Operating Instructions: BM & BMS

Description	BM	BMS
The Bolt Module (BM) is used to interlock circuit breakers, valves, and earth switches etc. It is used where hazards need to be indirectly interlocked. • Mechanically secure energy sources • Robust Metal Alloy or Stainless casing. • Over 200,000 unique lock differs managed by Fortress Interlocks in accordance with ISO/TS 19837 • 16mm diameter bolt with 16mm of travel (Bolt extensions available). • Standard operation: Key free, bolt shot (with other sequences available).		

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.

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	BM	BMS
Housing Materials Body	Die-cast zinc body with pearl bronze plate finish	Full stainless steel to S316
Lock Mechanism	Die-cast zinc body with stainless operating mechanism (selected seperately)	
Internals	Full stainless steel	
Max Side Load	10KN	
Bolt	All stainless steel components	

Safety Data		
Standards	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

Standard Functionality

BM1 / BMS1 (Single Module)

With the key free the bolt is usually in the extended position.To retract the bolt the key must be inserted and trapped (reverse sequence is available upon request). The operation of the key extends or withdraws the bolt. The bolt may be used to interface with the mechanical linkages e.g. levers or cams on proprietary switchgear applications. Mounting kits must be either fabricated to suit or some are available from switchgear manufacturers.

BM2 / BMS2-5 (Multiple Modules)

With the keys in the NIL free, the bolt is usually in the extended position. To retract the bolt the NIL nearest the bolt must have the key inserted, turned and trapped. The key(s) in the NOL can then be turned and removed (other sequences are available on request)

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.
- For a BM, the bolt in Normal state is defined by letters ‘A’ and ‘D’ within the part number

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

BMR3-2-1-....-A

Normally In Locks
Number of locks with keys inserted when bolt is in refernance position (closest to the bolt, and will control bolt if quantity >0

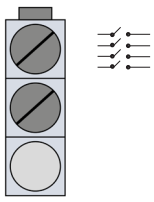
Normally Out Locks
Number of locks with keys free when bolt is i referance position.

Bolt position in Normal State:
- Bolt withdrawn (A)
- Bolt shot (D)

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).

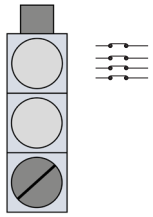
For a typical machine guarding system, the system will be described with all units in their Normal State (i.e. machine running). For more complicated systems like switch gear interlocking, the system might be described with some units in their Normal State, and others in their Opposite State. Similarly, 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.

BMR3-2-1..A (Normal)
Standard Sequence



Bolt: Withdrawn
R Switch: 40/0C

BMR3-2-1..A (Opposite)
Standard Sequence



Bolt: Shot
R Switch:4C/0O

For the BM standard sequence (Z) with Bolt Function ‘A’.

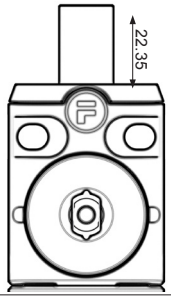
- The Normally in locks are positioned closest to the bolt of the BM unit
- Normally in locks will control the bolt position (given the quantity of NIL > 0).
- If the number of NIL = 0, the topmost NOL will control the bolt.
- The top key from a group must be removed first, followed by any of the lower keys in that group. This sequence is reversed when inserting keys. A group is defined as either NIL or NOL.
- When removing a key, all locks in the other group must have keys inserted before the key is releasable
- A rear mounted “R” switch is operated by the lock closest to the Bolt
- A bottom mounted “L” switch is operated by the top Normally Out Lock (or lock closest to the head if the unit only has Normally In Locks)

Alternative sequences are available and will be indicated in the part number

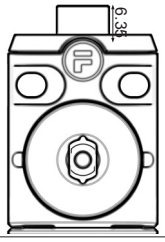
BM sequences can follow ‘A’ or ‘D’; where NIL are positioned nearest the bolt, and NOL are positioned furthest from the bolt.

A – Bolt is withdrawn
D – Bolt is shot
See figure 1 for terminology reference

Figure 1: Bolts

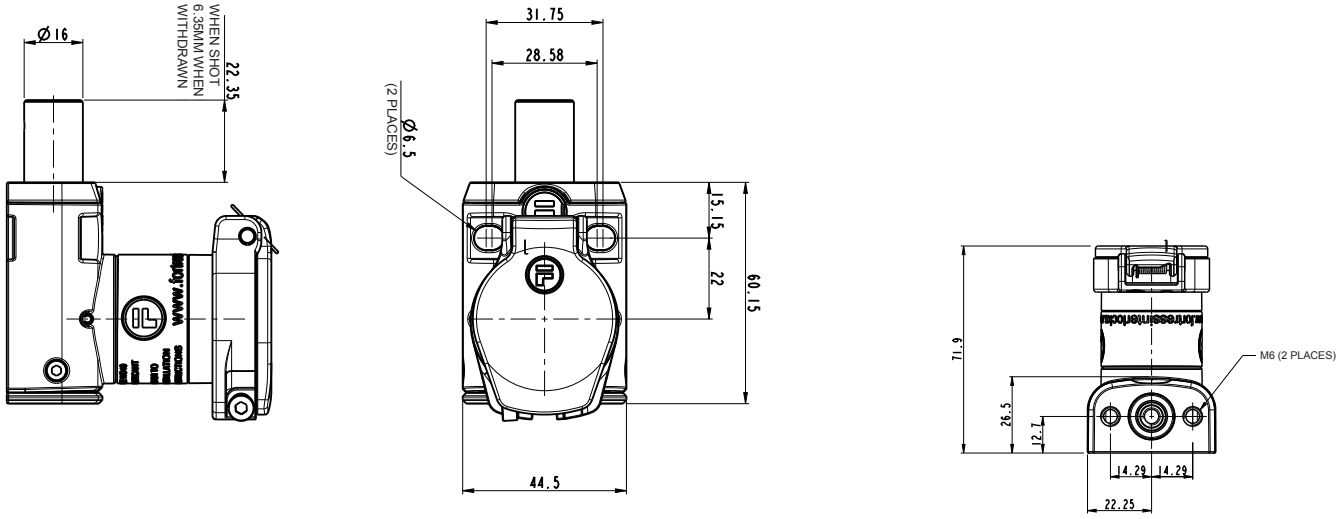


Bolt Shot



Bolt Withdrawn

Figure 2: Dimensional Drawing - BM & BMS



Tools & Fixings Required:

• 2 x Cap head / hexagonal head bolts for each module.

Front of Board mounting:

• M6 x 25mm

Back of Board mounting:

• M6 x 55mm

Suitable driver for above.

If using through holes:

• 1 x Drill Ø6.5

• 2 x M6 Full nuts per module.

If using threaded holes:

• 1 x Drill Ø5

• 1 x off M6 Tap.

End Fixings for mounting:

• M6 x 20mm longer than the panel thickness (Maximum length).

All fixings must be used.

Mounting

Mount this unit well away from sources of vibration or use anti-vibration mountings in order to avoid the effects of vibration, shock and bump.

Mount the unit only in its correctly assembled condition to flat steel plate of minimum thickness 3.0mm or 6.0mm if aluminum. BM(S) can be mounted in any orientation, observing the following rules:

1. Locate the unit so that all the locks are within easy reach.
2. The bolt may be used to interface with mechanical linkages e.g. levers or cams on proprietary switchgear applications. Mounting kits must be either fabricated to suit or some are available from switchgear manufacturers. The bolt travels a distance of 16mm when free. When sequencing is used to prevent movement of the bolt, tolerances in the lock allow up to 6mm of bolt movement (see Figure 1 above). Ensure this tolerance movement does not allow any proprietary application to change state.
3. Mount the unit to the panel using the chosen fixings.
4. Tighten the fixings to a Torque of 8 to 10Nm (5.9 to 7.4 lbf.ft)
5. All fixing screws must be permanently prevented from removal, either by vibration or by personnel using standard tools.
6. If a bolt extension is used, it should be supported at approx 25mm from the end to keep it straight.

Commissioning Mechanical Function Test

Mechanical Function Test - Typical example Sequence Z - BM(S)..-A

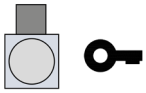
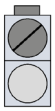
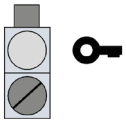
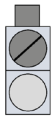
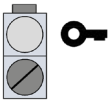
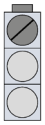
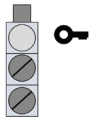
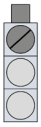
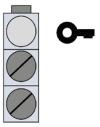
1. Start with keys inserted into all NIL positions and keys removed from NOL positions.
2. Check Bolt is withdrawn.
3. Insert all keys into NOL positions.
4. Check Bolt remains withdrawn (unless number of NIL = 0, in which case bolt will operate as first NOL is entered).
5. Remove the top NIL and check that the bolt moves to the shot position.
6. Check that all of the key(s) in NOL are trapped.
7. Remove remaining NIL key(s) and check NOL cannot be freed.

Mechanical Function Test – Typical example Sequence Z – BM(S)..-D

1. Start with keys inserted into all NIL positions and keys removed from NOL positions.
2. Check Bolt is shot.
3. Insert all keys into NOL positions.
4. Check Bolt remains withdrawn (unless number of NIL = 0, in which case bolt will operate as first NOL is entered).
5. Remove the top NIL and check that the bolt moves to the withdrawn position.
6. Check that all of the key(s) in NOL are trapped
7. Remove remaining NIL key(s) and check NOL cannot be freed.

Product	Dimension A Overall Length	Dimension B Nº of slotted holes	Dimension C Nº of CL locks
BM(S)1	345.90	12	6
BM(S)2	403.05	14	7
BM(S)3	460.20	16	8
BM(S)4	517.35	18	9
BM(S)5	574.50	20	10
BM6	60.15	2	1
BM7	117.30	4	2
BM8	174.45	6	3
BM9	231.60	8	4
BM10	288.75	10	5

A 3mm gap between the front face of a BM/BMS and any galvanised metal work is recommended to reduce the likeliness of a galvanic reaction occuring.

Article	Key Position First Lock	Key Position Second Lock	Key Position Third Lock	Standard Sequence	Bolt Position	Extenadable to	Normal State	Opposite State
BM(S)1-1-0-...-A	Trapped	-	-	Z	Withdrawn	Up to BM(S)5-...-A		
BM(S)1-1-0-...-D	Trapped	-	-	Z	Shot	Up to BM(S)5-...-D		
BM(S)2-1-1-...-A	Trapped	Free	-	Z	Withdrawn	Up to BM(S)5-...-A		
BM(S)2-1-1-...-D	Trapped	Free	-	Z	Shot	Up to BM(S)5-...-D		
BM(S)3-1-2-...-A	Trapped	Free	Free	Z	Withdrawn	Up to BM(S)5-...-A		
BM(S)3-1-2-...-D	Trapped	Free	Free	Z	Shot	Up to BM(S)5-...-D		

Alternative Sequencing

Z Sequence – standard sequencing; lock closest to the top is a NIL, NIL are partially sequential and NOL are partially sequential.

Partially sequential is defined where the top key from a group of locks (i.e. NOL or NIL) must be removed first, followed by any remaining keys within that group.

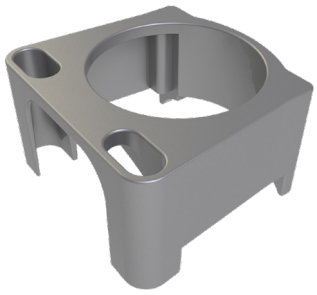
Y Sequence – this is a non-standard sequence where NIL and NOL are both non-sequential; this means the locks within each group (i.e. NOL or NIL) can be operated in any order.

W Sequence – this is a non-standard sequence where NIL are partially sequential, however NOL are sequential; this means the locks in must be operated in order starting with the top position, and finishing with the bottom most position.

V Sequence – this is a non-standard sequence where both NIL and NOL are sequential; this means the locks in each group must be operated in order starting with the top-most position and finishing with the bottom most position.

Installation back of board

For guidance installing this product to the back of a an enclosure, please see the ‘M-BOB’ section in the ‘Operating Instructions: Accessories’.



Extending a Key Exchange

For guidance to extend your key exchange, please see the ‘XMA/XMSA’ section in the ‘Operating Instructions: Accessories’

Service and Inspection

Regular weekly inspection of the following is necessary to ensure trouble-free, lasting operation:
• Secure mounting of components.
• Debris and wear.
If lubrication / cleaning is required use WD40.
DO NOT USE DRY LUBRICANT.
The frequency of lubrication / cleaning will depend on the environment. In extreme cases of dust / particle build up flush out the mechanism with WD40. In the case of un-hardened cement dust pre-lubrication with or even immersion in, concrete release agent / diesel oil should be sufficient.
There are no user serviceable parts in a BM / BMS module. If damage or wear is found, the whold module must be replaced.

Disposal

The BM / BMS does not contain any certified hazardous materials so should be disposed of as industrial waste.

Liability Coverage is voided under the Following Conditions:

• If these instructions are not followed.
• Non-compliance with safety regulations.
• Installation not performed by authorised personnel.
• Non-implementation of functional checks

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

This guide should be retained for future reference.