant digit of the total display is incremented. The least significant digit represents 1 revolution so this has to be divided by 1000 to produce one output pulse per 1000 revolutions.

Example 2

This example illustrates how a two input Counter can add two pulse inputs together. A user wishes to count the total number of components entering a hopper filled from two separate sources. Each source has a sensor which produces one pulse each time a component enters the hopper.

The user wishes to empty the hopper when it contains 10,000 components. The Counter is required to produce a 500ms long output pulse to initiate the empting routine when the hopper contains 10,000 components. Before the next cycle starts, the counter is to be reset to zero by an external contact closure.

Summary

Source 1 sensor	1 pulse / component
Source 2 sensor	1 pulse / component
Counter function	Input 1 + input 2
Required total display	0 components
Rate display	Not required
Counter direction	uP
Clear value	0
Pulse output	500ms long pulse when 10,000 components are in the hopper.

Counter Configuration

Total display

SCALE.t 1.0
Count A:b
dP totAL 0
uP or dn uP
CLr VAL 0

The display is required to show the sum of the components from both sources and both sensors produce 1 pulse / component. Therefore SCALE.t is set to 1 and the counting function to A:b. Total display resolution of 1 component is required, hence decimal point is positioned after the least significant digit where it is automatically suppressed and not visible.
The display is required to count upwards and is to be reset to zero so reset value is set to 0.

Rate display

di SP-2 oFF

The rate display is not required so display is turned off.

Pulse output

SourCE SCALEd
diVidE 10000
durAtion 500

The Counter generates a pulse each time the least significant digit of the total display is incremented. The least significant digit represents 1 component therefore divide and duration are set to output one pulse when the hopper contains 10,000 components.

Example 3

Monitoring the rotation of a pulley allows the position and speed of a cable passing over it to be measured and displayed using a two input Counter configured for a quadrature input.

In this example a user wanted to measure the position and speed of a cable passing over a pulley located at the top of a crane jib. The pulley incorporated a quadrature encoder with proximity detector outputs producing 16 pulses per metre movement of the pulley circumference and hence the cable.

The cable position display was required in metres with a resolution of 0.1 metres and the speed display in metres per second with a resolution of 0.1 metres per second.

In addition to the local display, a remote display of cable position was required.

The quadrature encoder consists of two proximity detectors mounted so that their output are electrically 90° apart as shown in Fig 11c. Multiple targets are equally spaced around the pulley which provide 16 pulses per metre movement of the pulley's circumference.

The required remote display is to be provided by the Counter's optional 4/20mA current sink output which is required to represent 0 to 500m of cable.

Note: The 4/20mA output is a current sink which is passive and appears as a loop powered transmitter that requires powering.

The Counter's pulse output can be used to retransmit pulse input A or pulse input b, but not the combined quadrature display. Therefore in this example the cable position display is retransmitted as a 4/20mA current.

Summary

Quadrature encoder output	16 pulses / metre
Required position display	0.0 metres
Required rate display	0 0 metres / second
4/20mA output	
Position 0.0m	4.000mA
Position 500.0m	20.000mA

Counter Configuration

Total display (cable position)

InPut-A	Pr.dEt
InPut-b	Pr.dEt
Count	AreA b
SCALE.t	16.0
dP totAL	0.0

The two input Counter is required to operate with a quadrature sensor which has proximity detector outputs. Therefore both input InPut-A and InPut-b are configured for proximity inputs and a qauadrature input AreA b is selected in the Count function.

The cable position is to be shown in metres with a resolution of 0.1m from the quadrature detector output of 16 pulses per metre of cable movement providing a signal resolution of 0.0625m/pulse. SCALE.t is therefore set to 16.0 with the displayed decimal point positioned to show 0.1 of a metre resolution.

Rate display (Cable speed)

dP rAtE	0.0
t-bASE	tb-1

The cable speed is required in metres per second with a display resolution of 0.1m from the quadrature detector output of 16 pulses per metre of cable movement. SCALE.r is therefore set to 16.0 to produce a display in metres with the displayed decimal point positioned to show a resolution of 0.1. Speed is required in metres per second so the timebase is set to tb-1.

4/20mA output

4-20tYPE	totAL
4.000	0.0
20.000	5000.0

A 4/20mA output representing the cables position between 0 and 500 metres is required. Cable position is shown on the Counter's total display therefore the 4-20tYPE function is set to totAL which links the 4/20mA output to the total display.

The 4.000 and 20.000 functions define the displayed position at which the retransmitted output is 4mA and 20mA.

11. Additional information

If additional information or help is required with Counter configuration, please call one of our sales engineers who will be pleased to help.

Although Counters are easy to configure on-site, they can be supplied configured to customer specified requirements with a printed slide-in scale card for no additional charge.