

Installation & Maintenance Instructions

# UE 120 SERIES

Explosion-Proof

Types J120, H121, H122 (Pressure Switch)

Types J120K, H121K, H122K (Differential Pressure Switch)



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# 120 Series



Explosion-Proof

Types J120, H121, H122 (Pressure Switch)

Types J120K, H121K, H122K (Differential Pressure Switch)

## 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 DEVICE IS INSTALLED.**



**BEFORE INSTALLING, CHECK THE SENSOR MODEL SELECTED FOR COMPATIBILITY BETWEEN THE PROCESS MEDIA AND THE SENSOR AND WETTED PARTS.**

<b>Cert number</b>	<b>20150512-E40857</b>
<b>Applicable Area</b>	North America
<b>Markings</b>	Class I, Groups B, C and D; Class II, Groups E, F and G; Class III
<b>Applicable Standards</b>	UL 1203; CAN/CSA C22.2 No. 25 CAN/CSA C22.2 No. 30

<b>Cert number</b>	<b>DEMKO 09 ATEX 0815573X</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 IP66
<b>Applicable Standards</b>	EN IEC 60079-0; EN 60079-1; EN 60079-31

<b>Cert number</b>	<b>IECEX UL 03.0001X</b>
<b>Applicable Area</b>	International
<b>Markings</b>	Ex db IIC T6 Gb Ex tb IIIC T85°C Db IP66 -40°C to +75°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
<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



**120 SERIES FOR USE IN CLASS I, DIV. 1, GROUPS 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 71°C (160°F).**



**ATEX AND IEC SPECIFIC CONDITIONS OF USE: DIMENSIONS OF THE FLAMEPROOF JOINTS ARE OTHER THAN THE RELEVANT MINIMUM OR MAXIMUM SPECIFIED IN TABLES 1 AND 2 OF EN 60079-1/IEC 60079-1. PRESSURE OPERATED SWITCHES ARE TO BE MARKED WITH AN "X" AND THE DIMENSIONS OF THE FLAMEPROOF JOINTS ARE AS FOLLOWS:**

#### 120's

- **Activation Plunger to adjustment screw hole gap joints:** 1.140 in/28.96 mm min length by 0.0039 in/0.099 mm max annular gap.
- **Plunger Guide to enclosure through threaded joints:** minimum 8 ½ fully engaged threads.
- **Cover to enclosure through threaded joints:** minimum 7 ½ fully engaged threads.

#### 121's and 122's

- **Activation Plunger to enclosure through hole gap joints:** 1.000 in/25.40 mm min length by 0.0030 in/0.076 mm max annular gap.
- **Adjustment shaft to shaft through hole gap joints:** 1.050 in/26.67 mm min. length by 0.0035 in/0.089 mm max. annular gap.
- **Cover to enclosure through threaded joints:** minimum 7 ½ fully engaged threads.



**ATEX AND IEC SPECIFIC CONDITIONS OF USE: ENCLOSURE CONTAINS ALUMINUM. CARE MUST BE TAKEN TO AVOID IGNITION HAZARD DUE TO IMPACT OR FRICTION.**



**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.**



**TO PREVENT IGNITION OF HAZARDOUS ATMOSPHERES, DISCONNECT SUPPLY CIRCUITS BEFORE OPENING. KEEP COVER TIGHT WHILE CIRCUITS ARE ENERGIZED.**



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





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

\* Proof Pressure - the maximum pressure to which a pressure sensor may be 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 120 Series pressure and differential pressure switches are actuated when a bellows, diaphragm or piston sensor responds to a pressure change. This response at a pre-determined set point(s) actuates a SPDT, DPDT or dual SPDT snap-acting microswitch(es), which convert the pressure signal into an electrical signal. Control set point(s) may be varied by turning the internal adjustment hex (J120 & J120K models) or the external knob and pointer(s) (H121, H121K, H122, & H122K models) according to the procedures outlined. (See 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.

## Part I - Installation



- Screwdriver
- Adjustable Wrench to 1-1/2"

## Mounting



**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 IS PROVIDED WITH TWO 3/4" NPT ELECTRICAL CONDUIT OPENINGS, EITHER OF WHICH OR BOTH CAN BE USED DURING INSTALLATION. A 3/4" EXPLOSION-PROOF PLUG IS PROVIDED FOR PROPERLY PLUGGING THE UNUSED CONDUIT OPENING. THE EXPLOSION-PROOF PLUG MUST BE PROPERLY INSTALLED AND IS CERTIFIED AS PART OF THE DEVICE AND CARRIES NO INDIVIDUAL MARKINGS.**



**THE CONNECTION OF THE DEVICE SHALL BE MADE BY CABLE ENTRIES OR A STOPPING BOX SUITABLE FOR THE CONDITIONS OF USE AND CORRECTLY INSTALLED AND CERTIFIED BY TYPE OF EXPLOSION PROTECTION - EXPLOSION-PROOF 'd'.**



**DEVICE CAN BE MOUNTED IN ANY ORIENTATION BUT VERTICAL MOUNTING IS RECOMMENDED TO PREVENT MOISTURE FROM ENTERING THE ENCLOSURE.**



**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. DO NOT TIGHTEN BY TURNING THE ENCLOSURE AS THIS WILL DAMAGE THE SENSOR AND WEAKEN WELDED JOINTS.**



**FOR DIFFERENTIAL PRESSURE MODELS, MOUNT USING A WRENCH ON LOW AND HIGH SIDE PRESSURE CONNECTION HEX OR MOUNT AGAINST A RIGID SUPPORT THEN CONNECT LOW AND HIGH PRESSURE PORTS.**

Device may be surface mounted via the four 1/4" screw holes on the enclosure or mounting bracket. It can also be mounted directly to a rigid pipe using the pressure connection.

## Type J120 and J120K Models 520-525, 530-535

It is recommended that types J120 and J120K models 520-525 and 530-535 be mounted vertically (pressure connection facing down, see figure 1A). If horizontal mounting is required, mount device so vent hole faces down (see Figure 1B). Set-point may shift and require set-point adjustment. Consult factory for additional information.

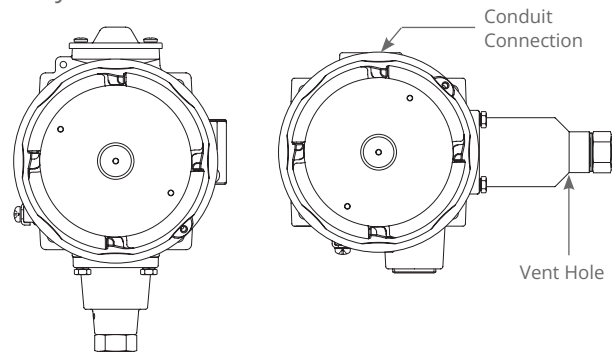


Figure 1A:  
H121, H121K, H122, H122K

Figure 1B:  
J120, J120K

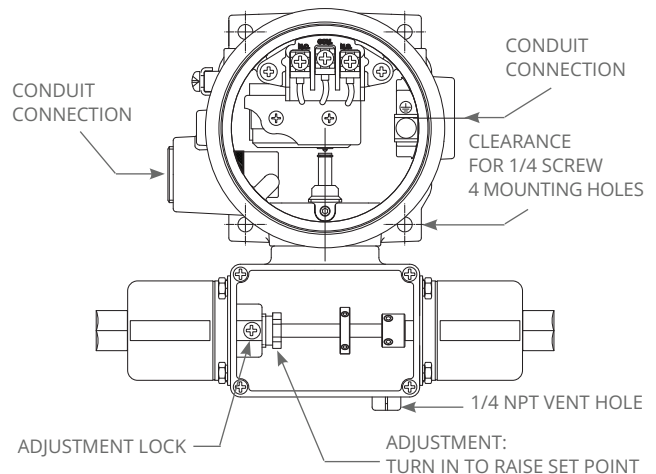
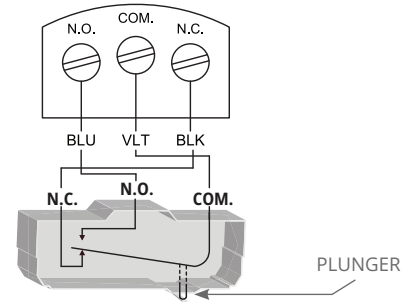


Figure 2  
Opposed Sensor Models

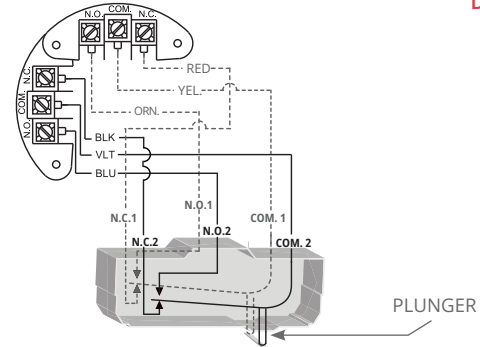
Differential Pressure Types J120K, H121K, H122K  
 Opposed Sensor Models 36-39,  
 (S)147(B)-(S)157(B), 367

Opposed sensor differential pressure switches should be mounted with their pressure connection in the horizontal position (See Figure 2). This will properly orient the 1/4" NPT venting conduit at the bottom of the middle compartment (standardly supplied with plastic plug).

SPDT



DPDT



2SPDT

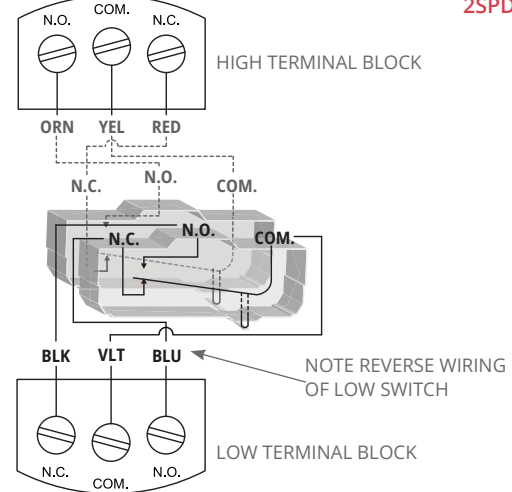


Figure 3

## Wiring



**DISCONNECT ALL SUPPLY CIRCUITS BEFORE WIRING DEVICE. WIRE DEVICE IN ACCORDANCE WITH LOCAL AND NATIONAL ELECTRICAL CODES. MAXIMUM RECOMMENDED WIRE SIZE IS 14 AWG AND RECOMMENDED TIGHTENING TORQUE FOR FIELD WIRING TERMINALS IS 7 TO 17 IN.-LBS. IT IS IMPERATIVE TO USE PROPERLY RATED EXPLOSION-PROOF SEALING FITTINGS FOR ELECTRICAL WIRE ENTRY.**



**USE 90 °C (194 °F) MIN. RATED COPPER CONDUCTOR ONLY. FOR AMBIENT TEMPERATURES BELOW -10 °C (14 °F), USE SUITABLE FIELD WIRING.**



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



**THE EXTERNAL GROUNDING TERMINAL IS NOT TO BE USED AS THE PRIMARY EQUIPMENT GROUNDING TERMINAL. THE INTERNAL GROUNDING TERMINAL SHALL BE USED AS THE PRIMARY EQUIPMENT GROUNDING MEANS AND THE EXTERNAL GROUNDING TERMINAL IS ONLY FOR A SUPPLEMENTAL (SECONDARY) GROUNDING CONNECTION WHERE LOCAL AUTHORITIES PERMIT OR REQUIRE SUCH A CONNECTION.**



**TO PREVENT IGNITION OF HAZARDOUS ATMOSPHERES, SEAL CONDUIT RUNS WITHIN 18" OF ENCLOSURE.**



**ENSURE ELECTRICAL CONDUIT ENTRIES ARE PROPERLY SEALED TO PREVENT MOISTURE ENTRY.**



**TO PREVENT SEIZURE OF ENCLOSURE COVER, DO NOT REMOVE LUBRICANT FROM THREADS. THREADS SHOULD ALSO BE FREE OF DIRT AND OTHER CONTAMINANTS.**

- 1 Remove cover and wire device (See Figure 3).
- 2 Wire directly to the terminal block. An internal grounding terminal is located near the right-hand conduit opening.
- 3 Replace cover and hand tighten to fully engage cover O-ring.

## Part II - Adjustments



- Screwdriver
- 5/8" Open End Wrench
- 5/64" Allen Wrench

For set point adjustment and re-gapping (if necessary), connect device to a calibrated pressure source.

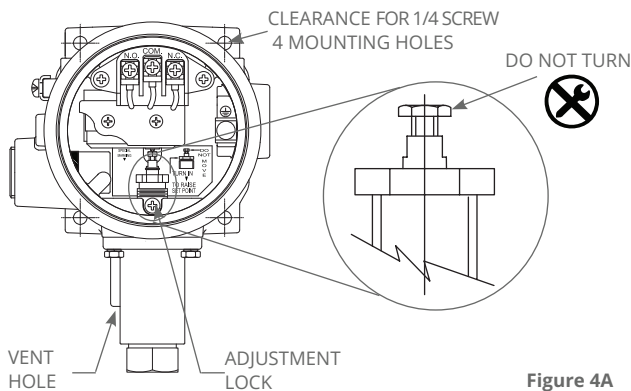
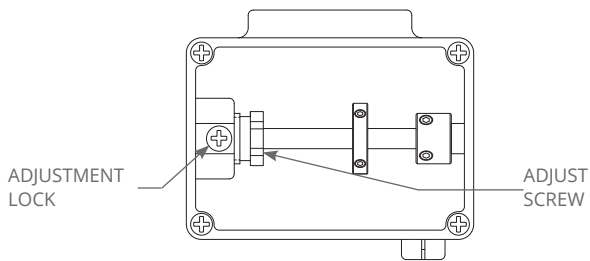


Figure 4A



J120K: Opposed Sensor, Models 36-39, 147-157, S147B, S157B, 367 Figure 4B

## Types J120 (All) and J120K Models 455-559 (See Figure 4A)

- 1 Remove cover.
- 2 Loosen phillips screw adjustment lock.
- 3 Adjust set point by turning 5/8" hex adjustment screw clockwise to increase setting, or counterclockwise to decrease setting.
- 4 Secure adjustment screw by tightening adjustment lock.

## Type J120K Models 36-39, 147-S157B, & 367 (See Figure 4B)

- 1 Remove front cover and gasket from sensor assembly located below enclosure by unscrewing 4 phillips screws.
- 2 Loosen phillips screw adjustment lock.
- 3 Adjust set point by turning 5/8" hex adjustment screw clockwise to increase setting or counterclockwise to decrease setting.
- 4 Secure adjustment screw by tightening adjustment lock.

## Types H121, H121K

Adjust set point by turning external knob and pointer to desired setting on scale.

## Types H122, H122K

Individual microswitches may be set together or separately by up to 100% of range. The front (Low) microswitch should never be set higher than the rear (High) microswitch. Turning external knobs will increase or decrease each switch setting independently.

## Device with options

### Types with Adjustable Deadband Switch (Select Models & Option 1519)

Models 15622, 15834-15839, 15875 and types with option code 1519 incorporate a snap switch with integral adjustment wheel (see figure 5). Turning this wheel increases or decreases the pressure rise setting. The fall setting remains constant. To use the adjustable deadband switch:

- 1 Determine set point and deadband values. For example, a rising set point of 20 psi with a deadband value of 6 psi.
- 2 Set the falling set point at desired deadband value (determined by subtracting the deadband value from the desired set point) using the standard adjustment screw as outlined above. Using the example from step 1,  $20 - 6 = 14$ , so you would set the fall set point at 14 psi. This is your constant.
- 3 Set your deadband by turning the adjustment wheel clockwise to increase or counter clockwise to decrease the setting. Using the example from step 1, turn the wheel clockwise or counter clockwise until 20 psi is achieved. This is your set point.

Consult UE for additional information.

### Option 1519 & Select Models

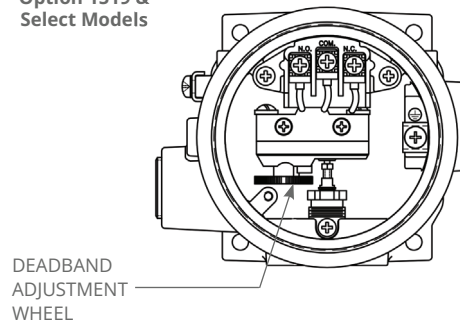


Figure 5

### Option M210

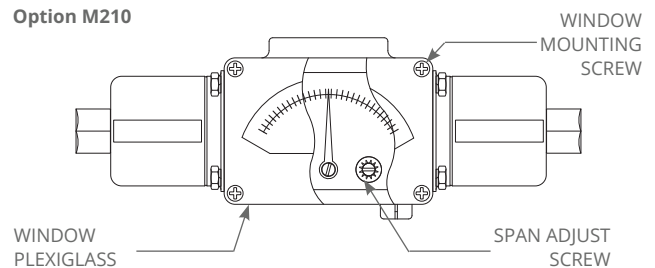


Figure 6

## Option M210 Indicator for Differential Pressure Controls, Span Adjustment

To adjust indication for maximum accuracy at any desired set point, follow steps 1 thru 3 listed below (See Figure 6).

- 1 Remove front window and gasket (four screws) to gain access to span adjustment.
- 2 Connect device to calibrated gauge and set required differential pressure.
- 3 Using a screwdriver, slowly turn the span adjustment to obtain required indication. Remount the front gasket and window.

**NOTE:** Spanning adjustment will not affect the mid-range indication. The adjustment is factory calibrated and sealed to indicate tampering.

**AFTER COMPLETING SETTING ADJUSTMENT, BE SURE TO REINSTALL ENCLOSURE COVER.**

## Re-gapping procedure

- 5/8" Open End Wrench
- 3/16" Open End Wrench (2)

**SOME MODELS HAVE A TWO-PIECE ADJUSTABLE PLUNGER (SEE FIGURE 7). THIS FEATURE IS CHARACTERIZED BY A 3/16" HEX SCREW INSTALLED IN THE 1/4" HEX PLUNGER. FOLLOW THE SET-POINT PROCEDURE BELOW TO AVOID DISTURBING THE GAPPING. GAPPING IS FACTORY-SET AND CRITICAL TO THE FUNCTION OF THE SWITCH. THE GAPPING PROCEDURE SHOULD ONLY BE PERFORMED IF THE PLUNGER WAS ACCIDENTALLY ADJUSTED.**

- 1 Loosen adjustment lock.
- 2 Turn 5/8" hex adjustment screw clockwise to approximately midrange. This puts a load on the sensor and exposes the plunger flats. (See Figure 7).
- 3 Using a 3/16" wrench on the plunger flats and a 3/16" wrench on the plunger hex screw, turn hex counter-clockwise from plunger until micro-switch actuates. If microswitch has already actuated, turn plunger hex screw clockwise until microswitch deactuates.
- 4 Continue per following instructions, depending on model.

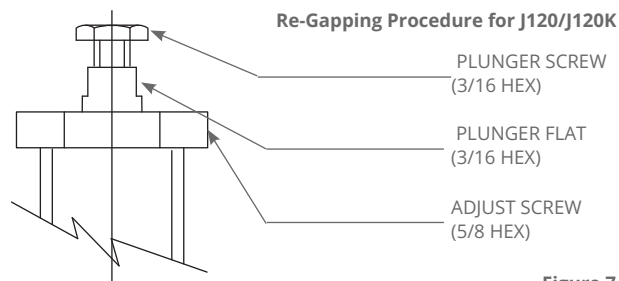


Figure 7

Models 171-174, 521-525, 531-535, and 540-548

Turn hex clockwise an additional 1-1/2 flats from this point. This will provide a 5-9 mil gap.

Models 183-189, 190-194, 483-489, 490-494, 565-567

Turn hex clockwise 1 flat from this point. This will provide a 4-7 mil gap.

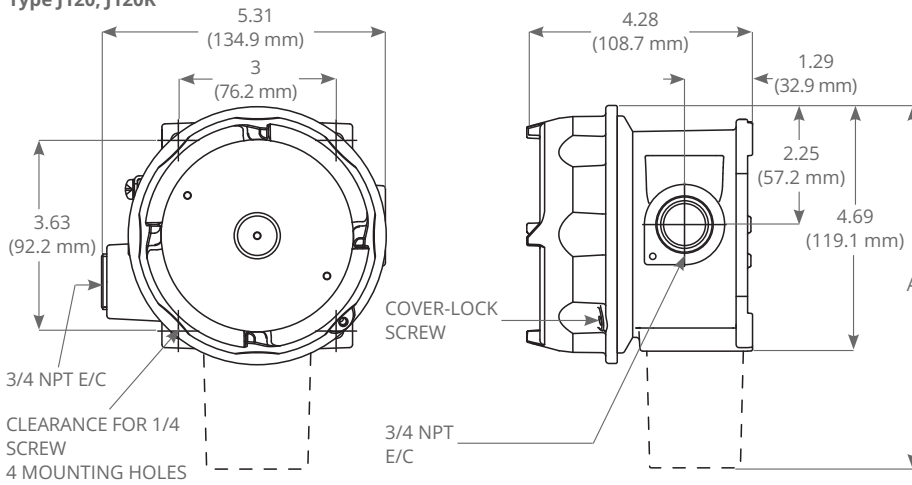
## Recommended Practices

- 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.

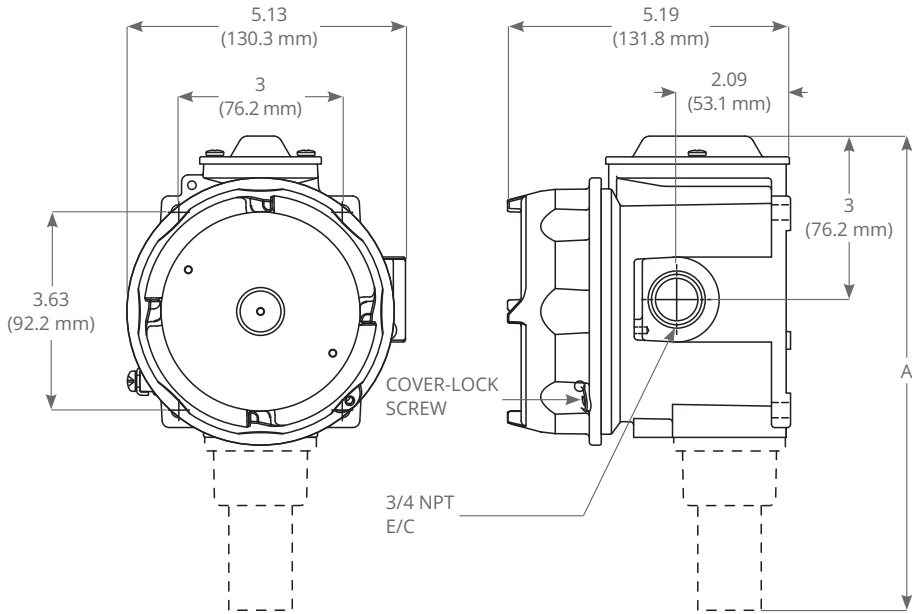
## Part III - Dimensions

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

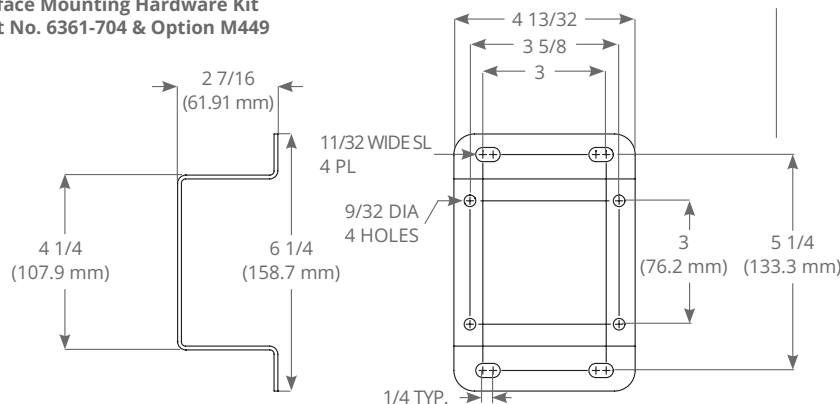
### Internal Set Point Adjustment Type J120, J120K



### External Set Point Adjustment Type H121, H122, H121K, H122K



### Surface Mounting Hardware Kit Part No. 6361-704 & Option M449



### Types J120, J120 K - Dimension A

Models	Inches	mm	NPT (Inches)
<b>Pressure</b>			
126-164	7.25	184.2	1/4
S126B-S164B	7.63	193.8	1/2
171-174	8.72	221.5	1/2
183-186, 483-486	8.41	213.6	1/2
188-189, 488-489	7.47	189.7	1/2
190-194, 490-494	7.44	189.0	1/2
270-274	8.13	206.5	1/4
358-376	8.09	205.5	1/4
450, 452	8.81	223.8	1/4
451, 453, 454	8.06	204.7	1/4
520-525	9.25	235.0	1/2
530-535	8.84	224.5	1/2
550, 552	8.81	223.8	1/4
551, 553-555	8.34	211.8	1/4
565-567	7.53	191.3	1-1/2" Sanitary
612, 616	7.88	200.2	1/4
680	8.13	206.5	1/4
701-705, 15622, 15834-15839	7.44	189.0	1/4

### Differential Pressure

36-39, 147-157, 367	7.59	192.8	1/4
S147B-S157B	7.59	192.8	1/2
455-457, 559	8.44	214.4	1/4
540-543	9.34	237.2	1/8
544-548	9.41	239.0	1/8

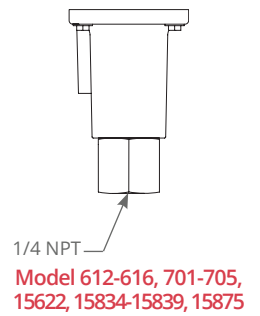
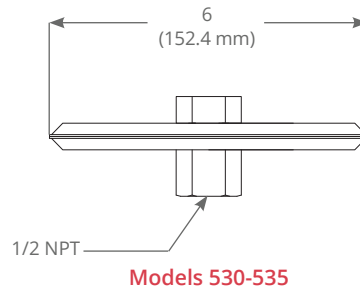
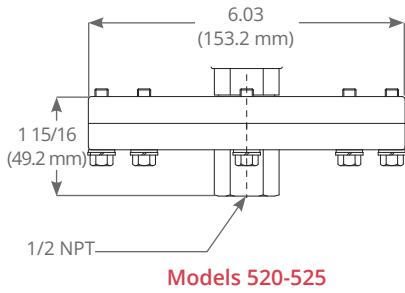
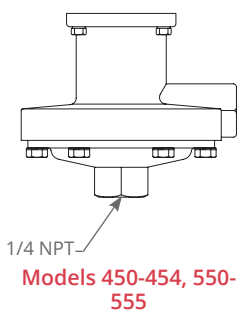
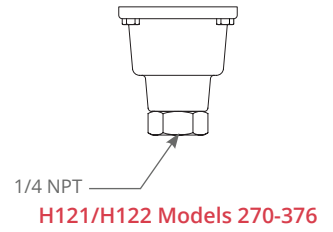
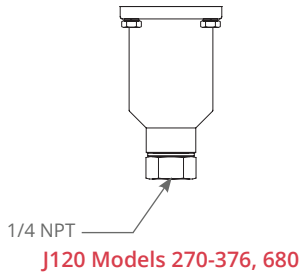
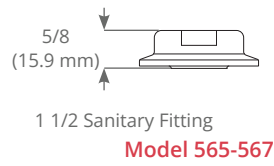
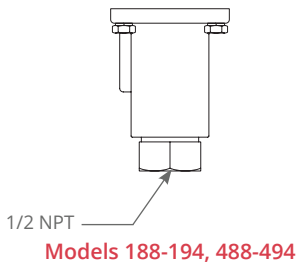
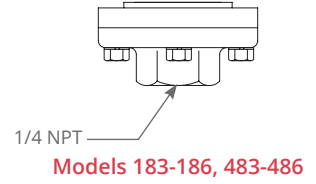
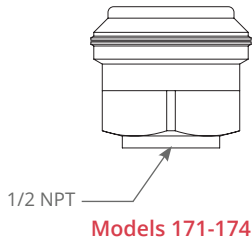
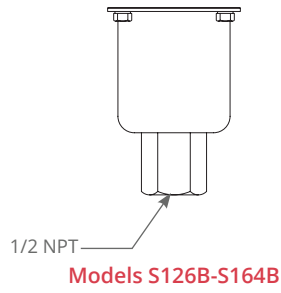
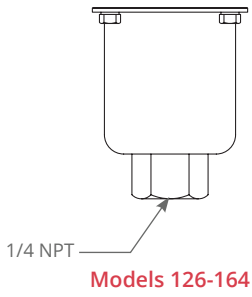
### Types H121, H122, H121K, H122K

#### Pressure

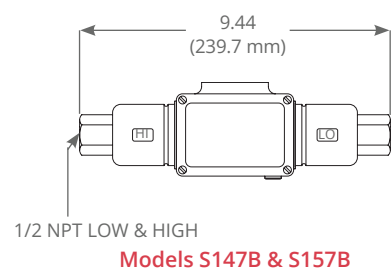
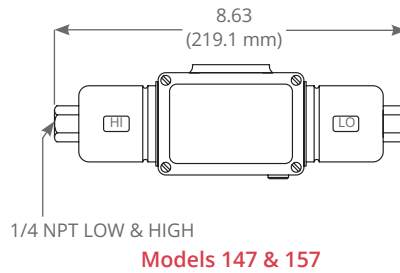
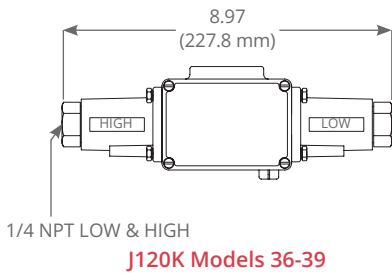
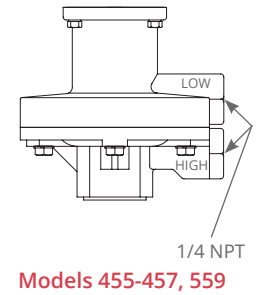
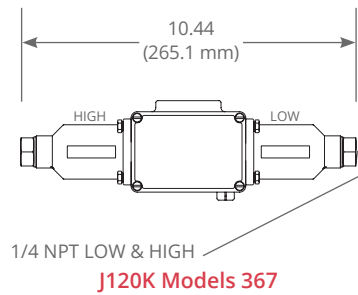
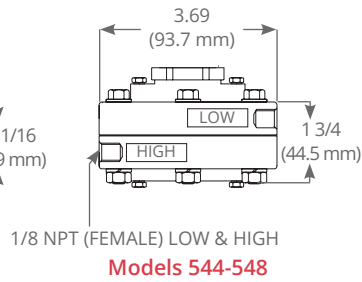
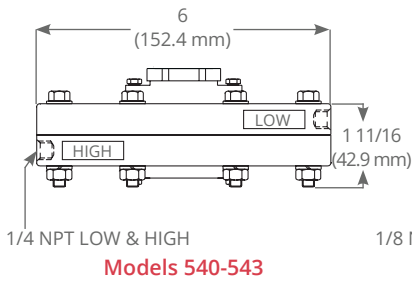
126-164	8.09	205.5	1/4
S126B-S164B	8.50	215.9	1/2
270-274	7.88	200.2	1/4
358-376	7.81	198.4	1/4
450, 452	9.69	246.1	1/4
453, 454	8.94	227.1	1/4
550, 552	9.75	247.7	1/4
553-555	9.31	236.5	1/4
612, 614, 15875	8.75	222.3	1/4
701-705	8.31	211.1	1/4

#### Differential Pressure

147-157	8.44	214.4	1/4
S147B-S157B	8.44	214.4	1/2
456-457, 559	9.31	236.5	1/4



## DIFFERENTIAL PRESSURE





## French Warnings Translations

Pg	Warning Text	T 3	TO PREVENT IGNITION OF HAZARDOUS ATMOSPHERES, SEAL CONDUIT RUNS WITHIN 18 INCHES OF ENCLOSURE	Pour éviter l'ignition des atmosphères dangereuses, sceller les conduits électriques à l'intérieur de l'enclosure
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 corporelles. Ces consignes doivent être lues attentivement et bien comprises avant l'installation de l'appareil.
1	120 SERIES FOR USE IN CLASS I, DIV. 1, GROUPS 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 71°C (160°F).			Le 120 Series est adapté à une utilisation dans les lieux de Classe I, Division 2, de Groupes A, B, C et D; Classe II, Division 2, Groupes F et G; Classe III lieu dangereux. Boîtier de type 4X, IP66. Plage de température ambiante -50°C (-58°F) à 71°C (160°F).
1	ATEX AND IEC SPECIFIC CONDITIONS OF USE: DIMENSIONS OF THE FLAMEPROOF JOINTS ARE OTHER THAN THE RELEVANT MINIMUM OR MAXIMUM SPECIFIED IN TABLES 1 THROUGH 2 OF EN 60079-1/IEC 60079-1. PRESSURE OPERATED SWITCHES ARE TO BE MARKED WITH AN "X" AND THE DIMENSIONS OF THE FLAMEPROOF JOINTS ARE AS FOLLOWS:			Conditions spécifiques d'utilisation ATEX et IEC: Les dimensions des joints antidéflagrants sont différentes du minimum ou du maximum spécifié dans les tableaux 1 à 2 de la norme EN 60079-1/IEC 60079-1. Les pressostats doivent être marqués d'un "X" et les dimensions des joints antidéflagrants sont listées page 1.
1	ATEX AND IEC SPECIFIC CONDITIONS OF USE: ENCLOSURE CONTAINS ALUMINIUM. CARE MUST BE TAKEN TO AVOID IGNITION HAZARD DUE TO IMPACT OR FRICTION.			Conditions spécifiques d'utilisation ATEX et IEC: Le boîtier contient de l'aluminium. Des précautions doivent être prises pour éviter tout risque d'inflammation dû à un choc ou à un frottement.
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 ne peut être remplacé sur le terrain. Tout remplacement de composant invalidera toutes les approbations et certifications données par un tiers. L'appareil peut alors ne plus être adapté à une utilisation dans un lieu de Classe I, Division 1.
1	TO PREVENT IGNITION OF HAZARDOUS ATMOSPHERES, DISCONNECT SUPPLY CIRCUITS BEFORE OPENING. KEEP COVER TIGHT WHILE CIRCUITS ARE ENERGIZED.			Pour éviter l'inflammation d'atmosphères dangereuses, déconnecter les circuits d'alimentation avant d'ouvrir l'appareil. Maintenir le couvercle fermé lorsque les circuits sont sous tension.
2	INSTALL DEVICE WHERE SHOCK, VIBRATION AND TEMPERATURE FLUCTUATIONS ARE MINIMAL. DO NOT MOUNT DEVICE IN AMBIENT TEMPERATURES THAT EXCEED THE LIMITS ON THE NAMEPLATE FOR THE APPROPRIATE AREA			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	DEVICE IS PROVIDED WITH TWO 3/4" NPT ELECTRICAL CONDUIT OPENINGS, EITHER OF WHICH OR BOTH CAN BE USED DURING INSTALLATION. A 3/4" EXPLOSION-PROOF PLUG IS PROVIDED FOR PROPERLY PLUGGING THE UNUSED CONDUIT OPENING. THE EXPLOSION-PROOF PLUG MUST BE PROPERLY INSTALLED AND IS CERTIFIED AS PART OF THE DEVICE AND CARRIES NO INDIVIDUAL MARKINGS.			L'appareil possède deux ouvertures de conduit électrique de 3/4" NPT, l'une ou les deux pouvant être utilisées lors de l'installation. Un presse-étoupe antidéflagrant de 3/4" est fourni pour obturer correctement l'ouverture de conduit non utilisée. Le presse-étoupe antidéflagrant doit être correctement installé et est certifié en tant que partie de l'appareil et n'a donc pas de marquage individuel.
2	THE CONNECTION OF THE DEVICE SHALL BE MADE BY CABLE ENTRIES OR A STOPPING BOX SUITABLE FOR THE CONDITIONS OF USE AND CORRECTLY INSTALLED, AND CERTIFIED BY TYPE OF EXPLOSION PROTECTION - FLAMEPROOF ENCLOSURE 'd'.			Le raccordement de l'appareil doit être effectué par des presse-étoupes ou par une boîte de jonction certifiée selon le mode de protection requis Ex "d" et correctement installée.
3	DISCONNECT ALL SUPPLY CIRCUITS BEFORE WIRING DEVICE. WIRE DEVICE IN ACCORDANCE WITH LOCAL AND NATIONAL ELECTRICAL CODES. MAXIMUM RECOMMENDED WIRE SIZE IS 14 AWG AND RECOMMENDED TIGHTENING TORQUE FOR FIELD WIRING TERMINALS IS 7 TO 17 IN-LBS. IT IS IMPERATIVE TO USE PROPERLY RATED EXPLOSION-PROOF SEALING FITTINGS FOR ELECTRICAL WIRE ENTRY.			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. Il est impératif d'utiliser des raccords d'étanchéité antidéflagrants correctement dimensionnés pour l'entrée des fils électriques.
3	USE 90 °C (194 °F) MIN. RATED COPPER CONDUCTOR ONLY. FOR AMBIENT TEMPERATURES BELOW -10 °C (14 °F), USE SUITABLE FIELD WIRING.			Le câblage d'alimentation en cuivre doit être homologué 90°C minimum. Pour des températures ambiantes inférieures à -10°C, utiliser un câblage d'alimentation de terrain approprié.
3	DO NOT EXCEED ELECTRICAL RATINGS LISTED ON NAMEPLATE. OVERLOAD ON A SWITCH CAN CAUSE FAILURE, EVEN ON THE FIRST CYCLE.			Le câblage d'alimentation en cuivre doit être homologué 90°C minimum. Pour des températures ambiantes inférieures à -10°C, utiliser un câblage d'alimentation de terrain approprié.
3	THE EXTERNAL GROUNDING TERMINAL IS NOT TO BE USED AS THE PRIMARY EQUIPMENT GROUNDING TERMINAL. THE INTERNAL GROUNDING TERMINAL SHALL BE USED AS THE PRIMARY EQUIPMENT GROUNDING MEANS AND THE EXTERNAL GROUNDING TERMINAL IS ONLY FOR A SUPPLEMENTAL (SECONDARY) GROUNDING CONNECTION WHERE LOCAL AUTHORITIES PERMIT OR REQUIRE SUCH A CONNECTION.			La borne de mise à la terre externe de l'appareil ne doit pas être utilisée comme borne primaire de mise à la terre de tout l'équipement. La borne de mise à la terre interne doit être utilisée comme moyen de mise à la terre primaire et la borne de mise à la terre externe n'est que supplémentaire (secondaire) lorsque la réglementation locale l'autorise ou l'exige.

### 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.

### LIMITED 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 120 SERIES

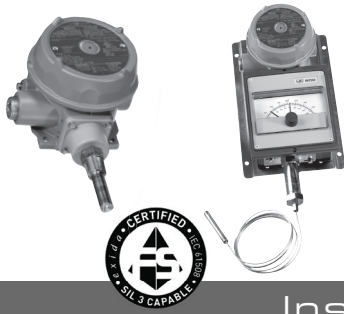
Explosion-Proof Temperature and  
Indicating Temperature Switches and Controls  
Local Mount Types B121, B122, C120  
Remote Mount Types E121, E122, F120; 820E, 822E



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# 120 Series



Explosion-Proof Temperature and Indicating Temperature Switches and Controls

Local Mount Types B121, B122, C120

Remote Mount Types E121, E122, F120; 820E, 822E



## 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 DEVICE IS INSTALLED.**

<b>Cert number</b>	<b>20160531-E43374</b>
<b>Applicable Area</b>	North America
<b>Markings</b>	Class I, Groups B, C and D; Class II, Groups E, F and G; Class III
<b>Applicable Standards</b>	UL 1203; CAN/CSA C22.2 No. 25 CAN/CSA C22.2 No. 30

<b>Cert number</b>	<b>DEMKO 09 ATEX 0815573X</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 IP66
<b>Applicable Standards</b>	EN IEC 60079-0; EN 60079-1; EN 60079-31

<b>Cert number</b>	<b>IECEX UL 03.0001X</b>
<b>Applicable Area</b>	International
<b>Markings</b>	Ex db IIC T6 Gb Ex tb IIIC T85°C Db IP66 -40°C to +75°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
<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

**⚠ 120 SERIES FOR USE IN CLASS I, DIV. 1, GROUPS 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 71°C (160°F).**

**⚠ TO PREVENT IGNITION OF HAZARDOUS ATMOSPHERES, DISCONNECT SUPPLY CIRCUITS BEFORE OPENING. KEEP COVER TIGHT WHILE CIRCUITS ARE ENERGIZED.**

**⚠ ATEX AND IEC SPECIFIC CONDITIONS OF USE: DIMENSIONS OF THE FLAMEPROOF JOINTS ARE OTHER THAN THE RELEVANT MINIMUM OR MAXIMUM SPECIFIED IN TABLES 1 THROUGH 2 OF EN 60079-1/IEC 60079-1. TEMPERATURE OPERATED SWITCHES ARE TO BE MARKED WITH AN "X" AND THE DIMENSIONS OF THE FLAMEPROOF JOINTS ARE AS FOLLOWS:**

#### 120's

- **Activation Plunger to adjustment screw hole gap joints:** 1.140 in/28.96 mm min length by 0.0039 in/0.099 mm max annular gap
- **Plunger Guide to enclosure through threaded joints:** minimum 8 ½ fully engaged threads
- **Cover to enclosure through threaded joints:** minimum 7 ½ fully engaged threads

#### 121's & 122's

- **Activation Plunger to enclosure through hole gap joints:** 1.00 in/25.40 mm min length by 0.0030 in/0.076 mm max annular gap
- **Adjustment shaft to shaft through hole gap joints:** 1.050 in/26.67 mm min. length by 0.0035 in/0.089 mm max. annular gap
- **Cover to enclosure through threaded joints:** minimum 7 ½ fully engaged threads

**⚠ ATEX AND IEC SPECIFIC CONDITIONS OF USE: ENCLOSURE CONTAINS ALUMINUM. CARE MUST BE TAKEN TO AVOID IGNITION HAZARD DUE TO IMPACT OR FRICTION.**

**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.

**⚠ 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.**



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

The 120 Series temperature switch utilizes either a liquid filled sensing stem (immersion stem, direct mounting) or liquid filled sensing bulb (bulb & capillary, remote mounting) to detect a temperature change. The response at a pre-determined set point(s), actuates a SPDT, dual SPDT, or DPDT snapacting micro switch(es), converting the temperature signal into an electrical signal. Control set point(s) may be varied by turning the adjustment hex (C120, F120) or the external knob(s) and pointer(s) (B121, B122, E121, E122, 820E, 822E) according to the procedures outlined (See Part II - Adjustments). Please refer to the product technical 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



- Screwdriver
- Adjustable Wrench to 1-1/2"

## Mounting



**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 IS PROVIDED WITH TWO 3/4" NPT ELECTRICAL CONDUIT OPENINGS, EITHER OF WHICH OR BOTH CAN BE USED DURING INSTALLATION. A 3/4" EXPLOSION-PROOF PLUG IS PROVIDED FOR PROPERLY PLUGGING THE UNUSED CONDUIT OPENING. THE EXPLOSION-PROOF PLUG MUST BE PROPERLY INSTALLED AND IS CERTIFIED AS PART OF THE DEVICE AND CARRIES NO INDIVIDUAL MARKINGS.**



**DO NOT KNOCKOUT ANY PLUGS ON EXPLOSION-PROOF TYPES 820E OR 822E.**



**THE CONNECTION OF THE DEVICE SHALL BE MADE BY CABLE ENTRIES OR A STOPPING BOX SUITABLE FOR THE CONDITIONS OF USE AND CORRECTLY INSTALLED, AND CERTIFIED BY TYPE OF EXPLOSION PROTECTION - FLAMEPROOF ENCLOSURE 'd'.**



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

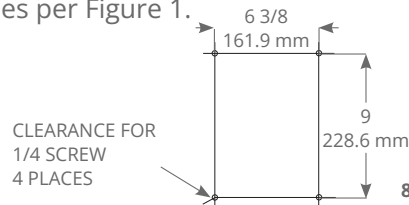


**ALWAYS USE A WRENCH ON LOCAL MOUNT, IMMERSION STEM HEX (SEE DIMENSIONAL DRAWINGS). DO NOT TIGHTEN BY TURNING THE ENCLOSURE AS THIS WILL DAMAGE THE SENSOR AND WEAKEN WELDED JOINTS.**

The conduit connection must be properly sealed (potted) for horizontal installation. Device may be surface mounted via the four 1/4" screw holes on the enclosure or mounting bracket.

## Type 820E and 822E

Units must be surface mounted. Drill mounting holes per Figure 1.



**Figure 1:**  
820E, 822E Mounting



**IF A SEAL FITTING IS REQUIRED, INSTALL THE NIPPLE AND THE SEAL FITTING PRIOR TO SURFACE MOUNTING THE CONTROLLER.**

## Mounting Bulb and Capillary

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



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

## Wiring



**DISCONNECT ALL SUPPLY CIRCUITS BEFORE WIRING DEVICE. WIRE DEVICE IN ACCORDANCE WITH LOCAL AND NATIONAL ELECTRICAL CODES. MAXIMUM RECOMMENDED WIRE SIZE IS 14 AWG AND RECOMMENDED TIGHTENING TORQUE FOR FIELD WIRING TERMINALS IS 7 TO 17 IN-LBS. IT IS IMPERATIVE TO USE PROPERLY RATED EXPLOSION-PROOF SEALING FITTINGS FOR ELECTRICAL WIRE ENTRY.**



**USE 90 °C (194 °F) MIN. RATED COPPER CONDUCTOR ONLY. FOR AMBIENT TEMPERATURES BELOW -10 °C (14 °F), USE SUITABLE FIELD WIRING.**



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



**THE INTERNAL GROUNDING TERMINAL SHALL BE USED AS THE PRIMARY EQUIPMENT GROUNDING MEANS. THE EXTERNAL GROUNDING TERMINAL IS NOT TO BE USED AS THE PRIMARY EQUIPMENT GROUNDING TERMINAL AND IS ONLY FOR SUPPLEMENTAL (SECONDARY) GROUNDING WHERE LOCAL AUTHORITIES PERMIT OR REQUIRE SUCH A CONNECTION.**



**TO PREVENT IGNITION OF HAZARDOUS ATMOSPHERES, SEAL CONDUIT RUNS WITHIN 18" OF ENCLOSURE.**



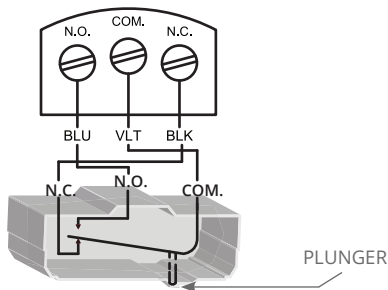
**ENSURE ELECTRICAL CONDUIT ENTRIES ARE PROPERLY SEALED TO PREVENT MOISTURE ENTRY.**

- 1 Remove cover and wire device (See Figure 2).
- 2 Wire directly to the terminal block. An internal grounding terminal is located near the right-hand conduit opening.
- 3 Replace cover and hand tighten to fully engage cover O-ring.



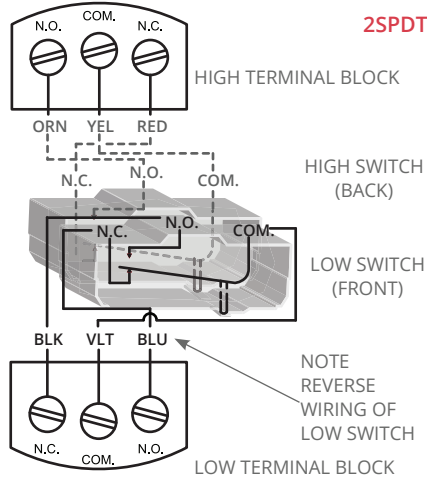
**TO PREVENT SEIZURE OF ENCLOSURE COVER, DO NOT REMOVE LUBRICANT FROM THREADS. THREADS SHOULD ALSO BE FREE OF DIRT AND OTHER CONTAMINANTS.**

Types B121, C120, E121, F120, 820E, also for option 1180



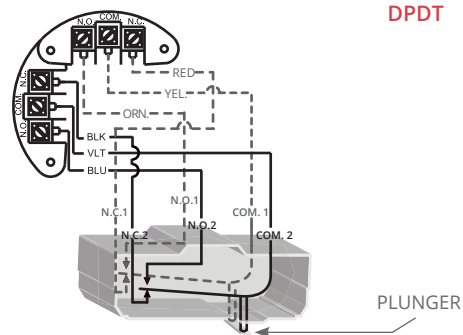
SPDT

Types B122, E122



2SPDT

Options 1010, 1190, 1195 (for types B121, C120, E121, F120 only)



DPDT

Figure 2

Type 822E

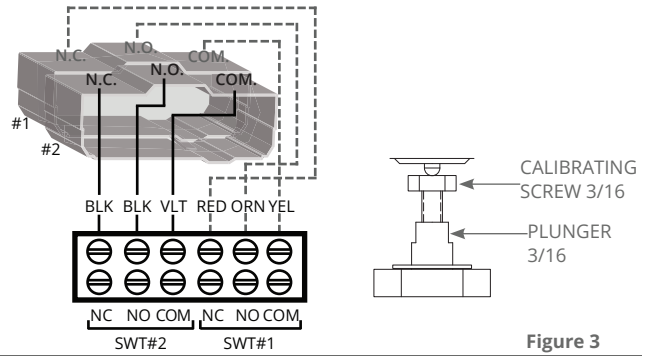


Figure 3

## Part II - Adjustments



- 3/16 Open End Wrench (2)
- 1/4 Open End Wrench
- 5/64 Allen Wrench
- 5/16 Open End Wrench (2 required for 822E only)



**AFTER COMPLETING SETTING ADJUSTMENT ON B121, B122, E121 & E122, BE SURE TO RE-INSTALL ADJUSTMENT COVER.**

For set point adjustment and re-gapping (if necessary), connect device to a calibrated temperature source.

### Types C120, F120

- 1 Remove cover
- 2 Adjust set point by holding plunger with 3/16" open end wrench and turning the calibrating screw with another 3/16" open end wrench (see figure 3).
- 3 Turn clockwise to increase setting or counter-clockwise to decrease setting.

### Types B121 and E121

- 1 Remove adjustment cover.
- 2 Adjust set point by turning external knob and pointer to desired setting on scale (see figure 4).

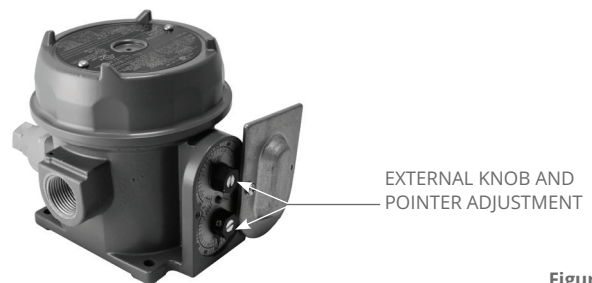


Figure 4

### Types B122 and E122

Individual switches may be set together or separately by up to 100% of range. The front (low) switch should never be set higher than the rear (high) microswitch. Turning external knobs will increase or decrease each switch setting independently (see figure 4).

## Type 820E

To adjust the switch:

- 1 Remove the set point adjustment knob and clear cover from the indicating enclosure (square) to access the pointer mechanism for adjustment.
- 2 Connect test lights or listen for the individual switch clicks to indicate switch operation.
- 3 Move the set point adjustment pointer (red) up the scale past the indicating pointer (black). This permits checking the set point by moving the actuating lever upward with a finger, or tool, simulating thermal assembly movement. Note switch operation on the test lights.
- 4 Loosen adjustment pointer mounting screw "A" and move the adjustment pointer (red) until it aligns with the indicating pointer (black) (see Figure 5). When the switch clicks re-tighten the screw.

## Type 822E

**NOTE:** Type 822E has a single set point adjustment-knob and adjustment pointer (red) for both switches. Both switches are standardly factory set together within 5% of the adjustable set point range. Turning the set point adjustment knob adjusts both switches simultaneously, maintaining a fixed separation between them. To adjust the switches:

- 1 Remove the explosion-proof enclosure cover to access the switches for adjustment.
- 2 Remove the set point adjustment knob and clear cover from the indicating enclosure (square) to access the pointer mechanism for adjustment.
- 3 Connect test lights or listen for the individual switch clicks to indicate switch operation.
- 4 Move the adjustment pointer (red) up the scale past the indicating pointer (black), actuating both switches, by moving the actuating lever upward with a finger, or a tool, simulating thermal assembly movement (see Figure 5). Note switch operation on the test lights.
- 5 The set point of switch #1 is determined by the adjustment pointer (red). The set point of switch #2 may be adjusted by up to 25% of the range span below the switch #1 set point by turning adjustment "D" with a 5/16" open end wrench (clockwise) to lower the set point. See page 6 for 822E dual switch adjustment. The set point of switch #2 should never be set above that of switch #1.
- 6 To align the switch #1 adjustment pointer (red) with the indicating pointer (black), loosen the adjustment pointer mounting screw "A" and align the adjustment pointer (red) with the indicating pointer (black), then re-tighten screw "A" (see Figure 5).

### **NOTE: Indicating Pointer Deflection (820E, 822E)**

The indicating pointers will read slightly low when the bulb temperature is 15° F above the controller setting. This deflection is normal and repeatable (approximately 0.5% of scale range on single switch models) and is due to the transference of the switching mechanism load to the thermal system. It can be measured by moving the setting pointer from the high to the low end of the scale and observing the resultant indicating pointer deflection.

### **NOTE:**

To adjust the Indicating Pointer (820E, 822E):

- 1 Use an accurate test thermometer such as a thermocouple with its probe mounted directly to the center of the sensing bulb.
- 2 Before making any adjustments, allow process temperature to stabilize; i.e., successive on-off cycles repeated.
- 3 Correct any difference between the indicating pointer (black) and the test thermometer by holding the compensator with a 5/16" wrench while turning the zero adjustment "C" on the thermal assembly with a second 5/16" wrench (see Figure 5) until the indicating pointer (black) reads the same value as the test thermometer. Turning the zero adjustment "C" clockwise lowers indicated reading.
- 4 Compare the process temperature with the set point adjustment pointer (red).
- 5 Loosen the adjustment pointer mounting screw "A" to align set point adjustment pointer (red) with the indicating pointer (black), then re-tighten screw "A".

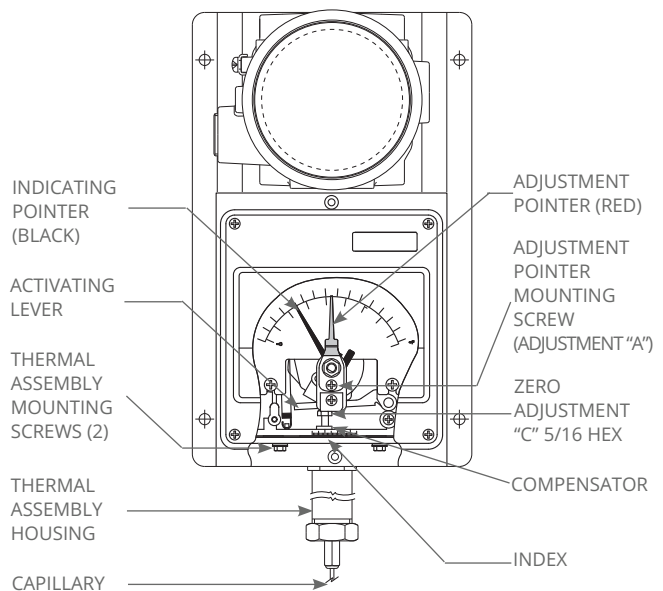


Figure 5: Indicating Enclosure Internals

## Correction of Capillary (820E, 822E)

If the length of capillary immersed in the process differs from the amount immersed (6", see Mounting Bulb & Capillary in Part I - Installation) at the factory calibration bath, a calibration shift will occur.

The error may be corrected as follows:

- 1 Move pointer to the highest temperature setting. Note indicating scale reading with the head and sensor at room temperature.
- 2 Loosen the two thermal assembly mounting screws.
- 3 Re-position the housing index against the calibration on the instrument case (or skeleton casting) at a rate of 1 division line per capillary length listed in Figure 6. Move to the left if capillary is to be added to the process, or to the right if capillary is to be removed from process.

Model Number	Range	Cap Length / Division <sup>[1]</sup>
1	-180 to 120°F	2 ft
2	-125 to 350°F	1 1/2 ft
3	-125 to 500°F	1 ft
4	-40 to 120°F	4 ft
5	-40 to 180°F	3 ft
6	0 to 250°F	2 1/2 ft
7	0 to 400°F	2 ft
8	50 to 650°F	2 ft

[1] Added to or taken away from the process

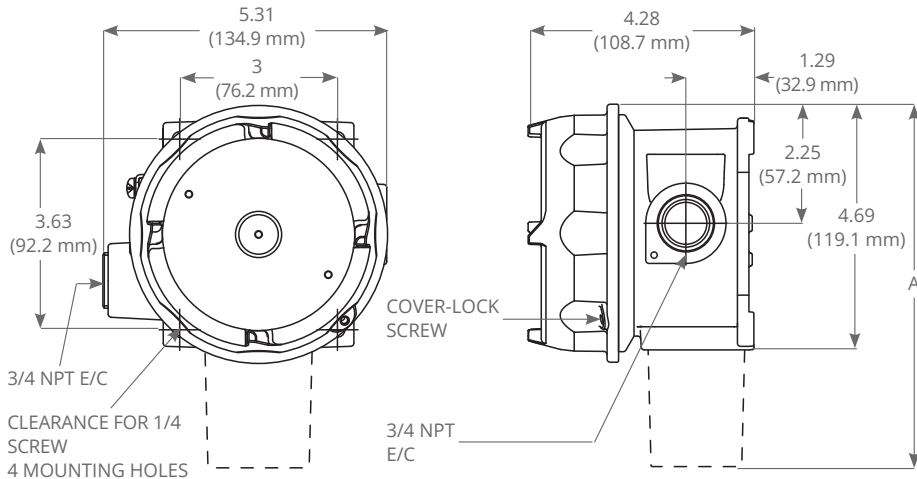
## Recommended Practices

- 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

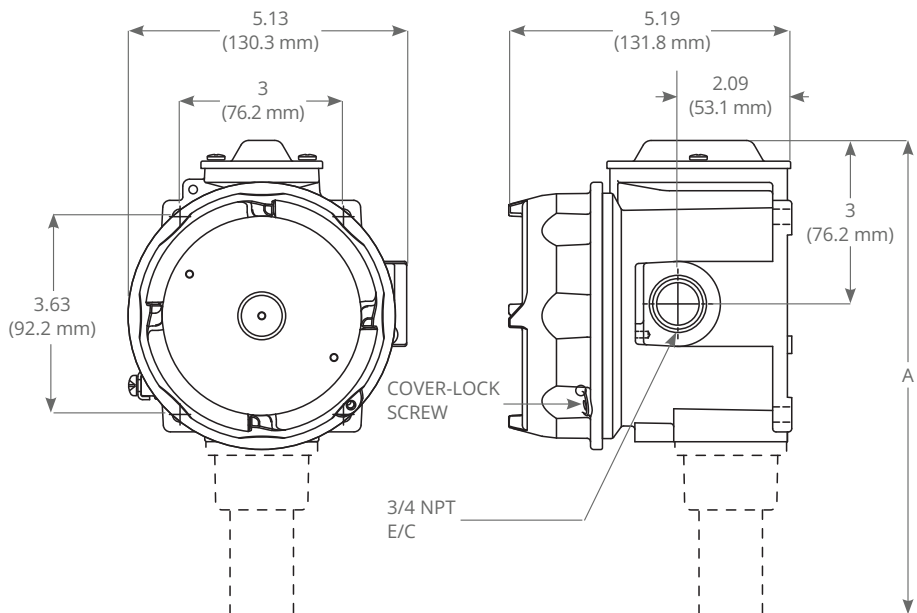
(Dimensional drawings for all models may be found at [www.ueonline.com](http://www.ueonline.com))

### Internal Set Point Adjustment, Type C120, F120



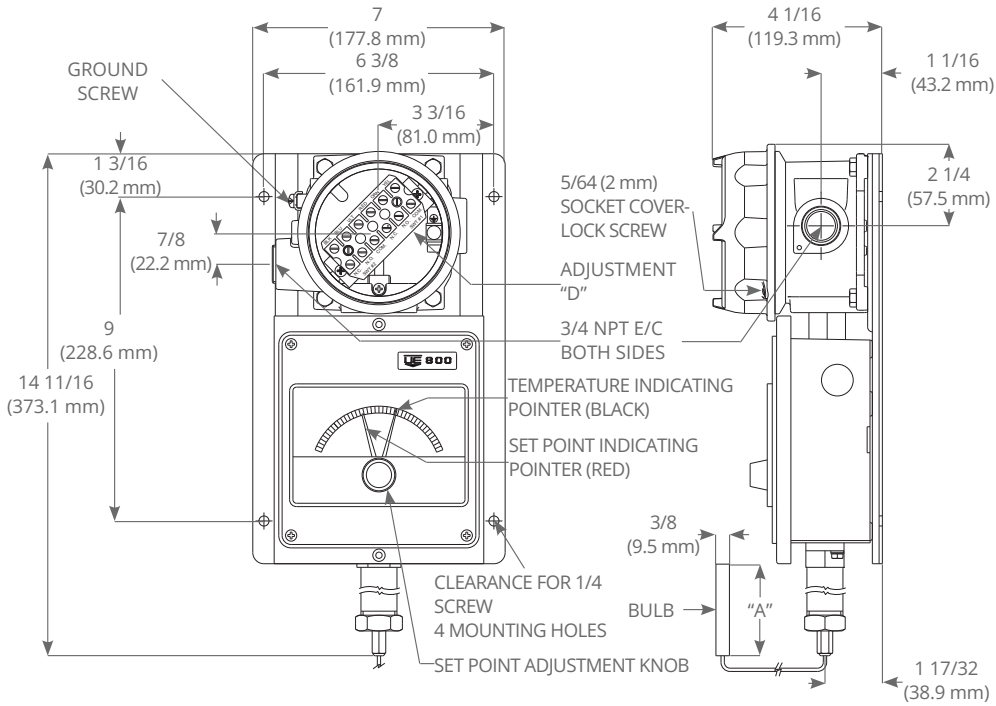
Dimension A			
Model	Inches	mm	Sensor
120	9.12	231,4	Immersion stem
121	8.97	227,4	Immersion stem
1BS-8BS	8.47	214,8	Bulb & capillary

### External Set Point Adjustment, Type B121, B122, E121, E122

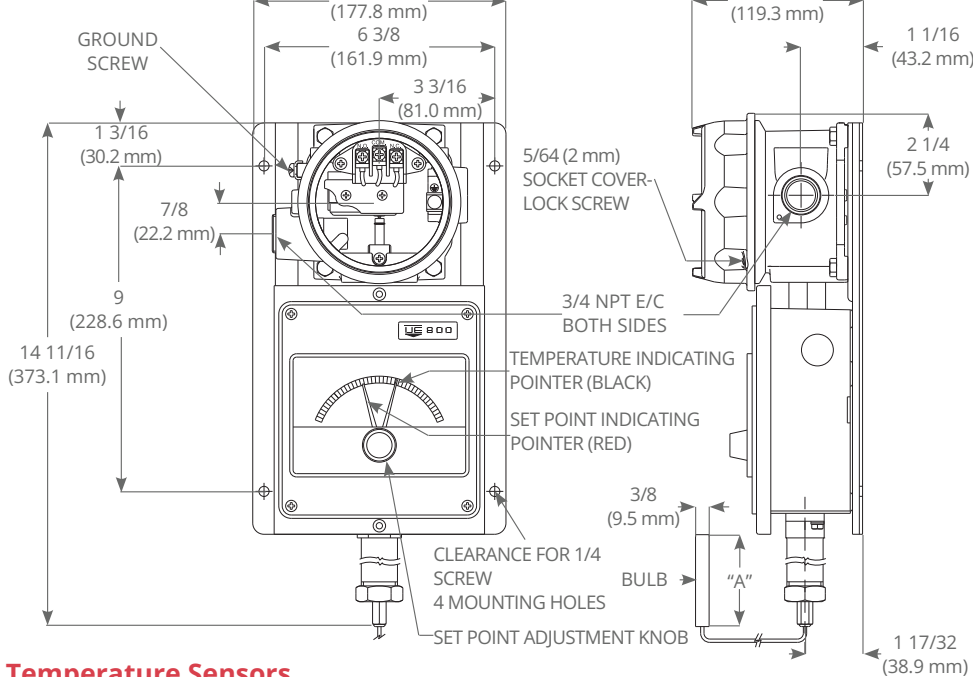


Dimension A			
Model	Inches	mm	Sensor
120, 121 (B121)	10.0	254,0	Immersion stem
120 (B122)	10.0	254,0	Immersion stem
121 (B122)	9.84	250,0	Immersion stem
2BS-8BS	9.31	236,6	Bulb & capillary
13242, 13322	10.0	254,0	Immersion stem (Freeze protection)
13273, 13321	9.31	236,6	Bulb & capillary (Heat tracing)

**Type 822E dual switch**



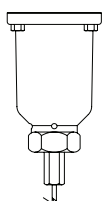
**Type 820E single switch**



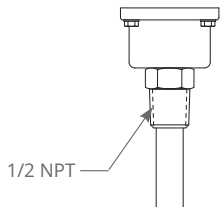
Dimension A		
Models	Inches	mm
2BS	2.44	62,0
3BS	2.13	54,0
4BS	6.75	171,5
5BS	5	127,0
6BS	4.5	114,3
7BS	3	76,2
8BS	3.25	82,6

Dimension B		
Models	Inches	mm
2BS/BSA	2.63	66.7
3BS	2.13	54,1
4BS	6.75	171,5
5BS	5	127,0
6BS	4.5	114,3
7BS	3	76,2
8BS	3.25	82,6
13273	9.51	241,5
13321	9.51	241,5

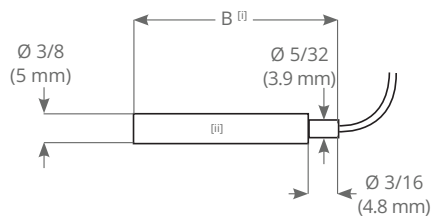
**Temperature Sensors**



**Type E121, E122, F120**  
Models 2BS-8BS  
Remote Mount  
Temperature Assembly



**Type B121, B122, C120**  
Models 120-121  
Direct Mount  
Temperature Assembly



**Remote Bulb**

Ⓜ USE DIMENSION "B" FOR SEPARABLE WELL INSTALLATIONS  
Ⓜ Except model 13273, 13321 bulb OD is Ø 1/4 (6,35 mm)



# French Warnings Translations

Page	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 corporelles. Ces consignes doivent être lues attentivement et bien comprises avant l'installation de l'appareil.
1	ATEX AND IEC SPECIFIC CONDITIONS OF USE: DIMENSIONS OF THE FLAMEPROOF JOINTS ARE OTHER THAN THE RELEVANT MINIMUM OR MAXIMUM SPECIFIED IN TABLES 1 THROUGH 2 OF EN 60079-1/IEC 60079-1. PRESSURE OPERATED SWITCHES ARE TO BE MARKED WITH AN "X" AND THE DIMENSIONS OF THE FLAMEPROOF JOINTS ARE AS FOLLOWS:	Conditions spécifiques d'utilisation ATEX et IEC: Les dimensions des joints résistant à la flamme sont différentes du minimum ou du maximum spécifié dans les tableaux 1 à 2 de la norme EN 60079-1:2014 / IEC 60079-1:2014 Les pressostats et les thermostats doivent être marqués d'un "X" et les instructions d'installation du fabricant précisent les dimensions des joints antidéflagrants sont listées page 1.
1	ATEX AND IEC SPECIFIC CONDITIONS OF USE: ENCLOSURE CONTAINS ALUMINUM. CARE MUST BE TAKEN TO AVOID IGNITION HAZARD DUE TO IMPACT OR FRICTION.	Conditions spécifiques d'utilisation ATEX et IEC: Le boîtier contient de l'aluminium. Des précautions doivent être prises pour éviter tout risque d'inflammation dû à un choc ou à un frottement.
1	TO PREVENT IGNITION OF HAZARDOUS ATMOSPHERES, DISCONNECT SUPPLY CIRCUITS BEFORE OPENING. KEEP COVER TIGHT WHILE CIRCUITS ARE ENERGIZED.	Pour éviter l'inflammation d'atmosphères dangereuses, déconnecter les circuits d'alimentation avant d'ouvrir l'appareil. Maintenir le couvercle fermé lorsque les circuits sont sous tension.
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 ne peut être remplacé sur le terrain. Tout remplacement de composant invalidera toutes les approbations et certifications données par un tiers. L'appareil peut alors ne plus être adapté à une utilisation dans un lieu de Classe I, Division 2.
2	INSTALL DEVICE WHERE SHOCK, VIBRATION AND TEMPERATURE FLUCTUATIONS ARE MINIMAL. DO NOT MOUNT DEVICE IN AMBIENT TEMPERATURES THAT EXCEED THE LIMITS ON THE NAMEPLATE FOR THE APPROPRIATE AREA	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	IT IS IMPERATIVE TO USE PROPERLY RATED EXPLOSION-PROOF SEALING FITTINGS FOR ELECTRICAL WIRE ENTRY. TYPES C120, F120, 820E AND 822E ARE PROVIDED WITH TWO 3/4" NPT ELECTRICAL CONDUIT OPENINGS, EITHER OF WHICH OR BOTH CAN BE USED DURING INSTALLATION. A 3/4" EXPLOSION PROOF PLUG IS PROVIDED FOR PROPERLY PLUGGING THE UNUSED CONDUIT OPENING. THE EXPLOSION PROOF PLUG MUST BE PROPERLY INSTALLED.	Il est impératif d'utiliser des raccords d'étanchéité antidéflagrants pour les fils électriques. Les types C120, F120, 820E et 822E possèdent deux ouvertures de conduits électriques de 3/4" NPT, l'une ou les deux pouvant être utilisées lors de l'installation. Un presse-étoupe antidéflagrant de 3/4" est fourni pour obturer correctement l'ouverture de conduit non utilisée. Le presse-étoupe antidéflagrant doit être correctement installé.
2	TO PREVENT IGNITION OF HAZARDOUS ATMOSPHERES, SEAL CONDUIT RUNS WITHIN 18 INCHES OF ENCLOSURE	Pour éviter l'inflammation d'atmosphères dangereuses, sceller les conduits situés à moins de 18 inches du boîtier.
2	DO NOT KNOCKOUT ANY PLUGS ON EXPLOSION-PROOF TYPES 820E OR 822E.	Ne pas percer le presse-étoupe antidéflagrant sur les types 820E ou 822E.
2	THE CONNECTION OF THE DEVICE SHALL BE MADE BY CABLE ENTRIES OR A STOPPING BOX SUITABLE FOR THE CONDITIONS OF USE AND CORRECTLY INSTALLED, AND CERTIFIED BY TYPE OF EXPLOSION PROTECTION - FLAMEPROOF ENCLOSURE 'D'	Le raccordement de l'appareil doit être effectué par des presse-étoupes ou raccordé à une boîte de jonction certifiée selon le mode de protection requis, correctement installé et certifié Ex "d".
2	IF A SEAL FITTING IS REQUIRED, INSTALL HE NIPPLE AND THE SEAL FITTING PRIOR RO SURFACE MOUNTING THE CONTROLLER.	Si un joint d'étanchéité est nécessaire, installer l'écrou de raccord et le joint d'étanchéité avant d'installer le contrôleur.
2	DISCONNECT ALL SUPPLY CIRCUITS BEFORE WIRING DEVICE. WIRE DEVICE IN ACCORDANCE WITH LOCAL AND NATIONAL ELECTRICAL CODES. MAXIMUM RECOMMENDED WIRE SIZE IS 14 AWG AND RECOMMENDED TIGHTENING TORQUE FOR FIELD WIRING TERMINALS IS 7 TO 17 IN-LBS	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	ELECTRICAL RATINGS STATED IN LITERATURE AND ON NAMEPLATE MUST NOT BE EXCEEDED—OVERLOAD ON A SWITCH CAN CAUSE FAILURE 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.
3	USE 90 °C (194 °F) MIN. RATED COPPER CONDUCTOR ONLY. FOR AMBIENT TEMPERATURES BELOW -10 °C (14 °F), USE SUITABLE FIELD WIRING.	Le câblage d'alimentation en cuivre doit être homologué 90°C minimum. Pour des température ambiantes inférieures à -10°C, utiliser un câblage d'alimentation de terrain approprié.
3	THE EXTERNAL GROUNDING TERMINAL IS NOT TO BE USED AS THE PRIMARY EQUIPMENT GROUNDING TERMINAL. THE INTERNAL GROUNDING TERMINAL SHALL BE USED AS THE PRIMARY EQUIPMENT GROUNDING MEANS AND THE EXTERNAL GROUNDING TERMINAL IS ONLY FOR A SUPPLEMENTAL (SECONDARY) GROUNDING CONNECTION WHERE LOCAL AUTHORITIES PERMIT OR REQUIRE SUCH A CONNECTION	La borne de mise à la terre externe ne doit pas être utilisée comme borne primaire de mise à la terre de l'appareil. La borne de mise à la terre interne doit être utilisée comme moyen de mise à la terre primaire et la borne de mise à la terre externe n'est que supplémentaire (secondaire) lorsque la réglementation locale l'exige.

## 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



Supplied by

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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			