

Installation & Maintenance Instructions

UE 100 SERIES

Type H100 (Pressure Switch)

Type H100K (Differential Pressure Switch)



Supplied by

247able.com

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100 Series



Type H100 (Pressure Switch)

Type H100K (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 DAMAGE TO EQUIPMENT OR PERSONAL INJURY. THESE INSTRUCTIONS MUST BE THOROUGHLY READ AND UNDERSTOOD BEFORE DEVICE IS INSTALLED.



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

Cert number	20181026-E42272
Applicable Area	North America
Markings	UL Recognized
Applicable Standards	UL 508; C22.2 No. 14

Cert number	DEMKO 11 ATEX 1105261X
Applicable Area	Europe (EU)
Markings	II 1 G Ex ia IIC T6 Ga
Applicable Standards	EN IEC 60079-0; EN 60079-11

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



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



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. 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.



THIS PRODUCT DOES NOT HAVE ANY FIELD REPLACEABLE PARTS. ANY SUBSTITUTION OF COMPONENTS SHALL INVALIDATE AGENCY CERTIFICATION(S).



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

The 100 Series pressure and differential pressure switches are activated when a bellows, diaphragm or piston sensor responds to a pressure change. This response, at a pre-determined set point, actuates a single snap-acting switch, converting the pressure signal into an electrical signal. Control set point may be varied by turning the internal adjustment hex. (See Adjustment - PART II). Please refer to the datasheet at www.ueonline.com for product specifications. Date code format on nameplate is "YYWW" for year and week.

Part I - Installation



- Adjustable wrench
- Screwdriver
- Hammer (for alternate wire knockouts)

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



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.

Controls may be surface mounted via the two mounting ears on either side of the enclosure, or directly to a rigid pipe by using the pressure connection. Low pressure and differential pressure units, models 520-535, 540-543, 544-548, are also available with an optional surface mounting bracket.

ON MODELS SUPPLIED WITH AN EXTERNAL MANUAL RESET BUTTON, BE SURE TO LEAVE SUFFICIENT FINGER SPACE OVER THE RESET BUTTON FOR THE OPERATOR TO RESET THE CONTROL.

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.

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

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

1 Remove the two screws retaining the cover and cover gasket.

2 A 1/2" NPT conduit connection is provided on the left hand side of the enclosure. Two cast-in 7/8" diameter knockouts are located on the side and back of the enclosure (See dimensional drawings). These can easily be knocked out by placing the blade of a screwdriver in the groove and tapping sharply with a hammer. The three switch terminals are clearly labeled "common", "normally open" and "normally closed".

If lead wires are supplied, color coding is as follows:

TERMINALS	Manual Reset (Option 1530) SPDT	DPDT (Option 1010)	
		Circuit 1	Circuit 2
Common (COM)	Violet	Violet	Yellow
Normally Closed (NC)	Black	Black	Red
Normally Open (NO)	Blue	Blue	Orange

A grounding screw and clamp (cast in symbol) is provided which meets a 35 lb. pull test. Keep the wire as short as possible to prevent interference with the plunger and if applicable, the optional adjustable differential switch wheel (option 1519).

Part II - Adjustments

- 5/8" Open End Wrench
- 1/4" Wrench
- 3/16" Wrench
- Screwdriver

ALL MODELS HAVE A TWO-PIECE ADJUSTABLE PLUNGER (SEE FIGURE 1). 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.

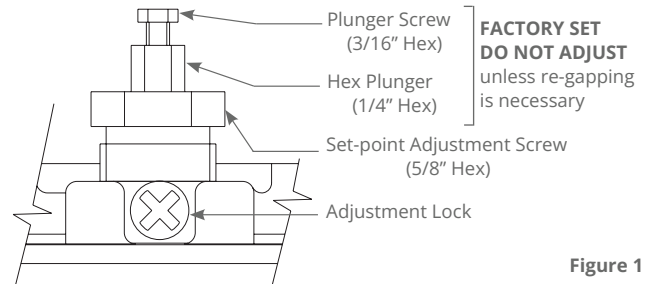


Figure 1

Types H100 and H100K

1 Remove cover. Loosen Phillips screw adjustment lock.

2 Adjust set point by turning 5/8" hex adjustment screw clockwise to raise set point, or counter clockwise to lower set point. Tension on adjustment screw can be increased by tightening adjustment lock onto it. (See Figure 1). Controls include uncalibrated reference scales for high, low or mid range settings. When making adjustments, do not exceed the proof pressure rating on nameplate as this may cause a shift in set point.

Types with adjustable deadband switch (select Models & Option 1519)

Models 15623, 15731-15737, 15884, and types with option code 1519 incorporate a snap switch with integral adjustment wheel. Turning this wheel raises or lowers the pressure rise set point. The fall set point 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 raise or counter clockwise to lower the set point. Using the example from step 1, turn the wheel until 20 psi is achieved. This is your set point.

Consult UE for additional information.

Types with Manual Reset Button (Option 1530)

These optional models incorporate a snap switch that when actuated, remains actuated until the pressure decreases and the reset button (located on top of the control) is manually depressed to reset the switch.



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

Re-Gapping Procedure (refer to Figure 1)



- 5/8" Open End Wrench
- 3/16" Open End Wrench
- 1/4" Open End Wrench

- 1 Loosen adjustment lock.
- 2 Turn 5/8" hex adjustment screw clockwise, to approximately mid range. This puts a load on the sensor and exposes the plunger flats.
- 3 Using a 1/4" wrench on the plunger and a 3/16" wrench on the plunger hex screw, turn hex screw counter-clockwise from plunger until switch actuates. If switch is already actuated, turn plunger hex screw clockwise, until switch deactuates. Turn hex screw clockwise from this point. (See Table 1 for Flats and approximate Gap.)
- 4 Check set according to Part II Adjustments.
- 5 Connect wires and replace cover securely.

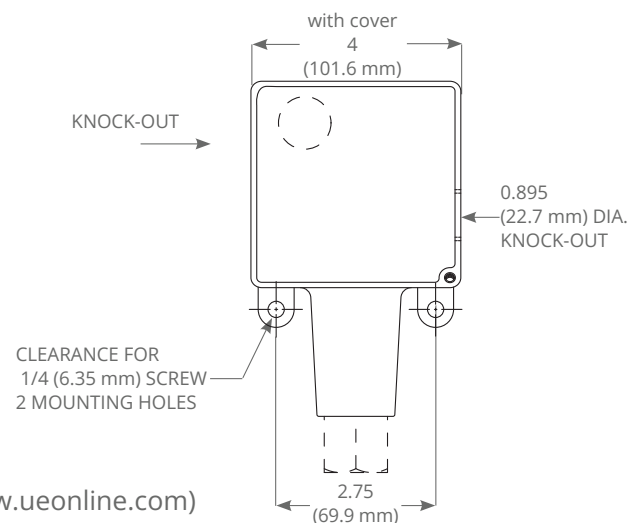
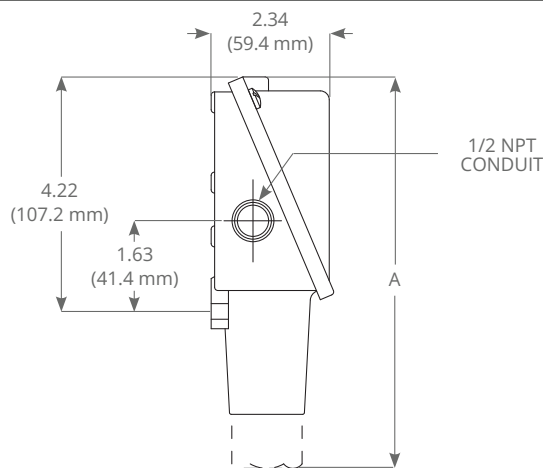
Models	Flats	Approx. Gap
171-174	2 to 2 1/2	.0085 to .0105"
183-194	1 to 1 1/2	.004 to .006"
483-494	1 to 1 1/2	.004 to .006"
358-376	5 to 6	.020 to .025"
700-706	3 1/2 to 4	.014 to .017"
521-525	2 to 2 1/2	.0085 to .0105"
15737	5 to 6	.020 to .025"
531-535	2 to 2 1/2	.0085 to .0105"
540-548	2 to 2 1/2	.0085 to .0105"
565-567	1 to 1 1/2	.004 to .006"
15623	5 to 6	.020 to .025"
15731-15736	5 to 6	.020 to .025"

Table 1

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.

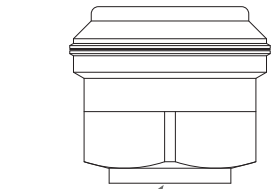
Part III - Dimensions



(Dimensional drawings for all models may be found at www.ueonline.com)

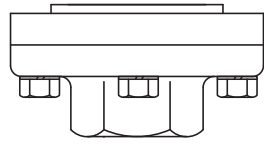
Dimension A			
Models	Inches	mm	Pressure Connection
Pressure			
171-174	7.63	193.8	1/2 NPT
183-186, 483-486	7.56	192.0	1/2 NPT
188-189, 488-489	6.63	168.4	1/2 NPT
190-194, 490-494	6.63	168.4	1/2 NPT
218	6.56	166.6	1/4 NPT
270-274	7.00	177.8	1/4 NPT
358-376	7.00	177.8	1/4 NPT

Dimension A			
Models	Inches	mm	Pressure Connection
520-525, 15737	8.44	214.4	1/2 NPT
530-535	8.00	203.2	1/2 NPT
565-567	6.63	168.4	1-1/2" Sanitary Fitting
610-616, 680, 15884	7.00	177.8	1/4 NPT
701-706, 15623, 15731-15736	6.63	168.4	1/4 NPT
Differential Pressure			
540-543	8.47	215.1	1/8 NPT
544-548	8.53	216.7	1/8 NPT



1/2 NPT

Models 171-174



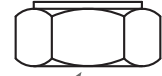
1/2 NPT

Models 183-186, 483-486



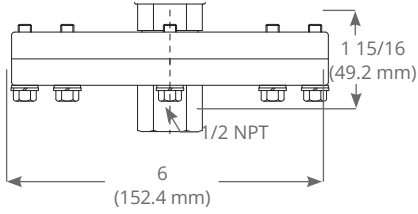
1/2 NPT

Models 188-194, 488-494

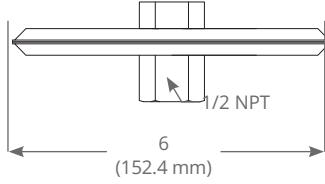


1/4 NPT

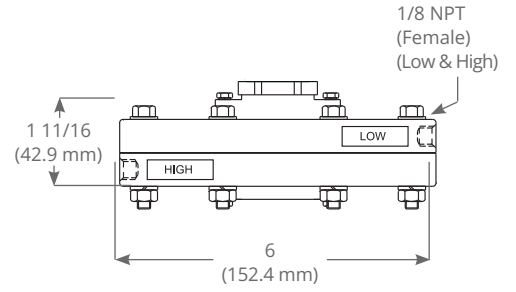
**Models 218-376, 610-706,
15623-15736, 15884**



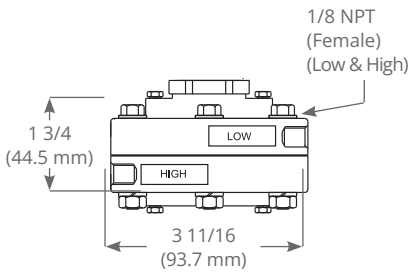
Models 520-525, 15737



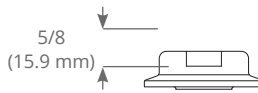
Models 530-535



Model 540-543



Models 544-548



Model 565-567

French Warnings Translations

Page	Warning Text	Texte d'Avertissement
1	MISUSE OF THIS PRODUCT MAY CAUSE DAMAGE TO EQUIPMENT OR PERSONAL INJURY. THESE INSTRUCTIONS MUST BE THOROUGHLY READ AND UNDERSTOOD BEFORE UNIT IS INSTALLED.	Une mauvaise utilisation de cet appareil peut endommager l'équipement ou provoquer 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: 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	THIS PRODUCT DOES NOT HAVE ANY FIELD REPLACEABLE PARTS. ANY SUBSTITUTION OF COMPONENTS SHALL INVALIDATE AGENCY CERTIFICATION(S).	Aucun composant ne peut être remplacé sur le terrain. Tout remplacement de composant invalidera toutes les approbations et certifications données par un tiers.
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	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	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.

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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WWW.UEONLINE.COM

Installation & Maintenance Instructions

UE 100 SERIES

Temperature Switches Types B100, C100, E100 & F100



Supplied by

247cable.com

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



100 Series

Temperature Switches
Types B100, C100, E100 & F100



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 DAMAGE TO EQUIPMENT OR PERSONAL INJURY. THESE INSTRUCTIONS MUST BE THOROUGHLY READ AND UNDERSTOOD BEFORE UNIT IS INSTALLED.

Cert number	20181204-E10667
Applicable Area	North America
Markings	UL Recognized
Applicable Standards	UL 873; C22.2 No. 24

Cert number	DEMKO 11 ATEX 1105261X
Applicable Area	Europe (EU)
Markings	II 1 G Ex ia IIC T6 Ga
Applicable Standards	EN IEC 60079-0; EN 60079-11

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

⚠ 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. 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 SHALL INVALIDATE AGENCY CERTIFICATION(S).

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

The 100 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 actuates a SPDT snap-acting microswitch, converting the temperature signal into an electrical signal. Control set point may be varied by turning the internal adjustment hex (C100, F100) or reference dial (B100, E100) according to the procedures outlined (See Part II – Adjustments).

Please refer to the product technical datasheet at www.ueonline.com for product specifications.

Part I - Installation

- ⚠** Adjustable wrench
- Flathead screwdriver
- Hammer (for alternate wire knockouts)

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.

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

i ALWAYS USE A WRENCH ON LOCAL MOUNT, IMMERSION STEM HEX (SEE FIGURE 3). DO NOT TIGHTEN BY TURNING THE ENCLOSURE AS THIS WILL DAMAGE THE SENSOR AND WEAKEN WELDED JOINTS.

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

i ON MODELS SUPPLIED WITH AN EXTERNAL MANUAL RESET BUTTON, BE SURE TO LEAVE SUFFICIENT FINGER SPACE OVER THE RESET BUTTON FOR THE OPERATOR TO RESET THE CONTROL.

For remote mounting, mount the unit via the (2) 1/4" screw clearance holes on the enclosure (See Dimensions). Fully immerse the bulb and 6" capillary in the control zone. 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 that it will not be exposed to temperatures beyond the instrument range limits.

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.



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



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

1 Remove the two screws retaining the cover and cover gasket.

2 A 1/2" NPT conduit connection is located on the left side of the enclosure. Two cast-in 7/8" diameter knockouts for electrical conduit are located on the side and rear of enclosure (See Dimensions). These can easily be knocked out by placing the blade of a screwdriver in the groove and tapping sharply with a hammer.

3 Connect conduit to the enclosure and wire directly to the switch terminals according to local and national electrical codes. Bring the wires up to terminals from the rear of the enclosure allowing enough slack so as not to affect switch movement when making setting adjustments. The three switch terminals are clearly labeled "common", "norm open", and "norm closed".

If lead wires are supplied, color coding is as follows:

TERMINALS	Manual Reset Option 1530 SPDT
Common (COM)	Violet
Normally Open (NO)	Blue
Normally Closed (NC)	Black

A grounding screw and clamp (cast in symbol) is provided which meets a 35 lb. pull test. Keep the wire as short as possible to prevent interference with the plunger and, if applicable, the optional adjustable deadband switch wheel (option1519).

Part II - Adjustments



• 3/16 Open End Wrench

NOTE: For set point adjustments and recalibration, immerse sensor (immersion stem or bulb and 6" of capillary) in a calibrated temperature source and stabilize unit.

Types C100 and F100

Remove cover. Switch has a hex adjustment screw inside enclosure (See Figure 1). If switch transfer point differs from actual temperature, adjust setting. To raise the temperature setting, turn the hex clockwise. To lower the temperature setting, turn the screw counter-clockwise. When making adjustments, do not exceed the maximum temperature rating on nameplate.

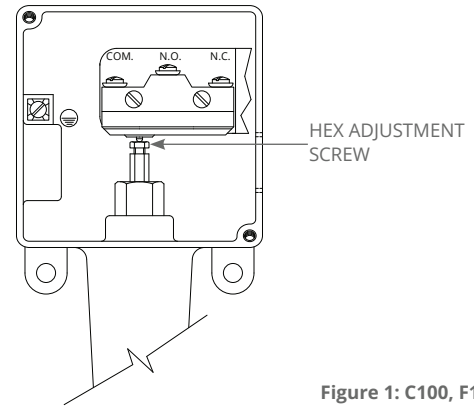


Figure 1: C100, F100

Types B100 and E100 (with reference dial)

To change the set point, turn dial and align with pointer. Controls are factory calibrated for maximum accuracy at the midpoint of the scale.

Re-calibration

To re-calibrate, turn dial to desired set point (See Figure 2). If the actual temperature and set point temperature do not agree, turn hex adjustment screw clockwise to raise and counterclockwise to lower temperature setting.

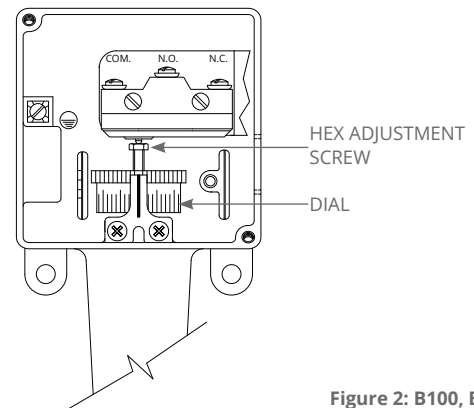


Figure 2: B100, E100

Types with Adjustable Deadband Switch (Option 1519)

Types with option code 1519 incorporate a snap switch with integral adjustment wheel. Turning this wheel raises or lowers the temperature rise set point. The fall set point remains constant. To use the adjustable deadband switch: To increase deadband, turn the adjustment wheel left. This increases the rise set point while keeping the fall set point constant.

Consult UE for additional information.

Types with Manual Reset Button (Option 1530)

These optional models incorporate a snap switch that when actuated, remains actuated until the temperature decreases and the reset button (located on top of the control) is manually depressed to reset the switch.



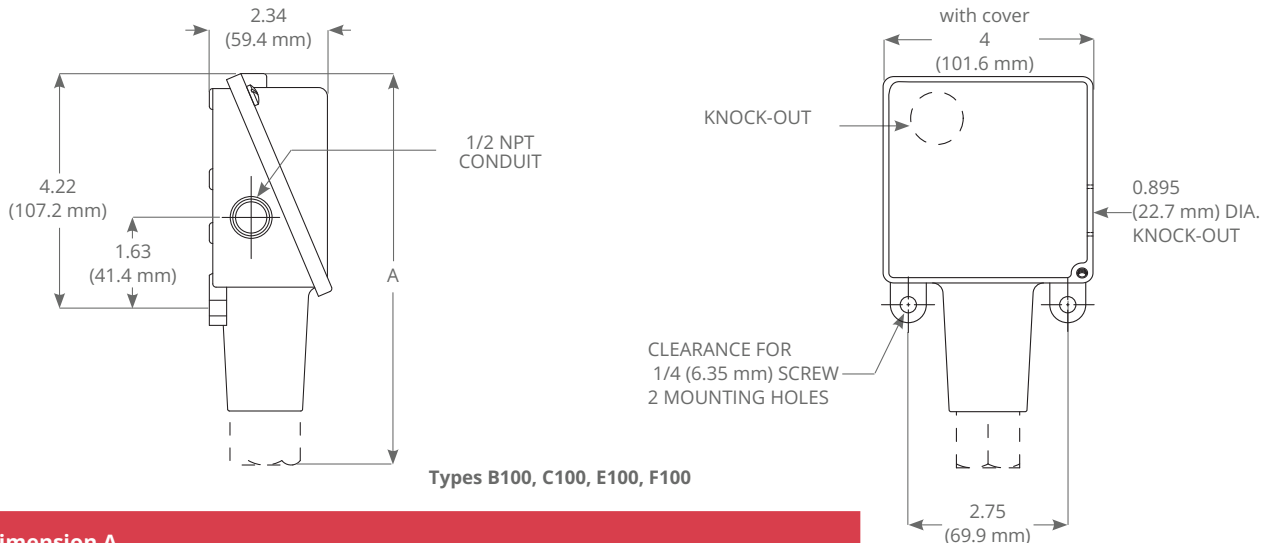
AFTER COMPLETING SETTING ADJUSTMENT, BE SURE TO REINSTALL ENCLOSURE COVER.

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)

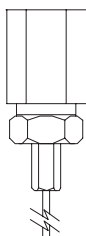


Types B100, C100, E100, F100

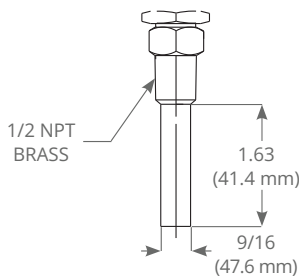
Dimension A

Type	Model	Inches	mm	Connection
B100, C100	120-121, 13546	9.38	238.3	Immersion stem
E100, F100	1-8, 13545	8.69	220.7	Bulb & Capillary

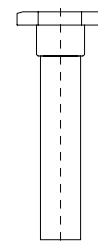
Temperature Sensors



Bulb & Capillary
Models 1BC-8BC, 1BS-8BS, 13545

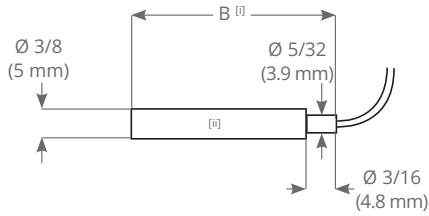


Immersion Stem
Models 120-121, 13546



Immersion Stem
13546

Figure 3



Remote Bulb

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

Dimension B		
Models	Inches	mm
1BC/BS	3.75	95.3
2BC/BS/ BCA/BCB/ BSA/BSB	2.60	66.0
3BC/BS	2.13	54.1
4BC/BS	6.75	171.5
5BC/BS	5.00	127.0
6BC/BS	4.50	114.3
7BC/BS	3.00	76.2
8BC/BS	3.25	82.6
13545	11.63	295.4

French Warnings Translations

Page	Warning Text	Texte d'Avertissement
1	MISUSE OF THIS PRODUCT MAY CAUSE DAMAGE TO EQUIPMENT OR PERSONAL INJURY. THESE INSTRUCTIONS MUST BE THOROUGHLY READ AND UNDERSTOOD BEFORE UNIT IS INSTALLED.	Une mauvaise utilisation de cet appareil peut endommager l'équipement ou provoquer 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: 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	THIS PRODUCT DOES NOT HAVE ANY FIELD REPLACEABLE PARTS. ANY SUBSTITUTION OF COMPONENTS SHALL INVALIDATE AGENCY CERTIFICATION(S).	Aucun composant ne peut être remplacé sur le terrain. Tout remplacement de composant invalidera toutes les approbations et certifications données par un tiers.
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. 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	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.

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.

UE UNITED ELECTRIC
CONTROLS

180 Dexter Avenue
 Watertown, MA 02472 - USA
 Telephone: 617 926-1000 - Fax: 617 926-2568
www.ueonline.com

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 DOMESTIC REGIONAL SALES OFFICES
 PLEASE VISIT OUR WEBPAGE
WWW.UEONLINE.COM

IMT100 08

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 1×10^{-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 Test¹

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.

¹ 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
Design				
	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			
Implementation				
	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
Verification and Testing				
	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			
Maintenance				
	Tubing blockage / partial blockage tested			
	Safety loop function tested			