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- ▶ [Reed Switch/Go Switch](#)
- ▶ [Magnum Silver Bullet](#) Linear Valve Position Sensor
- ▶ [Transmitters](#) RS/CS Position Transmitter
- ▶ [Transmitters](#) Spectrum DT Position Transmitter

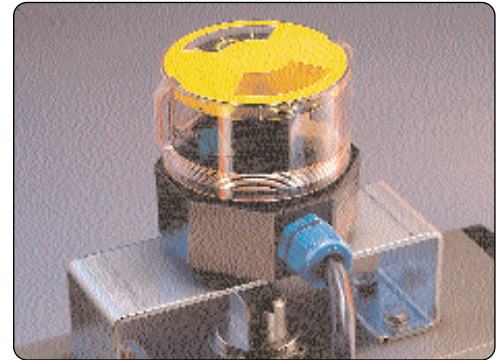
- ▶ [NEMA Enclosure Standards](#)
- ▶ [Area Classifications](#)
- ▶ [European Enclosure Standards](#)
- ▶ [Intrinsically Safe Definitions & Standards](#)
- ▶ [Intrinsic Safety Principles](#)

Valve Position Monitors

Meeting Harmonized European Standards

EC2000

The new EC2000 is a highly corrosion resistant CENELEC approved IP66 valve position monitor having the capability to house a wide range of P+F sensors, including the advanced Kriterium®. The Kriterium proximity sensor, a joint design effort between Pepperl+Fuchs and Westlock meets all requirements of the DIN19234 (NAMUR) standard and carries approval certifications from PTB, CENELEC, FM and CSA. In addition, the EC2000 is also available with mechanical Micro Switches for high current or simple apparatus applications.



AccuTrak® 2200

The explosionproof AccuTrak 2200 meets EExd IIB T6 to CENELEC EN50014/50018 for use in Group IIA and IIB, Zone 1 & 2 Flammable Atmospheres (CENELEC Certified).



AccuTrak® 2600

The Westlock Series 2600 is specifically engineered to meet all hazardous area Groups and Zones. Certified to CENELEC EN50014/50018, for EExd IIC T6 areas, the Series 2600 has the flexibility to satisfy an extensive range of diverse requirements.



AccuTrak® 3400

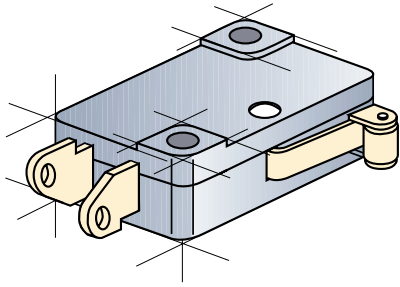
The Westlock 3400 Series is the first of its kind to be listed and certified to CENELEC EN50014, EN 50019, EN50028 for use in all gas groups Zone 1 & 2 flammable atmospheres.

A Highly engineered valve position monitor, junction housing and optional prewired, integrally mounted solenoid valve. IP67 and flammable atmospheres rated, the 3400 series eliminates the need for expensive intrinsically safe barriers and independent junction boxes by combining CENELEC approved methods (encapsulation and increased safety) to create a single, integrated device.



Micro Switch V3

Mechanical (Simple Apparatus)



Technical Data

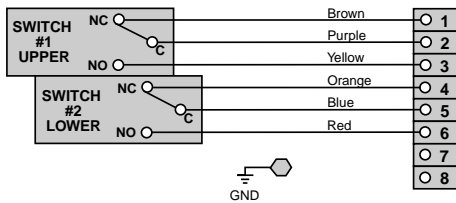
Operating Force	150 Gram Max
Release Force	15 Gram Min.
Differential Travel	.05 - .25 mm.
Overtravel	1 mm.

Electrical Rating

Contact Arrangement	SPDT (Form C) (Normally Open)
	15 amps/125/250 VAC
	10 amps/24 VDC
	0.5 amps/125 VDC
	0.25 amps/250 VDC

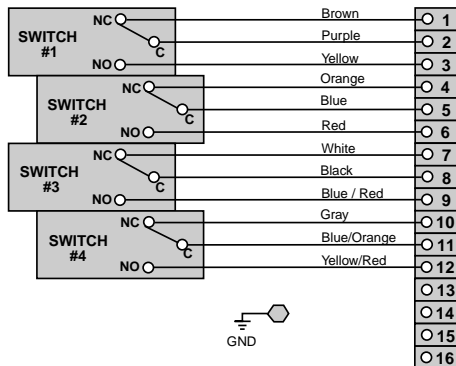
2 - SPDT Mechanical Switches

with 8 Point Terminal Strip



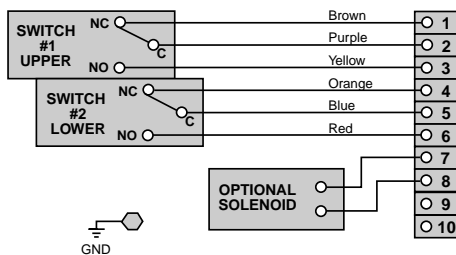
4 - SPDT Mechanical Switches

with 16 Point Terminal Strip

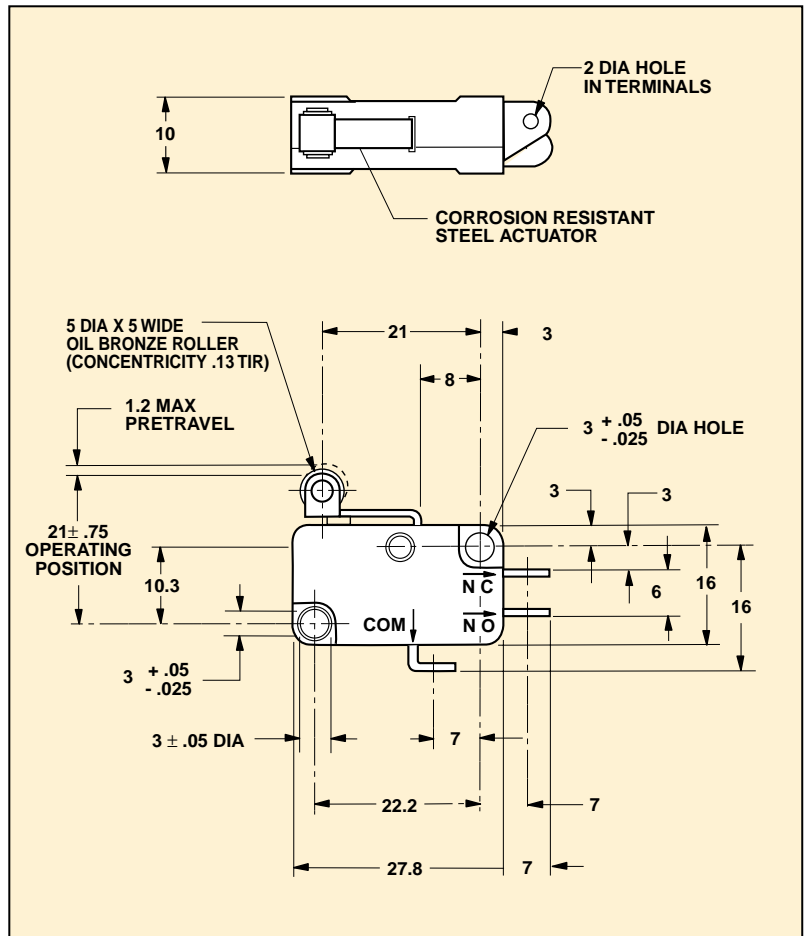


2 - SPDT Mechanical Switches

with Solenoid & 10 Point Terminal Strip



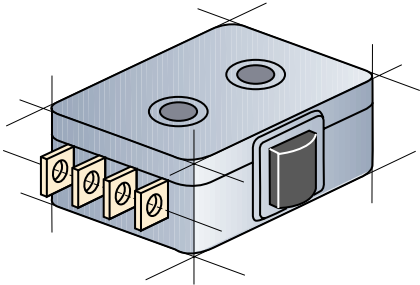
DIMENSIONS (mm)



Westlock reserves the right to change product designs and specifications without notice, and is not responsible for errors and omissions.

DPDT Switch (Licon)

Mechanical



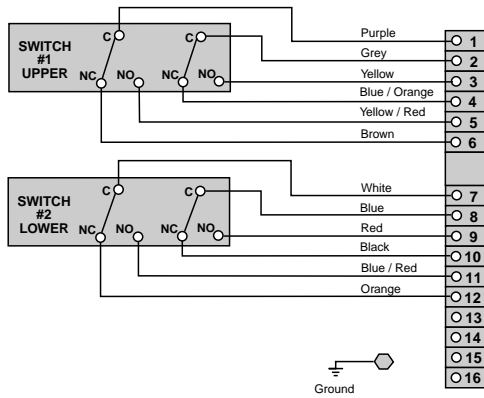
Technical Data

Contacts	Silver Plated
Approvals	UL, CSA

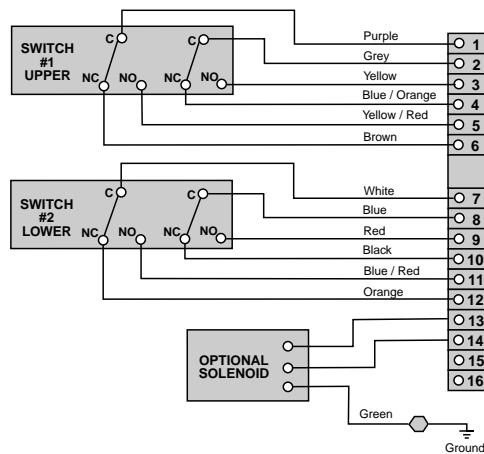
Electrical Rating

Contact Arrangement	DPDT (Form ZZ)
	10 amps/125/250 VAC
	10 amps/RES 28 VDC wiping action
	For inductive Load: 6 amps/120 VAC
	0.2 amps/125 VDC

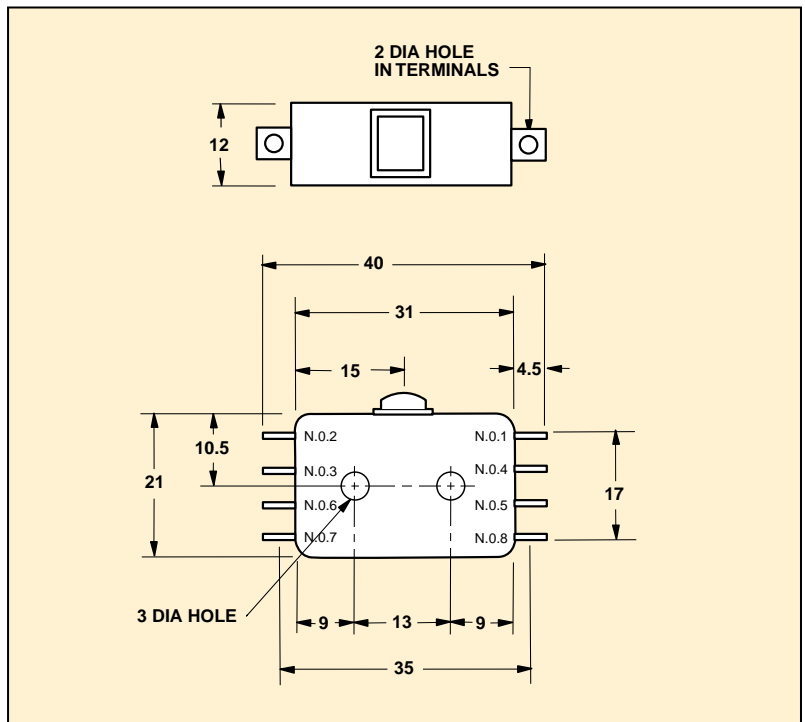
2 - DPDT Mechanical Switches with 16 Point Terminal Strip



2 - DPDT Mechanical Switches with Solenoid & 16 Point Terminal Strip

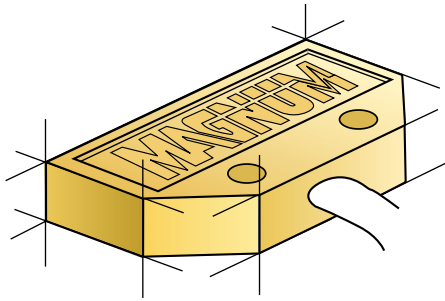


DIMENSIONS (mm)



Magnum® XT-90

Hermetically Sealed Proximity Sensor (Simple Apparatus)



Valox® Housing

Tungsten Contacts

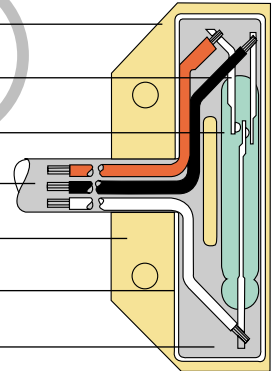
Hermetic Seal (Glass)

3 Conductor PVC Insul.

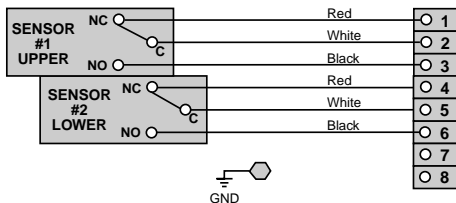
Acid/Alkali Resistant

Ultrasonic Weld

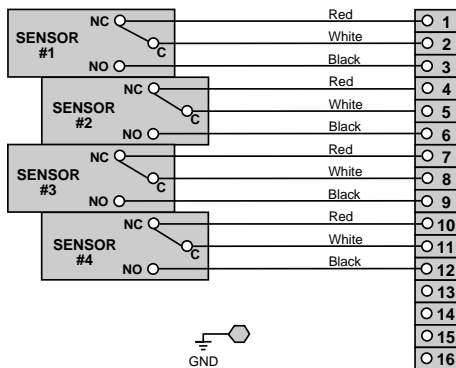
Epoxy Resin



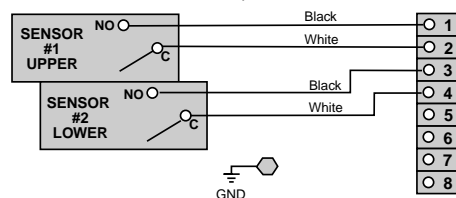
2 - SPDT Magnum Sensors with 8 Point Terminal Strip



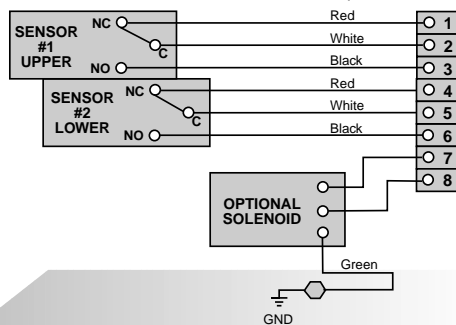
4 - SPDT Magnum Sensors with 16 Point Terminal Strip



2 - SPST Magnum Sensors with 8 Point Terminal Strip



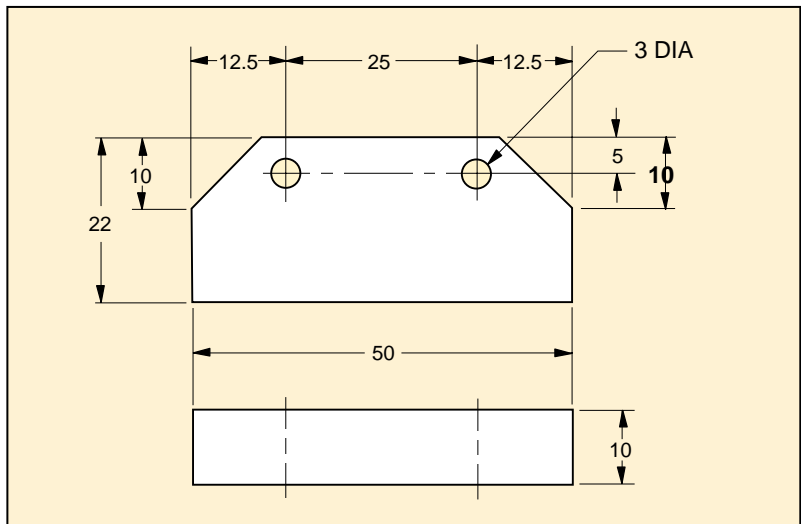
2 - SPDT Magnum Sensors with Solenoid & 8 Point Terminal Strip



Technical Data

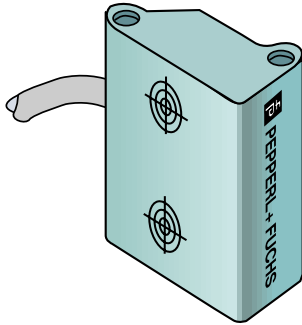
Contact Arrangement	SPDT, Form C (Normally Open)
Contacts	Pure Tungsten
Operating Time	3.0 m Sec.
Initial Contact Resistance	.50 ohms (Max)
Seal	Hermetic
Housing (Flame Retardant)	High Impact Valox®
Approvals	UL, CSA
Temperature Range	-40°F to +185°F
Operational Life	600,000 Cycles (full rated load)
Repeatability	.125 mm.
Warranty	5 Years
Protection Class	IP 67
Electrical Rating	
Contact Arrangement	SPDT Form C (Normally Open)
	3 amps/120 VAC, 1.5 amps/240 VAC
	2 amps/24 VDC

DIMENSIONS (mm)



P+F Kriterion™ Sensor

Inductive Proximity Sensor (Intrinsically Safe)



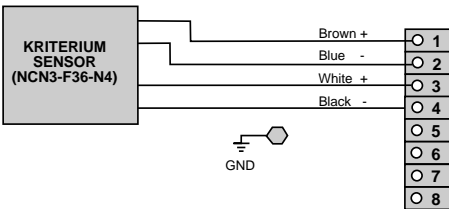
This dual sensor is designed to meet the parameters for the V3 style miniature electro-mechanical switches with button-type plunger. With the same mounting dimensions it is a viable alternative to mechanical switches.

This sensor is available in NAMUR output which makes it ideal for use on control valves, actuators or other equipment which may be located in potentially explosive atmospheres and, therefore, needs to be Intrinsically Safe.

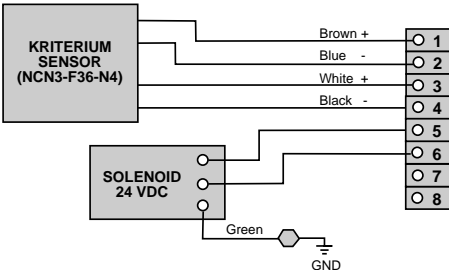
Technical Data

Nominal Sensing Range	3mm
Hysteresis	Approx. 5%
Repeatability	≤ 0.01mm
Switching Frequency	1.5 KHz
Nominal Input Voltage	8 VDC
Input Voltage Range	5 - 25 VDC
Current Consumption/ Output	Cam Trigger Present ≤ 1 mA Cam Trigger Absent ≥ 3 mA
Operating Temp. Range	-25°C to 100°C
Protection Class	IP68
Shock	≤ 30g, T ≤ 11ms
Vibration	f ≤ 55 Hz, @ 1mm Amplitude
Applied Standard	DIN 19234 (NAMUR)
Approvals	FM, CE, PTB
Connection Method	Cable, PVC Blue, 4 Conductor, 254 mm (10 inch) Black, Brown, Blue, White

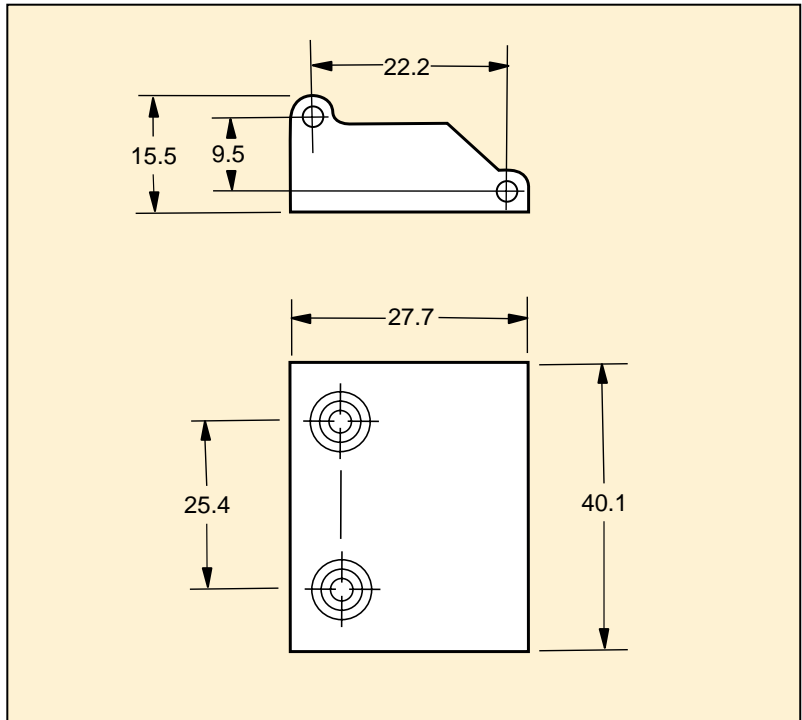
P+F Kriterion Sensors with 6 Point Terminal Strip



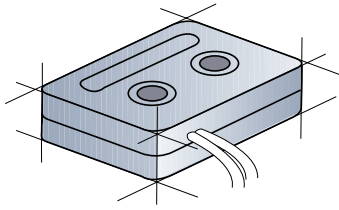
P+F Kriterion Sensors with 24 VDC Solenoid & 6 Point Terminal Strip



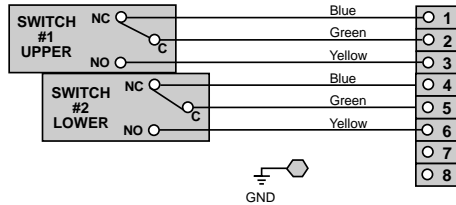
DIMENSIONS (mm)



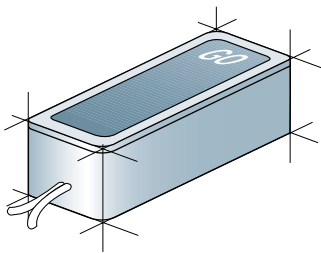
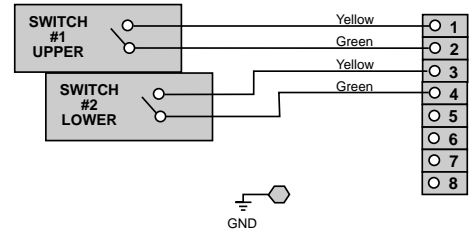
Reed Switch /Go® Switch



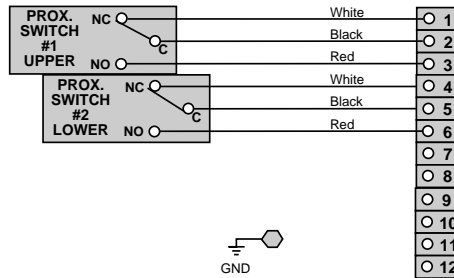
2 - SPDT Reed Proximity Switches
with 8 Point Terminal Strip



2 - SPST Reed Proximity Switches
with 8 Point Terminal Strip



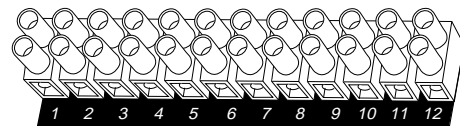
2 - SPDT GO Switches
with 8 Point Terminal Strip



Terminal Block

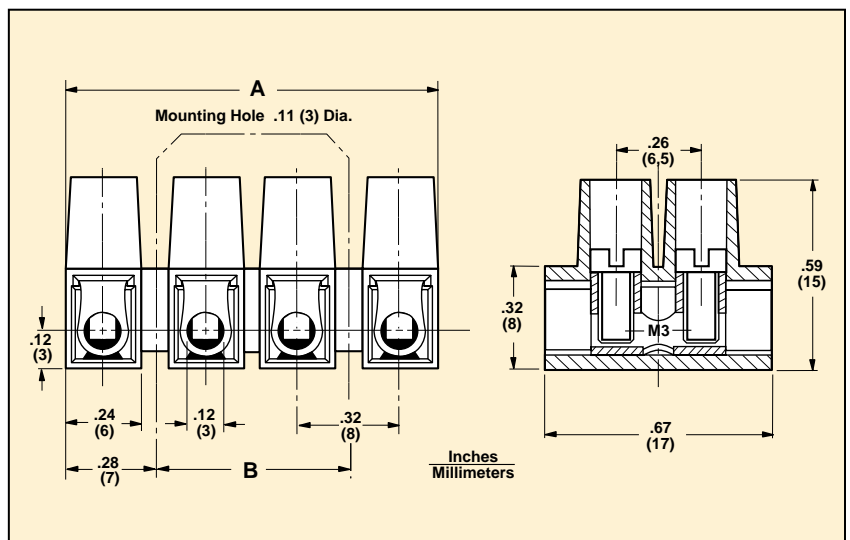
Tublar, Double Screw Terminal Block

Current Rating: 30 Amps
Wire Range: 12-26 AWG
Approvals: UL, CSA, VDE



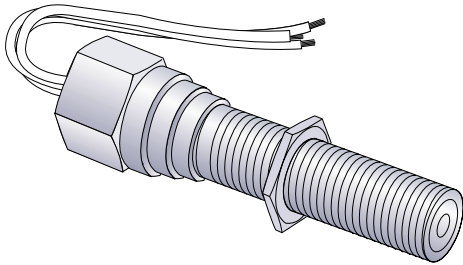
DIMENSIONS (inches/mm)

Number of Circuits	DIMENSIONS			
	A		B	
	In.	mm.	In.	mm.
01	.24	6	-	-
02	.55	14	-	-
03	.87	22	.31	8
04	1.18	30	.63	16
05	1.50	38	.94	24
06	1.81	46	1.26	32
07	2.13	54	1.57	40
08	2.44	62	1.89	48
09	2.76	70	2.20	58
10	3.07	78	2.52	64
11	3.39	86	2.83	72
12	3.70	94	3.15	80

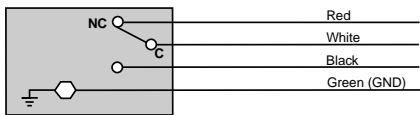


Magnum® Silver Bullet™

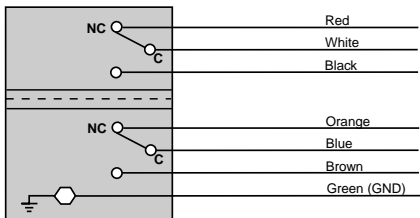
Linear Valve Position Sensor



1 - SPDT Silver Bullet Sensor



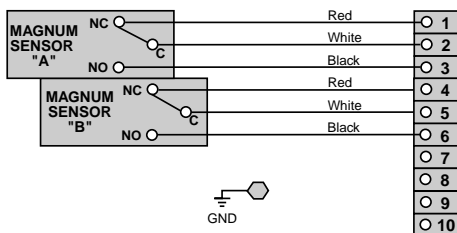
1 - DPDT Silver Bullet Sensor



Standard 316 Silver Bullet sensors are supplied with 18" leads 18 AWG conductors (stranded, tinned copper in PVC insulation) in gray PVC jacket.

Module³

with 10 Point Terminal Strip

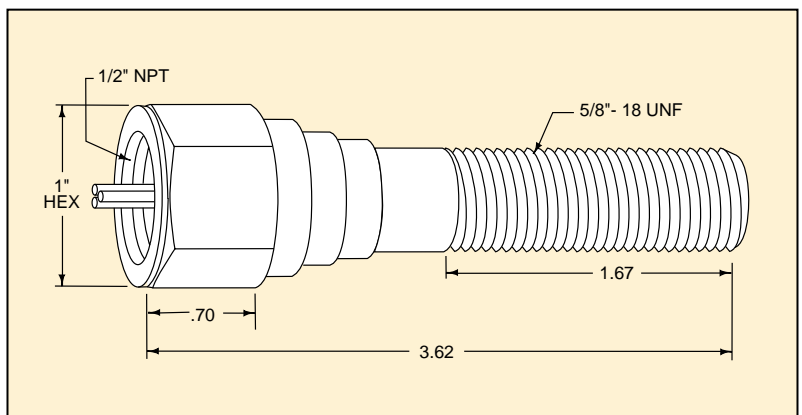


The Silver Bullet, supported by UL and CSA Hazardous Location, Division 1 & 2 certification, isolates critical interior contact areas from moisture and corrosion intrusion. Housed in a 316 stainless jacket, the highly corrosion resistant tungsten contacts are hermetically sealed in an inert atmosphere, then encapsulated in a plastic coating to cushion the sensor in case of shock and vibration and then re-encapsulated in a premium grade polymer impervious to moisture, chemicals and solvents.

Technical Data

Hermetically Sealed:	corrosion-resistant / cost-effective
High Current:	3 amps/120VAC; 2amps/24VDC
Full Metal Jacket:	316 stainless steel
Agency Certification:	UL, CSA, NEMA 4, 4X, 7, 9 Class I, Groups A, B, C, D; Class II, Groups E, F, G; Div. 1 & 2
Repeatability:	.005 in.
Hysteresis:	.040 in.
Trigger:	Ferromagnetic (stainless steel encapsulated)
Operational Life:	600,000 cycles (full rated load)

DIMENSIONS (inches)



Transmitters

RS/CS Position Transmitter

Description

The all new analog current transmitter features the latest in solid state transmitter design. A field proven design sends a 4-20mA output signal to any 2 wire indicating device. The high performance electronic circuit functions with one of the lowest operating voltages in the industry: 5 volts DC with a maximum load resistance of 1650 ohms at 38 volts DC.

Non-interacting zero and span potentiometers easily adjust the desired settings. In most cases, one pass of the setup procedure is all that is required. Reversal of a single connector changes potentiometer direction.

The printed circuit boards small physical size allows it to be utilized in various enclosures. Standard printed circuit boards offer fuse and transient protection for the transmitter and low current proximity sensors. The printed circuit board has a conformal coating which resists harsh environments.

User Design Flexibility

The Westlock Dual Display Monitor allows a user the flexibility to design a valve monitoring system around processing requirements as the need for additional information is required. The Full Range AccuTrak offers design and operating personnel the following distinct advantages.

- 0-100% readout of valve travel is continuously monitored by an analog output signal. By combining an analog current output signal with two limit switches, the AccuTrak now offers complete travel range display, accuracy and speed of response. Additionally, a 1000 ohm resistive analog output, proportional to valve position, can be provided for continuous remote monitoring, trend analysis, or computer interface.

- Limit switches for positive end position monitoring of valve travel.

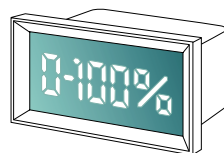
- Local mechanical display of valve position throughout the full range of travel.

4-20 mA Transmitter

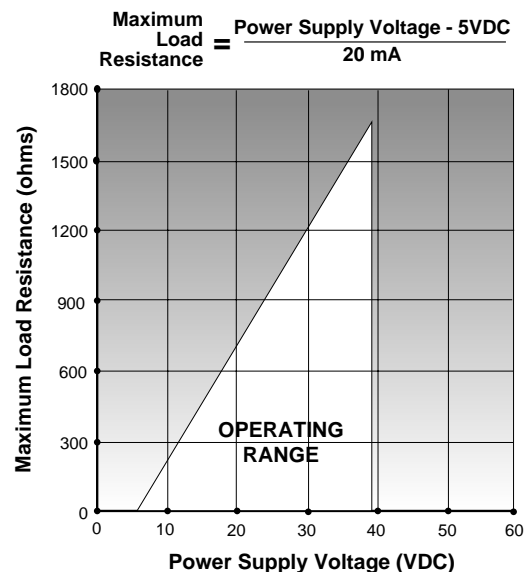
- Precision analog position transmitter.
- Operates with any voltage from 5 to 38 volts DC.
- Reverse polarity protected.
- Transient protected.
- Easy set up, non-interactive adjustment.
- CW and CCW rotation easily accommodated.
- Accommodates long cable runs and multiple receivers.
- Available with proximity sensors or mechanical switches.

CS POSITION TRANSMITTER

Power Supply Range:	5 volts DC to 38 volts DC
Operating Temperature Range:	-24°C to 85°C
Recommended Power Supply:	24 volts DC
Output Signal Range:	4 to 20 milliamperes DC
Load Impedance:	0 to 950 ohms at 24 volts DC
Output Current Limit:	55 milliamperes DC
Ambient Temperature:	For a 100°C change in ambient temperature. The maximum zero shift is plus or minus .3%, and the maximum span shift is plus or minus .4% of span.
Maximum Rotation:	95°
Minimum Rotation:	45°
Linearity:	Plus or minus 1.0%
Hysteresis:	.55% of full scale
Repeatability:	Plus or minus .3% of full scale
Power Supply:	Output signal changes .018% when the supply voltage is varied between 5 and 38 volts DC.

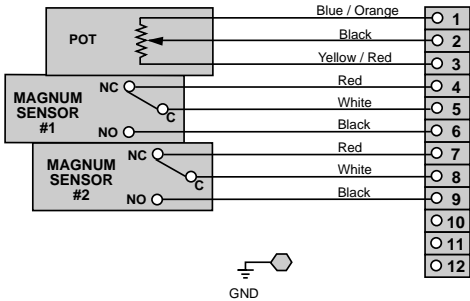


The RS and CS options monitor valves throughout a 0-100% range. At full open or closed, switches will confirm end position limits.



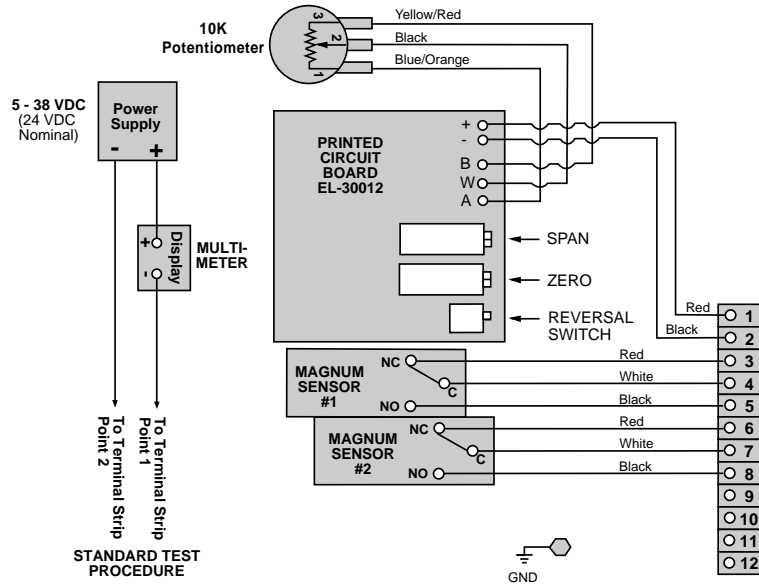
2 - SPDT Magnum Sensors

with RS Option & 12 Point Terminal Strip



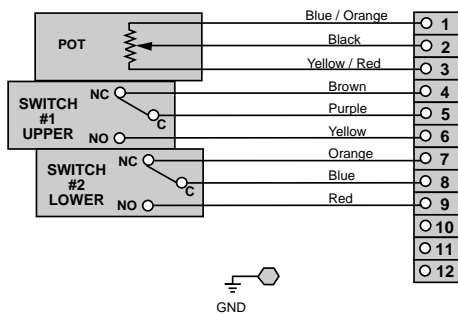
2 - SPDT Magnum Sensors

with CS (4-20 mA) Transmitter & 12 Point Terminal Strip



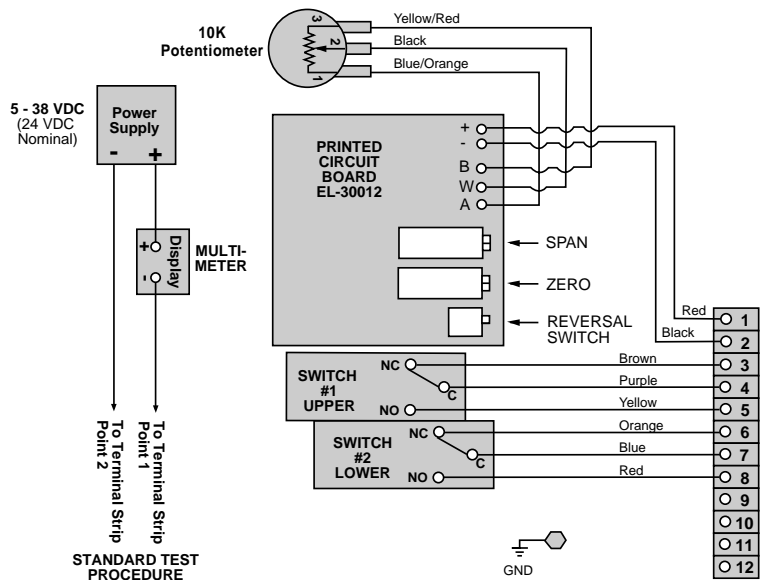
2 - SPDT Mechanical Switches

with RS Option & 12 Point Terminal Strip



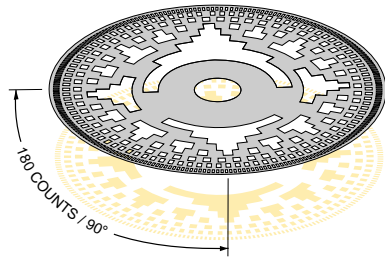
2 - SPDT Mechanical Switches

with CS (4-20 mA) Transmitter & 12 Point Terminal Strip



Transmitters

Spectrum DT Position Transmitter



General Description

The Westlock digital valve position transmitter represents a state of the art departure from conventional practice. Sensing of valve position is accomplished in a totally digital manner. No potentiometers, LVDTs, or other analog means are employed for determination of shaft angle. Philosophically, the design is intended to offer advantages of digital sensing, with the flexibility offered by conventional 4 to 20 mA analog transmission, which remains the most popular signal standard in the process industry.

The transmitter is based upon use of an optical absolute shaft encoder, providing non-contact determination of shaft angle by methods inherently free of error and instability. The only moving part is a disc, carrying coded patterns corresponding to shaft angle. The disc is read optically, utilizing high reliability LEDs and phototransistors. Importantly, the LEDs are excited for only very small time intervals (duty cycle is typically less than 1%), further increasing reliability. High quality ceramic integrated circuits are used, again in the interest of greatest reliability.

A minimum of analog circuitry is employed, resulting in superior stability. Maintenance is also simplified due to use of digital sensing. In that regard, replacement of one small board, without need of any calibration whatsoever, constitutes a complete electronics changeout.

Although the transmitter is a rotary motion device, it can be equipped with linkage in the same manner as many popular valve positioners, for control valve use. Where linearization is required, it can be provided via encoder disc pattern characterization.

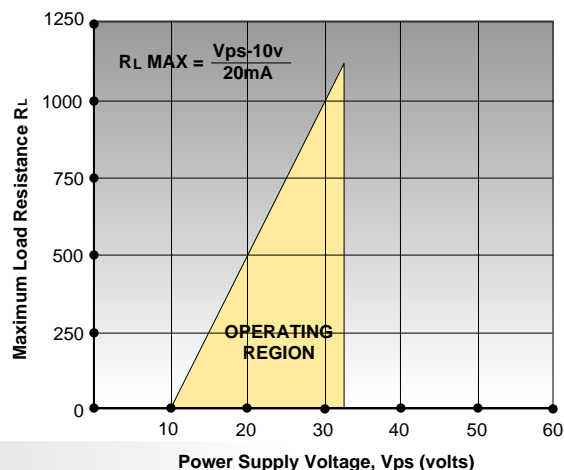
Resolution is 1/2 degree, corresponding to 180 encoder sensing increments in 90° of shaft rotation. Although the 4 and 20 mA endpoints are normally provided to cover a 90° angular segment, 19° of over-range is provided, resulting in a maximum loop current of 23.38 mA. Underrange capability is also provided, again at two encoder counts per degree of rotation, down to the transmitter keepalive current of approximately 3.5 mA.

Operating Description

The shaft encoder is an 8 bit device, utilising grey code parallel outputs. Grey to binary conversion takes place before further signal processing, as shown in the accompanying block diagram, Fig 1. Data corresponding to shaft position is latched, and fed to a high quality digital to analog convertor, with timing synchronized to encoder LED excitation. A precision, low drift voltage reference is utilized for the D/A convertor DC source, as it is for the scaling and live zero circuitry which follows. Voltage to current conversion develops the true current sink output characteristic provided by the transmitter. Current sampling and feedback assure that a current which is truly representative of shaft position is generated.

The internal power supply is derived in total from the 4 to 20 mA signal loop. Stored energy from that power supply is delivered to the encoder LEDs for excitation on a pulsed basis for a period of several milliseconds approximately once each second. In this manner, LED current excitation requirements in excess of 100 mA can readily be met despite the constraints imposed by 2 wire current loop operation. Operation of the data latch and D/A convertor, as mentioned above, is synchronized to LED excitation.

Power Supply Requirements

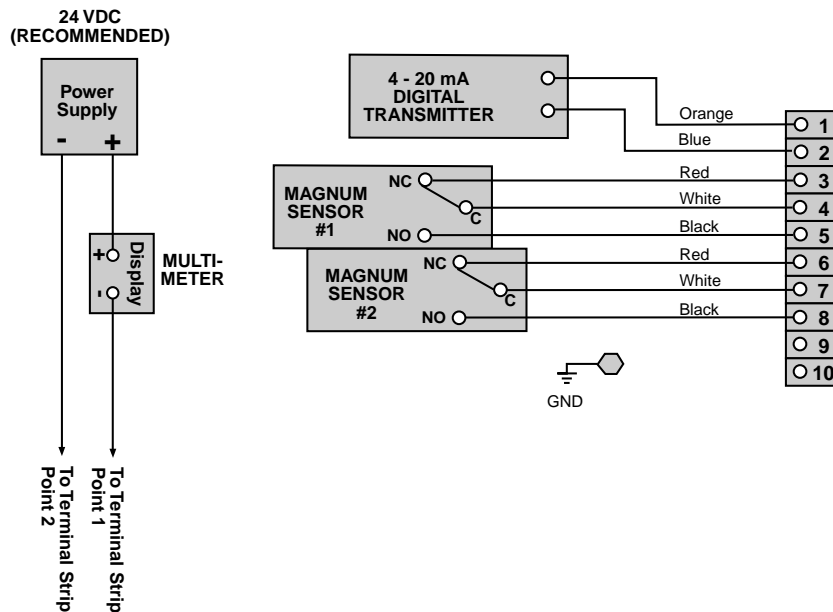


Technical Data

Transmitter type:	Angular position, intended primarily for control valve applications, damper applications, and similar uses.
Output:	4 to 20 milliamperes (2 wire), proportional to position. Position range is 90° (reversible) corresponding to nominal output current range.
Operating principle:	Absolute shaft encoder, non-contacting.
Electrical overrange capability:	19° nominal at each° end of 90° span. For travel below range bottom, output current will limit at minimum of approximately 3.2 mA.
Mechanical overrange capability:	Infinite (shaft may be continuously rotated).
End of range wraparound:	Provided 180° away from range midpoint.
Terminal voltage req.	10 to 32 volts DC. Reverse polarity protected.
Temperature range:	-29°C to +82°C. Sunshade available for use when needed.
Temperature effect:	Less than 0.01%°C referred to full scale.
Humidity range:	10% to 90%, non-condensing.
Terminal voltage effect:	Less than 0.1%, from 10 to 32 volts.
Linearity:	Within one encoder count increment.
Output update rate:	Once per second.
Startup stabilisation time:	6 seconds, nominal.
Resolution	0.5° 180 counts in 90°

Spectrum 4-20 mA Transmitter

with 2 SPDT Magnum Sensors &
10 Point Terminal Strip



NOTE: THERE IS NO REQUIRED POLARITY FOR THE 2 WIRE 4 -20 mA WIRING OF THE TRANSMITTER

NEMA Enclosure Standards

The following is from NEMA Standard #250

An enclosure is a surrounding case constructed to provide a degree of protection to personnel against incidental contact with the enclosed equipment and to provide a degree of protection to the enclosed equipment against specified environmental conditions.

A brief description of the more common types of enclosures used by the electrical industry relating to their environmental capabilities follows. Refer to the appropriate sections of this Standards Publication for more information regarding applications, features, and design tests.

Definitions Pertaining to Non-Hazardous Locations

Type 1 Enclosures

are intended for indoor use primarily to provide a degree of protection against contact with the enclosed equipment.

Type 2 Enclosures

are intended for indoor use primarily to provide a degree of protection against limited amounts of falling water and dirt.

Type 3 Enclosures

are intended for outdoor use primarily to provide a degree of protection against windblown dust, rain, sleet, and external ice formation.

Type 3R Enclosures

are intended for outdoor use primarily to provide a degree of protection against falling rain, sleet, and external ice formation.

Type 3S Enclosures

are intended for outdoor use primarily to provide a degree of protection against windblown dust, rain, sleet, and to provide for operation of external mechanisms when ice laden.

Type 4 Enclosures

are intended for indoor or outdoor use primarily to provide a degree of protection against windblown dust and rain, splashing water, and hose directed water.

Type 4X Enclosures

are intended for indoor or outdoor use primarily to provide a degree of protection against corrosion, windblown dust and rain, splashing water, and hose-directed water.

Type 5 Enclosures

are intended for indoor use primarily to provide a degree of protection against settling airborne dust, falling dirt, and dripping non-corrosive liquids.

Type 6 Enclosures

are intended for indoor or outdoor use primarily to provide a degree of protection against the entry of water during occasional temporary submersion at a limited depth.

Type 6P Enclosures

are intended for indoor or outdoor use primarily to provide a degree of protection against the entry of water during prolonged submersion at a limited depth.

Type 11 Enclosures

are intended for indoor use primarily to provide, by oil immersion, a degree of protection to enclosed equipment against the corrosive effects of liquids and gases.

Type 12 Enclosures

are intended for indoor use primarily to provide a degree of protection against dust, falling dirt, and dripping non-corrosive liquids.

Type 12K Enclosures

with knockouts are intended for indoor use primarily to provide a degree of protection against dust, falling dirt, and dripping non-corrosive liquids other than at knockouts.

Type 13 Enclosures

are intended for indoor use primarily to provide a degree of protection against dust, spraying water, oil, and non-corrosive coolant.

Definitions Pertaining to Hazardous (Classified) Locations

Type 7 Enclosures

are for use in indoor locations classified as Class I, Groups A, B, C, or D, as defined in the National Electrical Code.

Type 8 Enclosures

are for indoor or outdoor use in locations classified as Class I, Groups A, B, C, or D, as defined in the National Electrical Code.

Type 9 Enclosures

are for use in indoor locations classified as Class II, Groups E, F, G, as defined in the National Electrical Code.

Type 10 Enclosures

are constructed to meet the applicable requirements of the Mine Safety and Health Administration.

Area Classifications

Hazardous (Classified) Locations In Accordance with Article 500, National Electrical Code

Class I

Combustible material in the form of a gas vapor.

Class II

Combustible material in the form of a dust.

Class III

Combustible material in the form of a fiber, such as a textile flyings.

The Group sub-divides the Class:

Group A

Atmosphere containing acetylene.

Group B

Atmospheres containing hydrogen, gases or vapors of equivalent hazards, such as manufactured gas.

Group C

Atmospheres containing ethyl ether vapors, ethylene or cyclopropane.

Group D

Atmospheres containing gasoline, hexane, naphtha, benzine, butane, propane, alcohol, acetone, benzol, lacquer, solvent vapors, or natural gas.

Group E

Atmospheres containing metal dust, including magnesium and their commercial alloys, and other metals of similarly hazardous characteristics.

Group F

Atmospheres containing carbon black coal or coke dust.

Group G

Atmospheres containing flour, starch or grain dust.

Division 1

locations are those places where ignitable concentrations of flammable gases or vapors exist under normal conditions, or may frequently exist because of leakage or maintenance operations or where malfunctions may release ignitable vapors and simultaneously cause failure of electrical equipment.

Division 2

locations are those where flammable liquids or gases are present but are normally confined and can escape only through accident or abnormal operation. Also included are areas made safe by mechanical ventilation, but might become hazardous because of failure or abnormal operation of the equipment. A third division 2 situation is an area adjacent to a Division 1 location where ignitable concentrations of gas or vapor might be occasionally communicated.

Note: The Division defines the probability of an explosive mixture being present (e.g. A hazardous mixture is normally present in a Division 1 area, but will only be accidentally present in a Division 2 area.

European Enclosure Standards

The IEC publication 529 and DIN Standard number 40050 both address the classification of degrees of protection provided by enclosures. The following is brief overview of the coding system described in these standards.

General: The degrees of protection are indicated by a symbol consisting of the two code letters IP, always the same, (international Protection) and two reference numbers indicating the degree of protection.

Example:



An enclosure with this designation is protected against the penetration of solid objects of more than 1mm diameter and against splashed water.

First Number

***Test and assessment in italic*

- 0 = no special protection. **no test*
- 1 = protected against a rigid sphere of 50mm \varnothing
**A rigid 50 mm sphere must not pass through an opening with an applied force of 50 N.*
- 2 = protected against solid objects greater than 12.5mm \varnothing
**A rigid 12 mm sphere must not pass through an opening with an applied force of 30 N.*
- 3 = protected against solid objects greater than 2.5mm.
**A straight rigid steel wire 2.5 mm in dia. must not enter the equipment with an applied force of 3 N.*
- 4 = protected against solid objects greater than 1mm.
**A straight rigid steel wire 1 mm in dia. must not enter the equipment with an applied force of 1 N.*
- 5 = dust protected
**A straight rigid steel wire 1 mm in dia. must not enter the equipment with an applied force of 1 N. Also dust chamber test to DIN 40 052.*
- 6 = dust-tight and complete protection against contact.
**A straight rigid steel wire 1 mm in dia. must not enter the equipment with an applied force of 1 N. Also dust chamber test to DIN 40 052.*

Second Number

***Test and assessment in italic*

- 0 = no special protection. **no test*
- 1 = protected against vertical falling water
**Dripping device or sprinkler nozzle in accordance with DIN 40 053 part 1 or part 5 respectively.*
- 2 = protected against vertical falling water drops when enclosure tilted at 15°
**Dripping device or sprinkler nozzle in accordance with DIN 40 053 part 1 or part 5 respectively.*
- 3 = protected against splashing water at an angle up to 60°
**Oscillating tube or spray nozzle in accordance with DIN 40 053 part 2 or part 3 respectively depending on the shape and size of sample.*
- 4 = protected against splashing water from any direction
**Oscillating tube or spray nozzle in accordance with DIN 40 053 part 2 or part 3 respectively depending on the shape and size of sample.*
- 5 = protected against water jets
**Jet nozzle of nominal size 6 in accordance with DIN 40 053 part 4.*
- 6 = protected against powerful water jets
**Jet nozzle of nominal size 12 in accordance with DIN 40 053 part 4.*
- 7 = protected from the effects of temporary immersion
**Enclosure is completely immersed in water and the following conditions must be met:*
 - a) water must be at least 150mm over the highest point of the enclosure
 - b) lowest part of the enclosure must be at least 1m below the surface
 - c) test must last for at least 30 minutes
 - d) water temperature must not deviate by more than 5°C; water must not enter in harmful quantities.
- 8 = protected from the effects of continuous immersion
**Test conditions have to be agreed to by the manufacturer and the customer, but can not be less stringent than those described in 7 above.*

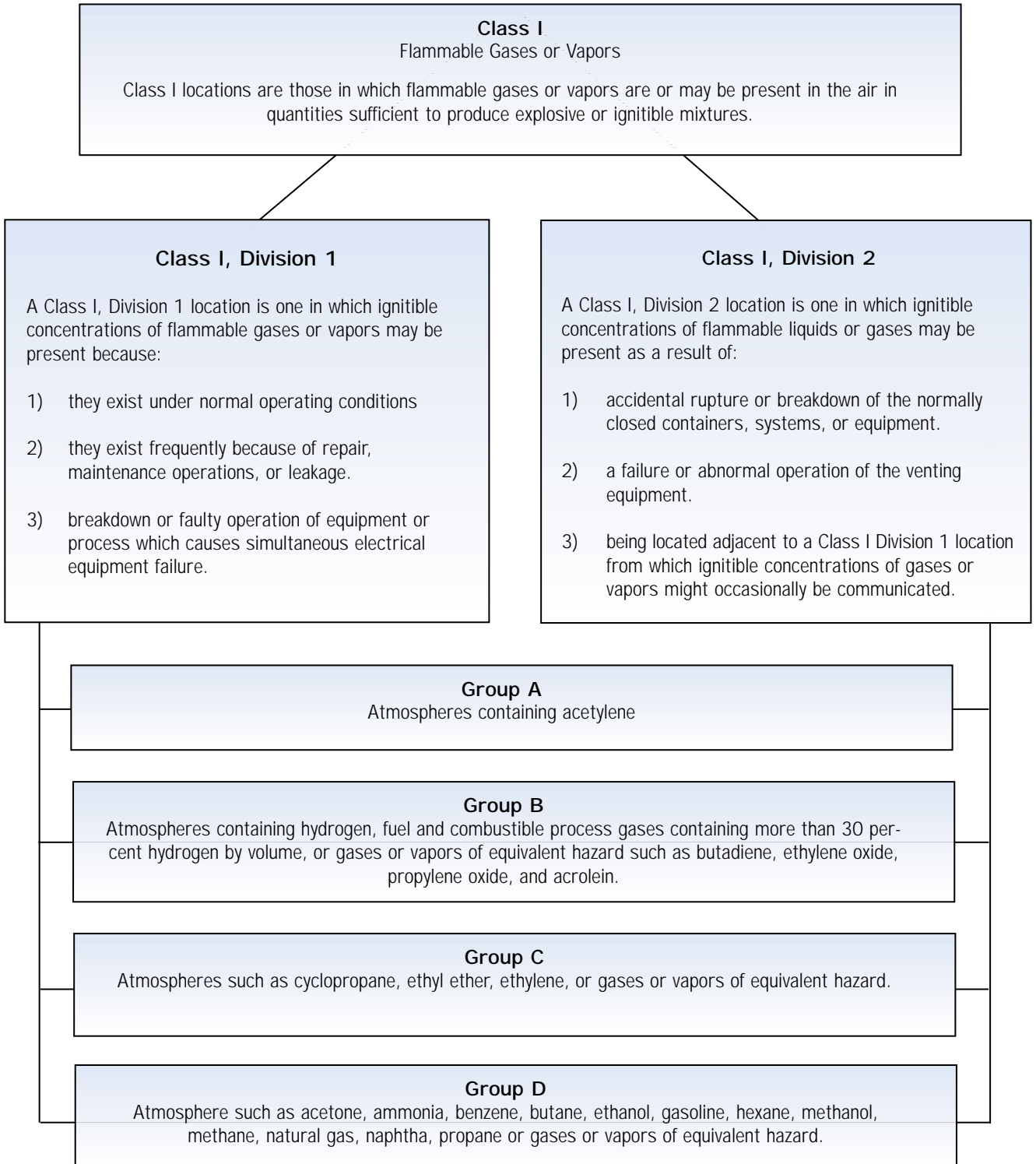
European Hazardous Area Protection Concepts Used By Westlock

Westlock Valve Monitoring Systems are designed with specific safety measures to prevent ignition of a surrounding explosive substance during normal operation when installed in a hazardous area. The following are the most commonly used methods of protection incorporated into the design of Westlock equipment.

Protection Concept	European International Electromechanical Commission (I.E.C.)	CENELEC or BASEEFA Standard	USA National Electrical Code (N.E.C.)	Description	I.E.C.	N.E.C.
EEx'ia'	Intrinsically Safe	EN.50020 (BS.5501 Pt. 7)	Intrinsically Safe	Apparatus or system which is incapable of causing ignition of a mixture of flammable or combustible material in air due to the limitation of electrical energy in the circuit.	Zone 0 Zone 1 Zone 2	Class I & II, Div. 1 Class I & II, Div. 1 Class I & II, Div. 2
EEx'd'	Flameproof	EN.50018 (BS.5501 Pt. 5)	Explosionproof	Designed to withstand an internal explosion and prevent the ignition of the surrounding atmosphere.	Zone 1 Zone 2	Class I & II, Div. 1 Class I & II, Div. 2
EEx'e'	Increased Safety	EN.50019 (BS.5501 Pt. 6)	Not yet recognized by N.E.C.	Increased measures are taken to prevent the possibility of excessive heat, arcs or sparks igniting flammable gases or combustible materials.	Zone 1 Zone 2	Not yet recognized by N.E.C.
EEx'N'	Non-incendive	BS.6941	Non-incendive	Electrical circuits that under normal conditions do not release sufficient energy to ignite the surrounding atmosphere.	Zone 2	Class I & II, Div. 2
EEx'me'	Encapsulated/Increased Safety	EN.50014/ EN.50019/ EN.50028	Not yet recognized by N.E.C.	Encapsulated/Increased Safety equipment refers to an apparatus certified to CENELEC standards which is designed so as the components capable of igniting an explosive atmosphere by either sparking or heating are enclosed in compound in such a way to prevent the possibility of ignition.	Zone 1 Zone 2	Not yet recognized by N.E.C.

Intrinsically Safe Definitions & Standards

Hazardous (Classified) Locations In Accordance with Article 500, National Electrical Code*



Simple Apparatus Devices For Use In Intrinsically Safe Systems

“Hazardous Areas” are areas where flammable materials are handled and any leak or spill has the potential to form an explosive atmosphere.

“Intrinsically Safe” is a practice where one is restricting the energy available to electrical equipment in this potentially hazardous area so that a spark or hot surface can not occur due to any type of electrical fault. The IEC (International Electrical Code) states that: “Equipment must not store or generate more than 1.2V, 0.1A, 20 micro joules, and 25mW.” A certified IS interface (Barrier) limits the voltage and current that can reach the equipment in the hazardous area under fault conditions.

“Simple Apparatus” devices are able to be used in an Intrinsically Safe area without certification because they do not store energy (See definition below). They include thermocouples, resistive sensors, LED’s and switches. The proper IS interface must still be used with any Simple Apparatus device.

“Simple Apparatus” such as thermocouples, resistive sensors, LED’s and switches may be employed in a hazardous area without certification provided that it does not generate or store more than 1.2V, 0.1A, 20 μ J and 25mW. This IEC definition is now used in the USA and Canada.

“Simple Apparatus” can be defined as the following: a device that does not generate or store energy.

From the definition above, it is clear that all switches manufactured or supplied by Westlock Controls can be used in Intrinsically Safe systems. Switches included are as follows:

1. Magnum XT-90 proximity sensors
2. 316 Silver Bullet
3. V3 mechanical switches (SPDT)
4. 22-104 mechanical switches (DPDT)
5. Reed proximity sensors (SPDT or SPST)
6. GO proximity sensors

Intrinsic Safety Principles

IEC

USA & CANADA

Intrinsic Safety (IS)	Technique that achieves safety by limiting the electrical spark energy (and surface temperature) that can arise in hazardous areas to levels that are insufficient to ignite an explosive atmosphere.													
Categories	<p>Ex ia: Explosion protection maintained with up to two component or other faults. IS apparatus may be located in, and associated apparatus may be connected into Zone 0, 1 and 2 hazardous areas (Germany requires galvanic isolation for Zone 0).</p> <p>Ex ib: Explosion protection maintained with up to one component or other faults. IS apparatus may be located in, and associated apparatus may be connected into Zone 1 and 2 hazardous areas.</p>	One Category Only: Safety maintained with up to two component or other faults. IS apparatus may be connected into Division 1 and 2 hazardous locations.												
Area Classification	<p>Zone 0: Explosive gas-air mixture continuously present, or present for long periods.</p> <p>Zone 1: Explosive gas-air mixture is likely to occur in normal operation.</p> <p>Zone 2: Explosive gas-air mixture not likely to occur, and if it occurs, it will exist only for a short time.</p> <hr/> <p>UK (Germany)</p> <p>Zone Z: (Zone 10) Combustible dust is, or may be, present as a cloud during normal operating conditions.</p> <p>Zone Y: (Zone 11) Accumulations of combustible dust may be present under abnormal operating conditions, and give rise to ignitable mixtures of dust and air.</p>	<p>Division 1: Hazardous concentration of flammable gases or vapors, or combustible dusts in suspension, continuously, intermittently or periodically present under normal operating conditions.</p> <p>Division 2: Volatile flammable liquids or flammable gases present, but normally confined within closed containers or systems from which they can escape only under abnormal operating or fault conditions. Combustible dusts not normally in suspension not likely to be thrown into suspension.</p>												
Gas and Dust Classification	<p>Flammable gases, vapors and mists are classified according to the spark energy required to ignite the most easily ignitable mixture with air. Apparatus is grouped according to the gases that it may be used with.</p> <p><i>Surface Industries</i></p> <p>Group IIC: acetylene</p> <p>Group IIC: hydrogen</p> <p>Group IIB: ethylene</p> <p>Group IIA: propane</p> <p style="text-align: center;">↑ more easily ignited</p> <p>Dusts under consideration</p> <p>Mining Industry</p> <p>Group I: methane (firedamp)</p>	<p>Flammable gases, vapors and mists are classified according to the spark energy required to ignite the most easily ignitable mixture with air. Apparatus is grouped according to the gases that it may be used with.</p> <p><i>Surface Industries</i></p> <p>Class I, Group A: acetylene</p> <p>Class I, Group B: hydrogen</p> <p>Class I, Group C: ethylene</p> <p>Class I, Group D: propane</p> <p style="text-align: center;">↑ more easily ignited</p> <p>Class II, Group E: metal dust</p> <p>Class II, Group F: carbon dust</p> <p>Class II, Group G: flour, starch, grain</p> <p>Class III: fibers and flyings</p> <p><i>Mining Industry</i></p> <p>Unclassified: methane (firedamp)</p>												
Temperature Classification	<p>Hazardous area apparatus is classified according to the maximum surface temperature produced under fault conditions at an ambient temperature of 40°C, or as otherwise specified.</p> <table border="0" style="width: 100%;"> <tr> <td style="text-align: center;">T1</td> <td style="text-align: center;">T2</td> <td style="text-align: center;">T3</td> <td style="text-align: center;">T4</td> <td style="text-align: center;">T5</td> <td style="text-align: center;">T6</td> </tr> <tr> <td style="text-align: center;">450°C</td> <td style="text-align: center;">300°C</td> <td style="text-align: center;">200°C</td> <td style="text-align: center;">135°C</td> <td style="text-align: center;">100°C</td> <td style="text-align: center;">85°C</td> </tr> </table>		T1	T2	T3	T4	T5	T6	450°C	300°C	200°C	135°C	100°C	85°C
T1	T2	T3	T4	T5	T6									
450°C	300°C	200°C	135°C	100°C	85°C									
Gas Characteristics	<p>Details of the classification (C) and the ignition temperatures (T) of commonly used gases and vapors are contained in:</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 50%;">IEC 79-12 (C)</td> <td style="width: 50%;">NFPA 325M (C)</td> </tr> <tr> <td>EN 50 014 (C)</td> <td>NFPA 497M (includes dusts) (CT)</td> </tr> <tr> <td>BS 5501: Part 1 (C)</td> <td>CSA C22.1 (CT)</td> </tr> <tr> <td>VDE 0170/0171, Teil 1 (C)</td> <td></td> </tr> <tr> <td>BS 5345: Part 1 (CT)</td> <td></td> </tr> <tr> <td>VDE 0165 (CT)</td> <td></td> </tr> </table>		IEC 79-12 (C)	NFPA 325M (C)	EN 50 014 (C)	NFPA 497M (includes dusts) (CT)	BS 5501: Part 1 (C)	CSA C22.1 (CT)	VDE 0170/0171, Teil 1 (C)		BS 5345: Part 1 (CT)		VDE 0165 (CT)	
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Approval	National certifying authorities issue certificates for approved equipment, defining how it may be used.	FM and UL (USA) and CSA (Canada) issue reports and publish listings of approved equipment, defining how it may be used.												
Standards	All countries in Western Europe work to CENELEC standards EN 50 020 (apparatus) and EN 50 039 (systems). EC member countries issue Certificates of Conformity to these standards and accept products and systems certified by other members. Other countries either work to their own standards based on IEC 79-11 (eg. Australia, Brazil, Japan, USSR) or accept products and systems certified to European and/or North American standards.	FM and UL work to their own standards, FM 3610 and are UL913, based on ANSI/UL913. Canada works to CSA C22.2, No. 157. NFPA 70												
Codes of Practice	IEC 79-14 BS 5345: Part 4 VDE 0165	ANSI/ISA-RP 12.6 NFPA - 70 Article 504												