Leica iCON grade iGGx
Installation Manual

Version 2.0

- when it has to be **right**

Leica Geosystems

HITCHDOC HE1597_R0; INSTALL MANUAL, LEICA iGGx

Introduction

Purchase

Congratulations on your purchase of a iCON grade control panel. The iCON grade control panel is an ideal tool for increasing productivity in all aspects of the construction earthmoving industry.

To use the product in a permitted manner, please refer to the detailed safety directions in the User Manual. The User Manual forms part of this manual and must be read in conjunction with this manual.

Legal, Safety & Environmental Issues / Symbols

Legal

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Liability

This document is strictly for the use of qualified service engineers with the requisite technical skills. Only persons who have successfully completed the appropriate service training provided by Leica Geosystems AG and are in the employ of a company in the Leica Geosystems Group or of an agency, distributor, or service workshop duly authorized by Leica Geosystems AG have the status of qualified service engineer. Leica Geosystems AG accepts no liability whatever for direct or indirect damage that may occur due to the unauthorized or improper use or interpretation of this document by any person who is not a qualified service engineer in accordance with the above definition.

Safety / Environment

Service technicians have the following obligations:

- To understand and follow the safety information and instructions on the product and in the user manual.
- To be familiar with local regulations relating to industrial and non-industrial accident prevention in the knowledge that these regulations are up to date.
- To inform Leica Geosystems AG immediately in writing if the equipment becomes unsafe.
- Dispose of the equipment and its components in accordance with the regulations in force in your country.

Service Safety Hints

User manual

The user manual also contains important safety notices. Please read the user manual thoroughly before switching on the instrument for the first time.

The iCON grade User Manual contains important safety directions. Refer to the chapter "Safety Directions" in the User Manual for further information.

To ensure safety when using the system, please also observe the directions and instructions contained in the User Manual and Safety Handbook issued by the Machine manufacturer.

Introduction

This handbook is only for use by Leica Geosystems-trained service personnel. It is no substitute for attendance at an appropriate training course. The reader is assumed to be familiar with the user manual supplied with each instrument. Before starting to study the present handbook, the service technician must be able to use the instrument in accordance with the user manual.

Opening or Dismantling of Instruments

Opening or dismantling of an Instrument may only be attempted in clean, dust-free rooms and only by suitably trained technicians. With this measure, malfunctioning of the instrument caused by dust or other contamination may be prevented. In addition, ESD-precaution must strictly be observed when-ever instruments with electronic components are opened or dismantled.

Symbols

Listing of symbols and their meaning

The symbols used in this manual have the following meanings:

Type	Description
Danger	Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
Warning	Indicates a potentially hazardous situation or an unintended use which, if not avoided, could result in death or serious injury.
Caution	Indicates a potentially hazardous situation or an unintended use which, if not avoided, may result in minor or moderate injury and/or appreciable material, financial and environmental damage.
	Important paragraphs which must be adhered to in practice as they enable the product to be used in a technically correct and efficient manner.

General Installation Information

Warning

This product may be installed on building and construction machinery only by an appropriately trained and qualified specialist.

Caution

Installing near mechanically moving machine components may damage the product.

Precautions:

Deflect the mechanically moving machine components as far as possible and define a safe installation zone.

Warning

Unauthorized modification of machines by mounting the product may alter the function and safety of the machine.

Precautions:

Follow the instructions of the machine manufacturer. If no appropriate instruction is available, ask machine manufacturer for instructions before mounting the product.

Prior to installation of an hydraulic system for automatic control of a machine, the installer has to collect data about the type, model, serial number, whether it is open center, closed center, load sense or pilot controlled hydraulic system. Refer also to the machines manufacturer's user manual or marketing material to get the information and also refer the Leica Geosystems Machine database to collect information on known machines.

For hydraulic hoses it is important to find a suitable place for the hydraulic valve on the machine and measure the hose length between the connections on the cylinders and hydraulic valve providing sufficient length. Identify the type of hydraulic connections on the machine such as JIC or ORFS-Fittings.

Only personal that have been trained and authorised by Leica Geosystems are allowed to perform hydraulic, mechanical or electrical installations on machines.

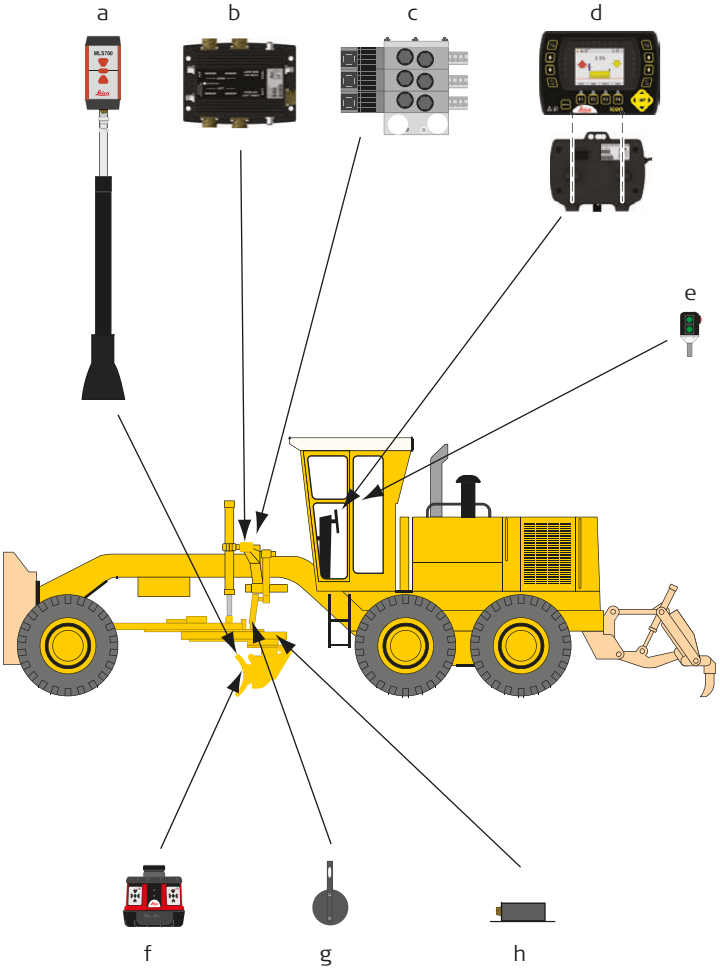
Table of Contents

In this manual

1 System Overview

Overview Grader

A Leica iCON grade system for grader can be equipped in various ways. Below you will find an example of one of the ways:



a) Power mast/manual mast; Laser receiver on mast
b) Junction box
c) Hydraulic valve
d) iCON grade Control panel iCP32, Cradle MMB1300
e) Multi switch
f) Sonic tracker
g) Rotation sensor
h) Cross slope sensor

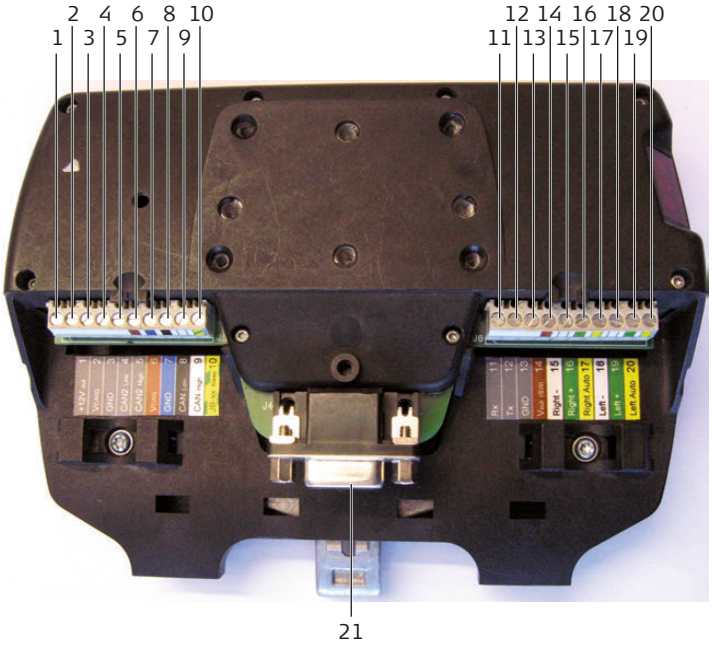
2 System Installation

2.1 iCON grade Control Panel

Programming the panel

Programming the control panel is done through a standard serial port. The serial port is located under the wire cover on the MMB1300.

Cradle with wire cover removed



1	+12V out	11	Rx
2	VCAN2	12	TX
3	GND	13	GND
4	CAN2 LOW	14	Vout (SW)
5	CAN2 HIGH	15	Right -
6	VCAN	16	Right +
7	GND	17	Right Auto
8	CAN LOW	18	Left -
9	CAN HIGH	19	Left +
10	JB-xx Sleep	20	Left Auto
		21	Serial port RS232

The programming is performed using a graphical upload program, called “hmcprogrammer.exe” together with three .dll files. They can be downloaded, packed together with a short user guide, in a .zip file from the home page together with the firmware update files.
The .zip file should be unpacked in a known folder on the PC, for example use c:\update\hmcprog\.
See chapter "How to Upgrade the Firmware" for further instructions.

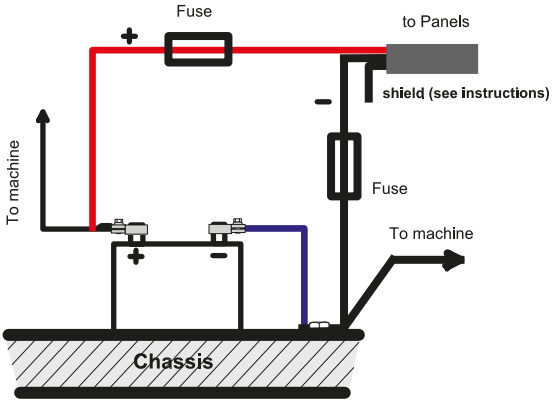
2.2 System Components

Power Cable

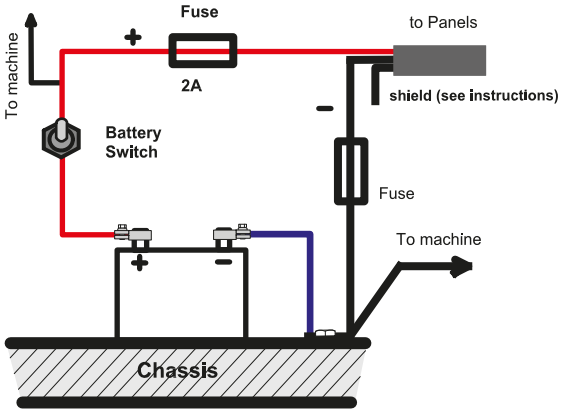
1. The power cable should be run through the machine and connected either to the machine side of the battery isolation master switch or directly to the battery.
2. Connect the **positive (red) leads** of the power cable to the **positive terminal**.
3. Connect the **negative (black) leads** of the power cable to a suitable **grounding lug** on the chassis of the machine.

☞ Cradle voltage range = 10 - 28 V

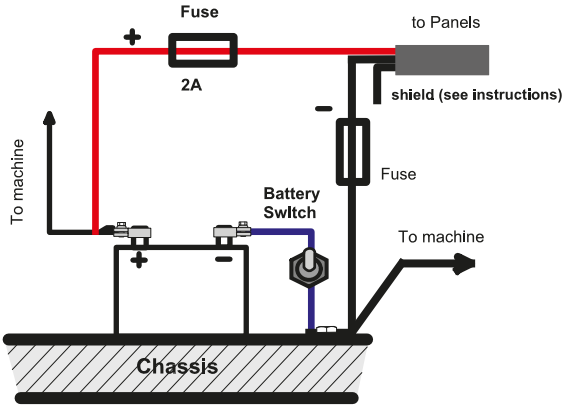
No battery disconnected:



Positive battery disconnected:



Negative battery disconnected:



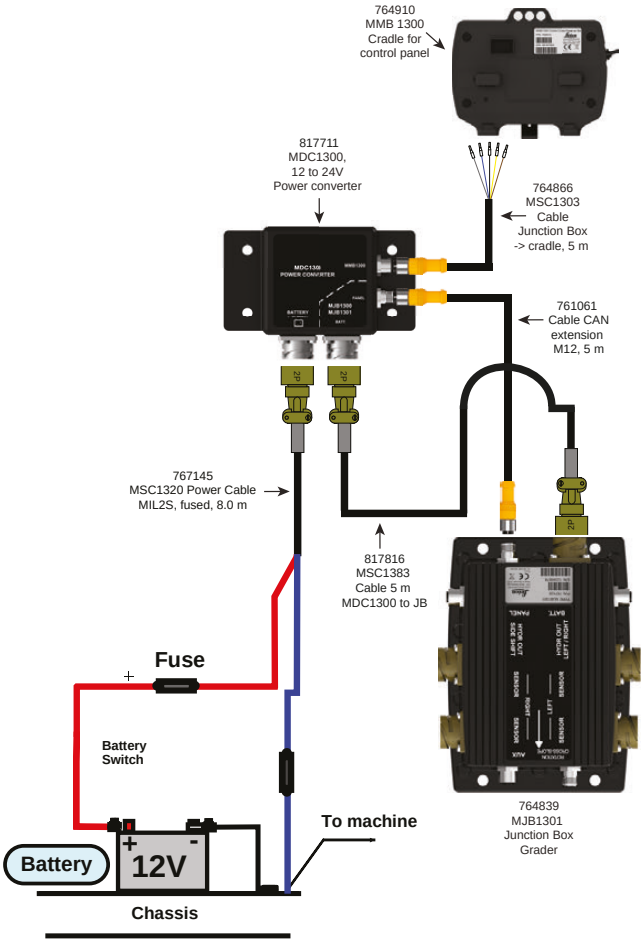
2.2.1 Installation on 12 Volt Machines

Description

A converter is required for full support of 12 Volt machines. The MDC1300 Power Converter will scale the power up to 24 V to support the MMB1300 Cradle. This converter is installed between the Junction Box (MJB1300 or MJB1301) and the Cradle (MMB1300) as described in the images below.

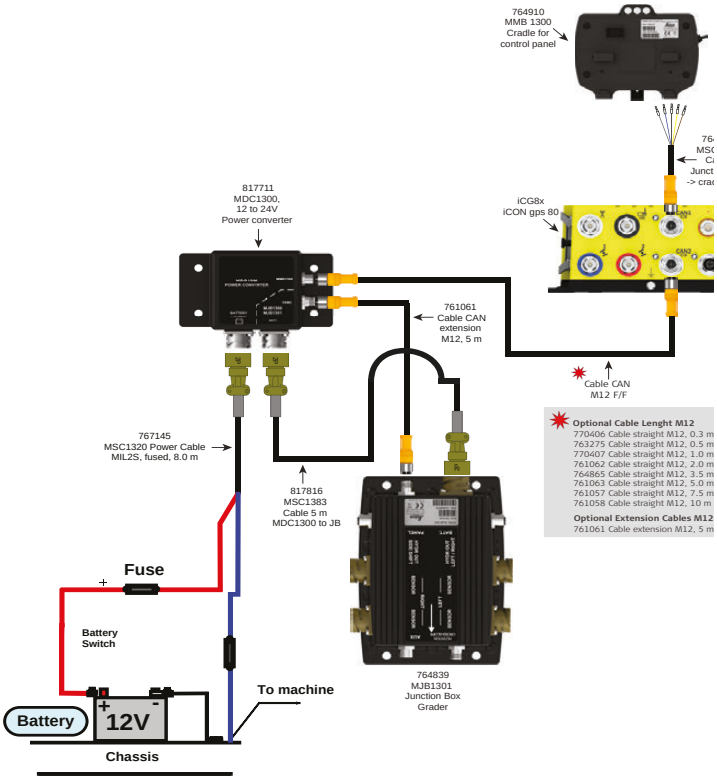
MDC1300 on a 2D system

Below you will find a diagram describing how the MDC1300 is installed on a 2D system:



MDC1300 on a 3D system

Below you will find a diagram describing how the MDC1300 is installed on a 3D system:



2.3 Slope Sensor mounting

2.3.1 Slope sensor mounting

Mounting the sensor

It's important to take care when installing sensors that measure a slope. If they are not aligned with the axel that they are supposed to measure they will have an error in the measurement, and that will result in inaccuracy in the final grade.
This chapter will discuss the things that need to be focus on when mounting sensors that measure a slope.

The sensors in question are:

- Cross slope sensor (single & dual)
- Mast slope sensor
- Main fall sensor (junction box)
- Rotation sensor

Calibration offset

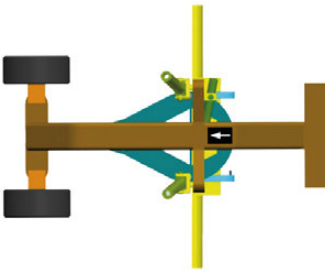
It is always a recommended to have the calibration offset as close to 0.0% as possible.
When mounting a cross slope sensor on a blade it should be mounted level when the blade is level.

If the sensor is mounted with a large calibration offset it will cause a misreading of the slope when the machine is driving up or down hill, or the mast is tilted. This misreading will end up as a height error in the automatic grading.

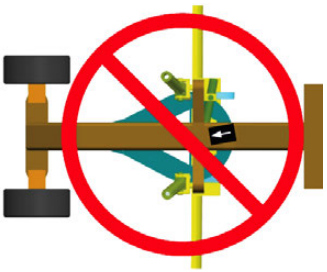
Sensor alignment

Because the sensor only can measure the slope in one direction it's necessary to make sure the sensor is mounted parallel to the direction that you want to measure the slope.

The mainfall sensor is designed to measure if a grader is driving up or down hill, but if the junction box is mounted so that it's pointing to the side it will not measure the right mainfall. Therefore it's important to mount the junction box so that it's parallel with the gooseneck.

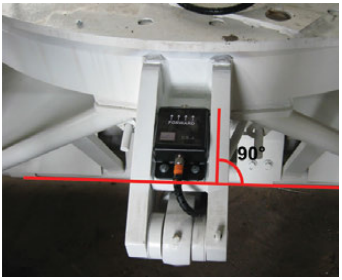


Junction box mounted parallel with the gooseneck.



Junction box not mounted parallel with the gooseneck.

When installing the cross slope or mast slope sensor it's a good idea to first take a good look at the machine and blade to see if there is a feature/part of the blade assembly that is either parallel or perpendicular to the blade edge. If this is the case then that feature/part can be used as a reference when mounting the sensor. An example of this can be seen in figure below where the two "walls" that the sensor is mounted in between looks to be designed so that they are perpendicular to the blade edge.



Sensor mounted perpendicular to the blade edge.


Mounting plate centred on the swivel.

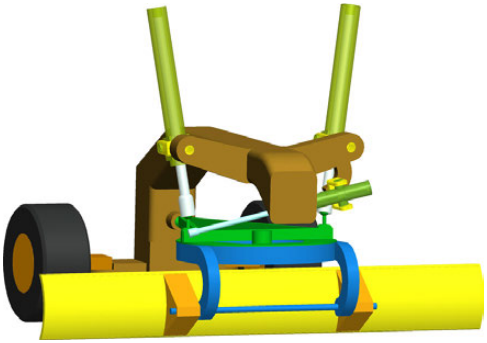
When mounting the rotation sensor, it's important to get the mounting plate centred on the swivel. If the mounting plate is placed off centre it will rotate in an oval shaped curve instead of a perfect circle shaped curve. This will course an error in the measured rotation.

Mounting the mast slope sensor

To install the junction box, complete the following steps:

1. Place the machine on a flat and level surface.
2. Place the blade on the ground and tilt the blade so that the mast is vertical (often the blade is tilted all the way back).
3. The mast tilt sensor needs to be mounted on the part that tilts with the blade, but not the part that is side shifted. This would be the

orange part in figure below. The sensor should be mounted with the connector facing forwards and the label facing to the left.



Sensor mounted on the part that tilts with the blade.

4. When the mast is vertical, the mast tilt sensor should be mounted so that it's horizontal. Ideally the sensor should be mounted with an offset of less than 1.5%. The figure below shows the mounting backed welded in place.

5. Run the cable from the mast tilt sensor to a CAN Junction Box, and place the CAN Junction Box, somewhere near the rotation sensor.
6. Connect the cable from the cross slope sensor to the CAN Junction Box, and connect a cable from the CAN Junction Box, to the rotation sensor.

2.4 Junction Box

2.4.1 MJB1301 Junction Box

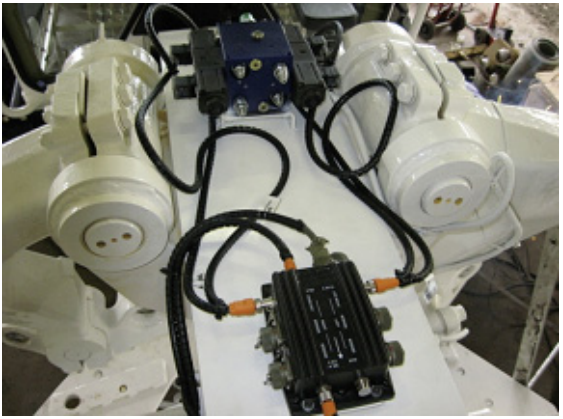
Junction box for Grader

The junction box for grader is used for connecting the slope and elevation sensors on the machine. It also contains the electronics for driving the hydraulic valves. The mainfall sensor, which is integrated in the junction box, is intended to measure the grader's slope in its driving direction. The junction box for Dozer does not have any leveling sensor.

The junction box consists of two parts:

- Junction box
- Mounting bracket for junction box

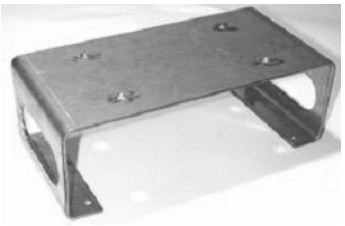
The junction box for Grader is normally mounted on top or below the gooseneck.



The picture shows the junction box mounted on top of the gooseneck just in front of the swivel table.

For mounting the junction box underneath the gooseneck there is a special upside-down mounting bracket.

Standard mounting bracket



Upside-down mounting bracket

Installation of the junction box for Grader

To install the junction box, complete the following steps:

1. Place the grader on a level surface.
2. Find a suitable place on top of the gooseneck to mount the bracket.

☞ Please make sure that the swivel table cannot come into contact with the junction box, even in the case of extreme movements.

3. Before the mounting bracket is fastened to the gooseneck, check that the placement of the junction box and its bracket are as level as possible (± 5.0%).
4. Weld the mounting bracket on to the gooseneck.

⚠ **Warning** Before starting to weld, check that the machines battery is disconnected and that any electronic systems are removed. Contact your dealer, if necessary.

5. Install the junction box with the help of the screws enclosed with the mounting kit and make sure to observe the mounting direction. Appropriate stickers mark the moving direction **<-**, **LEFT SENSOR** and **RIGHT SENSOR**.
6. Connect all cables to the junction box. See picture on page 18 for an overview where to connect the different cables.

Junction box Grader connectors

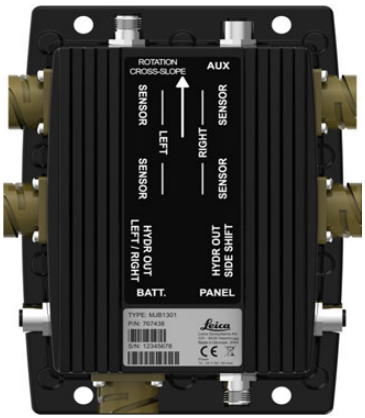
Con 1	Left and right hydraulic output	Con 6	Sensor Connector Right You can connect a Laser Sensor, Sonic Tracker or Electric Mast, free of choice
Con 2	Sensor Connector Left You can connect a Laser Sensor, Sonic Tracker or Electric Mast, free of choice	Con 7	Sensor Connector Right You can connect a Laser Sensor, Sonic Tracker or Electric Mast, free of choice
Con 3	Sensor Connector Left You can connect a Laser Sensor, Sonic Tracker or Electric Mast, free of choice	Con 8	Sideshift hydraulic output
Con 4	Connection of Rotation and Cross Slope sensor	Con 9	Connection of Control Box
Con 5	AUX Output - Extra Valve output	Con 10	Power connection

7. The cable to the rotation/cross slope sensor can be installed behind the gooseneck side cover or on some graders even inside the gooseneck.

2.4.2 Updating the Junction Box Firmware

Programming MJB1301

MJB1301



Programming the MJB1301 is done through a standard serial port and the **upload kit**. The upload kit uses a 9V battery to work.

Upload kit

Battery location

The programming is performed using a graphical upload program, called “hmcprogrammer.exe” together with three .dll files. They can be downloaded, packed together with a short user guide, in a .zip file from the home page together with the firmware update files.
The .zip file should be unpacked in a known folder on the PC, for example use c:\update\hmcprog\.
See chapter "6 How to Upgrade the Firmware" for further instructions.

2.5 Cross Slope Sensor

Cross slope sensor

The blade slope sensor consists of the following components:

- Single Cross Slope Sensor
- Mounting bracket with screws

Suggested placement of the cross slope sensor

Install the sensor

To install the sensor, complete the following steps:

1. Level the blade using a sprit level.
2. Place the bracket into the pocket at the rear of the circle and tack weld in place. Align the plate parallel to the blade.

Warning

Before starting to weld, check that the machines battery is disconnected and that any electronic systems are removed. (Contact your dealer, if necessary.)

Warning

The alignment of the cross slope sensor is very critical to the accuracy of the slope. Tack weld the bracket lightly at first so as to be able to move the bracket when checking measurements.
Please also refer to the section " Sensor alignment" in this chapter.

3. The bracket must also be mounted so that the sensor, when installed, will not come into contact with the mainframe when the cylinders are retracted and the circle is rotated.
4. When the position of the bracket has been checked and, if necessary, adjusted, then securely weld the bracket into the pocket.
5. Bolt the cross slope sensor to the bracket.
6. Connect the M12 connector to the sensor, and drag the cable up to the hydra swivel were the rotation sensor is going to be mounted. Make sure that the cable will not be damaged by the movement of the blade or the circle.
7. Fasten the cable with cable ties.

2.6 Rotation Sensor

Rotation sensor

The rotation sensor consists of the following parts:

- Rotation sensor
- Machine specific mounting plate
- Nylon spacing ring
- Nylon locking ring
- Anti rotation arm

☞ The following instructions apply to most graders on the market. To install rotation sensors on other machine types, like Volvo and Champion, refer to the instructions included in the machine's kit.

The rotation sensor is in most cases mounted on top of the hydra swivel in the drawbar.

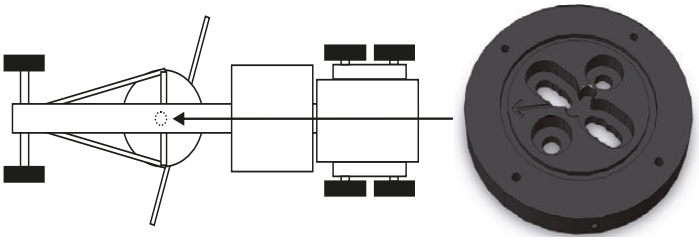
Install the sensor

To install the sensor, complete the following steps:

1. Rotate the circle so that the blade is square to the machine.
2. Disassemble the rotation sensor by loosening the four bolts in the locking ring and carefully pulling the sensor apart.
3. Remove the existing hydra swivel lid and replace it with the sensor mounting plate.

☞ Remember to move the gaskets from the existing lid to the mounting plate.

4. Place the mounting plate so that the arrow is facing forward as shown below.



5. Place the nylon spacing ring in to the groove on the mounting plate.
6. Place the sensor on the mounting plate, making sure that the sensor arm fits into the recessed groove.
7. The top of the sensor must be fixed, so that only the base rotates when the blade rotates. To do this, rotate the sensor to a position where one end of a 6mm iron rod can pass through the rectangular hole in the anti rotation arm and the other end can be welded or screwed onto the grader.

⚠ Warning

Before starting to weld, check that the machines battery is disconnected and that any electronic systems are removed. (Contact your dealer, if necessary.)

☞

The anti rotation arm can be unscrewed and reversed to have the connectors on the rotation sensor facing forward instead of backwards.

8. Attach the cables from the cross slope sensor and junction box to the connectors on the rotation sensor. Make sure that the cable to the cross slope sensor is loose, so that the blade can rotate freely through its whole range.
9. Once the sensor is positioned, go into the **Calibrate -> Rotation offset** menu. Look at the sensors current rotation, the number in **<>**. Observe what the rotation angle reads.
10. If the rotating angle is within plus or minus 80° of zero, no adjustment is needed, please continue to step 15. If the rotation angle is outside the 80° tolerance the rotation arm needs to be adjusted.
11. Remove the cables from the rotation sensor, and remove the fixation of the anti rotation arm. Lift up the sensor.
12. Make a mark at the bottom of the sensor were the drive arm is currently located. Turn the drive arm until the sensor angle reads 0°. Loosen the screw holding the drive arm using a Torx T6 screwdriver. Move the drive arm to the position of the mark without the centre axel moving.
13. Place material, such as a folded business card or credit card, under the drive arm to space the arm from the sensor, and tighten the screw holding the drive arm.

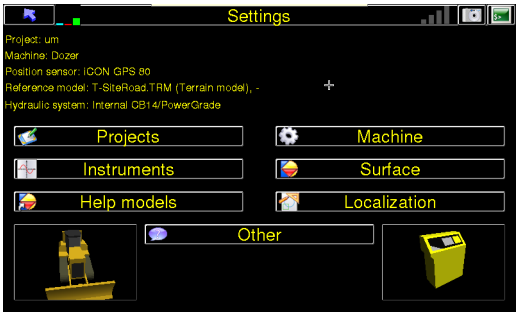
14. Refit the sensor and attach the cables. Check the rotation angle reading, if it's still outside the 80° tolerance repeat step 11. to 13.
15. Repeat step 6. to 8. to reattach the rotation sensor.
16. Place the four washers over the holes in the mounting plate and carefully place the locking ring on top. Insert and tighten the four bolts in the locking ring.

2.7 Setting up dual GNSS

Blade measurements

To make the system run as dual GNSS, please follow the description below to measure the blade:
The settings for measuring the blade can be found at:
Main menu > Settings > Machine

1. Enter the menu **Machine** in the Settings menu.



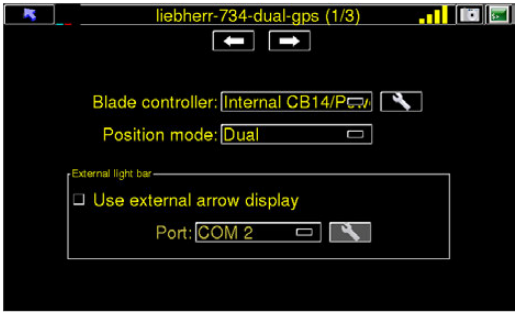
The menu Settings

2. Create a profile in the **Machine manager** menu.

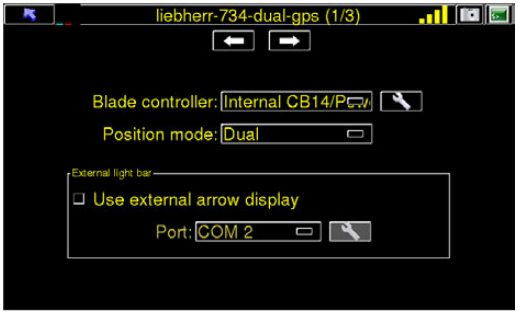
The menu Machine manager

3. Enter the settings by pressing the button.

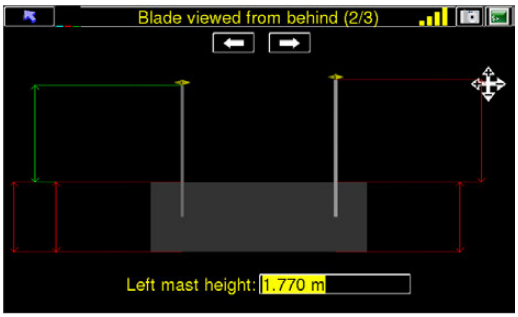
4. The menu option **Position mode**, must be set to Dual.



5. Go to the second page (2/3) by pressing the ← and → arrows to change pages.



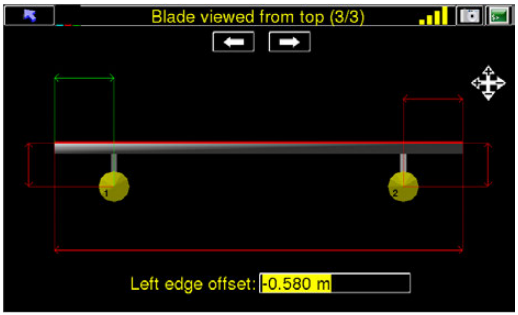
6. At this menu option you setup the measurements of the blade and position of the GNSS antenna.
   When pushing a line on the screen, the line becomes green and the length of the line can be entered in the bottom of the screen.



Blade view from behind.

7. Go to the third page (3/3) by pressing the ← and → arrows to change pages.

8. At this menu option you setup the measurements of the blade and position of the GNSS antenna.
   When pushing a line on the screen, the line becomes green and the length of the line can be entered in the bottom of the screen.



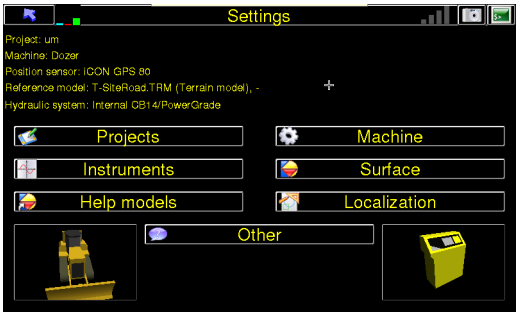
Top view of the blade.

9. Exit the settings page by pressing the button. You will be asked to save the settings.
   Press “Yes” if the settings are correct.
   Pressing “No” will undo the settings.

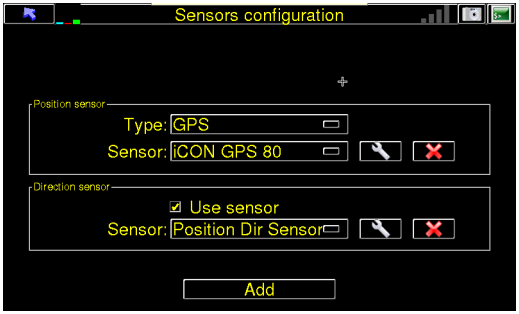
Setup Dual GPS in 3D mode

To setup the system as dual GNSS, please follow the description below:
The settings for dual GNSS can be found at:
Main menu > Settings > Instruments

1. Enter the menu **Instruments** in the Settings menu.

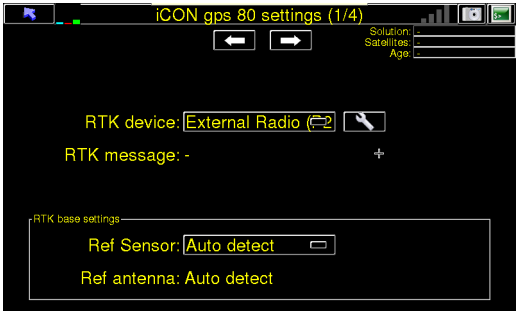


2. Make sure that the settings in the Sensor configuration menu are correct.



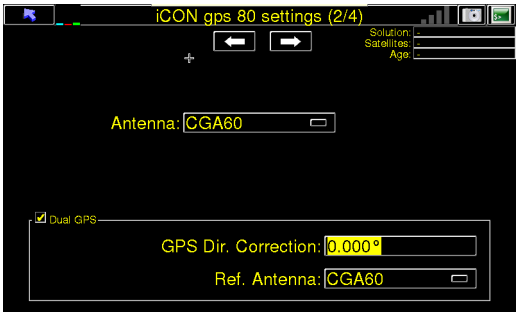
Sensor configuration menu

3. Enter the settings by pressing the button in the **Position sensor** section.



iCON gps 80 settings (1/4).

4. Go to page 2/4 by pressing the and arrows to change pages.

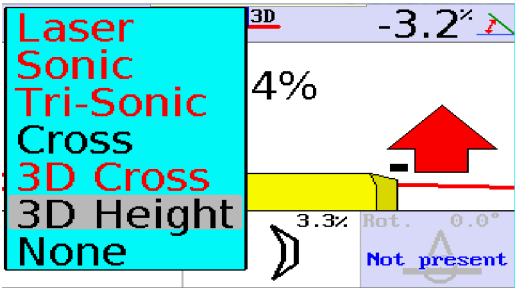


5. Mark the check box **Dual GPS**.
6. Exit the settings page by pressing the button. You will be asked to save the settings.
   Press “Yes” if the settings are correct.
   Pressing “No” will undo the settings.

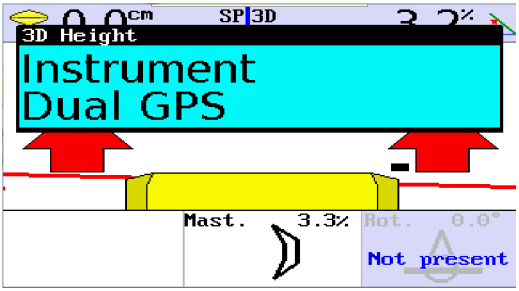
Setup Dual GNSS in 2D mode

When you want to setup the 2D system to run in Dual GNSS mode, please follow the instructions below:

1. Push the left or right key to open the sensor selection menu. The following screen appears:



2. Choose 3D Height as input source.
3. Press F4 "**Adjust**".



Use the / keys to select "Dual GPS".

2.8 Elevation Sensors

2.8.1 Installing the Elevation Sensors

How to install the elevation sensors

For controlling the elevation, several different sensors can be used, but they are installed in more or less the same way.

The elevation sensors are:

- Ultrasonic tracker
- Tri-Sonic
- Laser receiver
- GPS antenna
- Prism

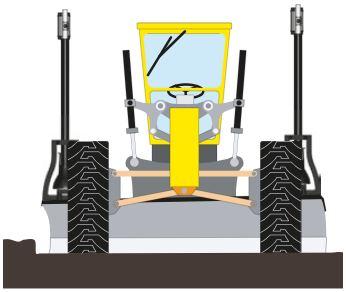
The elevation sensors can either be installed on a L-Bar or a manual/electronic mast.

The installation parts for the elevation sensor consist of:

- L-Bar/ Mast Mounting bracket
- L-Bar/Manual mast/Electronic mast
- Sonic arm (Only for ultrasonic tracker/Tri-Sonic)
- Elevation sensor

The following items should be considered when deciding on a suitable position on the blade for welding the elevation sensor mounting bracket:

- The Ultrasonic/Tri-Sonic tracker must be able to sit vertically above the reference surface or string line while the machine is moving. In order to do this the sonic arm must extend past the end of the blade.
- The L-Bar must clear the circle when the blade is side shifted.
- The masts need to be positioned the following way;



When running a dual laser system, one mast is mounted in each side of the blade.

Both masts should be able to extend high enough to be able to receive a laser strike over the roof of the cab.

2.8.2 Installing the L-Bar

How to install the L-Bar

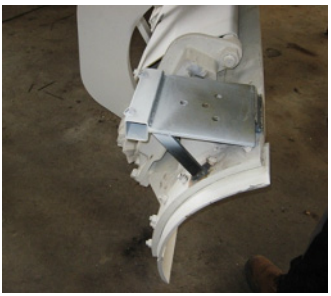
Mounting bracket for L-Bar

1. Find a suitable position for the L-Bar Mounting bracket close to the end of the blade.
2. Weld the L-Bar Mounting bracket firmly to the blade.

⚠ Warning

Before starting to weld, check that the machines battery is disconnected and that any electronic systems are removed. (Contact your dealer, if necessary.)

3. Insert the short end of the L-Bar into the bracket far enough so that the longer tube end is away from the blade end and vertical. Tighten the bolts to prevent the L-Bar from rotating in the bracket.
4. Install the sonic arm onto the L-Bar and hand tighten using the ratchet handle assembly. Attach the Ultrasonic or Tri-Sonic sensor onto the sonic arm by inserting the round tracer feature into the bracket at the end of the sonic arm and tighten using the ratchet handle assembly.
5. Install the laser receiver onto the L-Bar by loosening the mounting clamp on the laser receiver and putting it over the L-Bar. Hand tighten the finger screw on the mounting clamp firmly to prevent the laser receiver from rotating or sliding on the L-Bar.

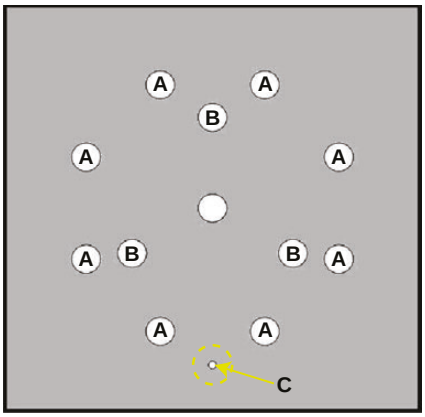


Mounting bracket for manual/electric mast.

2.8.3 Installing the Manual/Power Mast

Mast mounting bracket

The mounting plate is used for installing the manual mast or the shock mount for the Power Mast.
This is an example of one of the many brackets that Leica Geosystems provide to mount masts on blades of dozers and graders



Mast mounting bracket
A = Holes for Manual Mast
B = Holes for Shock Mount
C = Hole for direction indication

The bracket is designed to be welded on to the machine, at a convenient location where the mast can be installed. The manual mast or shock mount is then bolted on to the mounting bracket.

When installing a Power Mast with shock mount on the bracket, take care to install the mast mounting bracket facing the right way. The cable connectors on the Power Mast should face the opposite way of the small hole for direction indication (C) on the bracket.

On a dozer where the mast is mounted at the front of the machine, the connectors face backwards and the mast mounting bracket should be installed with the small hole for direction indication (C) pointing forwards.

On a scraper blade where the mast is mounted behind the tractor, the connectors should face forwards and the mast mounting bracket should be installed with the small hole for direction indication (C) pointing backwards.

Manual mast

Manual mast

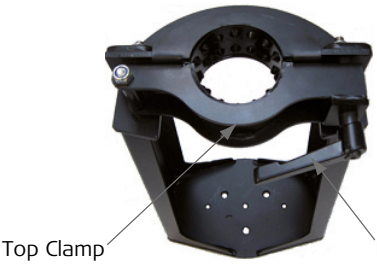
The manual mast is bolted directly on to the mounting bracket with the eight 8 mm bolts that are supplied with the mast.
The manual mast is designed to be installed without the use of a shock mount, and can therefore not fit in the shock mount for the Power Mast.

Power Mast

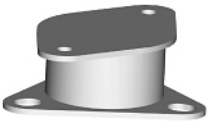
Power Mast

The Power Mast must always be installed in a shock mount, to protect the masts internal components.

Installing the shock mount



Shock mount



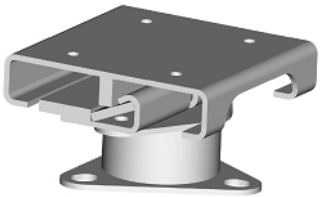
a) - Rubber shock absorber block

b) - Bottom quick mount bracket

c) - Top quick mount bracket

The shock mount is bolted to the mounting bracket with the three 16 mm bolts that are supplied with it.

- Put the three 16 mm bolts in the rubber shock absorber block, and then place the block in the shock mount. Align the block so that all three bolts go through the shock mount and through the mounting plate, and fasten the shock mount to the mounting bracket with the three 16 mm lock nuts.
- Fasten the bottom quick mount bracket to the shock absorber block with two bolts. The bracket must be mounted so that the grove in the middle of the bracket is facing the same way as the top clamp opens.
- Fasten the top quick mount bracket to the Power Mast with four bolts. The bracket must be mounted so that the open end is facing the same way as the connectors on the Power Mast.



The 3 units above (a, b and c) assembled to one single unit.

Installing the mast

To install the Power Mast in the shock mount, first loosen the handle on the top clamp and open the clamp. Then hold the mast at an angle and put the bottom of the mast into the shock mount. When the two quick mount brackets are aligned, push the top of the mast into the shock mount so that the mast stands vertical. Close the top clamp and secure it with the handle.

Power Mast mounting

2.8.4 Mounting of Laser Collars

Mounting of laser collars

When using the Linked Mast function, it is necessary to always mount the laser receivers on the mast in the same position. A laser collar accessory is used to ensure this location is fixed on the Power Mast.

To mount: Slide the collar Laser down over the inner tube of the Power Mast to a point just above the survey-height lines. Tighten the collar into place with the 3 screws.

Laser receiver rests on the collar

3 Calibrating the System

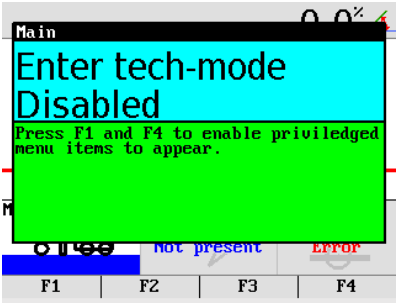
3.1 Installation Wizard

Description

After installing the machine components, the individual sensors will be calibrated using the Installation Wizard.

Enter Tech mode

1. Turn off the engine.
   Make sure the engine is not running before powering on the iCON grade system for the first time. This is to avoid unwanted hydraulic movements caused by incorrect hydraulic settings.
2. Press the centre of the MENU button ( ) then press the right part of the MENU button ( ) until the following screen appears:



Enter installation wizard

1. Enable Tech Mode by simultaneously pressing function keys F1 and F4.
2. Press the left part of the MENU button ( ) until the following screen appears:

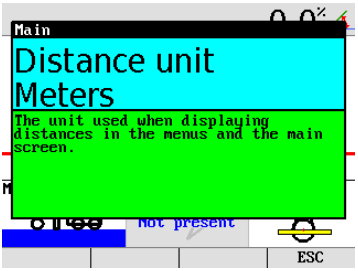
3. Press the centre of the MENU button ( ) to start the Installation Wizard.

Cycle through the menus using the left or the right part of the MENU button (/). Press the button or the button to select the correct setting for a particular menu item.

Step through each of the following menu items and then complete the Sensor Calibration.

Distance unit

Set the units of measurement.

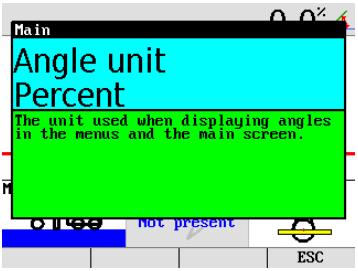


The options are:

- Meters
- Inches
- Feet

Angle unit

Set the angle units.

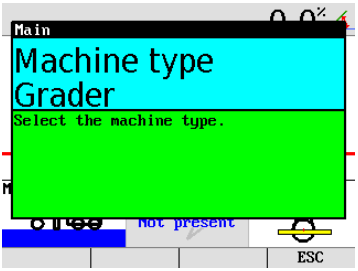


The options are:

- Percent (%)
- Permille (‰)
- Degrees (°)

Machine type

Set the machine type.

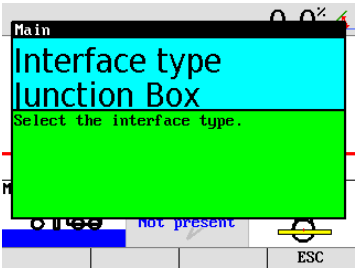


The possible machine types are:

- Dozer
- Grader

Interface type

Set the hardware used for hydraulic control.

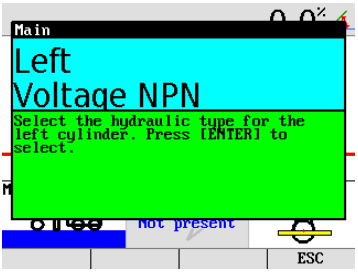


The options are:

- Junction Box
  For traditional hydraulic valve installations.
- CAT® Interface
  For controlling the blade using the CI-14 on Caterpillar® machines with electronic joysticks.
- CAT® SEA
  For controlling the blade through CAN-bus messages on ARO-prepared Caterpillar® machines with SEA-key enabled.
- John Deere IGC
  For controlling the blade through CAN-bus messages on IGC-enabled John Deere machines.

Left

When selecting interface type **Junction Box** the following menu options will appear:

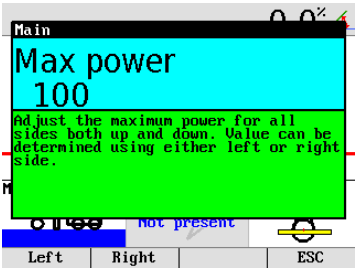


The next two menu items on Dozers and three menu items for Graders set the hydraulic valve type. Set this for Left, Right, and Side (for Graders).
The possible valve types are:

- Danfoss
- Voltage PNP
- Voltage NPN
- Proportional PNP
- Proportional NPN
  (Select proportional NPN for Pilot valves)
- On/Off NPN
  (Select frequency: 2-7 Hz)
- On/Off PNP
  (Select frequency: 2-7 Hz)

Max power

The Max Power setting determines power sent to the hydraulics. The setting is in percent of maximum power and depends on the type and volume of the hydraulic valves. Turn on the engine.

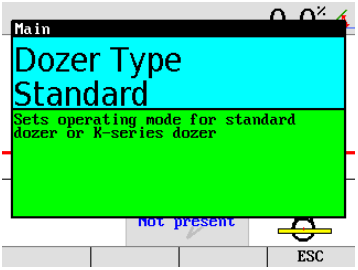


The options are:

- All Danfoss Valves: 100%.
- 2.5 amp: 100%.
- 2.0 amp: 80%.
- 1.5 amp: 60%.
- 1.0 amp: 40%.
- 0.5 amp: 20%.
- Pilot: 50%.)

Dozer type

If **CAT® Interface** was previously selected:

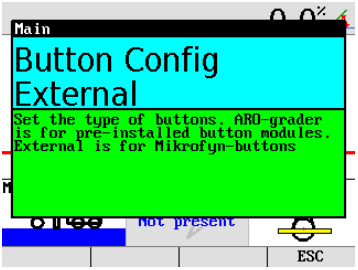


For Dozers, select the machine series:

- Standard (all series dozer except K-series)
- K-series

Button config

Set the correct button types.

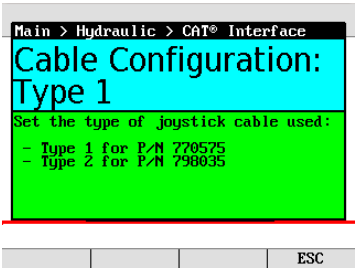


Grader:

- External
  For use with external iCON grade button modules.
- ARO M-Grader
  For use with pre-installed original button modules.

Cable Configuration

Select the cable type that is used in the installation, select Type 1 or Type 2.

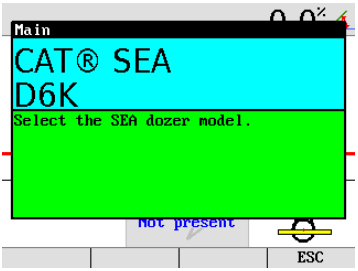


The options are:

- Type 1.
  For use with existing Dozer cables
- Type 2.
  For use with future version of the Dozer cable.

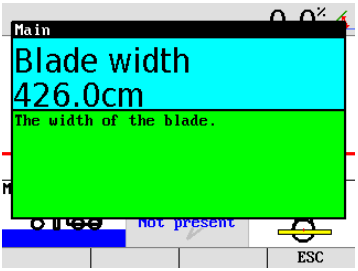
CAT® SEA

If **CAT® SEA** was previously selected:



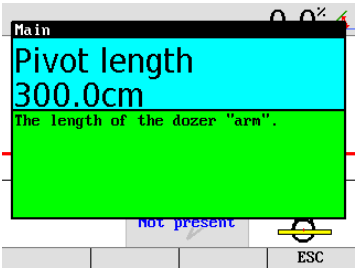
Blade width

Menu for entering the measured Blade Width.



Pivot length

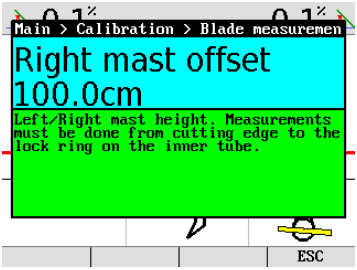
Menu for entering the measured Pivot length (Dozers only).



Mast offset Left and Right side

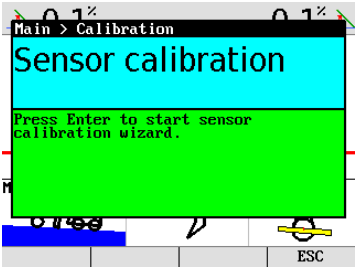
Mast offset is the distance from the cutting edge to the locking ring on the mast.

Measure mast offset for both masts.



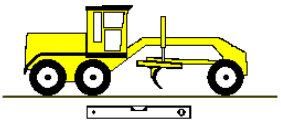
Sensor calibration

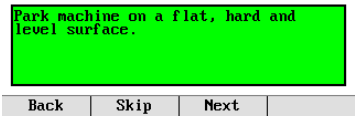
1. Select Sensor calibration. Follow the on-screen instructions to calibrate each sensor. The following example is for graders, but the dozer sensor calibration is similar.



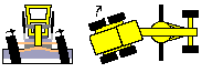
If any sensors are not installed or not connected, a warning screen will appear.

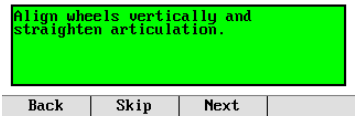
2. Park the machine on a flat, hard and level surface, preferably a paved road or similar. This will facilitate turning the machine around and facilitate proper machine alignment. If the machine is already aligned properly and is ready for calibration, skip ahead by pressing **Skip**. To start, press **Next**.



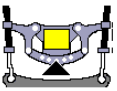


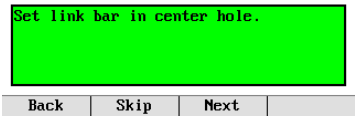
3. Straighten the machine's front wheels and articulation. This ensures correct values for calibrating the mainfall sensor. Press **Next** when complete.



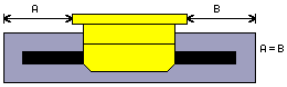


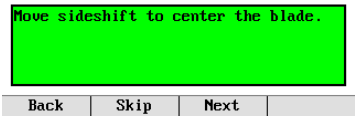
4. Centre the machine link bar. It must be set in its centred position for proper Cross Slope calibration. Press **Next** when complete.



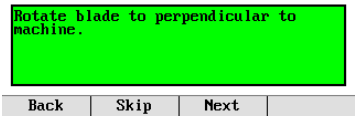


5. Centre the blade sideshift, ensuring that the distance from the machine base to the blade tip is the same on both sides. This is important for the measurements in the next step. Press **Next** when complete.

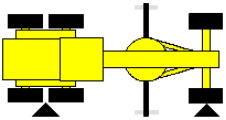


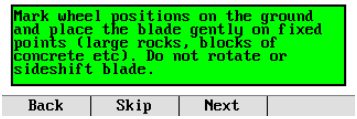


6. Rotate the blade so that the distance from the swivel to each blade tip is the same. This ensures that the blade is perfectly perpendicular to the axis along the machine. This is important for the correct calibration of the rotation sensor. Press **Next** when complete.

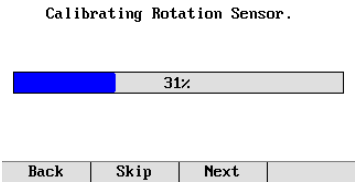


7. Mark the positions of the wheels on the ground and place the blade gently on solid blocks or other solid reference, ensure that the blade has not rotated or that sideshift has been altered. Press **Next** when complete.

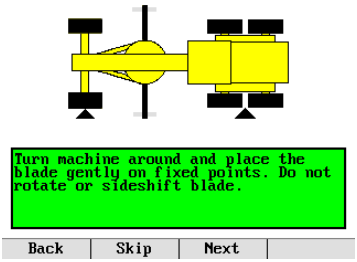




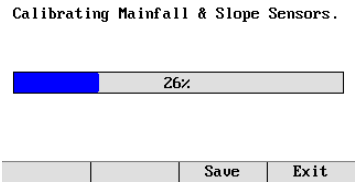
8. The rotation sensor will automatically calibrate, while at the same time collecting Mainfall and Cross Slope data. Press **Next** when complete.



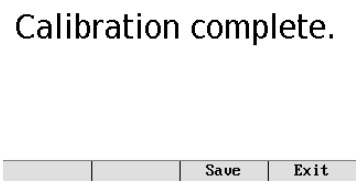
9. Turn the machine around and place the blade gently on the same blocks or reference as before, ensuring that the blade is not rotated or sideshift has altered. Align the wheels using the markings from step 7. This is important for the correct measurement of the Mainfall and Cross Slope values. Press **Next** when complete.



10. The Mainfall and Cross Slope sensors will now be calibrated automatically. Press **Next** when complete.



11. The calibration routine is complete. Save the calibrated values and exit the wizard by pressing **Save**. To exit the wizard without saving, press **Exit**.



Mast tilt

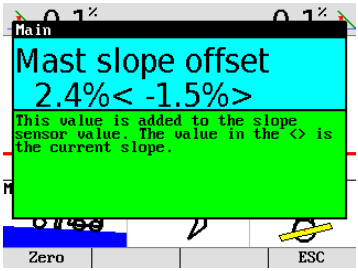
For motorgraders, set whether mast tilt has been installed:

The options are:

- Yes
- No

Mast slope offset

Use a level to calibrate the mast slope offset / sensor.



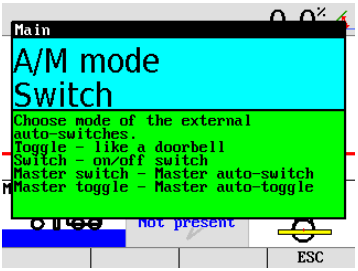
Automatic hydraulic valve calibration

The next screen is Automatic hydraulic valve calibration.

See section "3.3 Manual Calibration of Machine Hydraulics" for instructions and return to this step when done.

A/M mode

Set the operation mode of the Auto/Manual switch:



The options are:

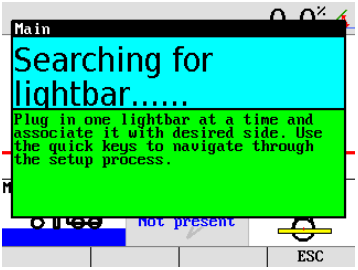
- Toggle
  For selecting individual channels using the A/M buttons on the panel.
- Switch
  For selecting individual channels using the orange switches on the iCON grade button modules or ARO-button modules.
- Master switch
  For use with an external On/Off switch.
- Master toggle
  For use with external or joystick-mounted toggle switches.

Lightbar config.

If lightbars are installed, you can configure them here. Follow the on-screen instructions. Unplug all but one lightbar. Press **Start** to begin.

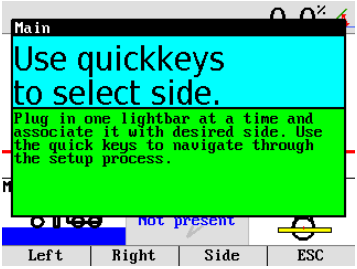
Searching for lightbar

The panel will search for the connected lightbar.



Use quickkeys to select side

Set the location for the connected lightbar by pressing **Left**, **Right** or **Side**.



Disconnect the lightbar and repeat these steps for the remaining lightbars.

Language

Set the user mode language.

End

The Installation Wizard is complete.
The machine should be ready to work.

3.2 Automatic Calibration of Machine Hydraulics

General

Automatic Calibration will set many of the hydraulic settings for the machine. Specifically, Idle Speed, Min Speed, Symmetry, and Gains for all sensors. It also sets deadband, cutoff thresholds and **cross coupling** values to default (recommended) values.

☞ **It is essential that the machine type is set correctly to dozer or grader, that the proper valve type is selected and that Max Power has been set correctly.**

Requirements for Automatic Calibration:

- Grader: Cross Slope Sensor and Blade Width Measurement.
- Dozer - Right (Tilt): Cross Slope Sensor and blade width measurement.
- Dozer - Left (Lift): Mast Slope Sensor and blade pivot measurement.

☞ If Dual-Slope Sensor is not installed, a second Single Slope Sensor can be rotated counter-clockwise 90° around the vertical axis and mounted temporarily on the blade using magnetic mounts. Disconnect the original Single Slope Sensor if it is mounted on the blade during the calibration of the Left/Lift side hydraulics.
Note: The SP sensor is a Dual Slope sensor, so rotating the sensor for left side Auto-Calibration is not necessary

Enter Auto Cal mode

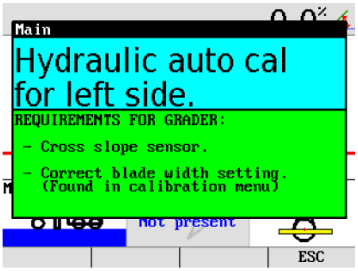
Enter the Tech Mode (F1 and F4) and then enter into the Hydraulics Menu (Menu -› Hydraulics -› Hydraulic -› Auto Cal, or enter through the installation wizard.

Auto calibrating the hydraulics

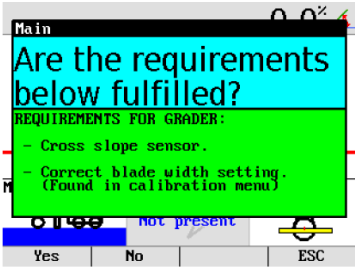
To calibrate the hydraulics, set machine on stable and flat surface. Follow the instructions on the screen.
The process will take between 5 and 15 minutes.

DO NOT LEAVE MACHINE UNATTENDED DURING AUTOMATIC CALIBRATION PROCESS. ENSURE THAT THE BLADE IS CLEAR OF ALL OBSTRUCTIONS AND PEOPLE.

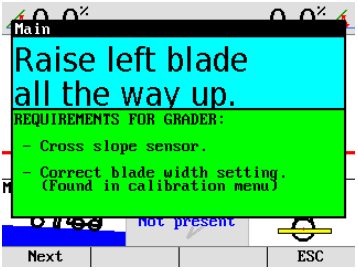
The Automatic Calibration routine will request that the operator moves the blade to the upper and lower limits of motion.



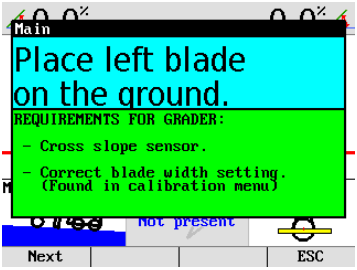
Press the **Enter** key to begin.



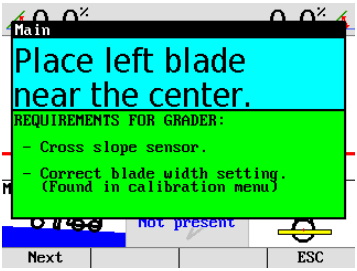
Press **Yes** when ready.



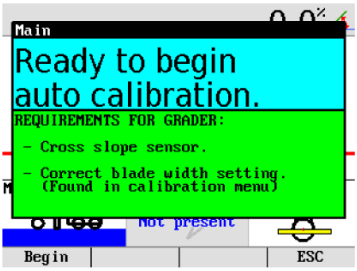
Raise the blade to its highest position. Press **Next** when complete.



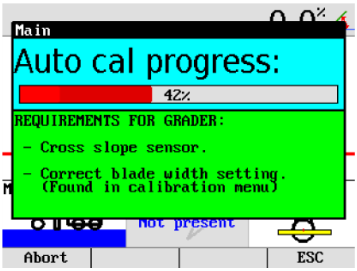
Set the blade on the ground. Press **Next** when complete. The blade operating window for the calibration has been set.



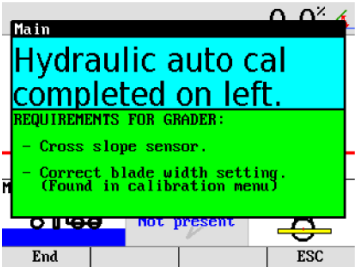
Move the blade approximately to the middle of the operating window defined by the highest blade position and the ground. Press **Next** when complete.



The auto-calibration process is ready to begin. Press **Begin** to start.



While calibrating, a progress bar will show a percentage complete. To cancel the calibration at any time, press **Abort**. Do not leave the machine at this time.



After 5 to 15 minutes, the auto-calibration for the selected side is complete.

Repeat for the other side.

If a rotated Cross Slope sensor was used to calibrate left side on a dozer, disconnect it or return the sensor to its original and proper position prior calibrating the tilt/right side. See below for any warnings or errors.

List of warnings

If there are any remarks setting the calibration, a warning will be displayed at the end of the routine. The following is a list of warnings:

- **Symmetry and Gains failed. Set manually.**
  This is a symptom of the hydraulics installation not being able to reach a high enough hydraulic speed for optimal performance. Please check proper hydraulic installation and equipment if blade response is not adequate.
- **Reversed Hydraulics corrected.**
  The hydraulics were connected backwards and corrected via software. Note that this setting will have no impact on performance, only that the correct configuration is found in the software settings and not in the cabling to the hydraulics.
- **Idle speeds have been set to Zero.**
  The auto calibration has detected that the blade lowers slightly when attempting to raise the blade at very lowspeeds.
  This is not as such a critical problem, and only means that ideal performance will be achieved through idle speeds set to zero. No further action is necessary.
- **One or more Gains set to 1.**
  This is typically caused by an incorrect “Max Power” setting. Verify setting and if changed, redo calibration.

The following errors are errors that will abort the Automatic Calibration:

- **No cross slope sensor**, **No mast slope sensor**, **No cross/mast slope sensor**.
  The above errors occur if the listed sensor is not attached or is unplugged during the calibration process.
- **No movement detected.**
  During setting the blade movement boundaries, no change in sensor value were detected.
  Check connection of sensors.
- **Slope sensor mounting reversed.**
  Cause: The cross/mast slope sensor is mounted upside down.
- **Hydraulics not responding.**
  The system is unable to move the hydraulics at all.
  Verify installation.
- **Interference detected. Try again.**
  Redo calibration if this message is shown.

3.3 Manual Calibration of Machine Hydraulics

General

The calibration of the machine hydraulics requires the setting of six variables:
Valve Type, Max Power, Min Speed, Idle Speed, Symmetry, Cross-coupling.

Recommended resources for calibration:

- Two people
- Tape measure
- Two concrete blocks or similar for marking blade and wheels
- A bubble Level or similar
- Spray paint or similar

☞ When measuring these values, it is recommended that the machine is at half engine speed.

The instructions include settings for Sideshift. If the machine does not have Sideshift installed, these settings can be skipped.

Step 1:
VALVE TYPE

There are two types of hydraulic valves that are supported for Motorgraders, Proportional NPN and Danfoss. Select the type that applies to the valve installed. If the installed valve type is **RHM** then the sideshift valve type **must be set to ON/OFF 7 Hz NPN**.

There are other options available in the menu that are used for other machine types but that will not apply for these instructions. Please consult with your distributor or a qualified service technician if you are unsure of the type installed on your machine.

Step 2:
MAX POWER

This informs the system of the valve size that is installed. Select the percentage that best corresponds to the installed valve.

2.5 amp coil and all Danfoss Valves: 100%

2.0 amp coil: 80%	1.0 amp coil: 40%
1.5 amp coil: 60%	0.5 amp coil: 20%

Step 3:
IDLE SPEED

Idle speed is the setting that the machine will use while in standby. Adjust the idle speed for each valve (lift and tilt) and in both directions (up and down). The TEST button should be used to verify the solution. The value should be just low enough to prevent the blade from moving. If there is any motion in the blade, the setting is too high. A tape measure is recommended to ensure that the blade is not moving. It is not recommended to "eye ball" the blade motion from the cab of the machine; two people are recommended.

For graders with Danfoss valves installed, a counter balance is recommended. If a counter balance is not installed, Idle Speeds should be set to zero (0).

If the hydraulic system is an open-center system the idle speed must be set to zero.
For Sideshift, the idle speed (left and right) must be set to zero.

Step 4: MIN SPEED

The Min Speed is the fine precision control of the blade. **Precise measurement of this setting is crucial for maximum performance**. Use of a tape measure and stopwatch are highly recommended for this setting.

Adjust the min speed for each valve (left and right side for Sideshift) in both directions (up / down or left / right for Sideshift) to the speed indicated below. Verify the solution by pressing the **10s** button in the **Min Speed calibration menu**. A tape measure is recommended.

For Lift, both left and right side:
Adjust this setting so that the blade moves 4 cm in 10 seconds measured at the edge of the blade. Verify for both up and down motion. If one setting results in too much movement and one setting lower is too little movement, then select the slower option.

Step 5: SYMMETRY

This compensates for the additional force required to lift the blade versus lowering the blade. It is important for the system to provide identical motion of the blade both upwards and downwards. Using a tape measure, adjust the Symmetry value so that the blade returns to the same position. Repeat for Lift, Tilt, and Sideshift.

☞ **Machine performance will vary depending on material type, weight, and the load on the blade. If the machine appears "too slow" or "too fast", DO NOT adjust any of the calibration settings. Performance adjustments are compensated with the Gain settings for the sensors used. Adjusting the Calibration values will not improve machine performance!**

Step 6: CROSS-COUPLING (X-COUPLING)

This setting is used for compensating for the motion of one side of the blade to the motion on the other. The result is that the use of positioning sensor with a slope sensor will react instantly on the slope side to any vertical movement from the distance sensor. The recommended setting is 35%.

☞ If the machine fails to calibrate correctly for Min Speed and Gain, then the Cross-Coupling should be set to Zero.

Step 7: Auto/Manual Switch Setup

Refer to chapter "3.9 Configuration of Auto / Manual Switches".

Step 8: BLADE OFFSET

While every attempt should be made to weld or bolt on the cross-slope sensor as true to horizontally flat as possible, this is often very difficult to accomplish. To compensate for what error may remain, the blade offset setting will correct for the difference between the actual and true sensor angles.

1. Position the blade in a horizontally flat position. Use two concrete blocks (or equivalent) placing one underneath each side of the blade. Lower the blade such that it rests on the two blocks. Mark the position of the blade on the two blocks with spray paint (or equivalent). Now change the setting such that the sensor value in the "< >" says zero.
2. Turn the machine 180 degrees (reversing direction) and put the blade back to the same position on the two blocks. Note down the **sensor value** in the "< >".

Subtract the **sensor value by half** and add the result to the Blade Offset value. If the **sensor value is negative**, then subtract this value from the Blade Offset value.

Step 9:
BLADE CUT-OFF

Together with mainfall cut-off, this setting controls the "noise" and vibration inherently present on heavy machinery and for handling brief accelerations/decelerations of the machine.

There are two blade cut-off settings, blade threshold and blade timeout. These are located in the Calibration menu.

Recommended values for the Blade Threshold is 1.5% and for the Blade Timeout 600 ms.

☞ Only a qualified service technician should modify these values.

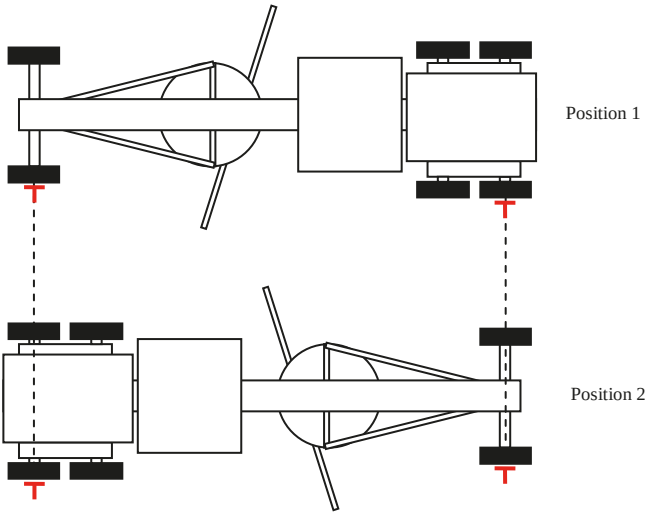
Step 10:
MAINFALL OFFSET

To calibrate the mainfall sensor complete the following steps:

1. Park the machine on level ground.
2. Put the frame in a straight position (that is, with the gooseneck not articulated).
3. Make sure that the front wheels of the grader are vertical.
4. Enter the menu on the control panel. Go to the **Calibrate -> Mainfall offset** menu option.
5. Adjust the mainfall offset until the number in **<>** becomes **0**.

If it isn't possible to park the grader at a completely level surface then a second calibration method can be used:

1. Park the machine on solid ground such as asphalt or concrete.
2. Mark the position of the front and rear wheels with marking spray paint or equivalent. This is position 1 on picture below.
3. Enter the menu on the control panel. Go to the **Calibrate -> Mainfall offset** menu option.
4. Write down the sensor value shown in the < >, remember to note the sign also.
5. Turn the machine around and place the front wheels were the rear wheels were and the rear wheels on the front wheels mark this is position 2 on picture below.
6. Enter the menu on the control panel. Go to the **Calibrate -> Mainfall offset** menu option.



Main fall sensor calibration

7. Write down the new sensor value.
8. Calculate the main fall offset by putting the two values in to this:

$$\text{Main fall offset} = \frac{\text{sensor value pos. 2 - sensor value pos. 1}}{2}$$

9. Set the main fall offset, that's the value inside the ( ) to the value just calculated.

Step 11:
MAINFALL CUTOFF

Like blade cutoff, this setting will control the "noise" and vibration inherently present on heavy machinery and for compensating for brief accelerations/decelerations of the machine. There are two mainfall cut-off settings, Mainfall Threshold and Mainfall Timeout. These are located in the Calibration menu.
Recommended value for the Mainfall Threshold is 0.6%.
Recommended value for the Mainfall Timeout is 300 ms.

☞ Only a qualified service technician should change these values.

Step 12:
ROTATION OFFSET

Refer to chapter "3.5 Calibrating the Rotation Sensor".

Step 13:
MAST CALIBRATION

Refer to chapter "3.4 Mast calibration".

3.4 Mast calibration

Content

This chapter will cover how to measure the following values:

- Mast height
- Blade wear
- In-front/behind value
- Left & Right blade offset

It will also tell how to calibrate the mast slope sensor

Before starting the measurements

It is very important that the machine is placed correctly before starting the measurements.

The following sensors must be calibrated before starting the measurements:

- Main fall sensor
- Rotation sensor
- Cross slope sensor

Park the machine at a level surface. (0% long slope and 0% cross slope). For the best result use a hard surface, like concrete or asphalt. If this is not possible, then make sure that the wheels and blade doesn't sink in to the surface material during the measurement.

Make sure the blade is at 90° to the machine (rotation is 0°).

Put the blade at the grading height ±5cm. (grading height is defined by a line from the underside of the front wheels of the grades to the underside of the back wheels). This must be done because when you move the blade up or down on a grader, the mast is tilted back or forth.

Put the blade level (0% cross slope).

If the machine is not fitted with a mast slope sensor it's important not to change the mast slope while operating the system. If the mast slope is changed it will create an error in the mast height and in-front/behind value, and a new measurement of the mast is needed.

It's recommended to tilt the blade all the way back towards the end stop, before doing the mast measurements. That way it's easy to get back to the original position if the blade has been tilted for some reason.

Sensor mount point (Figure 1)

It's recommended to adjust the mast mounting so that the mast is as vertical as possible in all directions. If the mast is then extended, the sensor mount point (A) will mainly move in the Z direction (height). If the mast was not vertical, and it's extended, the sensor mount point will not only move in the Z direction but also in the X and Y direction, and a new measurement is needed.

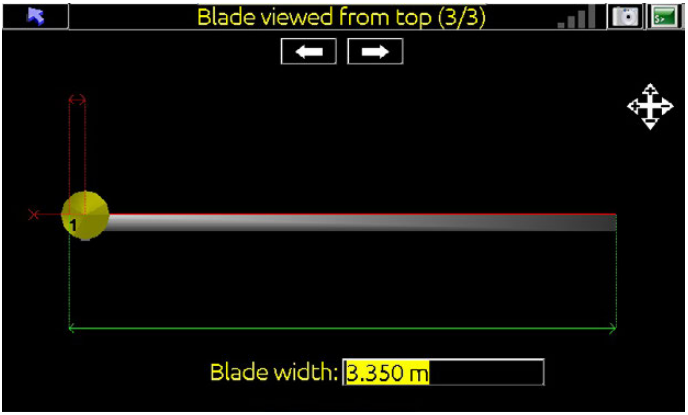
Left and right Blade offset

First the total blade with is measured from blade corner to blade corner. Then the horizontal distance from the blade corner to the sensor mount point is measured. This can be done by using a strait metal or wooden rod and a spirit leveller.

Place the rod so that the edge of the rod is at the centre of the sensor mount point, then use the spirit leveller to make sure that the rod is vertical in the blade direction. Then you can measure the horizontal distance from the rod edge to the blade corner. See Figure 2 below.

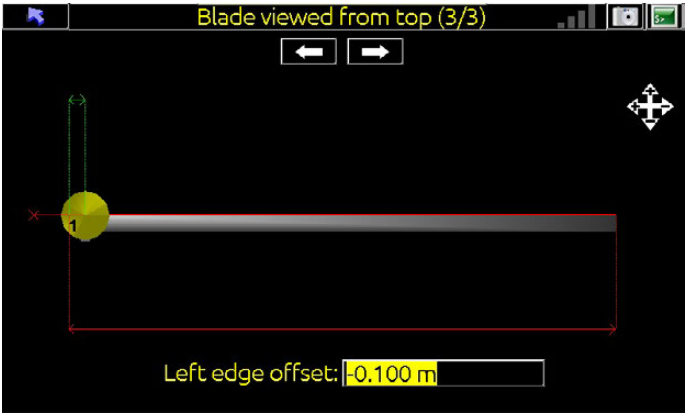
Left blade offset (Figure 2)

If the mast is mounted on the right side of the blade the distance to the right blade corner is measured instead.
When entering the value in 3D mode the Left blade offset is entered as a negative value, if the mast is mounted to the right of the blade corner, when looking at the back of the blade (as it is in figure 2).
In the example in figure 3 the total blade with was measured to 3.35 m



Enter left and right blade offset (Figure 3)

and the mast was mounted 0.1 m from the left blade corner.
That way the left blade offset is -0.1m.



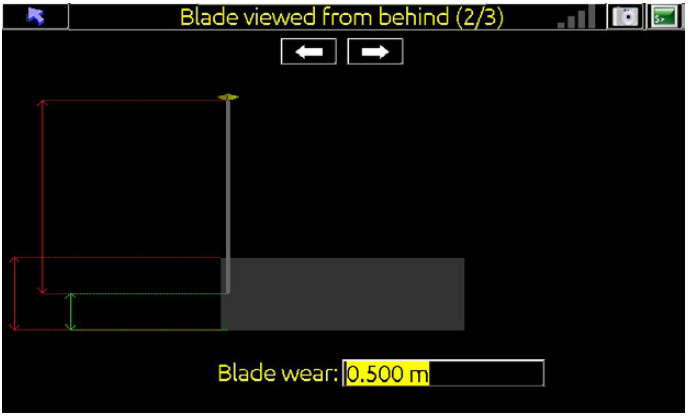
Enter left and right blade offset (Figure 4)

Measure the mast height

Measure the vertical height from the sensor mount point to the blade edge. See figure 5.

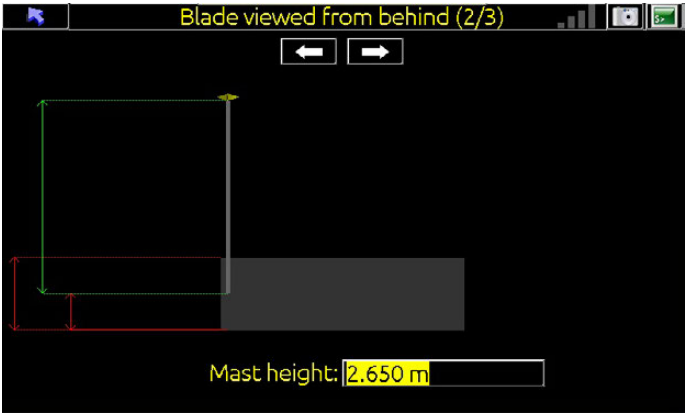
Mast Height (Figure 5)

If the machine is using a GPS the height is measured from the underside of the threaded metal insert on the GPS antenna, if it's using a prism the height is measured to the centre of the prism (for a MPR122 360 MA prism this is 5.0 cm from the bottom of threaded insert).
In 3D mode set the blade wear to 0.5m



Enter blade wear (Figure 6)

and then enter the measured mast height - 0.5m as the mast height. In the example below in figure 6 the total mast height is 2.650 m.



Enter blade wear (Figure 6)

Measure the in-front/behind value

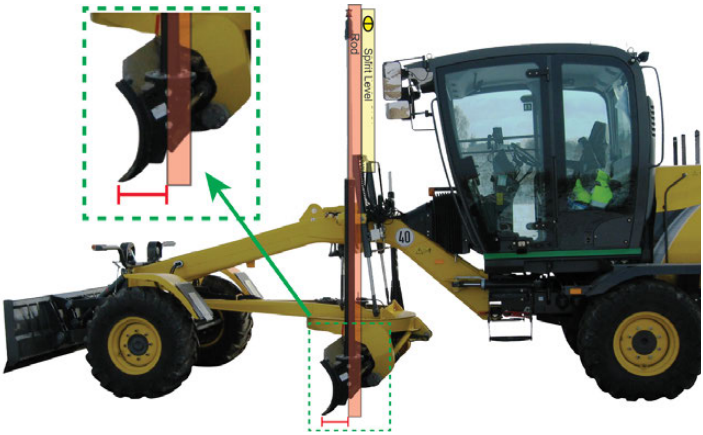
Measure the horizontal distance from the sensor mount point to the blade edge. See figure 7.

In-front/behind distance (Figure 7)

Measuring the horizontal distance can be done by using a strait metal or wooden rod and a sprit leveler.

Place the rod so that the edge of the rod is at the centre of the sensor mount point, then use the sprit leveler to make sure that the rod is vertical in the machine direction. Then you can measure the horizontal distance from the rod edge to the blade edge. See figure 8.

See if the sensor mount point is in front of or behind the blade edge and select that in the UMC3D, then enter the measured value. The example above in figure 5 has the mast 0.3 m behind the blade edge.



Measure the In-front/behind distance (Figure 8)

Calibrating the Mast slope sensor

When installing the mast slope sensor it's very important to make sure that the sensor is placed so that the calibration offset is as small as possible. Ideally it should be within +/- 2.0%.

The Mast Slope Offset is calibrated by:

1. Enter Tech Mode (F1 and F4).
2. Enter **Main** / **Calibration** / **Mast Slope Offset** and press the zero button.

3.5 Calibrating the Rotation Sensor

Calibrating the rotation sensor

To calibrate the rotation sensor complete the following steps:

1. Park the machine on level ground.
2. Put the frame in a straight position (that is, with the gooseneck not articulated).
3. Make sure that the front wheels of the grader are vertical.
4. Make sure that the link bar is centred with the locking pin in the middle hole.
5. Centre the blade on the circle using the blade sideshift. Measure each side of the blade from the circle frame to ensure that it is accurately centred. See picture below.

Centring blade sideshift

6. Rotate the blade so that it is more or less at a 90 degree angle to the machine.
7. Measure from the draft ball at the head of the A-frame to each end of the moldboard.

Measuring from the draft ball to the moldboard

☞ You do not have to measure to the very tip of the moldboard; however, you must measure to the same point at each end of the moldboard.

8. Compare the two measurements and if they are not equal, rotate the blade slightly.

9. Repeat step 7. and 8. until the two measurements are equal.
10. Make two chisel marks on the circle. One at the bottom (rotating) part and one at the top (fixed), see picture below. Whenever you need to rotate the blade to perpendicular, align the two chisel marks.

Chisel marks on the grader circle

11. Enter the menu on the control panel. Go to the **Calibrate -> Rotation offset** menu option.
12. Adjust the rotation offset until the number in **<>** becomes **0**.

3.6 Calibrating the Cross Slope Sensor

Calibrating the cross slope sensor

To calibrate the cross slope sensor complete the following steps:

1. Park the machine on level ground.
2. Put the frame in a straight position (that is, with the gooseneck not articulated).
3. Make sure that the front wheels of the grader are vertical.
4. Make sure that the link bar is centred with the locking pin in the middle hole.
5. Rotate the blade to the perpendicular mark.
6. Level the blade using a spirit level.
7. Enter the menu on the control panel. Go to the **Calibrate -> Cross slope offset** menu option.
8. Adjust the mainfall offset until the number in **<>** becomes **0**.

3.7 Installation and Configuration of MLB1300 Lightbars

How to install / configure the light-bars

1. Enter Tech Mode (F1 and F4).
2. Enter **Sensor Config Menu / Lightbar / Lightbar Config**.
3. Attach one lightbar only to CAN Cross Junction Box.
   - Press the centre of the MENU button ( ).
     Searching for lightbar will appear.
   - Select which side lightbar will be located (**Left**, **Right**, **Side**) using the quick keys.
   - Press the centre of the MENU button ( ) to complete configuration.
4. Repeat Step 3 for every additional lightbar.
5. When all lightbars have been programmed, connect all lightbars, select **ESC** and go to the next menu **Lightbar status**.
   Use the quick keys to verify correct programming.
   Only one lightbar should flash for each side.

☞ MLB1300 Installation Note: For Sideshift the lightbar needs to be mounted with the cable on the right to ensure proper guidance.

☞ MLB1300 User Note: When lightbars are used in 3D with 3D Height or 3D cross selected as sensors, the lightbars will only show cut/fill values on those sides.
Numerical Values are disabled when 3D is in use.
In 3D, it is the "upper - and lower tolerances" from within the 3D system that control when the lightbars show green.

3.8 Machine-joystick behaviour

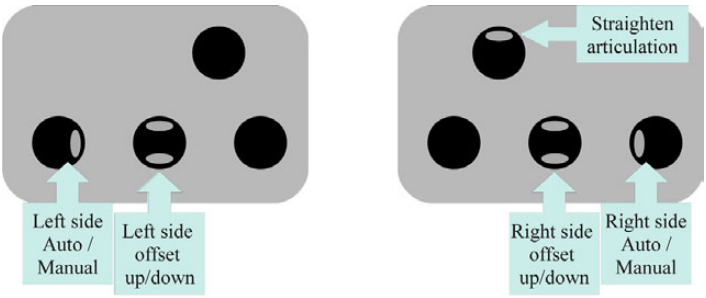
Caterpillar® M-graders

There is currently no support for the optional button modules in the M-graders with either CI-14 or SEA.

John Deere® IGC

GP Graders

GP Grader joystick button configuration:



John Deere IGC Grader joystick buttons

We are currently interpreting the IGC button messages in the following fashion:

If A/M mode is set to Master Toggle, both left and right side A/M buttons can toggle the system in or out of auto. Auto prepare must be set on the panel by pressing one or more Auto-buttons.

If A/M mode is set to Toggle, left side A/M button will toggle the left side in or out of auto, while the right side A/M button will toggle the right side in or out of auto.

The left and right side offset buttons will increase or decrease the offset for their respective side.
Simultaneous button presses will activate the seek mode for that side.

3.9 Configuration of Auto / Manual Switches

How to configure the Auto / Manual switches

1. Enter Tech Mode (F1 and F4).
2. Enter **Hydraulic** and select **A/M Mode** at the very end.
3. Use the up/down arrow keys on the MENU Button to cycle through **Toggle**, **Master**, **Switch**.
   - **Toggle**: Will set the Auto/Manual Switch to function like a doorbell for use when the switch is a push-button. However, it will control all hydraulics at once when prepared auto is enabled with the auto buttons on the panel.
   - **Switch**: Will set the Auto/Manual Switch to function like a light switch with an on/off - up/down operation.
   - **Master**: Will set the Auto/Manual Switch to function like a light switch with an on/off - up/down operation. However it will control all hydraulics at once (left/right/side or lift/tilt).
   - **Master Toggle**: Will set the Auto/Manual Switch to function like a light switch with an on/off - up/down operation. However it will control all hydraulics at once (left/right/side or lift/tilt). With door-bell behaviour.
4. Select **ESC** to exit menu.

☞ NOTE ON CAT-INTERFACES: The Auto/Manual Switch will override the joystick control on these machines.

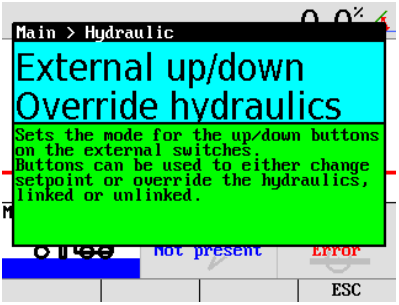
3.10 Hydraulic Override with External Switch

External A/M switch

The external A/M switch can be configured to control the hydraulics instead of increment/decrement of sensor offset. This can be active in both manual mode and in automatic mode. This feature is especially useful then using the system on machines without a joystick for controlling the blade. Examples would be tractor pulled scrapers and wheel loader attachments.

When using this feature, the signal from the external switch has higher priority than the signal from the different sensor inputs. Therefore is the operator able to instant taking control over the system then he e.g. reaches the end working track or emptying the scraper.

The feature can be selected in Tech-mode->main->hydraulic->External up/down.



Three settings are available.

Settings	Function of external switch	Typical application
Inc/Decrement (Default).	Increment/decrement of sensor offset. No hydraulic control.	Bulldozer and Motor-grader.
Override hydraulics.	Separate control of each hydraulic axis.	Tractor pulled scraper with a single axis lift control.
Linked override.	Control of both axis simultaneously.	Skid Steer grader attachment.

The speed of the hydraulic is based on the Laser Gain for left and right side.

3.11 CAN Joystick

How to configure the Auto / Manual switches

For more accurate manual control of the hydraulic a CAN based joystick can be used. This gives full proportional control of up to 3 axes and a master A/M switch.

Note: The joystick must be connected directly to the cradle CAN 2 and can not be connected to the normal can-bus network.

Before connecting the joystick the cable must be shortened to a suitable length so the M12 connector is removed. Alternatively, the cable can be extended with an extension cable.

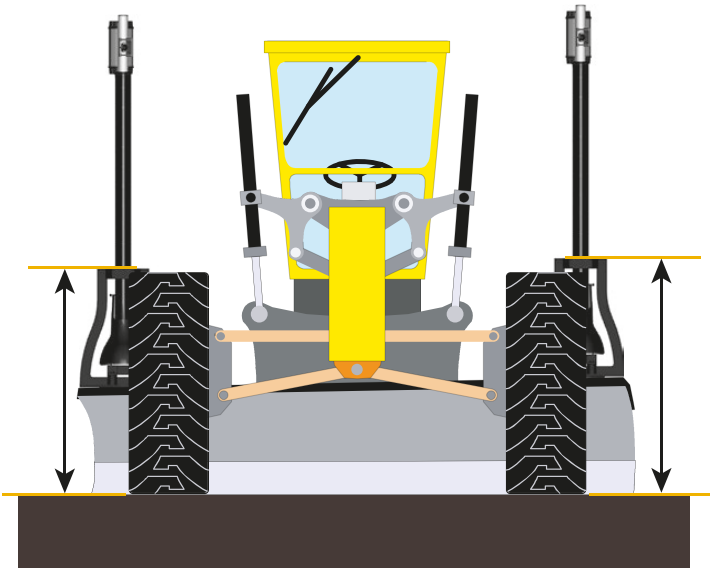
Pin	Description	Colour
2	V_{CAN2}	Brown
3	GND	Blue
4	CAN 2 Low	Black
5	CAN 2 High	White

3.12 Calibrating Mast Height Offset

Calibrating Mast Height Offset

Two extra measurements are required when using the Linked Function for two laser receivers mounted on Power Masts.

1. Measure the distance from the cutting edge to the top of the shock mount on the left mast.



2. Enter this value in the iCON grade control panel under Tech-mode- >main- >calibration- >blade measurements- >left mast offset.
3. Repeat this measurement for the right mast and enter the value under Tech-mode- >main- >calibration- >blade measurements- >right mast offset.

A description of the Linked Mast functionality can be found in the iCON grade User manual.

4 Deadband and Gain

DEADBAND

The deadband controls the precise motion of machine hydraulics. These values do not correspond to accuracy, but to hydraulic speeds. These values should not be confused with overall machine performance and/or precision.

Adjust the deadband for each sensor. This is done in the adjust menu for each sensor.

Sensor	Grader
GPS	1.0 cm
Laser	0.7 cm
Cross slope	0.3 %
Tracker	0.5 cm
Sideshift	2.0 cm

GAIN

This is the scaling (sensitivity) of hydraulic speeds for each of the sensors. These values should be measured at the initial calibration but can be fine-tuned as needed (heavy or rough material, wet dirt, fine grading, etc.).

To enter **Gains** select the appropriate **Sensor Select** buttons to open up the available sensors. Select appropriate sensor and then the F1 or F4 key (depending on left or right side) to enter the **Adjust** Menu.

Adjust the gain of the hydraulic system for each sensor. This is done by pressing the **2s** button in the **Adjust** menu for each sensor. This will control the hydraulics **Upwards** for two seconds. Revert if necessary using the **Revert** button.

Please follow the on-screen instructions!

Elevation:
Press the **2s** button to adjust the value so that it corresponds to the distances below. A simple tape-measure or ruler can be used to gauge the actual blade movement (taking great care around the machine). For example, after pressing the **2s** button, the blade should move approximately 15 cm for GPS.
Note that these values are indicative only, and different operators may prefer slightly faster or slower settings.

Sensor	Grader
Laser/Sonics/Tri-Sonics/GPS	13 cm
Tracker	7 cm

Second laser for cross slope:
This should be measured 1.5 meters from the centre of the blade. Press the **2s** button to adjust the value so that it corresponds to 8 cm for a laser sensor controlling tilt on a Dozer.

2D and 3D cross slope sensor:
This should be measured 1.5 meters from the centre of the blade. Press the **2s** button to adjust the value so that it corresponds to the distance below. For example, the blade should move 14 cm for 3D cross-slope.

Sensor	Grader
2D and 3D cross-slope	14 cm

Sideshift:
Enter the Tri-Sonic or 3D height adjust menu. Press the **2s** button to adjust the value so that it corresponds to the distance below.

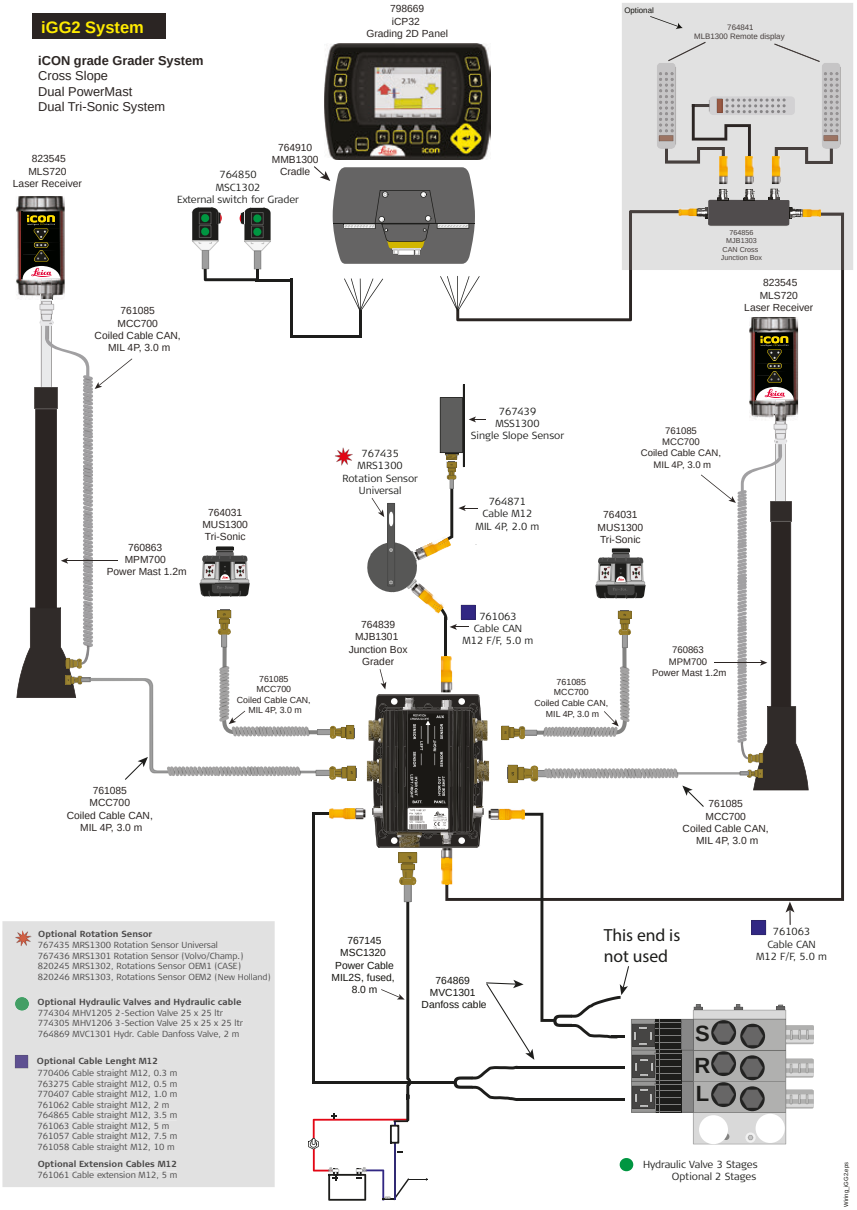
2D and 3D sideshift: 13 cm

5 Wirings

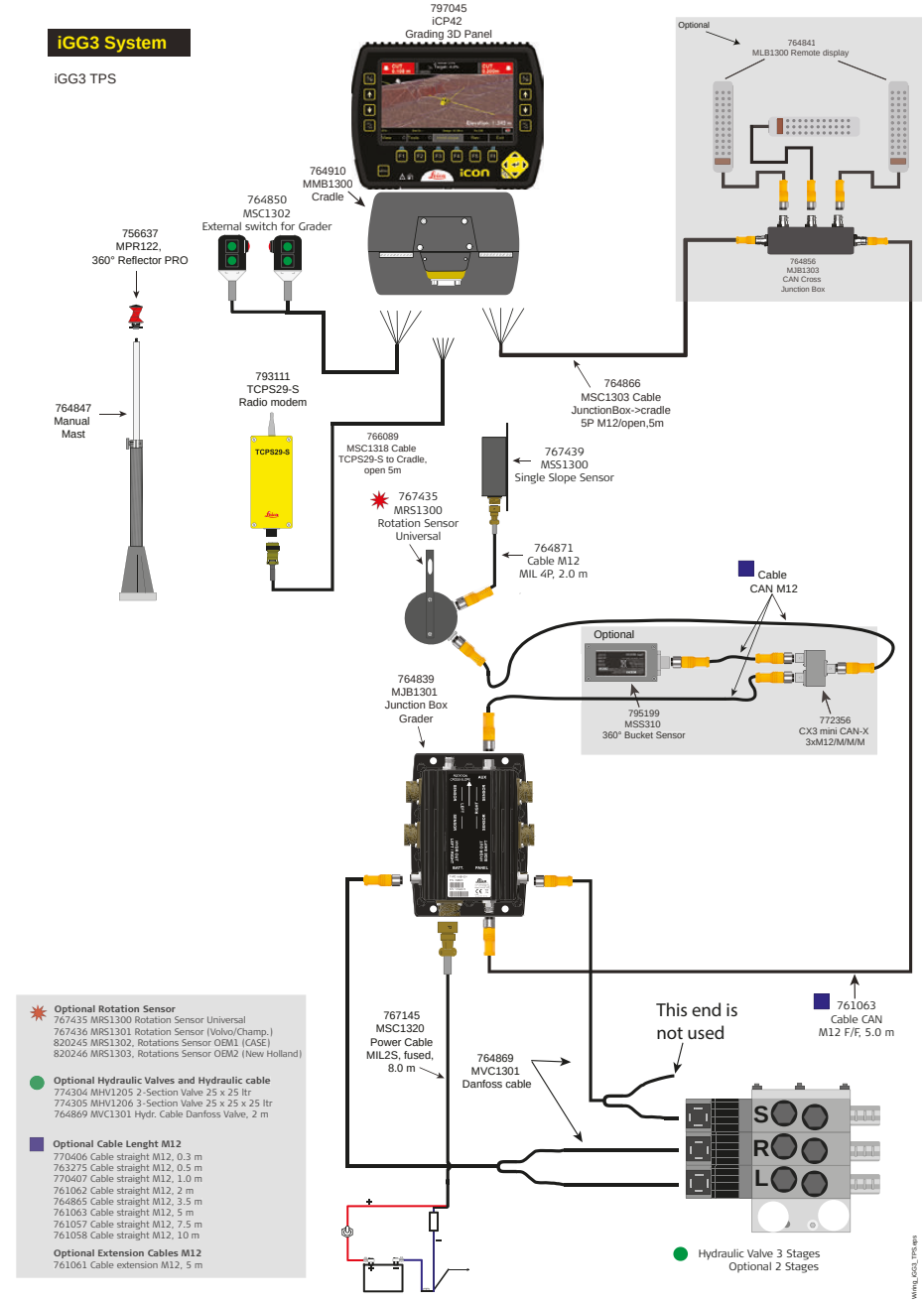
5.1 System Diagram Grader

2D System

Leica iCON grade 2D system for grader can be wired in various ways. Below you will find an example of one of the ways

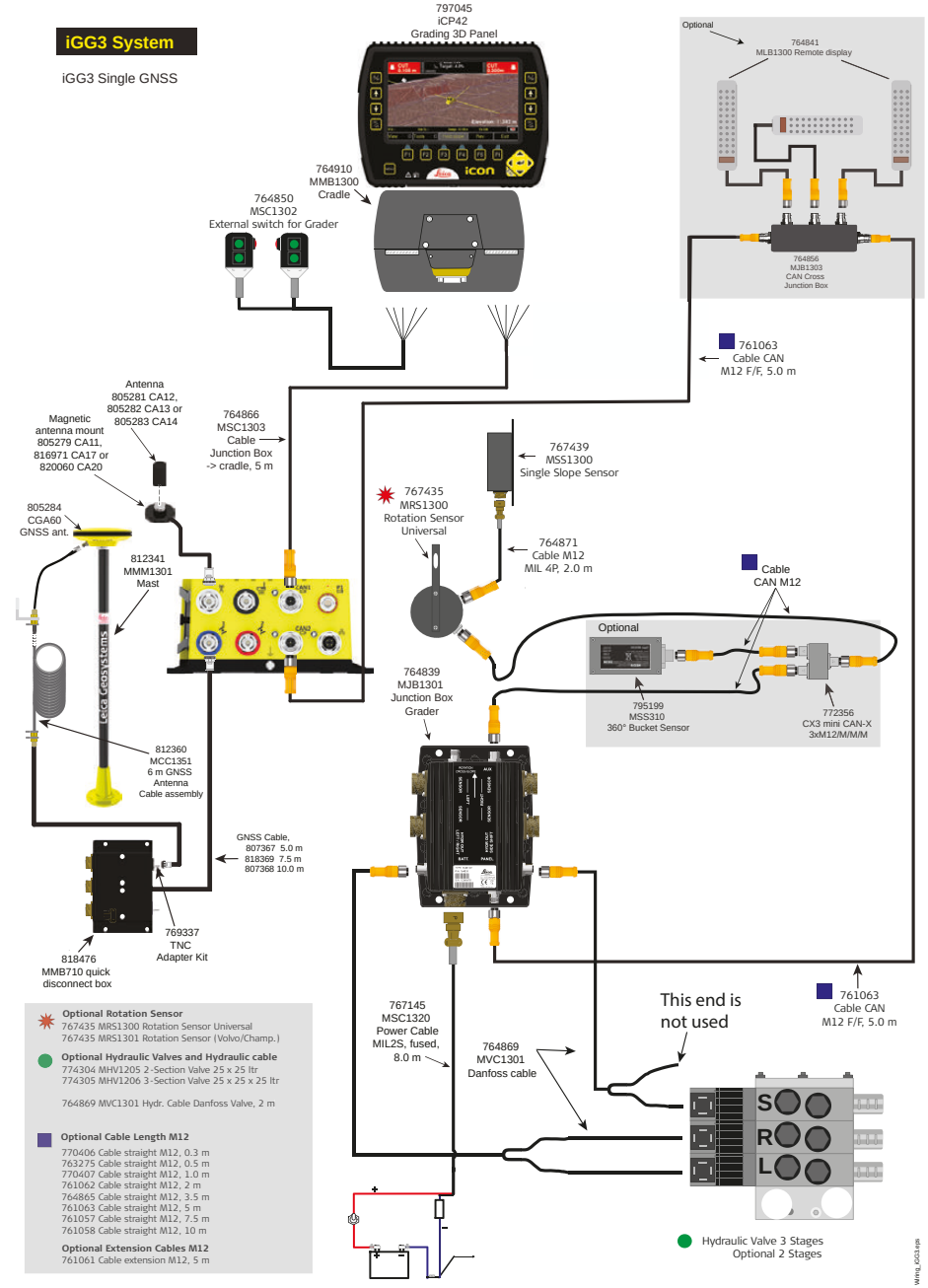


3D System with TPS Leica iCON grade 3D system with TPS for grader can be wired in various ways.Below you will find an example of one of the ways



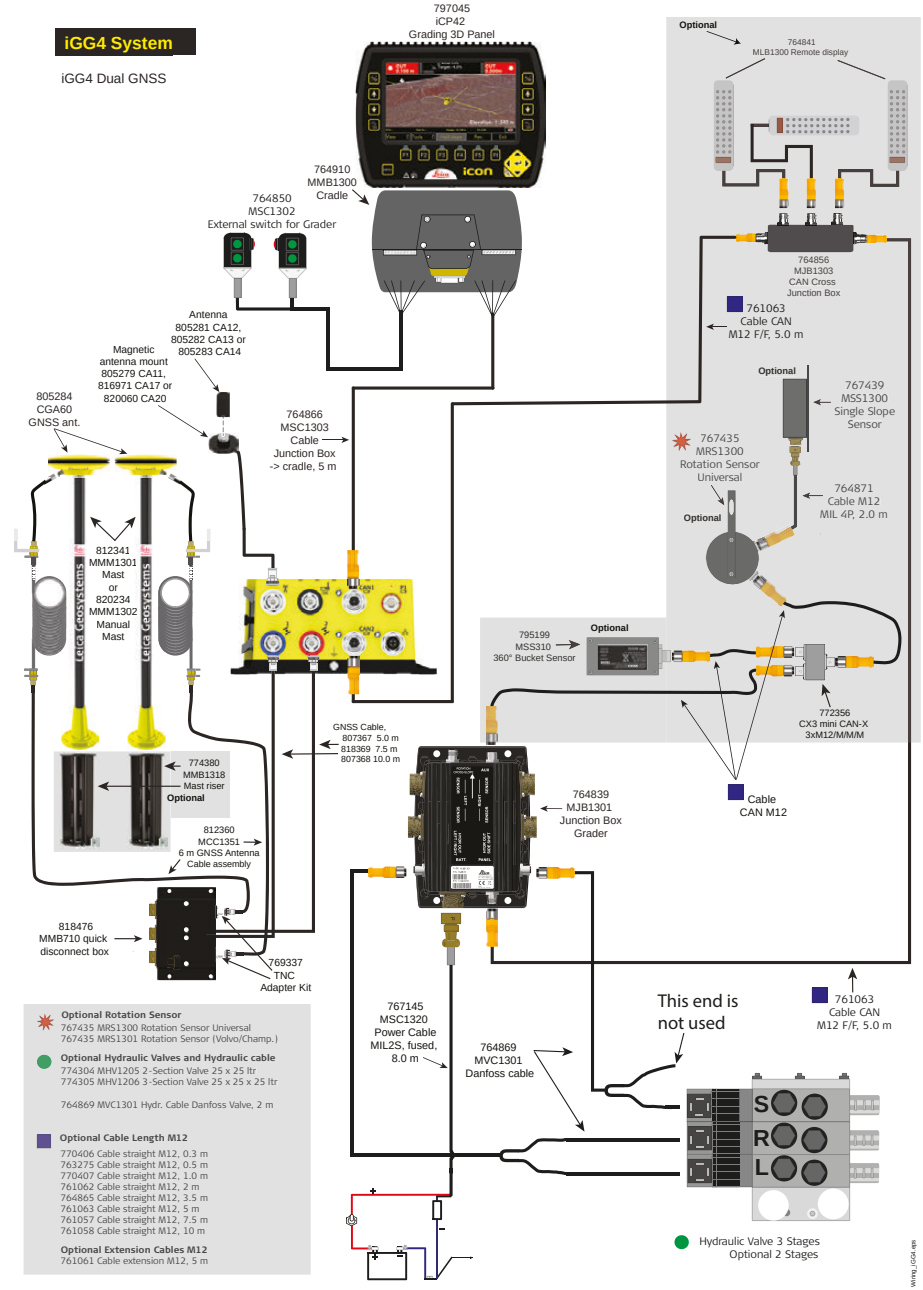
3D System with single GNSS

Leica iCON grade 3D system with single GNSS for grader can be wired in various ways. Below you will find an example of one of the ways:



3D System with Dual GNSS

Leica iCON grade 3D system with Dual GNSS for grader can be wired in various ways. Below you will find an example of one of the ways:



5.2 Junction Box Connectors

Junction Box MJB1301

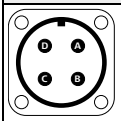
AUX connector, M12 5pin male

Picture	Pin	Output
	1	V_{CAN}
	2	
	3	GND
	4	
	5	

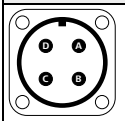
Cross and rotation sensor connector, M12 5pin male

Picture	Pin	Output
	1	V_{CAN}
	2	CAN high
	3	GND
	4	CAN low
	5	

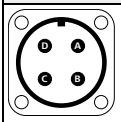
Left sensor connector, MIL 4pin male

Picture	Pin	Output
	A	V_{CAN}
	B	GND
	C	CAN low
	D	CAN high

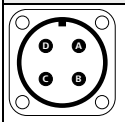
Right sensor connector, MIL 4pin male

Picture	Pin	Output
	A	V_{CAN}
	B	GND
	C	CAN low
	D	CAN high

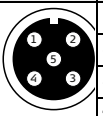
Left sensor connector, MIL 4pin male

Picture	Pin	Output
	A	V_{CAN}
	B	GND
	C	CAN low
	D	CAN high

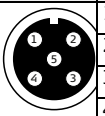
Right sensor connector, MIL 4pin male

Picture	Pin	Output
	A	V_{CAN}
	B	GND
	C	CAN low
	D	CAN high

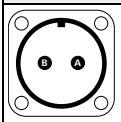
Left Hydraulic output, M12 5pin female

Picture	Pin	Output	Danfoss
	1	HYD_R_UP	R_U_S
	2	HYD_L_UP	L_U_S
	3	VOUT	U_{DC}
	4	HYD_L_DN	GND
	5	HUD_R_DN	GND

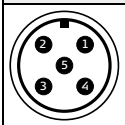
Right Hydraulic output, M12 5pin female

Picture	Pin	Output	Danfoss
	1	HYD_R_UP	L_U_S
	2	HYD_L_UP	R_U_S
	3	VOUT	U_{DC}
	4	HYD_L_DN	GND
	5	HUD_R_DN	GND

Power connector, MIL 2pin male

Picture	Pin	Output
	A	V_{BAT}
	B	GND

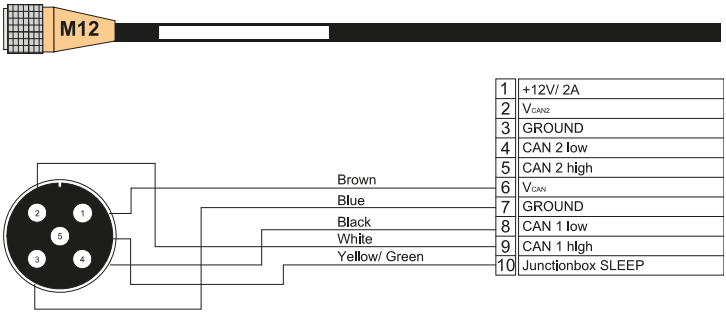
Control panel connector, M12 5pin male

Picture	Pin	Output
	1	V_{CAN}
	2	CAN high
	3	GND
	4	CAN low
	5	

5.3 Cables

Cradle wiring, basic system to cradle

Junctionbox



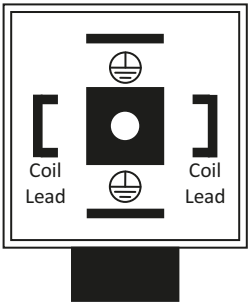
Cable Junction box to cradle, 5 pin M12, open end, 5m

External switch for Grader

Picture	Wire Colour	Signal	Pin for cradle connection
	Brown	$V_{out\ (SW)}$	14
	White	Right -	15
	Green	Right +	16
	Yellow	Right auto	17
	White	Left -	18
	Green	Left +	19
	Yellow	Left auto	20

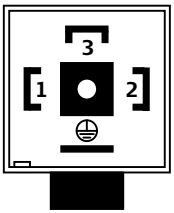
Hydraulic cables

Proportional Hydraulic cable for Junction box - UP/DOWN and SIDESHIFT

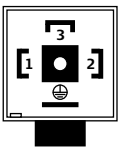


M12 5pin male			Hirschmann			
Pin	**Output**	**Color**	**A**	**B**	**C**	**D**
1	HYD_R_UP	Brown				Coil Lead
2	HYD_L_UP	White		Coil Lead		
3	VOUT	Blue	Coil Lead	Coil Lead	Coil Lead	Coil Lead
4	HYD_L_DN	Black	Coil Lead			
5	HYD_R_DN	Yellow/ Green			Coil Lead	

Danfoss Hirschmann proportional connector

Picture	Pin	Description
	1	U_{DC}
	2	U_S
	3	Error (not connected)
	GND	GND

Danfoss Hydraulic cable

M12 5pin male				Hirschmann		
Picture	**Pin**	**Color**	**Signal**	**Left**	**Right**	**Picture**
	1	Brown	R_U_S		2	
	2	White	L_U_S	2		
	3	Blue	U_{DC}	1	1	
	4	Black	L_GND	GND		
	5	Yellow/ Green	R_GND		GND	

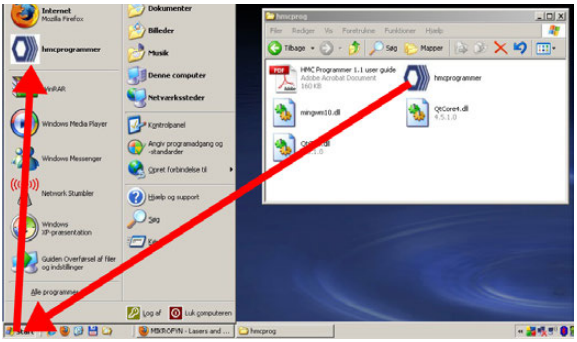
6 How to Upgrade the Firmware

Update

The latest firmware is available at our web site:
https://myworld.leica-geosystems.com
Follow the procedure below to upgrade the firmware:

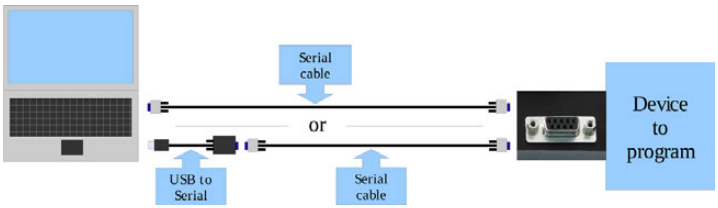
The programming is performed using a graphical upload program, called "hmcprogrammer.exe" together with three .dll files. They can be downloaded, packed together with a short user guide, in a .zip file from the home page together with the firmware update files.
The .zip file should be unpacked in a known folder on the PC, for example use c:\update\hmcprog\.

To make the use of the program easier in the future, create a link to the program on the START-menu. That is done by left-clicking on hmcprogrammer.exe and dragging it to the START-button while holding the mouse button down, then dropping it at the top of the START-menu.



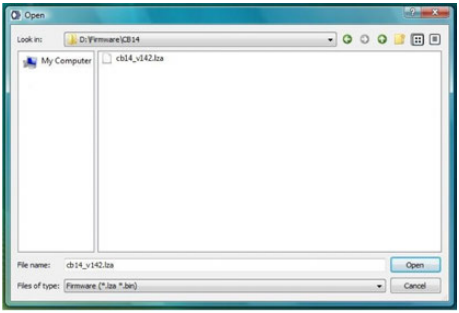
The HMCprogrammer software is compatible with Windows 2000, XP, Vista and Windows 7.
You do not need to place the firmware files together with the upload program. You can choose any folder you like.

1. Connect a serial cable to the female 9-pin D-sub connector on the back of the Control Panel or Cradle.



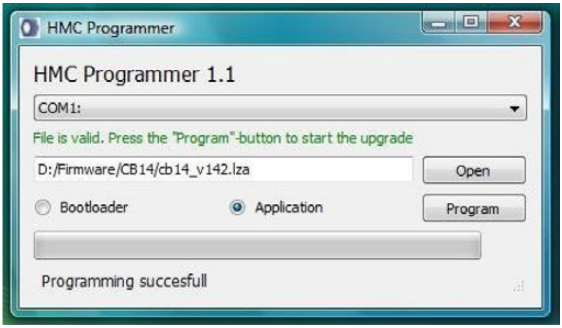
2. Start the program by clicking on the link you made above.
3. Select the COM-port using the drop-down box.
   The program will list all available COM ports.

4. Select the firmware file to upload by clicking on the "Open" button. A file selection dialogue box will appear.



5. Select "Application" unless you need to update the bootloader in a Cradle.

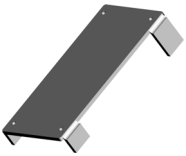
6. Start the programming process by clicking "Program".
   Note: If the device needs to have the system power turned on at this moment, "Power cycle device now..." will appear. Turn on system power, and the programming will start.
7. When the programming process is complete, "Programming successful" will appear. If not, an error message will be shown. Try again, perhaps using a different COM-port.

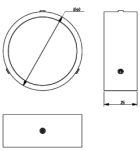

HMC Programmer
HMC Programmer 1.1
COM1:
File is valid. Press the "Program"-button to start the upgrade
D:/Firmware/CB14/cb14_v142.lza
Open
Bootloader
Application
Program
Programming succesfull

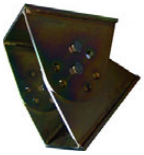
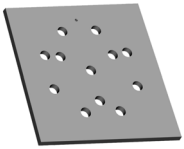
7 Spare Parts & Accessories

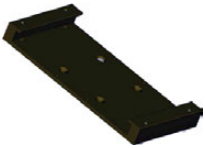
Overview

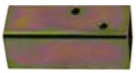
Picture	Article number	Description
	798669	iCON iCP32 Control Panel.
	797045	iCON iCP42 3D Control Panel.
	764910	MMB1300 Cradle
	764912	Bracket for Cradle RAM 1.5"
	785158	Glue-on Window Bracket for RAM mount 1" & 1.5".
	764839	MJB1301 Junction Box, Grader
	764856	CAN Cross Junction Box

Picture	Article number	Description
	761113	Quick Disconnect Bracket
	761116	Quick Disconnect Box
	769337	TNC Adapter Kit Quick Disc. Box/ Bracket
	761119	Bracket with legs for Junction Box
	761120	Bracket Junction Box, Flat
	823545	MLS720 Laser Receiver

Picture	Article number	Description
	764847	Manual mast with metric/feet 1.4m
	760863	MPM700 Power Mast 1.2m
	761998	Shock Mount for Power Mast
	812341	MMM1301, 1.4m Fixed Height Mast
	774382	Laser collar kit for Power Mast

Picture	Article number	Description
	777657	Snap hook 8*80mm stainless steel
	761126	Variable bracket weld-on for Mast
	762581	Mounting plate weld-on
	767154	Dust Caps for MIL Receptacle Connector
	767439	MSS1300 Single Slope Sensor
	767435	MRS1300 Rotation Sensor Universal
	767436	MRS1301 Rotation Sensor (Volvo/Champ.)

Picture	Article number	Description
	774308	Bracket for Rotation Sensor for Komatsu
	764916	Bracket for Junction box upside-down
	764917	Bracket f. junction box and hydr clamp-on
	761697	MJB300 CAN X 2xM12 1xMIL
	764841	MLB1300 Remote Display w. coil cable
	772356	CX3 mini CAN-X, 3xM12/M/M/M
	761702	Cable ties 4.8x200 mm, 100 pcs.
	765546	Carrying case for iCON 3D control panel.

Picture	Article number	Description
	765545	Carrying case for iCON 2D control panel
	761064	Mounting bracket Angle Sensor
	761065	Bracket for 360° Bucket sensor
	767145	MSC1320 Power Cable MIL2S, fused, 8.0 m
	764866	Cable Junction Box to cradle 5P M12/open, 5.0 m
	764849	MSC1301 External switch for Dozer
	764850	MSC1302 External switch for Grader
	761085	MCC700 Coiled Cable CAN, MIL 4P, 3.0 m

Picture	Article number	Description
	760870	PMSC704 Extension Cable MIL 4S/4P, 8.0 m
	760869	MSC703 Extension Cable MIL 4P/4S, 3.0 m
	764867	Extension CAN Y-Cable MIL 4S/4P, 5.0 m
	764868	MVC1300 Hydr. Cable Dual Pilot Valve, 1.0 m
	764869	MMVC1301 Hydr. Cable Danfoss Valve, 2.0 m
	764871	Cable M12 -MIL 4P, 2.0 m
	772760	Protected cable CAN M12 F/F, 2.0 m
	772761	Protected cable CAN M12 F/F, 3.5 m
	761056	Protected cable CAN M12 F/F, 5.0 m

Picture	Article number	Description
	770406	Cable CAN M12 F/F, 0.3 m
	763275	Cable CAN M12 F/F, 0.5 m
	770407	Cable CAN M12 F/F, 1.0 m
	761062	Cable CAN M12 F/F, 2.0 m
	764865	Cable CAN M12 F/F, 3.5 m
	761063	Cable CAN M12 F/F, 5.0 m
	761057	Cable CAN M12 F/F, 7.5 m
	761058	Cable CAN M12 F/F, 10 m
	761061	Extension cable CAN M12 M/F, 5.0 m
	772346	Connection cable CAN M12 M/M, 0.3 m

Picture	Article number	Description
	773130	Cable CAN M12 fused M/F, 0.3 m
	772359	Extension cable CAN M12 M/F, 0.3 m
	772355	Cable 6P MIL to CAN M12, 1.0 m
	777401	Cable for XJB-16 Junction Box
	761025	iCP41 Power cable 2P female

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Original text

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- when it has to be **right**

Leica Geosystems