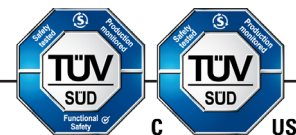

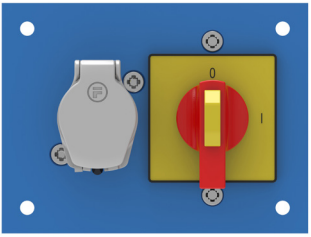


Operating Instructions: Lock Control Unit (LCU) / Switch Control Unit (SCU)



Control Interlocking

Description	LCU	SCU
<p>The LCU is a “key bank” with a switch. It incorporates one or more rotary switches and any combination of Normally In (keys trapped) and Normally Out (keys freed) locks.</p> <p>The SCU releases key(s) after switching the knob into a visible off position.</p> <ul style="list-style-type: none"> • Direct drive operation - positively opens contacts • Available as 20A, 32A and 63A variants • Most common contact arrangements are 2NO/2NC & 4NC. Other contact arrangements available on request • Mild steel construction as standard • Stainless steel construction as standard in combination with CLSS or MLSS lock types • Special switch ratings, and/or contact arrangements available on request. 		

Important:

This product is designed for use according to the installation and operating instructions enclosed. It must be installed by competent and qualified personnel who have read and understood the whole of this document prior to commencing installation. Any modification to or deviation from these instructions invalidates all warranties. Fortress Interlocks Ltd. accepts no liability whatsoever for any situation arising from misuse or mis-application of this product. This product is not to be used as a Mains Isolator or Emergency Stop. The unit is a component to be added to a permanent electrical installation meeting the requirements of the applicable IEC/EN standards. The voltages used on the LCU / SCU terminals must all be of the same type i.e. ALL Hazardous Live or ALL Machine Extra Low Voltage.

IF YOU HAVE ANY QUESTIONS OR QUERIES OF ANY NATURE WHATSOEVER PLEASE CONTACT THE SUPPLIER WHO WILL BE PLEASED TO ADVISE AND ASSIST.

It is the user's responsibility to implement proper management controls and risk assessment for master and spare keys, without which they can be used to defeat trapped key interlock systems; ISO/TS 19837 can offer further guidance.

Technical Specifications	LCU / SCU
Housing Materials	Mild steel with powder coat finish
Lock Mechanism	Die-cast zinc body with stainless operating mechanism (selected separately)
Minimum Operating Current	5mA at 20v

Safety Data	
Standards	EN60947-3: 2009 ISO EN14119: 2013 EN13849-1: 2008 EN13849-2: 2012 EN62061: 2005
Certifications	CE marked for all applicable directives
Category	Cat. 4, PLe (EN/ISO 13849-1) and SIL3 (EN/IEC 62061)
Functional safety data	B10d 5,000,000
	DC High 99% (with correct monitoring)

Operating Instructions: Lock Control Unit (LCU) / Switch Control Unit (SCU)

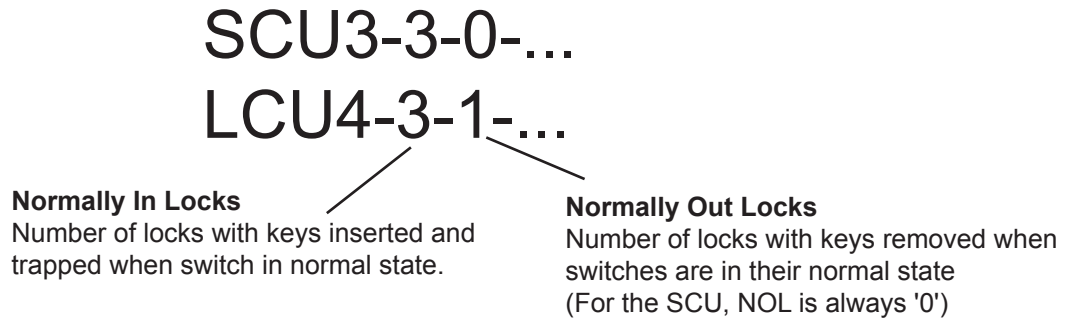
mGard Terminology

mGard part numbers describe their units in the reference state we call the “Normal State”, which means the following will be true:

- Switches will be in their described state, i.e. “Normally Closed” or “Normally Open”
- Any keys used as personnel keys will be inserted in a lock.

Locks are split into two groups, which are described in the part number as shown below:

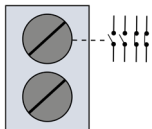
- **Normally In Locks (NIL)** have keys inserted in the Normal State
- **Normally Out Locks (NOL)** do not have keys inserted in the Normal State. (For SCU, the number of NOL is always '0')



The other reference point used to describe our units is the “Opposite State”, which means all the locks, switches and actuators will be in the opposite state to the Normal State. The schematics below represent the two reference states using the symbols defined in the Trapped Key Interlocking standard ISO TS19837 (2018).

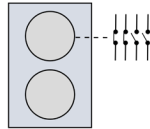
For a typical machine guarding system, the system will be described with all units in their Normal State (i.e. machine running). For more complicated systems like switch gear interlocking, the system might be described with some units in their Normal State, and others in their Opposite State. Similarly, the process to convert a system in its normal state to the system in its opposite state will result in steps where parts of the system are in Normal State, parts are in Opposite State.

LCU2-2-0- (Normal)
Standard Sequence



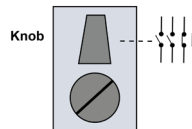
Switch: 2C/2O

LCU2-2-0- (Opposite)
Standard Sequence



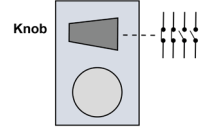
Switch: 2O/2C

SCU1-1-0- (Normal)
Standard Sequence



Switch: 2C/2O

SCU1-1-0- (Opposite)
Standard Sequence



Switch: 2O/2C

When defining the state of an SCU or LCU, the product is always described in the orientation shown in the diagram above where the switch is at the top of the unit. For the LCU and SCU standard sequence (V):

- The Normally In locks will always be closest to the switch of the unit
- The top key from the NIL group must be freed (rotated 120°) first, followed by the next locks in order of proximity to the top lock, nearest first. Keys must be inserted into the NOL group in order of furthest from the switch first, second furthest second etc. When returning keys within the NIL group, the bottom most NIL must be inserted first, operating locks in order, and finishing with the top-most lock. For LCU only, where NOL are present, keys must be removed from the top NOL first, followed in order as closest to the top lock working downwards.
- When removing a key, all locks in the other group must have keys inserted before the key is releasable
- The rear mounted switch is operated by the first lock.
- Additional switches can be added and operated by other locks within this system if required. Contact our team to discuss your solution.

Operating Instructions: Lock Control Unit (LCU) / Switch Control Unit (SCU)

Standard Functionality

LCU

In the key exchange condition, keys are held captive in Normally In Lock(s) and can only be released on insertion and entrapment of the keys into the Normally Out Lock(s), which also operates the switch. Alternatively, where all locks are Normally In, the switch operated Normally In Lock must have the key released first, operating the switch, before the remaining can be freed (in order adjacent to the switch controlled lock).

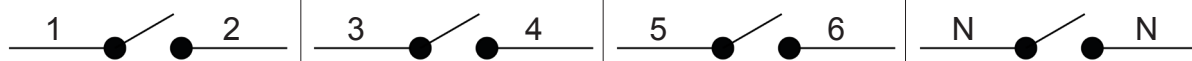
SCU

Normally In Locks have keys trapped when the switch is in the ON position. The switch must be turned to the OFF position, (or state of contact changed), before any of the keys can be removed. Once any of the Normally In Locks have keys removed, the switch cannot be operated and power restored.

Figure 1: Rotary Switch Wiring Details (With Control Key Removed / Knob Off)

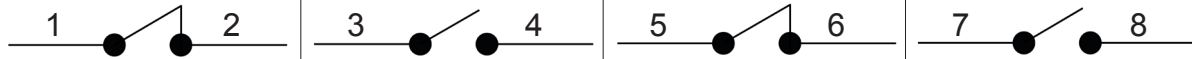
20A, 32A, 63A

0NO / 4NC



20A

2NO / 2NC



32A, 63A

2NO / 2NC

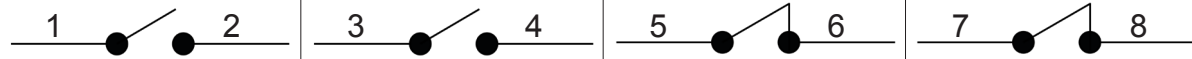


Figure 2: Common configurations

Article	Key Position First Lock	Key Position Second Lock	Key Position Third Lock	Standard Sequence	Switch operated by	Normal State	Opposite State
LCU2-2-0-...	Inserted and Rotated	Inserted and Rotated	-	V	Top NIL		
SCU1-1-0-...	Inserted and Rotated	-	-	V	Knob		

Operating Instructions: Lock Control Unit (LCU) / Switch Control Unit (SCU)

Figure 3a : Dimensional Drawing - LCU3

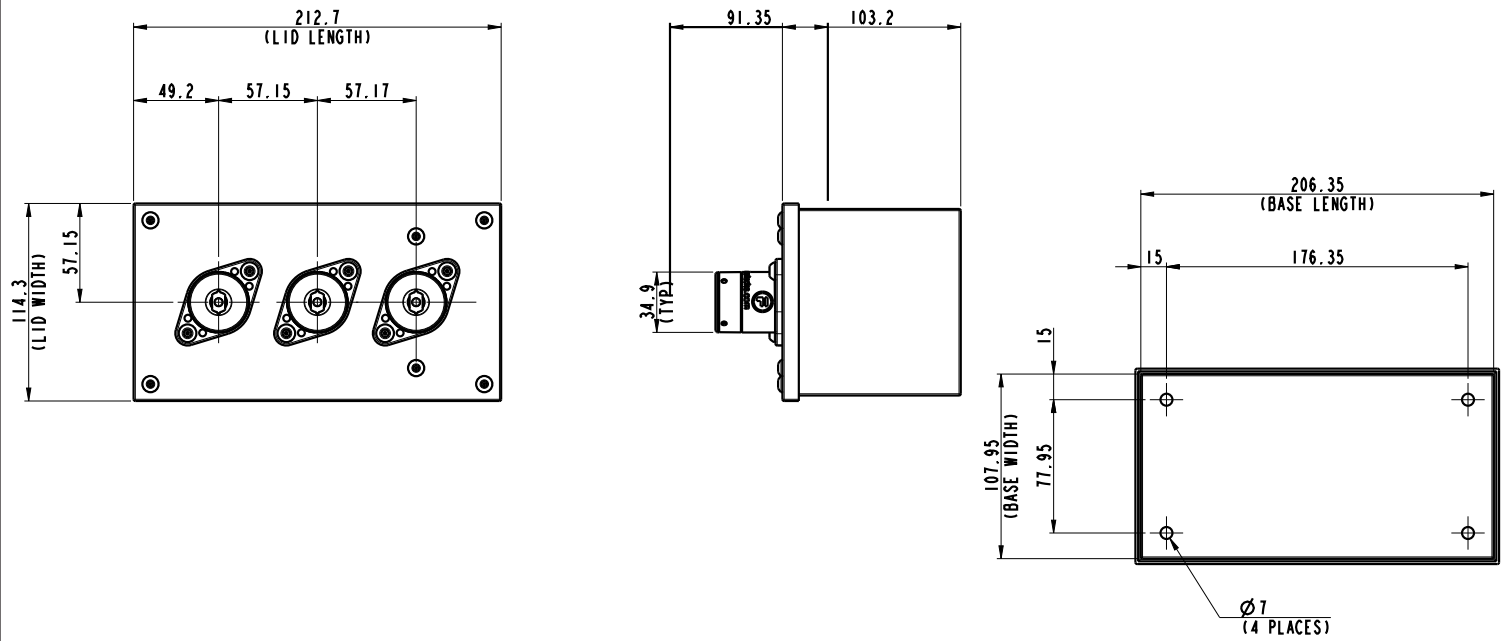
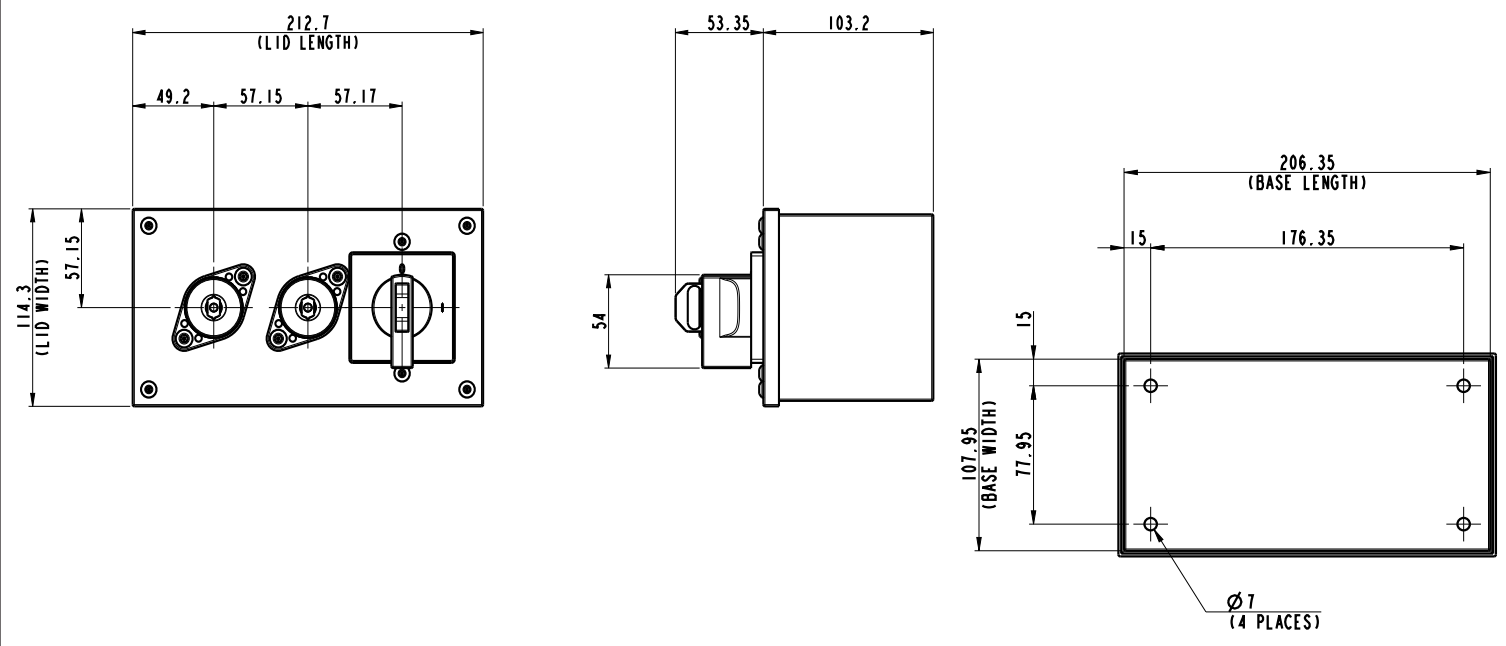


Figure 3b : Dimensional Drawing - SCU2



Operating Instructions: Lock Control Unit (LCU) / Switch Control Unit (SCU)

Figure 4: Switch states


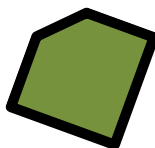


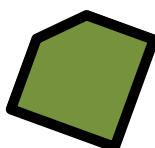

Switch Type	Switch Operated Lock State	Test Contacts via continuity**	Spindle Position (Facing lock at front of product)	Switch Angle (°)	Switch Contacts Closed (X)			
(2NO/2NC 20A) Contacts swapped state	Key Free	1 – 2 Closed 3 – 4 Open 5 – 6 Closed 7 – 8 Open			1	3	5	7
					2	4	6	8
				0	X		X	
Transition State (all contacts opened)	Key Partially Rotated	All Contacts Opened		15				
2 Normally Open Contacts, 2 Normally Closed Contacts	Key Fully Rotated	1 – 2 Open 3 – 4 Closed 5 – 6 Open 7 – 8 Closed		30		X		X
				30-90		X		X
				90		X		X
(4NC) Contacts swapped state	Key Free	1 – 2 Open 3 – 4 Open 5 – 6 Open 7 – 8 Open		270	T1	T2	T3	N
Transition State (all contacts opened)	Key Partially Rotated	All Contacts Opened		270-335				
				335-345				X
4 Normally Closed Contacts	Key Fully Rotated	1 – 2 Closed 3 – 4 Closed 5 – 6 Closed 7 – 8 Closed		0	X	X	X	X

Figure 4a: Standard 2NO/2NC Switch Contact

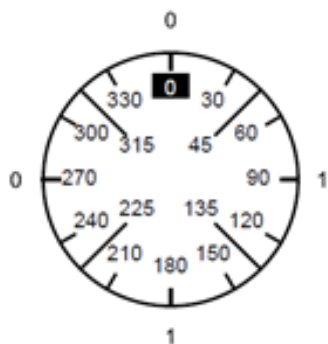
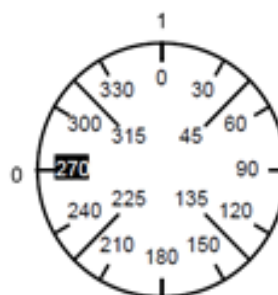
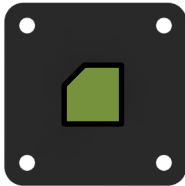
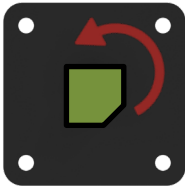


Figure 4b: Standard 4NC/0NO Switch Contact



Operating Instructions: Lock Control Unit (LCU) / Switch Control Unit (SCU)

** If your switch contacts do not operate as expected at the listed angles, it could be that your switch is 180° out of phase. This can be tested by rotating the spindle at the back by 180° with a gripping tool (such as pliers) and reinserting back into the product assembly. Re-test the contacts at the back of the switch to confirm contacts operate as expected



Neutral connections on a switch (such as those on the 4NC switch reference 'N') are closed before the main poles (this is shown in Figure 4). These are referred to as 'early make' and typically use on undervoltage/PFR coil circuits to ensure they are energised prior to the circuits making.

Auxiliary contacts typically close after the main poles are switched such that open contacts will change to closed after the switch contacts, 'late make'. When changing from closed to open, auxiliary contacts will 'early break' to change state before the main contacts.

OFF	ON	
Open	Closed	Main Poles
Open	Closed	Early Make ('N' Poles)
Open	Closed	Late Make / Early Break (Aux Poles)

Tools and Fixings Required

Back of Board:

- M6 Tap or Dia. 6.5 Drill
- 3.5mm Flat Blade Electrical Screwdriver
- 4 x M6 Screws
- 4 x M6 Nuts
- 4 x M6 Washers

Front of Board:

- M4 Tap or Dia. 4.5 Drill
- 3.5mm Flat Blade Electrical Screwdriver
- 4 x M4 Screws
- 4 x M4 Nuts
- 4 x M4 Washers

All fixings must be used.

Mounting

Back of Board - This unit can be fixed to the machine control panel.

Mount the unit only in its correctly assembled condition to flat metal plate of minimum thickness 3.0mm. The plate must be bonded to earth potential. A sound earth connection must be made to the front plate of the product. When a protective earth is required ensure it meets appropriate regulations for the installation.

1. Locate the unit so that all the locks are within easy reach.
2. Machine the panel
3. Mount the unit to the panel using the 4 M6 screws, nuts and washers, as applicable.
4. All fixing screws must be permanently prevented from removal, either by vibration or by personnel using standard tools.

Front of Board - This unit is housed in a metal enclosure and is designed to be fixed in front of the machine control panel.

1. Locate the unit so that all the locks are within easy reach.
2. Mount the unit to the panel using the 4 M4 screws, nuts and washers, as applicable. The fixing holes are accessible with the lid removed.
3. All fixing screws must be permanently prevented from removal, either by vibration or by personnel using standard tools.

Operating Instructions: Lock Control Unit (LCU) / Switch Control Unit (SCU)

Maximum Permissible Wire Gauge

Wire Type	Units	20A	32A	63A
Single Core or Stranded	mm ²	2 x 2.5	2 x 6	2 x 16
	AWG	2 x 12	2 x 8	2 x 6
Flexible Wire	mm ²	2 x 2.5	2 x 4	2 x 10
	AWG	2 x 14	2 x 10	2 x 6

The 20A, 32A and 63A switches will accept 2 wires per terminal, one either side of the terminal screw. Only copper wires are to be used.

Wire Strip Length

The wire strip length is the length of wire left exposed at the end of a cable when the insulation is removed. The recommended lengths are shown below.

Switch	Strip Length (mm)
20A	8
32A	11
63A	15

Minimum Voltage and Current

The standard 20A switch has been tested to work down to 5mA at 20V. For lower voltage and current requirements, please contact Fortress.

DC Ratings

The rotary switches are all AC but have the following DC ratings:

DC Voltage	20A Switch	32A Switch	63A Switch
24V	20A	32A	63
48V	12A	25A	50
60V	4.5A	10	16
110V	1A	2	3
220V	0.4	0.6	0.7
440V	0.27A	0.3	-

Mechanical and Electrical Life

The mechanical life of the lock and bolt mechanism is 1,000,000 operations. The life of the rotary switch is shown below:

Switch Type	Mechanical Life (N° of Operations)	AC - 21A Electrical Life (N° of Operations)
20A	1,500,000	100,000
32A	1,500,000	100,000
63A	1,500,000	100,000

Electrical Connection

Check that the unit to be installed is of the same electrical type and rating as the machine control circuits. Please refer to the Terminal Numbers for the Key Operated Rotary Switch. Bond the unit to Earth potential via the Earth point provided. When a protective earth is required ensure it meets appropriate regulations for the installation. Test the unit for correct operation.

Commissioning

Mechanical Function Test

1. Isolate electrical supplies.
2. Insert all the keys.
3. Check that all the keys in Normally In Locks are trapped in positions when the switch operated lock has a key trapped (for LCU) or the switch knob is in the ON state (SCU).
4. Check that all the switches are in the states shown in the wiring diagrams - see figure 1.
5. Remove the key from the switch operated lock (LCU) or operate the switch knob (SCU).
6. Check that the rotary switch changes state.
7. Check that all the remaining keys can now be removed in order. For SCU, check that the switch knob is trapped when any other keys are removed. For LCU, check the switch operated key cannot be inserted and rotated when any other keys are removed.

Operating Instructions: Lock Control Unit (LCU) / Switch Control Unit (SCU)

Liability coverage is voided under the following conditions:

1. If these instructions are followed
2. Non-compliance with safety regulations.
3. Installation and electrical connection not performed by authorised personnel.
4. Non-implementation of functional checks.

Environmental Specification

Maximum Relative Humidity: 80%@<=31°C 50%@40°C
 Environment Type: Indoor
 Maximum Altitude: 2000m
 Ambient Temperature: -5°C to +40°C
 Transient Overvoltages Installation: Uimp 2500V
 Pollution Degree: (IEC 664)

Fortress Interlocks Ltd reserves the right to modify the design at any time and without notice.

This guide should be retained for future reference.

Product	Number of Locks	Front of Board		In Enclosure	
		Dimension A	Dimension B	Dimension A	Dimension B
	Single Row				
LCU2	2	212.7	168.3	209.6	184.2
LCU3	3	269.9	225.4	266.9	241.3
LCU4	4	327.0	282.6	323.9	298.5
LCU5	5	384.2	339.7	381.0	355.6
LCU6	6	441.4	396.9	438.2	412.8
LCU7	7	498.5	454.0	495.3	469.9
LCU8	8	555.6	511.2	522.5	527.0
SCU1	1	155.5	111.1	152.4	127.0
SCU2	2	212.7	168.3	209.6	184.2
SCU3	3	269.9	225.4	266.9	241.3
SCU4	4	327.0	282.6	323.9	298.5
SCU5	5	384.2	339.7	381.0	355.6
SCU6	6	441.4	396.9	438.2	412.8
SCU7	7	498.5	454.0	495.3	469.9
SCU8	8	555.6	511.2	522.5	527.0