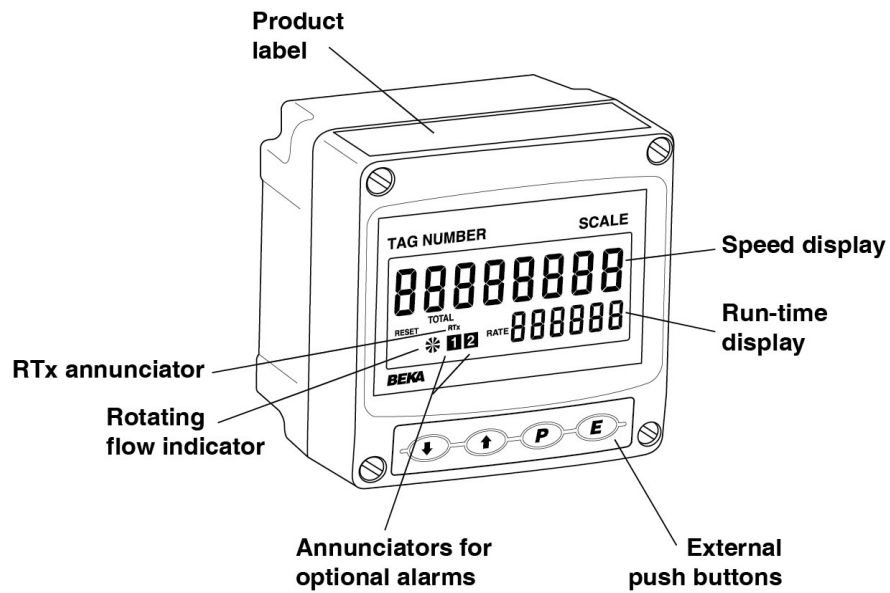


BA514G

General Purpose Tachometer

Issue 5



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The BA514G is CE marked to show compliance with the European EMC Directive 2004/108/EC
It is also UKCA marked to show compliance with UK Electromagnetic Compatibility Regulations
UKSI 2016:1091 (as amended)

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1. DESCRIPTION

The BA514G is a general purpose, field mounting Tachometer primarily intended for measuring rotational speed. To assist with routine maintenance, the Tachometer includes a run-time clock that records the number of hours that the monitored machinery has been operating. The BA514G is controlled and configured via the four front panel push buttons, a user defined four digit code may be entered to prevent accidental access to the instrument's configuration menu.

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

2. OPERATION

Fig 1 shows a simplified block diagram of the BA514G Tachometer. The instrument 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 BA514G has a single pair of input terminals for connection to all types of sensor. When connected to a sensor requiring energising to determine its state, 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. The isolated pulse output can be configured to synchronously retransmit the input pulse, or a frequency divided frequency output with a defined pulse width.

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

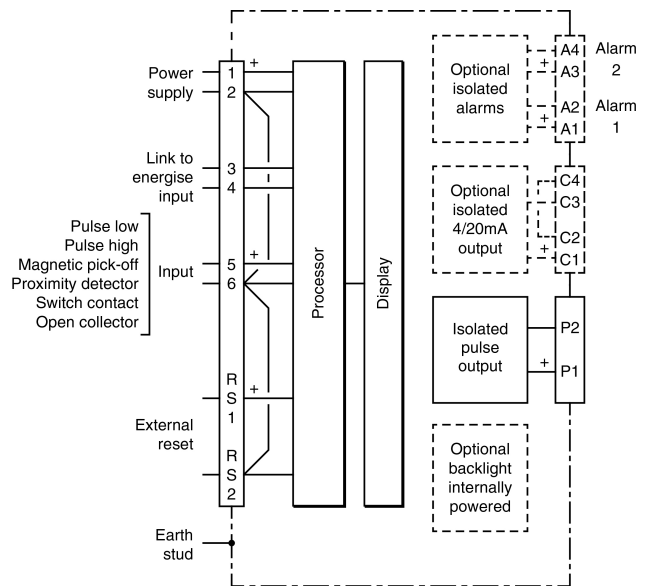


Fig 1 BA514G block diagram

2.1 Initialisation

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









All segments of the display are activated



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

2.2 Controls

The BA514G 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

-  +  Resets run-time display to zero. This is a configurable function. See 5.15
-  +  Run-time grand total. If buttons are pressed for ten seconds or longer grand total run-time is reset to zero. This is a configurable function. See 5.16
-  +  Shows in succession, firmware version number, instrument function fRECH_0 and any output accessories that are fitted:
 - R Dual alarm outputs
 - P Pulse output (*Always fitted*)
 - C 4/20mA output
-  +  Access to configuration menu

Note: When optional alarms are fitted, the Tachometer may be configured to provide direct access to the alarm setpoints from the display mode when the  and  buttons are operated simultaneously. See 8.4.12 and 8.4.13

2.3 Displays

The BA514G has two digital displays and associated annunciators, plus a pulse input indicator as shown on the 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 5.8

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 SCALE in the pulse output configuration menu.

SCALE

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

drE

Annunciator continuously activated.

3. SYSTEM DESIGN

Fig 2 illustrates the basic circuit that is used for all BA514G Tachometer installations. For simplicity, connections for the pulse output are shown in section 5.20. The optional alarms and 4/20mA output are described in section 8 this manual.

When designing a system it is important to remember that terminals 2, 6 and RS2 are interconnected within the BA514G. See Fig 1.

3.1 Power supply

The BA514G Tachometer requires a minimum of 10V between terminal 1 & 2 and consumes:

	10mA	without optional backlight
plus	6mA	when terminals 3 & 4 are linked
plus	16mA	with optional backlight

A 24V dc regulated supply with a current limit is suitable.

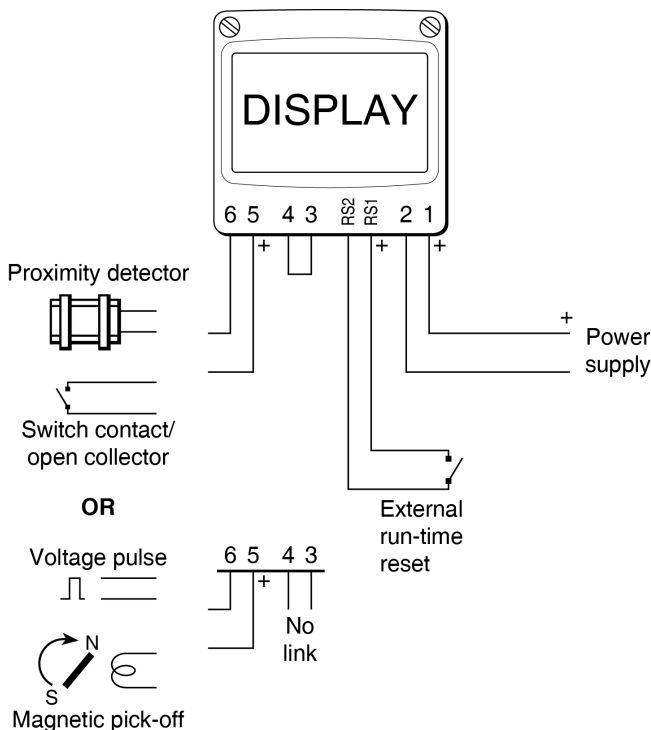


Fig 2 Basic Tachometer system

3.2 Pulse input

Fig 2 illustrates how the BA514G can display the speed and total run-time from sensors with a wide variety of pulse outputs.

3.2.1 Input switching thresholds

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

Sensors with a switch contact, proximity detector or an open collector output require energising to determine their state which is achieved by linking Tachometer terminals 3 and 4.

3.2.2 Switch contact input

Any sensor with a switch contact output such as a reed relay may be connected to the Tachometer. The BA514G contains a configurable debounce circuit to prevent contact bounce being counted. See section 5.6.

3.2.3 Open collector input

Sensors with an open collector output may be directly connected to input terminals 5 & 6. Polarity should be observed. The BA514G contains a configurable debounce circuit to prevent false triggering. See section 5.6.

3.2.4 2-wire proximity detector input

Most NAMUR 2-wire proximity detectors may be directly connected to a BA514G input terminals 5 & 6 providing the minimum operating voltage of the proximitor is greater than 7.5V. The BA514G contains a configurable debounce circuit to prevent false triggering. See section 6.6.

3.2.5 Magnetic pick-off input



Sensors incorporating a magnetic pick-off to detect rotation will have a low level ac voltage output unless the sensor incorporates an amplifier. In the BA514G input configuration menu is a low level voltage pulse input intended for use with a magnetic pick-off. The BA514G Tachometer contains a configurable debounce circuit to prevent false triggering. Three levels of de-bounce protection are independently available. See section 5.6.

3.2.6 Voltage pulse input

Two voltage pulse input ranges are selectable in the BA514G Tachometer configuration menu, 0.1 to 5 V and 0.1 to 5 H. The Tachometer input terminals 5 and 6 may be connected to any voltage pulse output sensor. The BA514G contains a configurable debounce circuit to prevent false triggering. See section 5.6.

3.3 Remote reset

The BA514G Tachometer's run-time display may be remotely reset to zero by connecting terminals RS1 and RS2 together. Permanent interconnection inhibits the run-time clock. Remote resetting may be accomplished by any switch contact.

The BA514G run-time display may also be reset when the  and  push buttons are operated simultaneously in the display mode i.e. when the instrument is displaying speed. See 5.15

4. INSTALLATION

4.1 Location

The BA514G Tachometer is housed in a robust IP66 glass reinforced polyester (GRP) enclosure incorporating an armoured glass window and stainless steel fittings, making it suitable for exterior mounting in most industrial on-shore and off-shore installations. The Tachometer should be positioned where the display is not in continuous direct sunlight.

Field wiring terminals are located on the rear of the Tachometer assembly as shown in Fig 4.

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

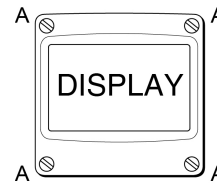
An insulated M4 stud is provided in the bottom right hand corner the back-box for interconnecting cable screens.

The BA514G Tachometer may be pipe mounted using a BA393G pipe mounting kit, or panel mounted using a BA394 or BA395 panel mounting kit. All are available as accessories.

4.2 Installation Procedure

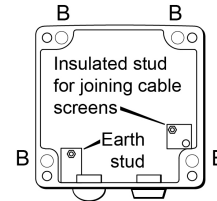
Fig 3 illustrates the instrument installation procedure.

- Remove the Tachometer assembly by unscrewing the four captive 'A' screws.
- Mount the enclosure back-box on a flat surface and secure with screws or bolts through the four 'B' holes. Alternatively use one of the pipe or panel mounting kits which are available as accessories.
- Remove the temporary hole plug and install an appropriate IP and temperature rated M20 x 1.5mm cable gland or conduit fitting. If two entries are required, the supplied IP66 stopping plug should be replaced with an appropriate IP and temperature rated M20 x 1.5mm cable gland or conduit fitting.
- Feed the field wiring through a gland in the back-box and tighten to maintain ingress protection. Connect the field wiring to the terminals as shown in Fig 4. Replace the instrument assembly on the back-box and evenly tighten the four 'A' screws.



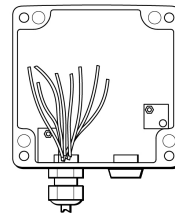
Step A

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



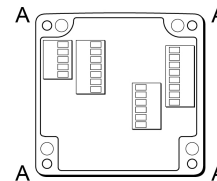
Step B

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



Step C

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



Step D

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

Fig 3 BA514G installation procedure

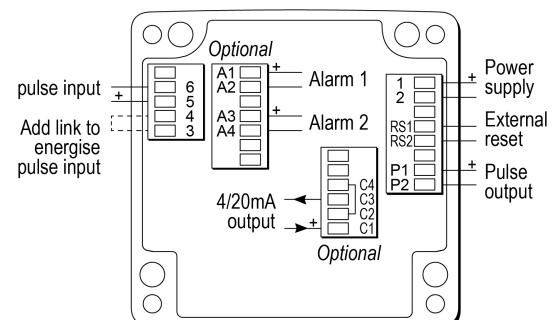
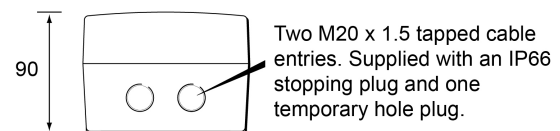
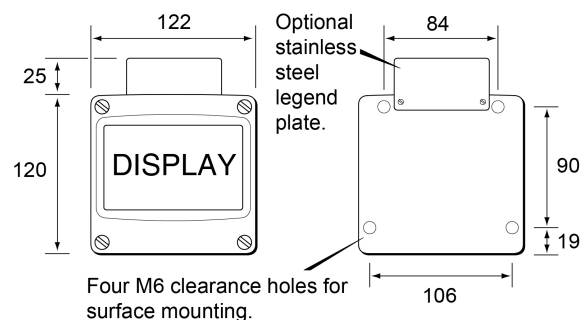


Fig 4 Dimensions and terminal connections

4.3 EMC

The BA514G complies with the requirements of the European EMC Directive 2014/30/EU and UK Electromagnetic Compatibility Regulations UKSI 2016:1091 (as amended). For specified immunity all wiring should be in screened twisted pairs, with the screens earthed at a common point.

4.4 Units of measurement and tag marking on scale card.

The Tachometer's units of measurement and tag information can be shown on a scale card which slides into the instrument.

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

To remove the scale card from a Tachometer carefully pull the transparent tab at the rear of the instrument assembly away from the assembly as shown in Fig 5a.

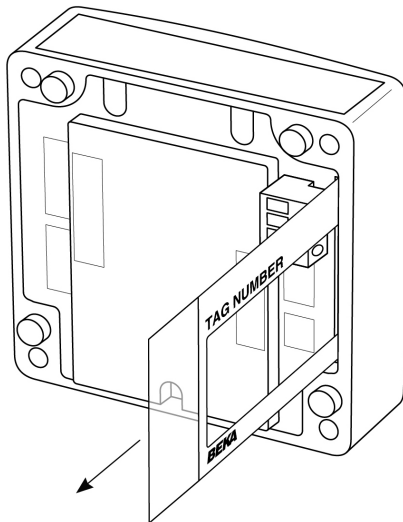


Fig 5a Removing scale card

To replace the scale card carefully insert it into the slot on the right hand side of the input terminals as shown in Fig 5b. Force should be applied evenly to both sides of the scale card to prevent it twisting. The card should be inserted until about 2mm of the transparent tab remains protruding.

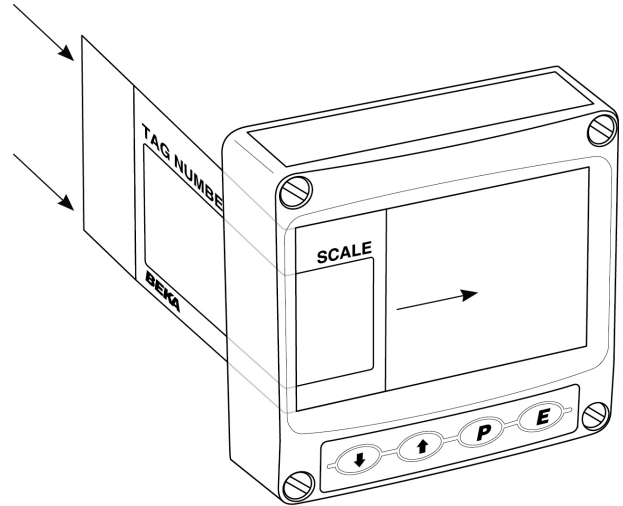


Fig 5b Inserting scale card into the instrument assembly.

5.0 CONFIGURATION & CALIBRATION

The BA514G 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 6.

Each menu function is summarised in section 5.3 of this manual and each summary includes a reference to more detailed information.

For simplicity the pulse output is described separately in section 5.20 and factory fitted optional alarms and 4/20mA output are described separately in section 8.

All new Tachometer are supplied calibrated as requested at the time of ordering. If calibration is not requested, the Tachometer will have factory 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	dEFRAULt
Update	uPdARtE	0.5
Run-time display	di SP-2	on
Decimal point (speed)	dP	0000.0
Speed scale factor	SCALE.5	001.00
Timebase	t-bRSE	t6-60
Filter	F, LER	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

5.1 Configuration structure

Fig 6 shows the BA514G calibration structure.

The pulse input is divided by SCALE.5 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.5 should be set to 18.0.

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

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

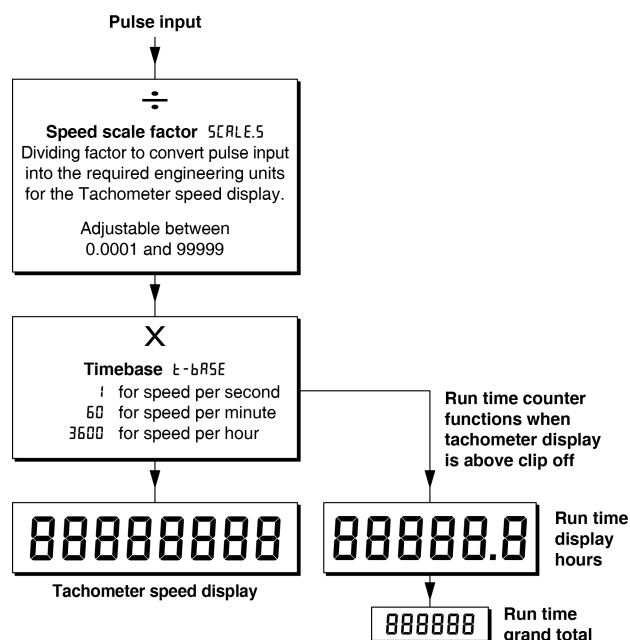


Fig 6 Calibration structure

5.2 Accessing configuration functions

Throughout this manual push buttons are shown as , , and . Legends displayed by the instruments are shown in a seven segment font as they appear on the Tachometers e.g. INP.UL and uPdARtE.

Access to the configuration menu is obtained by operating the and push buttons simultaneously. If the instrument is not protected by a security code the first parameter INP.UL will be displayed. If a security code other than the default code 0000 has already been entered, the instrument will display CoDE. Press to clear this prompt and enter the security code for the instrument using the or push button to adjust the flashing digit, and the push button to transfer control to the next digit. If the correct code has been entered pressing will cause the first parameter INP.UL 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 7.

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

5.3 Summary of configuration functions

This section summarises all the configuration functions. When read in conjunction with Fig 7 it provides a quick aid for configuring the Tachometer. If more detail is required, each section contains a reference to a full description of the function.

Display	Summary of function	Display	Summary of function
Input	<p>Input Contains sub-menu with two functions:</p> <p>InputType Select Input type</p> <p>DEBOUNCE Set debounce</p> <p>See section 5.4</p> <p>InputType Configures the Tachometer to accept one of six types of input:</p> <p>OPCOL Open collector *</p> <p>VOLT5 L Voltage pulse <1 >3V</p> <p>VOLT5 H Voltage pulse <3 >10V</p> <p>COL Magnetic pick-off</p> <p>PRDET Proximity detector *</p> <p>CONTACT Switch contact *</p> <p>* Link terminals 3 & 4</p> <p>See section 5.5</p> <p>DEBOUNCE Defines level of input debounce applied to the pulse input to prevent false counting, three levels are selectable:</p> <p>DEFAULT</p> <p>MEDIUM</p> <p>LIGHT</p> <p>See section 5.6</p>	dP	<p>Decimal points Defines the position of the decimal point in the Tachometer speed display.</p> <p>See section 5.9</p>
InputType		SCALE.5	<p>Speed scale factor SCALE.5 is a dividing factor, adjustable between 0.0001 and 99999, that converts the pulse input into the required Tachometer speed display.. e.g. If a sensor monitoring a rotating shaft generates 18 pulses per revolution, to produce a Tachometer speed display in revolutions SCALE.5 should be set to 18.0.</p> <p>See section 5.10</p>
DEBOUNCE		TIMEBASE	<p>Timebase Selectable multiplier allowing Tachometer speed display to be in units per second, per minute or per hour.</p> <p>Select:</p> <p>TIMEBASE per second</p> <p>TIMEBASE per minute</p> <p>TIMEBASE per hour</p> <p>See section 5.11</p>
DEBOUNCE		FILTER	<p>Display filter Adjustable digital filter that reduces the noise on the Tachometer speed display, comprising two parameters each adjustable between 0 and 9. The first digit defines the amount of filtering applied to the display, the second the deviation from the displayed value at which the filter will be overridden and the Tachometer display will move rapidly to the new value.</p> <p>See section 5.12</p>
UPDATE	<p>Display update interval Defines the interval between display updates from 0.5 to 5 seconds.</p> <p>See section 5.7</p>	CLIP-OFF	<p>Clip-off Clip-off is the Tachometer speed display threshold below which the run-time clock is inhibited.</p> <p>See section 5.13</p>
5P-2	<p>Run-time display Turns the lower display, which shows run-time in hours, ON or OFF.</p> <p>See section 5.8</p>		

Display	Summary of function	Display	Summary of function
LoL LLr	<p>Local reset</p> <p>Contains sub-menu with two functions enabling the run-time display and grand total run-time to be reset to zero via the front panel push buttons when the Tachometer is in the display mode.</p> <p>See section 5.14</p> <p>LLr tot</p> <p>When 'on' is selected, operating the  and  buttons simultaneously for more than three seconds in the display mode resets the run-time display to zero.</p> <p>See section 5.15</p> <p>LLr GLtot</p> <p>When on is selected, operating the  and  buttons simultaneously for more than 10 seconds in the display mode resets the run-time grand total to zero.</p> <p>See section 5.16</p>	<p>LLr GLtot</p> <p>Resets grand total run-time to zero.</p> <p>This function resets the grand total run-time to zero from within the configuration menu when LLr YE5 is selected, and SurE is entered to confirm the instruction.</p> <p>Note: Once reset, the original grand total can not be recovered.</p> <p>See section 5.17</p> <p>LLodE</p> <p>Security code</p> <p>Defines a four digit alphanumeric code that must be entered to gain access to the configuration menu. Default code 0000 disables the security function and allows unrestricted access to all configuration functions.</p> <p>See section 5.18</p> <p>r5Et dEF</p> <p>Reset to factory defaults</p> <p>Returns the Tachometer to the factory defaults shown in section 5.0 To prevent accidental use the request must be confirmed by entering SurE before the reset will be executed.</p> <p>See section 5.19</p>	

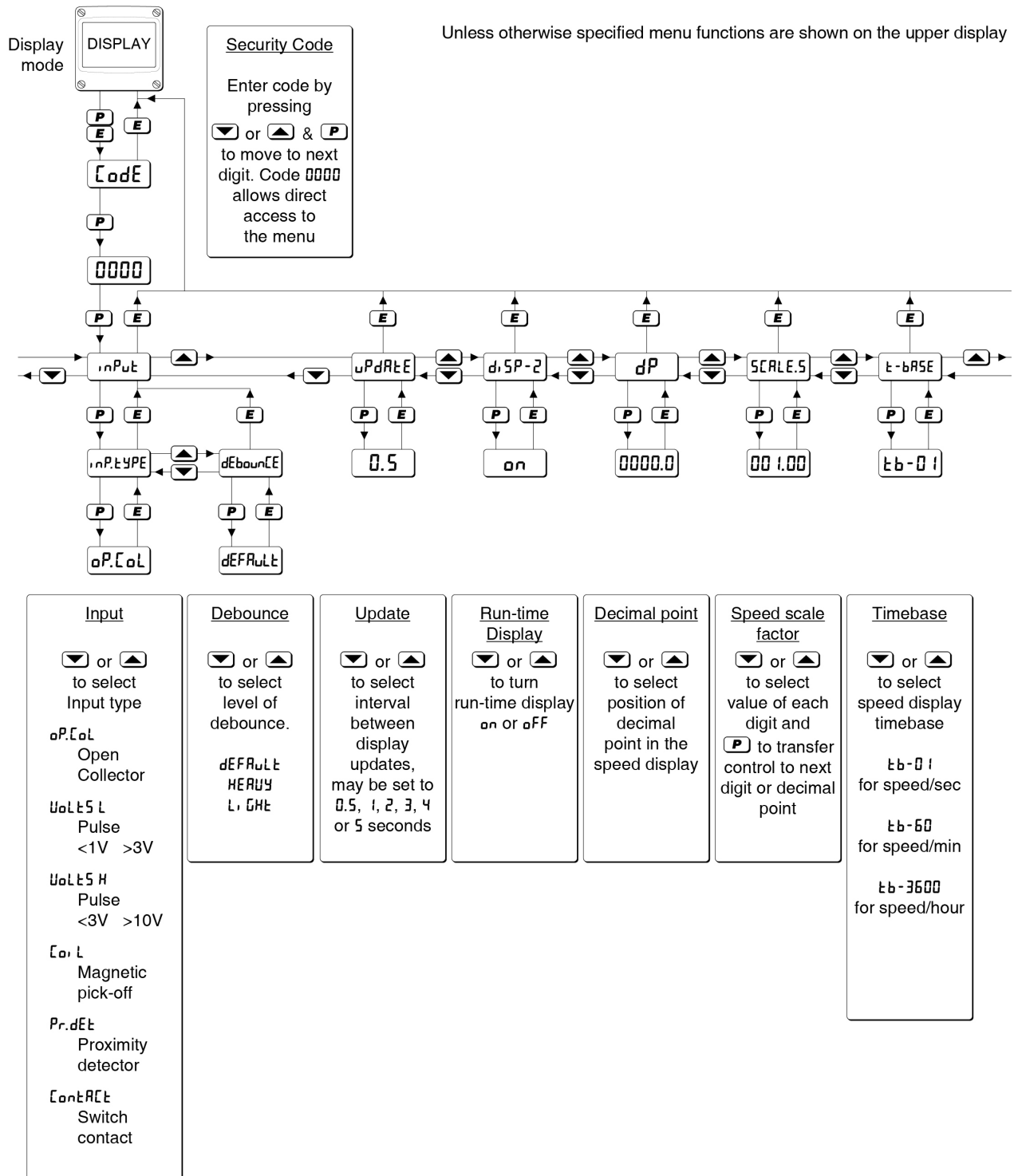
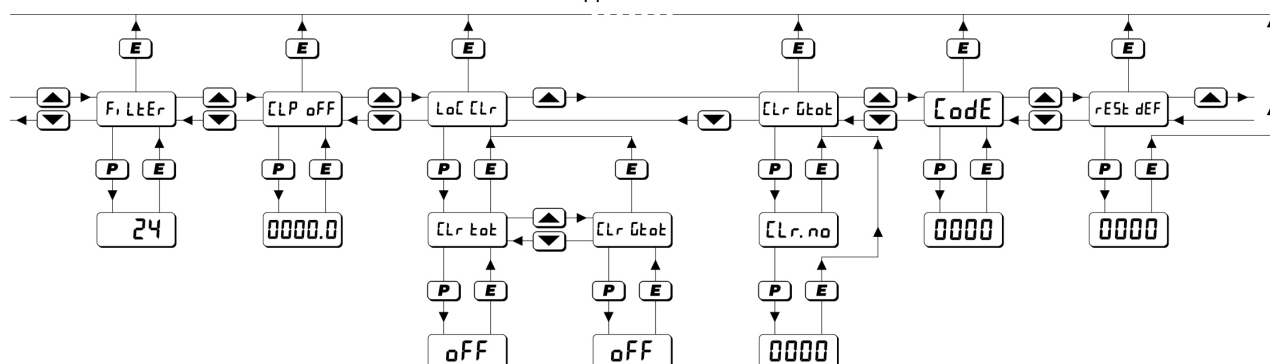


Fig 7 Configuration menu

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



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

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

5.5 Input type: InputType

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

One of following six types of input may be selected:

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

Notes:

- 1 Maximum voltage input +30V.
- 2 For sensors that require energising to determine their state 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 5.6 for the typical maximum operating frequency.

5.6 Debounce: Debounce

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

The following table shows the minimum time that the input pulse must be continuously above the upper input switching threshold and continuously below the lower switching threshold to ensure that the Tachometer processes the input pulse. Input switching thresholds are shown in section 5.5.

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

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	12Hz	2kHz
Light	1000Hz	100kHz

The minimum operating input frequency is 0.01Hz. Below this frequency the speed display is forced to zero.

The Debounce function is a sub-menu located in the Input function. Select Input in the configuration menu and press P which will reveal the InputType prompt, press the Down or Up button to select Debounce followed by P to reveal the existing setting. Pressing the Down or Up 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.

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

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

To adjust the update interval select $\mu P d R E$ from the configuration menu and press \boxed{P} to reveal the current time. Pressing the \blacktriangledown or \blacktriangle button will scroll through the six times. When the required interval has been selected press \boxed{E} to enter the selection and return to the configuration menu.

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

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

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

5.9 Position of the decimal point: dP

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

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

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

The units of the Tachometer speed display are pulses per unit of time. The unit of time is the timebase of the instrument which is determined by $t-b R 5 E$ which is described in section 5.11.

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

When this digit has been adjusted as required, pressing \boxed{P} will transfer control to the next digit. When all the digits have been adjusted pressing \boxed{P} will transfer control to the decimal point which may be positioned between any of the digits, or may be omitted by moving it to the right of the least significant digit. When the required speed scale factor has been entered, press \boxed{E} to return to the $5C R L E.5$ prompt in the configuration menu.

5.11 Timebase: $t-b R 5 E$

The timebase multiplies the Tachometer speed display by 1, 60 or 3,600 depending upon whether the Tachometer is required to display speed per second, per minute or per hour. e.g. RPS, RPM or RPH. See Fig 6.

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

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

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

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

The digital display filter has two independent adjustable parameters enabling the Tachometer speed display response to be tailored for optimum performance. The filter parameters are controlled by a two digit number. The first digit defines the amount of filtering applied to the display as shown below.

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

The second digit defines the deviation from the displayed speed at which the filtering defined by the first digit will be overridden and the Tachometer speed display will move rapidly to the new value.

Second digit	Magnitude of input step change which will override the filter and move the speed display rapidly to the new value..
X0	Off
X1	1%
X2	2%
X3	4%
X4	8%
X5	12%
X6	16%
X7	24%
X8	32%
X9	64%

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

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

To check or change the filter select **FILTER** in the configuration menu and press **P** which will reveal the current settings with the first digit flashing. Pressing the **▼** or **▲** button will change the flashing digit and **P** will transfer control to the second digit. While making adjustments the filtered Tachometer display is shown on the lower display in place of run-time so that stability can be assessed while adjustments are being made. When set as required, press the **E** button to enter the revised parameters and return to the **FILTER** prompt in the configuration menu.

5.13 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 5.8.

To check or change the clip-off threshold select **CLP OFF** from the configuration menu and press **P** which will reveal the current setting. The threshold is shown in the units already selected for the Tachometer speed display with one digit flashing. The value of the flashing digit may be adjusted by pressing the **▼** or **▲** button, when set as required pressing **P** will transfer control to the next digit. When all the digits have been adjusted, press the **E** button to enter the revised threshold and return to the **CLP OFF** prompt in the configuration menu.

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

Note:

To avoid confusion, when the speed scale factor **SCALE.5**, timebase **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.

5.14 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.

5.15 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 which will show if the local run-time reset is **on** or **OFF**. If set as required operate the **E** button twice to return to the configuration menu, or the **▼** or **▲** button to change the setting followed by the **E** button twice to enter the change and return to the **LoC CLR** prompt in the configuration menu.

Note:

The run-time display may also be reset to zero remotely by connecting terminals RS1 and RS2 together for more than one second. See section 3.3 of this manual.

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

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

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

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

Note:

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

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

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

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

To zero the grand total from within the configuration menu select $\llcorner \llcorner \llcorner \llcorner$ and press \llcorner which will cause the instrument to display $\llcorner \llcorner . no$ with no flashing. Press the \llcorner or \llcorner push button until $\llcorner \llcorner . 9E5$ is displayed and then press \llcorner 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 $5urE$ using the \llcorner or \llcorner button to adjust the flashing digit and the \llcorner button to move control to the next digit. Pressing \llcorner will then reset the grand total to zero and return the Tachometer to the configuration menu.

Note:

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

5.18 Security code: $\llcorner \llcorner \llcorner$

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 $\llcorner \llcorner \llcorner$ from the configuration menu and press \llcorner which will cause the Tachometer to display 0000 with one digit flashing. The flashing digit may be adjusted using the \llcorner or \llcorner push button and the \llcorner button to transfer control to the next digit. When all the digits have been adjusted press \llcorner to return to the $\llcorner \llcorner \llcorner$ 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.

5.19 Reset configuration to factory defaults:

$r5E\llcorner dEF$

$r5E\llcorner dEF$ resets the Tachometer configuration to the factory default configurations shown in section 5.0.

To reset the Tachometer to the factory default configurations select $r5E\llcorner dEF$ from the configuration menu and press \llcorner which will result in the instrument displaying 0000 with the first digit flashing. To confirm the instruction $5urE$ should be entered. Using the \llcorner or \llcorner button set the first flashing digit to 5 and press \llcorner which will transfer control to the second digit which should be set to u . When $5urE$ has been entered pressing the \llcorner button will reset all the configuration functions and return the instrument to the display mode.

5.20 Pulse output

The BA514G Tachometer has an opto-isolated open collector pulse output with following electrical parameters:

R_{on}	=	$60\Omega + 3V$
R_{off}	=	$1M\Omega$
V_{max}	=	$30V$ dc
I_{max}	=	$10mA$

The output pulse may be a synchronous duplicate of the input pulse or the input frequency may be divided 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. R_{on} is less than $60\Omega + 3V$.

drEct

Annunciator continuously activated

5.20.1 System design

The Tachometer's pulse output is a passive circuit i.e. not powered, but it is totally isolated from all other Tachometer circuits, therefore terminals P1 and P2 may be connected to most other instrument with an open collector pulse input.

Fig 8 shows how to produce a voltage pulse that could be used to drive a remote counter. The positive terminal of the pulse output circuit P1 is connected to the Tachometer's positive supply terminal 1. When an output pulse occurs and the open collector output 'closes', P2 is connected to P1 and the pulse current flows through resistor R1. The current flowing in the circuit is determined by R1 which should be chosen to limit the pulse output current to less than 10mA. For a 24V supply R1 should be greater than $2,200\Omega$.

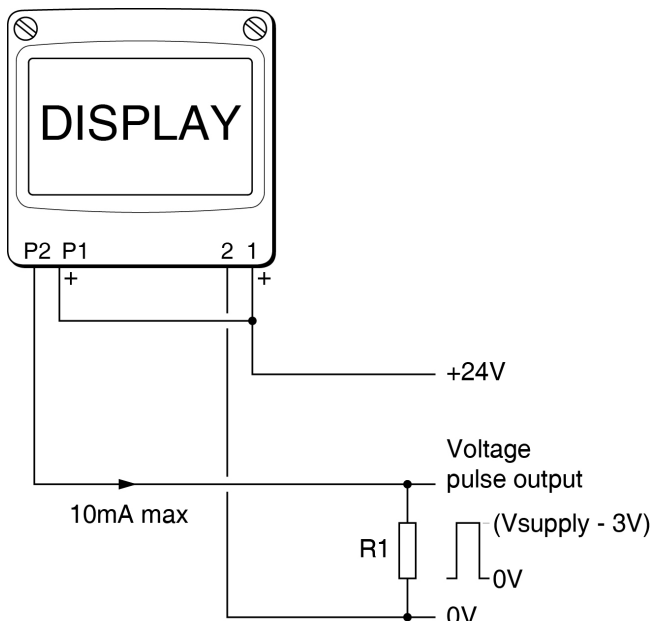


Fig 8 Transferring pulse output to the safe area

5.20.2 Configuration

The pulse output sub-menu which is within the instrument configuration menu is shown in Fig 9. For re-transmission applications the output pulse may be a synchronous duplicate of the input pulse by selecting *drEct* in the *Source* function.

When *SCALEd* is selected in the *Source* function, two additional functions, *drUdE* 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.

5.20.3 Access pulse output sub-menu: PULSE oP

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

Using the ∇ or \blacktriangle push button scroll through the configuration menu until *PULSE oP* is displayed, pressing P will then access the pulse output sub-menu which is shown in Fig 9.

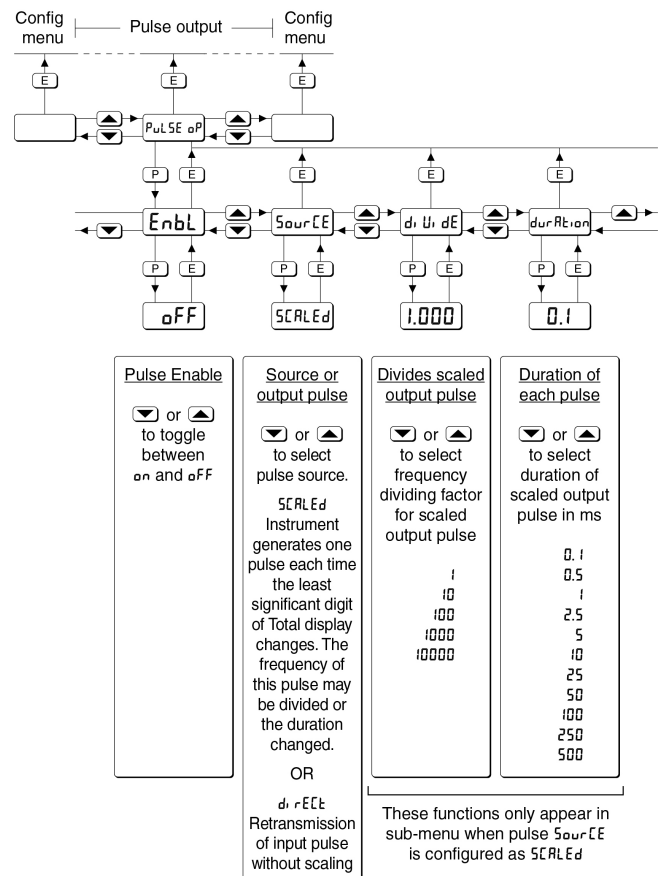








Fig 9 Pulse output configuration sub-menu

5.20.4 Enable pulse output: *Enbl*







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

5.20.5 Source of output pulse: *Source*

The output pulse may be derived from:

direct Output is synchronous duplicate of the Tachometer input pulse.







Scaled Input pulse scaled prior to re-transmission.
Input pulse frequency may be divided by the *divide* function and the output pulse width defined by the *duration* function

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

5.20.6 Divide output pulse frequency: *divide*

When *Scaled* is selected in the *Source* sub-function (5.20.5) the output pulse is derived from input pulse divided by one of the following five divisors:

1
10
100
1000
10000







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

Note: This function only appears in the pulse output sub-menu when the *Scaled* is selected in the *Source* sub-function (5.20.5).

5.20.7 Output pulse width: *duration*

When *Scaled* is selected in the *Source* sub-function (5.20.5) the output pulse width is defined by this function. One of following millisecond pulse widths may be selected:

0.1
0.5
1
2.5
5
10
25
50
100
250
500

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

Note: This function only appears in the pulse output sub-menu when *Scaled* is selected in the *Source* sub-function (5.20.5).

5.20.8 Pulse storage

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

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

6. CONFIGURATION EXAMPLE

In this example a BA514G Tachometer is connected to a proximity detector producing 105 pulses per revolution.

The BA514G 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.

6.1 Configuration procedure

The BA514G 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 7.

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 **dEFRuLE** 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 5.4, 5.5 and 5.6

Step 3 Select the interval between display updates

Using the **[▼]** or **[▲]** button select **uPdRtE** 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 **uPdRtE** prompt in the configuration menu by pressing the **[E]** button.

See 5.7

Step 4 Run-time display

Using the **[▼]** or **[▲]** button select **d, 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 **d, SP-2** prompt in the configuration menu. See 5.8

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 5.9

Step 6 Enter the speed scale factor

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







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

Using the **[▼]** or **[▲]** push button select **SCALE5** from the configuration menu and press **[P]** to reveal the existing value with one digit flashing. This should be changed to 105.0 using the **[▼]** or **[▲]** push button to adjust the flashing digit and the **[P]** button to transfer control to the next digit and to position the decimal point. Finally, enter the new value and return to the **SCALE5** prompt in the configuration menu by pressing **[E]**.

See 5.10

Step 7 Enter the speed timebase

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

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

See 5.11








Step 8 Adjust the display filter

The digital display filter has two independent adjustable parameters enabling the rate display response to be tailored for optimum performance. The filter parameters are controlled by a two digit number. The first digit defines the amount of filtering applied to the display, for initial configuration it is recommended it is set to 2 which is a time constant of 4.3 seconds.

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

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








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

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

See 5.12

Step 9 Define clip-off

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










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







See 5.13

Step 13 Local reset of total and grand total

Two separate functions in the `LdL 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 BA514G Tachometer is in the display mode.

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

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

See 5.15 and 5.16

Step 14 Reset the grand total to zero

Before completing configuration the run-time grand total should be reset to zero. Using the ▼ or ▲ button select `ELr.GtOt` in the configuration menu and press `P` which will cause `ELr.no` to be displayed. Again using the ▼ or ▲ button select `ELr.YE5` 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 `5urE` 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 `ELr.GtOt` prompt in the configuration menu.
See 5.17.

Step 15 Define the security code

Defining a security code prevents unauthorised access to the configuration menu. Using the ▼ or ▲ button select `EdE` 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 5.18.

Step 16 Return to the display mode

Configuration of the BA514G is now complete. Pressing the `E` button will save the new configuration and return the Tachometer to the display mode. The BA514G will display `dRtR` followed by `5RUE` while the new information is stored in permanent memory, which will be protected from unauthorised adjustment by the security code.

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

7. MAINTENANCE

7.1 Fault finding during commissioning

If a BA514G Tachometer 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 30V on terminals 1 & 2 with terminal 1 positive.
Tachometer is receiving power but pulse input indicator not rotating	No input pulses, incorrect input configuration, incorrect linking of terminals 3 & 4.	Input configuration. Linking of terminals 3 & 4. That input signal polarity is correct.
Pulse input indicator rotating, but incorrect speed display	Incorrect speed display calibration.	SCALE 5 E-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.	d, SP-2 is activated See 5.8 If HOLD annunciator is activated, enter smaller CLIP-OFF value. See 5.13 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 5.12
Unable to enter configuration menu.	Incorrect security code.	That the correct security code is being used. See 5.18 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 5.13
Alarms do not function.	Alarms have been disabled following calibration change.	Re-enable both alarms. See 8.4.3

7.2 Fault finding after commissioning

ENSURE PLANT SAFETY BEFORE STARTING MAINTENANCE

If a BA514G 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 30V on terminals 1 & 2.
Pulse input indicator not rotating.	No input pulses.	Output from sensor. Wiring between sensor and Tachometer.
Pulse input indicator rotating, run-time display not functioning. HOLD annunciator activated.	Input below clip-off threshold.	Adjust CLIP-OFF threshold.
Unstable rate display	Noisy pulse input signal	Locate source of electrical noise, or increase debounce and rate display filter.

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

7.3 Servicing

We recommend that faulty BA514G Tachometers are returned to BEKA associates or to your local BEKA agent for repair.

7.4 Routine maintenance

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

7.5 Guarantee

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

7.6 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.

8. ACCESSORIES

8.1 Units of measurement & instrument identification on scale card.

New BA514G Tachometers are supplied with a printed scale card showing the units of measurement and tag information specified when the instrument was ordered. If this information was not supplied a blank scale card will be fitted which can easily be marked with a dry transfer or a permanent marker on-site.

Custom printed scale cards are available as accessories and may be easily fitted as shown in section 4.4 of this manual.

8.2 Legend plate

The BA514G can be supplied with a blank or custom laser engraved stainless steel legend plate as shown in Fig 4. The plate, which after installation is visible from the front of the instrument, is supplied loose with two fixing screws for securing it to the rear of the instrument's back-box. This plate can typically accommodate:

- 1 row of 5 alphanumeric characters 10mm high
- or 1 row of 6 alphanumeric characters 7mm high
- or 2 rows of 10 alphanumeric characters 5mm high

8.3 Display Backlight

The BA514G Tachometer can be supplied with a factory fitted backlight that produces green illumination enhancing display contrast and enabling it to be read at night or in poor lighting conditions. The backlight is internally powered from the instrument so that no additional wiring is required, but the instrument supply current increases to 32mA.

8.4 Alarms

The BA514G Tachometer can be supplied with factory fitted, dual isolated solid state single pole alarm outputs that may be independently configured.

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

CAUTION

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

When the BA514G Tachometer 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 BA514G 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.

8.4.1 Solid state output

Each alarm has a galvanically isolated single pole solid state switch output as shown in Fig 10. The outputs are polarised and current will only flow in one direction. Terminals A1 and A3 should be connected to the positive side of the supply.

$$\begin{aligned} R_{on} &= \text{less than } 5\Omega + 0.7V \\ R_{off} &= \text{greater than } 1M\Omega \end{aligned}$$

The solid state output of each alarm may be used to switch any circuit with parameters equal or less than:

$$\begin{aligned} V &= 30V \text{ dc} \\ I &= 200mA \end{aligned}$$

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

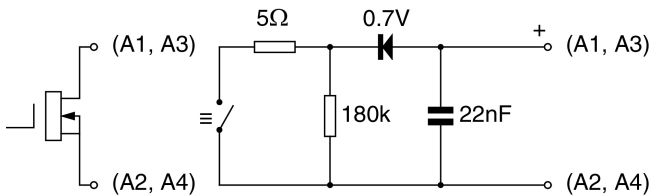
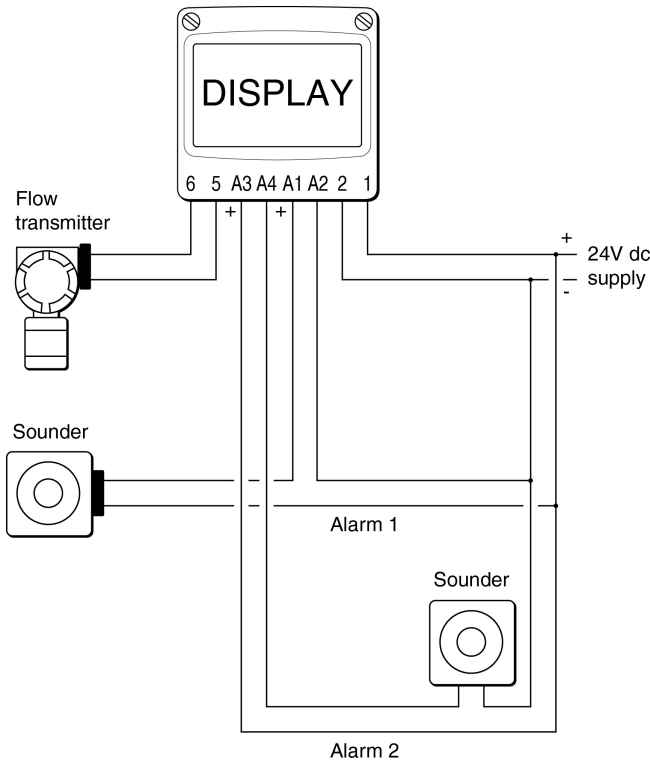


Fig 10 Equivalent circuit of each alarm output

Fig 11 Typical alarm application
(Shown without recommended screened cables)

8.4.2 Configuration and adjustment

When a BA514G is supplied with alarms the configuration menu is extended as shown in Fig 12 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 8.4.3
TYPE	Type of alarm Defines whether the alarm operates on the speed or run-time display. See section 8.4.4
SP 1SPeEd or SP 1Hour 5	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 8.4.5
Hi .Lo	Alarm function Defines whether the alarm has a high or low function. See section 8.4.6
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 8.4.7
H5Er	Hysteresis Adjusts the alarm hysteresis. Only available on a speed alarm. See section 8.4.8
dELd	Alarm delay time Adjusts the delay between the display equalling the setpoint and the alarm output being activated. See section 8.4.9
S. L	Alarm silence time Defines the time that the alarm output remains in the non-alarm condition following acceptance of an alarm. See section 8.4.10
FLSH	Flash display when alarm occurs When enabled, alternates the speed or run-time display between the value and alarm reference RL1 or RL2 when an alarm output is activated. See section 8.4.11
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 8.4.12

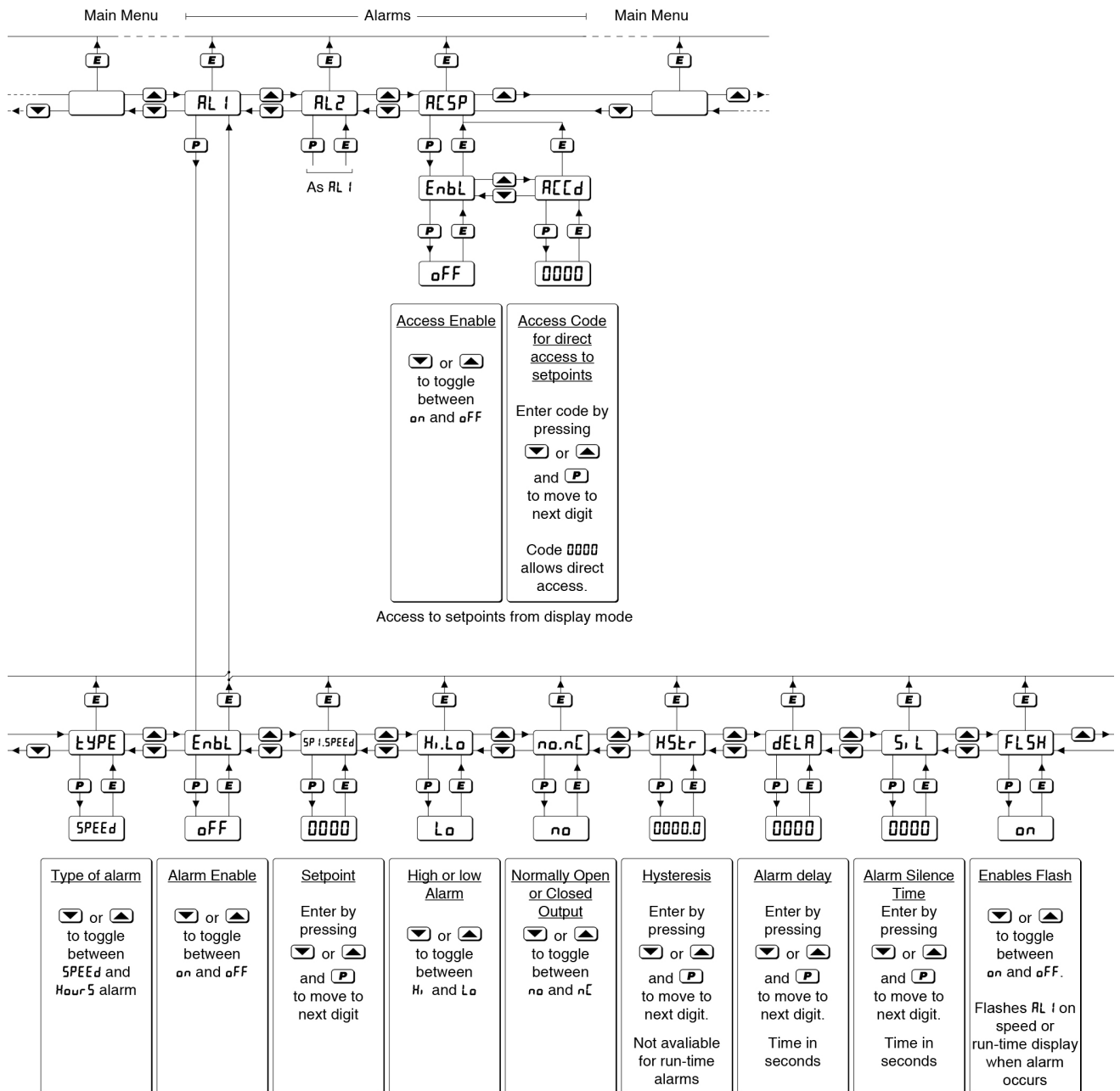

















Fig 12 Alarm menu structure

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

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

Note: When **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.







8.4.5 Setpoint adjustment: **SP1x & SP2x**

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

All the setpoints are adjusted in the same way, for example, to adjust the setpoint of Alarm 1 which has been configured to operate on the speed display. Using the  or  push button select **SP1SPEED** in the **AL1** sub-menu and press  which will reveal the existing setpoint with one digit flashing. The required setpoint can be entered using the  or  push button to adjust the flashing digit and the  button to transfer control to the next digit. When set as required press  to enter the value and return to the **SP1SPEED** prompt in the alarm 1 sub-menu.







8.4.6 Alarm function: **Hi.Lo**

Alarm 1 and Alarm 2 are totally independent, both may be Hi or Lo, or one may be conditioned as a Hi alarm and the other as a Lo alarm.

Using the  or  push button select **Hi.Lo** from the selected alarm sub-menu and press  to check or change the function. The  or  push button will toggle the alarm function between **Hi** and **Lo**, when set as required, press the  button to return to the **Hi.Lo** prompt in the alarm sub-menu.








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

Each single pole alarm output may be open or closed in the non-alarm condition. When the BA514G power supply is turned off or disconnected, the alarm output(s) will open irrespective of whether normally open or normally closed outputs have been selected. Therefore, when designing an alarm system normally closed **nL** should be selected so that the output opens when an alarm occurs or if the power supply fails.

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

8.4.8 Hysteresis: **H5Lr**

Hysteresis is only available on speed alarms so the **H5Lr** 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 **H5Lr** in the selected alarm sub-menu and press  which will reveal the existing hysteresis with one digit flashing. The required hysteresis can be entered using the  or  push button to adjust the flashing digit and the  button to transfer control to the next digit. When set as required press  to enter the value and return to the **H5Lr** prompt in the alarm sub-menu.

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

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

8.4.9 Alarm delay: **dELR**

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

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

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

8.4.10 Alarm silence time: 5, L

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

After an alarm has occurred, operating the **[P]** button will cause the alarm output to revert to the non-alarm condition for the configured alarm silence time. When an alarm is silenced the alarm annunciator will flash until the silence time expires.

To adjust the alarm silence time select 5, L using the **[▼]** or **[▲]** push button in the selected alarm sub-menu and press **[P]** which will reveal the existing alarm silence time in seconds with one digit flashing. The required delay time can be entered using the **[▼]** or **[▲]** push button to adjust the flashing digit and the **[P]** button to transfer control to the next digit. When set as required press **[E]** to enter the value and return to the 5, L prompt in the alarm sub-menu.

8.4.11 Flash display when alarm occurs: FL5H

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

When enabled, this function alternates the speed or run-time display between the numerical value and the alarm identification AL1 or AL2 when an alarm occurs.

Using the **[▼]** or **[▲]** push button select FL5H from the selected alarm sub-menu and press **[P]** to check or change the function. The **[▼]** or **[▲]** push button will toggle the function between OFF and ON, when set as required, press the **[E]** button to return to the FL5H prompt in the alarm sub-menu.

8.4.12 Access Setpoint: RESP

This function activates a separate menu that provides direct access to the alarm setpoints when the Tachometer is in the display mode i.e. displaying speed by simultaneously operating the **[P]** and **[▲]** buttons. An operator can therefore adjust the alarm setpoints without having access to the configuration and alarm sub-menus. Protection against unauthorised or accidental adjustment is provided by a separate security access code.

Using the **[▼]** or **[▲]** push button select RESP from the configuration menu and press **[P]** to reach the enable function ENBL. Pressing **[P]** will reveal the existing setting which can be toggled between ON and OFF by pressing the **[▼]** or **[▲]** push button. When set as required, press the **[E]** button to return to the ENBL prompt from which a separate security access code can be entered using the REED function which can be selected using the **[▼]** or **[▲]** push button.

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

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

8.4.13 Adjusting alarm setpoints from the display mode.

Access to the two alarm setpoints from the Tachometer display mode i.e. when displaying speed is obtained by operating the **[P]** and **[▲]** push buttons simultaneously as shown in Fig 13. If the setpoints are not protected by a security code the alarm setpoint prompt SP SPEED or SP HOUR5 will be displayed depending upon whether a speed or run-time alarm has been configured. If the setpoints are protected by a security code, LOdE 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 SPEED or SP HOUR5 to be displayed. If an incorrect security code is entered, or a button is not pressed within ten seconds, the instrument will automatically return to the display mode. Once within the menu pressing the **[▼]** or **[▲]** buttons will toggle the display between the two alarm setpoint prompts SP 1x and SP 2x.

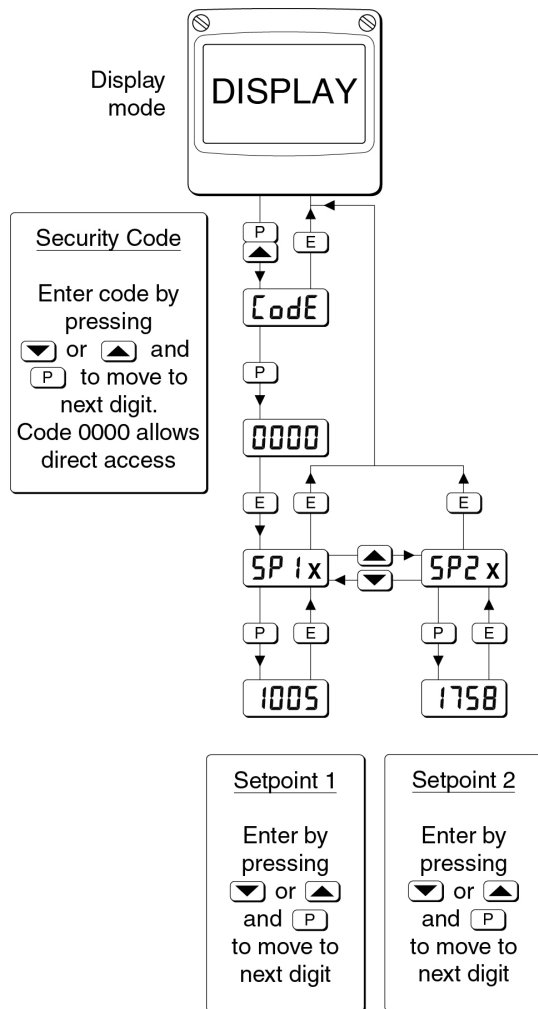


Fig 13 Setpoint adjustment from the display mode

To adjust an alarm setpoint select $5P\ 1x$ or $5P2x$ and press **P** which will reveal the current setting. The flashing digit of the setpoint may be adjusted using the ▼ or ▲ push button and the **P** button to transfer control to the next digit. When the required setpoint has been entered, pressing **E** will return the display to the $5P\ 1x$ or $5P2x$ prompt from which the other setpoint may be selected, or the instrument may be returned to the display mode by pressing **E** again.

Note: Direct access to the alarm setpoints is only available when the menu is enabled, see section 8.4.12

8.5 4/20mA output

The BA514G Tachometer can be supplied with a factory fitted galvanically isolated 4/20mA output which may be configured to represent any part of the Tachometer speed display.

8.5.1 System design

The Tachometer 4/20mA output is a passive current sink i.e. not powered, but it is totally isolated from all other Tachometer circuits. It is effectively a 2-wire 4/20mA transmitter requiring a minimum supply of 5V with its current being controlled by the Tachometer speed display. Terminals C2 and C4 are internally linked and may be used for joining a return 4/20mA wire.

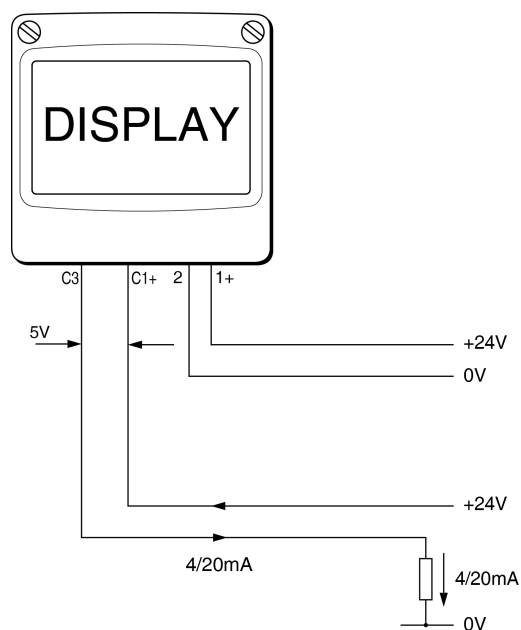


Fig 14 Application of 4/20mA output
(Shown without recommended screened cables)

Fig 14 shows a typical application in which a BA514G Tachometer is transmitting a 4/20mA current to another instrument.

8.5.2 Configuration and calibration

When a Tachometer is supplied with an optional 4/20mA output the configuration menu is extended as shown in Fig 15. The 4/20mA output sub-menu is accessed via the 4-20 oP 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.

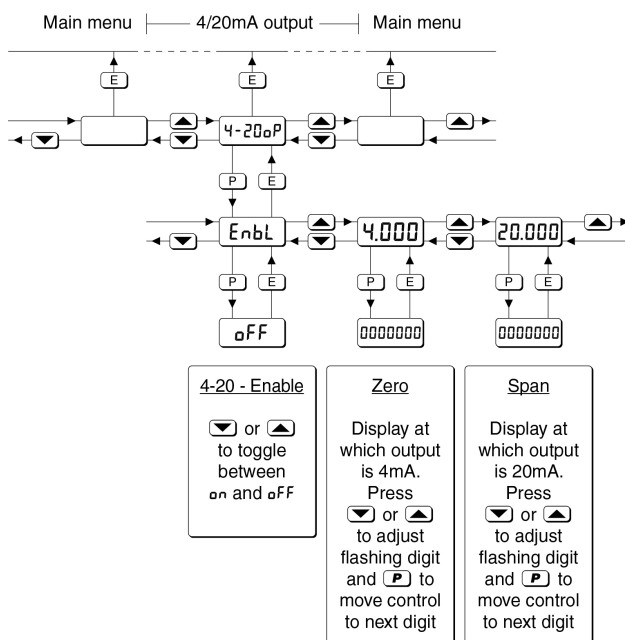


Fig 15 4/20mA output configuration sub-menu

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








Access the Tachometer configuration menu as described in section 5.2. Using the ▼ and ▲ push buttons scroll through the menu until 4-20 oP is displayed, pressing P will then access the 4/20mA output sub-menu which is shown in Fig 15.

8.5.4 Enable 4/20mA output: EnbL

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








8.5.5 Display which corresponds 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  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  button to transfer control to the next digit. When set as required, press  to enter the value and return to the 4.000 prompt in the 4/20mA output sub-menu.

8.5.6 Display which corresponds 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  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  button to transfer control to the next digit. When set as required, press  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.