

BOURDON TUBE OPERATED PRESSURE SWITCHES

231/2/3/4
 ISSUE H

- ▲ Precision stainless steel mechanism for arduous atmospheres and high humidity.
- ▲ Ranges available up to 600 bar (8500 psi)
- ▲ Weatherproof and Explosionproof models.
- ▲ Models for fixed switching differential, adjustable differential and HI-LO operation.
- ▲ Hermetically sealed microswitch options.
- ▲ Safety vented design as standard.



Models 231-4 bourdon tube pressure switches complement the 200 series for ranges above 75 bar (1000 psi).

The standard material for the bourdon tube is 316 stainless steel. For applications where this is unsuitable, eg Sea Water and Sour Gas (NACE MR-01-75). Monel is available on certain ranges.

HOW TO ORDER

When ordering, please state the relevant product code for each instrument, made up as follows:

Enclosure. See Table 1.	_____	<input type="checkbox"/>
Model. See Table 2.	_____	<input type="checkbox"/>
Electrical Entry. See Table 3.	_____	<input type="checkbox"/>
Material of Wetted Parts. See Table 4.	_____	<input type="checkbox"/>
Range. See Table 5.	_____	<input type="checkbox"/>
Switching Options. See Table 6.	_____	<input type="checkbox"/>
Process Connection. See Table 7.	_____	<input type="checkbox"/>
Options. See Table 8.	_____	<input type="checkbox"/>
Special Engineering. See Table 9.	_____	<input type="checkbox"/>

By consultation with our engineers. See Table 9.

ENCLOSURES

FINISH

All enclosures except Type A are finished in light grey epoxy resin paint. Special finishes to order.

INTRINSIC SAFETY

Pressure switches neither store nor generate electricity and are therefore normally usable in intrinsically safe circuits without further certification provided that the power source of the circuit is certified Exi and the installation is in accordance with the relevant codes of practice (e.g. ANSI/ISA 12.6 or BS 5345 Part 4, 1977). Because of the low voltages and currents of I.S. circuits, we recommend using gold and/or sealed contacts.

Temperatures in Table 1 refer to limitations for certified enclosures. See **TECHNICAL DATA**.

Low Voltage Directive (LVD) - 72/23/EC Amended by 93/86/EEC.

The LVD does not apply to products with enclosure codes 'H', 'K', 'M', 'N' for use in hazardous areas. Switch products with enclosure codes 'H', 'K', 'M', 'N', are covered by the Explosive Atmospheres Directive ATEX - 94/9/EC and when CE-marked will indicate compliance with this directive alone. The following directives do not apply to switch products manufactured by Delta Controls: Electromagnetic Compatibility EMC - 89/336/EEC amended by 93/68/EEC.

Machinery Safety Directive MSD - 89/392/EEC amended by 93/68/EEC.

MODELS

TABLE 1







SAFE AREA ENCLOSURES		Code
General Purpose Weatherproof The basic enclosure is pressure die-cast in zinc alloy, with weather protection not less than NEMA type 4, IP66.		W
Weatherproof For Aggressive Atmospheres Investment cast enclosure In austenitic stainless steel with weather protection not less than NEMA type 4X, IP66.		A
EXPLOSIONPROOF ENCLOSURES DIVISION 1 (ZONE 1)		
Aluminium Alloy EExd IIC T6(-60 to +40°C), T4(-60 to +80°C) Gravity die-cast enclosure In aluminium-silicon alloy. BASEEFA certified to CENELEC EN 50 014 and EN 50 018. Suitable for outdoor use, IP66. N.B. Electrical Entry must be specified since usage differs between CENELEC countries	 	H
Australian Approval Exd IIC T6 (-60 to +40°C)	SAA	
Cast Iron EExd IIC T6 (-60 to +40°C), T4(-60 to +80°C) As Code H, but sand cast in high quality grey iron.	 	K
Australian Approval Exd IIC T6 (-60 to +40°C)	SAA	
Many countries have a separate approvals system for underground mining use. For the UK we offer approval by HSE(M). Group 1 Temperature class T6, plus weather protection IP55. Cast Iron Only.		M
ExN ENCLOSURES DIVISION 2 (ZONE 2)		
Type of Protection ExN II T6 (-20 to +40°C) As Code 'W' but BASEEFA certified to BS 46883 Part 3 ExN II T6. Weatherproof to NEMA type 4/IP66. Limited switching facility (see Table 6).		N

TABLE 2

	Code
Fixed Switching Differential. See table 10A & 10D Basic model giving close, fixed switching differential using proprietary microswitch operated by high integrity stainless steel mechanism. Set point field adjustable over full range against calibrated scale. SPDT & DPDT options available	231
Adjustable Switching Differential. (Limited Span) See table 10B & 10E Achieved by special microswitch with built in adjuster SPDT only. Not available with enclosure code N.	232
Adjustable Switching Differential. (Wide Span) See table 10B & 10E Separate control of set and reset points with individual setting points on calibrated scale.	233
HI-LO Switching (Adjustable Gap) See Tables 10C & 10F Two individual set points, with independent adjustment against scale.	234

ELECTRICAL ENTRY

Adaptors are available for other popular thread sizes.

ENCLOSURES 'W' and 'N'

Standard option code 1 (22mm dia) is provided with a nylon 22/20 reducer and fibre washer suitable for a standard M20 cable gland and back nut. Option code 0 elbow adaptor is factory fitted. Adapter kits may also be provided retrospectively to fit at site if required. Ask for details.

'W' and 'N' SAFETY NOTE

If a metal cable gland is site fitted it must either be earthed locally or an earth/gland plate must be used to connect the body of the gland at the enclosure earthing point. Earth/gland plates can be provided either factory fitted or in kit form for site assembly. Ask for details.

MATERIAL OF WETTED PARTS

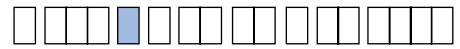
SETTING RANGES

NOTE: Range codes shown are for bar/psi units only. Code will differ for other units.

1 bar = 100kPa = 14.5 psi

For ranges and models requiring Monel wetted parts not shown in Table 5, refer to Chemical Seals in **TECHNICAL DATA.**

TABLE 3



	Code
Enclosure W & N: 22mm Dia Clearance hole.	1
Enclosure W: M20 x 1.5 elbow adaptor glass filled nylon.	0
Enclosure N: M20 x 1.5 straight adaptor. (Approved) glass filled nylon	0
Enclosures H, K & A: M20 x 1.5 ISO thread.	0
Enclosures H & K: M20 x 1.5 ISO thread, dual entry.	5
Enclosures H & K: 3/4-NPT.	3
Enclosures H & K: 3/4-NPT INT, dual entry	6
Enclosures M: Cable size and type must be specified.	*

* Code on application.

TABLE 4



	Code
Bourdon tube and process connection of 316 stainless steel welded fabrication	2
Nicekl alloy (Monel) bourdon tube and connection. * For wetted parts required to conform with Sour Gas or Sour Crude applications as laid down in NACE standard MR-01-75.*	M

* See Table 5 for availability.

TABLE 5



	Pmax	Range Bar/PSI	AVAILABILITY			Code
			MODELS			
			231	232 233 234	ST ST	
	125	0 to 100	ST ST	Monel	ST ST	U0
	1800	0 to 1500	✓	-	✓	UB
	184	0 to 160	✓	-	✓	U5
	2670	0 to 2000	✓	-	✓	UF
	287	0 to 250	✓	-	✓	V5
	4160	0 to 3500	✓	-	✓	V2
	460	0 to 400	✓	✓	✓	W6
	6670	0 to 6000	✓	✓	✓	W2
	690	0 to 600	✓	✓	✓	Y3
	10,000	0 to 8500	✓	✓	✓	YB

SWITCHING OPTIONS

TABLE 6



A much wider variety of switching options can be engineered to customers special requirements for models 231 and 234 pressure switches, including heavy DC, manual latching, pneumatic output etc. Please consult our engineers for further information.
On models 232 and 233, only the switching options specified can be supplied. * Suitable for use with ExN Enclosure (Code N).

Model 231										
UL/CSA RATING (RESISTIVE) §SEE NOTE	IEC 947-5-1/EN 60947-5-1 RATING								Contact	Code
	Designation & Utilization Category		Rated operational current I_e (A) at rated operational voltage U_e	U_i	U_{imp}	VA rating				
							Make	Break		
5 Amps @ 110/250V AC Light Duty for AC only	AC14 DC13	D300 R300	0.6/0.3A @ 120/240V AC 0.22/0.1A @ 125/250V DC	250V	0.8kV	AC DC	432 28	72 28	SPDT DPDT	00 01
5 Amps @ 110/250V AC and 2 Amps @ 30V DC General purpose precision	AC14 DC13	D300 R300	0.6/0.3A @ 120/240V AC 0.22/0.1A @ 125/250V DC	250V	0.8kV	AC DC	432 28	72 28	SPDT DPDT	02 03
1 Amp @ 125V AC and §100 mA @ 30V DC gold alloy contacts for low voltage switching	1A @ 125 VAC RESISTIVE (IEC 1058-1/EN 61058-1)								SPDT DPDT	04 05
§5 Amps @ 110/250V AC and 5 Amps @ 30V DC Environmentally sealed	AC14 DC13	D300 R300	0.6/0.3A @ 120/240V AC 0.22/0.1A @ 125/250V DC	250V	0.5kV	AC DC	432 28	72 28	SPDT* DPDT*	08 09
§1 Amp @ 30V AC and 30V DC Environmentally sealed with gold contacts	AC14	E150	0.3A @ 120V AC	125V	0.5kV	AC	216	36	SPDT* DPDT*	0G 0H
5 Amps @250V AC and 2 Amps @ 30V DC Hermetically sealed. Gold plated silver contacts	AC14 DC13	D300 R300	0.6/0.3A @ 120/240V AC 0.22/0.1A @ 125/250V DC	250V	0.5kV	AC DC	432 28	72 28	SPDT DPDT	H2 H3†, H6‡

†2 Single pole, double throw, simultaneous falling under pressure.
‡2 Single pole, double throw, simultaneous rising under pressure.

Model 232 (Cannot be supplied with enclosure Code N)										
5 Amps @ 110/250V AC Adjustable for AC only	AC14	D300	0.6/0.3A @ 120/240V AC	250V	0.8kV	AC	432	72	SPDT	0C
5 Amps @ 110/250V AC and 2 Amps @ 30V DC Adjustable	AC14 DC13	D300 R300	0.6/0.3A @ 120/240V AC 0.22/0.1A @ 125/250V DC	250V	0.8kV	AC DC	432 28	72 28	SPDT	0D

Model 233										
5 Amps @ 110/250V AC and 2 Amps @ 30V DC General purpose precision	AC14 DC13	D300 R300	0.6/0.3A @ 120/240V AC 0.22/0.1A @ 125/250V DC	250V	0.8kV	AC	432	72	SPDT	02

Model 234										
5 Amps @ 110/250V AC Light duty for AC only	AC14 DC13	D300 R300	0.6/0.3A @ 120/240V AC 0.22/0.1A @ 125/250V DC	250V	0.8kV	AC DC	432 28	72 28	SPDT	00
5 Amps @ 110/250V AC and 2 Amps @ 30V DC General purpose precision	AC14 DC13	D300 R300	0.6/0.3A @ 120/240V AC 0.22/0.1A @ 125/250V DC	250V	0.8kV	AC DC	432 28	72 28	SPDT	02
1 Amp @ 125V AC and §100 mA @ 30V DC Gold alloy contacts for low voltage switching	1A @ 125 VAC RESISTIVE (IEC 1058-1/EN 61058-1)								SPDT	04
§5 Amps @ 110/250V AC and 5 Amps @ 30V DC Environmentally sealed	AC14 DC13	D300 R300	0.6/0.3A @ 120/240V AC 0.22/0.1A @ 125/250V DC	250V	0.5kV	AC DC	432 28	72 28	SPDT*	08
§1 Amp @ 30V AC and 30V DC Environmentally sealed with gold contacts	AC14	E150	0.3A @ 120V AC	125V	0.5kV	AC	216	36	SPDT*	0G

The electrical rating is dependent on the microswitch fitted to the instrument. The electrical ratings defined by each approval that the micro switch complies with and is shown on the product nameplate, ie UL/CSA, or IEC. It should be noted that the instrument must be used within the electrical rating specified from the approval you require. This table lists the actual IEC ratings against the Designation & Utilization Category marked on the nameplates. In the absence of any verification by UL/CSA the microswitch §manufacturer's rating is stated in **italics and bold**.
If in doubt seek guidance from the factory.

NOTE: For low energy circuits e.g. 30V and up to 100mA, we recommend using gold alloy contact switches.
 U_i = rated insulation voltage: U_{imp} = rated impulse withstand voltage across contacts.

PROCESS CONNECTION

Other thread specifications and sizes are available without using adaptors.

Adaptors are available for applications where their use is permitted.

TABLE 7



	Code
Rc 1/4 (1/4 BSP tr INT) to BS21 (ISO 7/1)	A
1/4 -18NPT INT	F
1/4 -14NPT INT	H
1/4 -14NPT EXT	J

OPTIONS AND TREATMENTS

Combinations available, apply for details.

TABLE 8



	Code
Tropicalisation High humidity environment.	01
Marine and Offshore Saline atmosphere or salt spray.	02
Ammonia Process (wetted) parts and construction suitable for atmospheric ammonia.	03
Oxygen Service 2: Process (wetted) parts are cleaned for oxygen.	04
Oxygen Service 3: Process and non process parts are cleaned for use with oxygen.	05
Stainless Steel Pipe Mounting Bracket Permits local 2" pipework to be utilised for mounting the instrument.	10
Tagging - Variety of tagging methods are available	APPLY FOR DETAILS
Applies when - no option is required and selection is made from special engineering	00

SPECIAL ENGINEERING

To your individual requirements, where specified.

For your convenience, enter your special listing in spaces provided.

TABLE 9



PERFORMANCE DATA

BAR UNITS (SI)

**TABLE 10A MODELS 231
FIXED SWITCHING DIFFERENTIAL**

TABLE 10

BAR UNITS **TABLE 10A**

MODEL 231

Code	Range	SPDT Options					DPDT Options				
		00	02	04	08/0G	H2	01	03	05	09/0H	H3/H6
U0	0 to 100	1.2	2.5	1.2	2	3.6	2.4	2.4	2.4	3	3.6
U5	0 to 160	2	6	2	4	6	4	6	4	6	8
V5	0 to 250	3	9	3	10	9	6	12	6	15	12
W6	0 to 400	8	24	8	20	24	16	24	16	30	32
Y3	0 to 600	12	36	12	60	36	24	30	24	90	50

**TABLE 10B MODELS 232, 233
ADJUSTABLE SWITCHING DIFFERENTIAL**

BAR UNITS **TABLE 10B**

Code	Adjustable Range	MODEL 232				MODEL 233			
		SPDT Only							
		OC				OD			
		From		To		From		To	
U0	0 to 100	2	5	4	12	18	100		
U5	0 to 160	3.2	8	6.4	19	35	160		
V5	0 to 250	6	15	12	36	54	250		
W6	0 to 400	12	30	24	72	100	400		
Y3	0 to 600	18	45	36	108	150	600		

**TABLE 10C MODELS 234
HI-LO SWITCHING**

BAR UNITS **TABLE 10C**

MODEL 234

Code	Range	00		02		04		08/0G					
		Diff	Gap		Diff	Gap		Diff	Gap				
			Min	Max		Min	Max		Min	Max			
U0	0 to 100	1.2	11	100	3.6	13	100	1.2	11	100	6	16	100
U5	0 to 160	2	25	160	8	28	160	2	25	160	10	33	160
V5	0 to 250	3	38	250	10.5	44	250	3	38	250	15	53	250
W6	0 to 400	8	80	400	24	96	400	8	80	400	40	120	400
Y3	0 to 600	12	100	600	36	124	600	12	100	600	60	160	600

PSI UNITS

**TABLE 10D MODELS 231
FIXED SWITCHING DIFFERENTIAL**

PSI UNITS **TABLE 10D**

MODEL 231

Code	Range	SPDT Options					DPDT Options				
		00	02	04	08/0G	H2	01	03	05	09/0H	H3/H6
UB	0 to 1500	18	36	18	29	52	35	35	35	44	52
UF	0 to 2000	29	87	29	58	87	58	87	58	87	116
V2	0 to 3500	44	131	44	145	130	87	174	87	218	174
W2	0 to 6000	116	348	116	290	348	232	348	232	435	464
YB	0 to 8500	174	522	174	870	508	348	435	348	1305	725

**TABLE 10E MODELS 232, 233
ADJUSTABLE SWITCHING DIFFERENTIAL**

PSI UNITS **TABLE 10E**

Code	Adjustable Range	MODEL 232				MODEL 233			
		SPDT Only							
		OC				OD			
		From		To		From		To	
UB	0 to 1500	29	73	58	174	261	1500		
UF	0 to 2000	47	116	93	276	500	2000		
V2	0 to 3500	87	218	174	522	780	3500		
W2	0 to 6000	174	435	328	1044	1450	6000		
YB	0 to 8500	261	653	522	1566	2176	8500		

**TABLE 10F MODELS 234
HI-LO SWITCHING**

PSI UNITS **TABLE 10F**

MODEL 234

Code	Range	00		02		04		08/0G					
		Diff	Gap		Diff	Gap		Diff	Gap				
			Min	Max		Min	Max		Min	Max			
UB	0 to 1500	18	160	1500	52	189	1500	18	160	1500	87	232	1500
UF	0 to 2000	29	363	2000	116	406	2000	29	363	2000	145	480	2000
V2	0 to 3500	44	551	3500	152	638	3500	44	551	3500	218	770	3500
W2	0 to 6000	116	1160	6000	348	1393	6000	116	1160	6000	580	1740	6000
YB	0 to 8500	174	1450	8500	522	1798	8500	174	1450	8500	870	2320	8500

Due to manufacturing tolerances the figures quoted in these tables are for guidance only. Should the differential be critical for specific applications our engineers should be consulted prior to ordering.

TECHNICAL DATA

ACCURACY

Set point repeatability $\pm 1\%$ of span at 20°C ambient.

AMBIENT TEMPERATURE RANGE

All models are suitable for operating within a range of ambient temperature from -25 to +60°C (-13 to +140°F). Special build available for temperatures down to -60°C (-76°F).

MAXIMUM PROCESS TEMPERATURE

Subject to appropriate installation practice, the component parts withstand up to +120°C (+248°F). For higher temperatures, refer to **SPECIAL ENGINEERING**.

CAUTION:

Moving parts have been treated with a water repelling lubricant before leaving factory. Occasional inspection and the application of a water repelling lubricant is recommended to ensure moving parts remain free under all conditions.

WARNING: Does not apply to Oxygen Services, see Table 8.

ELECTRICAL CONNECTIONS

Terminal block

Cable entry is to a non-pinching terminal block made of a non-hygroscopic thermosetting plastic, suitable for cables up to 2.5mm²/14AWG.

Earthing/Grounding

An earthing facility is provided.

'W' and 'N' SAFETY NOTE

If a metal cable gland is site fitted it must either be earthed locally or an earth/gland plate must be used to connect the body of the gland at the enclosure earthing point. Earth/gland plates can be provided either factory fitted or in kit form for site assembly. Ask for details.

Dielectric Strength

The electrical assembly is capable of withstanding *2kV between live parts and earth/ground and 500V between open contacts.

*1.2kV for microswitch Codes H2, H3 and H6. Refer to Table 6.

Electrical Entry

Standard options are listed in Table 3. Pg, UNI and ET threads can be accommodated by adaptors. Dual entry available in some enclosures.

Pollution degree (EN 60947-5-1) -

all products are suitable for use in pollution degree 3. For extreme conditions where condensation may readily form, then sealed contacts should be used. See Table 6 codes 08/09, 0G/0H, H2/H3/H6.

Electrical Isolation - These products are not suitable for electrical isolation. Always isolate circuit separately to carry out any electrical work.

OPTIONAL EXTRAS

Chemical Seals

Chemical seals of our own or proprietary manufacture can be fitted when required.

Mounting Position/Location/Installation

Vertical as shown, **in dimensions**, taking care to avoid siting in locations that transmit excessive shock or vibration. For further advice contact our engineers.

UNIT WEIGHTS (Approx)

ENCLOSURES	
'W' and 'N'	3.1kg/5.8lb
'A'	3.9kg/8.6lb
'H'	4.6kg/10.2lb
'K'	9.4kg/20.7lb
'M'	9.9kg/21.8lb

APPROVALS

CENELEC/BASEEFA



BASEEFA certified to CENELEC EN50 014 and EN50 018. for use in Zone 1 hazardous areas.

Enclosure Codes H and K and all models.
BASEEFA No. Ex 86B 1341

BASEEFA certified to BS 4683 Part 3. For use in ZONE 2 hazardous areas.



Enclosure Code N.
BASEEFA No. Ex 77019/B

HSE (M) certified to BS 4683. For use in group 1 (Mining) applications.
Enclosure Code M
HSE No. FLP 78011

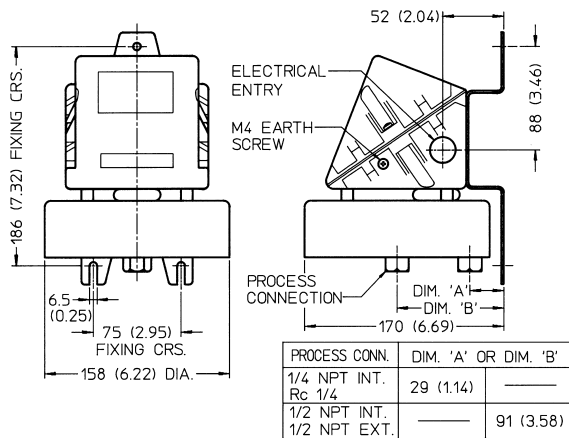


AUSTRALIAN (SAA) APPROVAL

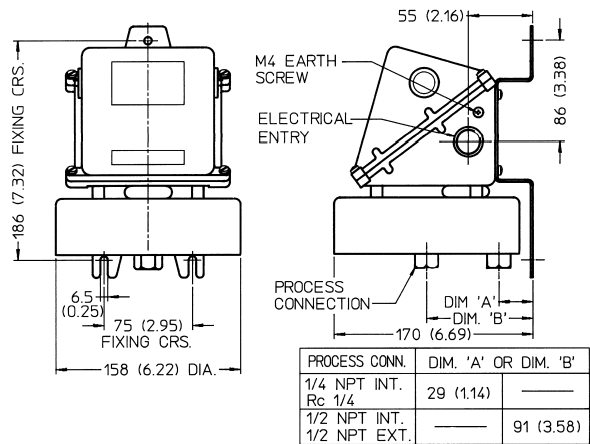
Standard Association of Australia
Explosion protection Electrical Equipment
Type of Protection Ex d IIC T6
Cert No. Aus EX1137

DIMENSIONS

'W & N' ENCLOSURES

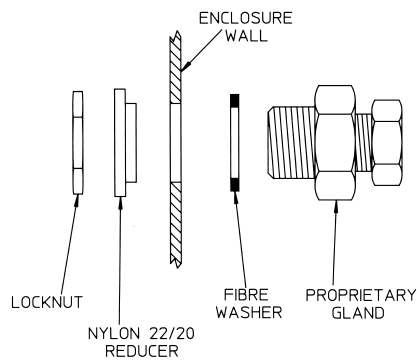


'A' ENCLOSURE

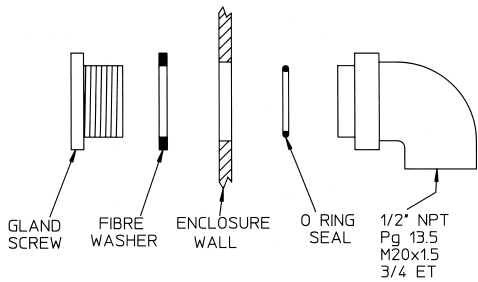


ALL DIMENSIONS mm (inches)

CABLE GLAND ASSEMBLY 'W/N'

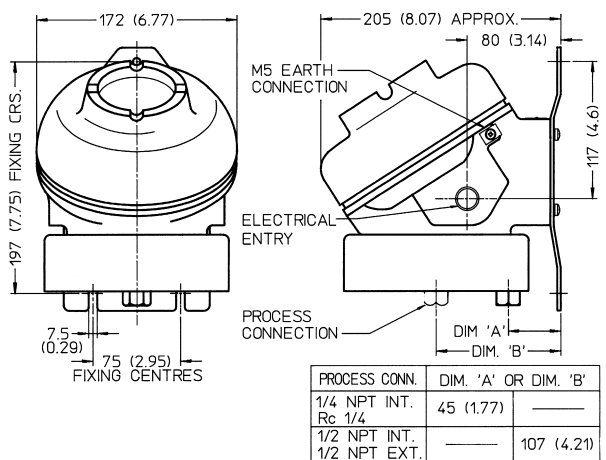


ELBOW ASSEMBLY 'N'



ALL DIMENSIONS mm (inches)

'H, K & M' ENCLOSURES



ALL DIMENSIONS mm (inches)

In the interest of development and improvement Delta Controls Ltd, reserve the right to amend, without notice, details contained in this publication. No legal liability will be accepted by Delta Controls Ltd for any errors, omissions or amendments.



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