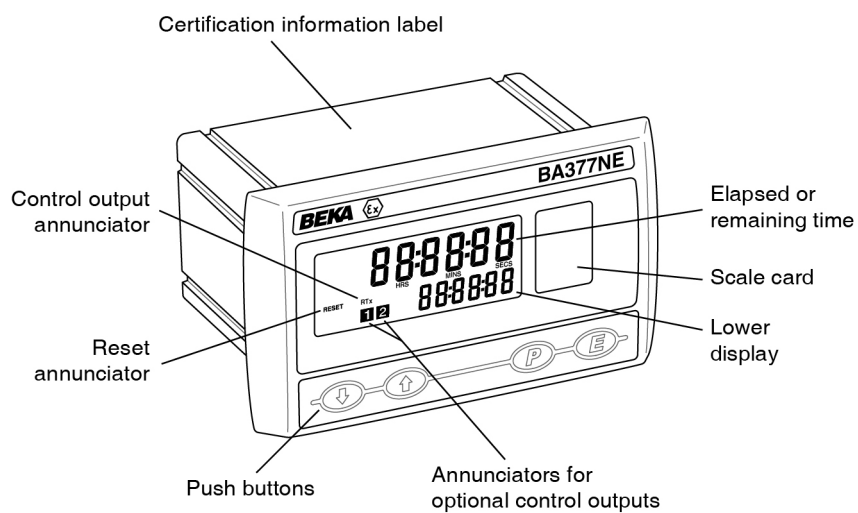


BA377NE
Rugged one input
Ex nA and Ex tc
Timer or Clock
Issue 7



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1. DESCRIPTION

The BA377NE is an Ex nA non-sparking and Ex tc certified, panel mounting instrument with a single input that can be installed in Zone 2 or Zone 22 without the need for Zener barriers or galvanic isolators. It may be configured on-site as a Timer or as a Clock. As a Timer the BA377NE is able to measure and display the elapsed time between external events, or control external events via two optional factory fitted control outputs.

When configured as a Clock, the instrument can display time in a variety of formats and the two optional control outputs may be configured to switch loads *on* and *off* at pre-set times.

This instruction manual is divided into sections.

Common features

2. Ex nA certification
3. System design for hazardous areas
4. Installations
5. Accessories

Timer

6. Operation as a timer
7. Configuration example
8. Maintenance

Clock

9. Operation as a clock
10. Configuration example
11. Maintenance

The common features sections of this instruction manual describe ATEX Ex nA certification for use in gas atmospheres.

Ex tc dust certification is described in Appendix 1.

For international applications the BA377NE has IECEx gas and dust certification which is described in Appendix 2.

For applications in the USA and Canada the BA377NE has ETL and cETL certification which is described in Appendix 3.

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

2. Ex nA NON - SPARKING CERTIFICATION

The BA377NE has ATEX and IECEx gas and dust certification. This section of the instruction manual describes ATEX gas certification. Dust, IECEx and other approvals are each described in separate appendixes to this manual. The Ex nA and Ex tc certification of the instrument is unaffected by whether it is configured as a Timer or as a Clock.

2.1 ATEX Ex nA certification

Notified Body Intertek Testing and Certification Ltd have issued the BA377NE with a Type Examination Certificate number ITS16ATEX48409X. This has been used to confirm compliance with the European ATEX Directive for Group II, Category 3G equipment. The instrument carries the Community Mark and, subject to local codes of practice, may be installed in any of the European Economic Area (EEA) member countries and in the EEA EFTA states, Iceland, Liechtenstein and Norway. ATEX certificates are also acceptable in Switzerland and Turkey. The European Commission's Blue Guide lists the member states, overseas countries and territories that have adopted harmonisation legislation.

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

2.2 Zones, gas groups and T rating

The Timer or Clock has been certified as Group II Category 3G Ex ic nA IIC T5 Gc $-40^{\circ}\text{C} \geq T_a \geq +60^{\circ}\text{C}$ apparatus. This is non-sparking apparatus complying with EN 60079-15 *Equipment protection by type of protection 'n'* that minimises the risk of arcs or sparks capable of creating an ignition hazard occurring during conditions of normal operation.

The instrument's front panel push button contacts are non incendive and have been certified intrinsically safe Ex ic without the need for an external Zener barrier or galvanic isolator, as shown on the Type Examination Certificate. This allows the Timer or Clock to be adjusted and configured live when installed in a Ex n panel enclosure located in Zone 2.

When connected to a suitable system and correctly mounted in a panel enclosure complying with the requirements for Type of protection 'n', the panel enclosure containing the BA377NE may be installed in:

Zone 2 explosive gas air mixture not likely to occur, and if it does will only exist for a short time.

Be used with gases in groups:

Group A propane
Group B ethylene
Group C hydrogen

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

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

At ambient temperatures between -40 and +60°C.

This allows use with all commonly used industrial gases except carbon disulphide CS₂.

2.3 Special conditions for safe use

Special conditions for safe use are specified by the Ex nA certificate indicated by the certificate number's 'X' suffix. These state that the BA377NE Timer or Clock should be:

- Mounted such that the instrument terminals are protected by at least an IP54 enclosure compliant with IEC 60079-0 & IEC 60079-15.
- Be supplied from limited energy circuits with output parameters in normal operation equal to, or less than the instruments input parameters.

These special conditions for safe use can be satisfied by mounting the BA377NE in an Ex n, Ex e or Ex p panel enclosure. For ATEX Category 3 installations in Zone 2, self or third party certified Ex n, Ex e or Ex p panel enclosures may be used. Additional requirement apply for non-metallic panel enclosures.

2.4 Power supply

The input safety parameters for the power supply terminals 1 and 2 are:

U_i = 30V dc
I_i = 100mA

This allows the BA377NE to be powered from any dc supply which in normal operation has an output voltage of less than 30V. See section 3.1 for power supply recommendations.

2.5 Input terminals

The BA377NE Timer or Clock has a single pair of input terminals 5 and 6 that may be configured for use with different types of sensor.

For sensors that require energising to determine their state, such as switch contacts or a 2-wire proximity detector, an external link between terminals 3 & 4 of the BA377NE connects an internal 7V, 6mA supply to the input terminals. Energising is not required when the Timer or Clock input is connected to a voltage source.

Fitting an external link between terminals 3 & 4 changes the Timer or Clock's input safety parameters as shown below. This table also shows the types of sensor requiring energising (link fitting).

Type of input	Link 3 & 4	Safety parameters		
		Input U _i	Output U _o	I _o
Switch contact	Yes	15V	10.5V	9.2mA
Proximity detector	Yes	15V	10.5V	9.2mA
Open collector	Yes	15V	10.5V	9.2mA
Magnetic pick-off	No	30V	1.1V	0.5mA
Voltage input (low)	No	30V	1.1V	0.5mA
Voltage input (high)	No	30V	1.1V	0.5mA

2.6 Remote reset terminals

The BA377NE total display may be reset to zero by connecting the external reset terminals RS1 and RS2 together for more than one second. The two reset terminals have the following safety parameters in normal operation:

U_i = 30V
U_o = 3.8V
I_o = 1mA

2.7 Control outputs - optional

Each of the two optional control outputs is a separate galvanically isolated Ex nA circuit with the following input parameters:

U_i = 30V dc
I_i = 200mA

This allows each control output to switch any dc circuit providing that in normal operation the maximum supply voltage is not greater than 30V dc and the switched current is not greater than 200mA.

Providing that the BA377NE Timer or Clock is correctly installed in a panel enclosure located in Zone 2 complying with the requirements for Ex n protection, the two control outputs may be used to switch suitably protected equipment located in Zone 1 or 2 of a hazardous area, or equipment located in a safe area.

2.8 Certification label information

The BA377NE product certification label is fitted in a recess on the top outer surface of the enclosure. It shows the ATEX and IECEx certification information plus BEKA associates name and location and the instrument serial number. Certification information from other authorities may also be included.



BA377NE Certification information label

3. SYSTEM DESIGN FOR HAZARDOUS AREAS

When correctly installed in Zone 2 the BA377NE Timer or Clock may be connected to almost any apparatus in the safe area and to Ex n, Ex e, Ex p and Ex d protected apparatus located in Zone 2. Because the BA377NE is not certified intrinsically safe it should not be connected to an intrinsically safe system.

BEKA Application Guide AG310, *Guide for Installation of [extra low voltage d.c.] Ex nA instrumentation*, which can be downloaded from www.beka.co.uk, contains explanations and recommendations for the installation of Ex nA equipment.

In addition to being able to be connected to other equipment in the safe area and in Zone 2, the BA377NE may also be connected to suitably protected and certified equipment located in Zone 1. This is illustrated in Fig 4 and explained in Application Guide AG310.

There are four design requirements:

1. The BA377NE must be installed in a panel enclosure complying with the requirements for Ex n protection as shown in section 4 of this manual.
2. The BA377NE should be powered from a circuit that has output safety parameters in normal operation equal to, or less than, the input safety parameters for terminals 1 and 2 specified by the BA377NE ATEX Type Examination Certificate.
3. Hazardous area apparatus to which the BA377NE is connected should be protected by a technique suitable for the Zone in which the equipment is located such as Ex n or Ex e if located in Zone 2. Equipment protected by intrinsic safety should not be connected to a BA377NE.
4. Wiring should comply with Clause 9 of EN 60079-14.

When designing a system it is important to remember that terminals 2, 6 and RS2 are interconnected within the BA377NE. See Figs 7 & 11.

3.1 Power supply

The BA377NE Timer or Clock require a minimum of 10V between terminal 1 & 2 and consumes:

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

A 24V dc regulated supply with a current limit located in a safe area is suitable. The power supply should meet the requirements for personnel safety so that 'live maintenance' can safely be performed. The implicit requirement for galvanic isolation from the mains supply ensures that the possible difficulties from circulating earth currents caused by mains faults is minimised. In European terms if the power supply is CE marked it is almost certainly acceptable.

To comply with the requirements of EN 60079:14 *Electrical installations design, selection and erection*, each of the wires entering the hazardous area should be individually fused and contain a means of isolation. These two requirements may be satisfied by using DIN rail mounted terminals incorporating a fuse with easily removable fuses which can be extracted to achieve isolation as shown in Fig 1. Clear identification of, and easy access to the means of isolation is essential for their effective use. It is also necessary to ensure that the maintenance procedure makes sure that unauthorised re-closure of the switches does not occur. It is not considered necessary to have a means of isolation or electrical protection for the screen.

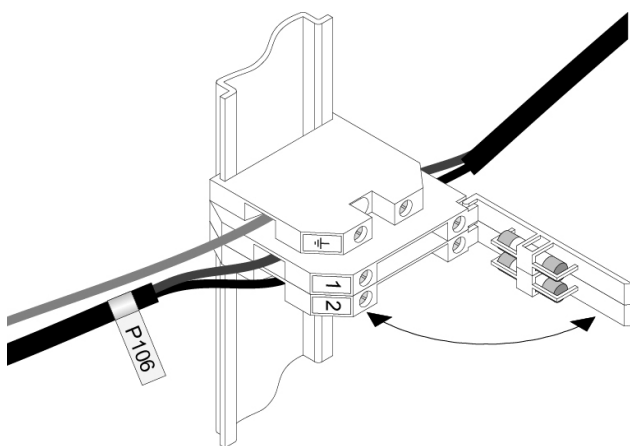


Fig 1 DIN rail mounting terminals incorporating a fuse

For some applications Ex nA instrumentation energised by a current limited power supply or instrument that can be switched off, is considered adequate and to comply with the requirements of the standard.

3.2 Sensor input

The BA377NE can be controlled from a wide variety of sensors located in a Zone 2 hazardous areas or in a safe area. Fig 2 shows the connections when the sensor is located in Zone 2 and Fig 3 the connections required when the sensor is in a safe area.

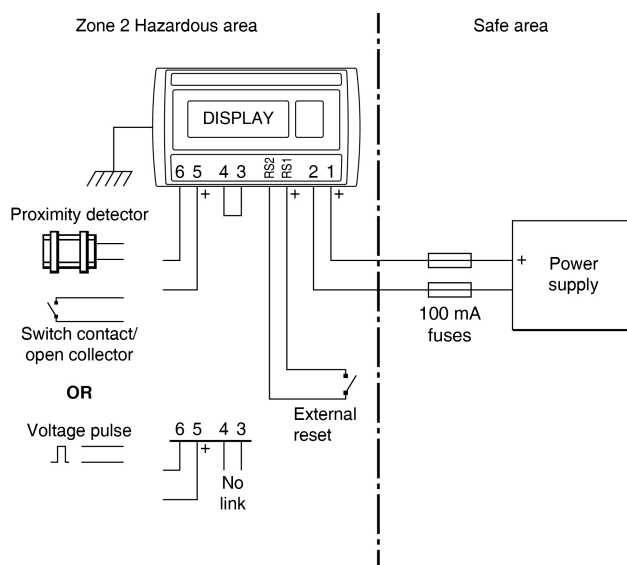


Fig 2 Connections for sensor in Zone 2

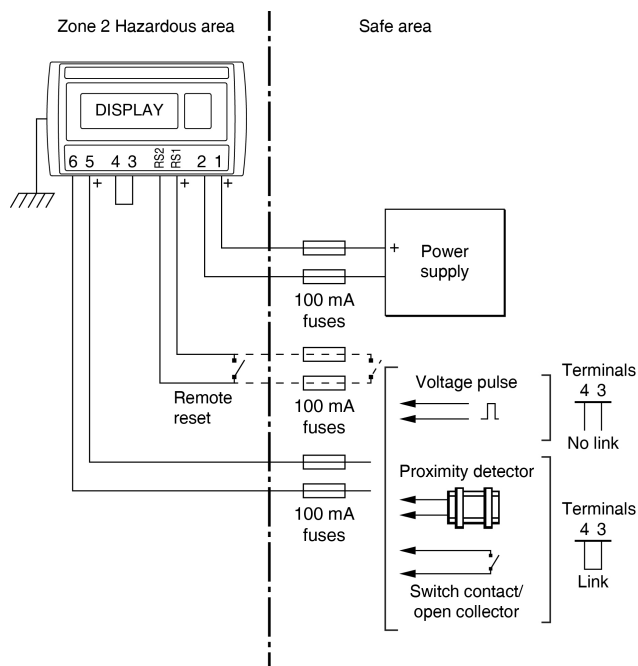


Fig 3 Connections for sensor in safe area

Providing the BA377NE Timer or Clock is correctly installed in an Ex n panel enclosure located in Zone 2, the input terminals may be connected to a certified sensor located in Zone 1 as shown in Fig 4. The sensor should have Ex e or Ex d certification permitting installation in Zone 1. Intrinsically safe Ex i certified sensors should not be used.

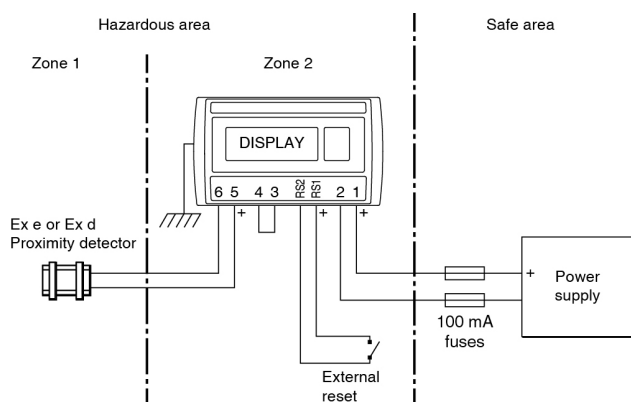


Fig 4 Connection to an Ex d or Ex e sensor in Zone 1.

3.2.1 Input switching threshold

For reliable totalisation the Timer or Clock input must fall below the lower threshold and rise above the upper thresholds shown in the following table.

Input transducer	Switching thresholds	
	Lower	Upper
Open collector	2k Ω	10k Ω
Low voltage range	1.0V	3.0V
High voltage range	3.0V	10.0V
Proximity detector	1.2mA	2.1mA
Switch	100 Ω	1000 Ω

Switch contact, proximity detector and open collector sensors require energising which is achieved by linking BA377NE terminals 3 and 4.

3.2.2 Switch contact input

Any mechanically or magnetically activated switch contact located in Zone 2 or in the safe area may be directly connected to the BA377NE input terminals 5 and 6, providing the sensor and associated wiring can withstand a 500V rms insulation test to earth. Most magnetically activated reed relays comply with these requirements.

The BA377NE contain a configurable debounce circuit to prevent false triggering. See section 6.5.6.

3.2.3 Open collector input

Open collector sensors located in Zone 2 or in the safe area may be directly connected to input terminals 5 & 6 providing the sensor and associated wiring can withstand a 500V rms insulation test to earth.

The BA377NE contain a configurable debounce circuit to prevent false triggering. See section 6.5.6.

3.2.4 2-wire proximity detector input

Most Zone 2 certified NAMUR 2-wire proximity detectors may be directly connected to a BA377NE input terminals 5 & 6 providing minimum operating voltage is greater than 7.5V. The sensor and the associated wiring should be able to withstand a 500V rms insulation test to earth.

The BA377NE contain a configurable debounce circuit to prevent false triggering. See section 6.5.6.

3.2.5 Magnetic pick-off input

[0, L in the input configuration menu is a low level voltage input intended for use with a magnetic pick-off sensor which is not suitable for controlling the BA377NE.

3.2.6 Voltage input



Two voltage input ranges are selectable in the BA377NE Timer or Clock configuration menu, U_{oL}Lt5 L and U_{oL}Lt5 H. The Timer or Clock input terminals 5 and 6 may be connected to any Zone 2 certified voltage, providing the output in normal operation is equal to or less than 30V and the sensor and associated wiring are able to withstand a 500V rms insulation test to earth.

The BA377NE contain a configurable debounce circuit to prevent false triggering. See section 6.5.6.

3.3 Remote reset

The BA377NE Timer or Clock's total display may be remotely reset to zero by connecting terminals RS1 and RS2 together. Permanent interconnection inhibits timing. Remote resetting may be accomplished by any mechanically operated switch located in Zone 2 as the Timer or Clock's reset circuit is non incensive. The reset switch and the associated wiring should be able to withstand a 500V rms insulation test to earth.

A BA377NE may also be remotely reset from the safe area. Any switch may be used. Fig 3 illustrates how a BA377NE may be reset from both the safe and the hazardous area.

The BA377NE total display may also be reset when the  and  push buttons are operated simultaneously in the display mode i.e. when the instrument is displaying elapsed time. See 6.5.19

3.4 Control outputs (optional)

The BA377NE can be supplied with factory fitted dual, solid state, single pole control outputs that may be independently configured with normally open or normally closed outputs.

CAUTION

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

When the BA377NE Timer or Clock power supply is turned off or disconnected, the control outputs will open irrespective of whether normally open or normally closed outputs have been selected.

Control output annunciators on the instrument display indicate the status of each output. If a control output delay or silence time has been selected the annunciator will flash during the delay or silence period.

3.4.1 Solid state output

Each control output has a galvanically isolated single pole solid state switch output as shown in Fig 5. 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.

$$R_{on} = \text{less than } 5\Omega + 0.7V$$

$$R_{off} = \text{greater than } 1M\Omega$$

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

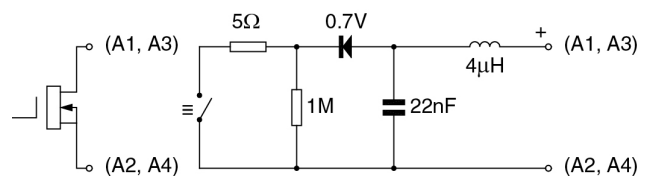


Fig 5 Equivalent circuit of each control output

3.4.2 Ex nA certification

Each control output is a separate galvanically isolated Ex nA circuit with the following input parameters:

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

This allows each control output to switch any dc circuit providing that in normal operation the maximum supply voltage is not greater than 30V dc and the switched current is not greater than 200mA.

Providing that the BA377NE Timer or Clock is correctly installed in a panel enclosure located in Zone 2 complying with the requirements for Ex n protection, the two control outputs may be used to switch suitably protected equipment located in any Zone of a hazardous area, or equipment located in a safe area.

Fig 6 shows a typical application in which a BA377NE Timer or Clock, mounted in an Ex n panel enclosure located in Zone 2, is being controlled by a flameproof Ex d 2-wire sensor located in Zone 1. Control output 1 is switching an Ex e sounder in Zone 1 and control output 2 is switching a sounder located in the safe area.

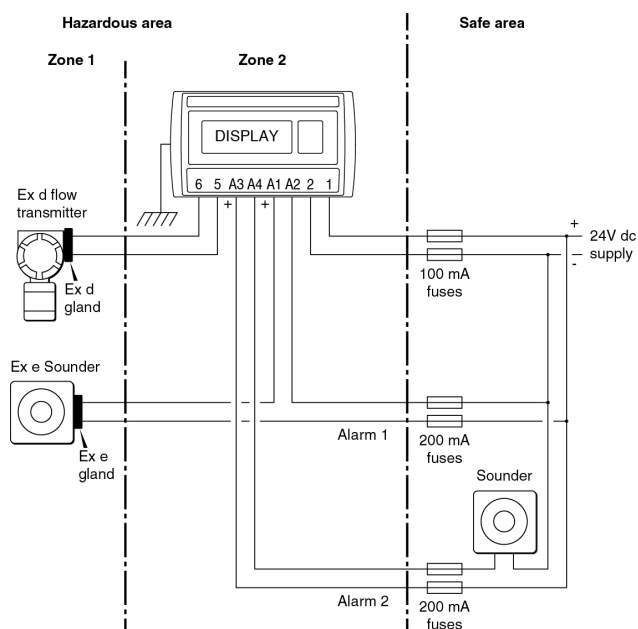


Fig 6 Typical control output application
(Shown without recommended screened cables)

To comply with the requirements of EN 60079-14 *Electrical installations design, selection and erection*, each of the wires entering the hazardous area should be individually fused and contain a means of isolation. These two requirements are frequently satisfied by using fuse holders with easily removable fuses and removing the fuses to achieve isolation. This is a satisfactory method at the low voltages and currents common in instrumentation systems. Clear identification of, and easy access to the means of isolation is essential for their effective use. It is also necessary to ensure that the maintenance procedure makes sure that unauthorised re-closure of the switches does not occur. It is not considered necessary to have a means of isolation or electrical protection for the screen. Figure 2 illustrates an example of this type of fused terminal block.

For some application Ex nA instrumentation energised by a current limited power supply or instrument that can be switched off, is often considered adequate and to comply with the requirements of the standard.

4. INSTALLATION

4.1 Location

When installed in a panel enclosure complying with the requirements for Ex n protection as shown in section 3.2 of this manual, the BA377NE may be located in a Zone 2 hazardous area providing that the operating temperature is between -40°C and $+60^{\circ}\text{C}$ and the installation complies with the Timer or Clocks certification requirements. Certified Ex e panel enclosures are frequently used as Ex n panel enclosures as they satisfy the same impact and ingress protection requirements.

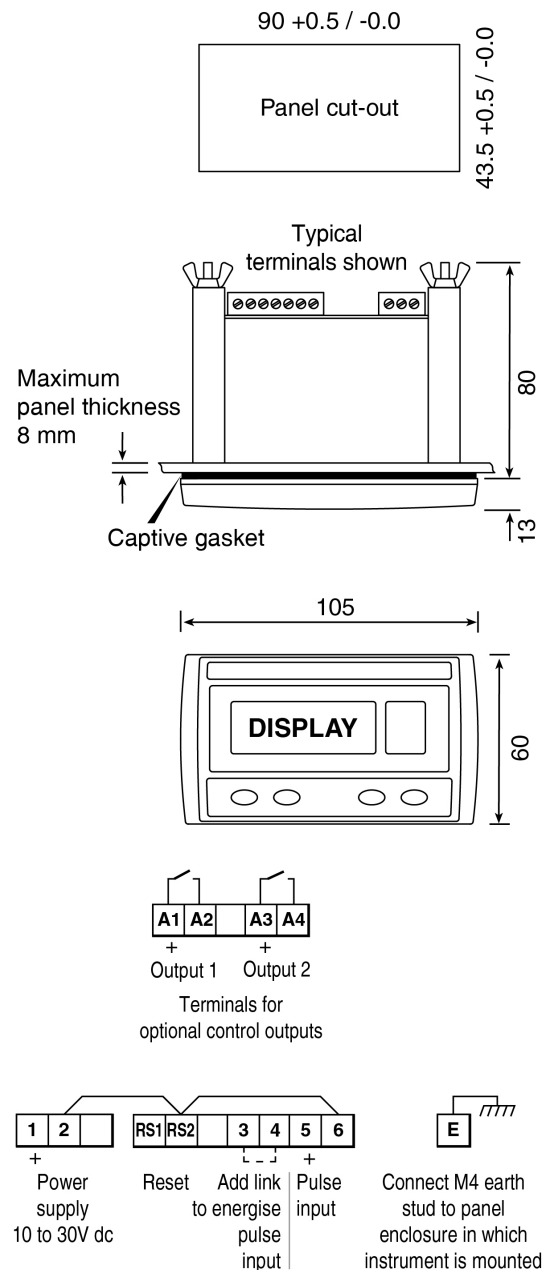
The BA377NE Timer or Clock has a stainless steel housings with a 7J front of panel impact resistance incorporating a 10mm thick toughened glass window which can withstand a 4J impact. This, together with a captive silicone gasket which seals the joint between the instrument and the panel, enclosure provides IP66 ingress protection. The BA377NE has IP20 rear protection which can be increased to IP66 by an optional A495 rear cover sealing kit.

Although the front of the BA377NE Timer or Clock has IP66 protection, it should be shielded from continuous direct sunlight and severe weather conditions.

Fig 7 shows the overall dimensions of the BA377NE together with the recommended panel enclosure cut-out dimensions and terminals.

4.2 Installation Procedure

- Cut the aperture specified in Fig 7 in the panel enclosure. Ensure that the edges of aperture are de-burred.
- Inspect the Timer or Clock's captive gasket and ensure that it is not damaged before inserting it into the panel enclosure aperture.
- If the enclosure panel is less than 1.0mm thick, or is non-metallic, an optional BEKA stainless steel support plate should be slid over the rear of the indicator before the panel clamps are fitted to evenly distribute the clamping force and prevent the enclosure panel being distorted or creeping.
- Slide a panel clamp into the two grooves at each corner of the indicator housing with the M3 stud protruding through the hole at the rear of the clamp. Fit the stainless steel spring washer over the stud and secure with the stainless steel wing nut.
- Evenly tighten the four clamps to secure the instrument. The recommended minimum tightening torque for each wing nut is 22cNm (1.95 lbf in).
- Connect the panel enclosure wiring to the rear terminal blocks. To simplify installation, the terminals are removable so that wiring can be completed before the instrument is installed. Wiring should be supported to prevent damage resulting from vibration.
- Finally, fit a silicone rubber push-on cap to the end of each M3 threaded rod.



Support panel wiring to prevent vibration damage

Note: Optional backlight is internally powered

Fig 7 BA377NE dimensions and terminals

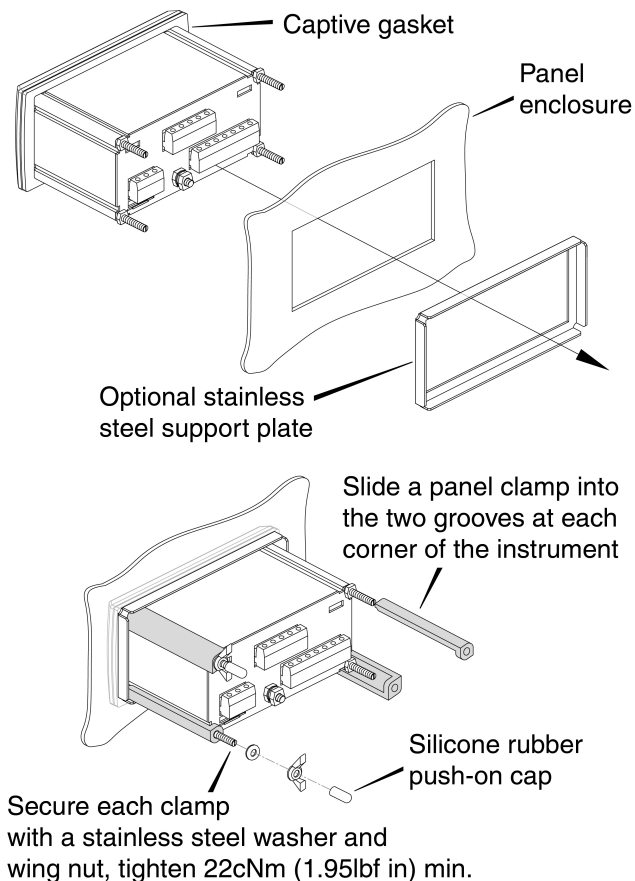


Fig 8 Installation procedure

4.3 Timer or Clock earthing

The BA377NE has an M4 earth stud on the rear panel which should be electrically connected to the panel enclosure in which the Timer or Clock is mounted, or to the plant equipotential conductor.

4.4 EMC

The BA377NE complies with the requirements of the European EMC Directive 2014/30/EU. For specified immunity all wiring should be in screened twisted pairs, with the screens earthed in the safe area.

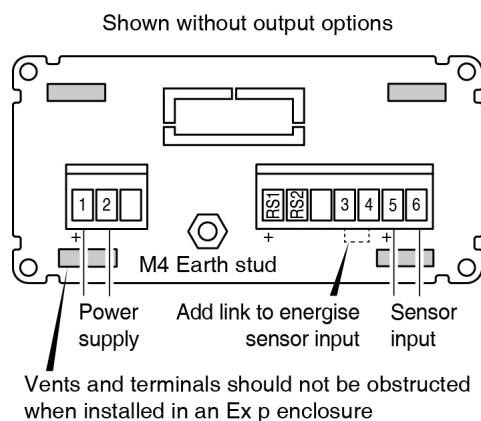


Fig 9 Rear terminals without accessories

4.5 Scale card

The BA377NE's units of measurement are shown on a printed scale card in a window at the right hand side of the display. The scale card is mounted on a flexible strip that is inserted into a slot at the rear of the instrument as shown in Fig 10. Thus the scale card can easily be changed without removing the BA377NE from the panel or opening the instrument enclosure.

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

A pack of self-adhesive scale cards printed with common units of flow measurement is available as an accessory from BEKA associates. Custom printed scale cards can also be supplied - see 5.3

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

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

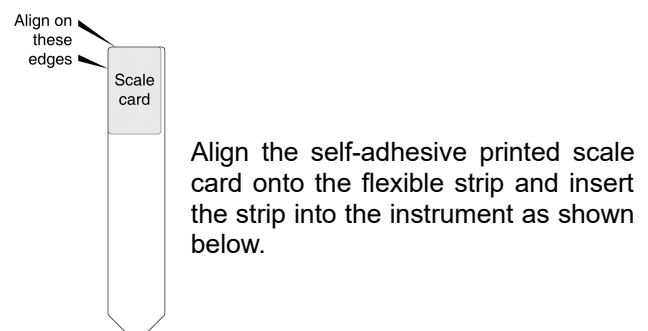


Fig 10 Inserting the flexible strip carrying the scale card into slot at the rear of the instrument.

5. ACCESSORIES

5.1 Display backlight

The BA377NE Timer and Clock can be supplied with a factory fitted backlight that produce 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 power supply so no additional field wiring is required, but the supply current increases as shown below.

	BA377NE current consumption
Without backlight	10mA
Additional for backlight	22mA
Addition with terminals 3 & 4 linked	6mA

Total current	38mA max

5.2 Control outputs

Although the dual isolated control outputs are factory fitted options, they are described in the main body of this instruction manual as they will be used for the majority of applications. If control outputs are required they should be specified when the instrument is ordered.

5.3 Scale card

The BA377NE has a window on the right hand side of the display through which a scale card showing the units of measurement such as hours can be seen. New instruments are fitted with a scale card showing the units of measurement specified when the instrument was ordered, if the units are not specified a blank scale card will be fitted. A pack of scale cards pre-printed with common units of measurement is available as an accessory. These can easily be fitted on-site without opening the instrument enclosure or removing it from the panel. See section 4.5 of this instruction manual.

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

5.4 Tag information

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

5.5 Rear cover sealing kit

The BA377NE Timer or Clock's rear of panel ingress protection can be increased from IP20 to IP66 with a BA495 rear cover sealing kit. Manufactured from 316 stainless steel the cover incorporates two M20 unthreaded entries for cable glands.

Note:

The BA495 rear cover sealing kit provides additional rear impact and ingress protection but it is not Ex nA certified. Therefore the BA377NE Timer or Clock must still be mounted within an Ex nA, Ex e or Ex p enclosure as described in section 4 of this manual to comply with Ex nA certification requirements.

6. OPERATION AS A TIMER

When configured as a Timer the BA377NE can measure and display the elapsed time between external events such as measuring and displaying how long machinery is operating. The Timer can be started and stopped by a remote sensor, or from the front panel push buttons.

The addition of two optional factory fitted isolated control outputs allows the Timer to control external events such as opening a valve for a predetermined time. Again the Timer can be started and stopped by a remote sensor, or from the front panel push buttons.

When controlling external events the **CYCLE** function enables the BA377NE Timer to be configured to repeat the timing period up to 99 times with a configurable delay between timed periods up to 100 hours or to repeat continuously.

The BA377NE may be configured to *time-up* from zero to the set time **SEt t**, or to *time-down* from the set time to zero. The set time may be entered and displayed in hours, minutes or seconds, or a combination of units. Elapsed or remaining time is continuously displayed and a separate display may be activated to show the Timer set time **SEt t**. Resetting the timer cycle can be accomplished via the front panel push buttons or by a remote contact.

A grand total time is maintained which can be viewed by operating the front panel push buttons. It may be reset to zero from within the configuration menu, or the instrument may be configured to allow resetting from the front panel push buttons.

Fig 11 shows a simplified block diagram of the BA377NE when configured as a Timer. The input can be configured to accept inputs from a wide variety of sensors. When the sensor requires energising, such as a switch contact, open collector or a two wire proximity detector, a link connected between terminals 3 & 4 supplies power to the sensor input.

The instrument can be supplied with the following factory fitted accessories:

Internally powered Backlight

Dual isolated Control Outputs

The two factory fitted solid state isolated control outputs may be independently configured to close and open at specified parts of the timer cycle, such as when the timer starts or finishes.

6.1 Initialisation

Each time power is applied to a BA377NE initialisation is performed. After a short delay the following display sequence occurs:

All segments of the display are activated

BA377NE is ready to start functioning using the configuration information stored in the instrument's permanent memory.

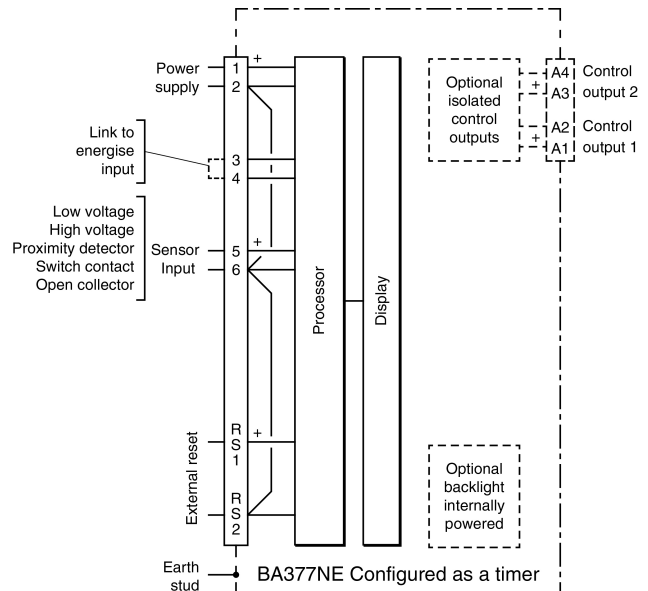



















Fig 11 BA377NE block diagram with Timer configuration.

6.2 Controls when configured as a Timer

The BA377NE is controlled and configured via four front panel push buttons. In the display mode i.e. when the instrument is displaying time the push button functions are:

Push Button Functions

-  When local control is enabled starts the Timer. See 6.5.8
-  When local control is enabled stops the Timer. See 6.5.8
-  +  Shows the grand total (run time) in hours and tenths of an hour irrespective of Timer configuration. If buttons are held for longer than ten seconds the grand total may be reset to zero if the grand total reset sub-function `ELR Etk` is enabled in the `Lo rSEt` configuration function. See 6.5.20
- To reset the grand total to zero from the display mode press the  +  buttons for ten seconds until `ELr.no` is displayed, using the  or  button change the display to `ELr. yE5` and press .
-  +  Resets the Timer to zero or to the set time `SEt t` depending on whether the Timer is configured to *time-up* or *time-down* when the two buttons are operated simultaneously for more than two seconds. This is a configurable function. See 6.5.19
-  +  When enabled in the configuration menu, operating these two buttons simultaneously provides direct access to the set time `SEt t` and allows adjustment when the timer is in the display mode. See 6.5.15
-  +  Shows in succession, firmware version number, instrument function `ELRP5E` and any output accessories that are fitted:
 - R Dual Control Outputs
-  +  Access to configuration menu

6.3 Displays when configured as a Timer

The BA377NE has two digital displays and associated annunciators as shown on front cover of this manual.

Elapsed time The upper display shows the elapsed time since the Timer was started when *timing-up* from zero and the remaining time when *timing-down* from the set time. The display may be formatted as hh:mm:ss; hh:mm; mm:ss or ss.

Lower display The display options available on the lower display depend on whether the Timer repeat cycle function `LYLE5`, which can repeat the timing period up to 99 times, or continuously with a configurable delay between periods, is enabled.

`LYLE5` disabled

The lower display shows the set time `SEt t`, or the lower display may be disabled if not required. See 6.5.7

`LYLE5` enabled

The lower display shows the total number of repeat cycles requested together with the number of the current cycle. Each operation may be briefly named at it's start or periodically throughout the cycle. The lower display may also be disabled if not required. See 6.5.7

Reset annunciator

Activated while elapsed time is being reset to zero or to the set time `SEt t`.

Grand total annunciator

Activated when the grand total time is being shown on the upper display.

Control output annunciators

Show status of both optional control outputs.

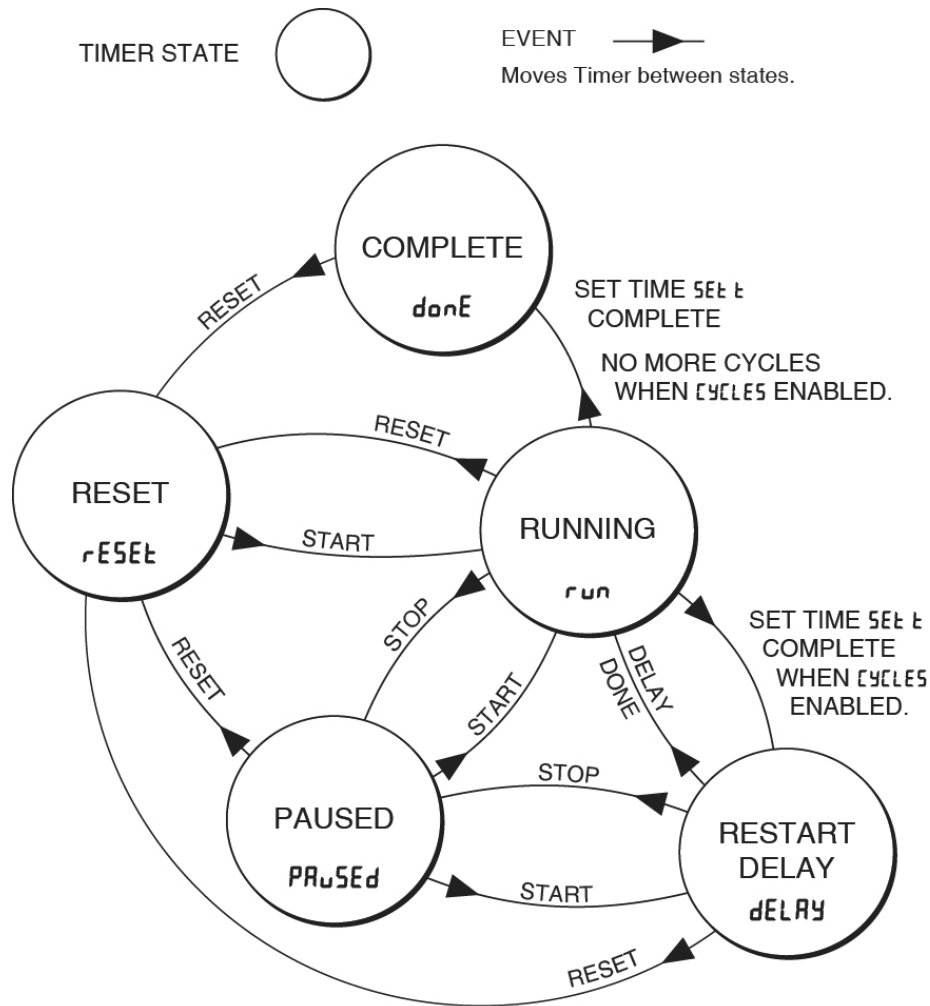




Fig 12 Timer structure showing states and events

6.4 Timer structure

Fig 12 illustrates the Timer structure and function as a state diagram. It applies when the instrument is measuring the time between events or is controlling external events.

The circles in Fig 12 represent the five Timer states, *Reset*, *Running*, *Restart-delay*, *Paused* and *Complete*. The lines between the circles represent the event required to move the Timer between states. e.g. to initiate timing the Timer is moved from the *Reset* state to the *Running* state by a start event. This could be an input signal or operation of the  button. Similarly, to pause the Timer while it is timing, the Timer must be moved from the *Running* state to the *Pause* state by a stop event which could be an input or operation of the  button.

Reset

In this state the Timer is readied for operation. The Timer is stopped and loaded with zero for timing-up or 5Et t for timing-down.

Running

Entered by a start event from the *Reset* or *Paused* states. The Timer times-up to 5Et t or times-down to zero depending upon its configuration.

Pause

Entered by a stop event from *Running* or *Restart-delay*. Timer is stopped, a start event returns the timer to its previous state.

Restart-delay

Entered automatically from *Running*. At the end of the delay time automatically returns to *Running*.

Complete

Entered automatically from *Running* when there are no more timing cycles to perform.

When the CYCLES function is enabled the timing cycle can be repeated a specified number of times, or continuously.

6.5 Configuration as a Timer

The BA377NE is configured via the four front panel push buttons. All the configuration functions are contained in an easy to use intuitive menu that is shown diagrammatically in Fig 13.

Each menu function is summarised in section 6.5.2 of this manual and each summary includes a reference to more detailed information.

All new BA377NE instruments are supplied configured as requested at the time of ordering. If configuration is not requested, the BA377NE will be supplied with default Timer configuration as shown below, but the instrument can easily be re-configured on-site.

Function	Display	Default
Access code	LoadE	0000
Function	Function on	ELAPSE
Input	Input	oP.LoL
Debounce	debounceE	default
Display 2	display 2	Setd
Start stop	Start stop	LoCAL
Units	units	12:00:00
Set time	Set time	00:00:00
Enable repeat cycle	cycleE	oFF
Access set time from display mode.	Access set time	oFF
Direction of count	up or dn	dn
Recovery from power supply failure.	Power fail	idle
Local total reset	local reset	on
Local grand total reset	local grand reset	oFF
External reset	external reset	Setd
Enable control output 1 *	enable	oFF
Enable control output 2 *	enable	oFF

* Optional output

6.5.1 Accessing configuration functions

Throughout this manual front panel push buttons are shown as ▼, ▲, P and E and legends displayed by the instrument are shown in a seven segment font just as they appear on the instrument e.g. Input and Load.

Access to the configuration menu is obtained by operating the P and E push buttons simultaneously. If the instrument is not protected by an access security code the first parameter Function will be displayed. If a security code other than the default code 0000 has already been entered, the instrument will display LoadE. Press P to clear this prompt and enter the security code for the instrument using the ▼ or ▲ push button to adjust the flashing digit and the P push button to transfer control to the next digit. If the correct code has been entered pressing E will cause the first parameter Function to be displayed. If an incorrect code is entered, or a push button is not operated within ten seconds, the instrument will automatically return to the display mode.

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







Once within the main configuration menu the required function can be selected by scrolling through the menu using the ▼ or ▲ push button. The Timer configuration menu is shown diagrammatically in Fig 13.

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

6.5.2 Summary of Timer configuration functions

This section summarises all the Timer configuration functions. When read in conjunction with Fig 13 it provides a quick aid for configuring the Timer. If more detail is required, each section of this summary contains a reference to a full description of the function.

Display	Summary of function
Function on	Instrument function Defines the function of the instrument. May be set to: ELAPSE Timer configuration CLACK Clock configuration All the entries in this Timer summary assume that the BA377NE is configured as a Timer by selecting ELAPSE. See section 6.5.3
Input	Configuration of Input Contains a sub-menu with two sub-functions: INPUTYPE Selects input sensor type DEBOUNCE Defines input debounce See section 6.5.4 INPUTYPE Configures the Timer sensor input to accept one of six types of input: OPCL Open collector • VOLTS L Voltage <1 >3V VOLTS H Voltage <3 >10V PRDET Proximity detector • CONTACT Switch contact • • Energise input by linking terminals 3 & 4. See section 6.5.5 DEBOUNCE Defines the level of debounce applied to the input to prevent false functioning: DEFRAULT HERRY L, CH See section 6.5.6

Display	Summary of function														
d, SP-2	Lower display Configures the lower display to show set time SEt or, when the CYCLE5 repeat function is activated, the restart delay count-down plus the cycle count number. With CYCLE5 not enabled: <table><tr><td>Select</td><td>Lower display shows</td></tr><tr><td>SEt</td><td>Set time SEt</td></tr><tr><td>oFF</td><td>Disables lower display.</td></tr></table> See section 6.5.7 With CYCLE5 enabled: <table><tr><td>Select</td><td>Lower display shows</td></tr><tr><td>SEt</td><td>Cycles requested and cycles performed with time-down shown during requested delay period. Brief notification of timer status i.e. CYCLE or dELAY at start of each period.</td></tr><tr><td>LRbEL</td><td>Exactly as SEt but with periodic notification of timer status i.e. CYCLE or dELAY.</td></tr><tr><td>oFF</td><td>Disables lower display.</td></tr></table> See section 6.5.7	Select	Lower display shows	SEt	Set time SEt	oFF	Disables lower display.	Select	Lower display shows	SEt	Cycles requested and cycles performed with time-down shown during requested delay period. Brief notification of timer status i.e. CYCLE or dELAY at start of each period.	LRbEL	Exactly as SEt but with periodic notification of timer status i.e. CYCLE or dELAY.	oFF	Disables lower display.
Select	Lower display shows														
SEt	Set time SEt														
oFF	Disables lower display.														
Select	Lower display shows														
SEt	Cycles requested and cycles performed with time-down shown during requested delay period. Brief notification of timer status i.e. CYCLE or dELAY at start of each period.														
LRbEL	Exactly as SEt but with periodic notification of timer status i.e. CYCLE or dELAY.														
oFF	Disables lower display.														
SEArSEoP	Starting and stopping the timer Defines how the Timer is started and stopped. <table><tr><td></td><td>Start</td><td>Stop</td></tr><tr><td>LoCAL</td><td> button</td><td> button</td></tr><tr><td>Control 1</td><td>Input high</td><td>Input low</td></tr><tr><td>Control 2</td><td>Input low</td><td>Input high</td></tr></table> High and low inputs are specified for a voltage input. For other types of sensor input. See section 6.5.8		Start	Stop	LoCAL	 button	 button	Control 1	Input high	Input low	Control 2	Input low	Input high		
	Start	Stop													
LoCAL	 button	 button													
Control 1	Input high	Input low													
Control 2	Input low	Input high													

Display	Summary of function	Display	Summary of function
uni t5	Units of display Selects displayed units. 12:00:00 Hours, minutes & seconds 12:00 Hours & minutes * 30:00 Minutes & seconds 30 Seconds Excludes delay of optional control outputs which is always shown in seconds and the grand total which is always shown in hours. *Only available if 5Et t and r5t dELR , if already entered, specify zero seconds or seconds which are exactly divisible by sixty. See section 6.5.9	uP or dn	Direction of count Defines whether the Timer <i>times-down</i> from 5Et t to zero or <i>times-up</i> from zero to the set time 5Et t. See section 6.5.16
5Et t	Set time When controlling an external event via the optional control outputs the BA377NE will <i>time-down</i> from the set time to zero or <i>time-up</i> from zero to the set time. Note: Timer will only start if a non zero value is entered for set time 5Et t. See section 6.5.10	P-FR, L	Power Failure Defines how the Timer functions when power is restored after a power failure. Contains three sub-functions i dLE, PRuSE and COnE, nuE. i dLE Timer returns in stopped state as if having completed a single timing cycle displaying Timer value when power was lost. Timing resumes when reset followed by start instructions are received. PRuSE Timer returns in paused state displaying Timer value when power was lost. Timing resumes when start instruction is received. COnE, nuE Timer will continue without any manual intervention. See section 6.5.17
CYCLE5	Repeat timing cycle Contains a sub-menu with three sub-functions, EnbL, CYCL Cnt and r5t dELR. See section 6.5.11 Cycle function enable EnbL Enables or disables the CYCLE5 function without changing the parameters. See section 6.5.12 Cycle count CYCL Cnt Defines the number of times that the timer cycle is repeated. See section 6.5.13 Restart delay r5t dELR Defines the time delay between timer cycles. See section 6.5.14	LoC r5Et	Local reset Contains two sub-functions which when enabled allow the Timer and the grand total, which represents total Timer run-time, to be reset to zero via the front panel push buttons while the Timer is in the display mode. See section 6.5.18 Local total reset r5EtEnbL When on is selected, Timer is reset to zero, or 5Et t if <i>timing-down</i> , when the ▼ and ▲ buttons are operated simultaneously for more than 2 seconds in the display mode. See section 6.5.19 Local grand total reset CLr Gtnt When on is selected the grand total, which represents total run-time, may be reset to zero by operating the [E] + ▲ buttons simultaneously for more than 10 seconds in the display mode. Note: Once reset, the grand total can not be recovered. See section 6.5.20
RC5Et t	Access 5Et t and r5t dELR from display mode. Enables 5Et t and r5t dELR to be adjusted from the display mode. Also contains a sub-function RCLd which defines a separate code to protect access from the display mode to 5Et t and r5t dELR . See section 6.5.15		

Display	Summary of function
oP1	<p>Control output 1 (Optional) Contains sub-menu with four sub-functions, <i>EnbL</i>, <i>oP1 on</i>, <i>oP1 off</i> and <i>oP1 dELR</i>. See section 6.5.21</p> <p>Control output enable <i>EnbL</i> Enables or disables control output 1 without changing the parameters. See section 6.5.22</p> <p>Control output 1 on at <i>oP1 on</i> Defines when the control output turns <i>on</i> (closes). See section 6.5.23</p> <p>Control output 1 off at <i>oP1 off</i> Defines when the control output turns <i>off</i> (opens). See section 6.5.24</p> <p>Control output 1 delay <i>oP1 dELR</i> Introduces a configurable delay between the <i>oP1 on</i> condition occurring and the control output turning <i>on</i> (closing). See section 6.5.25</p>
oP2	<p>Control output 2 (Optional) Functions as control output 1. See section 6.5.26</p>

Display	Summary of function
[Lr Tot	<p>Resets grand total to zero This function resets the grand total, which represents the total Timer run-time, from within the configuration menu when <i>[Lr YE5</i> is selected and <i>SurE</i> is entered to confirm the instruction. Note: Once reset, the grand total can not be recovered. See section 6.5.27</p>
[odE	<p>Security code Defines a four digit alphanumeric code that must be entered to gain access to the instrument's configuration menu. Default code 0000 disables the security function and allows unrestricted access to all configuration functions when the [P] and [E] buttons are operated simultaneously in the display mode. See section 6.5.28</p>
rSEt dEF	<p>Reset to factory defaults Resets the BA377NE to the factory default configuration shown in section 6.5 when <i>YE5</i> is selected and confirmed by entering <i>SurE</i>. See section 6.5.29</p>

6.5.3 Instrument function: Funct, on

The BA377NE may be configured as a Timer or as a Clock. This section of the instruction manual describes the Timer, for details of Clock configuration see section 9.

To reveal the existing function of the instrument select **Funct, on** from the configuration menu and press **[P]**. If **ELAPSE** is displayed, the instrument is already configured as a Timer therefore press **[E]** to return to the **Funct, on** prompt in the configuration menu. If **CLCK** is displayed, press the **[▲]** or **[▼]** button to change the setting to **ELAPSE** followed by the **[P]** button 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 **5UR** using the **[▼]** and **[▲]** buttons to adjust the flashing digit and the **[P]** button to move control to the next digit. When **5UR** has been entered, pressing **[E]** will reconfigure the instrument to a Timer and return the display to **Funct, on** in the configuration menu.

6.5.4 Input: , nPult

The **, nPult** function contains two sub-functions **, nP.etype** which defines the type of sensor that may be connected to the input and **dEBounceEE** which adjust the amount of input noise rejection.

6.5.5 Input type: , nP.etype

, nP.etype is a sub-menu in the **, nPult** function which defines the type of input sensor that may be connected to the input. To check or change the type of input, select **, nPult** in the configuration menu and press **[P]** which will reveal the **, nP.etype** prompt, pressing **[P]** again will show the existing input type. If set as required press **[E]** twice to return to the configuration menu, or repeatedly press the **[▲]** or **[▼]** button until the required type of input is displayed and then press **[E]** twice to return to the configuration menu.

One of following six types of input may be selected:

Display	Input type	Switching thresholds	
		Low	High
oPCL	Open collector ²	2	10kΩ
UoL tS L	Voltage range low ¹	1	3V
UoL tS H	Voltage range high ¹	3	10V
Pr.dEt	Proximity detector ²	1.2	2.1mA
CLCK RCL	Switch contact ²	100	1000Ω

Notes:

1. Maximum voltage input +30V.
2. For sensors that require energising i.e. proximity detectors, switch contacts and those with open collector outputs, terminals 3 & 4 of the BA377NE Timer should be linked together.
3. For the Timer to function correctly, the input signal must fall below the lower switching threshold and rise above the higher switching threshold for the minimum times shown in the debounce section 6.5.6 below.

6.5.6 Debounce: dEBounceEE

dEBounceEE is an adjustable sub-menu in the **, nPult** function which prevents the Timer mis-functioning when the input 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 Timer input that has been selected in the **, nP.etype** function.

The following table shows the minimum time that the input signal must be continuously above the upper input switching threshold and continuously below the lower switching threshold to ensure that the Timer processes the input signal. Input switching thresholds are shown in section 6.5.5.

Debounce level	Min continuous input	
	Type of Input	
	Contact	All others
Default	1600μs	40μs
Heavy	3200μs	350μs
Light	400μs	5μs

6.5.7 Lower display: **d, SP-2**

The configuration of the lower display which has six 12mm high digits, depend upon whether the repeat timer function **CYCLE**, which can repeat the timing period up to 99 times or continuously with a configurable delay between periods, is enabled. The configuration options are:

CYCLE disabled

The lower display shows the set time **SEt t** or the lower display may be disabled.

CYCLE enabled

The lower display shows the total number of repeat cycles requested together with the current cycle number. During the configurable delay between cycles the display times-down from the requested delay time to zero. Each operation may be briefly named at it's start or periodically throughout the cycle.

The lower display may also be disabled if not required.

To check or change the configuration of the lower display select **d, SP-2** from the configuration menu and press **[P]** which will reveal the existing setting which can be changed by pressing the **[▲]** or **[▼]** button followed by the **[E]** button to enter the selection and return to the configuration menu.

If the **CYCLE function is not enabled the following two options are available:**

- SEt d** Lower display shows the Timer's set time **SEt t**, from which the BA377NE will time-up or time-down depending upon the direction of count selected in the **uP** or **dn** function.
- oFF** Lower display disabled.

If the **CYCLE function is enabled the following three options are available:**

- SEt d** Lower display shows the number of cycles requested together with the current cycle number. During the configurable delay period the display times-down from the requested delay to zero. A brief notification of timer status i.e. **CYCLE** or **dELAY** is shown at start of each period.

02 - 11

Current cycle number Number of cycles requested, not shown when cycle is continuously repeated.

LABEL Exactly the same as **SEt d**, but timer status i.e. **CYCLE** or **dELAY** is shown periodically.

oFF Lower display disabled.

6.5.8 Starting & stopping the Timer: **SEArSEt oP**

The Timer may be started and stopped by a sensor input signal or by operation of the front panel **[▲]** or **[▼]** push buttons.

To check or change the control of the Timer, select **SEArSEt oP** from the configuration menu and press **[P]** which will reveal the existing setting which can be changed by pressing the **[▲]** or **[▼]** button followed by the **[E]** button to enter the selection and return to the configuration menu. Options available are:

Voltage inputs or control from front panel

Display	Start	Stop
Control 1	Input high	Input low
Control 2	Input low	Input high
LoEAL	[▼] button	[▲] button

Contact and open collector inputs

Display	Start	Stop
Control 1	Open	Closed
Control 2	Closed	Open

Proximity detector input

Display	Start	Stop
Control 1	Low current	High current
Control 2	High current	Low current

6.5.9 Units of display: **un, t5**

Defines the format of all displayed times, except the delay time of the optional control outputs which is shown in seconds and the grand total which is shown in hours and tenths of an hour.

To check or change the units of display, select **un, t5** from the configuration menu and press **[P]** which will reveal the existing setting. The required units can be selected by pressing the **[▲]** or **[▼]** button followed by the **[E]** button to enter the selection and return to the configuration menu. The options available are shown below:

Display	
12:00:00	Hours, minutes & seconds
12:00	Hours & minutes*
30:00	Minutes & seconds
30	Seconds

* Only available when time in seconds specified in any Timer function is zero or divisible by 60.

The Timer's maximum elapsed time in any format is equivalent to 99 hours, 59 minutes & 59 seconds.

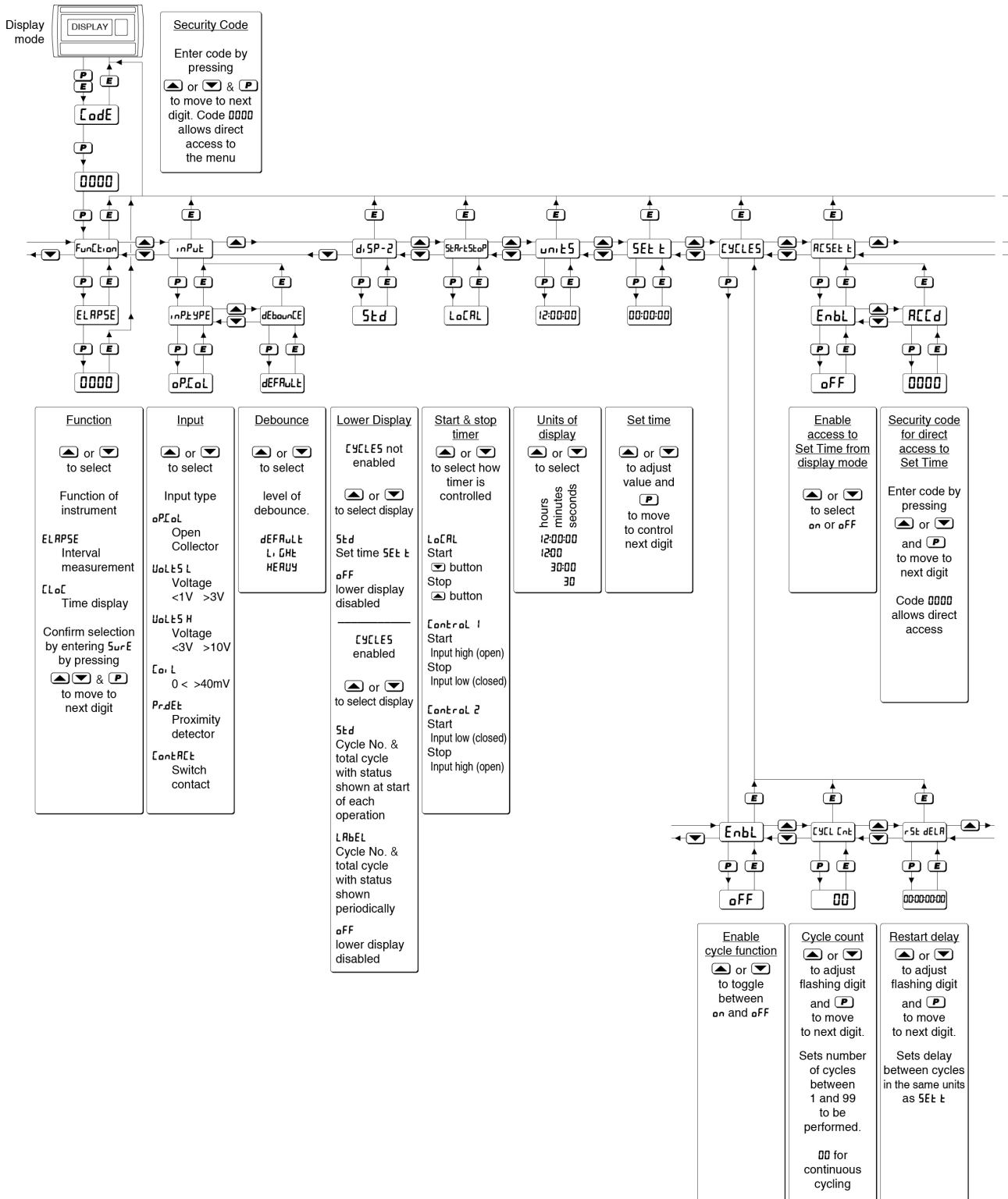
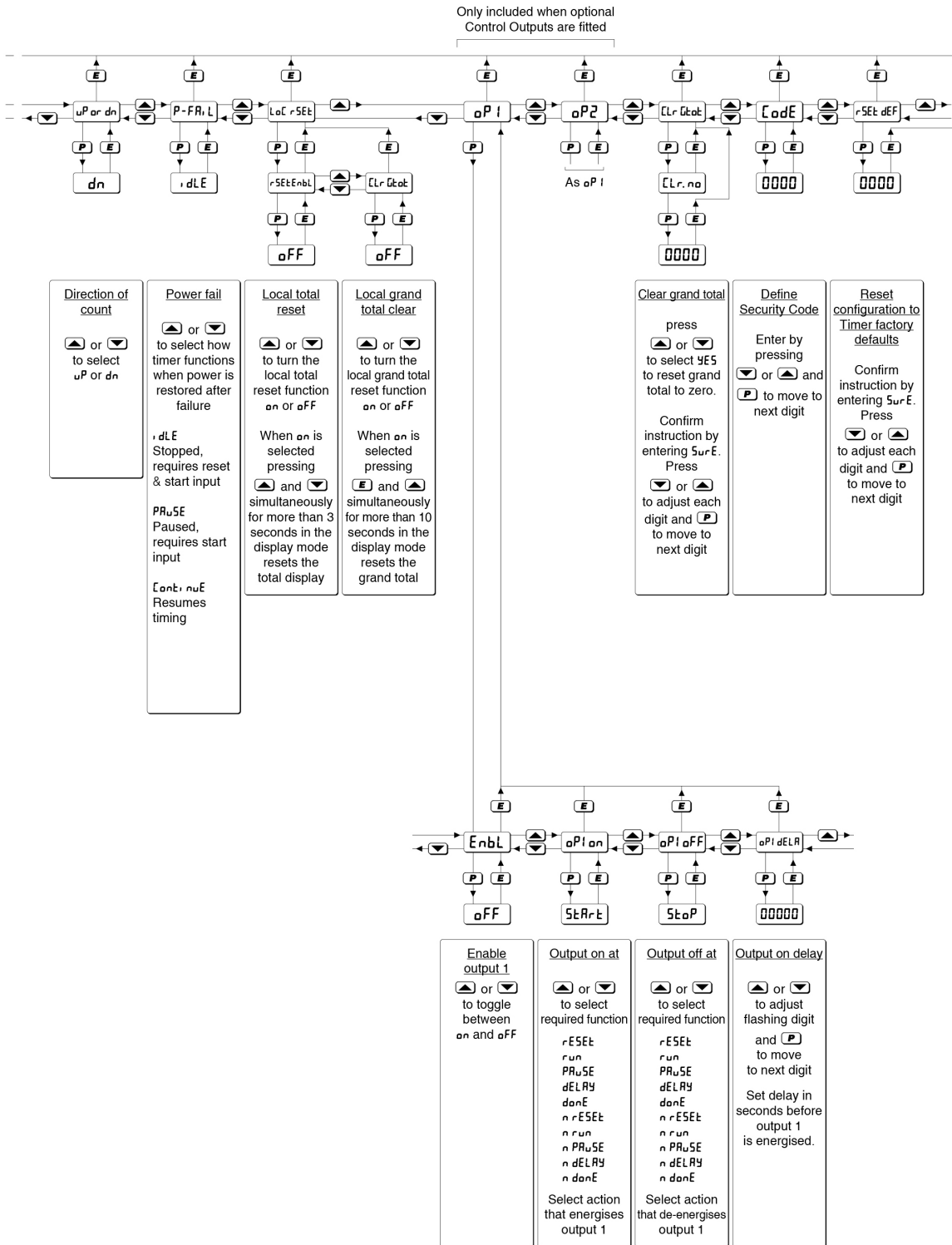


Fig 13 Timer Configuration menu



6.5.10 Set time: 5EŁ Ł

This is the Timer's setpoint. When controlling an external event via the optional control outputs the BA377NE will time-down from the set time to zero or time-up from zero to the set time.

To check or change the set time, select 5EŁ Ł from the configuration menu and press **[P]** which will reveal the existing setting with the most significant digit flashing. The flashing digit may be adjusted by pressing the **[▲]** or **[▼]** button followed by the **[P]** button to transfer control to the next digit. When set as required, enter the selection and return to the 5EŁ Ł prompt in the configuration menu by operating the **[E]** button.

Note: If 5EŁ Ł is zero the Timer will not function when an external start input is received or the **[▼]** button is operated.

6.5.11 Repeat timing cycle: ŁYŁŁE5

This powerful function which allows the BA377NE timing cycle to be repeated up to 99 times or continuously with a configurable delay between cycles of up to 99 hours, 59 minutes & 59 seconds.

To check or adjust the repeat timing cycle, select ŁYŁŁE5 from the configuration menu and press **[P]** which will enter a sub-menu containing three sub-functions, EŁbŁ, ŁYŁŁ ŁŁŁ and Ł5Ł dELŁ which are described in the following sections.

6.5.12 Cycle function enable: EŁbŁ

This sub-function allows the repeat timing cycle to be enabled or disabled without altering any of the repeat timing cycle parameters. To check or change the function select EŁbŁ from the repeat timing cycle sub-menu and press **[P]** which will reveal if the repeat cycle function is ON or OFF. The setting can be changed by pressing the **[▼]** or **[▲]** button followed by the **[E]** button to return to the repeat timing cycle sub-menu.

6.5.13 Cycle count: ŁYŁŁ ŁŁŁ

This sub-function defines the number of times that the timer cycle is repeated. It may be set to any number between 1 and 99, or to 00 for continuous repetition.

To check or change the function select ŁYŁŁ ŁŁŁ from the repeat timing cycle sub-menu and press **[P]** which will reveal two digits with the most significant flashing. The flashing digit may be adjusted by pressing the **[▲]** or **[▼]** button followed by the **[P]** button to transfer control to the next digit. When set as required, enter the selection and return to the ŁYŁŁ ŁŁŁ prompt in the sub-menu by operating the **[E]** button.

6.5.14 Restart delay: Ł5Ł dELŁ

This sub-function defines the time delay between repeat timing periods. It is shown in the format selected in the units function and may be set to any time between zero and the maximum time allowed in the selected format.

Time format selected in	Maximum delay
ŁŁŁ Ł5	
12:00:00	99:59:59
12:00	99:59
30:00	5999:59
30	359999

To check or change the reset delay time select Ł5Ł dELŁ from the repeat timing cycle sub-menu and press **[P]** which will reveal the delay time in the selected format with the most significant digit flashing. The flashing digit may be adjusted by pressing the **[▲]** or **[▼]** button followed by the **[P]** button to transfer control to the next digit. When set as required, enter the selection and return to the Ł5Ł dELŁ prompt in the sub-menu by operating the **[E]** button.

Can also be adjusted from the Timer display mode, see 6.5.15

6.5.15 Adjusting the set time 5EŁ Ł and restart delay Ł5Ł dELŁ from the display mode: RŁ5EŁ Ł

When this function is enabled the Timer's set time 5EŁ Ł and restart delay Ł5Ł dELŁ can be adjusted from the display mode by simultaneously operating the **[P]** and **[▲]** push buttons. Thus allowing an operator to adjust these parameters without having access to the instrument's configuration menu. The function contains two sub-functions, EŁbŁ which activates the function and RŁŁŁŁ which defines a separate code for access to 5EŁ Ł with the Timer in the display mode.

To check or change the function, select RŁ5EŁ Ł in the configuration menu and press **[P]** which will reveal the EŁbŁ prompt, pressing **[P]** again will show if the function is ON or OFF. If adjustment of the set time from the display mode is not required press the **[▲]** or **[▼]** button to select OFF and then press **[E]** Ł twice to return to the configuration menu. If the function is required, select ON and press **[E]** to return to the EŁbŁ prompt from which RŁŁŁŁ, which allows a separate access code to be entered, can be selected by pressing the **[▲]** or **[▼]** button.

Access to 5EŁ Ł and Ł5Ł dELŁ from the display mode may be protected by a four digit alphanumeric security code which must be entered to gain access. Default security code 0000 allows unrestricted access.

With **REEd** displayed, press **[P]** to enter a new access code. The Timer will display **0000** with one digit flashing. The flashing digit may be adjusted using the **[▲]** or **[▼]** push button, when set as required operating the **[P]** button will transfer control to the next digit. When all the digits have been entered press **[E]** twice to return to the **RESEt** prompt in the configuration menu. The revised access code will be activated when the BA377NE is returned to the display mode.

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

6.5.16 Direction of count: **uP or dn**

The Timer may be configured to *time-up* from zero to the set time **SEt** while displaying elapsed time, or to *time-down* from the set time **SEt** to zero while displaying the remaining time.

When the repeat timing cycle function **[YEL5]** is enabled, it is recommended that a down count is selected so that the progress of the timer can be observed with a known completion time i.e zero. If set as an up counter, elapsed will be displayed, but **SEt** at which the Timer will stop is not shown.

To check the direction of count, select **uP or dn** from the configuration menu and press **[P]** which will reveal the existing setting which can be changed by pressing the **[▲]** or **[▼]** button followed by the **[E]** button to enter the selection and return to the configuration menu.

6.5.17 Power Fail: **P-FAIL**

Defines how the Timer powers-up and functions when power is restored after a power supply interruption. Three options are available, **dLE**, **PRuSE** and **Cont, nuE**.

dLE The Timer is stopped in the state it achieves when it has timed-up to **SEt** or timed-down to **0000**, with the elapsed or remaining time when power was lost shown on the upper display. The Timer must be reset before it can be restarted. If the repeat timing cycle is in use the number of cycles completed will be lost when the Timer is reset.

PRuSE The Timer is stopped in the state it achieves following receipt of a stop input to pause timing. The elapsed or remaining time when power was lost is shown on the upper display. Timing resumes when a start instruction is received. If a start input exists when power is restored timing will start immediately.

Cont, nuE When power is restored the Timer will continue from where it stopped without any manual intervention. To check or change the function, select **P-FAIL** from the configuration menu and press **[P]** which will reveal the existing setting which can be changed by pressing the **[▲]** or **[▼]** button followed by the **[E]** button to enter the selection and return to the configuration menu.

6.5.18 Local reset: **LoC rSEt**

The Local reset function contains two separate sub-functions **rSEt.EnbL** and **[Lr] GtOt** which when enabled allow the Timer and the grand total to be reset via the instrument's front panel push buttons while the Timer is in the display mode.

6.5.19 Local total reset: **rSEt.EnbL**

rSEt.EnbL is a sub-function in the **LoC rSEt** function which when activated allows an operator to reset the Timer from the display mode by operating the **[▲]** and **[▼]** push buttons simultaneously for more than three seconds.

To check or change the local total reset select **LoC rSEt** in the configuration menu and press **[P]** which will reveal the **rSEt.EnbL** prompt, press **[P]** again to show if the local total reset is **on** or **oFF**. If set as required operate the **[E]** button twice to return to the configuration menu, or the **[▲]** or **[▼]** button to change the setting followed by the **[E]** button twice to enter the change and return to the **LoC rSEt** prompt in the configuration menu.

Note:

The Timer may also be reset remotely by connecting terminals RS1 and RS2 together for more than one second. See section 3.3



6.5.20 Local grand total reset: **[Lr] GtOt**

The grand total is the total run-time of the Timer that may be viewed by operating the **[E]** and **[▲]** push buttons simultaneously in the display mode. When activated **[Lr] GtOt** allows an operator to reset the grand total display to zero from the display mode by operating the **[E]** and **[▲]** push buttons simultaneously for more than ten seconds.

[Lr] GtOt is a sub-function in the **LoC rSEt** menu. To check or change the setting select **LoC rSEt** in the configuration menu and press **[P]** which will reveal **rSEt.EnbL**. Using the **[▼]** or **[▲]** button select **[Lr] GtOt** and press **[P]** which will show if local grand total reset is **on** or **oFF**. If set as required operate the **[E]** button twice to return to the configuration menu, or the **[▼]** or **[▲]** button to change the setting followed by the **[E]** button twice to enter the change and return to the **LoC rSEt** prompt in the configuration menu.

6.5.21 Control output 1 (optional): **oP I**

Control output 1 is an optional factory fitted, galvanically isolated solid state switch contact which can be configured to turn *on* and *off* when the Timer enters a specified states. When control output 1 is *on* the '1' annunciator on the Timer display is activated.

The function contains four sub-functions, **EnbL**, **oP I on**, **oP I oFF** and **oP I dELAY**. To gain access to the sub-menu select **oP I** in the configuration menu and press **P** which will show the **EnbL** prompt from which the other sub-functions can be accessed using the  or  button.

Control output 1 may be configured to turn *on* when the Timer enters a selected Timer state and to turn *off* when the Timer enters another specified Timer state. e.g. if *run* is selected in the **oP I on** sub-function and *done* is selected the **oP I oFF** function. Control output 1 will turn *on* when the Timer enters the *run* state and will stay *on* until the Timer enters the *done* state. Alternatively, the control output phase may be reversed by selecting the *n* states such as *n reset*.



If control output 1 is required to be *on* in only one Timer state, this can be achieved with the following configuration.

oP I on	state required	e.g. <i>run</i>
oP I oFF	<i>n</i> state required	e.g. <i>n run</i>

In this example when the Timer enters the *run* state control output 1 turns *on*. When the Timer moves from the *run* to any other state, control output 1 turns *off*.



The Timer configuration example in section 7.2 of this manual illustrates the use of the control outputs. Further examples can be found in Application Guide AG374 which is available on the BEKA website.

6.5.22 Control output 1 enable: **EnbL**

This function allows control output 1 to be enabled or disabled without altering any other control output parameters. To check or change the function select **EnbL** from the control output 1 sub-menu and press **P** to reveal if control output 1 is *on* or *oFF*. The setting can be changed by pressing the  or  button followed by the **E** button to return to the control output 1 sub-menu.

6.5.23 Control output 1 *on* at : **oP I on**

Control output 1 may be configured to turn *on* when the Timer enters in any one of the five Timer states. Alternatively, the control output 1 phase may be reversed, by selecting an *n* state which will cause the control output to turn *on* when the Timer enters any other than the specified Timer state. Timer states are shown in Fig 12.

To define when control output 1 turns *on* select **oP I on** from the sub-menu and press **P** to show the existing setting. Pressing the  or  button will scroll through the options:

Display	Control output 1 turns <i>on</i> when Timer enters selected state
<i>reset</i>	Reset state
<i>run</i>	Running state
<i>Paused</i>	Paused state
<i>dELAY</i>	Restart delay state
<i>done</i>	Complete state
	Control output 1 turns <i>on</i> when Timer enters any other than the selected state
<i>n reset</i>	Reset state
<i>n run</i>	Running state
<i>n Paused</i>	Paused state
<i>n dELAY</i>	Restart delay state
<i>n done</i>	Complete state

When the required setting has been selected press **E** to enter the selection and return to the sub-menu.

6.5.24 Control output 1 off at: $\alpha P I \alpha FF$

Control output 1 may be configured to turn *off* when the Timer enters any one of the five Timer states. Alternatively, the phase of control output 1 may be reversed, by selecting an *n* state which will cause the control output to turn *off* when the Timer enters any other than the specified Timer state. Timer states are shown in Fig 12.

To define when control output 1 turns *off* select $\alpha P I \alpha FF$ from the sub-menu and press \boxed{P} to show the existing setting. Pressing the \blacktriangledown or \blacktriangle button will scroll through the options:

Display	Control output 1 turns off when Timer enters selected state
$rESEt$	Reset state
$r un$	Running state
$PRuSEd$	Paused state
$dELAY$	Restart delay state
$done$	Complete state
	Control output 1 turns off when Timer enters any other than the selected state
$n rESEt$	Reset state
$n r un$	Running state
$n PRuSEd$	Paused state
$n dELAY$	Restart delay state
$n done$	Complete state

When the required setting has been selected press \boxed{E} to enter the selection and return to the control output 1 sub-menu.

6.5.25 Control output 1 on delay time: $\alpha P I dELR$

Control output 1 may be delayed from turning *on* (output closed) for a fixed time following the selected condition occurring. e.g. when the Timer enters the *r un* state. This delay is useful for many control applications, for example when the control output is connected to the reset terminals RS1 and RS2 to automatically reset the BA377NE Timer.

The delay can be adjusted in 1 second increments up to 32,400 seconds, which is 9 hours. If a delay is not required zero should be entered. To adjust the delay select $\alpha P I dELR$ from the control output 1 sub-menu and press \boxed{P} which will reveal the existing delay time with one digit flashing. The flashing digit can be adjusted using the \blacktriangledown or \blacktriangle button and the \boxed{P} button to move to the next digit. When the required delay has been entered, press \boxed{E} to return to the control output 1 output sub-menu.

6.5.26 Control output 2 (optional): $\alpha P2$

Control output 2 is an optional, galvanically isolated solid state switch contact which can be independently configured to turn *on* and *off* when the Timer is any of its five states. Its functions and configuration are identical to control output 1 described in sections 6.5.21 to 6.5.25

The control output status is shown by the '2' control output display annunciator on the instruments front panel.

6.5.27 Reset grand total from within the configuration menu: $\boxed{Lr} \boxed{Gt} \boxed{at}$

The grand total is the total run-time of the Timer that may be viewed by operating the \boxed{E} and \blacktriangle push buttons simultaneously in the display mode.

The grand total can be reset to zero from within the configuration menu using this $\boxed{Lr} \boxed{Gt} \boxed{at}$ function, or from the display mode if $\boxed{Lr} \boxed{Gt} \boxed{at}$ is activated in the local grand total clear function - see 6.5.20

To zero the Timer grand total from within the configuration menu select $\boxed{Lr} \boxed{Gt} \boxed{at}$ and press \boxed{P} which will cause the instrument to display $\boxed{Lr} . no$ with *no* flashing. Press the \blacktriangledown or \blacktriangle push button until $\boxed{Lr} . yE5$ is displayed and then press \boxed{P} which will result in a $\boxed{0000}$ prompt being displayed with the first digit flashing. This is a request for the instruction to be confirmed by entering *5urE* using the \blacktriangledown and \blacktriangle buttons to adjust the flashing digit and the \boxed{P} button to move control to the next digit. Pressing \boxed{E} will then reset the grand total to zero and return the Timer to the configuration menu.

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

6.5.28 Security code: Code

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

To enter a new security code select **Code** from the configuration menu and press **P** which will cause the Timer 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 the new security code has been entered press **E** to return to the **Code** prompt. The revised security code will be activated when the Timer is returned to the display mode.

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

6.5.29 Reset configuration to Timer factory defaults: rSEt dEF

When the BA377NE is configured as a Timer this function resets the instrument to the Timer factory defaults shown in sections 6.5

To reset the configuration select **rSEt dEF** from the configuration menu and press **P**. The BA377NE will display 0000 with the first digit flashing which is a request to confirm the instruction by entering **5urE**. Using the **▲** or **▼** button set the first flashing digit to 5 and press **P** to transfer control to the second digit which should be set to **u**. When **5urE** has been entered pressing the **E** button will reset all the configuration functions and return the instrument to the display mode.

Note:

rSEt dEF does not reset the grand total to zero.

7. TIMER APPLICATION EXAMPLES

This section illustrates three common applications for the BA377NE when configured as a Timer.

7.1 Measuring the time that a contact is closed.

In this example a BA377NE is required to display the time that a Zone 2 contact is closed. The display is required in hours and minutes within the hazardous area and is to be reset to zero by a push button located in the same hazardous area, not by the instrument front panel push buttons. The operator is required to zero the grand total by operating the **E** + **▲** buttons simultaneously. No security codes are required to protect access to the configuration menu or to the grand total reset. When power is restored after a supply interruption the Timer is to resume normal operation without manual intervention.

Figure 14 shows the wiring for the BA377NE.

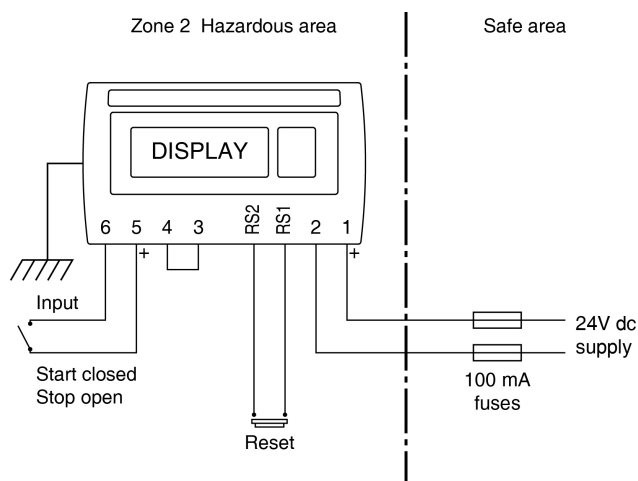


Fig 14 Wiring for displaying time a contact is closed

The required instrument configurations for this example are shown below.

Function	Display	Setting
Access code	Code	0000
Function	Function	ELAPSE
Input	Input	Contact
Terminals 3 & 4 linked to energise input		
debounce	debounce	default
Display 2	di SP-2	off
Start stop	Start stop	Control 2
Units	units	12:00
Set time	Set time	9999:99:99
Direction of count	up or dn	up
Power fail	P-Fail	Contact
Local total reset	rSEt.Enbl	off
Local grand total reset	Clr Tot	on

7.2 Controlling an Ex nA solenoid valve

The BA377NE Timer is required to open an Ex n solenoid valve for 5 minutes when an external contact is closed. 55 minutes after the valve is closed it is to be opened again for another 5 minute period. This process is to be repeated 10 times after which the Timer is to automatically reset so that is ready to start the next 10 cycles when the external contact is closed.

In this example illustrated in Fig 15, control output 2 has been wired to the timer reset terminals and configured with a five seconds control output delay after the solenoid valve has closed for the tenth time. Therefore five seconds after the tenth cycle has been completed the system automatically resets and is ready for the next timing cycle to be initiated.

The lower display is required to show timer status at the start of each period.

After a power interruption the timer is required to resume operation from the point at which it stopped when the start button is operated.

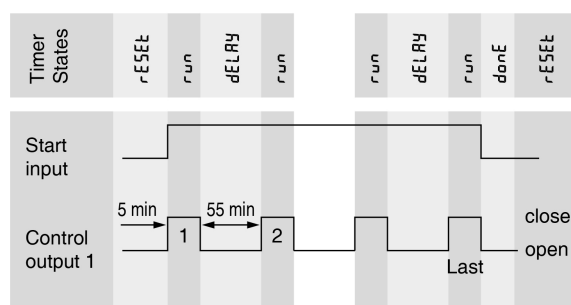
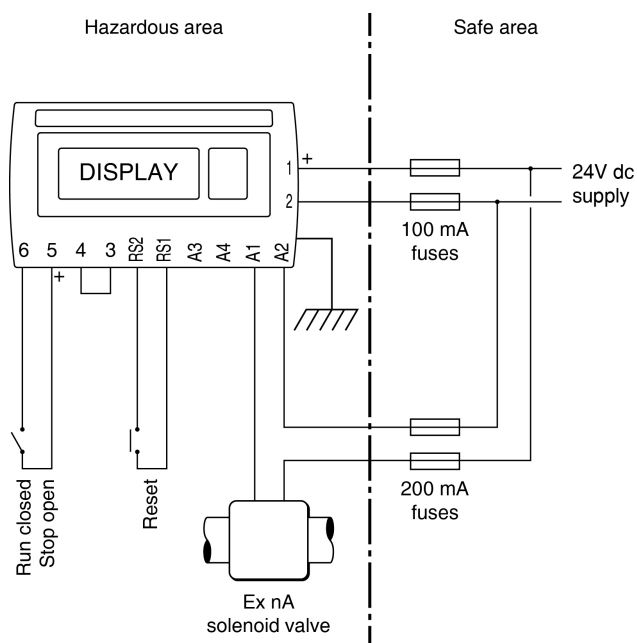


Fig 15 Control of Ex nA solenoid valve in a hazardous area.

The required instrument configuration for this example are shown below.



Function	Display	Setting
Access code	Code	0000
Function	Function	ELAPSE
Input debounce	INPUTTYPE	CONTACT
	DEBOUNCE	DEFAULT
Display 2	di SP-2	Std
Start stop	Start stop	Control 2
Units	units	12:00
Set time	Set t	00:05
Timer repeat cycle	CYCLES	
Cycle function enable	EnbL	on
Cycle count	CYCL CNT	10
Reset delay	rst dELAY	00:55
Access set time from display mode.	ACCESS - t	oFF
Direction of count	uP or dN	uP
Power failure	P-FAIL	PRUSE
Local total reset	rESEt.EnbL	on
Local grand total reset	CLr GtOt	oFF
Enable control output 1	EnbL	on
Control output 1 on at	oP1 on	run
Control output 1 off at	oP1 oFF	n run
Control output 1 delay	oP1 dELAY	00000
Enable control output 2	EnbL	on
Control output 2 on at	oP2 on	done
Control output 2 off at	oP2 oFF	rESEt
Control output 2 delay	oP2 dELAY	00005

In this example local total reset `rESEt.EnbL` is `on`. This enables the Timer to be reset when power is first connected by operating the and down button simultaneously for more than 3 seconds.

8. MAINTENANCE when configured as a Timer

8.1 Fault finding during commissioning

If a BA377NE fails to function as a Timer 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.
Instrument configuration menu does not correspond with Timer section of this manual.	BA377NE may be configured as a clock.	That <code>Function</code> in configuration menu is set to <code>ELAPSE</code> not to <code>Clock</code> .
Timer will not start.	Timer not reset	Reset timer via external contact or by operating  and  buttons simultaneously if the local total reset <code>RESET.Enbl</code> has been activated.
	Set time <code>SEt t</code> has not been entered.	Enter a value for <code>SEt t</code> other than zero.
Timer will not respond to external input.	Input incorrectly configured, or sensor incorrectly connected.	Input configuration and input energising link is correctly fitted for selected sensor.
Control output(s) do not function.	Control outputs have not been enabled.	Enable Control Output(s) in the configuration menu.
Unable to enter configuration menu.	Incorrect security code	That the correct security code is being used. Contact BEKA if code is lost.



8.2 Fault finding after commissioning

EN 60079-17 *Electrical installations inspection and maintenance* permits live maintenance in Zone 2 if a risk analysis demonstrates that this does not introduce an unacceptable risk. The removal of covers [opening of Ex n enclosure] is permitted if this can be done without contaminating the interior of the instrument with dust or moisture. Some end-users may prefer not to permit live maintenance to minimise risk.

ENSURE PLANT SAFETY BEFORE STARTING MAINTENANCE

Live maintenance within the hazardous area should only be performed when it is permitted by risk analysis, or when there is no risk of a flammable atmosphere being present.

If a BA377NE 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 with terminal 1 positive.
Timer will not start.	Timer not reset	Reset timer via external contact or by operating  and  buttons simultaneously if local total reset <code>RESET.Enbl</code> has been activated.
	Reset terminals RS1 & RS2 are linked which will inhibit Timer.	Remove link.
Control output(s) do not function.	Control Outputs have not been enabled.	Enable Control Output(s) in the configuration menu.
Unable to enter configuration menu.	Incorrect security code	That the correct security code is being used. Contact BEKA if code is lost.

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

Note:

If configuration changes are made to input, start-stop, cycle, up or down, P1 or P2 functions the Timer will be forced into a fail safe state condition. This stops the Timer in the state it achieves when it has timed-up to Set t or timed-down to 0000. The Timer must be reset before it can be restarted.

8.3 Servicing

We recommend that faulty BA377NE Timers are returned to BEKA associates or to our local agent for repair. It is helpful if a brief description of the fault symptoms is provided.

8.4 Routine maintenance

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

8.5 Guarantee

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

8.6 Customer comments

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

9. OPERATION AS A CLOCK

When configured as a clock the BA377NE can display local time in a variety of twelve or twenty four hour formats. The displayed time can be adjusted via the front panel push buttons which may be protected by a user definable four digit security code to prevent unauthorised or accidental adjustment.

The clock may be synchronised to an external time standard via the instrument's reset terminals. When these two terminals are connected together by an external switch contact, the clock display will be reset to a preconfigured time and will resume running from this time when the contacts are opened.

When fitted with the optional galvanically isolated control outputs the clock can be configured to turn each solid state output on and off twice during each twenty four hour period.

Fig 16 shows a simplified block diagram of the BA377NE configured as a clock.

The instrument can be supplied with the following factory fitted accessories:

Backlight Internally powered

Dual isolated control outputs

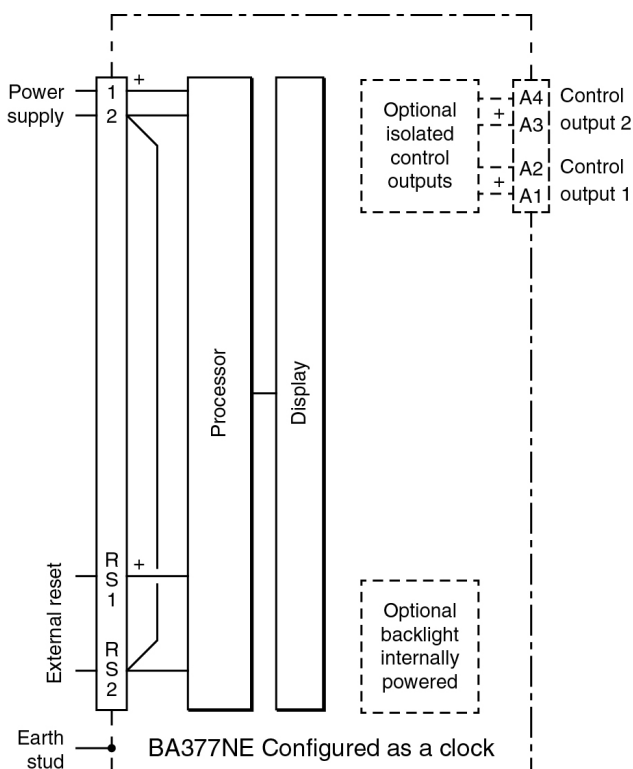


Fig 16 BA377NE block diagram with clock configuration.

9.1 Initialisation and loss of power

Each time power is applied to a BA377NE initialisation is performed. After a short delay the following display sequence occurs:

All segments of the display are activated

Instrument starts functioning using the configuration stored in the instrument's permanent memory.

Following initialisation, the instrument will display a flashing display which is a request for the local time to be entered. The clock will not start to function until a display time has been entered, or the remote reset contacts are closed and opened to synchronise the clock to a preconfigured time.

If during normal operation the power supply is interrupted for more than 30ms, the display will return to the flashing condition and the display time will have to be re-entered. Longer interruptions may be tolerated by powering the Clock from a lightly loaded instrument supply with large output capacitance.

9.2 Controls when configured as a clock

The BA377NE clock is configured and adjusted via four front panel push buttons. In the display mode i.e. when the instrument is displaying time, the push button functions are:

P + **▼** Shows in succession, firmware version number, instrument function [L][a][] and output accessories that are fitted:
-R Dual Control Outputs

P + **E** Access to configuration menu

Note: When optional control outputs are fitted, the BA377NE Clock may be configured to provide direct access to the control output *on* and *off* times from the display mode when the **P** and **▲** push buttons are operated simultaneously. - see section 9.4.13

9.3 Displays when configured as a clock

The BA377NE clock has a single digital display plus annunciators.

Time display Shows time in selected 12 or 24 hour format.

Reset annunciator Activated while clock is being synchronised and external reset contacts are closed.

Control output annunciators Show status of both optional control output.

9.4 Configuration as a clock

The BA377NE 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 17.

Each menu function is summarised in section 9.4.2 of this manual and each includes a reference to more detailed information.

All new BA377NE instruments are supplied configured as requested at the time of ordering. If configuration is not requested, the BA377NE will be supplied with default Timer configuration as shown in section 6.5.

If a BA377NE Clock is requested without detailed configuration information, the instrument will supplied with default Clock configuration as shown below, but can easily be re-configured on-site.

Default Clock Configuration

Function	Display	Default
Access code	[adE	0000
Function	Functi on	[LoC
Display	d, SPtRY	12:00
Synchronise time	SYnE t	R 12:00:00
Enable control output 1*	EnbL	aFF
Enable control output 2*	EnbL	aFF
Enable access alarm	ALSP	aFF
times from display mode.		
Access code for alarm	ALCd	0000
times from display mode.		

Note: * Control outputs are an option

9.4.1 Accessing configuration functions

Throughout this manual push buttons are shown as ▼, ▲, P and E and legends displayed by the Clock are shown in a seven segment font as they appear on the instrument e.g. d, SPtRY and [adE.

Access to the configuration menu is obtained by operating the P and E push buttons simultaneously. If the instrument is not protected by an access security code the first parameter Functi on will be displayed. If a security code other than the default code 0000 has already been entered, the instrument will display [adE. Press P to clear this prompt and enter the security code for the instrument using the ▼ or ▲ push button to adjust the flashing digit, and the P push button to transfer control to the next digit. If the correct code has been entered pressing E will cause the first parameter Functi on 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 main configuration menu the required function can be selected by scrolling through the menu using the ▼ and ▲ push buttons. The Clock configuration menu is shown diagrammatically in Fig 17.

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



9.4.2 Summary of Clock configuration functions.

This section summarises all the Clock configuration functions. When read in conjunction with Fig 17 it provides a quick aid for configuring the Clock. If more detail is required, each section of this summary contains a reference to a full description of the function.

Display	Summary of function								
Func_{on}	Instrument function Defines the function of the instrument. May be set to: <table> <tr> <td>ELAPSE</td><td>Timer</td></tr> <tr> <td>CLoc</td><td>Clock</td></tr> </table> <p>All the entries in this Clock configuration summary assume that the BA377NE is configured as a Clock by selecting CLoc.</p> <p>See section 9.4.3</p>	ELAPSE	Timer	CLoc	Clock				
ELAPSE	Timer								
CLoc	Clock								
diSPLAY	Display format Defines the clock display format, four alternatives are available. Select: <table> <tr> <td>12:00:00</td><td>Twelve hours with seconds</td></tr> <tr> <td>12:00</td><td>Twelve hours without seconds</td></tr> <tr> <td>24:00:00</td><td>Twenty four hours with seconds</td></tr> <tr> <td>24:00</td><td>Twenty four hours without seconds</td></tr> </table> <p>See section 9.4.4</p>	12:00:00	Twelve hours with seconds	12:00	Twelve hours without seconds	24:00:00	Twenty four hours with seconds	24:00	Twenty four hours without seconds
12:00:00	Twelve hours with seconds								
12:00	Twelve hours without seconds								
24:00:00	Twenty four hours with seconds								
24:00	Twenty four hours without seconds								
SEt	Set clock display time Enables the clock displayed time to be adjusted, the clock resumes operation when the instrument is returned to the display mode. <p>See section 9.4.5</p>								
SynC t	Synchronising time Defines the time to which the clock display is set when the reset terminals RS1 and RS2 are connected together. The Clock restarts from the synchronising time when terminals RS1 and RS2 are disconnected. <p>See section 9.4.6</p>								

Display	Summary of function										
oP 1	Control output 1 (Optional) Control output 1 can turn <i>on</i> (output closed) and <i>off</i> (output open) twice in each twenty-four hour period. This function contains five sub-function: <table> <tr> <td>EnbL</td><td>Enables output 1 and defines if it turns on and off once or twice in each 24 hours.</td></tr> <tr> <td>oP 1: on 1</td><td>Time when oP 1 turns <i>on</i> 1st time</td></tr> <tr> <td>oP 1: oFF 1</td><td>Time when oP 1 turns <i>off</i> 1st time</td></tr> <tr> <td>oP 1: on 2</td><td>Time when oP 1 turns <i>on</i> 2nd time</td></tr> <tr> <td>oP 1: oFF 2</td><td>Time when oP 1 turns <i>off</i> 2nd time</td></tr> </table> <p>See section 9.4.7 to 9.4.9</p>	EnbL	Enables output 1 and defines if it turns on and off once or twice in each 24 hours.	oP 1: on 1	Time when oP 1 turns <i>on</i> 1 st time	oP 1: oFF 1	Time when oP 1 turns <i>off</i> 1 st time	oP 1: on 2	Time when oP 1 turns <i>on</i> 2 nd time	oP 1: oFF 2	Time when oP 1 turns <i>off</i> 2 nd time
EnbL	Enables output 1 and defines if it turns on and off once or twice in each 24 hours.										
oP 1: on 1	Time when oP 1 turns <i>on</i> 1 st time										
oP 1: oFF 1	Time when oP 1 turns <i>off</i> 1 st time										
oP 1: on 2	Time when oP 1 turns <i>on</i> 2 nd time										
oP 1: oFF 2	Time when oP 1 turns <i>off</i> 2 nd time										
oP 2	Control output 2 (Optional) As control output 1 described above. <p>See section 9.4.10 to 9.4.12</p>										
ACSP	Access control output alarm-times from display mode. Contains two sub-functions, EnbL which when activated allows the control output times to be adjusted from the display mode (displaying time). The second sub-function RCLd defines a four digit alphanumeric access code which may be used to protect access to the alarm-times from the display mode. Default code 0000 disables this security feature and allows unrestricted access. <p>See section 9.4.13</p>										
Code	Security code Defines a four digit alphanumeric code that may be used to protect access to the Clock configuration menu. Default code 0000 disables this security function and allows unrestricted access to all configuration functions when the [P] and [E] buttons are operated simultaneously in the display mode. <p>See section 9.4.14</p>										
rSEt dEF	Reset to factory defaults Resets the BA377NE to the factory default configuration shown in section 9.4 when SE5 is selected and confirmed by entering SurE. <p>See section 9.4.15</p>										

9.4.3 Instrument function: **Funct, on**

The BA377NE may be configured as a Timer or as a Clock. This section of the instruction manual describes the Clock configuration, for details of Timer configuration see section 6.5.

To reveal the existing function of the instrument select **Funct, on** from the configuration menu and press **[P]**. If **CLoc** is displayed, the instrument is already configured as a Clock therefore press **[E]** to return to the **Funct, on** prompt in the configuration menu. If **ELAPSE** is displayed, press the **[▲]** or **[▼]** button to change the setting to **CLoc** followed by the **[P]** button 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 **[▲]** or **[▼]** button to adjust the flashing digit and the **[P]** button to move control to the next digit. When **5urE** has been entered, pressing **[E]** will change the instrument to a Clock and return the instrument to the display mode. To configure the Clock enter the configuration menu by pressing the **[P]** and **[E]** buttons simultaneously until **Funct, on** is displayed.

9.4.4 Display format: **d, SPLAY**

The BA377NE Clock may be configured to display time in a 12 or 24 hour format with or without seconds. When a 12 hour format is selected, AM is denoted by an **A** prefix at the left hand side of the display, similarly a **P** is displayed to denote PM.

To check or change the display format of the clock, select **d, SPLAY** from the configuration menu and press **[P]** which will reveal the existing setting which can be changed by pressing the **[▲]** or **[▼]** button followed by the **[E]** button to enter the selection and return to the configuration menu. The options available are shown below:

12:00:00	Twelve hour format with seconds
12:00	Twelve hour format without seconds
24:00:00	Twenty four hour format with seconds
24:00	Twenty four hour format without seconds

9.4.5 Set clock display time: **5Et**

This function sets the time displayed by the Clock which must be entered each time the BA377NE Clock is powered. Until a set time is entered the Clock will display a flashing **00:00:00** or **00:00** for 24 hour formats, or **A 12:00:00** or **A 12:00** for 12 hour formats.

To adjust the clock set time, select **5Et** from the configuration menu and press **[P]** that will show **00:00:00** or the existing set time with the hours flashing. When setting the clock display time seconds are always shown.

Using the **[▲]** or **[▼]** button adjust the flashing hours and then press **[P]** to transfer control to the minutes display, pressing **[P]** again will transfer control to the seconds display. When the clock display time has been adjusted press **[E]** to start the Clock and return to the **5Et** prompt in the configuration menu.

9.4.6 Enter synchronising time: **5YnE t**

When the external reset terminals RS1 and RS2 are connected together the clock is stopped and the displayed time is set to the synchronising time. When the connection between the reset terminals is removed, the clock restarts from the synchronising time. This function enables the BA377NE clock to be synchronised with a master clock.

To enter the synchronising time, select **5YnE t** from the configuration menu and press **[P]** which will reveal the existing synchronising time with the hours flashing. Using the **[▲]** or **[▼]** button adjust the hours and then press **[P]** to transfer control to the minutes display, pressing **[P]** again will transfer control to the seconds display. When the synchronising time has been set as required, press **[E]** to return to the configuration menu.

9.4.7 Control output 1 (Optional): **oP 1**

Control output 1 is an optional factory fitted galvanically isolated solid state switch contact output which can be configured to turn *on* (output closed) and *off* (output open) twice in each twenty-four hour period. The control output status is shown by the 1 control output display annunciator.

Function **oP 1** contains a sub-menu with five sub-functions:

EnbL	Number of times output 1 turns <i>on</i> & <i>off</i> in 24 hours.
oP 1: on 1	First time oP 1 turns <i>on</i> (closes)
oP 1: off 1	First time oP 1 turns <i>off</i> (opens)
oP 1: on 2	Second time oP 1 turns <i>on</i> (closes)
oP 1: off 2	Second time oP 1 turns <i>off</i> (opens)

To check or change the function of Control output 1 select **oP 1** from the configuration menu and press **[P]** which will reveal the first sub-function **EnbL**.

9.4.8 Enable Control output 1: *EnbL*

This is a sub-function in the Control output 1 function *oP 1* which allows output 1 to be enabled or disabled without changing any of the *on* or *off* times and also determines whether output 1 turns *on* and *off* once or twice in each twenty four hour period.

Select *oP 1* in the configuration menu and press **[P]** which will result in the *EnbL* prompt being displayed. Pressing **[P]** again will enter the sub-function from which one of the three options may be selected using the **[▲]** or **[▼]** button:

Display	Control output 1
<i>oFF</i>	Control output 1 disabled
<i>on: 1</i>	Turns <i>on</i> & <i>off</i> once per 24 hours
<i>on: 2</i>	Turns <i>on</i> & <i>off</i> twice per 24 hours

When the required option is displayed operating **[E]** will enter the selection and return to the *EnbL* prompt from which another sub-function may be selected if control output 1 has not been disabled.

9.4.9 On and off times: *oP 1: on 1; oP 1: oFF 1* *oP 1: on 2; oP 1: oFF 2*

The control output will have one or two *on* and *off* times depending upon whether control output 1 has been configured to turn *on* and *off* once or twice in each 24 hour period. - see 9.4.8.

All of the times are adjusted in the same way. To adjust any of them select *oP 1* from the configuration menu and press **[P]** which will result in the *EnbL* prompt being displayed. The **[▲]** or **[▼]** button will scroll through the sub-functions. Only *oP 1: on 1* and *oP 1: oFF 1* will be present if control output 1 has been configured to switch *on* and *off* once in a 24 hour period in the *EnbL* sub-function.

Select the required sub-function

<i>oP 1: on 1</i>	Time oP1 turns <i>on</i> first time
<i>oP 1: oFF 1</i>	Time oP1 turns <i>off</i> first time
<i>oP 1: on 2</i>	Time oP1 turns <i>on</i> second time
<i>oP 1: oFF 2</i>	Time oP1 turns <i>off</i> second time

When selected, pressing **[P]** will show the existing time with the hours flashing. Using the **[▲]** or **[▼]** button adjust the hours and then press **[P]** to transfer control to the minutes display, pressing **[P]** again will transfer control to the seconds display. When the time has been set as required press **[E]** to return to the sub-menu from which another *on* and *off* times may be selected for adjustment. When all the *on* and *off* times have been entered, return to the configuration menu by pressing the **[E]** button twice.

9.4.10 Control output 2 (Optional): *oP2*

Control output 2 is an optional factory fitted output which can be configured to turn *on* (output closed) and *off* (output open) twice in each twenty-four hour period. The control output status is shown by the 2 control output display annunciator.

Function *oP2* contains a sub-menu with five sub-functions:

<i>EnbL</i>	Number of times output 2 turns <i>on</i> & <i>off</i> in 24 hours.
<i>oP 2: on 1</i>	First time when oP 2 turns <i>on</i> (closes)
<i>oP 2: oFF 1</i>	First time when oP 2 turns <i>off</i> (opens)
<i>oP 2: on 2</i>	Second time when oP 2 turns <i>on</i> (closes)
<i>oP 2: oFF 2</i>	Second time when oP 2 turns <i>off</i> (opens)

To check or change the function of Control output 2 select *oP2* from the configuration menu and press **[P]** which will reveal the first sub-function *EnbL*.

9.4.11 Enable control output 2: *EnbL*

This is a sub-function in the Control output 2 function *oP2* which allows output 2 to be enabled or disabled without changing any of the *on* or *off* times and also determines whether output 2 turns *on* and *off* once or twice in each twenty four hour period. Select *oP2* in the configuration menu and press **[P]** which will result in the *EnbL* prompt being displayed. Pressing **[P]** again will enter the sub-function from which one of the three options may be selected using the **[▲]** or **[▼]** button:

Display	Control output 2
<i>oFF</i>	Control output 2 disabled
<i>on: 1</i>	Turns <i>on</i> & <i>off</i> once per 24 hours
<i>on: 2</i>	Turns <i>on</i> & <i>off</i> twice per 24 hours

When the required option is displayed operating **[E]** will enter the selection and return to the *EnbL* prompt from which another sub-function may be selected if control output 2 has not been disabled.

9.4.12 On and off times: *oP2: on 1; oP2: oFF 1* *oP2: on 2; oP2: oFF 2*

The control output will have one or two *on* and *off* times depending upon whether control output 2 has been configured to turn *on* and *off* once or twice in each 24 hour period. - see 9.4.11.

All of the times are adjusted in the same way. To adjust any of them select *oP2* from the configuration menu and press **[P]** which will result in the *EnbL* prompt being displayed. The **[▲]** or **[▼]** button will scroll through the sub-functions. Only *oP2: on 1* and *oP2: oFF 1* will be present if control output 2 has been configured to switch *on* and *off* once in a 24 hour period in the *EnbL* sub-function.

Select the required sub-function

oP2:on 1	Time oP2 turns <i>on</i> first time
oP2:off 1	Time oP2 turns <i>off</i> first time
oP2:on 2	Time oP2 turns <i>on</i> second time
oP2:off 2	Time oP2 turns <i>off</i> second time

When selected pressing **[P]** will show the existing time with the hours flashing. Using the **[▲]** or **[▼]** button adjust the hours and then press **[P]** to transfer control to the minutes display, pressing **[P]** again will transfer control to the seconds display. When the time has been set as required press **[E]** to return to the sub-menu from which another *on / off* time may be selected for adjustment. When all the *on / off* times have been entered, return to the configuration menu by pressing the **[E]** button twice.

9.4.13 Access control output *on* & *off* times from display mode: **ACSP**

This function activates a separate menu that provides direct access to the control output's *on* and *off* times when the Clock is the display mode (displaying time). An operator may therefore adjust the *on* and *off* times without having access to the instrument configuration menu. Further protection is provided by a separate security code. When this function is enabled the *on* and *off* times of the two control outputs may be adjusted from the display mode by simultaneously operating the **[P]** and **[▲]** push buttons. The function contains two sub-functions, **ENBL** which activates the function and **ACCD** which defines a separate access code that may be used to prevent the *on* and *off* times being accidentally adjusted from the display mode.

To check or change the function, select **ACSP** in the configuration menu and press **[P]** which will reveal the **ENBL** prompt, pressing **[P]** again will show if the function is *on* or *off*. If adjustment of the control output times from the display mode is not required press the **[▲]** or **[▼]** button to select *off* and then press **[E]** twice to return to the configuration menu. If the function is required, select *on* and press **[E]** to return to the **ENBL** prompt from which **ACCD**, which allows a separate access code to be entered, can be selected by pressing the **[▲]** or **[▼]** button.

Access to the control output times from the display mode may be protected by a four digit alphanumeric security code which must be entered to gain access. Default security code **0000** allows unrestricted access. With **ACCD** displayed, press **[P]** to enter a new access code. The BA377NE Clock will display **0000** with one digit flashing. The flashing digit may be adjusted using the **[▲]** or **[▼]** push button, when set as required operating the **[P]** button will transfer control to the next digit. When all the digits have been adjusted press **[E]** twice to return to the **ACSP** prompt in the configuration menu. The revised security code will be activated when the BA377NE is returned to the display mode.

9.4.14 Security code: **LoDE**

Access to the instrument's configuration menu may be protected by a four digit alphanumeric 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 **LoDE** from the configuration menu and press **[P]** which will cause the Clock 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 **LoDE** prompt. The revised security code will be activated when the Clock is returned to the display mode.

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

9.4.15 Reset configuration to Clock factory defaults: **rSEt dEF**

When the BA377NE is configured as a Clock, this function resets the configuration to the Clock factory defaults shown in sections 9.4 of this manual.

To reset the instrument configuration select **rSEt dEF** from the configuration menu and press **[P]**. The Clock will display **0000** with the first digit flashing which is a request to confirm the instruction by entering **5urE**. Using the **[▲]** or **[▼]** button set the first flashing digit to 5 and press **[P]** to transfer control to the second digit which should be set to **u**. When **5urE** has been entered pressing the **[E]** button will reset all the configuration functions to the factory defaults and return the instrument to the display mode as a Clock with default configuration.

10. CLOCK CONFIGURATION EXAMPLE

In this example a BA377NE is required to function as a Clock. Time is to be displayed in a 24 hour format including seconds. For external synchronisation the displayed time is required to change to 12:00:00 when the external reset terminals are connected together.

Both control outputs are required to close and open once in each 24 hour period. Control output 1 (OP1) is to turn *on* (close) at 07:30:00 and *off* (open) at 09:30:00, control output 2 (OP2) is to turn *on* (close) at 18:00:00 and *off* (open) at 22:30:00.

For this application the operator needs to adjust the control output *on* and *off* times from the display mode via an access code of 1111. To prevent tampering the instrument configuration menu is to be protected by security code of 1209

10.1 Configuration procedure

The BA377NE may be configured as a Clock on-site without disconnection from external wiring.

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 *FuncE, on* which is the first item in the configuration menu. See Fig 18.

Step 2 Configure instrument as a Clock

With *FuncE, on* displayed press **[P]** to reveal the existing function of the instrument. If *ELoE* is displayed no change is required, therefore return to the *FuncE, on* prompt by pressing the **[E]** button.

If *ELAPSE* is displayed, press the **[▲]** or **[▼]** button to change the setting to *ELoE* followed by the **[P]** button which will result in a 0000 prompt being displayed with the first digit flashing. This is a request for the instruction to be confirmed by entering *SurE* using the **[▼]** and **[▲]** buttons to adjust the flashing digit and the **[P]** button to move control to the next digit. Pressing **[E]** will then change the instrument to a Clock and return the display to *FuncE, on* in the configuration menu.

Step 3 Select display format

Using the **[▲]** or **[▼]** button select *d, SPlAY* in the configuration menu and press **[P]** which will reveal the current display format. Using the **[▲]** or **[▼]** button select 24:00:00 which is the required 24 hour format with seconds and press **[E]** to enter the selection and return to the configuration menu.

See 9.4.4

Step 4 Enter the synchronisation time

Using the **[▲]** or **[▼]** button select *SYnE t* in the configuration menu and press **[P]** to reveal the current synchronisation time with the hours flashing. Using the **[▲]** or **[▼]** push button adjust the hours to 12 and press **[P]** to transfer control to the minutes. Using the **[▲]** or **[▼]** push button adjust the minutes to 00 and press **[P]** to transfer control to the seconds which should be adjusted to 00, in the same way. When the seconds are set enter the selection and return to the *SYnE t* prompt in the configuration menu by pressing the **[E]** button.

See 9.4.6

Step 5 Enable control output 1 and enter the *on* and *off* times.




Using the **[▲]** or **[▼]** button select *OP1* in the configuration menu and press **[P]** to reveal the *EnbL* prompt in the control output 1 sub-menu.

In this application control output 1 is required to turn *on* and *off* once every 24 hours. With *EnbL* displayed press **[P]** and using the **[▲]** or **[▼]** button select *on t* followed by the **[E]** button to return to the *EnbL* prompt.















The control output *on* time should now be entered by selecting *OP1: on t* in the control output 1 sub-menu using the **[▲]** or **[▼]** button. Pressing **[P]** will reveal the existing *on* time which should be adjusted to 07:30:00 using the **[▲]** or **[▼]** button and the **[P]** button to transfer control to the following digits. When entered return to the *OP1: on t* prompt by pressing the **[E]** button.

The *off* time should now be entered by selecting *OP1: oFF t* from the sub-menu and adjusting the time to 09:30:00. Finally press **[E]** to return to the *OP1: oFF t* prompt in the sub-menu and press **[E]** again to return to *OP1* in the configuration menu.








Step 6 Enable control output 2 and enter the on and off times.

Using the  or  button select **oP2** in the configuration menu and press  to reveal the **EnbL** prompt in the control output 2 sub-menu. Follow the procedure described in step 5 above, but set control output 2 to turn on at **18:00:00** and off at **22:30:00**.


Step 7 Allow control output times to be adjusted from the display mode & enter separate security code.

Using the  or  button select **RESP** in the configuration menu and press  to reveal the **EnbL** prompt, pressing  again will show if this function is **on** or **off**. Using the  or  button select **on** followed by  to return to the **EnbL** prompt. A separate security code which must be entered to gain access to the alarm times in the operating mode, is entered in the **REEd** function which may be selected by operating the  or  button once. Pressing  will reveal the existing access code with one digit flashing. This should be changed to the required code of **1209** by adjusting the flashing digit using the  or  button and the  button to transfer control to the next digit. When **1209** has been entered press  twice to return to the configuration menu.















Step 8 Define the configuration menu security code.

Defining a security code prevents unauthorised access to the configuration menu. Using the  and  buttons select **EdE** from the configuration menu and press  which will reveal **0000** with the first digit flashing. This example requires the security code to be **1209**, using the  and  buttons set the flashing digit to **1** and press  to transfer control to the second digit. When all have been entered press  to return to the main configuration menu. See 9.4.14.

Step 9 Return to the display mode

The BA377NE is now configured as required for this example. Pressing the  button will save the configuration and return the BA377NE to the display mode with all the digits flashing indicating that the set time has to be entered.

Step 10 Enter the set time

Finally the current time to be displayed by the Clock should be entered. Re-enter the configuration menu by pressing the  and  buttons simultaneously which will result in **EdE** being displayed. Pressing  will allow the access code **1209** to be entered using the  or  button to adjust the flashing digit and the  button to transfer control to the next digit. When all four digits have been adjusted press  to enter the configuration menu and using the  or  button select **SEt** and press  to reveal **00:00:00** with the hours flashing. Using the  or  button adjust the flashing hours digit and press  to transfer control to the minutes and then to the seconds. When all have been set as required, press  to start the clock from the entered time and return to the display mode.

11. MAINTENANCE when configured as a Clock

11.1 Fault finding during commissioning

If a BA377NE fails to function as a Clock during commissioning the following procedure should be followed:

Symptom	Cause	Check:
No display	No power supply, or incorrect wiring. Note: Terminals 2 & RS2 are interconnected within the instrument.	That there is between 10 and 30V on terminals 1 & 2 with terminal 1 positive. That there are no connections to terminals 3, 4, 5 & 6.
Configuration menu does not correspond with the Clock section of this manual.	BA377NE is configured as a Timer.	That <code>FUNCTION</code> in configuration menu is set to <code>CLOCK</code> not to <code>ELAPSE</code> .
Clock display flashes 00:00:00	Local time has not been entered.	Enter the local time in the <code>SET</code> function of the instrument configuration menu.
Control output(s) do not function.	Control outputs have not been enabled.	Enable Control Output(s) in the configuration menu.
Clock will not start	Reset terminals RS1 and RS2 are connected together and the clock is resetting.	If reset annunciator on display is activated, disconnect link between RS1 and RS2.
Unable to enter configuration menu.	Incorrect security code	That the correct security code is being used. Contact BEKA if code is lost.

11.2 Fault finding after commissioning

EN 60079-17 *Electrical installations inspection and maintenance* permits live maintenance in Zone 2 if a risk analysis demonstrates that this does not introduce an unacceptable risk. The removal of covers [opening of Ex n enclosure] is permitted if this can be done without contaminating the interior of the instrument with dust or moisture. Some end-users may prefer not to permit live maintenance to minimise risk.

ENSURE PLANT SAFETY BEFORE STARTING MAINTENANCE

Live maintenance within the hazardous area should only be performed when it is permitted by risk analysis, or when there is no risk of a flammable atmosphere being present.

If a BA377NE fails after it has been functioning correctly as a Clock, 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 with terminal 1 positive.
Clock display flashes 00:00:00	Instrument power supply has been interrupted and local time has been lost.	Enter the local time in the <code>SET</code> function of the instrument configuration menu.
Control output(s) do not function.	Control outputs have not been enabled.	Enable Control Output(s) in the configuration menu.
Clock will not start	Reset terminals RS1 and RS2 are connected together and the clock is resetting.	If reset annunciator on display is activated, disconnect connection between RS1 and RS2.
Unable to enter configuration menu.	Incorrect security code	That the correct security code is being used. Contact BEKA if code is lost.

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

11.3 Servicing

We recommend that faulty BA377NE Clocks are returned to BEKA associates or to our local agent for repair.

11.4 Routine maintenance

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

11.5 Guarantee

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

11.6 Customer comments

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

Appendix 1 Dust certification

A1.0 ATEX dust certification

In addition to ATEX Ex nA certification permitting installation in explosive gas atmospheres which is described in the main section of this instruction manual, all BA377NE Timer or Clocks have ATEX dust ignition protection by enclosure certification Ex tc permitting installation in combustible dust atmospheres. The front panel push button switches are non incendive and have been certified intrinsically safe Ex ic without the need for Zener barriers or galvanic isolators.

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

The Timer or Clock's Ex tc dust input and output safety parameters are identical to the Ex nA gas parameters, therefore all the electrical circuits shown in the main section of this manual may also be used for dust applications.

A1.1 Zones, and Maximum Surface Temperature

The BA377NE has been ATEX dust certified

Group II, Category 3D
Ex ic tc IIIC T80°C Dc $-40 \leq T_a \leq 60^\circ\text{C}$

When connected to a suitable system the Timer or Clock may be installed in:

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

Be used with dust in subdivisions:

IIIA	combustible flyings
IIIB	non-conductive dust
IIIC	conductive dust

Having a Minimum Ignition Temperature of:

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

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

A1.2 Special conditions for safe use in dust atmospheres.

The BA377NE ATEX Type Examination Certificate has an 'X' suffix to show that special conditions for safe use are specified by the BA377NE Ex ic tc certificate. These state that the BA377NE Timer or Clock should be:

- Mounted such that the instrument terminals are protected by at least an IP54 enclosure certified to IEC 60079-15 or IEC 60079-0 as appropriate.

Note: An Ex t, Ex n, Ex e or Ex p certified enclosure satisfies this requirement.

- Instrument terminals must be supplied from limited energy circuits.

Note: This means that the BA377NE should only be connected to circuits with output parameters in normal operation equal to, or less than the instruments input parameters which are the same as the Ex nA input parameters specified in section 3 of this manual.

A1.3 Maintenance

The IEC guidance on maintenance procedures EN 60079-17 permits live maintenance in Zone 22 if a risk analysis demonstrates that this does not introduce an unacceptable risk. The removal of covers [opening of Ex tc enclosure] is permitted if this can be done without contaminating the interior of the enclosure and instrument with dust or moisture. Some end-users may prefer not to permit live maintenance to minimise risk.

ENSURE PLANT SAFETY BEFORE STARTING MAINTENANCE

Live maintenance within the hazardous area should only be performed when it is permitted by risk analysis or when there is no risk of a flammable atmosphere being present.

Before closing the Ex tc enclosure ensure that the sealing gaskets are undamaged and free from dirt and foreign bodies.

Inspection of the Timer or Clocks mechanical condition and removal of accumulated dust from the front of the instrument and the outside of the enclosure should be regularly performed. The interval between inspections depends upon environmental conditions. Removal of flammable dust should be performed with care to avoid creating a dust cloud.

Appendix 2 IECEx certification

A2.0 The IECEx Certification Scheme

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

A2.1 IECEx Certificate of Conformity

The BA377NE Timer or Clock has been issued with an IECEx Certificate of Conformity number IECEx ITS 16.0005X which specifies the following certification code:

Ex nA ic IIC T5 Gc
Ex ic tc IIIC T80°C Dc IP66
-40°C ≤ Ta ≤ +60°C

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

A2.2 Installation

The IECEx safety parameters are identical to the ATEX safety parameters described in the main section of this manual and both refer to equivalent standards. Therefore the ATEX installation requirements specified in the main sections and in Appendix 1 of this manual, also apply for IECEx installations, but the local code of practice should also be consulted.

The Timer or Clock's front panel push button contacts are non incandive and have been certified intrinsically safe Ex ic, without the need for an external Zener barrier or galvanic isolator, as shown on the IECEx certificate. This allows the Timer or Clock to be adjusted and configured live when installed in a Ex n panel enclosure located in Zone 2.

For ATEX installations self certified Category 3GD equipment, such as enclosures, may be installed in Zone 2 or 22, but self certified equipment is not permitted for IECEx installations.

A2.3 Special conditions for safe use

The IECEx certificate number has an 'X' suffix indicating that special conditions apply for safe use. These conditions are identical to the ATEX special conditions for safe use specified in the main sections and in Appendix 1 of this manual.

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

A3.0 cETL Mark

For installations in the USA and Canada, the BA377NE Timer or Clock has ETL and cETL Ex nA and Ex tc approval, Control Number 4008610. Copies of the Authorisation to Mark are available from the BEKA associates sales office and www.beka.co.uk

A3.1 ETL and cETL certification

The US and Canadian standards used for assessment and certification of the BA377NE are listed on the cETL Authorisation to Mark.

Installations must comply with BEKA associates Control Drawing CI330-53, which is attached to this appendix.

The ETL safety parameters are the same as the ATEX and IECEx parameters, the systems shown in sections 2, 3 & 4 of this manual may therefore also be used for US and Canadian installations subject to compliance with the local codes of practice.

ETL and cETL codes

CL I Zone 2 AEx nA ic IIC T5 Gc (US gas, Zone cert)

Zone 22 AEx ic tc IIIC T80°C Dc (US dust, Zone cert)

Ex nA ic IIC T5 Gc (Canadian gas, Zone cert)

Ex ic tc IIIC T80°C Dc (Canadian dust, Zone cert)

$-40^{\circ}\text{C} \leq T_a \leq 60^{\circ}\text{C}$

The Timer or Clock's front panel push button contacts are non incensive and have been certified intrinsically safe Ex ic, without the need for an external Zener barrier or galvanic isolator, as shown on the ETL Authorisation to Mark. This allows the Timer or Clock to be adjusted and configured live when installed in a Ex n panel enclosure located in Zone 2.