

Installation & Maintenance Instructions

# UE 12 SERIES

Explosion-Proof, Pressure, Vacuum,  
and Differential Pressure Switches



Supplied by

**247able.com**

Call us on +44 (0)118 916 9420 | Email [info@247able.com](mailto:info@247able.com)



# 12 Series

Explosion-Proof, Pressure, Vacuum, and Differential Pressure Switches

## Installation and Operation Instructions

Please read all instructional literature carefully and thoroughly before starting.  
Refer to the final page for the Warranty.

### GENERAL

**!** MISUSE OF THIS PRODUCT MAY CAUSE EXPLOSION AND PERSONAL INJURY. THESE INSTRUCTIONS MUST BE THOROUGHLY READ AND UNDERSTOOD BEFORE UNIT IS INSTALLED.

<b>Cert number</b>	<b>E40857-19971015</b>
<b>Applicable Area</b>	North America
<b>Markings</b>	Class I, Groups A, B, C and D; Class II, Groups E, F and G; Class III
<b>Applicable Standards</b>	UL 1203, UL 508; CAN/CSA C22.2 No. 14, CAN/CSA C22.2 No. 25, CAN/CSA C22.2 No. 30

<b>Cert number</b>	<b>DEMKO C8 ATEX 0717128X</b>
<b>Applicable Area</b>	Europe (EU)
<b>Markings</b>	II 2 G Ex db IIC T6 Gb; II 2 D Ex tb IIIC T85 °C Db
<b>Applicable Standards</b>	EN IEC 60079-0; EN 60079-1; EN 60079-31

<b>Cert number</b>	<b>IECEx UL 14.0072X</b>
<b>Applicable Area</b>	International
<b>Markings</b>	Ex db IIC T6 Gb Ex tb IIIC T85 °C Db IP66 -50 °C to +80 °C
<b>Applicable Standards</b>	IEC 60079-0; IEC 60079-1; IEC 60079-31

<b>Cert number</b>	<b>DEMKO 11 ATEX 1105261X</b>
<b>Applicable Area</b>	Europe (EU)
<b>Markings</b>	II 1 G Ex ia IIC T6 Ga; -50 °C to +60 °C
<b>Applicable Standards</b>	EN IEC 60079-0; EN 60079-11

<b>Cert number</b>	<b>IECEx UL 14.0075X</b>
<b>Applicable Area</b>	International
<b>Markings</b>	Ex ia IIC T6 Ga -50 °C ≤ Tamb ≤ +60 °C
<b>Applicable Standards</b>	IEC 60079-0; IEC 60079-11

**!** 12 SERIES FOR USE IN CLASS I, DIV. 1, GROUPS A, B, C & D; CLASS II, DIV. 1, GROUPS E, F & G; CLASS III HAZARDOUS LOCATIONS. ENCLOSURE TYPE 4X, IP66. AMBIENT TEMPERATURE RANGE -50°C (-58°F) TO 95°C (203°F).

**!** ATEX AND IEC SPECIFIC CONDITIONS OF USE: THE WIRING TO THE PRESSURE SWITCH MUST ONLY BE CONNECTED IN A SAFE AREA OR BY AN APPROVED TERMINAL BOX CERTIFIED TO EN 60079-0/IEC 60079-0, EN 60079-1/IEC 60079-1, AND EN 60079-31/IEC 60079-31 FOR HAZARDOUS LOCATIONS. THE EPOXY RESIN SHALL NOT BE SUBJECTED TO A TEMPERATURE GREATER THAN 125°C (257°F). THE WIRES SHALL BE PROTECTED AGAINST MECHANICAL DAMAGE, E.G., BY USE OF CONDUIT. OPTION M515 WITH DIN CONNECTOR IS NOT COVERED BY THIS CERTIFICATE. OPTION M460, EXTERNAL EARTH GROUND SCREW, IS TO BE USED IF METAL CONDUIT IS NOT USED. ELECTRICAL CONDUIT FITTING THREADED CONNECTION SHALL BE M20 X 1.5 WITH 7 THREADS MINIMUM ENGAGEMENT.

UE declarations and third-party issued Agency certifications are available for download at [www.ueonline.com](http://www.ueonline.com).

**i** PRIOR TO INSTALLATION, CHECK THE WETTED PARTS MATERIAL FOR COMPATIBILITY TO THE PROCESS MEDIA.

**!** THE DUAL SEAL DEVICE METHOD OF PRIMARY SEAL FAILURE ANNUNCIATION IS VISIBLE LEAKAGE FROM THE ENCLOSURE. DEPENDING UPON MEDIA SENSED, ADDITIONAL METHODS OF LEAK DETECTION SHALL BE REQUIRED.

**!** THIS PRODUCT DOES NOT HAVE ANY FIELD REPLACEABLE PARTS. ANY SUBSTITUTION OF COMPONENTS SHALL INVALIDATE AGENCY CERTIFICATION(S), AND IMPAIR SUITABILITY FOR CLASS I, DIV. 1 LOCATION.

**i** PROOF PRESSURE \* LIMITS STATED IN THE LITERATURE AND ON NAMEPLATES MUST NEVER BE EXCEEDED, EVEN BY SURGES IN THE SYSTEM. OCCASIONAL OPERATION OF UNIT UP TO PROOF PRESSURE IS ACCEPTABLE (E.G., START-UP, TESTING). CONTINUOUS OPERATION SHOULD NOT EXCEED THE DESIGNATED OVER RANGE \*\* OR WORKING PRESSURE RANGE\*\*\*.

\* Proof Pressure - the maximum pressure to which a pressure sensor maybe occasionally subjected, which causes no permanent damage (e.g., start-up, testing). The unit may require re-gapping.

\*\* Over Range Pressure - the maximum pressure to which a pressure sensor may be continuously subjected without causing damage and maintaining set point repeatability.

\*\*\* Working Pressure Range - the pressure range in which two opposing sensors can be safely operated and still maintain set point provided the difference in pressure between the low and high sides does not exceed the designated adjustable range.

The 12 Series switch utilizes a diaphragm or a piston sensor to detect a pressure change. The response, at a predetermined set point, actuates a SPDT or DPDT snap-acting switch, converting a pressure signal into an electrical signal. Control set point may be varied by turning the internal slotted adjustment screw according to procedures outlined in Part II-Adjustments. Please refer to product datasheet at [www.ueonline.com](http://www.ueonline.com) for product specifications. Date code format on nameplate is "YYWW" for year and week.

**DEVICE MUST NOT BE ALTERED OR MODIFIED AFTER SHIPMENT. CONSULT UE IF MODIFICATION IS NECESSARY.**

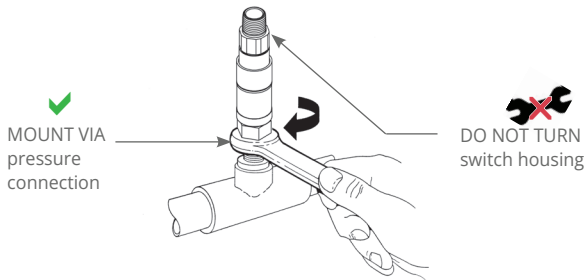


Figure 1

## Part I - Installation

### Mounting

- 1 1/16" Open end wrench

**INSTALL DEVICE WHERE SHOCK, VIBRATION AND TEMPERATURE FLUCTUATIONS ARE MINIMAL. DO NOT INSTALL DEVICE IN AMBIENT TEMPERATURES THAT EXCEED PUBLISHED LIMITS ON THE NAMEPLATE.**

**DEVICE SHOULD BE MOUNTED TO PREVENT MOISTURE FROM ENTERING THE ENCLOSURE. VERTICAL MOUNTING IS RECOMMENDED.**

**NOTE:** Due to product sensitivity on sensor Type W, it is recommended that these models be mounted vertically with pressure connection facing down. Other types of mounting may cause slight set-point shifts, which may require readjustment.

**CONSIDER THE USE OF A PRESSURE SNUBBER IF SEVERE PRESSURE SURGES ARE EXPECTED.**

**FOR PRESSURE MODELS, MOUNT VIA PRESSURE CONNECTION. ALWAYS USE A WRENCH ON PRESSURE CONNECTION HEX (SEE FIGURE 1). DO NOT TIGHTEN BY TURNING THE ENCLOSURE AS THIS WILL DAMAGE THE SENSOR AND WEAKEN WELDED JOINTS.**

**FOR DIFFERENTIAL PRESSURE MODELS, MOUNT USING THE ATTACHED MOUNTING BRACKET AGAINST A RIGID SUPPORT, AND THEN CONNECT LOW AND HIGH PRESSURE PORTS.**

**IF USING WITH A JUNCTION BOX, IT IS RECOMMENDED THAT THE PRODUCT BE MOUNTED VERTICALLY WITH THE PRESSURE CONNECTION FACING DOWN.**

If product is to be set after mounting, verify that adjustment opening is accessible, "Front" marking on nameplate facing operator.

### Panel Mounting via 1/2" NPTM or M20 Electrical Connection

When panel mounting, mount through 7/8" clearance hole in panel. Use 1/2" or M20 conduit nut to secure in place. Always support the product by holding a wrench on the hex.

### Surface Mounting Bracket Kit (P/N 62169-13) (see Fig. 6)

- 1 Open the adjustment cover and orient the unit so that adjustment opening will be accessible when the switch is mounted.
- 2 Close the adjustment cover ensuring that the bracket does not interfere with the cover as this serves as the Dual Seal device method of primary seal failure annunciation and venting.

Failure to install the unit correctly with the mounting bracket may result in improper venting of the adjustment cover.

### Wiring

**DISCONNECT ALL SUPPLY CIRCUITS BEFORE WIRING UNIT. WIRE UNITS ACCORDING TO NATIONAL AND LOCAL ELECTRICAL CODES. THE WIRES SHOULD BE PROTECTED AGAINST MECHANICAL DAMAGE BY USE OF A CONDUIT OR OTHER SUITABLE MEANS.**

**DO NOT EXCEED ELECTRICAL RATINGS LISTED ON NAMEPLATE. OVERLOAD ON A SWITCH CAN CAUSE FAILURE, EVEN ON THE FIRST CYCLE.**

**DIN CONNECTOR (OPTION M515, FIGURE 4) IS NOT APPROVED FOR CLASS I, DIV. 1 HAZARDOUS LOCATIONS/ FLAMEPROOF ATMOSPHERES.**

1/2" NPT (male) or M20 (male) conduit connection is provided on top of the product with 72" long, 18 AWG leadwires. The product is available with SPDT or DPDT operation. External grounding screw and clamp is provided with option M460 for ATEX installation with non-metallic conduit systems (See Figure 2). To attach conduit connection hold electrical connection steady with wrench on hex, then thread on conduit.

Factory Sealed Leadwires are color coded:

TERMINALS	SPDT	DPDT	
		Circuit 1	Circuit 2
Common	Brown	Brown	Yellow
Normally Closed	Red	Red	Black
Normally Open	Blue	Blue	Violet
Ground	Green	Green	

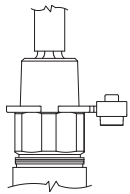


Figure 2

### DIN Connector with 4 Male Terminals (see Figure 4)

Connector conforms to DIN 43650. Use a female mating DIN connector (not UE supplied).

Coding: TERMINALS	
Terminal #1	Common
Terminal #2	Normally Closed
Terminal #3	Normally Open
⊕	Ground

## Part II - Adjustments

- Flathead screwdriver with 3/16" or 1/4" wide blade

- 1 Connect control to pressure source.
- 2 With power disconnected, slide cover toward electrical terminations while twisting it to overcome friction.
- 3 Connect power to terminals or leads.
- 4 Insert screwdriver into adjustment slot and turn clockwise to increase setting or counter clockwise to decrease setting (See Figure 3).

## Part III - Dimensions

Dimensional drawings for all models may be found at: [www.ueonline.com](http://www.ueonline.com)

### Standard Configuration

PRESSURE SWITCH / CONNECTION CHART							
Type	Description	Dimension A		Dimension B		Dimension C	
		In	mm	In	mm	In	mm
2	1/2" NPT (female)	4.4	111.1	0.7	16.5	1 1/16	27.0
3, 5	1/2" NPT (female)	4.4	111.1	0.6	15.2	1 1/16	27.0
4, 6, 8	1/4" NPT (female)	4.4	111.1	0.6	15.2	1 1/16	27.0
7, 9	1/2" NPT (female)	4.0	100.3	1.6	40.6	1 1/8	28.6
P0-P9	1/4" NPT (female)	4.4	111.1	1.0	25.4	1 1/16	27.0
W1-W2	1/2" NPT (female)	4.0	100.3	2.2	55.9	1 1/16	27.0
W3-W4	1/2" NPT (female)	4.0	100.3	1.7	42.9	1 1/16	27.0
K1-K3	1/8" NPT (female)	4.4	111.1	1.7	42.9	N/A	N/A
K4-K6	1/8" NPT (female)	4.4	111.1	1.8	44.5	N/A	N/A
Option	Description	Dimension "A"		Dimension "B"		Dimension "C"	
M511	1/4" NPT (male)			1.1	27.9	1 1/16	27.0
XP112	1/2" NPT (female)			0.6	15.2	1 1/16	27.0
XP113	1/2" NPT (female)			0.6	15.2	1 1/16	27.0

For setting on rise, apply desired pressure and turn adjustment clockwise until switch actuates (circuit across N.O. and COM terminals closes).  
 For setting on fall, apply pressure equal to normal system operating pressure. Reduce source pressure to setpoint value. Turn adjustment counter clockwise until switch actuates (circuit across N.C. and COM terminals closes).

**ⓘ AFTER COMPLETING SETTING ADJUSTMENT, BE SURE TO SLIDE ADJUSTMENT COVER BACK INTO PLACE.**

## Recommended Practices

- A redundant device is necessary for applications where damage to the primary device could endanger life, limb or property. A high or low limit switch is necessary for applications where a dangerous runaway condition could result.
- Monitor operation to observe warning signs of possible damage to device, such as drift in set point. Check device immediately.
- Preventative maintenance and periodic testing is necessary for critical applications where damage could endanger property or personnel.

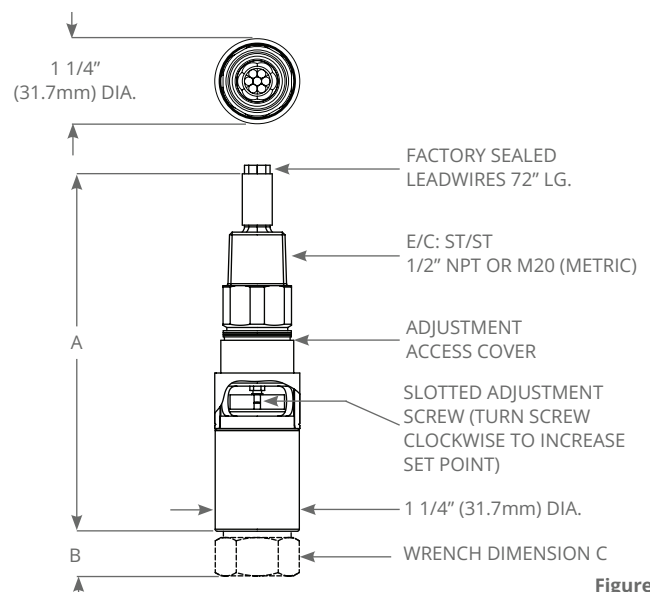
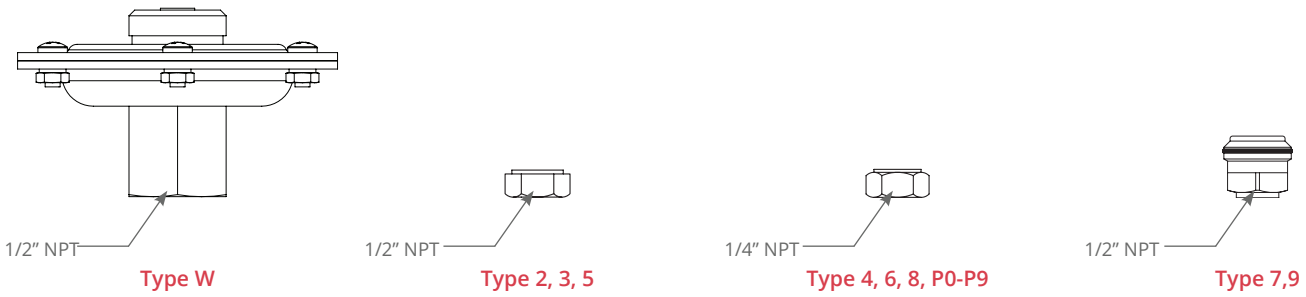


Figure 3

## Pressure Connections

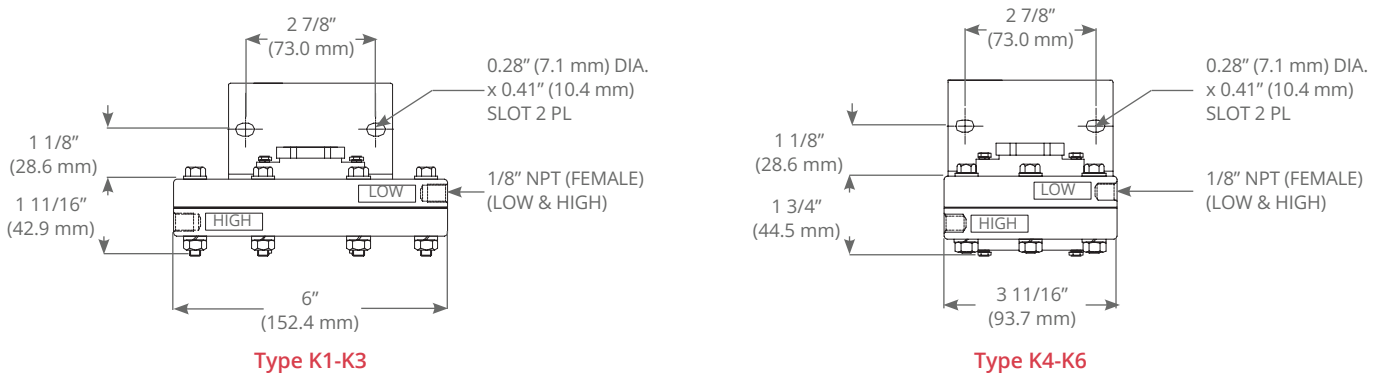


**Option M511**



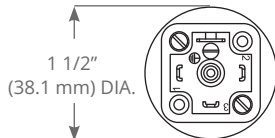
**Options XP112, XP113**

## Differential Pressure Connections

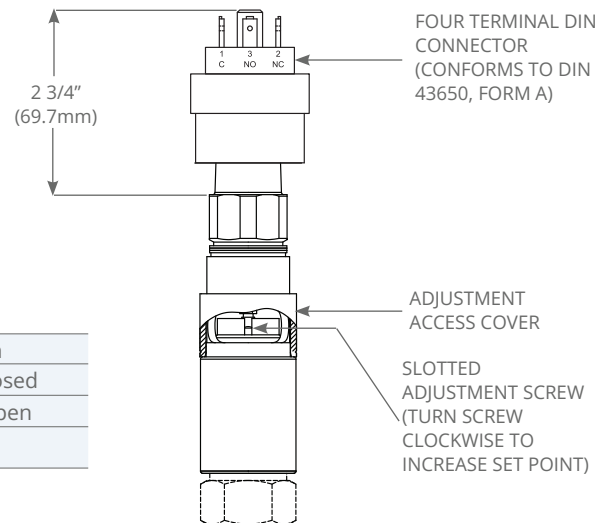


Types K1-K3 and K4-K6 shown with mounting bracket attached

## Option M515 DIN Connection



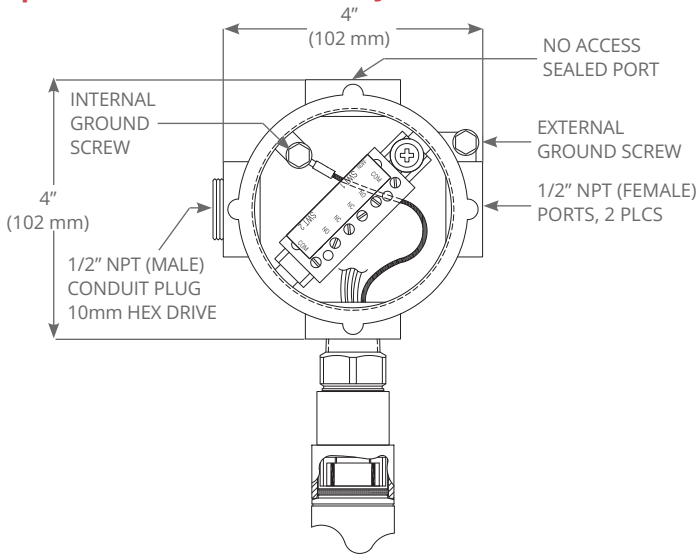
<b>Terminal #1</b>	Common
<b>Terminal #2</b>	Normally Closed
<b>Terminal #3</b>	Normally Open
	Ground



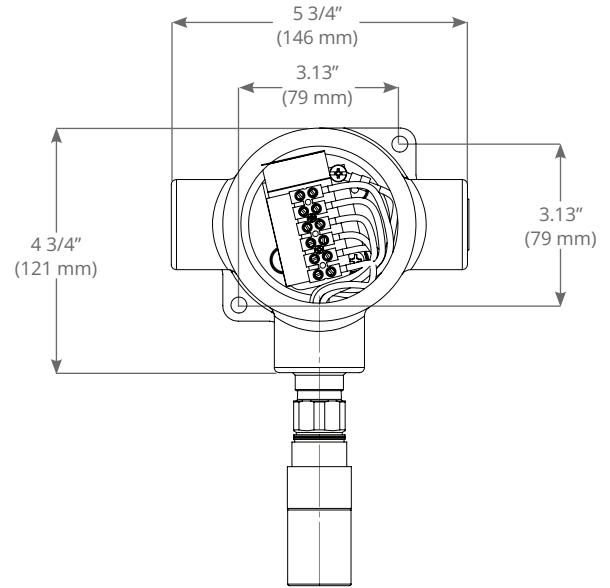
**NOTE:** Does not meet Div. 1 or 2, or ATEX requirements.

**Figure 4**

### Option M421, M423 & M513 Junction Boxes



M421 - EAC only; M423 - ATEX or IEC  
Not cULus approved. Cover not shown.



M513  
cULus only. Does not meet Enclosure Type 4X. Cover not shown.

### Option M430 Adjustment Cover Lock

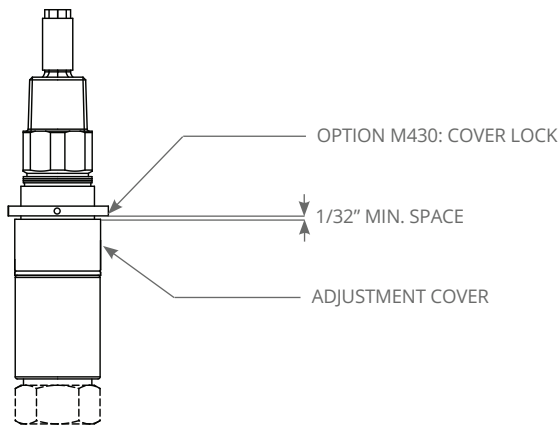


Figure 5

**NOTE:** A 1/32" min. space must be maintained between the bottom of the cover lock and the top of the adjustment cover to ensure proper dual seal annunciation and venting .

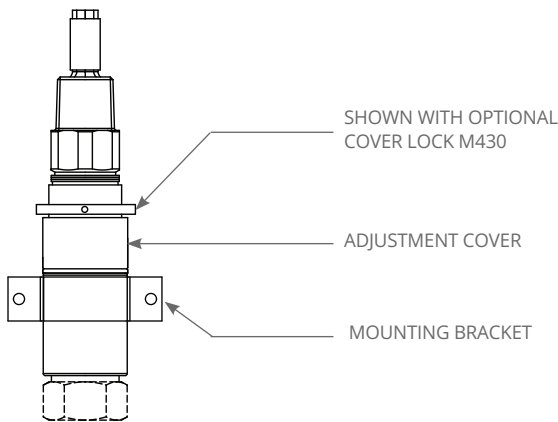
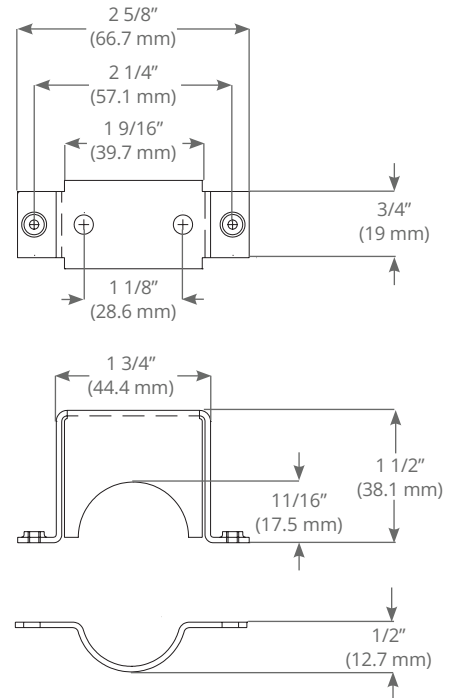


Figure 6



FRENCH WARNING TRANSLATIONS		
Pg	Warning Text	Texte d'Avertissement
1	MISUSE OF THIS PRODUCT MAY CAUSE EXPLOSION AND PERSONAL INJURY. THESE INSTRUCTIONS MUST BE THOROUGHLY READ AND UNDERSTOOD BEFORE UNIT IS INSTALLED.	Une mauvaise utilisation de cet appareil peut provoquer une explosion et/ou des blessures. Ces consignes doivent être lues attentivement et bien comprises avant l'installation de l'appareil.
1	12 SERIES PRESSURE-OPERATED SWITCH FOR USE IN CLASS I, GROUPS A, B, C AND D; CLASS II, GROUPS E, F AND G; CLASS III HAZARDOUS LOCATIONS. ENCLOSURE TYPE 4X, IP66. AMBIENT TEMPERATURE RANGE: -50°C (-58°F) TO 71°C (160°F).	Le pressostat 12 Series est adapté à une utilisation dans les lieux de Classe I, Division 1, de Groupes A, B, C et D ; Classe II, Division 1, Groupes E, F et G ; Classe III; ou non-dangereux. Boîtier de type 4X, IP66. Plage de température ambiante -50°C (-58°F) à 95°C (203°F).
1	ATEX AND IEC SPECIFIC CONDITIONS OF USE: THE WIRING TO THE PRESSURE SWITCH MUST ONLY BE CONNECTED IN A SAFE AREA OR BY AN APPROVED TERMINAL BOX CERTIFIED TO EN 60079-0/IEC 60079-0, EN 60079-1/IEC 60079-1, AND EN 60079-31/IEC 60079-31 FOR HAZARDOUS LOCATIONS. THE EPOXY RESIN SHALL NOT BE SUBJECT TO A TEMPERATURE GREATER THAN 125°C (257°F). THE WIRES SHALL BE PROTECTED AGAINST MECHANICAL DAMAGE, E.G. BY USE OF CONDUIT. OPTION M515 WITH DIN CONNECTOR IS NOT COVERED BY THIS CERTIFICATE. OPTION M460, EXTERNAL EARTH GROUND SCREW, IS TO BE USED IF METAL CONDUIT IS NOT USED. ELECTRICAL CONDUIT FITTING THREADED CONNECTION SHALL BE M20 X 1.5 WITH 7 THREADS MINIMUM ENGAGEMENT.	Conditions spécifiques d'utilisation ATEX et IEC: le câblage de l'appareil ne doit être connecté que dans une zone non dangereuse ou à une boîte de jonction et d'entrées de câble certifiées EN 60079-0/IEC 60079-0, EN 60079-1/IEC 60079-1, et EN 60079-31/IEC 60079-31 pour zone dangereuse. La résine Epoxy ne doit pas être soumise à une température supérieure à 125°C (257°F). Les fils doivent être protégés contre les dommages mécaniques par un conduit. L'option M515 avec un connecteur DIN n'est pas couverte par ce certificat. L'option M460, vis de mise à terre externe, doit être utilisée si on n'utilise pas de conduit métallique. Le raccord fileté du conduit électrique doit être de type M20 X 1,5 avec un engagement minimum de 7 filets.
1	THE DUAL SEAL DEVICE METHOD OF PRIMARY SEAL FAILURE ANNUNCIATION IS VISIBLE LEAKAGE FROM THE ENCLOSURE. DEPENDING UPON MEDIA SENSED, ADDITIONAL METHODS OF LEAK DETECTION MAY BE REQUIRED (PRESSURE MODELS ONLY)	La défaillance du joint primaire du dispositif à double étanchéité est indiquée par une fuite visible. En fonction du type de médium mesuré, d'autres méthodes de détection des fuites peuvent être nécessaires (pressostats seulement).
1	THIS PRODUCT DOES NOT HAVE ANY FIELD REPLACEABLE PARTS. ANY SUBSTITUTION OF COMPONENTS SHALL INVALIDATE AGENCY CERTIFICATION(S), AND IMPAIR SUITABILITY FOR CLASS I, DIV. 1 LOCATION.	Aucun composant de cet appareil ne peut être remplacé sur le terrain. Toute substitution de composant invalidera les approbations et certifications données par un tiers et compromettra l'utilisation dans un lieu de Classe I, Division 1.
2	INSTALL DEVICE WHERE SHOCK, VIBRATION AND TEMPERATURE FLUCTUATIONS ARE MINIMAL. DO NOT INSTALL DEVICE IN AMBIENT TEMPERATURES THAT EXCEED PUBLISHED LIMITS ON THE NAMEPLATE.	Installer l'appareil dans un endroit où les chocs, les vibrations et les variations de température sont minimales. Ne pas installer l'appareil dans un lieu où les températures ambiantes dépassent les limites indiquées sur la plaque signalétique de l'appareil.
2	DISCONNECT ALL SUPPLY CIRCUITS BEFORE WIRING DEVICE. WIRE DEVICE IN ACCORDANCE WITH LOCAL AND NATIONAL ELECTRICAL CODES. WIRES SHOULD BE PROTECTED AGAINST MECHANICAL DAMAGE BY USE OF A CONDUIT OR OTHER SUITABLE MEANS.	Avant le branchement de l'appareil, déconnecter l'installation sur laquelle l'appareil doit être monté. Réaliser le branchement électrique selon les codes électriques nationaux et locaux. Les fils doivent être protégés contre les dommages mécaniques par un conduit ou moyen approprié.
2	DO NOT EXCEED ELECTRICAL RATINGS LISTED ON NAMEPLATE. OVERLOAD ON A SWITCH CAN CAUSE FAILURE, EVEN ON THE FIRST CYCLE.	Les seuils électriques indiqués sur la plaque signalétique ne doivent jamais être dépassés. La surtension peut causer une panne de l'appareil dès les premier cycle.
2	DIN CONNECTOR (OPTION M515) IS NOT APPROVED FOR CLASS I, DIV. 1 HAZARDOUS LOCATION/FLAMEPROOF ATMOSPHERE.	Le connecteur DIN (Option M515) n'est pas approuvé pour la classe I, DIV. 1 zone dangereuse/ atmosphère inflammable.

### LIMITED WARRANTY

Seller warrants that the device hereby purchased is, upon delivery, free from defects in material and workmanship and that any such device which is found to be defective in such workmanship or material will be repaired or replaced by Seller (Ex-works, Factory, Watertown, Massachusetts. INCOTERMS); provided, however, that this warranty applies only to device found to be so defective within a period of 24 months from the date of manufacture by the Seller. Seller shall not be obligated under this warranty for alleged defects which examination discloses are due to tampering, misuse, neglect, improper storage, and in any case where devices are disassembled by anyone other than authorized Seller's representatives. EXCEPT FOR THE LIMITED WARRANTY OF REPAIR AND REPLACEMENT STATED ABOVE, SELLER DISCLAIMS ALL WARRANTIES WHATSOEVER WITH RESPECT TO THE DEVICE, INCLUDING ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.

### LIMITATION OF SELLER'S LIABILITY

Seller's liability to Buyer for any loss or claim, including liability incurred in connection with (i) breach of any warranty whatsoever, expressed or implied, (ii) a breach of contract, (iii) a negligent act or acts (or negligent failure to act) committed by Seller, or (iv) an act for which strict liability will be imputed to seller, is limited to the "limited warranty" of repair and/or replacement as so stated in our warranty of device. In no event shall the Seller be liable for any special, indirect, consequential or other damages of a like general nature, including, without limitation, loss of profits or production, or loss or expenses of any nature incurred by the buyer or any third party.

**UE specifications subject to change without notice.**



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FOR A LIST OF OUR INTERNATIONAL AND DOMESTIC REGIONAL SALES OFFICES PLEASE VISIT OUR WEBPAGE [WWW.UEONLINE.COM](http://WWW.UEONLINE.COM)

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Explosion-Proof Temperature Switch



Supplied by

**247cable.com**

Call us on +44 (0)118 916 9420 | Email [info@247able.com](mailto:info@247able.com)





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<b>Applicable Area</b>	North America
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UE declarations and third-party issued Agency certifications are available for download at [www.ueonline.com](http://www.ueonline.com).

**⚠ THIS PRODUCT DOES NOT HAVE ANY FIELD REPLACEABLE PARTS. ANY SUBSTITUTION OF COMPONENTS WILL INVALIDATE THIRD-PARTY ISSUED APPROVALS AND CERTIFICATIONS, AND MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 1 LOCATION.**

**i MAX. TEMPERATURE\* LIMITS LISTED ON NAMEPLATE MUST NEVER BE EXCEEDED, EVEN BY SURGES IN THE SYSTEM. OCCASIONAL OPERATION OF UNIT UP TO MAX. TEMPERATURE IS ACCEPTABLE, E.G., START-UP AND TESTING. EXCESSIVE CYCLING AT MAXIMUM TEMPERATURE LIMIT COULD REDUCE SENSOR LIFE. CONTINUOUS OPERATION SHOULD NOT EXCEED THE DESIGNATED ADJUSTABLE TEMPERATURE RANGE.**

\* Maximum Temperature - the highest temperature to which a sensing element may be occasionally operated without adversely affecting set point calibration and repeatability.

**i DEVICE MUST NOT BE ALTERED OR MODIFIED AFTER SHIPMENT. CONSULT UE IF MODIFICATION IS NECESSARY.**

The 12 Series temperature switch utilizes a liquid filled sensing stem (immersion stem, direct mounting) or sensing bulb (bulb & capillary, remote mounting) to detect a temperature change. The response, at a predetermined set point, actuates a SPDT or DPDT snap-acting microswitch, converting the temperature signal into an electrical signal. Control set point may be varied by turning the internal adjustment hex according to the procedures outline in Part II - Adjustments. Please refer to the datasheet at [www.ueonline.com](http://www.ueonline.com) for product specifications. Date code format on nameplate is "YYWW" for year and week.

## Part I - Installation

### Mounting

- 1 1/16" Open end wrench
- Screwdriver

**INSTALL DEVICE WHERE SHOCK, VIBRATION AND TEMPERATURE FLUCTUATIONS ARE MINIMAL. DO NOT INSTALL DEVICE IN AMBIENT TEMPERATURES THAT EXCEED PUBLISHED LIMITS ON THE NAMEPLATE.**

**IF USING WITH A JUNCTION BOX, IT IS RECOMMENDED THAT THE PRODUCT BE MOUNTED VERTICALLY WITH THE PRESSURE CONNECTION FACING DOWN.**

**DEVICE SHOULD BE MOUNTED TO PREVENT MOISTURE FROM ENTERING THE ENCLOSURE. VERTICAL MOUNTING IS RECOMMENDED.**

**ALWAYS USE A WRENCH ON LOCAL MOUNT, IMMERSION STEM HEX (SEE FIGURE 2). DO NOT TIGHTEN BY TURNING THE ENCLOSURE AS THIS WILL DAMAGE THE SENSOR AND WEAKEN WELDED JOINTS.**

Fully immerse the bulb and 6" of capillary in the control zone. For best control it is generally desirable to place the bulb close to the heating or cooling source in order to sense temperature fluctuations quickly. Be sure to locate the bulb so it will not be exposed to temperature beyond the instrument's range limits.

**AVOID BENDING OR COILING THE CAPILLARY TUBING TIGHTER THAN 1/2" RADIUS. EXERCISE CAUTION WHEN MAKING BENDS NEAR THE CAPILLARY ENDS.**

If a separable well or union connector is used follow separate instructions included with them.

#### Panel Mounting via 1/2" NPTM or M20 Electrical Connection

When panel mounting, mount through 7/8" clearance hole in panel. Use 1/2" or M20 conduit nut to secure in place. Always support the product by holding a wrench on the flat hex.

#### Surface Mounting Bracket Kit (P/N 62169-13) (see Fig. 4)

- 1 Open the adjustment cover and orient the unit so that adjustment opening will be accessible when the switch is mounted.
- 2 Close the adjustment cover ensuring that the bracket does not interfere with the cover.
- 3 Mount assembly in desired location, following instructions included with mounting bracket kit.

### Wiring

**DISCONNECT ALL SUPPLY CIRCUITS BEFORE WIRING UNIT. WIRE UNITS ACCORDING TO NATIONAL AND LOCAL ELECTRICAL CODES. THE WIRES SHOULD BE PROTECTED AGAINST MECHANICAL DAMAGE BY USE OF A CONDUIT OR OTHER SUITABLE MEANS.**

**DO NOT EXCEED ELECTRICAL RATINGS LISTED ON NAMEPLATE. OVERLOAD ON A SWITCH CAN CAUSE FAILURE, EVEN ON THE FIRST CYCLE.**

**DIN CONNECTOR (OPTION M515, FIGURE 5) IS NOT APPROVED FOR CLASS I, DIV. 1 HAZARDOUS LOCATIONS/ FLAMEPROOF ATMOSPHERES.**

1/2" NPT (male) or M20 (male) conduit connection is provided on top of the product with 72" long, 18 AWG leadwires. The product is available with SPDT or DPDT operation. External grounding screw and clamp is provided with option M460 for ATEX installation with non-metallic conduit systems (See Figure 1). To attach conduit connection, hold electrical connection steady with wrench on hex flats, then thread on conduit.

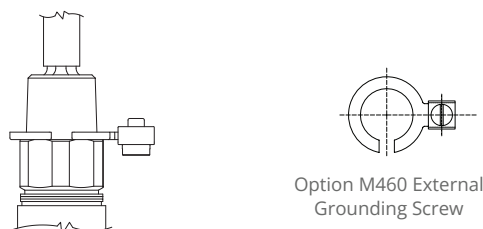


Figure 1

Factory Sealed Leadwires are color coded.

TERMINALS	SPDT	DPDT	
		Circuit 1	Circuit 2
Common	Brown	Brown	Yellow
Normally Closed	Red	Red	Black
Normally Open	Blue	Blue	Violet
Ground	Green	Green	

**DIN Connector with 4 Male Terminals (see Figure 5)** Connector conforms to DIN 43650. Use a female mating DIN connector (not UE supplied).

Coding: TERMINALS	
Terminal #1	Common
Terminal #2	Normally Closed
Terminal #3	Normally Open
⊕	Ground

## Part II - Adjustments

- Flathead screwdriver with 3/16" or 1/4" wide blade

- 1 Connect control to temperature source.
- 2 With power disconnected, slide cover toward electrical terminations while twisting it to overcome friction.
- 3 Connect power to terminals or leads.
- 4 Insert screwdriver into adjustment slot and turn clockwise to increase setting or counter clockwise to decrease setting. (See Figure 2)

For setting on rise, apply desired temperature and turn adjustment clockwise until switch actuates (circuit across N.O. and COM terminals closes). For setting on fall, apply temperature equal to normal system operating temperature. Reduce source temperature to setpoint value. Turn adjustment counter clockwise until switch actuates (circuit across N.C. and COM terminals closes).

**INFO** AFTER COMPLETING SETTING ADJUSTMENT, BE SURE TO SLIDE ADJUSTMENT COVER BACK INTO PLACE.

### Recommended Practices

- A redundant device is necessary for applications where damage to the primary device could endanger life, limb or property. A high or low limit switch is necessary for applications where a dangerous runaway condition could result.
- Monitor operation to observe warning signs of possible damage to device, such as drift in set point. Check device immediately.
- Preventative maintenance and periodic testing is necessary for critical applications where damage could endanger property or personnel.

### Part III - Dimensions

Dimensional drawings for all models may be found at: [www.ueonline.com](http://www.ueonline.com)

#### Standard Configuration

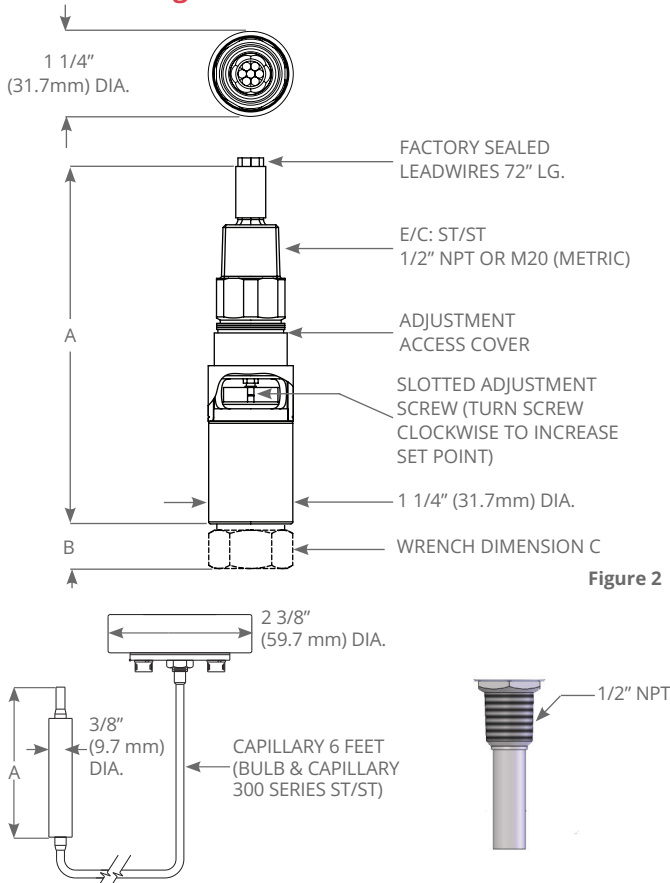


Figure 2

Type	Description	Dimension A		Dimension B	
		In	mm	In	mm
L1-L2	Local Temp	4.4	111.1	1.2	29.7
R1-R4	Remote Temp	4.4	111.1	0.6	15.2

#### Option M430 Adjustment Cover Lock

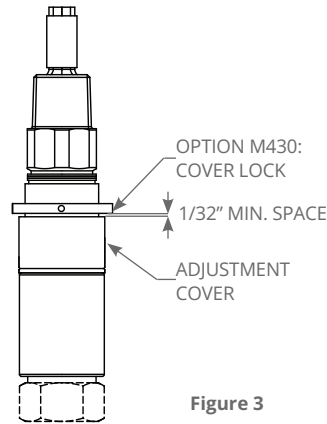


Figure 3

**NOTE:** A 1/32" min. space must be maintained between the bottom of the cover lock and the top of the adjustment cover to ensure proper dual seal annunciation and venting.

#### Surface Mounting Bracket (Kit P/N 62169-13)

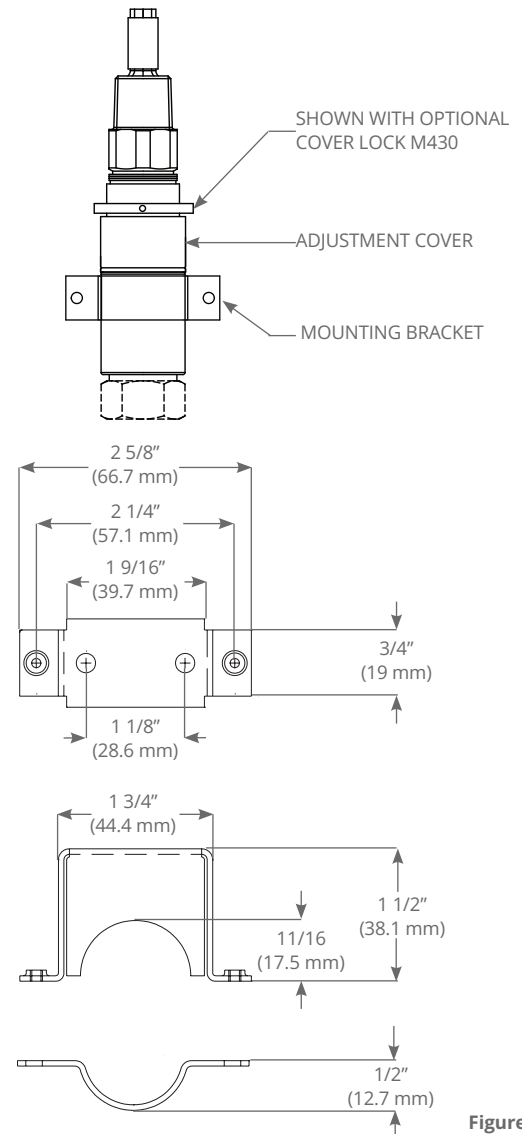
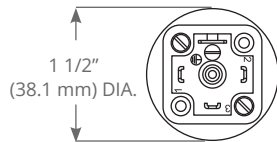



Figure 4

## Option M515 DIN Connection



**NOTE:** Does not meet Div. 1 or 2, or ATEX requirements.

<b>Terminal #1</b>	Common
<b>Terminal #2</b>	Normally Closed
<b>Terminal #3</b>	Normally Open
	Ground

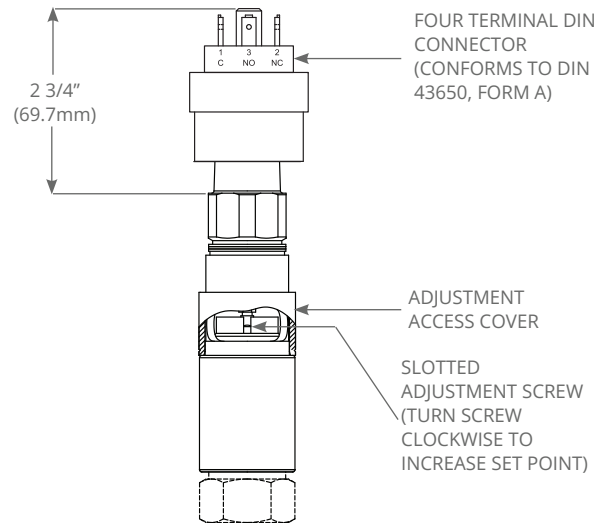
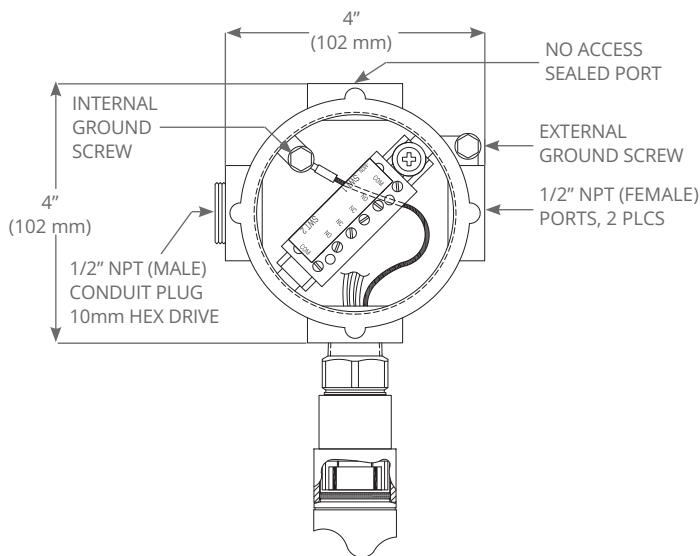
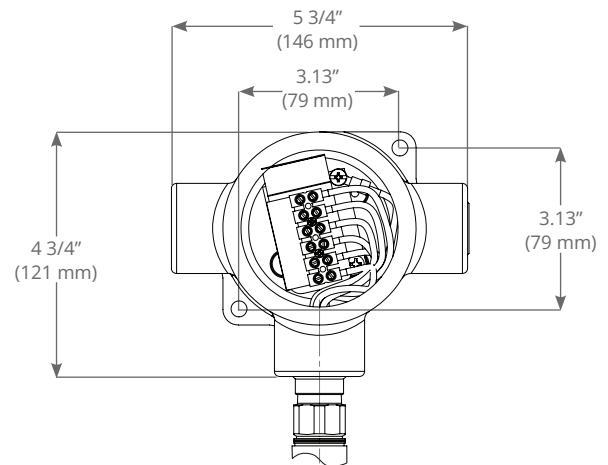


Figure 5

## Option drawings M421, M423 & M513 Junction Boxes



**M421 - EAC only; M423 - ATEX or IEC**  
Not cULus approved. Cover not shown.



**M513**  
cULus only. Does not meet Enclosure Type 4X. Cover not shown.

## French Warnings Translations

Pg	Warning Text	Texte d'Avertissement
1	MISUSE OF THIS PRODUCT MAY CAUSE EXPLOSION AND PERSONAL INJURY. THESE INSTRUCTIONS MUST BE THOROUGHLY READ AND UNDERSTOOD BEFORE UNIT IS INSTALLED.	Une mauvaise utilisation de cet appareil peut provoquer une explosion et/ou des blessures. Ces consignes doivent être lues attentivement et bien comprises avant l'installation de l'appareil.
1	12 SERIES TEMPERATURE SWITCH FOR USE IN CLASS I, GROUPS A, B, C AND D; CLASS II, GROUPS E, F AND G; CLASS III HAZARDOUS LOCATIONS. ENCLOSURE TYPE 4X, IP66. AMBIENT TEMPERATURE RANGE: -50°C (-58°F) TO 71°C (160°F).	L'interrupteur de température 12 Series est uniquement adapté à une utilisation dans les zones de Classe I, Groupes A, B, C et D; Classe II, Groupes E, F et G ; Classe III zones dangereuses. Boîtier de type 4X, IP66. Temperature ambiante: -50°C À 71°C.
1	ATEX AND IEC SPECIFIC CONDITIONS OF USE: THE WIRING TO THE TEMPERATURE SWITCH MUST ONLY BE CONNECTED IN A SAFE AREA OR BY AN APPROVED TERMINAL BOX CERTIFIED TO EN 60079-0/ IEC 60079-0, EN 60079-1/IEC 60079-1, AND EN 60079-31/IEC 60079-31 FOR HAZARDOUS LOCATIONS. THE EPOXY RESIN SHALL NOT BE SUBJECTED TO A TEMPERATURE GREATER THAN 125°C (257°F). THE WIRES SHALL BE PROTECTED AGAINST MECHANICAL DAMAGE, E.G. BY USE OF CONDUIT. OPTION M515 WITH DIN CONNECTOR IS NOT COVERED BY THIS CERTIFICATE. OPTION M460, EXTERNAL EARTH GROUND SCREW, IS TO BE USED IF METAL CONDUIT IS NOT USED. ELECTRICAL CONDUIT FITTING THREADED ENGAGEMENT SHALL BE M20 X 1.5 WITH 7 THREADS MINIMUM ENGAGEMENT.	Conditions spécifiques d'utilisation ATEX et IEC: le câblage de l'appareil ne doit être connecté que dans une zone non dangereuse ou à une boîte de jonction et d'entrées de câble certifiées EN 60079-0/IEC 60079-0, EN 60079-1/IEC 60079-1, et EN 60079-31/IEC 60079-31 pour zone dangereuse. La résine Epoxy ne doit pas être soumise à une température supérieure à 125°C (257°F). Les fils doivent être protégés contre les dommages mécaniques par un conduit. L'option M515 avec un connecteur DIN n'est pas couverte par ce certificat. L'option M460, vis de mise à terre externe, doit être utilisée si on n'utilise pas de conduit métallique. Le raccord fileté du conduit électrique doit être de type M20 X 1,5 avec un engagement minimum de 7 filets.
1	THIS PRODUCT DOES NOT HAVE ANY FIELD REPLACEABLE PARTS. ANY SUBSTITUTION OF COMPONENTS WILL INVALIDATE THIRD-PARTY ISSUED APPROVALS AND CERTIFICATIONS, AND MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 1 LOCATION.	Aucun composant de cet appareil ne peut être remplacé sur le terrain. Toute substitution de composant invalidera les approbations et certifications données par un tiers et compromettra l'utilisation dans un lieu de Classe I, Division 1.
1	INSTALL DEVICE WHERE SHOCK, VIBRATION AND TEMPERATURE FLUCTUATIONS ARE MINIMAL. DO NOT INSTALL DEVICE IN AMBIENT TEMPERATURES THAT EXCEED PUBLISHED LIMITS ON THE NAMEPLATE.	Installer l'appareil dans un endroit où les chocs, les vibrations et les variations de température sont minimales. Ne pas installer l'appareil dans un lieu où les températures ambiantes dépassent les limites indiquées sur la plaque signalétique de l'appareil.
2	DISCONNECT ALL SUPPLY CIRCUITS BEFORE WIRING DEVICE. WIRE DEVICE IN ACCORDANCE WITH LOCAL AND NATIONAL ELECTRICAL CODES. WIRES SHOULD BE PROTECTED AGAINST MECHANICAL DAMAGE BY USE OF A CONDUIT OR OTHER SUITABLE MEANS.	Avant le branchement de l'appareil, déconnecter l'installation sur laquelle l'appareil doit être monté. Réaliser le branchement électrique selon les codes électriques nationaux et locaux. Le diamètre maximal recommandé pour les fils est de 14 AWG. Le couple de serrage pour la borne de raccordement est de 7 à 17 IN-LBS.
2	DO NOT EXCEED ELECTRICAL RATINGS LISTED ON NAMEPLATE. OVERLOAD ON A SWITCH CAN CAUSE FAILURE, EVEN ON THE FIRST CYCLE.	Les seuils électriques indiqués dans la documentation et sur les plaques signalétiques ne doivent jamais être dépassés. La surtension peut causer une panne de l'appareil dès les premier cycle.
2	DIN CONNECTOR (OPTION M515, FIGURE X) IS NOT APPROVED FOR CLASS I, DIV. 1 HAZARDOUS LOCATION/FLAMEPROOF ATMOSPHERE.	Le connecteur DIN (Option M515) n'est pas approuvé pour la classe I, DIV. 1 zone dangereuse/ atmosphère inflammable.

## LIMITED WARRANTY

Seller warrants that the device hereby purchased is, upon delivery, free from defects in material and workmanship and that any such device which is found to be defective in such workmanship or material will be repaired or replaced by Seller (Ex-works, Factory, Watertown, Massachusetts. INCOTERMS); provided, however, that this warranty applies only to device found to be so defective within a period of 24 months from the date of manufacture by the Seller. Seller shall not be obligated under this warranty for alleged defects which examination discloses are due to tampering, misuse, neglect, improper storage, and in any case where devices are disassembled by anyone other than authorized Seller's representatives. EXCEPT FOR THE LIMITED WARRANTY OF REPAIR AND REPLACEMENT STATED ABOVE, SELLER DISCLAIMS ALL WARRANTIES WHATSOEVER WITH RESPECT TO THE DEVICE, INCLUDING ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.

## LIMITATION OF SELLER'S LIABILITY

Seller's liability to Buyer for any loss or claim, including liability incurred in connection with (i) breach of any warranty whatsoever, expressed or implied, (ii) a breach of contract, (iii) a negligent act or acts (or negligent failure to act) committed by Seller, or (iv) an act for which strict liability will be inputted to seller, is limited to the "limited warranty" of repair and/or replacement as so stated in our warranty of device. In no event shall the Seller be liable for any special, indirect, consequential or other damages of a like general nature, including, without limitation, loss of profits or production, or loss or expenses of any nature incurred by the buyer or any third party.

**UE specifications subject to change without notice.**



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Installation & Maintenance Instructions

# UE 100, 120, & 12 SERIES

Safety Manual



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**UNITED ELECTRIC  
CONTROLS**

*LEADERS IN SAFETY. ALARM & SHUTDOWN*

## **100, 120, & 12 Series Safety Manual**



**100 Series**



**120 Series**



**12 Series**



## 1 INTRODUCTION

This Safety Manual provides information necessary to design, install, verify and maintain a Safety Instrumented Function (SIF) utilizing the *100, 120, & 12 Series*. This manual provides necessary requirements for meeting the IEC 61508 or IEC 61511 functional safety standards.

### 1.1 Skill Level Requirement

System design, installation and commissioning, and repair and maintenance shall be carried out by suitably qualified personnel.

### 1.2 Terms and Abbreviations

Safety	Freedom from unacceptable risk of harm
Functional Safety	The ability of a system to carry out the actions necessary to achieve or to maintain a defined safe state for the equipment / machinery / plant / apparatus under control of the system.
Basic Safety	The equipment must be designed and manufactured such that it protects against risk of damage to persons by electrical shock and other hazards and against resulting fire and explosion. The protection must be effective under all conditions of the nominal operation and under single fault condition.
Safety Assessment	The investigation to arrive at a judgment - based on evidence - of the safety achieved by safety-related systems.
Fail-Safe State	State where the outputs are de-energized.
Fail Safe	Failure that causes the valve to go to the defined fail-safe state without a demand from the process.
Fail Dangerous	Failure that does not respond to a demand from the process. (i.e., being unable to go to the defined fail-safe state)
Fail Dangerous Undetected	Failure that is dangerous and that is not being diagnosed by proof testing or instrument diagnostics.
Fail Dangerous Detected	Failure that is dangerous but is detected proof testing or instrument diagnostics.
Fail Annunciation Undetected	Failure that does not cause a false trip or prevent the safety function but does cause loss of an automatic diagnostic and is not detected by another diagnostic.
Fail Annunciation Detected	

	Failure that does not cause a false trip or prevent the safety function but does cause loss of an automatic diagnostic or false diagnostic indication.
Fail No Effect	Failure of a component that is part of the safety function but that has no effect on the safety function.
Low demand mode	Mode where the frequency of demands for operation made on a safety-related system is no greater than twice the proof test frequency.

### 1.3 Acronyms

DTT	De-Energize to Trip
DU	Dangerous Undetected
FMEDA	Failure Modes, Effects and Diagnostic Analysis
FIT	Failure In Time (One FIT is $1 \times 10^{-9}$ failure per hour)
HFT	Hardware Fault Tolerance
MOC	Management of Change. These are specific procedures often done when performing any work activities in compliance with government regulatory authorities.
$PFD_{avg}$	Average Probability of Failure on Demand
PLC	Programmable Logic Controller
SFF	Safe Failure Fraction – The fraction of the overall failure rate of a device that results in either a safe fault or a diagnosed unsafe fault.
SIF	Safety Instrumented Function, a set of equipment intended to reduce the risk due to a specific hazard (a safety loop).
SIL	Safety Integrity Level, discrete level (one out of a possible four) for specifying the safety integrity requirements of the safety functions to be allocated to the E/E/PE safety-related systems where Safety Integrity Level 4 has the highest level of safety integrity and Safety Integrity Level 1 has the lowest.
SIS	Safety Instrumented System – Implementation of one or more Safety Instrumented Functions. A SIS is composed of any combination of sensor(s), logic solver(s), and final element(s).

### 1.4 Product Support

Product support can be obtained from:

United Electric Controls  
 180 Dexter Ave,  
 P.O. Box 9143  
 Watertown, MA 02471-9143

TechSupport@ueonline.com  
Telephone: 617-926-1000  
Fax: 617-926-2568

## 1.5 Related Literature

### Hardware Documents:

- *100 Series* Installation, Operation and Maintenance Instructions (IMP100 or IMT100)
- *100 Series* Product Bulletin (100-B)
- *120 Series* Installation, Operation and Maintenance Instructions (IMP120 or IMT120)
- *120 Series* Product Bulletin (120-B)
- *12 Series* Installation, Operation and Maintenance Instructions (IMP12 or IMT12)
- *12 Series* Product Bulletin (12-B)
- FMEDA Report (100 & 120 Series): UEC 16/02-130 R001
- FMEDA Report (12 Series): UEC 20/06-041 R001

### Guidelines/References:

- Practical SIL Target Selection – Risk Analysis per the IEC 61511 Safety Lifecycle, ISBN 978-1-934977-03-3, exida
- Control System Safety Evaluation and Reliability, 3rd Edition, ISBN 978-1-934394-80-9, ISA
- Safety Instrumented Systems Verification, Practical Probabilistic Calculations, ISBN 1-55617-909-9, ISA

## 1.6 Reference Standards

### Functional Safety

- IEC 61508: 2010 Functional safety of electrical/electronic/ programmable electronic safety-related systems
- ANSI/ISA 84.00.01-2004 (IEC 61511 Mod.) Functional Safety – Safety Instrumented Systems for the Process Industry Sector

## 2 PRODUCT DESCRIPTIONS

### 100 Series

The *100 Series* is a cost-effective pressure, vacuum, differential pressure, and temperature switch for process plants and OEM equipment. The rugged, one-piece enclosure features a slanted cover for wiring accessibility. A wide variety of microswitch and process-connection options make this versatile series ideal for applications requiring a rugged weather-proof mechanical switch. Typical applications that utilize the *100 Series* are heat tracing, freeze protection, processing equipment (pumps, compressors), inputs for annunciator panels, and fire suppression systems.

### 120 Series

Meeting hazardous location requirements through worldwide approvals and certifications, UE's *120 Series* is the choice where potentially explosive or highly corrosive atmospheres exist. The *120 Series* offers a variety of pressure, vacuum, differential pressure and temperature ranges, as well as process connections, wetted materials and sensor types. With a common flexible platform, models can quickly be adapted at the factory for special requirements, such as ranges, process connections and electrical ratings. Typical industries using *120 Series* switches include chemical, petrochemical, refinery, and oil & gas production and transmission.

### 12 Series

*12 Series* hazardous location, pressure, vacuum, differential pressure, and temperature switches are ideal for operation in tough applications where space is at a premium. A snap-action Belleville spring assembly is used in most models to provide vibration resistance and prolonged switch life. The 316 stainless steel enclosure and hermetically sealed switch provide rugged protection from the environment. Approved for use in hazardous locations worldwide, the 12 Series is installed within applications ranging from offshore oil rigs to rotating equipment, and more.

## 3 DESIGNING A SIF USING UNITED ELECTRIC CONTROLS SWITCHES

### 3.1 Safety Function

The safety function of the switches is the micro switch changing its state when the input pressure or temperature rises above (increasing to trip), or falls below (decreasing to trip), the set point within the stated safety accuracy. The safe state is defined by the user and application.

The achieved SIL level of the designed function must be verified by the designer.

### 3.2 Environmental limits

The designer of a SIF must check that the product is rated for use within the expected environmental limits. Refer to the specific series switch Bulletin for the switches environmental limits.

### 3.3 Application limits

The materials of construction of each series are specified in their respective Bulletins available through United Electric Controls. It is especially important that the designer check for material compatibility considering on-site conditions. If any of United Electric Controls products are used outside of their application limits or with incompatible materials, the reliability data provided becomes invalid. The electrical ratings and pressure/temperature range information for each series offered by United Electric Controls can be found in their respective Bulletins.

### 3.4 Design Verification

A detailed Failure Mode, Effects, and Diagnostics Analysis (FMEDA) report is available from *United Electric Controls*. This report details all failure rates and failure modes as well as the expected lifetime.

The achieved Safety Integrity Level (SIL) of an entire Safety Instrumented Function (SIF) design must be verified by the designer via a calculation of  $PFD_{AVG}$  considering architecture, proof test interval, proof test effectiveness, any automatic diagnostics, average repair time and the specific failure rates of all products included in the SIF. Each subsystem must be checked to assure compliance with minimum hardware fault tolerance (HFT) requirements. The exida exSILentia® tool is recommended for this purpose as it contains accurate models for the 100, 120, & 12 Series and their failure rates.

When using any *United Electric Controls Switch* in a redundant configuration, a common cause factor of at least 5% should be included in safety integrity calculations.

The failure rate data listed in the FMEDA reports are only valid for the useful life time of their mentioned series. The failure rates will increase sometime after this time period. Reliability calculations based on the data listed in the FMEDA report for mission times beyond the lifetime may yield results that are too optimistic, i.e., the calculated Safety Integrity Level will not be achieved.

## 3.5 SIL Capability

### 3.5.1 Systematic Integrity

The *products* have met manufacturer design process requirements of Safety Integrity Level (SIL) 3. These are intended to achieve sufficient integrity against systematic errors of design by the manufacturer. A Safety Instrumented Function (SIF) designed with these products must not be used at a SIL level higher than stated without “prior use” justification by the end user or diverse technology redundancy in the design.

### 3.5.2 Random Integrity

The *100, 120, and 12 Series* are classified as Type A devices according to Table 2 of the IEC 61508-2 standard. According to IEC 61508 the architectural constraints of an element must be determined. This can be done by following the 1H approach according to 7.4.4.2 of IEC 61508 or the 2H approach according to 7.4.4.3 of IEC 61508, or the approach according to IEC 61511:2016 which is based on 2H.

The 1H approach involves calculating the Safe Failure Fraction for the entire element.

The 2H approach involves assessment of the reliability data for the entire element according to 7.4.4.3.3 of IEC 61508.

The failure rate data used for this analysis meets the exida criteria for Route 2H which is more stringent than IEC 61508. Therefore, the *100/120/12 Series* Switch meets the hardware architectural constraints for up to SIL 2 at HFT=0 (or SIL 3 @ HFT=1) when the listed failure rates are used.

If Route 2H is not applicable for all devices that constitute the entire element, the architectural constraints will need to be evaluated per Route 1H.

The architectural constraint type for the *100/120/12 Series* Switch is A. The hardware fault tolerance of the device is 0. The SIS designer is responsible for meeting other requirements of applicable standards for any given SIL.

When the sensor element assembly consists of multiple components the SIL must be verified for the entire assembly using failure rates from all components. This analysis must account for any hardware fault tolerance and architecture constraints.

### 3.5.3 Safety Parameters

For detailed failure rate information refer to the Failure Modes, Effects and Diagnostic Analysis Reports for the series in question.

## 3.6 Connection of UE Mechanical Switches to the SIS Logic-solver

*United Electric Control Switches* can be connected to a safety rated logic solver which is actively performing the safety function. A low current switch option is recommended for use with a logic solver. *United Electric Control Switches* can also be connected directly to the final element in which the microswitch is performing the safety function.

### 3.7 General Requirements

- The system's response time shall be less than the process safety time. *United Electric Control Switches* will change state in less than 1s under specified conditions.
- All SIS components, including *United Electric Control Switches*, must be operational before process start-up.
- The user shall verify that *United Electric Control Switches* are suitable for use in safety applications by confirming the nameplate is properly marked. Product model number, range, electrical ratings and configuration ID are found on the product nameplate.
- If *United Electric Control Switches* are connected directly to the final element, it is recommended the microswitch be de-rated to 60% and if it is being used with a non-resistive load, it is also recommended the user add external transient protection.
- Personnel performing maintenance and testing on *United Electric Control Switches* shall first be assessed as being competent to do so.
- Results from the proof tests shall be recorded and reviewed periodically.
- The useful life of *United Electric Control Switches* are discussed in their respective Failure Modes, Effects and Diagnostic Analysis Reports.

## 4 INSTALLATION AND COMMISSIONING

### 4.1 Installation

- The *United Electric Control Switch* must be installed per standard practices outlined in the Installation Manuals.
- The *United Electric Control Switch* must not be modified.
- The environment must be checked to verify that environmental conditions do not exceed the ratings.
- The *United Electric Control Switch* must be accessible for physical inspection.

### 4.2 Physical Location and Placement

The *United Electric Control Switch* shall be accessible with sufficient room for connections and shall allow manual proof testing to take place.

The *United Electric Control Switch* shall be mounted in an environment experiencing vibrations within the allowable range listed in its respective bulletin. If excessive vibration can be expected special precautions shall be taken to ensure the integrity of connectors or the vibration should be reduced using appropriate damping mounts. The shock and vibration specifications can be found in the switches respective bulletin.

### 4.3 Connections

Connections to *United Electric Control Switches* are to be made per the Installation, Operation and Maintenance Instructions (Reference *Hardware Documents* in Section 1.5).

Recommended methods for process connections to *United Electric Control Switches* can be found in the installation and maintenance instructions. The length of tubing/piping between the *UEC Switch* and the process connection shall be kept as short as possible and free of kinks to minimize restrictions and potential clogging. Long or kinked tubes/pipes may also increase response time.



## 5 OPERATION AND MAINTENANCE

### 5.1 Proof test without automatic testing

The objective of proof testing is to detect failures within a *United Electric Controls Switch* that are not detected by any automatic diagnostics of the system. Of main concern are undetected failures that prevent the safety instrumented function from performing its intended function.

The frequency of proof testing, or proof test interval, is to be determined in reliability calculations for the safety instrumented functions for which a *United Electric Controls Switch* is applied. The proof tests must be performed at least as frequently as specified in the calculation in order to maintain the required safety integrity of the safety instrumented function.

The following proof test is recommended. The results of the proof test should be recorded and any failures that are detected and that compromise functional safety should be reported to *United Electric Controls*.

**Table 1: Recommended Proof Test<sup>1</sup>**

Step	Action
1.	Take appropriate action to avoid a false trip.
2.	Inspect the device for any visible damage, corrosion or contamination.
3.	Increase the pressure/temperature to reach the increasing set point value and verify that the electric signal proceeds into the safe state.
4.	Lower the pressure/temperature to reach the decreasing set point value and verify that the electric signal returns to the normal state.
5.	Repeat steps 3 and 4 twice or more to evaluate the average set point value and repeatability.
6.	Restore the connection to full operation.
7.	Restore normal operation.

The Proof Test Coverage for the tests listed in Table 1 will detect >85% of possible DU failures in *United Electric Controls Switches*.

The person(s) performing the proof test of a *United Electric Controls Switch* shall be trained in SIS operations, including bypass procedures, maintenance and company Management of Change procedures. No special tools are required.

### 5.2 Repair and Replacement

Repair procedures in the *United Electric Controls Switches* Installation, Operation and Maintenance manuals must be followed.

<sup>1</sup> This Proof Test represents an Increase to Trip application. For a Decrease to Trip application, steps 3 & 4 are reversed.

### 5.3 Manufacturer Notification

In case of malfunction of the system or SIF, the *United Electric Controls Switch* shall be put out of operation and the process shall be kept in a safe state by other measures.

*United Electric Controls* must be informed when the *United Electric Controls Switch* is required to be replaced due to failure. The failure shall be documented and reported to *United Electric Controls* using the contact details in Section 1.4 of this safety manual.

### 5.4 Useful Life

The useful life of *United Electric Controls Switches* are 10 years or 100,000 cycles.

## Appendix A Sample Start-up Checklist

This appendix provides a Sample Start-up Checklist for a *United Electric Controls Switch*. A Start-up Checklist will provide guidance during the *Switches* deployment.

## 1 START-UP CHECKLIST

The following checklist may be used as a guide to employ *United Electric Controls Switches* in safety critical SIF compliant to IEC61508.

#	Activity	Result	Verified	
			By	Date
<b>Design</b>				
	Target Safety Integrity Level and PFDavg determined			
	Correct mode chosen (Increase to trip, Decrease to Trip)			
	Switch mode chosen (Normally Open, Normally Closed)			
	Design decision documented			
	Media compatibility and suitability verified			
	SIS logic solver requirements for automatic tests defined and documented			
	Routing of fluid connections determined			
	Design formally reviewed and suitability formally assessed			
<b>Implementation</b>				
	Physical location appropriate			
	Media connections appropriate and according to applicable codes			
	SIS logic solver automatic test implemented			
	Maintenance instructions for proof test released			
	Verification and test plan released			
	Implementation formally reviewed and suitability formally assessed			

#	Activity	Result	Verified	
			By	Date
<b>Verification and Testing</b>				
	Electrical connections verified and tested			
	Media connection verified and tested			
	SIS logic solver automatic test verified			
	Safety loop function verified			
	Safety loop timing measured			
	Bypass function tested			
	Verification and test results formally reviewed and suitability formally assessed			
<b>Maintenance</b>				
	Tubing blockage / partial blockage tested			
	Safety loop function tested			