Title

PULLKEY SWITCH

TYPE ESS3

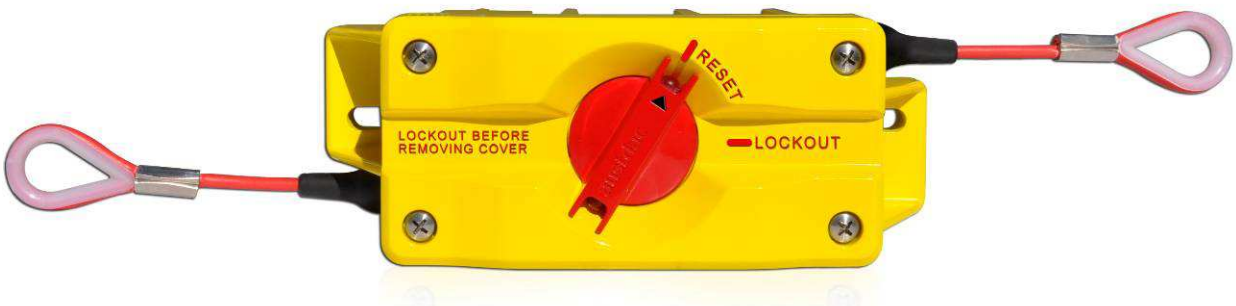
USER MANUAL

Document Number

52-300-12

Issue

07



REVISION CONTROL

Issue	Details	Date	Written	Designed	Approved
07	Address and Logo update	2017.03.23	CW	CW	PC
06	Add UL number	2014.09.09	SCa	SCa	RG
05	Add mounting instructions	2011.09.14	PB’	PB’	NK
04	Change +50ºC to +60ºC	2011.07.14	PB’	PB’	MC

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1 GENERAL DESCRIPTION

The Austdac pull key or cable-pull limit switch type ESS3 finds many applications in controlling distributed plant such as conveyors or belts used in the mining or materials handling industries. The pull key is used to provide controlled stop functions for distributed plant or conveyors. The pull key can be operated using the front centrally located knob or each of the two side located flexible cable-pull actuators. The side cable-pull actuators can be used in tensioned and non-tensioned systems.

Photograph 1 General view of ESS3 Pullkey

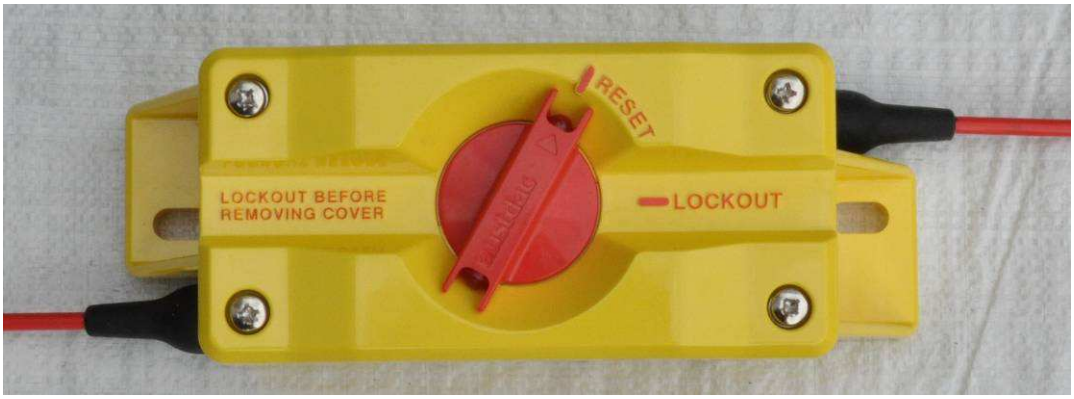
Each of the cable-pull actuators is fitted with an eyelet to allow easy attachment of the lanyard or pull wire using some of the accessories described in section 7 of this manual. The ESS3 provides six independent uncommitted voltage free changeover or SPDT contacts for use in controlling the conveyor. The contacts can be configured to handle low voltage mains circuits up to five amps or extra low voltage circuits with currents as low as 100uA.

The pull cord operated pull key measures 270mm (W) x 100mm (H) x 115mm (D) including its convenient mounting feet that allow the ESS3 to be mounted on a gear tray or conveyor structure with two M10 (3/8”) bolts. The large centrally located knob provides indication of the switch status through its position and through two reflective ‘cats eyes’ that can only be seen from a long distance when the switch is in the stop or lockout position.

2 FRONT PANEL LAYOUT

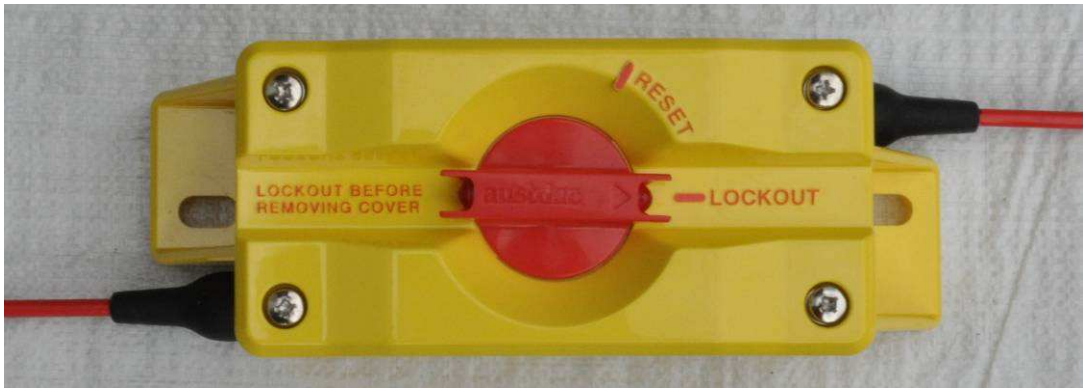
The front panel has a centrally located red switch actuator and indicator knob. This knob can be used to operate the switch or be used as an indicator of the status of the switch. The knob rotates between the two switch status positions, the ‘RESET’ or ‘ON’ position and the ‘LOCKOUT’ or ‘OFF’ position.

The knob is surrounded by a raised area of the front cover with a channel through this raised area either side of the knob. If the switch is in the ‘RESET’ state the knob points to the ‘RESET’ indicator text on the raised portion of the front cover. The raised area hides the knob cat’s eyes from general view providing long distance indication that the switch is in the ‘RESET’ or ‘ON’ state. If the switch is in the ‘LOCKOUT’ or ‘OFF’ state the knob is rotated to align with the channels on both sides. This allows the cats eyes to be seen at a distance indicating that the switch is in the ‘LOCKOUT’ or ‘OFF’ state



Photograph 2 The switch in the reset or on state

Photograph 2 shows the pullkey in the ‘RESET’ or ‘ON’ state, the knob slopes at 60º.



Photograph 3 The switch in the lockout or off state

Photograph 3 shows the pullkey in the ‘LOCKOUT’ or ‘OFF’ state, the knob is now horizontal exposing the cats eyes through the channels of the cover.

3 MODELS

The Pullkey type ESS3 is available in various models depending on the actuation method and the type of switch module fitted. Refer to table 1 below for a list of models and features.

PULLKEY TYPE ESS3 MODEL NUMBERS NOTE 1				
MODEL	OPERATION METHOD	FITTED SWITCHES	TYPE FITTED	RATING
PKEY001	SLACK ROPE	SW1a, b	DC1	5A 125Vac
		SW2a, b		
		SW3a, b		
PKEY051	TENSIONED	SW1a, b	DC1	5A 125Vac
		SW2a, b		
		SW3a, b		
PKEY002	SLACK ROPE	SW1a, b	DC3	0.1A 125Vac
		SW2a, b		
		SW3a, b		
PKEY052	TENSIONED	SW1a, b	DC3	0.1A 125Vac
		SW2a, b		
		SW3a, b		
PKEY003	SLACK ROPE	SW1a, b	DC3	0.1A 125Vac
		SW2a, b	DC1	5A 125Vac
		NOT FITTED		
PKEY053	TENSIONED	SW1a, b	DC3	0.1A 125Vac
		SW2a, b	DC1	5A 125Vac
		NOT FITTED		
NOTE 1 This table does not apply to monitored lanyard installations (see section 5). Always contact Austdac Inc for additional guidance and information for these types of installations.				

Table 1 Pullkey type ESS3 model numbers

Models fitted with DC1 type switches with a rating of 5 amps at 125 volts a.c. are designed to be used in systems that simply place pullkey switches in series along a conveyor and control a contactor that in turn controls the conveyor motor. These types of installations employ low voltage circuits that can cause electric shock and should only be maintained by persons with appropriate qualifications or licenses.

Models fitted with DC3 type switches with a rating of 0.1 amps at 125 volts a.c. are designed to be used in signal line systems that use microprocessor based transmitters that send codes to a control system rather than switch a simple series circuit. These types of installations employ extra low voltage circuits typically less that 24 volts d.c. making them safer and capable of meeting various ‘touch potential’ laws. These systems tend to be lanyard actuated.

4 MOUNTING INSTRUCTIONS

The PULLKEY ESS3 should be mounted with 2 x M8 or M10 bolts (not supplied) directly to the mounting fixture. Fixing centres are 230mm apart.

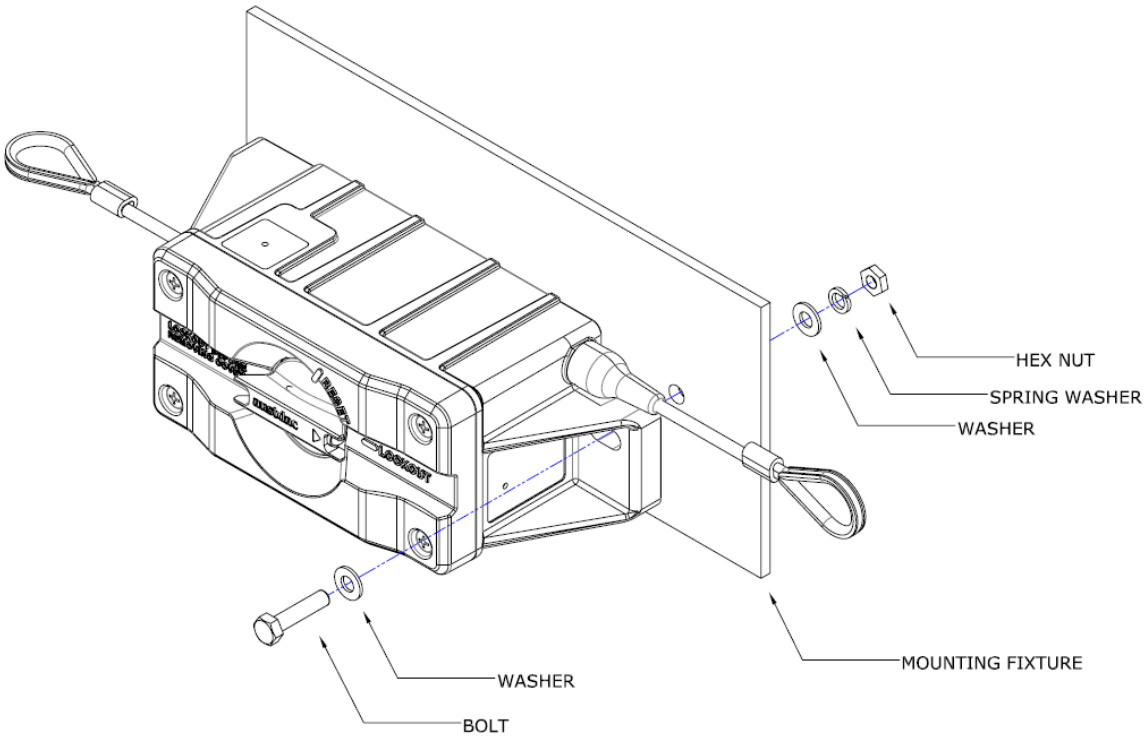
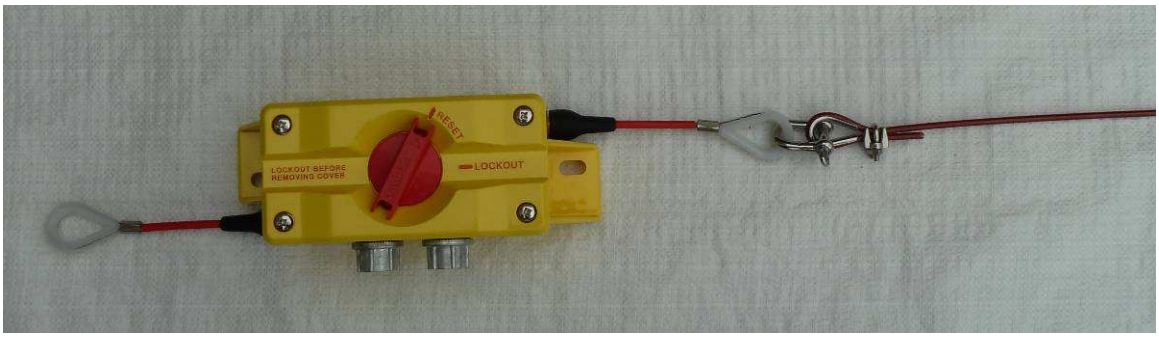


Figure 1 Pullkey Typical Mounting

5 SLACK ROPE OPERATION

The slack rope variant of the ESS3 employs a non-tensioned plastic coated stainless steel cable as the means of actuation. All electrical cabling between pullkeys is in conduit or cable ducting. This method of operation is particularly suitable to installations prone to wide temperature changes and conveyor structure that may move as it does **not** produce nuisance trips or stops associated with coefficient of expansion characteristics of actuation cables and movement in conveyor structure. This method of actuation can not detect a broken actuating cord.

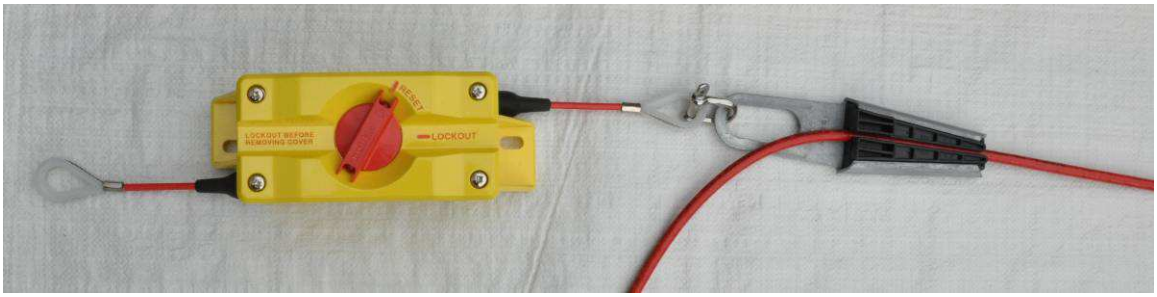


Photograph 4 ESS3 Pullkey with Slack rope setup

The slack rope method of operation requires that the pull cord have very little slack without any tension. This is achieved by pulling any slack around one of the eyelets at either end of the pull cord and securing it using a ‘U’ bolt clamp.

6 MONITORED LANYARD OPERATION

Monitored lanyard installation is only intended when the pullkey type ESS3 is fully integrated into industrial machinery or conveyor control systems using control signals of less than 32 volts ac or 48 volts dc. This type of installation is **not** to be carried out without prior additional guidance from Austdac Inc to ensure that the installation is in accordance with UL, NFPA and NEC requirements. The monitored lanyard method of operation can distinguish between intentional operation and system faults. The monitored lanyard method of actuation can also detect a broken actuating cord.

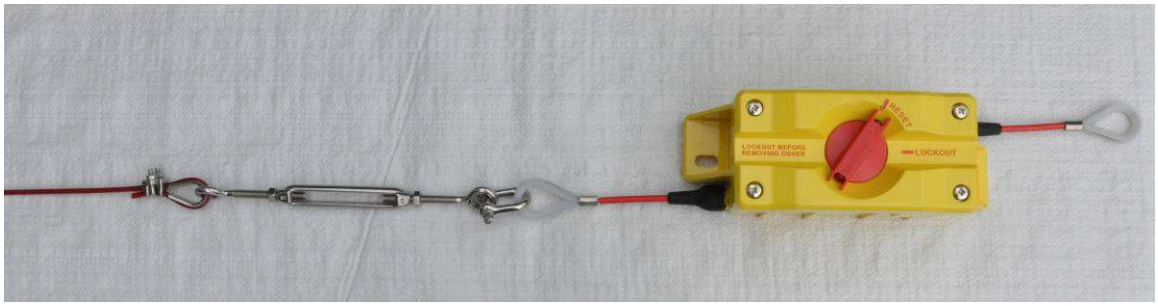


Photograph 5 ESS3 Pullkey with monitored lanyard setup

Photograph 5 above shows an example of the monitored lanyard method of actuation. No tensioning of the pull cord is required for this method of actuation.

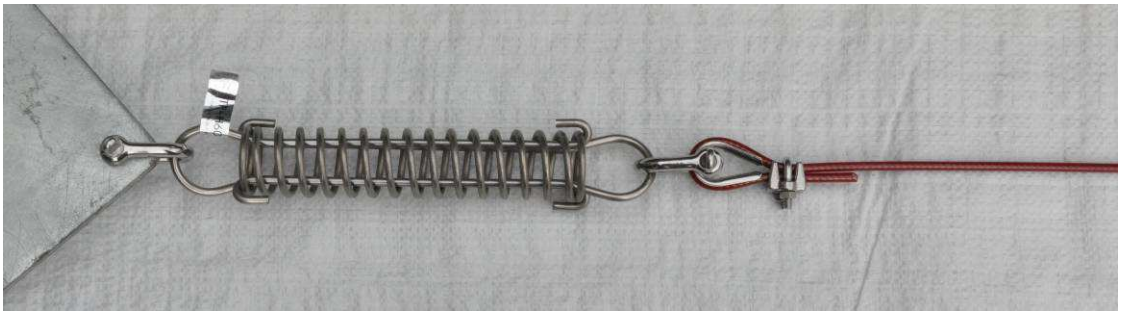
7 TENSIONED OPERATION

The tensioned variant of the ESS3 employs tensioned plastic coated stainless steel cable as the means of actuation. All electrical cabling between pullkeys is in conduit or cable ducting. This method of operation is prone to coefficient of expansion issues and movement within conveyor structure. This method requires correct tensioning of the actuation cable and constant checking for conveyor structure movement and re-tensioning to avoid nuisance trips or stops. The monitoring of the actuation cable is carried out by the tensioned actuation cable. The tensioned method can not distinguish between an intentional operation or system problem or fault. This method of actuation can detect a broken actuating cord.



Photograph 6 ESS3 Pullkey with Tension Setup

The actuating cord or steel cable needs to be tensioned correctly before the pullkey front panel knob can be placed in the ‘reset’ position. To achieve the correct tension the pull cord needs to be connected to the pullkey via fully extended turnbuckle as shown in photograph 5 above. The other end of the pull cord should be secured to another pullkey in a similar fashion or to a tension spring as shown in photograph 6 below.



Photograph 7 Tension Spring Secured to Structure

The pull cord should then be made taut by pulling any slack around one of the eyelets at either end of the pull cord and securing it using a ‘U’ bolt clamp. The turnbuckle should then be wound to tension the pull cord, continue tensioning the pull cord until the tension gauge indicates the correct tension position as shown in photograph 7 below. Lock off the turnbuckle using the two back nuts fitted to the turnbuckle. Place the pullkey in the ‘reset’ position.

The tension gauge should be used periodically to check for the correct tension and the turnbuckle adjusted accordingly.

Photograph 8 Use of tension gauge in tensioned installations

Photograph 8 above shows correct use of tension gauge in setting up the correct tension of the type ESS3 tensioned pullkey.

8 IEC 61508 DIVERSITY

Some installations may require two switches in series to help meet redundancy requirements of IEC61508; simply placing two switches in series may not achieve the required failure rate required by the installation. The pullkey type ESS3 has internal switches that are actuated and not actuated depending on the position of the front panel control knob.

PULLKEY TYPE ESS3 SWITCH ACTUATION			
POSITION	SW1a + SW1b	SW2a + SW2b	SW3a + SW3b
RESET	Not actuated	Actuated	Not actuated
LOCKOUT	Actuated	Not actuated	Actuated

Table 2 ESS3 switch actuation details

By wiring the correct switches in series the reliability of the breaking of the series circuit can be significantly improved.

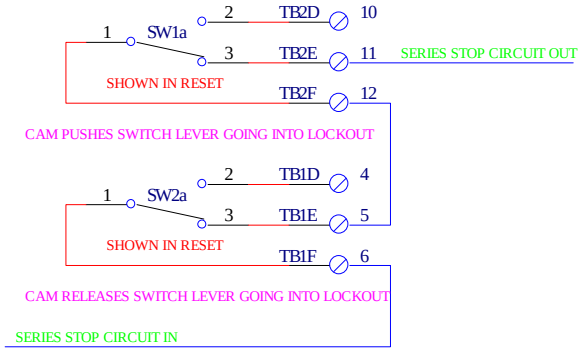


Figure 2 Switch Wiring with Diversity

Figure 1 above shows switch SW1 wired in series with SW2 and because the two switches are operated differently by the cam, they are both less likely to fail from a common cause failure.

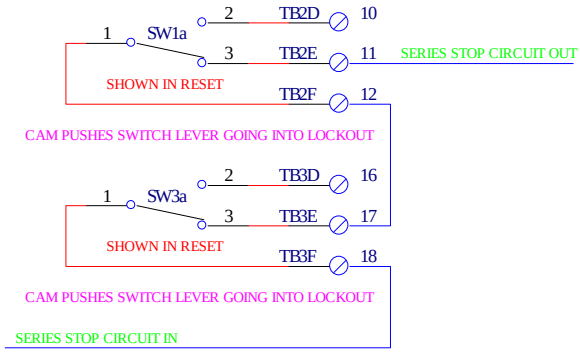


Figure 3 Switch Wiring without Diversity

Figure 2 above shows switch SW1 wired in series with SW3 and because both switches are operated by the same method, they are both likely to fail from a common cause failure.

9 TERMINATIONS AND CONNECTIONS

All connections to the type ESS3 pullkey are via cage-clamp terminals located within the main body of the pullkey. Access to these terminals is gained by loosening the four front panel retaining screws and removing the front cover. These terminals can accommodate up to 2.5mm^2 or 14awg conductors. All contact references (NO, NC) are for the pullkey in the reset position.

SWITCH SW1a TERMINATIONS		
TERMINAL	DESIGNATION	DESCRIPTION
10	NO	NORMALLY OPEN CONTACT
11	NC	NORMALLY CLOSED CONTACT
12	COM	COMMON CHANGEOVER CONTACT

Table 3 Switch SW1a Termination Details

Figure 4 Switch SW1a Schematic

The pullkey cam activates the lever of switch SW1a when the pullkey is placed in the lockout position and deactivates the switch lever when the pullkey is placed in the reset position.

SWITCH SW1b TERMINATIONS		
TERMINAL	DESIGNATION	DESCRIPTION
7	NO	NORMALLY OPEN CONTACT
8	NC	NORMALLY CLOSED CONTACT
9	COM	COMMON CHANGEOVER CONTACT

Table 4 Switch SW1b Termination Details

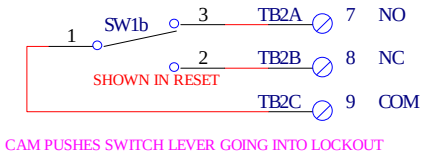


Figure 5 Switch SW1b Schematic

The pullkey cam activates the lever of switch SW1b when the pullkey is placed in the lockout position and deactivates the switch lever when the pullkey is placed in the reset position.

SWITCH SW2a TERMINATIONS		
TERMINAL	DESIGNATION	DESCRIPTION
4	NO	NORMALLY OPEN CONTACT
5	NC	NORMALLY CLOSED CONTACT
6	COM	COMMON CHANGEOVER CONTACT

Table 5 Switch SW2a Termination Details

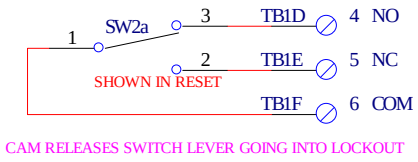


Figure 6 Switch SW2a Schematic

The pullkey cam deactivates the lever of switch SW2a when the pullkey is placed in the lockout position and activates the switch lever when the pullkey is placed in the reset position. This is the opposite of switches SW1 and SW3. This provides some degree of diversity to the operation of the switch if a contact of SW2 is placed in series with a contact of SW1 or SW3 which in turn eliminates a dangerous failure mode. Note that the schematic and termination details are shown correctly and the user does not have to swap the No and NC connections around.

SWITCH SW2b TERMINATIONS		
TERMINAL	DESIGNATION	DESCRIPTION
1	NO	NORMALLY OPEN CONTACT
2	NC	NORMALLY CLOSED CONTACT
3	COM	COMMON CHANGEOVER CONTACT

Table 6 Switch SW2b Termination Details

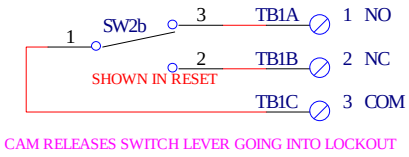


Figure 7 Switch SW2b Schematic

The pullkey cam activates the lever of switch SW2b when the pullkey is placed in the lockout position and deactivates the switch lever when the pullkey is placed in the reset position. This is the opposite of switches SW1 and SW3. This provides some degree of diversity to the operation of the switch if a contact of SW2 is placed in series with a contact of SW1 or SW3 which in turn eliminates a dangerous failure mode. Note that the schematic and termination details are shown correctly and the user does not have to swap the NO and NC connections around.

SWITCH SW3a TERMINATIONS		
TERMINAL	DESIGNATION	DESCRIPTION
16	NO	NORMALLY OPEN CONTACT
17	NC	NORMALLY CLOSED CONTACT
18	COM	COMMON CHANGEOVER CONTACT

Table 7 Switch SW3a Termination Details

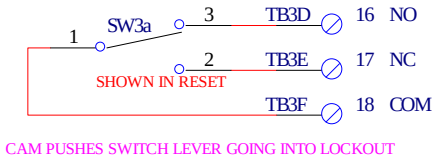


Figure 8 Switch SW3a Schematic

The pullkey cam activates the lever of switch SW3a when the pullkey is placed in the lockout position and deactivates the switch lever when the pullkey is placed in the reset position.

SWITCH SW3b TERMINATIONS		
TERMINAL	DESIGNATION	DESCRIPTION
13	NO	NORMALLY OPEN CONTACT
14	NC	NORMALLY CLOSED CONTACT
15	COM	COMMON CHANGEOVER CONTACT

Table 8 Switch SW3b Termination Details

Figure 9 Switch SW3b Schematic

The pullkey cam activates the lever of switch SW1a when the pullkey is placed in the lockout position and deactivates the switch lever when the pullkey is placed in the reset position.

10 CABLE ENTRY

The Pullkey type ESS3 is available with conduit or cable gland type entries depending on the type of installation.

Photograph 9 Pullkey with conduit hubs fitted

Photograph 10 Earth continuity of conduit hubs

Photograph 11 Earth continuity detail

11 SPECIFICATIONS

Name	Lanyard-operated pull key or cable-pull limit switch
Type	ESS3
Models	See table 1
Size	270mm (W) x 98mm (H) x 115mm (D)
Mass	1.55kg
Fixing	2 x M8 or M10 bolts
Fixing centres	230mm
Fixing slots	20mm x 11mm
Ingress protection	IP66 NEMA 4X
Enclosure material	Polycarbonate UL 94 V-0
Enclosure colour	Yellow
Knob material	Polycarbonate UL 94 V-0
Knob colour	Red
Operating temperature range	-50ºC to 60ºC
Storage temperature range	-50ºC to 80ºC
Operating relative humidity range	10% to 90% Non condensing
UL listing	UL NKCR.E335081
Terminations	Cage clamp 2.5mm^2 (14awg) maximum
Contact configuration	6 x independently operated SPDT (changeover)
Diversity	4 contacts not operated and 2 contacts operated in reset position
Maximum switching voltage (UL1054)	125 AC
Rated switching current (UL1054)	5A AC
Electrical life at rated AC load (UL1054)	6,000 operations
Maximum switching voltage	24V DC
Rated switching current (non inductive load)	1A DC
Rated switching current inductive load L/R = 3mS	0.5A DC
Electrical life at rated DC load	6,000 operations
Mechanical life	2 x 10^6 operations
Switch status indication	passive reflective
Cable entries	Up to 4 x down facing
Auxiliary entries	1 x up facing M20 nipple or cable entry

Actuator pull force (straight out) ..... 1 to 10N

Actuator pull force (pull down over pigtails at 3m spacing) ..... 1 to 10N

Actuator pull distance (non tensioned) 40mm

Actuator pull distance (tensioned) 20mm

Actuator release distance (tensioned) 20mm

Actuator tension force 5N

Knob angular force ..... 1 to 10N

Knob angular displacement ..... 60 degrees

Internal volume 1.195L