Installation and Calibration Manual

3D-MC²
**Terms and Conditions**

Thank you for buying this Topcon product. This manual has been prepared to assist you with the care and operation of the product and its use is subject to these Terms and Conditions.

**Usage and Safety**

This product is designed for use by professionals. Always use safety precautions when operating this or any Topcon product.

**Copyrights**

All information contained in this Manual is the intellectual property of, and copyrighted material of TPS. All rights are reserved. You may not use, access, copy, store, display, create derivative works of, sell, modify, publish, distribute, or allow any third party access to, any graphics, content, information or data in this Manual without TPS' express written consent and may only use such information for the care and operation of your Product. The information and data in this Manual are a valuable asset of TPS and are developed by the expenditure of considerable work, time and money, and are the result of original selection, coordination and arrangement by TPS.

**Trademarks**

3D-MC², MC², GX-60, MC-R3, Topcon, and Topcon Positioning Systems are trademarks or registered trademarks of TPS. Other product and company names mentioned herein may be trademarks of their respective owners.

**Disclaimer of Warranty**

EXCEPT FOR SUCH WARRANTIES AND LICENSES PROVIDED WITH THE PRODUCT, THIS MANUAL AND THE PRODUCT ARE PROVIDED “AS-IS”. TOPCON AND ITS DISTRIBUTORS SHALL NOT BE LIABLE FOR TECHNICAL OR EDITORIAL ERRORS OR OMISSIONS CONTAINED HEREIN; NOR FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES RESULTING FROM THE FURNISHING, PERFORMANCE OR USE OF THIS MATERIAL OR THE PRODUCT.

**License Agreement**

Use of any computer programs or software supplied by Topcon or downloaded from the Topcon website in connection with the Product implies acceptance of the Terms and Conditions.
Table of Contents

Introduction .......................................................... 1-1

MC² Sensor Installation ............................................ 2-1
  Preferred Method .................................................. 2-1
  Alternate Method .................................................. 2-3

MC² Sensor Cable Connections .............................. 3-1

3D-MC² Setup and Calibration ............................... 4-1
  Entering 3D-MC² Parameters .................................... 4-1
  MC² Sensor Calibration ......................................... 4-10
  Calibrating Blade Slope ....................................... 4-10
  Calibrating Mainfall Slope ................................... 4-12
  Setting Valve Offsets ......................................... 4-14
  Setting Elevation Gain ....................................... 4-15
Introduction

3D-MC² is an addition to the GPS+ system that allows a dozer to run and operate at high speed while maintaining smooth grade, using an MC² sensor in place of the standard slope sensor.

Figure 1-1. 3D-MC² Components on a Dozer
Notes:
MC² Sensor Installation

Preferred Method

Use Mounting Bracket Kit P/N 9625-1004 to install the MC² Sensor onto the dozer’s blade.

1. Weld the bracket onto the blade near the center of rotation. See Figure 2-1.

**NOTICE**

Install the MC² sensor near the center of the blade and not toward the right or left sides.

Figure 2-1. MC² Location on Blade
2. Use all three socket head screws (2060-1058) and washers (2060-0180) to install the MC² Sensor onto the bracket. See Figure 2-2.

Figure 2-2. MC² Bracket Installation - Preferred
**Alternate Method**

Mounting the MC² Sensor to the blade using the existing slope sensor bracket may be possible on machines with a previously installed system.

Use Adapter Plate P/N 9625-1001 (supplied) with the existing slope sensor bracket to install the MC² Sensor onto the dozer’s blade. The adapter plate is designed to provide additional clearance for the MC² Sensor and existing weld.

---

**NOTICE**

Do not attempt to install the MC² Sensor using the adapter plate unless all three mounting bolts can be used.

---

1. Using the adapter plate (9625-1001) as a guide, drill a third mounting hole in the existing slope sensor bracket. See Figure 2-3 on page 2-4.

2. Install the adapter plate onto the slope sensor bracket using the three supplied flat head screws (2060-0181).

3. Install the nut onto the rear screw from the underside of the slope sensor bracket.

4. Use all three socket head screws (2060-1058) and washers (2060-0180) to install the MC² Sensor onto the bracket.
Figure 2-3. MC² Bracket Installation - Alternate
MC² Sensor Cable Connections

Figure 3-1. Typical System Cables
Figure 3-2. Converting 9168 System Cables

- Figure 3-2 shows the cable connections for converting an existing 9168 system to a new configuration.
- Conversion cables are used to connect various components such as MC-R3 Controller, Main GPS Antenna, AUX GPS Antenna, and LPS Antenna.
- The diagram illustrates the attachment of upper connectors and ground connections.
- Bullet connectors are used for the Auto/Manual switch and valve cables.

- Existing 9168 Cables:
  - Chassis Ground
  - Radio Antenna
  - LPS Antenna

- Conversion Cables:
  - 5-Pin bayonet connector
  - 11-Pin rotated bayonet connector
  - 40-Pin Connector "A"
  - 40-Pin Connector "B"

- MC2 Sensor Cable Connections: 3D-MC² Installation and Calibration Manual
3D-MC² Setup and Calibration

Entering 3D-MC² Parameters

For proper 3D-MC² control, make the additional measurements described in this chapter from the MC² sensor using a plum bob and tape measure. Measurement accuracy must be within 1/2” for ideal performance.

All MC² (IMU) measurements are referenced to the point of the arrow on the top label of the MC². See Figure 4-1.

Figure 4-1. MC² Sensor Label Arrow
1. In 3DMC, press Topcon Logo ▶ Control ▶ Machine setup.

![Control Menu](image)

**Figure 4-2. Control Menu**


![Machine files Screen](image)

**Figure 4-3. Machine files Screen**
3. Enter the machine information, and press Next.

![Configuration name/type Screen](Figure 4-4. Configuration name/type Screen)

4. Select 3DMC² as the sensor type, and press Next.

![Slope Sensors Screen](Figure 4-5. Slope Sensors Screen)
5. To enter 3DMC² Parameters (Figure 4-6 on page 4-5), take the following measurements and enter the data into the 3DMC² Parameters screen:

1. **IMU Behind**: Horizontal distance from the front most part of the cutting edge to the MC² arrow.
2. **IMU Inside**: Horizontal distance from the right corner of the cutting edge to the MC² arrow.
3. **IMU Above**: Vertical distance from the cutting edge to the MC² arrow.
4. **COR Inside**: Horizontal distance from the center of blade rotation to the right side of the blade.
   
   COR = Center of Rotation
   
   – For 6-way blades, the COR is centered horizontally 1/2 blade width. The COR is not usually centered vertically on the blade. Watch the back of the blade linkages while rotating the blade to identify the center.
   
   – For U-frame blades, the COR can be an imaginary location off of the blade and difficult to measure.
5. **COR Above**: Vertical distance from the center of blade rotation to the MC² arrow.
6. **Track length**: Horizontal distance from the center of the front sprocket to the center of the rear sprocket.
7. **Blade Offset**: With the blade square, the horizontal distance from the center of the front track hub to the MC² arrow.
8. Select **Topcon MC-A1** as the antenna type and enter the antenna measurement information.

1. **Above**: Vertical slant height measurement from the cutting edge to the antenna (Figure 4-7 on page 4-6).
2. **Inside**: Horizontal distance from the right edge of the blade to the antenna.
3. **Behind**: Distance of the antenna behind the cutting edge.
4. **Width**: Width of the blade.
Figure 4-7. Antenna Measurements
Antenna: Topcon MC-A1

Above (1)
10.26'

Inside (2)
5.25'

Behind (3)
0.00'

Width (4)
6.56'

Figure 4-8. Antenna Type and Measurements
5. Select the GPS precisions for measuring static points (Figure 4-9). Press **Next**.

![GPS Precisions Screen](image)

6. Select **UDP/IP** as the **Connection** type from the drop down menu in the GPS Comms Configuration screen as shown in Figure 4-10 on page 4-8. Your MC-R3 controller must have the G3 3D-MC² symbol, as shown on the GPS Comms Configuration Screen, to be compatible with the MC² Sensor. Press **Next**.
7. Set radio information and press **Next** (Figure 4-11). Refer to the serial number/radio label on the MC-R3 controller to determine the correct radio type. The radio type selection must match the radio contained in the MC-R3.
8. If using light bars, select and enter LD-40 information and press **Next** (Figure 4-12). If no light bars are in use, press **Next** to bypass LD-40 setup.

![Figure 4-12. LD-40 Setup Screen](image)

9. Press **Finish** to save the machine configuration file (Figure 4-13).

![Figure 4-13. Configuration Complete Screen](image)
MC² Sensor Calibration

Calibrating Blade Slope

1. Raise the blade a few inches, and tilt the blade to one direction making it obvious which way the blade is tilted
2. Place a level on the cutting edge, and measure the blade slope value.

---

Figure 4-14. Measure Blade Slope

---

Slope left = Positive blade slope value.
3. Press *Blade slope Set* on the *Adjust Slope* screen, and enter the measured slope value. Press *Set* again to save the value.

4. Rotate the blade in the opposite direction and verify that the smart level value matches.
Calibrating Mainfall Slope

1. Place the machine on a uniform surface (a concrete pad is best) so that both the tracks and the blade are on the same surface.

2. Make sure the blade is flat on the ground and square to the machine.

3. Measure the mainfall slope of the pad with the level (Figure 4-17).

4. Plum the mast. Match the angle of the mast to the angle of the mainfall slope as shown in the example in Figure 4-18 on page 4-13.

**NOTICE**

Uphill = Positive mainfall value.
5. Press **Mainfall slope Set** on the **Adjust Slope** screen, and enter the measured slope value. Press **Set** again to save the value.

![Adjust Slope](image)

6. Place the machine on a different main slope to verify that the value is correct.
**Setting Valve Offsets**

In general, set the offsets so that the valve just begins to move. Do not set artificially large values as is sometimes typical in standard systems.

![Valve Offsets](image)

Figure 4-20. Set Valve Offsets
Setting Elevation Gain

Gain settings vary by machine type, though in general, the raise gain value is higher than the lower gain value.

![Adjust elevation](image)

Figure 4-21. Set Elevation Gains

**NOTICE**

Slope gain is generally less than the raise and lower elevation gains.

![Adjust Slope](image)

Figure 4-22. Set Slope Gain