BEKA associates

BA333B, BA334B, BA337B, BA338B and BA339B

intrinsically safe totalisers

Instruction manual

CONTENTS

CE 1996

This product meets the essential protection requirements of Council Directive 89/336/EEC and has been tested to EN50 081-1:1992 pr EN50 082-2:1991

A Declaration of Conformity is available on request.

1 Description

The BA330B series consists of five intrinsically safe totalisers for use in hazardous areas. All the models are functionally identical, differing only in the number of digits, size of display and type of enclosure.

All the models will count and display any variable which can be converted into a series of pulses, for example the output pulses from a flowmeter can be counted to show the total flow, or the output from a proximity switch counted to indicate a total number of revolutions or operations.

All five instruments have been certified EEx ia IIC T4 by BASEEFA to the CENELEC standard. Apparatus certificate Ex 90C2408, systems certificate Ex 202410.

2 Operation

Figure 1 shows a block diagram of a totaliser. The instrument is powered by an external supply connected to terminals 5 & 6.

The input circuit can be conditioned by plug-in links to accept pulses from switch contacts, a 2-wire proximity detector or a voltage source. The input circuit incorporates a filter to prevent the counter responding to noise, and contact bounce when used with switch contacts.

A plug-in link connects the counter directly to the input circuit, or via an inverter, which enables the totaliser to be conditioned to increment on a positive or negative going input pulse. The counter can be reset to zero by connecting terminals 3 & 4 together.

Mounting	**FIELD**		**PANEL**		
Model	**BA333B**	**BA334B**	**BA337B**	**BA338B**	**BA339B**
Display					
No. of digits Height	4 25.4mm	8 12.7mm	4 12.7mm	4 25.4mm	8 12.7mm
Environmental					
Case	IP66		48 x 96 front IP50 (IP54 or IP65 with front cover) rear IP20	72 x 144 front IP50 (IP65 with optional front cover) rear IP20	
Case material	epoxy painted aluminium OR GRP (glass reinforced polyester)		noryl		

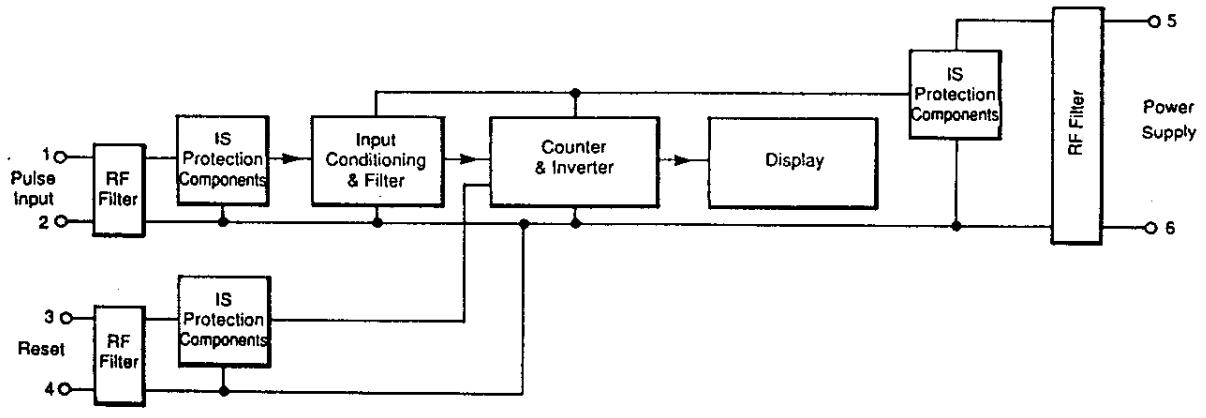


Fig 1. Block diagram of totaliser

3 BA330B Series Intrinsic Safety Certification

3.1 Explanation of Intrinsic Safety Certificates

All the BA330B series intrinsically safe totalisers have been certified by BASEEFA to BS5501:Part 1:1977 EN50 014 and BS5501:Part 7:1977 EN50 020. The totalisers bear the Community Mark and, subject to local Codes of Practice, may be installed in any of the CENELEC member countries, i.e. Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Luxembourg, The Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom. This guide describes installations which conform with the UK Code of Practice BS5345:Part 4:1977. When designing systems for installation outside the UK the local Code of Practice should always be consulted.
Copies of the BASEEFA apparatus certificate Ex90C2408 and the systems certificate Ex202410 are available from BEKA Associates.

3.2 Apparatus Certificate

The totalisers are certified EEx ia IIC T4 which allows them, when correctly connected, to be installed in:

Zone 0	Explosive gas-air mixture continuously present
Zone 1	Explosive gas-air mixture likely to occur in normal operation
Zone 2	Explosive gas-air mixture not likely to occur and if it does will only exist for a short time

Be used with gases or vapours in gas groups:

Group IIA	Propane
Group IIB	Ethylene
Group IIC	Hydrogen

Having a temperature classification of:

T1	450°C
T2	300°C
T3	200°C
T4	135°C

This allows the totalisers to be installed in all Zones, and to be used with most common industrial gases except carbon disulphide and ethyl nitrate.

3.3 Systems Certificate

When designing an intrinsically safe system incorporating a totaliser, it is necessary to consider the combined safety of all the barriers or isolators in the loop. The systems certificate defines a number of alternative configuration which may be used. Basically, one 28V 300Ω, one 10V 50Ω and a diode return Zener barrier, all of the same polarity, may be connected to the totaliser. Alternatively, a 28V 300Ω isolator plus certified intrinsically safe relays may be used.

3.3.1 Power Supply Terminals

The totaliser must always be powered from a certified intrinsically safe voltage source with a safety description equal to or less than 28V 300Ω 93mA. This supply may be obtained from either a Zener barrier or an intrinsically safe isolator.

Any Zener barrier certified to the CENELEC standard with a safety description equal to or less than the limits specified in the systems certificate may be used. The choice is not limited to the devices shown on the certificate. When using a 28V 300Ω Zener barrier, the safe area supply voltage should be between 20V and the maximum operating voltage of the barrier - usually 26.5V. The totaliser will function with the supply voltage on the safe area terminals of the barrier reduced to 10V, but the input switching points may not remain within the published specification.

If an intrinsically safe isolator is used to power the totaliser, only the devices listed on the systems certificate may be used.

A Zener barrier is the lowest cost method of powering a totaliser, but it does not provide galvanic isolation. This is not a disadvantage when counting pulses from a 2-wire proximity switch or a voltage free contact, both of which are electrically 'floating'. However, the lack of isolation may cause problems when counting voltage pulses from a source which is not 'floating'.

3.3.2 Input Terminals

The systems certificate permits Zener barriers, intrinsically safe relays and certified proximity detectors to be connected to the input terminals of the totaliser. Any Zener barrier certified to the CENELEC standard with a safety description equal to, or less than 10V 50Ω may be used.

If a certified intrinsically safe relay or proximity detector is connected to the input terminals of the totaliser, only the devices listed on the systems certificate may be used.

3.3.3 Reset Terminals

The Systems Certificate allows the totaliser to be reset to zero from the hazardous or the safe area. Resetting from the hazardous area can be accomplished by any mechanically operated switch which complies with the requirements of BS5345. When the totaliser is reset from the safe area, a Zener barrier or intrinsically safe relay is required to transfer the contact closure to the totaliser in the hazardous area. Any Zener barrier certified to the CENELEC standard with a safety description equal to or less than 10V 50Ω, or a low voltage drop diode return barrier, may be used. Diode return barriers which introduce a voltage drop greater than 1V are not suitable for this application.

4 Applications

4.1 Use with a 2-Wire Proximity Detector

2-wire proximity detectors are solid state switches which are activated when they come close to a target. They are available in many shapes and sizes, but most conform to the NAMUR electrical specification which defines the output current in the activated and unactivated conditions.

The totaliser will count and display the output from any 2-wire proximity detector which complies with the NAMUR standard. When used in a hazardous area the totaliser may be directly connected to any of the certified intrinsically safe proximitors listed on the totaliser systems certificate. See Figures 2 & 3.

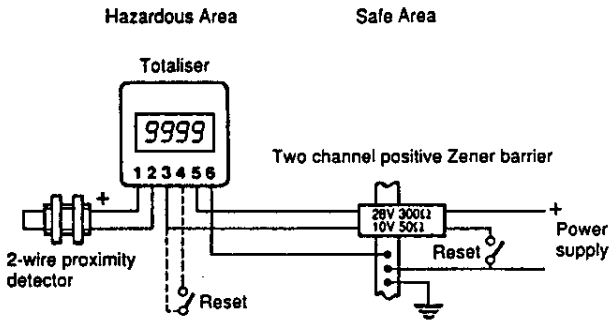


Fig 2. Hazardous area proximity detector, totaliser powered by Zener barrier

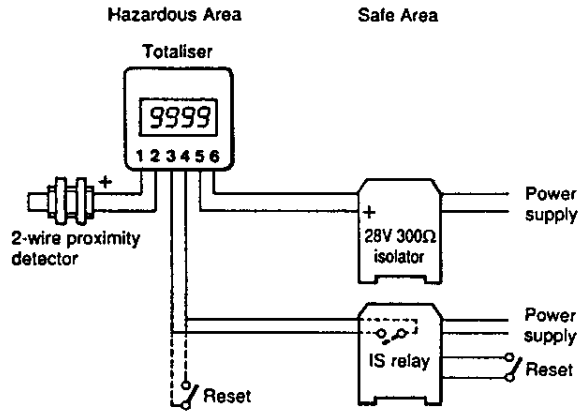


Fig 3. Hazardous area proximity detector, totaliser powered by intrinsically safe isolator

The output from a 2-wire proximity detector installed in a safe area can be displayed in a hazardous area using the circuit shown in Figure 4. For this application the proximity detector need not be intrinsically safe, but a Zener barrier must be installed in the cable connecting the proximity detector to the totaliser.

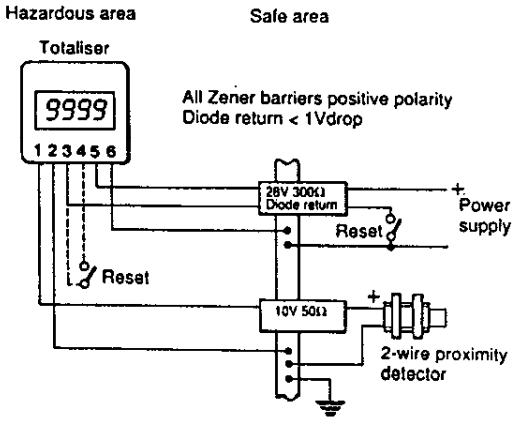


Fig 4. Safe area proximity detector, totaliser powered by Zener barrier

The output from open collector transistors and photo-transistors can be counted by a totaliser conditioned to operate with a proximity detector. The transistor must have an 'on' voltage of less than 2V, and an 'off' leakage current of less than 1mA. These requirements are not restrictive unless the transistor is fitted with protective diodes.

Figure 5 illustrates how the output from a photo-transistor in a hazardous area may be counted. Providing the transistor complies with the IS segregation requirements, it can normally be considered as 'simple apparatus' and therefore does not need to be certified. Figure 6 shows a similar installation with the transistor located in a safe area.

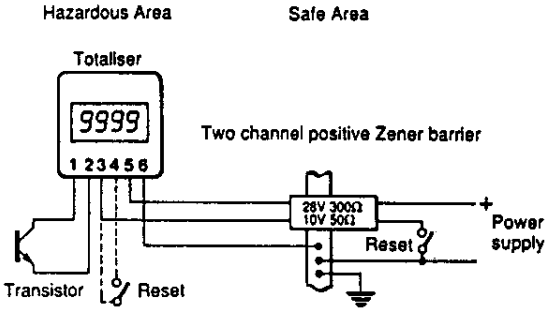


Fig 5. Hazardous area 'open collector ' transistor driving totaliser

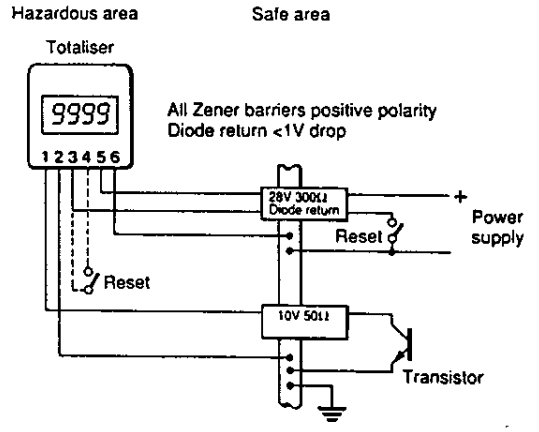


Fig 6. Safe area 'open collector' transistor driving totaliser via Zener barrier

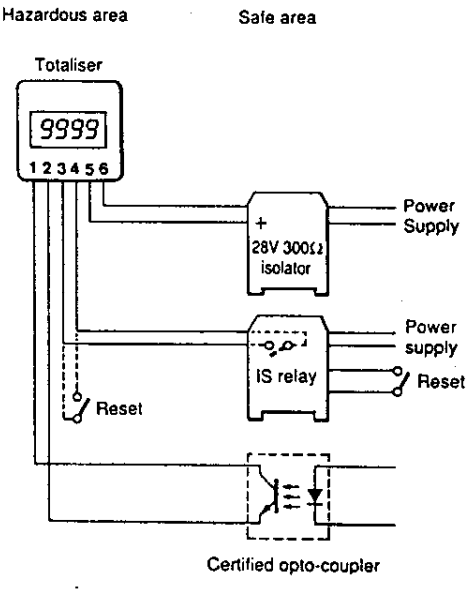


Fig 7. Certified opto-coupler transferring voltage pulse from safe area to totaliser in hazardous area

A certified intrinsically safe opto-coupler is a convenient way of transferring voltage or current pulses from a safe area to a totaliser installed in a hazardous area. When isolators are used to power and reset the totaliser, a certified opto-coupler provides a reliable 'solid state' alternative to an IS relay. Figure 7 shows a typical installation.

4.2 Use With Voltage Free Contacts

The number of times a pair of voltage free contacts opens or closes may be counted by a totaliser providing that the resistance of the contacts when closed is less than 100Ω, and the resistance when open is greater than 1000Ω. When conditioned for counting switch contacts, the totaliser has an open circuit input voltage of 8V which will break down most surface films.

Figures 8 & 9 show two alternative circuits for use with contacts located in a hazardous area. To comply with certification requirements, the contacts must be electrically segregated from all other circuits, and be mechanically actuated. Reed contacts actuated by a permanent magnet, as used in some flow meters, usually comply with these requirements.

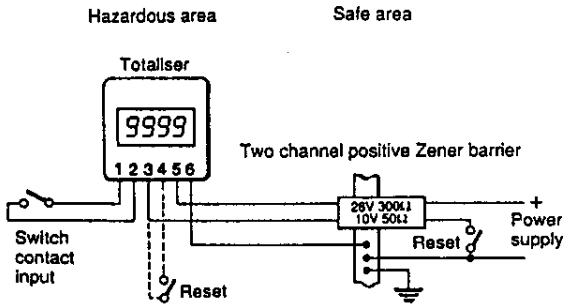


Fig 8. Hazardous area switch, totaliser powered by Zener barrier

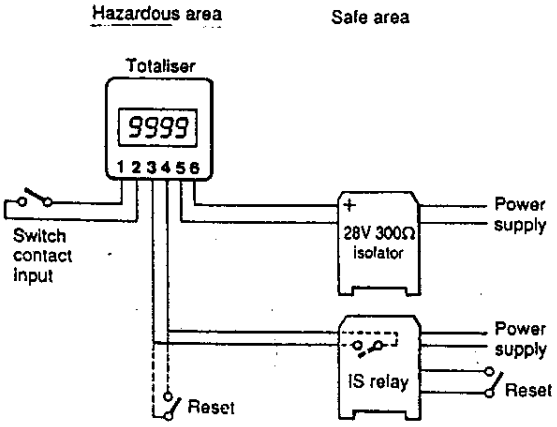


Fig 9. Hazardous area switch, totaliser powered by intrinsically safe isolator

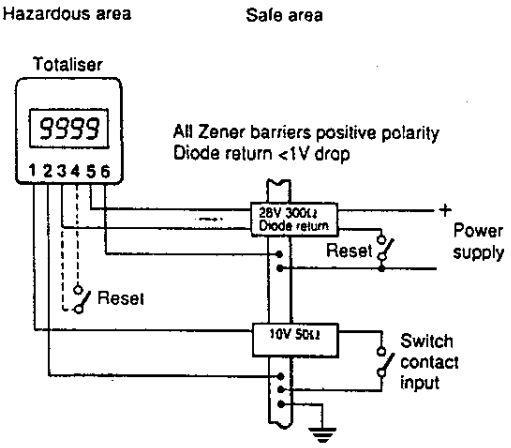


Fig 10. Safe area switch, totaliser powered by Zener barrier

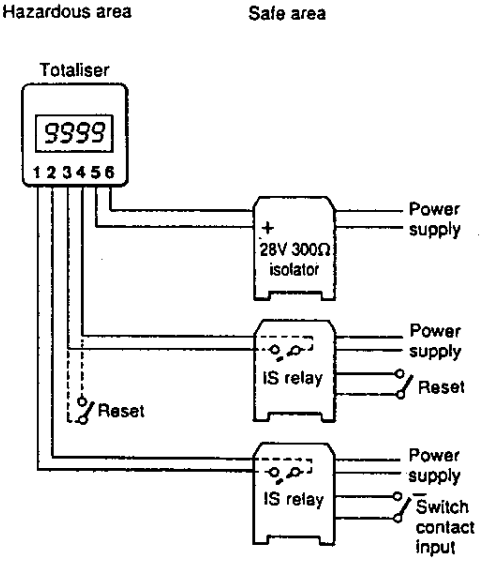


Fig 11. Safe area switch, totaliser powered by intrinsically safe isolator

Contact closures in a safe area may be counted and displayed by a totaliser located in a hazardous area. There are no restrictions on the type of switch contacts, or how they are activated. Figures 10 & 11 illustrate two typical installations.

4.3 Use With a Voltage Pulse Input

The totaliser will count and display the number of voltage pulses at its input terminals providing that the low level of the pulse is below +1V and the high level of the pulse is above +3V. Although the safety description of the totaliser input terminals is 12V 25mA 495Ω, the original systems certificate does not allow connection to specific voltage output devices within the hazardous area. For most applications the voltage pulse signal must therefore be transmitted via a Zener barrier from the safe area. Figures 12, 13 & 14 show alternative configurations.

The maximum voltage which may be applied to the safe area terminals of a Zener barrier is determined by the maximum working voltage of the barrier. This is usually 6V for a 10V 50Ω barrier which is used to transmit the voltage pulses to the totaliser in Figure 14. Higher voltages may

be applied to the Zener barrier providing the current is limited by an external resistor 'R' to a value less than the barrier fuse rating. For example, by fitting a 560Ω resistor in series with the barrier a 24V peak pulse signal may be counted without damaging the barrier.

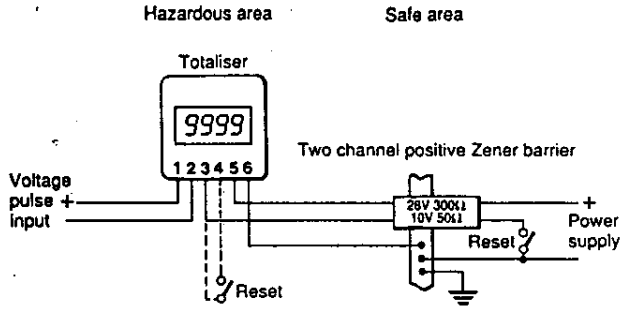


Fig 12. Hazardous area voltage pulse, totaliser powered by Zener barrier

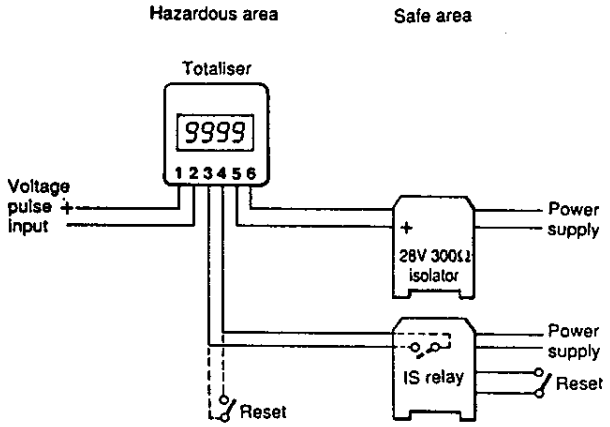


Fig 13. Hazardous area voltage pulse, totaliser powered by intrinsically safe isolator

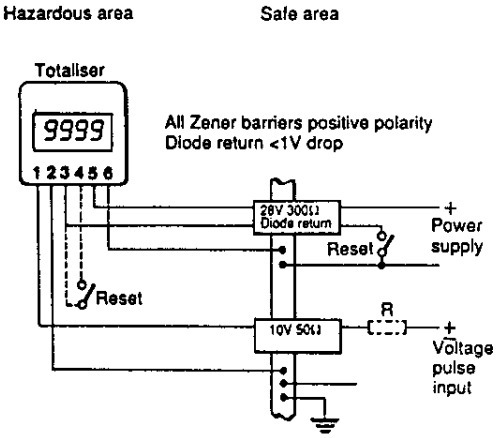


Fig 14. Safe area voltage pulse, totaliser powered by Zener barrier

5 Reset

The totaliser can be reset to zero by connecting terminals 3 and 4 together with a switch having an 'on' resistance of less than 1k. The switch should remain closed for at least 1 second to ensure correct zeroing. While the reset switch is closed, the totaliser ignores input pulses and displays zero. The reset switch may therefore be used to 'inhibit' the totaliser.

Note: With leading zero blanking turned 'on', the display is totally blank, apart from the selected decimal point, when the totaliser is reset.

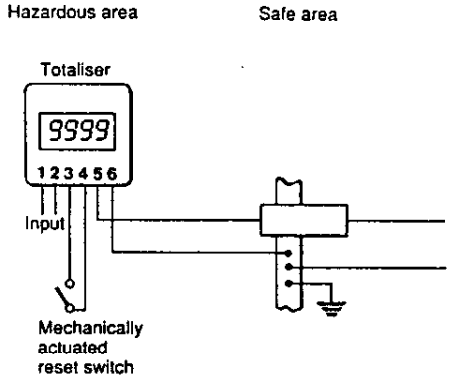


Fig 15. Resetting the totaliser from within the hazardous area

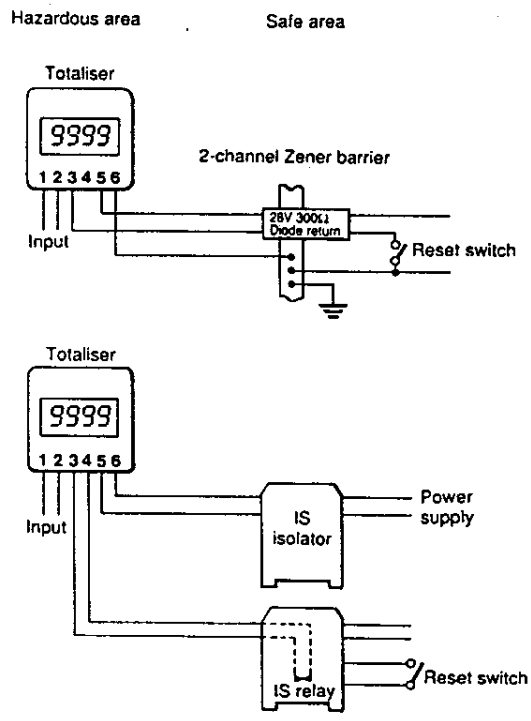


Fig 16. Resetting the totaliser from the safe area

6 Overrange

The totaliser will continue to count and display input pulses until the reset contacts are closed, or the maximum count of the totaliser is reached, i.e. 10^4 input pulses for the BA333B, BA337B and BA338B, and 10^8 input pulses for the BA334B and BA339B. When the maximum count is reached, the totaliser automatically resets to zero and continues counting; colons and all decimal points, except the one manually selected, are displayed to show that the instrument has overranged.

7 Installation

7.1 Field Mounting Totaliser

The BA333B and the BA334B field mounting totalisers are housed in epoxy painted die-cast aluminium, or glass reinforced plastic (GRP) enclosures. To simplify installation, the field wiring terminals are located in the enclosure so that it can be installed and wired without the totaliser in place.

The enclosure can be directly mounted onto any flat surface using the four corner 'D' holes, or can be clamped to pipework using one of the accessory pipe mounting kits. Whichever technique is used, it is important to choose a location which ensures that the totaliser always remains within the environmental limits shown in the specification, and that the display window is not exposed to direct sunlight.

When correctly installed, the enclosure will provide IP66 protection.

Installation Sequence

i Remove the enclosure cover by unscrewing the four captive 'A' screws.

ii Remove the totaliser from the enclosure by unscrewing the six captive 'B' screws and carefully lifting the assembly from the enclosure.

iii Remove the terminal cover from the enclosure by unscrewing the two captive 'C' screws.

iv Mount the enclosure on a flat surface and secure with screws or bolts through the four corner 'D' holes.
Alternatively, assemble the pipe mounting kit which is supplied with its own instruction sheet.

v Fit cable glands or conduit fittings into the two M20x1.5 holes at the bottom of the enclosure, ensure that the screw threads do not protrude too far into the terminal compartment.

vi Connect the field wiring to the terminals as shown in Figure 18. The aluminium enclosure is provided with an earth terminal which is internally connected to the enclosure. This terminal should be connected to a local earthing point to ensure personnel safety. This earth connection is not associated with the intrinsic safety of the indicator. The glass reinforced plastic (GRP) enclosure does not require a local earth connection. In this version the terminal at the right hand side of the seven way terminal block is fitted with a blank identification tag and should not be used.

vii Replace terminal cover and tighten the two 'C' screws.
Note: When the totaliser is installed in a hazardous area it is mandatory that this terminal cover is fitted.

viii Replace the totaliser in the enclosure and evenly tighten the six 'B' screws.

ix Replace the enclosure cover and evenly tighten the four 'A' screws.

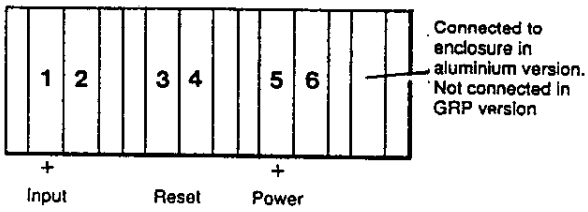
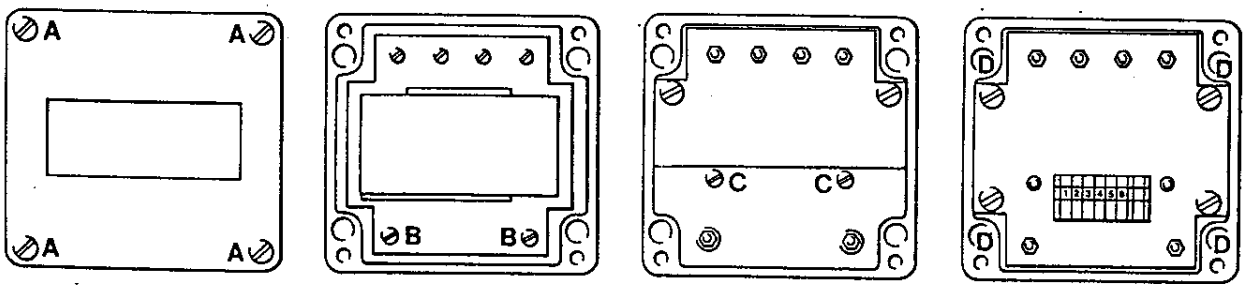


Fig 18. Terminal connections



Step 1 – Remove the enclosure cover by unscrewing the four 'A' screws.

Step 2 – Remove the totaliser from the enclosure by unscrewing the three captive 'B' screws.

Step 3 – Remove the terminal cover from the enclosure by unscrewing the two captive 'C' screws.

Step 4 – Mount the enclosure on a flat surface and secure with screws or bolts through the four corner 'D' holes. Alternatively assemble the pipe mounting kit which is supplied with its own instruction sheet.

Fig 17. Simplified view of totaliser showing assembly sequence

7.2 Panel Mounting Totalisers

The BA337B, BA338B and BA339B are panel mounting instruments housed in standard DIN cases.

Instrument	DIN case size	Panel cut-out
BA337B	48 x 98mm x 146mm deep	44 x 91
BA338B	72 x 144mm x 146mm deep	67 x 138
BA339B	72 x 144mm x 146mm deep	67 x 138

These instruments may be installed into any panel providing that the environmental limits shown in the specification are not exceeded.

Installation Sequence

i Insert the totaliser into the panel aperture from the front of the panel.

ii Clip two panel mounting brackets to opposite sides of the case as shown in Figure 19 and tighten the two screws until the totaliser is secure. Do not overtighten.

iii Connect wiring to the terminals as shown in Figure 20.

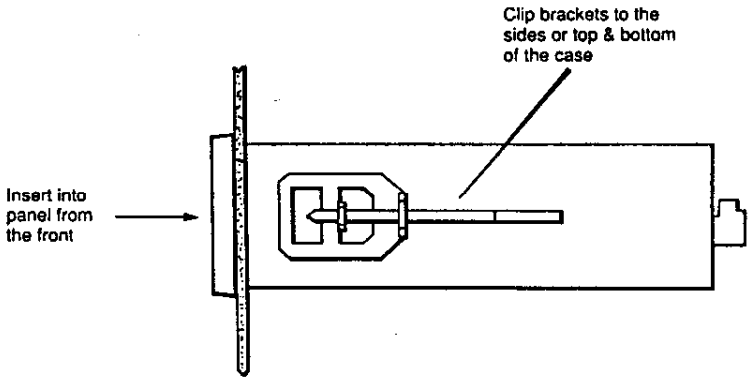


Fig 19. Installing panel mounting totaliser

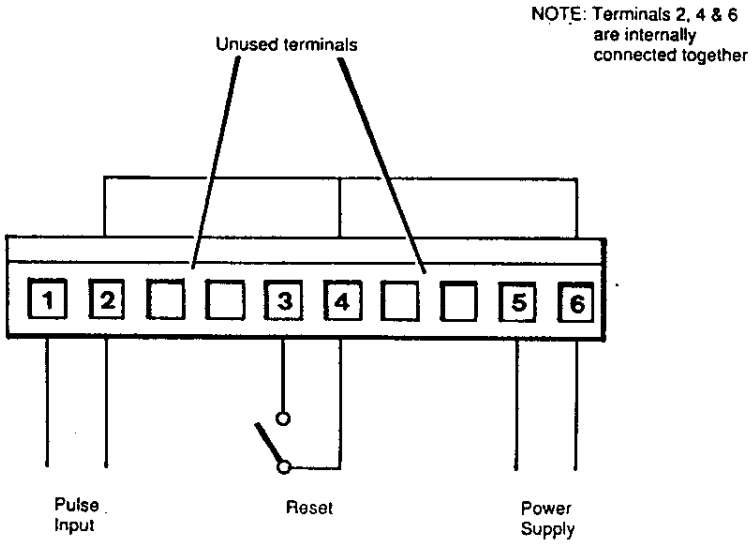


Fig 20. Terminal connections viewed from rear of totaliser

8 Conditioning

All models will be supplied conditioned as specified at time of ordering. If conditioning is not requested the totaliser will be set as follows:

Input type:	proximitor
Leading zero blanking:	off
Decimal point:	absent

8.1 Field Mounting Totalisers BA333B & BA334B

The location of all the plug-in conditioning links are shown in Figure 21. Access to these links is gained by unscrewing the four corner 'A' screws shown in Figure 17 and removing the totaliser cover.

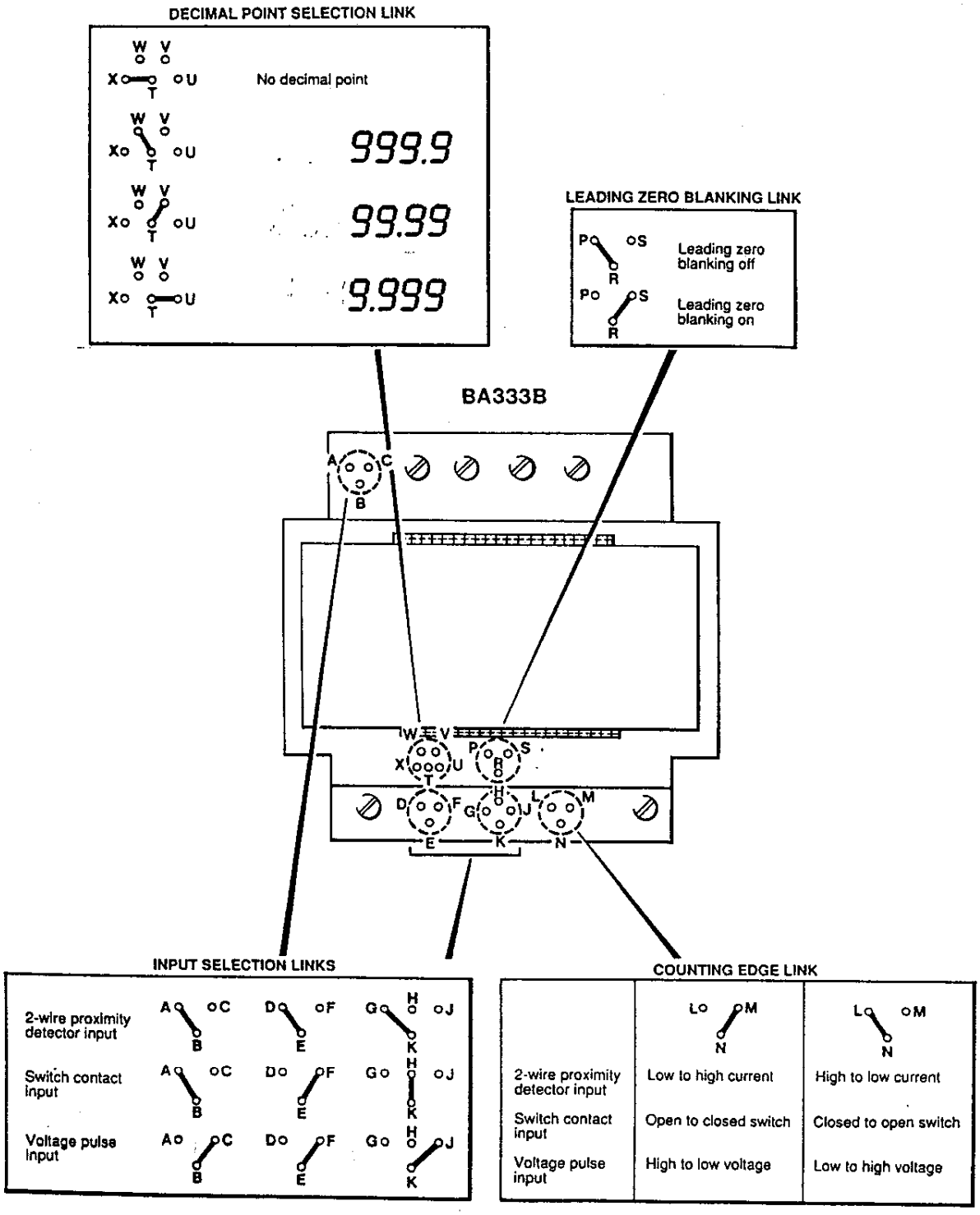
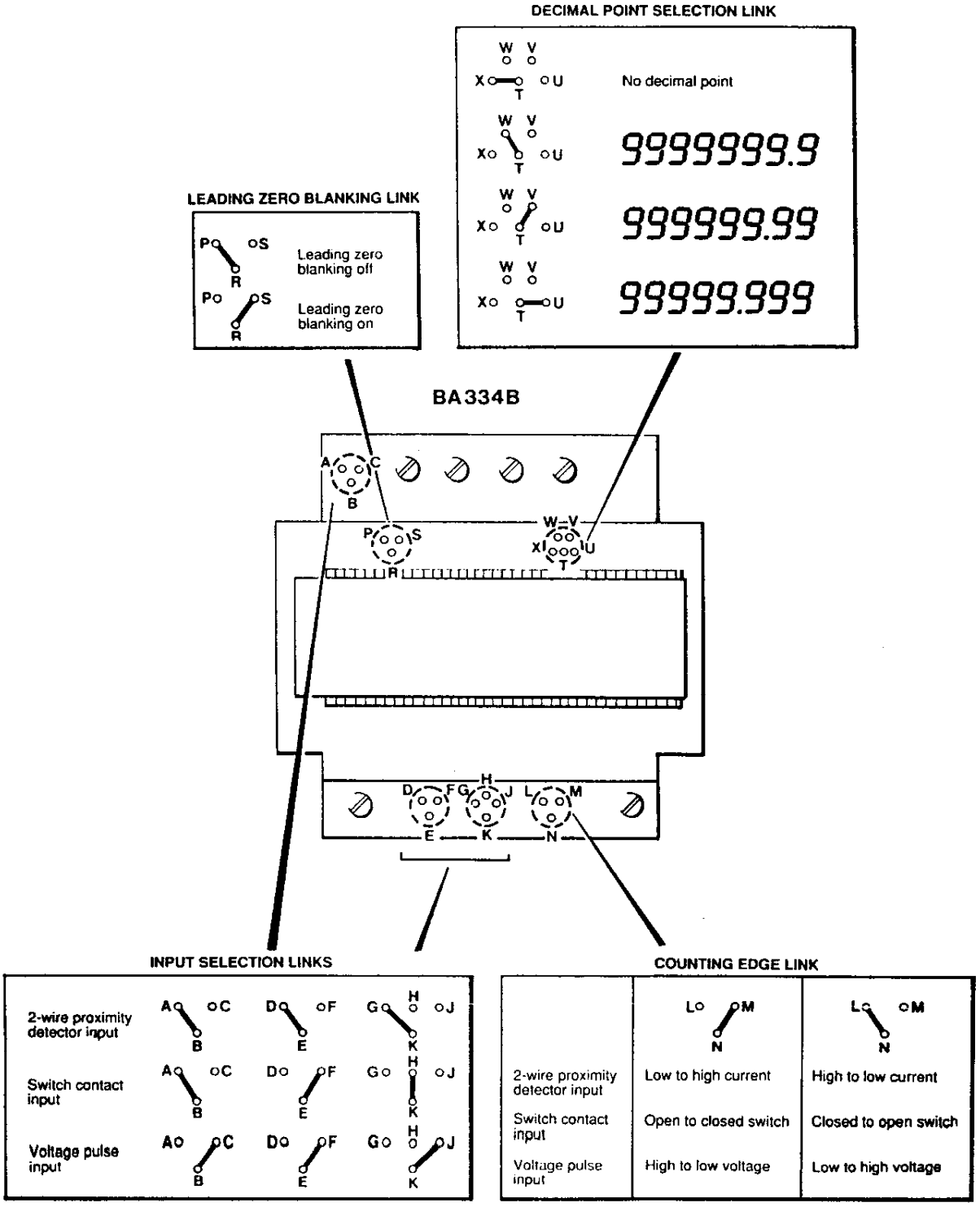


Figure 21 Location of conditioning links in field mounting totalisers


DECIMAL POINT SELECTION LINK
No decimal point
9999999.9
999999.99
99999.999
LEADING ZERO BLANKING LINK
Leading zero blanking off
Leading zero blanking on
BA334B
INPUT SELECTION LINKS
2-wire proximity detector input
Switch contact input
Voltage pulse input
COUNTING EDGE LINK
2-wire proximity detector input
Low to high current
High to low current
Switch contact input
Open to closed switch
Closed to open switch
Voltage pulse input
High to low voltage
Low to high voltage

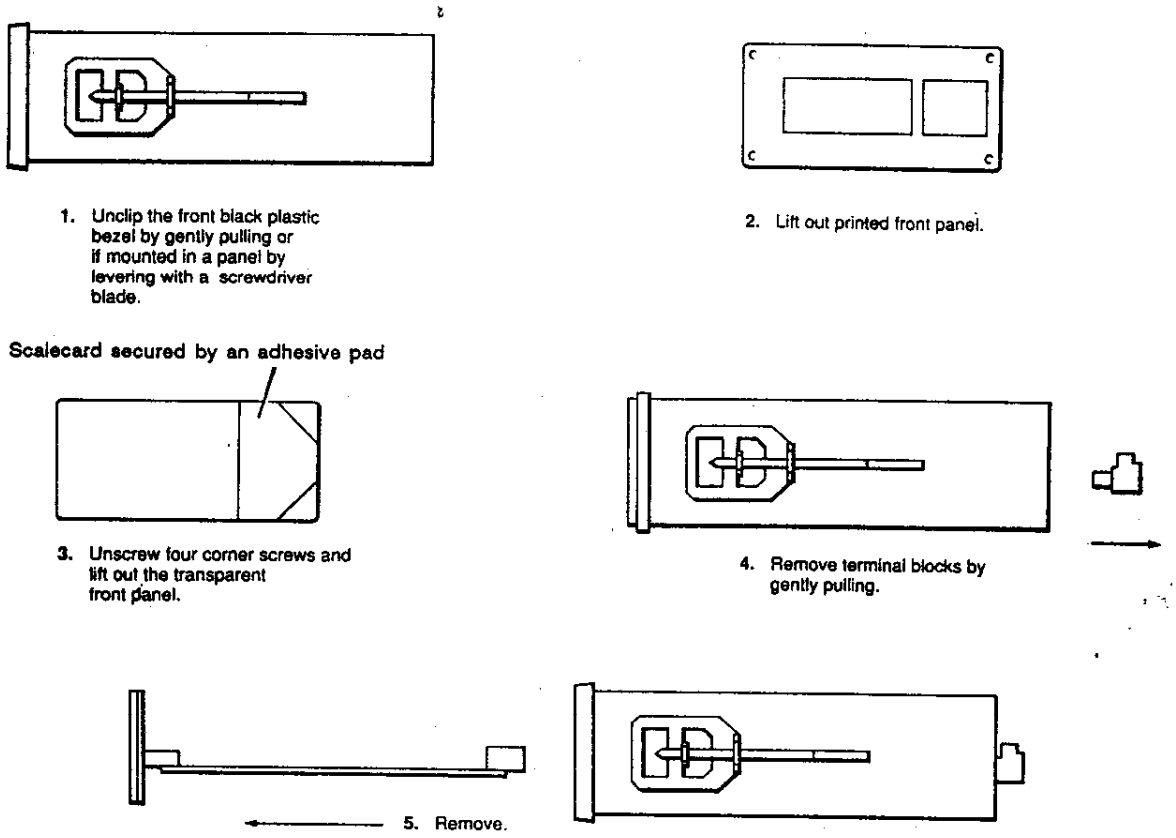


Figure 22 Simplified 'exploded' view of panel mounting totaliser

8.2 Panel Mounting Totalisers BA337B, BA338B & BA339B

All panel mounting models are conditioned by plug-in links which are located within the instrument. To obtain access to these links the totaliser must be removed from its case. This can be done with or without the instrument mounted in a panel as follows: (See Figure 22)

i Unclip the front black plastic bezel by gently levering with a screwdriver blade.
ii Lift out printed front panel.
iii Remove the four corner screws securing the transparent front panel.
iv Remove the rear terminal block by pulling gently.
v The totaliser can now be withdrawn from the front of the case.

The location of the conditioning links for all the panel mounting totalisers is shown in Figure 23.

8.3 Conditioning Links

8.3.1 Input

The input of all models can be conditioned to count pulses from:

2-wire proximity switch which complies with NAMUR standard
'high' current must be greater than 2.1mA
'low' current must be less than 1.2mA

Switch contact - voltage free
'closed' resistance must be less than 100Ω
'open' resistance must be greater than 1000Ω

Voltage
'high' voltage must be greater than 3V
'low' voltage must be less than 1V

8.3.2 Leading Zero Blanking

Leading zero blanking automatically switches off any zeros before the display count. The table below shows the effect on the display of an eight digit BA339B totaliser.

Totaliser display	Leading zero blanking
00000197	OFF
197	ON

Note: With leading zero blanking turned 'on', the display is totally blank, apart from selected decimal point, when the totaliser is reset to zero.

8.3.3 Decimal Point

The position of the displayed decimal point is defined by the position of an internal plug-in link. The decimal point may be positioned between any of the three least significant digits, as shown by 'x' in the table below. The decimal point may also be omitted if required.

BA333B, BA337B & BA338B	NxNxNxN
BA334B & BA339B	N N N N NxNxNxN

8.3.4 Counting Edge

The totaliser can be conditioned to count when the input changes from a high to a low state, or when the input changes from a low to a high state. The function of the plug-in link varies depending upon the type of input selected. See Figures 21 and 23.

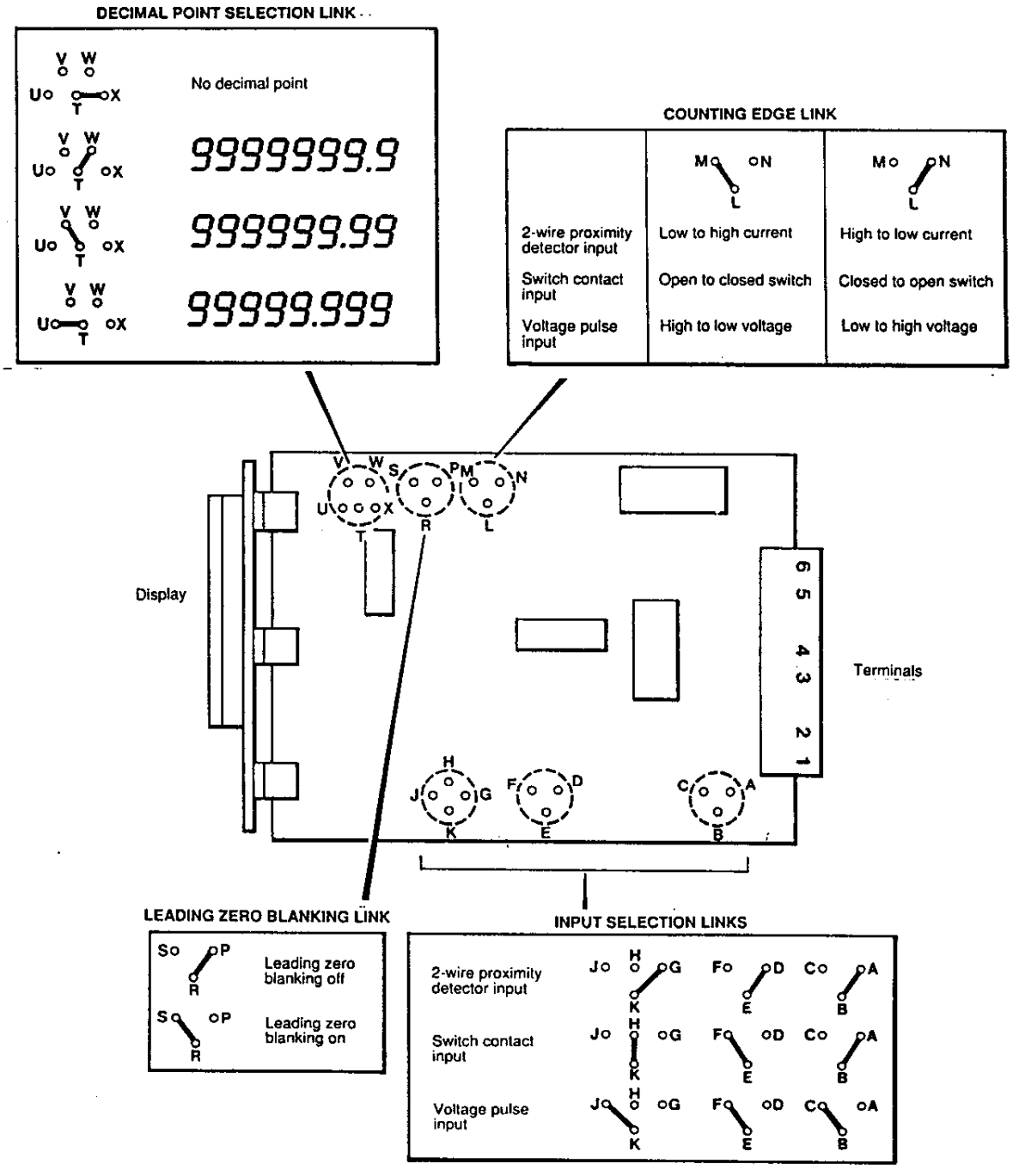


Figure 23 Location of conditioning links in panel mounting totaliser.

9 Maintenance

9.1 Fault Finding During Commissioning

If a BA330 series totaliser fails to function during commissioning, the following procedure should be used:

Symptom	Cause	Solution
No display	Incorrect wiring. No power supply on terminals 5 & 6	Correct wiring and check power supply; there should be at least 10V between terminals 5 & 6
	Totaliser reset with leading zero blanking 'on'	Totaliser will count and display when input pulses are received
Totaliser will not count	Links in totaliser set for incorrect type of pulse	Refer to Figures 21 & 23 for correct position of links
	Pulse frequency is higher than 100Hz	Refer to BEKA Associates for advice: counting speed can be increased by reducing internal filtering
	Totaliser permanently reset	Check that resistance of the circuit connected between terminals 3 & 4 is greater than 10k with reset switch open
Totaliser will not reset to zero	Resistance between terminals 3 & 4 is not low enough	Check that resistance of the circuit connected between terminals 3 & 4 is less than 1k with the reset switch closed. Also ensure that if diode return barrier is used in reset circuit it has a voltage drop of less than 1V
	Reset switch not closed for long enough	Reset switch should be closed for at least 1 second to guarantee reliable resetting to zero

9.2 Fault Finding After Commissioning

ENSURE PLANT SAFETY BEFORE STARTING MAINTENANCE

If a BA330 series totaliser fails after it has been operating correctly, the procedure shown in section 9.1 should be followed. If this does not reveal the cause of the problem, it is recommended that the totaliser is replaced with another unit.

9.3 Servicing

BA330 series totalisers have been designed so that they can be easily replaced without disturbing the field wiring. All models can be conditioned on site, so a single spare instrument can replace any totaliser which is damaged or fails. BEKA Associates, and most distributors, can despatch a replacement totaliser from stock for customers who are unable to justify purchasing a spare instrument.

BEKA Associates recommend that, except under exceptional circumstances, faulty totalisers are returned to the factory or local agent for repair. However, if this is not possible BEKA Associates will provide service information for the instrument.

9.4 Warranty

Totalisers which fail within the warranty period should be returned to BEKA Associates or the local distributor from whom the instrument was purchased. It is helpful if a brief description of the fault symptoms can be provided.

BEKA Associates Ltd. PO Box 39, Hitchin, Herts, SG5 2DD, UK. Tel: Hitchin (0462) 438301. Fax: Hitchin (0462) 453971. Printed in England.