Installation and removal instructions for Magnum drawout breaker two-way and three-way cable interlock kit

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Instructions apply to:
Magnum® series IZM and Magnum DS/SB
WARNING

(1) ONLY QUALIFIED ELECTRICAL PERSONNEL SHOULD BE PERMITTED TO WORK ON THE EQUIPMENT.

(2) ALWAYS DE-ENERGIZE PRIMARY AND SECONDARY CIRCUITS IF A CIRCUIT BREAKER CANNOT BE REMOVED TO A SAFE WORK LOCATION.

(3) DRAWOUT CIRCUIT BREAKERS SHOULD BE LEVERED (RACKED) OUT TO THE DISCONNECT POSITION.

(4) ALL CIRCUIT BREAKERS SHOULD BE SWITCHED TO THE OFF POSITION AND MECHANISM SPRINGS DISCHARGED.

FAILURE TO FOLLOW THESE WARNINGS FOR ALL PROCEDURES DESCRIBED IN THIS INSTRUCTION LEAFLET COULD RESULT IN DEATH, BODILY INJURY, OR PROPERTY DAMAGE.

WARNING

THE INSTRUCTIONS CONTAINED IN THIS IL AND ON PRODUCT LABELS HAVE TO BE FOLLOWED. OBSERVE THE FIVE SAFETY RULES:
– DISCONNECTING
– ENSURE THAT DEVICES CANNOT BE ACCIDENTALLY RESTARTED
– VERIFY ISOLATION FROM THE SUPPLY
– EARTHING AND SHORT-CIRCUITING
– COVERING OR PROVIDING BARRIERS TO ADJACENT LIVE PARTS

DISCONNECT THE EQUIPMENT FROM THE SUPPLY. USE ONLY AUTHORIZED SPARE PARTS IN THE REPAIR OF THE EQUIPMENT. THE SPECIFIED MAINTENANCE INTERVALS AS WELL AS THE INSTRUCTIONS FOR REPAIR AND EXCHANGE MUST BE STRICTLY ADHERED TO PREVENT INJURY TO PERSONNEL AND DAMAGE TO THE SWITCHBOARD.

General information

This information leaflet provides detailed installation instructions for installing and interconnecting one drawout Magnum® breaker to another type of low voltage circuit breaker (LVCB) in any position (see A, B, C in Table 1 and Table 2) for a two-way, three-way Type 31, or three-way Type 33 interlock configuration as shown in Figure 1. When purchasing kits for a two-way or a three-way interlock configuration setup, additional interlock kits (the types of interlock kits and the other breakers on which they can be installed that are compatible with this kit are listed in Table 3 and Table 4) are required for the other breaker(s) as well as the interconnecting cable kits (one, two, or three are required depending on whether a two-way, three-way Type 31, or three-way Type 33 interlock configuration is desired, respectively).

For two-way and three-way interlock configurations, the mechanical interlock holds one or more of the breakers tripped or open (prevents closure) when some combination of the others are closed. A lever assembly is mounted on each breaker and interfaces with the pole shaft and trip lever. The lever assemblies are interconnected with cables provided in interconnecting cable kits (listed in Table 5) that are compatible with this interlock kit. The cable kits, purchased separately, each contain two cables and can be used for any orientation of the breakers according to the installation recommendations in Step 7.

Refer to Figure 2 and Figure 3 for identification of interlock kit and interconnecting cable kit contents, respectively.

Table 1. Two-way interlock logic

<table>
<thead>
<tr>
<th>Breaker A</th>
<th>Breaker B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allowed states or conditions</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

0 = open
1 = closed

FIGURE 1. Cable routing for two-way and three-way Type 31 and Type 33 interlock configurations
Installation and removal instructions for Magnum drawout breaker two-way and three-way cable interlock kit

### Table 2. Two-way Type 31 and Type 33 interlock logic

<table>
<thead>
<tr>
<th>Breaker Type 33 (six cable)</th>
<th>Breaker Type 31 (four cable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>Allowed states or conditions</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
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<td>0</td>
<td>1</td>
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<td>0</td>
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</tr>
<tr>
<td>0</td>
<td>—</td>
</tr>
</tbody>
</table>

0 = open
1 = closed

### Table 3. Two-way interlock assembly kits for interconnected breakers

<table>
<thead>
<tr>
<th>Interconnected breaker</th>
<th>Interlock assembly kit for fixed breaker</th>
<th>Interlock assembly kit for drawout breaker</th>
</tr>
</thead>
<tbody>
<tr>
<td>NRX Type NF frame</td>
<td>IZMX-MIL2C-F16-2</td>
<td>IZMX-MIL2C-W16-2</td>
</tr>
<tr>
<td>NRX Type RF frame</td>
<td>IZMX-MIL2C-F40-2</td>
<td>IZMX-MIL2C-W40-2</td>
</tr>
<tr>
<td>Magnum DS®, SB or IZM</td>
<td>MCI2W3133FX</td>
<td>MCI2W3133DO</td>
</tr>
</tbody>
</table>

### Table 4. Three-way interlock assembly kits for interconnected breakers

<table>
<thead>
<tr>
<th>Interconnected breaker</th>
<th>Interlock assembly kit for fixed breaker</th>
<th>Interlock assembly kit for drawout breaker</th>
</tr>
</thead>
<tbody>
<tr>
<td>NRX Type NF frame</td>
<td>IZMX-MIL3133C-F16-2</td>
<td>IZMX-MIL3133C-W16-2</td>
</tr>
<tr>
<td>NRX Type RF frame</td>
<td>IZMX-MIL3133C-F40-2</td>
<td>IZMX-MIL3133C-W40-2</td>
</tr>
<tr>
<td>Magnum DS®, SB or IZM</td>
<td>MCI2W3133FX</td>
<td>MCI2W3133DO</td>
</tr>
</tbody>
</table>

### Table 5. Interconnecting cable kits (two cables per kit) (1)

<table>
<thead>
<tr>
<th>Cable kit length (Catalogue number)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5 m (5 ft) IZMX-MIL-CAB1520-2</td>
</tr>
<tr>
<td>1.8 m (6 ft) IZMX-MIL-CAB1830-2</td>
</tr>
<tr>
<td>2.4 m (8 ft) IZMX-MIL-CAB2440-2</td>
</tr>
<tr>
<td>3.0 m (10 ft) IZMX-MIL-CAB3050-2</td>
</tr>
</tbody>
</table>

(1) Cable kits are purchased separately as needed.

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### Figure 2. Interlock kit part identification, includes parts to install on a single drawout Magnum breaker and cassette (does not include cables)

- (A) M6 x 12 mm hex bolt 3x
- (B) M6 x 25 mm flathead screw 1x
- (C) Lock washer 3x
- (D) Drive arm 1x
- (E) Interlock assembly 1x
- (F) Grease tube 3x
- (G) Cable bracket 1x
- (H) M6 x 10 mm thread-forming screws 2x
- (I) Interlock link 1x

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Installation and removal instructions for Magnum drawout breaker two-way and three-way cable interlock kit

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Figure 3. Interconnecting cable kit part identification (includes cables)

**Installation of two-way cable interlock**

**Required tools**
- 10 mm hex socket
- 10 mm open-end wrench
- 11/16-inch open-end wrench
- 3/8-inch open-end wrench (2)
- 4 mm Allen wrench
- Pliers
- Ratchet
- Measuring instrument, in mm

Before proceeding with the following steps, ensure that all breakers are in the OPEN and DISCHARGED position.

**Step 1**
Remove the four hex-head captive bolts (six for 4-pole breaker) holding the cover in place as shown in Figure 4. Pull down on the charging handle (approximately 45 degrees) and remove the front cover.

**Step 2**
Remove drive arm window as shown in Figure 5. Either use a utility knife to cut the window from the cover, or use a punch and a small hammer to carefully punch out the window. Once the window is removed, use a small file to remove any burrs that remain. Make certain that all pieces and/or particles are cleaned up and removed before proceeding.

Figure 4. Details for Step 1

Figure 5. Details for Step 2
Step 3
Install the drive arm (D) to the end of the pole shaft using an M6 x 25 mm flat-head screw (B). Apply Loctite® Blue 242 to ensure that the screw cannot loosen during operation. The drive arm should be oriented as shown in Figure 6. Torque to 7,3–9,6 N·m (65–85 in-lb).

Step 4
Reinstall the front cover using the four hex-head captive bolts (six for 4-pole breaker) removed in Step 1.

Step 5
Fasten the interlock assembly (E) to the drawout cassette’s right-side sheet using three M6 x 12 mm hex bolts (A) and three lock washers (C) as shown in Figure 7. Torque to 4,5–5,6 N·m (40–50 in-lb).

Step 6
Fasten cable bracket (G) to the drawout cassette’s right-side sheet just below the interlock assembly (mounted in Step 5) using two M6 x 10 mm thread-forming screws (H) as shown in Figure 8. Torque to 7,3–9,6 N·m (65–85 in-lb). Ensure the trip paddle is behind (on the same side as the back of the breaker) the trip lever as shown in Figure 9.
Step 7

This step offers cable routing and installation procedures. Make sure that cables move freely in their cable housings before installation. When attaching cables to swivel fittings, ensure that both ends of the cable are connected to push swivel fittings or both ends of the cable are connected to pull swivel fittings (refer to Figure 11). For example, a cable connected to the drive lever pull swivel fitting on Breaker A must connect to the driven lever pull swivel fitting on Breaker B.

**ATTENTION**

**FIGURE 10 SHOWS THE TYPICAL CABLE ROUTING FOR TWO-WAY AND THREE-WAY TYPE 31 AND TYPE 33 INTERLOCK CONFIGURATIONS. NOTICE THAT DEPENDING ON THE POSITION OF THE BREAKER WITHIN THE INTERLOCK CONFIGURATION, THE CABLES WILL BE ATTACHED IN DIFFERENT LOCATIONS. THE CABLE MOUNTING ON BOTH SWIVEL FITTINGS OF THE DRIVE AND DRIVEN LEVERS ARE DESCRIBED BELOW. TABLE 6 SHOWS THE TWO-WAY INTERLOCK LOGIC DEPENDING ON POSITION. TABLE 7 SHOWS THE THREE-WAY TYPE 31 AND TYPE 33 INTERLOCK LOGIC DEPENDING ON POSITION.**

### Table 6. Two-way interlock logic

<table>
<thead>
<tr>
<th>Breaker A</th>
<th>Breaker B</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

0 = open  
1 = closed

### Table 7. Three-way Type 31 and Type 33 interlock logic

<table>
<thead>
<tr>
<th>Breaker A</th>
<th>Breaker B</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 0 0 0 0 0</td>
<td>0 1 0 1 0 1</td>
</tr>
<tr>
<td>0 0 0 1 0 0</td>
<td>0 1 0 0 1 0</td>
</tr>
</tbody>
</table>

0 = open  
1 = closed

**Figure 10. Cable routing for interlock configurations**
Installation and removal instructions for
Magnum drawout breaker two-way and
three-way cable interlock kit

Installation recommendations

- 102 mm (4 in) minimum allowable cable housing bend radius
- Use plastic wire ties / clamps to attach cable housing to structure after installation and adjustment
- Do not compress cable housing
- Recheck to ensure cables move freely

![Diagram of push and pull swivel fitting identification](image)

**Figure 11. Push and pull swivel fitting identification**

**Step 8**

This step describes how to first attach the drive (short rod) end of a cable to its interlock assembly and cable bracket. See Figure 12.

To attach the drive (short) end of the cable to the drive lever pull swivel fitting (refer to Figure 11), follow the directions below.

1. Remove the upper nut, compression spring, and 38,1 mm (1.5 in) tube spacer from end of rod of cable assembly.
2. Slide rubber boot toward tip of rod.
3. Unthread outer bulkhead nut, and slide nut and lock washer toward tip.
4. Insert threaded end of rod into swivel fitting.
5. Slide smaller diameter portion of bulkhead fitting into cable bracket slot.
6. Raise the cable assembly until threaded portion of bulkhead fitting enters slotted hole in cable bracket (threads show above bracket).
7. Bring bulkhead washer and nut down to threads and hand tighten.
8. Adjust two bulkhead nuts to approximately center the bulkhead fitting on the cable mounting bracket.
9. Hand tighten the bulkhead nuts at this time.
10. Slide rubber boot back into place over end of bulkhead fitting.
11. Replace 38,1 mm (1.5 in) tube spacer, compression spring, and upper nut on end of rod.
12. Lower nuts should be shouldered against end of thread and upper nut tightened against tube spacer.
13. Hold lower nuts and torque upper nut to 3,3–4,5 N·m (30–40 in-lb).

To attach the drive (short rod) end of a cable to the drive lever push swivel fitting of the drive lever (refer to Figure 11), follow the directions below (see Figure 12).

1. Remove upper nut from end of rod of cable assembly.
2. Slide rubber boot toward tip of rod.
3. Unthread outer bulkhead nut and slide nut and lock washer toward tip.
4. Insert threaded end of rod with 38,1 mm (1.5 in) tube spacer into swivel fitting, ensuring that the compression spring remains between the lower nuts and the swivel.
5. Slide smaller diameter portion of bulkhead fitting into cable bracket slot.
6. Raise the cable assembly until threaded portion of bulkhead fitting enters slotted hole in cable bracket (threads show above bracket).
7. Bring bulkhead washer and nut down to threads and hand tighten.
8. Adjust two bulkhead nuts to approximately center the bulkhead fitting on the cable mounting bracket.
9. Hand tighten the bulkhead nuts at this time.
10. Slide rubber boot back into place over end of bulkhead fitting.
11. Lower nuts should be shouldered against end of thread and upper nut tightened against tube spacer.
12. Hold lower nuts and torque upper nut to 3,3–4,5 N·m (30–40 in-lb).
Figure 12. Details for Step 8: Cable assembly drive (short rod) end mounting component identification, mounting cable assembly in cable bracket, and cable rod attachment to drive arm
Step 9
This step describes how to attach the driven (long rod) end of a cable attached to an interlock assembly on another breaker to the cable bracket and interlock assembly on this Magnum breaker. Refer to Figure 10 and Figure 11 for cable routing and correct swivel fittings to which the cables are connected.

The driven (long rod) end of the cable is attached to the corresponding push or pull swivel fitting on the driven lever on this cable interlock assembly similarly to Step 8 except the driven end does not utilize a compression spring between the swivel and nut. Remove and discard the 22.2 mm (0.875 in) cable tube spacer (K) on the rod end of the cable assembly (I) and replace it with the 38.1 mm (1.5 in) cable tube spacer (J). Install the cable as shown in Figure 13 and Figure 14.

Figure 13. Details for Step 9

Step 10
This step describes how to adjust the cables to ensure proper functionality of the cable interlock setup. Cable adjustments are made with the large bulkhead nuts ONLY and with all breakers OPEN. Nuts on the rod ends should not be moved.

Begin by adjusting or verifying that all bulkhead fittings are approximately centered on the cable mounting brackets (center of threaded section of bulkhead), allowing for room for adjustment in either direction. Hand tighten the nuts at this time.

Perform initial adjustments on the driven (long rod) end of cable. There should be a small (0–5 mm) clearance between the upper nut and the face of the driven lever pull swivel on which it pulls and between the lower nuts and the face of the driven lever push swivel on which it pushes as shown in Figure 14.

If there is too much clearance, adjust both bulkhead nuts to retract the cable housing (move threaded portion down).

If there is no clearance, advance the cable housing in the same manner (move threaded portion up).

If additional adjustment length is needed, the bulkhead nuts on the other end of cable can be used.

When the proper clearance is attained on the driven end, torque the cable bulkhead nuts on both ends to 11–13 N·m (100–120 in-lb) without moving the bulkhead fittings.

After the driven end has been adjusted and the bulkhead nuts have been tightened, perform adjustments on the drive (short rod) end of the cable. Adjust the bulkhead nuts up (move threaded portion down) such that the gap between the drive lever and the interlock assembly base shown on Figure 11 is less than 4 mm.

When the gap is less than 4 mm, torque the cable bulkhead nuts on both ends to 11–13 N·m (100–120 in-lb).

Figure 14. Details for Steps 9 and 10
Functional test of interlock assembly

Begin test sequence with all breakers OPEN.

Two-way interlock configuration functional test

Check 1: CHARGE and CLOSE Breaker A
- Verify that Breaker A closed using the OPEN/CLOSED indication
- Inspect the driven lever on Breaker B. Check that it rotated from its initial position
- CHARGE and attempt to CLOSE Breaker B. It should not respond to CLOSE attempt (no noise, spring discharge, or contact motion)
- If Breaker B responds to the CLOSE attempt, then additional adjustments may be required at the cable mounting brackets (refer to Steps 8, 9, and 10)

Check 2: Open Breaker A
- The interlock should release
- CLOSE Breaker B (if already CHARGED). Verify that it closes using the OPEN/CLOSED indication
- Breaker A should remain in the OPEN position
- OPEN Breaker B

Repeat Checks 1 and 2 above on Breaker B, using Breaker B as Breaker A and Breaker A as Breaker B
- Verify proper operation on both breakers

The mechanical interlock is now properly installed and adjusted for the two-way interlock configuration. Use a light amount of supplied lubricant (F) if any interlock parts are sticky or do not fully reset. This is only recommended if needed.

Type 31—Four-cable interlock assembly test

Refer to Table 2 for logic details.
- CHARGE and CLOSE Breaker A
- CHARGE and attempt to CLOSE Breaker B. It should not respond to CLOSE attempt (no noise, spring discharge, or contact motion)
- CHARGE and CLOSE Breaker C. Verify that Breaker C closes using the OPEN/CLOSED indication and that Breaker A remains CLOSED
- CHARGE and attempt to CLOSE Breaker B again. It should still not respond to CLOSE attempt (no noise, spring discharge, or contact motion)
- OPEN Breaker A. Verify that Breaker C is still CLOSED. CHARGE and attempt to CLOSE Breaker B. It should still not respond to CLOSE attempt (no noise, spring discharge, or contact motion)
- OPEN Breaker C. All breakers should now be OPEN
- CHARGE and CLOSE Breaker B. CHARGE and attempt to CLOSE Breakers A and C. Verify that they do not respond to CLOSE attempt (no noise, spring discharge, or contact motion)

The mechanical interlock is now properly installed and adjusted for the three-way Type 31 interlock configuration. Use a light amount of supplied lubricant (F) if any interlock parts are sticky or do not fully reset. This is only recommended if needed.

Type 33—Six-cable interlock assembly test

Refer to Table 2 for logic details.
- CHARGE and CLOSE Breaker A
- CHARGE and attempt to CLOSE Breakers B and C. Verify that neither breaker responds to CLOSE attempt (no noise, spring discharge, or contact motion)
- OPEN Breaker A. The interlock should release
- Repeat above test on Breakers B using B for A, C for B, and A for C and Breaker C using C for A, A for B, and B for C

The mechanical interlock is now properly installed and adjusted for the three-way Type 33 interlock configuration. Use a light amount of supplied lubricant (F) if any interlock parts are sticky or do not fully reset. This is only recommended if needed.

Figure 15. Functional test gap checks
Installation and removal instructions for Magnum drawout breaker two-way and three-way cable interlock kit
Installation and removal instructions for
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