mm H115

APPLICATION

- Intrinsically safe for Gas and Dust to:
  Class I, Zone 0 Ex ia / AEx ia
  Zone 20 Ex ia / AEx ia
  Class I, Division 1; Class II, Division 1;
  Class III, Division 1
- Non-contacting inductive technology to eliminate wear
- Travel set to customer's requirement
- Compact and self-contained
- High durability and reliability
- High accuracy and stability
- Sealing to IP68 10bar

As a leading designer and manufacturer of linear, rotary, tilt and intrinsically safe position sensors, Althen has the expertise to supply a sensor to suit a wide variety of applications. Our intrinsically safe incorporates electronics system EX08 which is CSA approved for use in potentially explosive **gas/vapour and dust** atmospheres. The H115 is a heavy-duty version of the H115 sensor with a stronger 12.6 mm push rod, recommended for applications where vibration is an issue or there is a need for longer travel sensors which are to be mounted horizontally between rod eyes. It remains an affordable, durable, high-accuracy position sensor designed for applications where the sensor would be completely submerged during normal operation. The unit is highly compact and space-efficient, being responsive along almost its entire length. Like all Althen sensors, the H115 provides a linear output proportional to travel. Each sensor is supplied with the output calibrated to the travel required by the customer, from 5 to 800 mm and with full EMC protection built in.

The sensor is very robust, the body and push rod being made of 316 stainless steel for long service life and environmental resistance. Overall performance, repeatability and stability are outstanding over a wide temperature range. The sensor is easy to install with mounting options including stainless steel M8 rod eye bearings and body clamps. The push rod can be supplied free or captive with female M8 thread, an M8 rod eye, dome end or magnetic tip. M12 and 1/2" rod eye option available. Captive push rods can be sprung loaded, in either direction, on sensors up to 300mm of travel. The H115 also offers a selection of mechanical and electrical options, environmental sealing is to IP68 10bar/IP69K.

SPECIFICATIONS

Dimensions[1] **Body diameter** **Body length (Axial version)** **Body length (Radial version)** **Push rod extension**	 35 mm calibrated travel + 168 mm calibrated travel + 189 mm calibrated travel + 7 mm, OD 12.6 mm
Independent Linearity	≤ ± 0.25% FSO @ 20°C - up to 450 mm ≤ ± 0.5% FSO @ 20°C - over 450 mm
Temperature Coefficients	< ± 0.01%/°C Gain & < ± 0.01%FS/°C Offset
Frequency Response	> 10 kHz (-3dB)
Resolution	Infinite
Noise	< 0.02% FSO
Intrinsic Safety[2]	Class I, Zone 0 Ex ia IIC T4 Ga AEx ia IIC T4 Ga Class I, Zone 20 Ex ia IIIC T135°C Da AEx ia IIIC T135°C Da Class I, Division 1, Groups A, B, C, D; T4 Class II, Division 1, Groups E, F, G, T135°C Class III Division 1; (Ta = -40°C to +80°C)

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SPECIFICATIONS (CONTINUED)

Sensor Input Parameters (connector option/s) (cable option/s)	Ui: 11.4V, Ii: 0.20A, Pi: 0.51W. Ci: 1.16µF, Li: 50µH Ci: 1.36µF, Li: 860µH with 1km max. cable
Environmental Temperature Limits (Non Icing) **Operating** **Storage**	 -40°C to +80°C -40°C to +125°C
Sealing	IP68 10bar
EMC Performance	EN 61000-6-2, EN 61000-6-3
Vibration	IEC 68-2-6: 10 g
Shock	IEC 68-2-29: 40 g
MTBF	350,000 hrs 40°C Gf
Drawing List[3] **H115-11**	 Sensor Outline

[1] *For full mechanical details see drawings H115-11*
[2] *Approval only applies to the specified ambient temperature range and atmospheric conditions in the range 0.80 to 1.10 Bar, oxygen ≤ 21%*
[3] *3D models, step or .igs format, available on request*

INTRINSICALLY SAFE EQUIPMENT

Intrinsically safe equipment is defined as “equipment which is incapable of releasing sufficient electrical or thermal energy under normal or abnormal conditions to cause ignition of a specific hazardous atmosphere mixture in its most easily ignited concentration.” CSA approved to;

Class I, Zone 0 Ex ia IIC T4 Ga AEx ia IIC T4 Ga

Class I, Zone 20 Ex ia IIIC T135°C Da AEx ia IIIC T135°C Da

Class I, Division 1, Groups A, B, C, D; T4

Class II, Division 1, Groups E, F, G, T135°C;

Class III Division 1;

(Ta = -40°C to +80°C)

Designates the sensor as belonging to; Class I, Zone 0 / Class I, Zone 20: can be used in areas with continuous, long or frequent periods of exposure to hazardous gas or dust.

Gas:

Protection class ia IIC, denotes intrinsically safe for Zones 0, 1 & 2 and IIA, IIB and IIC explosive gases.
Temperature class T4: maximum sensor surface temperature under fault conditions 135°C.

Dust:

Protection class ia IIIC, denotes intrinsically safe for Zones 20 & 21 explosive dust.
T135°C: maximum sensor surface temperature under fault conditions 135°C.

Ambient temperature range extended to -40°C to +80°C.

It is imperative Althen intrinsically safe sensors be used in conjunction with a galvanic barrier to meet the requirements of the product certification. The Althen G005 Galvanic Isolation Amplifier is purpose made for Althen IS sensors making it the perfect choice. Refer to the G005 datasheet for product specification and output configuration options.

For cable lengths exceeding 10 metres a five wire connection is recommended to eliminate errors introduced by cable resistance and associated temperature coefficients.

CSA approved sensors suitable for gas (G series) applications, are also available from Althen.

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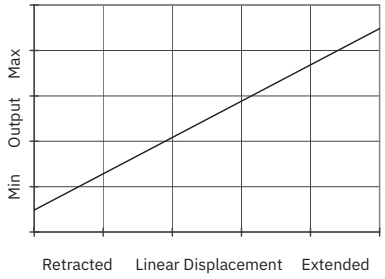
H115 .	a	b	c	d	e	f	g	h	j
	Displacement	A	Connections	Option	Option	Option	Option	Option	Z000

a Displacement		**Value**
Factory set to any length from 0-5 mm to 0-800 mm (e.g. 0- 254 mm)		**254**
b Output		
Supply V_{dc} (tolerance)	**Output**	**Code**
+5V (4.5 - 5.5V)	0.5 - 4.5V (ratiometric with supply)	**A**
Supply Current: 10mA nominal, 12mA max.		
c Connections		**Code**
Cable gland radial IP68 10bar/IP69K Pg7, 3-core cable		**Ixx**
Cable gland radial IP68 10bar/IP69K Pg7, 5-core cable		**IQxx**
Cable gland axial IP68 10bar/IP69K Pg7, 3-core cable		**Lxx**
Cable gland axial IP68 10bar/IP69K Pg7, 5-core cable		**LQxx**
Specify required cable length **'xx'** in cm. e.g. L2000 specifies axial cable gland with 20 m of cable, 50 cm supplied as standard. **Note!** maximum length supplied 15000cm.		
d Body Fittings		**Code**
None default		**blank**
M8 Rod-eye bearing radial version only		**N**
e Body Clamps		**Code**
Body Clamps 1 pair		**P**
Body Clamps 2 pairs		**P2**

f Sprung Push Rod		**Code**
Not sprung default		**blank**
Spring extend	300 mm maximum displacement and captive push rod only.	**R**
Spring retract		**S**
g Push Rod Fittings		**Code**
Female thread M8x1.25x12 deep default		**blank**
Dome end with spring extend option 'R'		**T**
M8 Rod-eye Bearing		**U**
Magnetic Tip		**WA**
h Push Rod		**Code**
Captive push rod retained default		**blank**
Non-captive push rod can depart body		**V**
j Z-code		**Code**
Calibration to suit G005 required		**Z000**
Tighter Independent Linearity; ≤± xx% FSO @20°C ≤± 0.1% 0 - 10 mm min. to 0 - 450 mm ≤± 0.25% 0 - 451 mm to 0 - 600 mm ≤± 0.5% 0 - 601 mm to 0- 800 mm max.		**Z650**
½" Rod eyes with options 'N' and/or 'U'		**Z825**
M12 Rod eyes with options 'N' and/or 'U'		**Z826**

Output Characteristic - Standard



THREE OR FIVE-WIRE MODE CONNECTION

The aim of this document is to help readers who do not understand what is meant by three or five wire modes of connection between the galvanic isolation amplifier and sensor, and the factors behind them. It is by no means an in-depth technical analysis of the subject.

Whether opting for a pre-wired Althen Intrinsically Safe sensor or one with a connector, choosing the right mode of connection and cable to suit the application requires careful consideration.

Interconnecting cables are not perfect conductors and offer resistance to current flow, the magnitude of resistance† depends on conductors resistivity, which changes with temperature, cross sectional area‡ and length. If the voltage were to be measured at both ends of a length of wire it would be found they are different, this is known as volts drop. Volts drop changes with current flow and can be calculated using Ohm's law, it should be noted that volts drop occurs in both positive and negative conductors. The effects of volts drop can be reduced by increasing the conductors cross sectional area, this does not however eliminate the effects due to temperature variation. There are instances where large cross-section cables are not practical; for example most standard industrial connectors of the type used for sensors have a maximum conductor capacity of 0.75mm², copper prices and ease of installation are other considerations.

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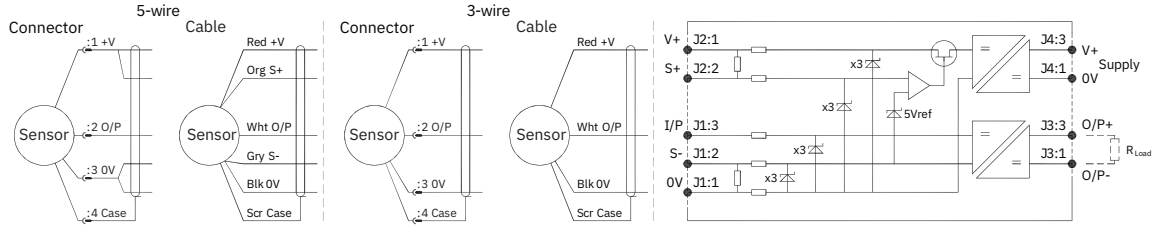
This is important because the effects of volts drop can significantly alter the perceived accuracy of the sensor which is ratiometric i.e. the output signal is directly affected by the voltage across the sensor. Changes in temperature will also be seen as gain variation in the sensor output.

Three wire mode connections are common and are suitable in most cases with short or moderate cable runs. Applications that do not require a high degree of accuracy but have cable runs, say in excess of 10m, volts drop can reduced by introducing a terminal box close to the sensor and using a larger cross-section cable for a majority of the cable run. Sensors supplied with three core cable are calibrated with the cable fitted which largely eliminates errors due to conductor resistance at room temperature however, as mentioned above, small gain errors due to temperature fluctuations should be expected.

Five wire mode connections have significant benefits as losses in the positive and negative conductors are compensated for by the galvanic isolation amplifier which can 'sense' the voltage across the sensor and dynamically adjust the output voltage so that the voltage across the sensor is correct. The effects of cable resistance and associated temperature coefficients are eliminated allowing for smaller conductors than a three wire connection for the same cable run. The amplifier can compensate for up to 15Ω per conductor with a current flow of 15mA, which is more than adequate for 150m of 0.25 mm² cable, longer lengths will require larger conductors.

For this reason Althen recommends five wire connections for cable lengths exceeding 10 metres in 0.25 mm² cable to preserve the full accuracy of the sensor.

See illustrations below for examples of connecting a sensor to the galvanic isolation amplifier.



Cable Length (metres)	Up to 150	150 - 300	300 - 450	450 - 600	600 - 900	900 - 1000
Cross Section (mm²)	0.25	0.5	0.75	1.0	1.5	2.0

The table above shows recommended conductor sizes with respect to cable length for both three and five wire connections, based on copper conductors. Three wire connections will introduce a gain reduction of 5% and a ±1% temperature dependence of gain over the range -40°C to +80°C for the cable temperature. (i.e. about –150 ppm/°C for the maximum lengths shown and less pro rata for shorter lengths.)

It should be noted that the maximum cable length, as specified in the sensor certification, takes **precedence** and **must not** be exceeded.

Althen sensors are supplied with three core 0.25 mm² cable as standard, however five core 0.25 mm² cable can be supplied on request. The galvanic isolation amplifier is available as;

G005-*** for 'G' and 'H' prefix sensors

X005-*** for 'E', 'M' and 'X' prefix sensors

† R = ρL/A ρ is the resistivity of the conductor (Ωm) L is the length of conductor (m) A is the conductor cross-sectional area (m²).

‡It is presumed that direct current flow is uniform across the cross-section of the wire, the galvanic isolation amplifier and sensor are a dc system.

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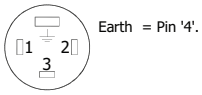
INSTALLATION INFORMATION

CSA Qualified Intrinsically Safe Device Certificate number 13.2588225	Ex ia IIC T4 Ga Class I, Zone 0, AEx ia IIC T4 Ga Class I, Division 1, Groups A, B, C, D; T4 Ex ia IIIC T135°C Da Zone 20, AEx ia T135°C Da; Class II, Division 1, Groups E, F, G, T135°C; Class III Division 1; (Ta = -40°C to +80°C)

Electronics Version	Output Description	Supply Voltage: V_s (tolerance)	Load resistance
EX08	0.5 - 4.5V (ratiometric with supply)	+5V (4.5 - 5.5V) 10mA Nom.	5kΩ min

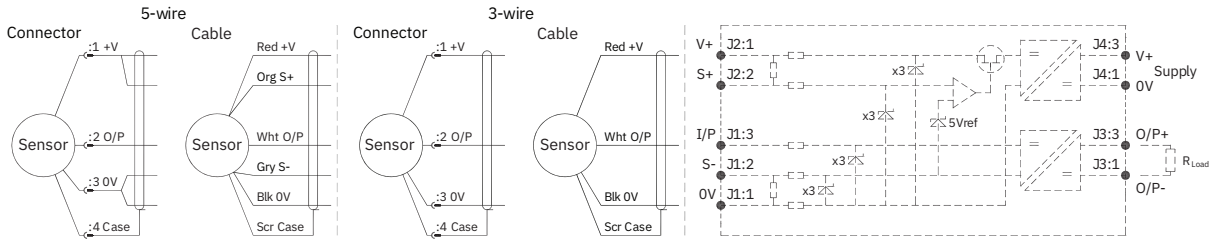
Connector Pin Layout:

DIN 43650 C



Earth = Pin '4'.

IEC 60947-5-2



PUTTING INTO SERVICE

This sensor must only be installed, operated and maintained by competent and suitably trained personnel. The installation and maintenance must be carried out in accordance with all appropriate international, national and local standard codes of practice and site regulations for intrinsically safe apparatus. The use, installation, or maintenance of the sensor, in any other way than intended, may impair its operation or the protection it provides.

The sensor must be used with a galvanic isolation barrier designed to supply the sensor with a nominal 5V and to transmit the sensor output to a safe area. The barrier parameters must not exceed:-

Ui = 11.4V	**Ii = 0.20A**	**Pi = 0.51W**
Ci = 1.36µF*	**Li = 860µH***	(with maximum length integral cable)
Ci = 1.16µF	**Li = 50µH**	(without integral cable)

*Figures for 1km cable where: Ci = 200pF/m & Li = 810nH/m

Cable characteristics must not exceed:-

Capacitance: ≤ 200 pF/m or max. total of: 200 nF

Inductance: ≤ 810 nH/m or max. total of: 810 µH

Approval only applies to specified ambient temperature range and atmospheric conditions in the range: 0.80 to 1.10 Bar, oxygen ≤ 21%.

Markings and safety parameter information for product marked EX06, see annex 1.

SPECIAL CONDITION FOR SAFE USE

The apparatus does not meet the 500 V r.m.s dielectric strength test between circuit and frame, in accordance with clause 6.3.13 of IEC 60079-11:2011. This must be taken into consideration on installation.

When using a Sensor that has an integral cable in a dust application, the free end of the cable shall be appropriately terminated for the zone of use.

Under certain extreme circumstances, the non-metallic and isolated metal parts incorporated in the enclosure of this equipment may generate an ignition-capable level of electrostatic charge. Therefore the equipment shall not be installed in a location where the external conditions are conducive to the build-up of electrostatic charge on such surfaces. This is particularly important if the equipment is installed in a zone 0 location. In addition, the equipment shall only be cleaned with a damp cloth.

Use: The sensor is designed to measure Linear or rotary displacement and provide a proportional analogue output signal.

Assembly and Dismantling:

The unit is not to be serviced or dismantled and re-assembled by the user.

WARNING: Substitution of components may impair intrinsic safety.

AVERTISSEMENT: La substitution de composants peut altérer la sécurité intrinsèque.

Maintenance:

Accumulated dust layer must not exceed a depth of 200mm.

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ENVIRONMENTAL CONDITIONS

Pollution degree: 2

Installation category: I

Humidity 80% to temperatures up to 31 °C decreasing linearly to 50% rH at 40 °C; /// max 80% rh, non condensing.

The sensor has been assessed for indoor use only. Where used outdoors suitable environmental protection **must** be provided.

Annex 1 - Markings and Entity Parameters for product with EX06 electronics system.

Class I, Zone 0

Ex ia IIC T4 (Ta= -40 to 80°C)

AEx ia IIC T4 (Ta= -40 to 80°C)

AEx iaD IIIC T93°C (Ta= -40 to 80°C)

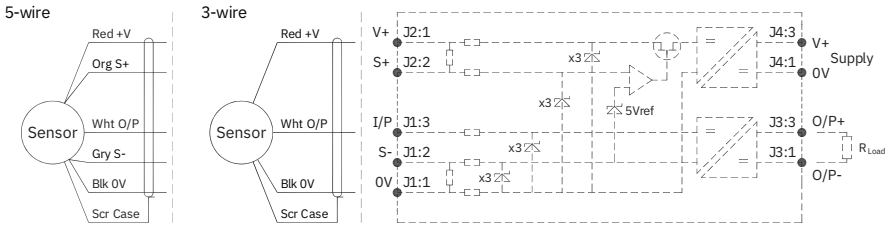
Ui = 11.4V	**Ii = 0.20A**	**Pi = 0.51W**
Ci = 1.36µF*	**Li = 710µH***	(with maximum length integral cable)
Ci = 1.16µF	**Li = 50µH**	(without integral cable)

*Figures for 1km cable where: Ci = 200pF/m & Li = 660nH/m

Cable characteristics must not exceed:-

Capacitance: ≤ 200 pF/m or max. total of: 200 nF

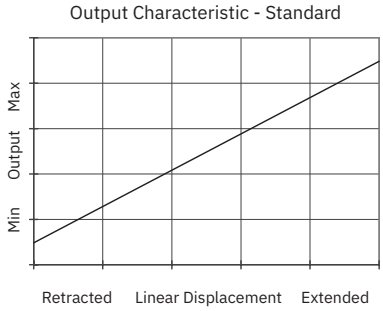
Inductance: ≤ 660 nH/m or max. total of: 660 µH



N.b. the free end of the cable must be appropriately terminated. Where the free end is to be terminated in a submerged position adequate sealing must be provided to protect connections.

OUTPUT CHARACTERISTIC

Target is extended 7 mm from end of body at start of normal travel. The output increases as the target extends from the sensor body, the calibrated stroke is between 5 mm and 800 mm.



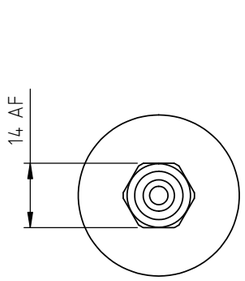
MECHANICAL MOUNTING

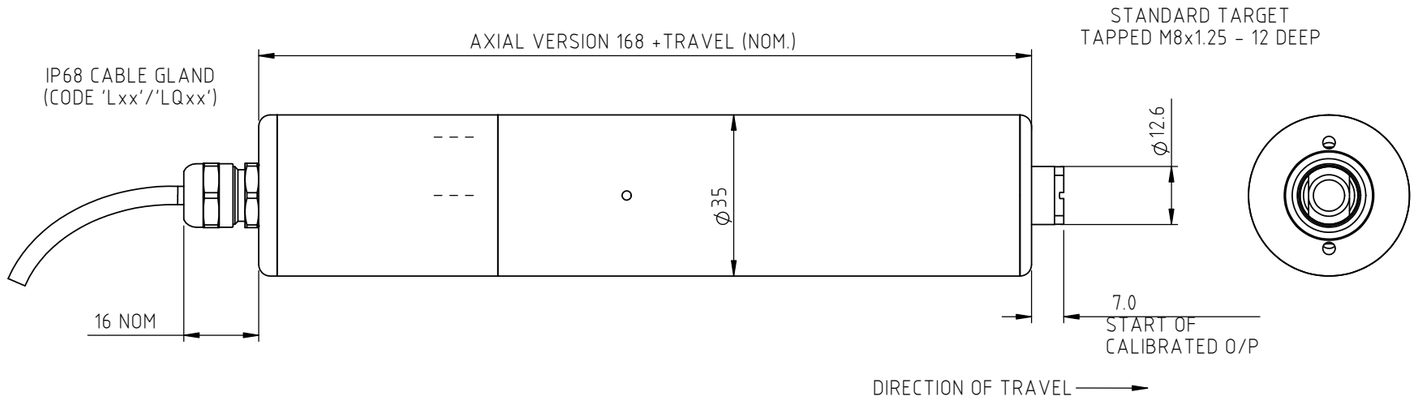
Depending on options; Body can be mounted by rod eye or by clamping the sensor body - body clamps are available, if not already ordered. Target by M8x1.25 female thread, rod eye or magnetic tip. It is assumed that the sensor and target mounting points share a common earth.

INCORRECT CONNECTION PROTECTION LEVELS

A	**Not protected** – the sensor is **not** protected against either reverse polarity or over-voltage. The risk of damage should be minimal where the supply current is limited to less than 50mA.

NOTE. ROD-EYE ORIENTATION NOT GUARANTEED





ELECTRICAL OPTIONS/ SPECIFICATIONS

OUTPUT	SUPPLY (NOM)
'A' 0.5 - 4.5V RATIOMETRIC	5V

SUPPLY CURRENT 12mA TYP. 20mA MAX.

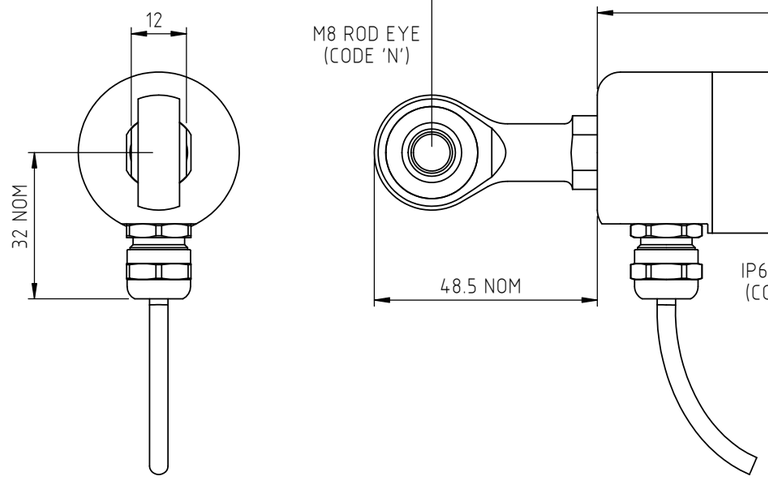
CONNECTIONS:	CABLE	
	3-CORE	5-CORE
+Ve	RED	RED
+SENSE (5-WIRE ONLY)	-	ORANGE
0V	BLACK	BLACK
-SENSE (5-WIRE ONLY)	-	GRAY
OUTPUT	WHITE	BLUE
BODY	SCREEN	SCREEN

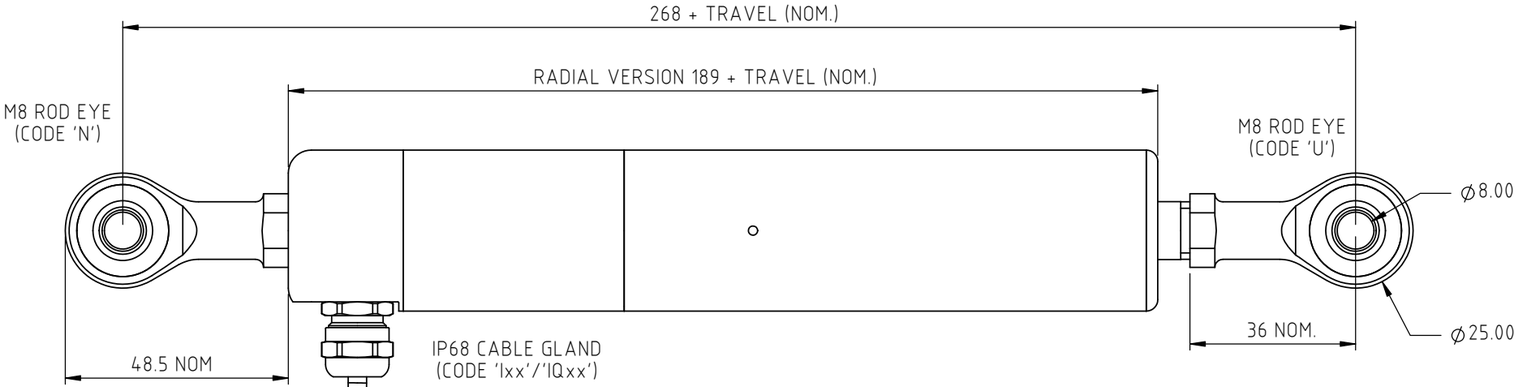
CABLE; 0.2mm², O/A SCREEN, PUR JACKET, SUPPLIED WITH 50cm OR REQUIRED LENGTH IN cm (15000cm MAX).
STANDARD 3-CORE: BLACK Ø4mm JACKET e.g. L50
OPTIONAL 5-CORE: BLUE Ø4.6mm JACKET e.g. LQ50

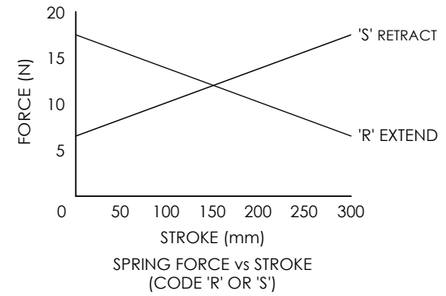
RANGE OF DISPLACEMENT FROM 0-5mm TO 0-800mm e.g. 76.
BODY MATERIAL:- STAINLESS STEEL 316.

FURTHER OPTIONS:
BODY CLAMP CODE 'P'
TWO BODY CLAMPS CODE 'P2'
CLAMP CONSISTS OF 2 PARTS AND
REQUIRES 2 OFF M6x55 (MIN.) CAPHEAD SCREWS.

SPRUNG PUSH-ROD, ≤300mm:
EXTENDED POSITION CODE 'R'. RETRACTED CODE 'S'
PUSH-ROD FREE CODE 'V' - NOT AVAILABLE WITH CODES 'R' OR 'S'

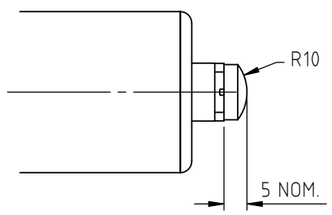




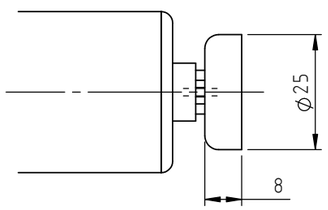


SPRING FORCE vs STROKE
(CODE 'R' OR 'S')

DOME END (CODE 'T')
NOTE: WITH CODE 'R'



MAGNETIC TIP
(CODE 'WA')



NOTE:- READ INSTALLATION SHEET H000-19
FOR FULL INSTRUCTIONS FOR USE.

CSA APPROVED TO
Class I Zone 0
Ex/AEx ia IIC T4 (Ta= -40 to 80°C)
AEx ia D IIIC T93°C(Ta= -40 to 80°C)
Ui 11.4V, Ii 0.2A, Pi 0.51W

APPROVED FOR USE IN CONJUNCTION
WITH A GALVANICALLY ISOLATED BARRIER.

NOTE: APPROVAL ONLY APPLIES AT NORMAL
ATMOSPHERIC PRESSURE!

MAXIMUM WORKING DEPTH: 100m (328 ft).
WHERE THE FREE END OF THE CABLE IS TO BE TERMINATED IN A SUBMERGED POSITION, ADEQUATE SEALING MUST BE PROVIDED TO PROTECT CONNECTIONS.

REV	CHANGE HISTORY	DR'WN	DATE	CHK'D
F	RAN1311MAG TIP OPTION 'WA' ADDED, RAN1425 AMEND MARKINGS	ASC	02/06/2023	ASC

THE PUSH-ROD RETRACTS 4mm NOM. BACK FROM THE START OF CALIBRATED TRAVEL.
THE PUSH-ROD EXTENDS 8mm NOM. BEYOND THE END OF CALIBRATED TRAVEL.
SPRUNG OPTIONS:- CODE 'R': 1mm, CODE 'S': 2mm.
CODE 'V': PUSH-ROD NOT RETAINED.

APPROVED BY	REV		
RDM	F		X ±0.4 X.X ±0.2 X.XX ±0.1 DIMS mm

DESCRIPTION
H115 INTRINSICALLY SAFE
RUGGED SUBMERSIBLE STAND ALONE
LINEAR POSITION SENSOR

SCALE	DRAWING NUMBER
3:4	H115-11
A3	SHEET 1 OF 1