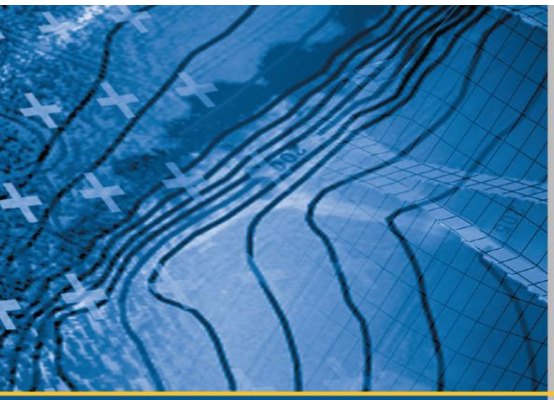

Installation and Operation Manual

Trimble® MX7

Trimble

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Trimble MX7
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It is the customer’s responsibility to ensure that there are adequate mounting facilities and the component layout has to be planned carefully. The customer must obtain the necessary approvals of their governing authority.

Trimble is not responsible for damage caused by improper installation or inadequate environmental conditions, or for obtaining any governing authority approvals.

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Document History

DATE	Version	Rev	Comments
2016-01-21	1.0	A	Release 1.0
2016-06-16	1.02	A	Including TMI 1.3
2016-06-28	1.10	A	Including FCC
2017-01-10	1.11	A	Bug-fixing; FAQ extension; GAMS TMI section
2017-01-13		B	Editorial changes
2018-11-16		C	Adding MX7 HW 3.0 (T001545)
2019-03-25		D	Change in Chapter Roof Rack
2019-09-17		E	Changes regarding of new Wifi-USB-Adapter

Table of Contents

Chapter 1 General

Manual Contents

This document is intended to help the user to install, set-up and use the Trimble MX7 Mobile Imaging System to record data. It provides a detailed explanation of the components used with the Trimble MX7 System.

Legend

General Warnings:	These boxes contain very important information.

Electrical Warnings:	These boxes contain very important information concerning electrical power.

Note:	These boxes contain hints for further information.

Abbreviations

The following table explains some of the acronyms and expressions used in this manual.

Abbreviation	Description
#SAT	The number of GNSS satellites being received by the GNSS receiver
Ah	Battery rating (**A**mpere **h**ours)
Applanix®	Registered trademark of Applanix Corporation
DMI	**D**istance **M**easuring **I**ndicator
fps	**F**rames **p**er **S**econd
Google Chrome	Registered trademark of Google Inc.
GAMS	**G**NSS **A**zimuth **M**easurement **S**ystem
Galileo	European GNSS system
GLONASS	Russian GNSS system
GNSS	**G**lobal **N**avigation **S**atellite **S**ystem
GPS	**G**lobal **P**ositioning **S**ystem
IMU	**I**nertial **M**easurement **U**nit
INS	**I**nertial **N**avigation **S**ystem (IMU with GNSS)
IP	**I**nternet **P**rotocol
L1/L2 GNSS Antenna	Dual frequency antenna for reception of the GNSS signal
LED	**L**ight **E**mitting **D**iode
PWR	**Pow**e**r**
RMS	**R**oot **M**ean **S**quare
SSD	**S**olid **S**tate **D**isk
UTC	**U**niversal **T**ime **C**oordinated
VDC	**V**olts **D**irect **C**urrent

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Trimble Inc.
935 Stewart Drive
Sunnyvale, California 94085
United States of America

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For purposes of this warranty the following definitions shall apply: (1) “Fix(es)” means an error correction or other update created to fix a previous software version that does not substantially conform to its Trimble specifications; (2) “Minor Update” occurs when enhancements are made to current features in a software program; and (3) “Major Upgrade” occurs when significant new features are added to software, or when a new product containing new features replaces the further development of a current product line. Trimble reserves the right to determine, in its sole discretion, what constitutes a Fix, Minor Update, or Major Upgrade.

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– proof of purchase
– a copy of this Trimble warranty
– a description of the nonconforming Product including the model number
– an explanation of the problem

The customer service representative may need additional information from you depending on the nature of the problem. Any expenses incurred in the making of a claim under this warranty will be borne by you.

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The Australian Consumer Law

Our goods come with guarantees that cannot be excluded under the Australian Consumer Law. You are entitled to a replacement or refund for a major failure and for compensation for any other reasonably foreseeable loss or damage. You are also entitled to have the goods repaired or replaced if the goods fail to be of acceptable quality and the failure does not amount to a major failure.

Trimble's warranty (set out above) is in addition to any mandatory rights and remedies that you may have under the Australian Consumer Law.

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Chapter 2 Safety Instructions and General

The Trimble MX7 system was developed for acquisition of 360° images in mobile mapping applications.

This system is designed for industrial usage only. Any other usage can be dangerous and is strictly forbidden. The system must be only used by well-trained persons.

Any unauthorized modification, to include, but not limited to software modifications through any source, can cause personal injury or damage to the system and renders all guarantees null and void.

Electronics

The system **must never** be connected to 110, 230, or 400 VAC! Opening the instrument is unacceptable and must therefore being avoided at all costs.

Electrostatics can destroy the system.

Mechanics

All mechanical parts must be checked before each mission.

Especially if the system will be installed each time new on a vehicle, the fixations (e.g. screws and cables) have to be checked before and after each mission.

During non-operating and storage the Sensor Head has to be protected against environmental conditions.

Usage

Maximum speed of vehicle with installed MX7 system must be lower than 110 km/h (68 mph).

Driver has to be aware of the additional total vehicle height, caused by the Trimble MX7!

The MX7 is designed to be used only on vehicles with rubber wheels on paved surfaces.

The driver is not allowed to operate the system while driving. It is recommended that a second person is dedicated to operate the system.

Chapter 3 Compliance Information

EUROPE

EC Compliance

CE

Trimble declares that the Trimble MX7 System and associated accessories comply with the applicable directives, standards and regulations.

WARNING: Trimble MX7 Equipment is Class A
This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures

WEEE

Notice to our European Customers

For product recycling instructions and more information, please go to:

https://www.trimble.com/Corporate/Environmental_Compliance.aspx

Recycling in Europe: To recycle Trimble® batteries and WEEE (Waste Electrical and Electronic Equipment, products that run on electrical power.),
Call +31 497 53 24 21 or mail a request for recycling instructions to:

Trimble Europe BV
c/o Menlo Worldwide Logistics
Meerheide 45
5521 DZ Eersel, NL

USA

FCC Statement

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference.

(2) This device must accept any interference received, including interference that may cause undesired operation.

NOTE: Trimble MX7 Equipment is Class A

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

In order to maintain compliance with FCC regulations shielded cables must be used with this equipment. Operation with non-approved equipment or unshielded cables is likely to result in interference to radio & television reception.

CANADA

ICES Statement

NOTE: Trimble MX7 Equipment is Class A

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

Chapter 4 Product Specification

Technical Parameters

Electrical

Parameter		Value
Input Power		12 - 24 VDC
Current	During startup During operation[1]	Up to 10 A @ 12 V (120 W) 8 A @ 12 V (96 W)

Mechanical

Parameter	Value
Weight of Sensor Head	11.3 kg (24.9 lb)
Weight of Quick Release Plate	1.0 kg (2.2 lb)
Weight of Power-Box	3.0 kg (6.6 lb)
Weight of Cables	0.6 kg (1.3 lb)
Dimensions	See appendix

Environmental

Parameter		Value
Temperature	operating[2] storage	0 °C to +35 °C (32 °F to 95 °F) -10 °C to +60 °C (14 °F to 140 °F)
Relative Humidity[3]	operating storage	20 % to 80 % 20 % to 95 %
IP Rating		IP65 (MX7 Sensor Head) IP20 (MX7 Power Box)
Maximum speed of vehicle		110 km/h (68 mph)

[1] Depending on temperature

[2] Not exposed to direct sun without driving > 10 km/h (6 mph)

[3] Non-condensing

Camera Performance Measurement

The camera system included inside the Trimble MX7 Sensor Head is built of six single cameras which produce a spherical image.

Some data about the performance of the camera are shown in the table below.

Parameter	Value
Image resolution (total)	30 megapixel
Image format	PGR (compressed 12 bit)
Shutter system	Global shutter
Frames per second	9fps by full resolution
Focus distance	About 2.0 m Sharpness from about 0.6 m to infinity
Field of view	90% of full sphere
Number of single cameras	6
Image resolution of single cameras	5 Megapixel
A/D converter	12 bit

Use a vehicle with none bright color to avoid exposure artefacts.

POS System Performance

The POS System is composed of a Trimble POS-Inertial System in combination with an IMU and GNSS L1/L2 Receiver.

Assuming the best operation conditions regarding satellite configuration, atmospheric conditions and other environmental effects the following performance with DMI option can be reached.

Table 1: Ideal POS System Performance

Terrestrial Applications	**No GNSS outages**		**60 second GNSS outage**	
	SPS	**Post-Processed[4]**	**SPS**	**Post-Processed[4]**
Position [m]	1.5 – 3.0	0.02 – 0.05	2.0 – 5.0	0.2 – 0.8
Velocity [m/s]	0.050	0.015	2.0 – 3.0	0.2 – 0.8
Roll [deg]	0.040	0.025	0.09	0.05
Pitch [deg]	0.040	0.025	0.09	0.05
True Heading[5] [deg]	0.250	0.080	0.35	0.20

[4] Calculated with POSPac MMS

[5] Typical mission profile, max RMS error

Chapter 5 System Components

Introduction

The Trimble MX7 is a compact, rugged, portable and easy to use mobile mapping system, with a spherical camera, GNSS receiver, and IMU sensor.

The complete Trimble MX7 System is made up of the following components, which are explained below.

- System Components
  - Sensor Head
  - Quick Release Plate
  - Power Box
  - WLAN – USB Stick
  - Cabling
  - Tools
  - Transport Case

- Optional Components
  - Roof Rack with Mounting Plate (optional)
  - Distance Measuring Indicator (optional)
  - GAMS (optional)

The optional components have their own manual and will be not fully explained in this document.

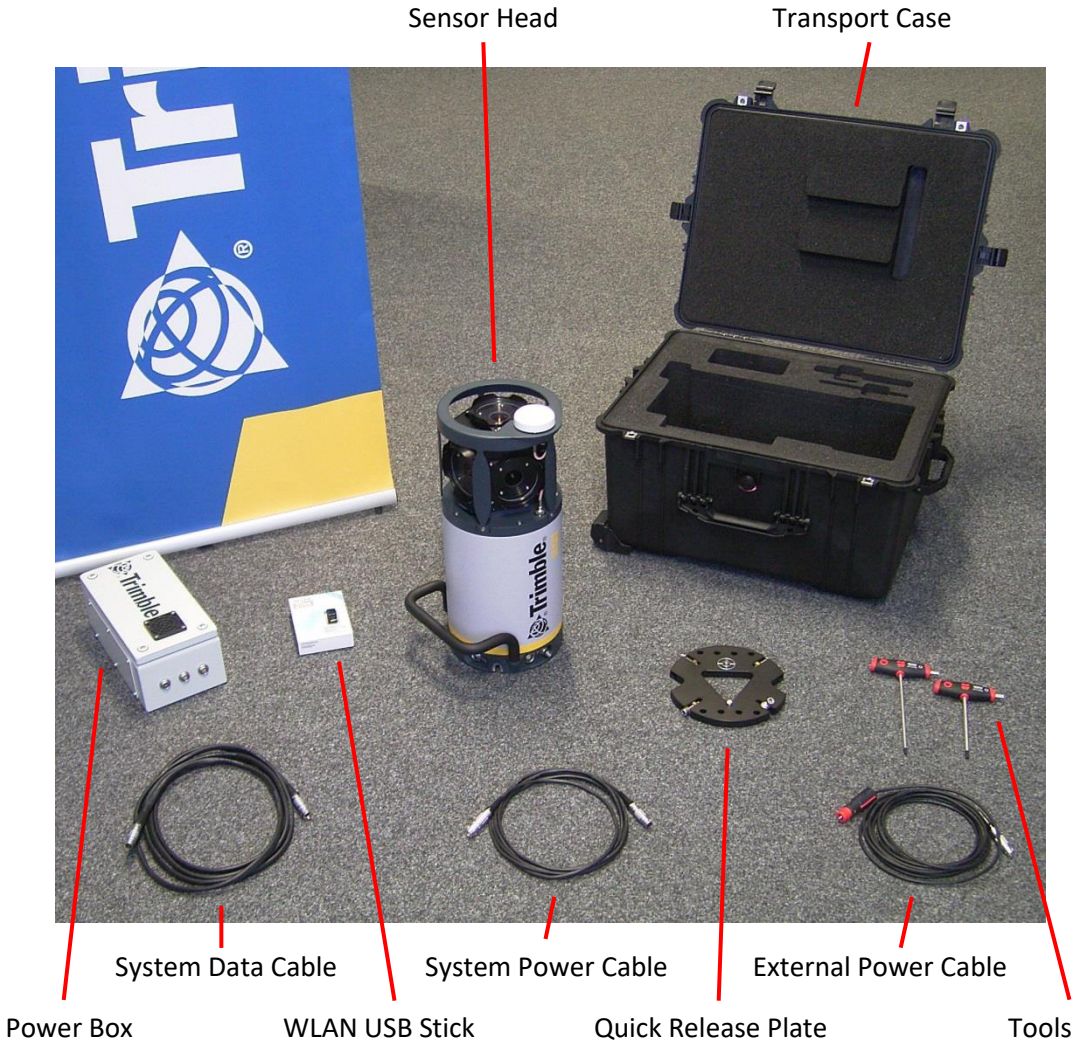


Figure 1: MX7 # System Components

MX7 Sensor Head

Figure 2: MX7 # Sensor Head

The main part of the instrument is the Sensor Head. The Sensor Head housing has the shape of a cylinder and includes the important components for capturing data.

The Sensor Head is shown in Figure 2. It can be easily carried by the handle. All connectors are located at the bottom plate. The connectors are sealed against dust and water.

If one connector is not used and a cover exist for the connector, the cover has to be installed to protect the connector.

Internal Components

Integrated inside the cylinder there is the POS system, the control and capture equipment and some further electronics including the internal data storage unit.

Camera Unit

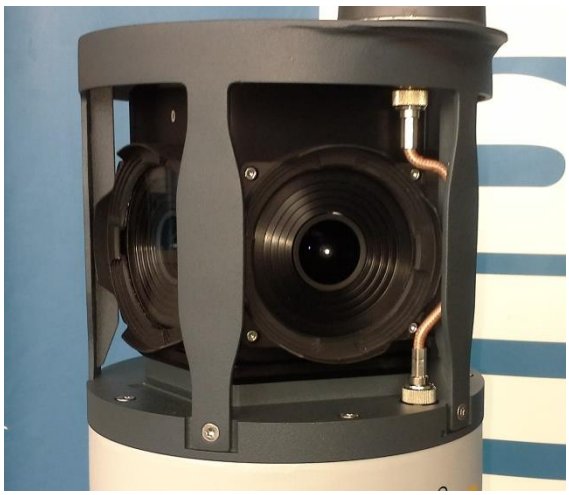


Figure 3: Sensor Head # Camera Unit

The camera system is based on a spherical camera system. It is built of six single cameras. Five cameras are located on one plane so that a panoramic view can be captured. The sixth camera is located on the top to complete a 90% spherical view. The camera unit is covered by a cage which secures the lens glasses without having influence on the optical performance of the camera system.

GNSS Antenna

The GNSS Antenna is located on top of the MX7 Sensor Head. The location is optimized for collecting satellite data as well as not to influence the optical performance of the camera system.

Figure 4: Sensor Head # GNSS Antenna

MX7 Connectors

The bottom plate of the Sensor Head includes five connector sockets.

The Power socket [PWR] and the Data socket [DATA] (see Figure 5) is used to connect Power Box and the Sensor Head with the System Power Cable and the System Data Cable.

Figure 5: Sensor Head # Power and Data Connectors

The USB3.0 socket [USB] (see Figure 6) will be used for downloading the captured mission data. If no device is connected, the protection cover has to be closed.

Figure 6: Sensor Head # USB3.0 Connector (opened and covered)

The last two sockets are used to connect optional components (see Figure 7).

For connecting the DMI to the Trimble MX7 System the EXT socket is used. For connecting the second GNSS Antenna for the POS GAMS functionality the ANT socket is used.

Figure 7: Sensor Head # DMI and second GAMS Antenna Connectors

Quick Release Plate

The Quick Release Plate (QRP) is the interface to mount the Sensor Head on the used vehicle. With the eight delivered screws (M6x12) and eight toothed washers the plate will be fixed to the vehicle.

With the Four-Screw-Mechanism the Sensor Head can be installed very easy onto this Quick Release Plate.

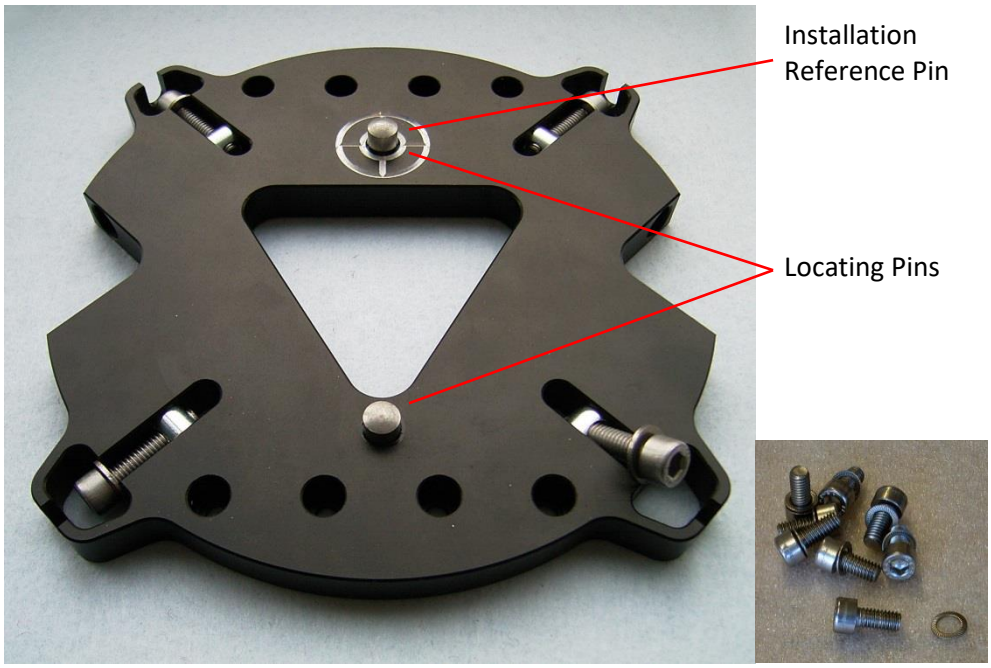


Figure 8: MX7 # Quick Release Plate

The Quick Release Plate has two locating pins which make sure that the Sensor Head can be installed easily in the right way.

Further the Installation Reference Pin is located on the Quick Release Plate. The Installation Reference Pin is used to determine the sensor mounting height as well as the lever arms for optional devices like DMI.

Power Box

The Power Box is the interface between the power of the vehicle provided by the cigarette lighter and the Trimble MX7 System. It must be located inside the vehicle. It also provides two USB2.0 Connectors used for a WIFI stick and as USB interface.

Figure 9: MX7 # Power Box

On the rear side there are three sockets:

- Power In (12 V)
- Power Out (24 V)
- Data

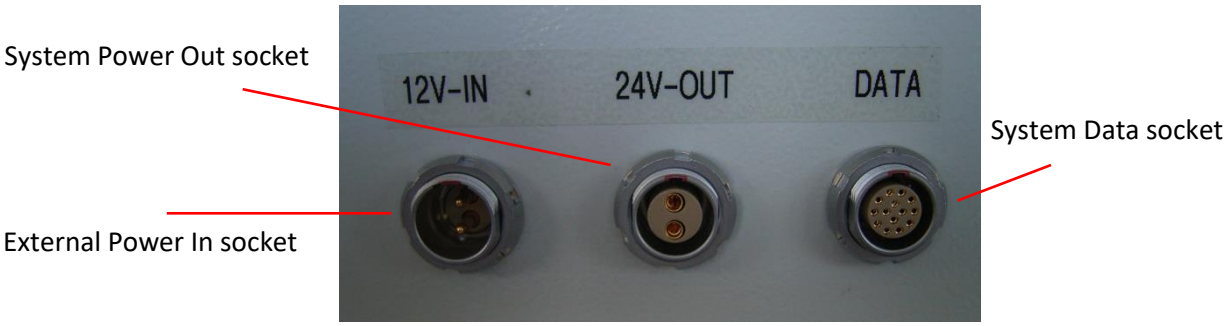


Figure 10: Power Box # Power and Data Connectors

On the long side there are two USB2.0 ports. Either of theses USB ports can be used for the WIFI Stick for communication with the tablet.

Figure 11: Power Box # USB2.0 Ports

On the front side is the Power Button (see Figure 12). By switching on the system, the BUTTON-LED light green when input voltage is provided. The green System Status LED above is blinking with about 1 Hz, when the internal control unit has booted.

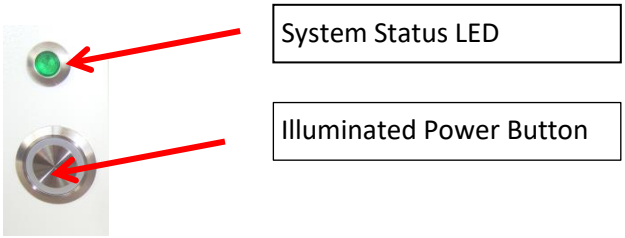


Figure 12: Power Box # ON-OFF Button

The Power Box can become warm. Ensure that all ventilation openings are free for air flow.

WLAN – USB Stick

The communication between the tablet and the Sensor Head will occur over WLAN. Therefore an access point is created by the Trimble MX7 System using a USB-WLAN-Stick (LM Technologies).

The USB stick must be plugged into one of the USB2.0 sockets on the Power Box. Using this USB-WLAN-Stick the Trimble MX7 System creates an access point allowing to connect to the Trimble MX7 System.

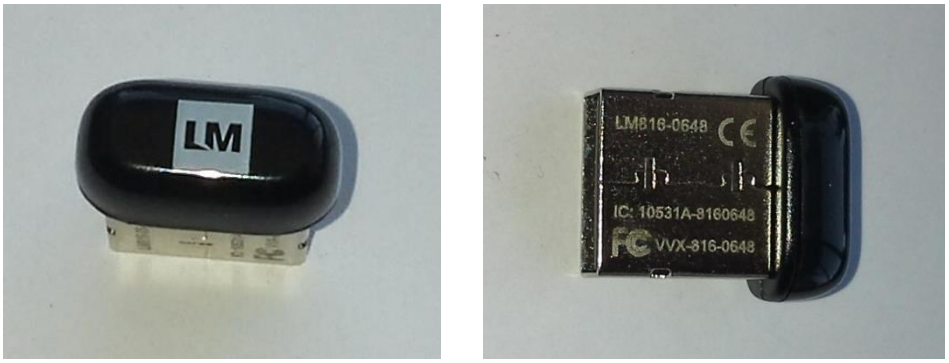


Figure 13: MX7 # USB-WLAN-Stick (WiFi Stick)

Only this WiFi Stick is supported. Other types of WiFi Sticks may not work correctly!

Ethernet Adapter

Optional is it possible to use an USB - Ethernet Adapter to connect to the Trimble MX7 System over LAN.

The Ethernet Adapter must be plugged into one of the USB2.0 sockets on the Power Box. Using this Network Adapter allows LAN connection to the Trimble MX7 System.

Only 'Manhattan USB 2.0 Ethernet Adapter' is supported

Figure 14: MX7 # Example for an USB 2.0 Ethernet Adapter

Cabling

Three cables are included with the Trimble MX7 System to handle the power and data. All cables have unique connectors which fit only to one socket.

Table 2: List of Cables

Name	Connection A	Connection B
System Power Cable	Power Box *Internal Power socket*	Sensor Head *Power socket*
System Data Cable	Power Box *Internal Data socket*	Sensor Head *Data socket*
External Power Cable (PWR-IN)	External Power Supply *Connector for vehicles cigarette lighter*	Power Box *External Power socket*

The System Power Cable provides the System Head with 24 VDC from the Power Box.

Figure 15: Cable # System Power Cable

The System Data Cable provides the connection of the Sensor Head and the WLAN-USB-Stick as well as a second USB device.

Figure 16: Cable # System Data Cable

The external power cable is prepared for use with the vehicles cigarette lighter. Ensure that the used cigarette lighter provides 10A @ 12 VDC. In case of issues with input power, please have a look at Chapter 9 “Maintenance, FAQ and Support”.

Figure 17: Cable # External Power Cable

Storage and Transportation

The Trimble MX7 System will be delivered in two special transportation cases, one for the Sensor Head and one for the Power Box.

For the Trimble MX7 System the transport cases should be used for storage and transportation of the system.

Ensure that the temperature and the humidity are within the specified range during storage and transportation.

The transportation cases provide only mechanical protection.

All components of the Trimble MX7 System are packaged and included in the transportation case for the Sensor Head (see Figure 18) with the exception of the Power Box. The Power Box has its own transportation case (see Figure 19).

Figure 18: MX7 # Storage and Transportation Box (Sensor Head)

Figure 19: MX7 # Storage and Transportation Box (Power Box)

Roof Rack (optional)

The optional MX7 Roof Rack of the Trimble MX7 System consists of one beam with four beam mounts and one Mounting Plate QRP MX7.

Please read carefully the further information in Chapter 8, Appendix:
Section “MX7 QRP Mounting” and “MX7 Roof Rack Mounting”

Please read and follow carefully the Section “Description to tighten screws” in Chapter 6, Installation.

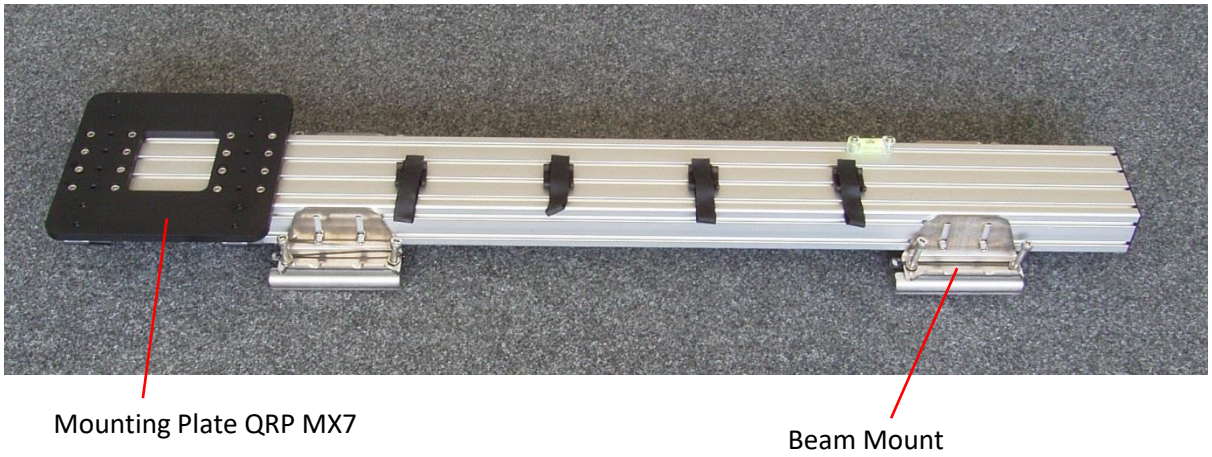


Figure 20: MX7 # Roof Rack

The Mounting Plate QRP MX7 is mounted by four brackets and several screws on the beam. Its function is to provide a secured mounting of the Quick Release Plate.

The four beam mounts will be used to assemble the MX7 Roof Rack to the vehicle roof bars. The beam mounts can also be moved and assembled on different positions on the beam.

The beam mounts are equipped with additional lockplates (Pos. 7), make sure they are insert like shown in the following picture.

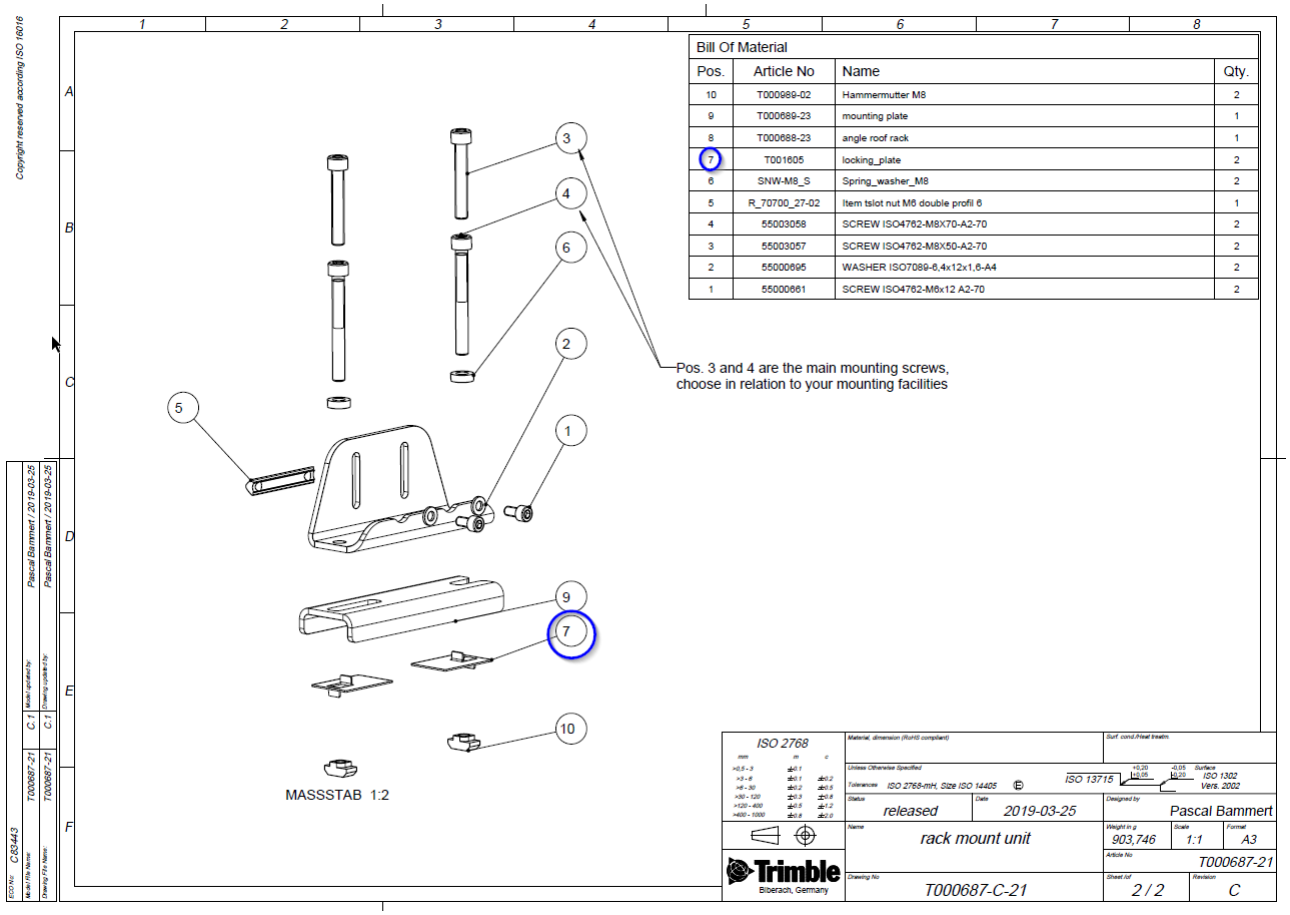


Figure 21: Locking Plates Pos 7 in Mounting Unit

The position of the Mounting Plate QRP MX7 is restricted as well as the positions of the beam mounts.

For the beam mounts the distance A (see Figure 22) between the centers of two beam mounts must be bigger or equal to 650 mm.

The Mounting Plate QRP MX7 can be mounted anywhere in between the beam mounts. If the position is outside the beam mounts like in Figure 22 than the distance B (see Figure 22) between the center of the beam mount and the inner side plane of the Mounting Plate QRP MX7 must be lower or equal to 70 mm.

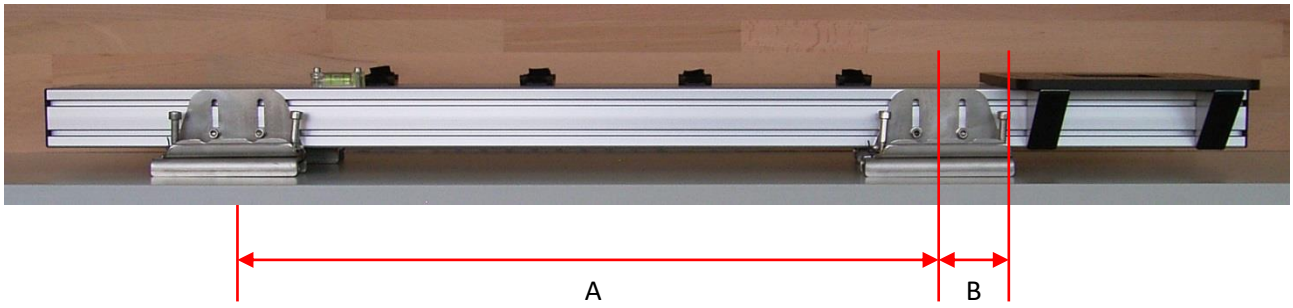


Figure 22: Roof Rack # Restricted mounting values for MX7 Roof Rack

The Quick Release Plate will be fixed on the Mounting Plate QRP MX7 by the eight screws and washers belonging to the MX7 Quick Release Plate. The torque for these screws must be 12 Nm.

For mounting the QRP please carefully ensure that all the specification about “Description to tighten screws” in Chapter 6, Installation is met.

Use all the provided special washers to ensure nothing can get loose.

The user is responsible that everything is mounted properly and the instructions/specifications of the used roof bars and roof rails are met.

Distance Measuring Indicator (optional)

To improve the measurement accuracy of the Trimble MX7 System an additional sensor for measuring the distance driven by the vehicle can be ordered.
For more information about the Distance Measuring Indicator use the manual 'Trimble MX7-DMI Installation & Operation Manual'.

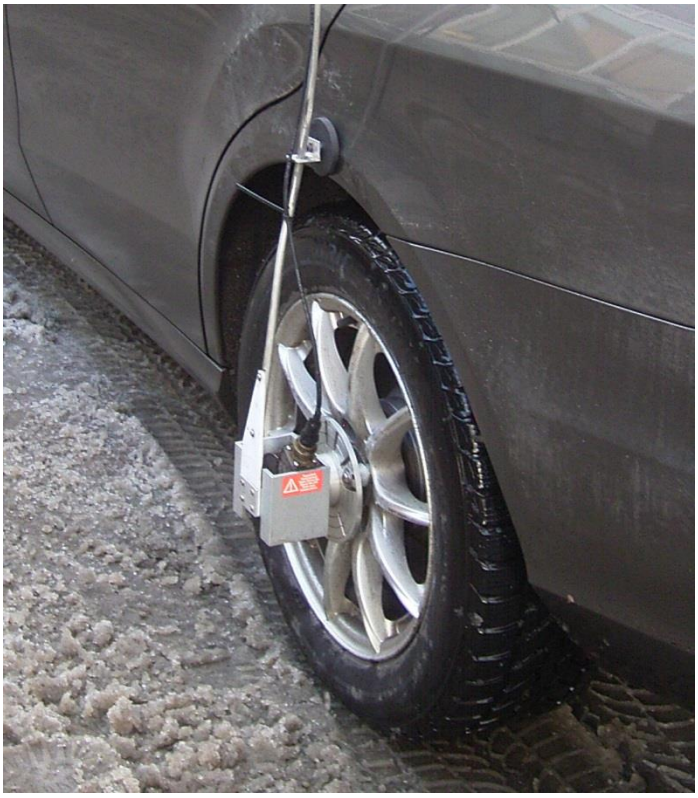


Figure 23: MX7 # DMI

GAMS (optional)

The Trimble “Trimble MX7 GAMS Antenna Kit” is an additional mechanical assembly group to use GAMS functionality (GNSS Azimuth Measurement System) with the Trimble MX systems.

For more information about the Distance Measuring Indicator use the manual ‘Trimble® GAMS Antenna Kit Installation & Operation Manual’.

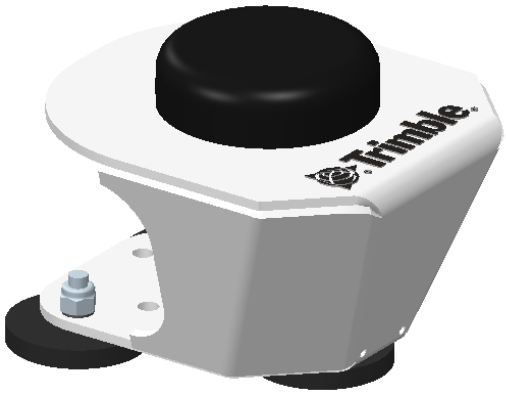


Figure 24: MX7 # GAMS antenna

Chapter 6 Installation

Safety Instructions

Operation and service of the system may only be performed by properly trained personnel.

It is the responsibility of the customer to ensure that there are adequate mounting facilities and that the component layout has been planned carefully. If necessary, the customer must obtain the necessary approvals of their local authority for the installation of the Trimble MX7 system or any of its components.

All screws need to be tighten with the correct torque.

Avoid to work over head. Use tools to get a better position for installation.

Switch off the vehicle engine during MX7 System installation.

Switch off any electric vehicle power during MX7 System installation

Description to tighten screws

Stand-alone screws:

Stand-alone screws have to tighten with a slow and continuously movement of the tool. Avoid any jerking movements. The torque value must be strictly complying with the given value in the manual.

Cluster of screws:

The screws in a cluster have to tighten crosswise in minimum three steps, until the given torque value has been reached.

- Step 1: ~33% of the end torque value,
- Step 2: ~66% of the end torque value,
- Step 3: 100% of the end torque value.

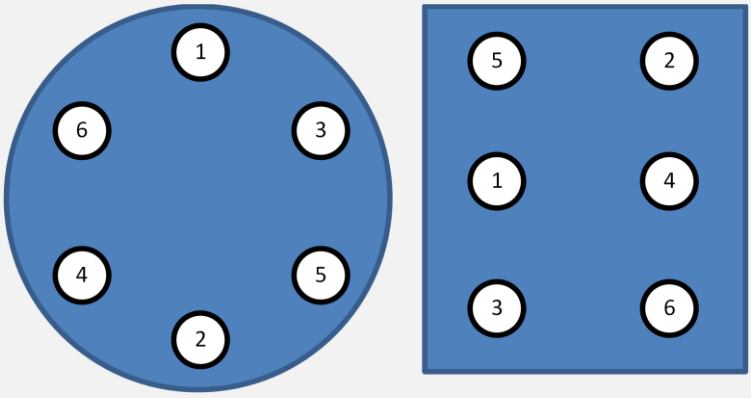
The order to tighten the screws is shown in the image. Always the screw sitting opposite of the last screw needs to be tightened next. After the first pair has been tigtened the next one close to the first one can be tightened and so one. See example below.

The handling of a single screw inside one step is the same as described for 'Stand-alone Screws'.

Example cluster screws:

A plate (blue circle or rectangle) mounted with 6 screws (white circles) will be tightened with a torque value of 14 Nm

Step 1: Tighten with torque 5 Nm
Step 2: Tighten with torque 10 Nm
Step 3: Tighten with torque 14 Nm
Sequence per step:



General:

After all screws have tightened with the end torque value, the right torque value has to be checked by a second person.

Installation of Quick Release Plate

Assembling

It is no assembling of the Quick Release Plate necessary, because all parts are preassembled.

Mounting

The Quick Release Plate has to be installed on the vehicle top. For mounting the plate includes eight holes and the Trimble MX7 System includes eight screws (M6x12) and eight toothed washer (for M6).

Fix the Quick Release Plate using all eight screw joints. Depends on your construction the screws have to be tightening with the correct torque. For example to mount the Quick Release Plate on the Trimble MX7 Roof Rack the torque is 12 Nm. All screw joints must be secured against loss.

Any screws must be tightening with the correct torque for the used construction. Be aware of the right workflow to tighten screws (see Safety Instructions of Installation Chapter).
Additionally, the mounting screws must be secured with thread locker.

The top plane with the Installation Reference Pin must be parallel orientated to the road surface. Best way is to park the vehicle on a flat road and check the orientation of the Quick Release Plate with water level. If necessary correct the orientation.

The Installation Reference Pin of the Quick Release Plate must be in the back of the vehicle (see driving direction in Figure 25).

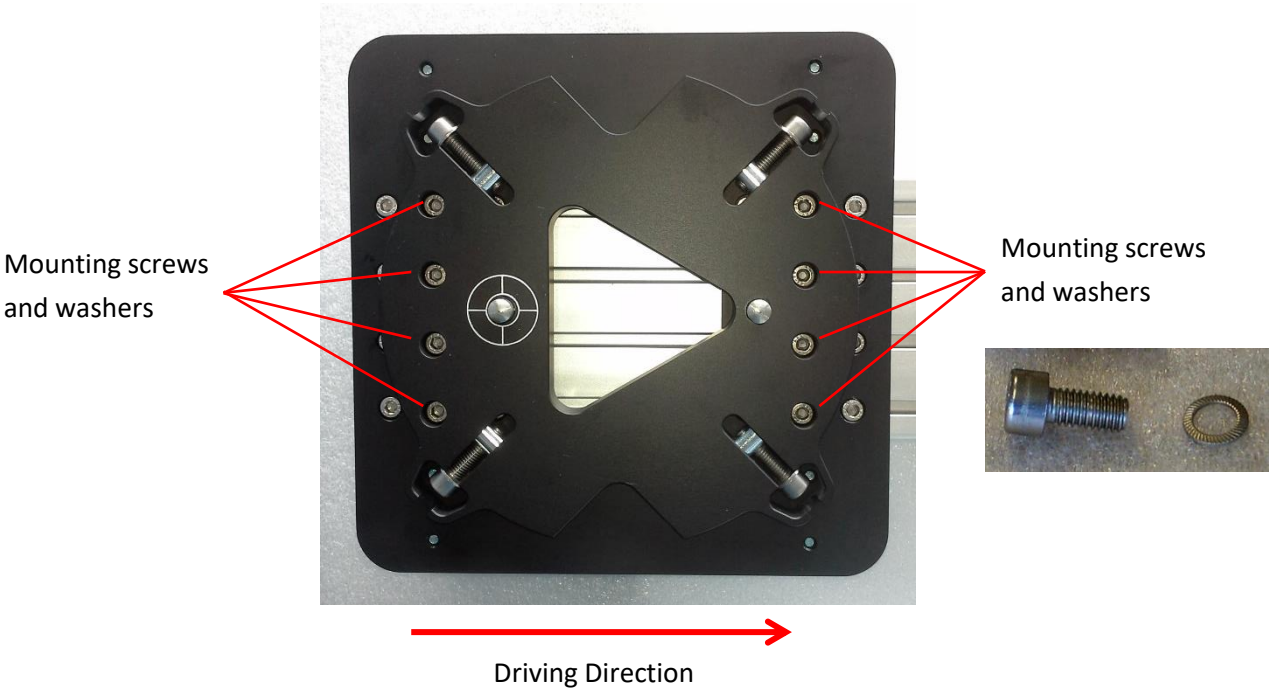


Figure 25: QRP # Mounting of Quick Release Plate (Example using the Trimble MX7 Roof Rack)

If mounting screws with different length are necessary, exchange the delivered screws only with screws of the same type (Size: M6, Material: Stainless Steel A2, Strength: 70).

To exchange screws or washers for the used construction, use the same type of material.

Trimble recommends the MX7 Roof Rack for installation of the Quick Release Plate.

Installation of Sensor Head

The installation of the Sensor Head should be done by two persons.

Mounting

Lift the Sensor Head and place it onto the Quick Release Plate and place it in onto the Quick Release Plate (see Figure 8) that the two pins fit into the respective pin holes of the sensor Head.

Avoid to work over head. Use tools to get an adequate position for installation.

The Sensor Head should be oriented in a way that the handle of the Sensor Head is on the Installation Reference Pin side of the Quick Release Plate. The handle has to face to the rear of the vehicle (see Figure 26).

The two pins of the Quick Release Plate allow only one correct mounting position for the Sensor Head.

Figure 26: MX7 # Sensor Head installed on the MX7 Roof Rack

Use the four screws integrated in the Quick Release Plate to fix the Sensor Head to the Quick Release Plate. Therefore, loosen the screws and swing them into the Sensor Head and tighten them that the Sensor Head is well fixed (see Figure 27). The torque of these screws must be 14 Nm. These four screws must be checked during operation from time to time.

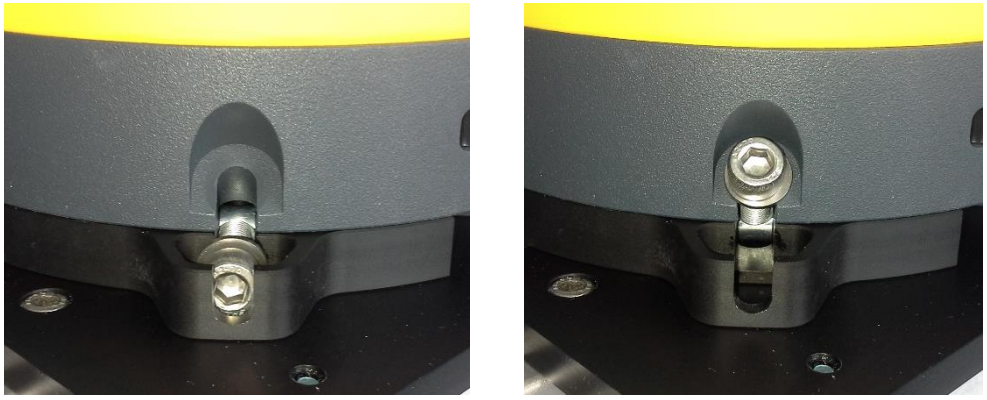


Figure 27: QRP # Mounting screws to fix the Sensor Head (loosen and tighten)

Any screws must be tightening with the correct torque for the used construction. Be aware of the right workflow to tighten screws (see Safety Instructions of Installation Chapter).

The screws which fix the Sensor Head onto the Quick Release Plate must be checked during operation from time to time.

If the Sensor Head is not mounted to the Quick Release Plate the four screws of the Quick Release Plate have to tighten in the position shown in the left image of Figure 27.

The screws of the Quick Release Plate can be lost if not tightened. Tighten these screws also if the Sensor Head is not installed.
Be aware of the right workflow to tighten screws (see Safety Instructions of Installation Chapter).

Connecting

The Sensor Head will be connected with the Power Box by the System Power Cable (see Figure 15) and the System Data Cable (see Figure 16).

Plug the System Power Cable into the Sensor Head power socket (see Figure 5) as well as the System Data Cable into the Sensor Head data socket (see Figure 5) at the rear of the Sensor Head (see Figure 28).

Lead both cables into the vehicle cabin. Secure the cable several times at the vehicle that both cables are close fixed to the vehicle and they can't imperil somebody or something during operation.

Fix all cables located outside the vehicle cabin that they can't imperil somebody or something during operation.

During mission operation (data collection) do not use the USB3.0 connector.
Protect the USB3.0 socket with the cover against dirt and water.

Measuring Sensor Mounting Height

The sensor mounting height is measured between street and the top of the Quick Release Plate, where the Trimble MX7 is mounted to.

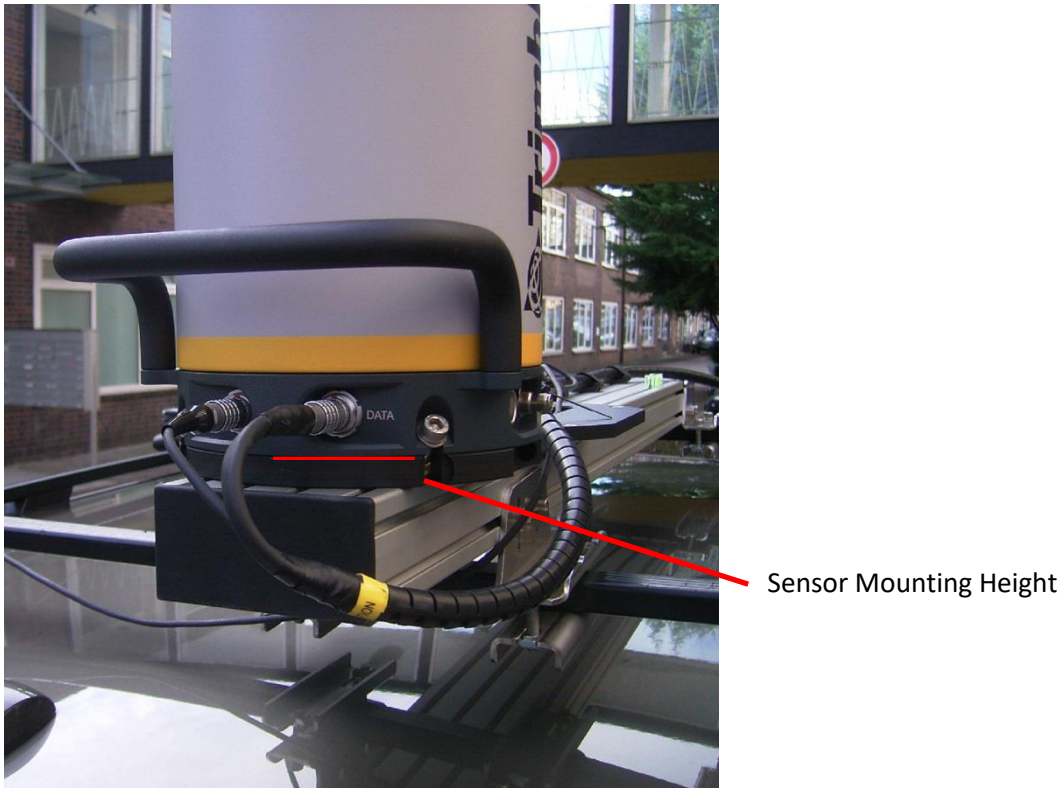


Figure 28: MX7 # Sensor mounting height and installed cable

Installation of Power-Box

Mounting

The Power Box has no special mounting mechanism. The Power Box has to be located inside the vehicle and should be secured against movement. The fans should not be obstructed.

The Power Box needs to be cooled. Therefore both fans must not be obstructed.

Ensure that the Power Box can't move during operation.
Danger: Persons inside the cabin can be hurt.

Connecting

Plug in the USB-WLAN Stick (see Figure 13) or USB2.0 Ethernet-Adapter (see Figure 14) into one of the Power Box USB2.0 sockets.

Figure 29: Power Box # Installed USB-WLAN Stick or USB2.0 Ethernet-Adapter

Plug the System Power Cable and the System Data Cable coming from the Sensor Head into the respective sockets. The System Power Cable (see Figure 15) plugs into the Power Box System Power Out socket (see Figure 10) and the System Data Cable (see Figure 16) plugs into the Power Box System Data socket (see Figure 10).

Plug the External Power Cable (see Figure 17) into the Power Box External Power In socket (see Figure 10).

All connections inside the Power Box are differently coded. Therefore mix-up of the cables is impossible.

Switch off the engine and the battery power supply of the vehicle. Lead the External Power Cable to the vehicles cigarette lighter and plug it into the socket.

The vehicle cigarette lighter must fit to the required electric specifications of the MX7 System.

Do the installation of the MX7 System, especially the Power Box, without any electric power coming from the vehicle.

Tablet / Laptop Installation

Mounting and Storage

Ensure that the tablet computer or laptop does not distract the driver.

The driver is not allowed to operate the system while driving. It is recommended that a second person is dedicated to operate the system.

Ensure that the tablet computer / laptop is mounted and stored in a safe place during usage.

Chapter 7 System Software

The MX7 System Software TMI is handled in the separate available Trimble TMI Manual

The Trimble TMI User Guide can be downloaded on 'www.imaging-download.com'

Chapter 8 Operation

Input Power Requirements

Please be aware that not all vehicles provide enough power to their cigarette lighters.

If you are using the MX7 in a vehicle with some kind of “smart charging systems”, please check carefully with the manufacturer whether this vehicle provides permanently enough power for operating the MX7.

Advice: always ensure that the car alternator is running during MX7 operation.

The Input Power need to be checked by a professional car repair shop or this information could be found in the car manual.

Please ensure that “Start/Stop Automatics” is de-activated of the car.

Safety Check

Complete a safety check before and after each mission.

All broken or damage components should be exchanged immediately.

All loose screws should be tightened.

Any screws must be tightening with the correct torque for the used construction. Be aware of the right workflow to tighten screws (see Safety Instructions of Installation Chapter).

Any dirty or wet parts of the system should be dried and cleaned.

Do not start any missions before resolving all issues with the system.

This can damage the system permanently.

The operator must take care to fulfill all requirements and certifications.

Checklist for Components

- Check the MX7 Sensor Head against damages like scratches and deformation of material.
- Check that all camera lenses are clean.
- Check that the MX7 Roof Rack is installed correctly.
    - Check if all screws of the MX7 roof rack are tight.
    - Check that the MX7 Roof Rack components show no cracks.
- Check that the MX7 Quick Release Plate is correctly mounted.
- Check that the MX7 Sensor Head is in operation position.
- Check that the operation position is secured by the fixing mechanism.
- Check that the MX7 Sensor Head is installed with the view in the right direction.
- Check that the four screws fixing the MX7 Sensor Head to MX7 Quick Release Plate are tightened in the right way.
- Check that all cables are installed correctly.
    - Check that the connectors are plugged in and fixed.
    - Check that the cables are fixed to the vehicle roof rack before being led inside the vehicle cabin.
    - Check that no cable is damaged or will be squeezed.
- Check that the MX7 Power Box is securely installed in the vehicle cabin.
- Check that the USB WLAN stick is plugged in into a USB socket of the MX7 Power Box or the connection will be done via Ethernet adapter.

- Check the MX7 tablet for damage.
- Check the MX7 tablet battery is charged.
- Check that the external power is connected and providing enough power.

Mission Operation

Most parameters for a mission have been set by default. Only a few steps must to be done to start a mission.

In case you are using GAMS in addition please check as well the provided GAMS manual for mission operation.

Checklist to operate a Mission

Please also check the separate available TMI manual for further instructions.

- Complete the safety check.
- Park the vehicle (with running engine) in an area with good sky view, away from buildings and other obstructions to have good satellite reception and to reduce GNSS multipath effect. Note that you should be within 20 km from the nearest base station.
- Provide power to the system.
- Switch on the MX7 by pressing the power ON-OFF button of the MX7 Power Box (see Figure 12).
- Switch on the MX7 Control Device (tablet). Make sure that power of the device will be provided during the whole planned mission.
- Wait approximately two minutes until the Trimble MX7 System provides the WLAN access point and the MX7 Control Device has connected to the access point or connected via Ethernet adapter over LAN.
- Click on the app icon ‘MX7 Start’ to start the Trimble Mobile Imaging software
  or
  Connect to the system as described in Trimble TMI User Guide (follow link in Chapter 7).
- If it is the first mission, prepare the presets for your car and mission in the ‘Settings’ dialogue.
- Start a new mission by clicking the ‘Mission’ button on the Main Menu.
- Set your mission presets in the ‘Mission Setup’ dialogue and create the mission by clicking the ‘Start’ button in the ‘Mission Start’ dialogue.

Do not drive during the initialization of the mission.

- After the initialization start driving with rapidly accelerate up to 60 km/h (if possible) and drive on straight and at constant speed. This will bring the system to fine align in about 3 min. Drive some curves at the end of the 3 minute period. During this time you should be in an area with good GNSS conditions (no tunnels, high buildings, dense canopy, etc.). The ‘Navigation’ button should turn to green.

- Start driving your mission.
  It is possible to divide the mission data in runs.
  A minimum of one run must be recorded.
  - Start capturing data in a run by pressing the 'REC' button.
  - Stop the recording of a run by pressing the 'STOP' button.
- After recording all runs of the mission:
  - Drive some curves and drive again straight at constant speed for about 3 min at the end.
  - Park the vehicle (with running engine) in an area with good view of sky and stay static for about 5 minutes. Note that you should be within 20 km from the nearest base station.
  - Click the button on the main menu to complete the mission. Confirm this operation on the 'Complete Mission' dialogue.
  - All mission data is now stored on the internal disk of the Trimble MX7 System.

After closing a mission (with one or more runs) the Trimble MX7 System has to be reinitialized again for the next mission

Ending the Trimble MX7 Operation

After collecting all data for the mission(s), the data should be copied to an external drive and the Trimble MX7 System should be shut down.

It is recommended to perform data backup as early as possible.

Checklist to end an Operation

- Backup the mission data.
  - Connect an external USB3.0 drive to the USB3.0 port of the MX7 sensor head.
  - Open the Backup Desktop by clicking the 'Backup' button on the main menu.

From the Backup Desktop follow the instructions for a backup described in Trimble TMI User Guide (follow link in Chapter 7).

- Shutdown the Trimble MX7 System.
  - Do not switch off the power on the Power Box before shutting down the Trimble MX7 System.
  - Follow the instructions described in Trimble TMI User Guide (follow link in Chapter 7).
- After successfully shutting down the Trimble MX7 System:
  - Switch off the system power by pressing the Power ON-OFF Button on the Trimble MX7 Power Box (see Figure 12).
  - If necessary, switch off the external power supply.

Check the system by performing a safety check.

Chapter 9 Maintenance, FAQ and Support

Maintenance

Dismantling or attempting to repair a Trimble MX7 System by unauthorized personnel can be hazardous and costly. Maintenance should be limited to the cleaning and inspection of external surfaces, lens-glass, operating controls, etc.

Preventative Maintenance

The preventative maintenance to be carried out by the operator should include:

- In Use
  - Avoid operating the system in rainy or misty weather.
  - Avoid mechanical shock.
  - Clean and dry the equipment before, during and after use if necessary.
- In Storage
  - Dry the system thoroughly before storing.
  - Correctly pack the equipment in the transportation / storage case provided.
  - Ensure the transportation / storage case is kept dry and clean inside.
  - Store within the equipment environmental temperature and humidity limits.
- In Transportation
  - Correctly pack the equipment in the supplied transportation cases.
  - Do not allow the equipment to slide around inside transport vehicles or containers.
- General
  - Carry out regular functional testing of the system.
  - Detect and report damage, malfunctions and poor performance.

Clean the Camera Lens Glass

- Perform all cleaning operations in a clean environment.
- To remove dust and dirt, first try to gently blow the debris off with an air compressor.
- If the debris will not come off using an air compressor, apply a small amount of optics cleaner (e.g. Photographic Solutions Eclipse Optics Cleaner) or ethyl alcohol to a clean lens cloth (e.g. Pentax lens cloth). The cloth should be moist but not dripping.
- Wipe the cloth or swab along the length of the glass surface in smooth movements. Do not press hard on the surface or rub repeatedly on one spot.
  If pooling or streaks occur, there may be too much solution – wait for it to dry, then repeat.
- When finished cleaning, examine the glass surface in light.
- If dust spots remain, repeat this procedure using a clean lens cloth.

Problem Solving

WLAN Issues

Problem	Potential reasons & Problem Solving

No WLAN connection	• MX7 is not powered up completely.
	  ○ Wait until MX7 is completely powered up.
	  ○ Check that the power supply is providing the specified amount of power required during startup and operation.
	• Distance between sensor and tablet too large.
	  ○ Reduce distance.
	• WiFi Stick not inserted correctly.
	  ○ Reconnect WiFi Stick.
	• WLAN shielded (e.g. by metal housing, metal mesh).
	  ○ Find a better location for Power Box and/or tablet.
	• Problems with the browser cache
	  ○ Close the browser app on your tablet
	  ○ Delete the browser cache using the property settings of the browser
	  ○ Re-start browser

WLAN “Saved and Secured”	• WLAN Access point could not be initialized correctly.
	  ○ Unplug the WiFi Stick, wait for 20 seconds and reconnect.
	• Power during start-up too low.
	  ○ Check that the power supply is providing the specified amount of power required during startup and operation.

Power-Box LED Signalization

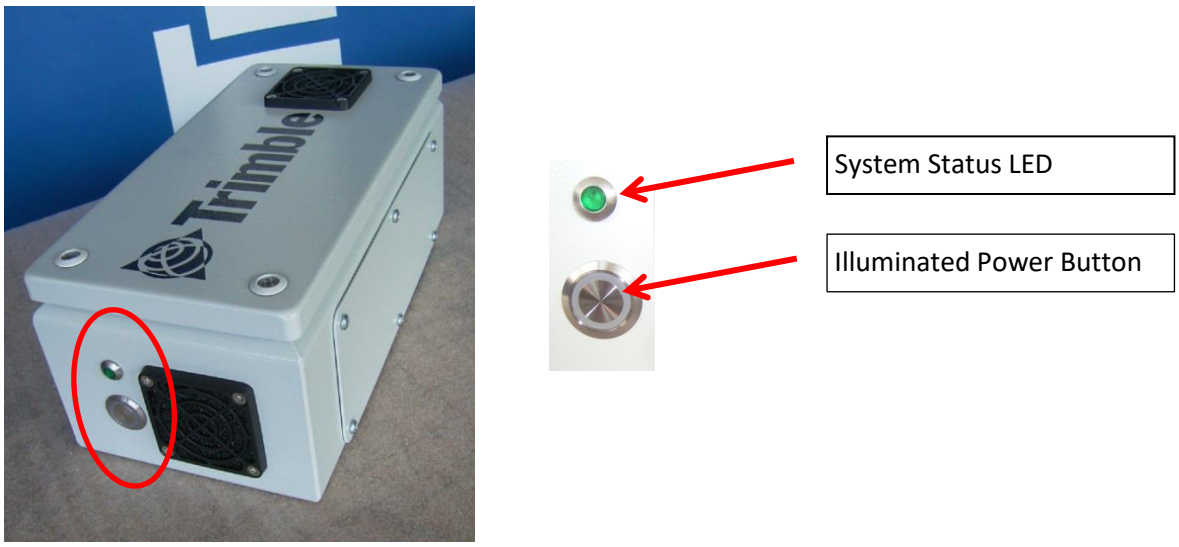


Figure 30: MX7 # Power-Box LED

The System Status LED is the system hard beat and is blinking with about 1 Hz permanently during normal operation.

Other behavior is an indication for a problem.

Problem	Potential reasons & Problem Solving

System switched off	• Power provided by the car is not available.
	  ○ Typical behavior for cars with “start/stop automatics”.
	  ○ Switch off “start/stop automatics” during usage of MX7.

Power button is pressed, but dark and System Status LED is off	• Power for the MX7 System seems not to be okay /not available

Power button lighted and System Status LED is permanent on	• Internal control unit is not working probably
	  ○ Re-powering of the system is required
	  ○ Check input power

Power button lighted and System Status LED is permanent off	• Internal control unit is not working probably
	  ○ Re-powering of the system is required
	  ○ Check of input power
	• Correct status after system shut-down
	  ○ For restart, please press Power button twice

Input Power Considerations

The Trimble MX7 can draw up to 10 A @ 12 V from the vehicle battery during the system startup. Depending on the model of the car, the vehicle battery management system can behave differently, which affects the re-charging of the battery and, consequently the amount of current that can be provided at a specific time. Therefore, in some instances, it is possible that the vehicle battery does not supply sufficient power for the system startup. In this case, the Trimble MX7 would shut down and attempt to reboot.

In case of a system reboot, the WiFi will drop temporarily and the TMI interface will hang. Note that the symptom is the same as for a generic WiFi issue. This is not to be confused and monitoring the System Status LED on the Power Box will help to rule out the possibility of a WiFi connection problem.

The Trimble MX7 startup sequence is as follows:

1. System Status LED is solid ON (system is booting)
2. System Status LED switches to blinking light (system is booted)
3. System Status LED stays blinking for more than 55 seconds (system receives enough power and is ready to operate)

   3a. Error scenario 1: System Status LED switches approx. 50-55 seconds after pressing the Power Button from blinking light to solid ON or solid OFF (system is restarting and repeats this power-on cycle)

   3b. Error scenario 2: System Status LED switches after starting a mission in TMI from blinking light to solid ON or solid OFF (system is restarting and repeats this power-on cycle)

In case 3a or 3b the system is restarting because the vehicle battery or the vehicle battery management system does not supply sufficient power. This reboot will continue until input power increases to the required amount.
As soon as a power shortage is identified the system must be manually shut down by pressing the Illuminated Power Button!

Problem	Potential reasons & Problem Solving
System does not start	○ Cigarette lighter does not provide enough power to start-up the Trimble MX7. ▪ The power to the cigarette lighter is limited to less than 120 W ▪ Cigarette lighter socket and connector does not fit together properly. ▪ Contact of the cigarette lighter socket is bended and does not provide a good connection ▪ Inside the cigarette lighter socket there is a corrosion and due to that a high transfer resistant ⇨ Add a new direct cable (min. AWG14 depending on cable length) from battery to Trimble MX7 (done by a professional car repair shop) ○ Capacity of car battery is already too low to start the Trimble MX7 ▪ Start car engine to charge the battery with car alternator (switch on some car loads, like light can help) ▪ Advice: always ensure that the car alternator is running during Trimble MX7 operation
Vehicles with “smart charging systems”	○ Some “smart charging systems” do not provide permanently enough power to the cigarette lighter to operate the Trimble MX7 ○ Some cars need to run an internal car load (e.g. lights) to activate the alternator.
Vehicle cannot provide enough power	○ Add a complete intendent 12 V Battery only for supporting the Trimble MX7

Firmware and Workflow Issues

Problem	Potential reasons & Problem Solving
Message: ”Mission start failed”	• Camera initialization issue. ○ Shutdown Trimble MX7, wait for 20 seconds and restart system.
Browser issue: no decimal point visual	• Old version of Google Chrome browser used (for example v33.x) ○ update the Google Chrome browser to version 45.x or later (Google Playstore)
Problems with virtual keyboard	• It is recommended to use the "Google keyboard" on an android device
Error Messages in TMI SW after new firmware installation or switch tablet between different systems	• In the browser cache there is sometimes old information, which is not compatible to different firmware or Trimble MX7 System. ○ Remove browser cache and history in your browser, running on the user tablet

Support

General

If you cannot solve existing problems by yourself, please contact Trimble Support by email:

Trimble Support Email Address: imaging_support@trimble.com

Or by phone:

- **APAC:** **+61-8-6189-7462**
  +64-3-963-5206
- **Americas:** **+1-289-695-4416**
- **Europe & Middle East:** **+49 7351 47402 47**

Please report your support case as precisely as possible.
For example:

- Short description of the problem.
- Workflow and how to reproduce the problem.
- If occurring during a mission:
  - Location of the mission.
  - Environmental conditions.

Also send the following information about your Trimble MX7 System:

- Serial number
- Is this used equipment?
- Duration of Trimble MX7 System usage

Chapter 10 Appendix

Technical Parameters

Cable Length

Name	Length
System Power Cable	3.5 m (11.48 ft)
System Data Cable	3.5 m (11.48 ft)
External Power Cable	3.0 m (9,84 ft)

DMI / Ext Socket

Socket: Lemo EEA.2K.316.CLL

Pin	Assignment	Signal	Remark
1	GND	RS232	Serial Com 4 output of Position &Navigation System
2	Must not be connected		*)
3	Must not be connected		*)
4	COM 4 RX	RS232	Serial Com 4 output of Position &Navigation System
5	COM 4 TX	RS232	Serial Com 4 output of Position &inc System
6	Must not be connected		*)
7	Must not be connected		*)
8	Must not be connected		*)
9	GND		GND for PPS
10	PPS	5V TTL	Pulse per second
11	Must not be connected		*)
12	Must not be connected		*)
13	DMI GND		DMI Input
14	DMI Phase B		DMI Input
15	DMI Phase A		DMI Input
16	12 V DMI Power		DMI Input

*) Any use of these pins for any other type of connection can damage the port and is therefore strictly prohibited!

Trimble MX7 Sensor Head Dimensions

All measurements are given in millimeters.

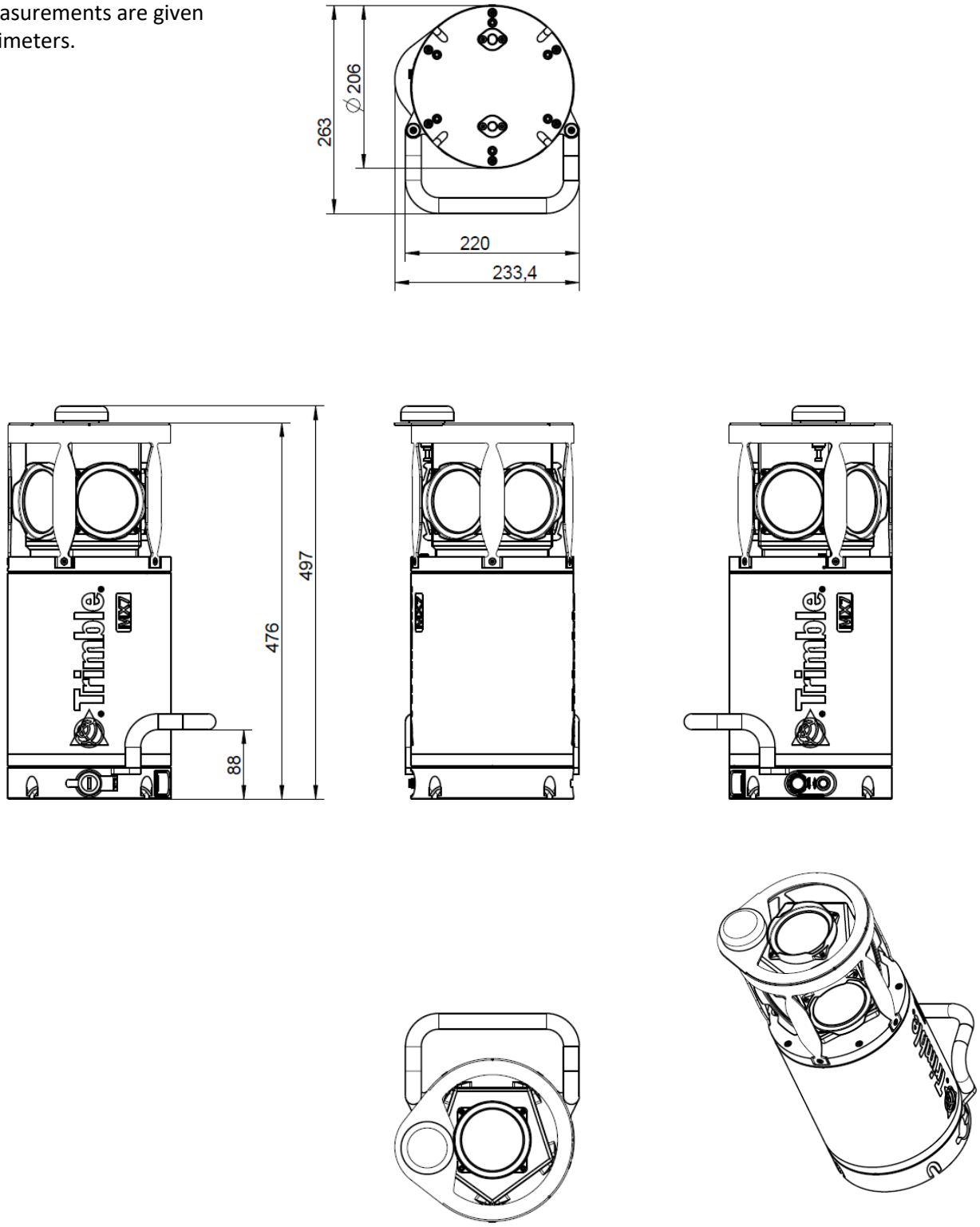


Figure 31: MX7 # Sensor Head Dimensions

MX7 Quick Release Plate Dimensions

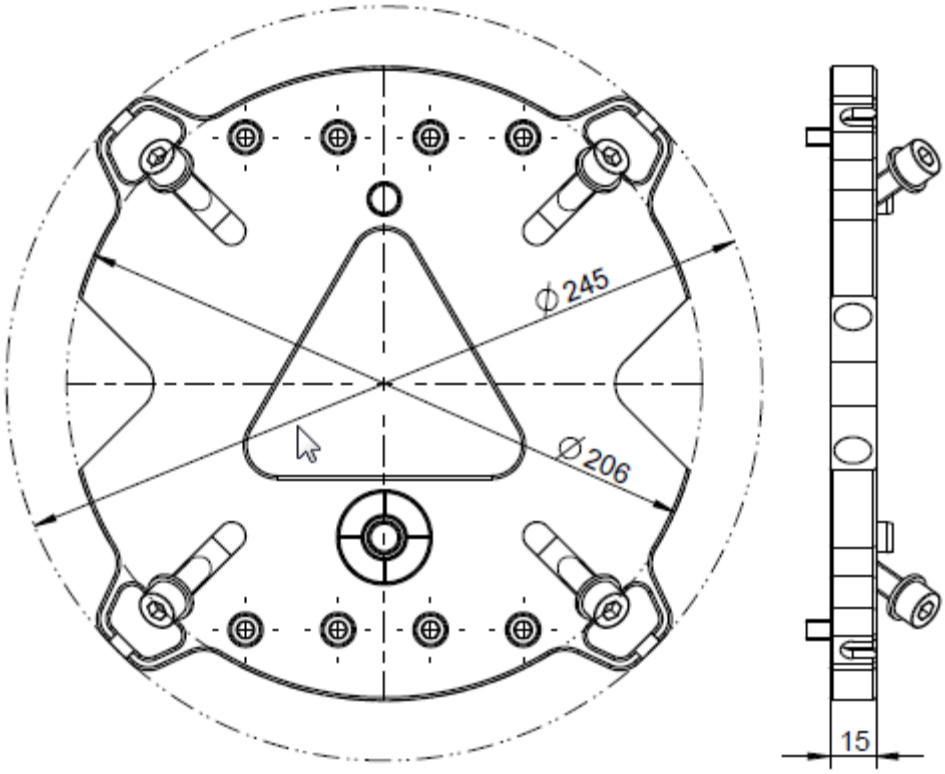


Figure 32: MX7 # Quick Release Plate Dimensions

MX7 Power Box Dimensions

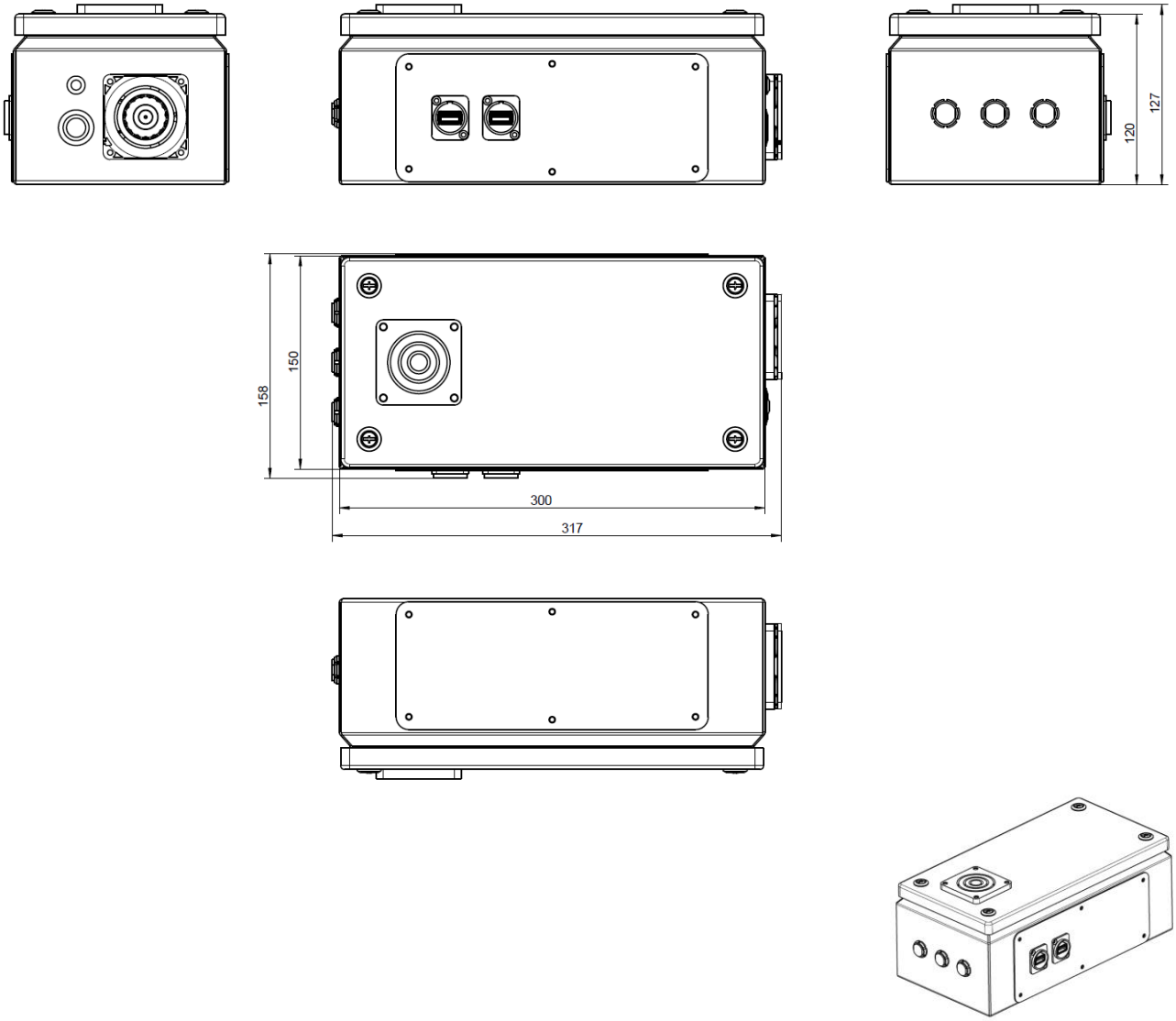


Figure 33: MX7 # Power Box Dimensions

MX7 QRP Mounting

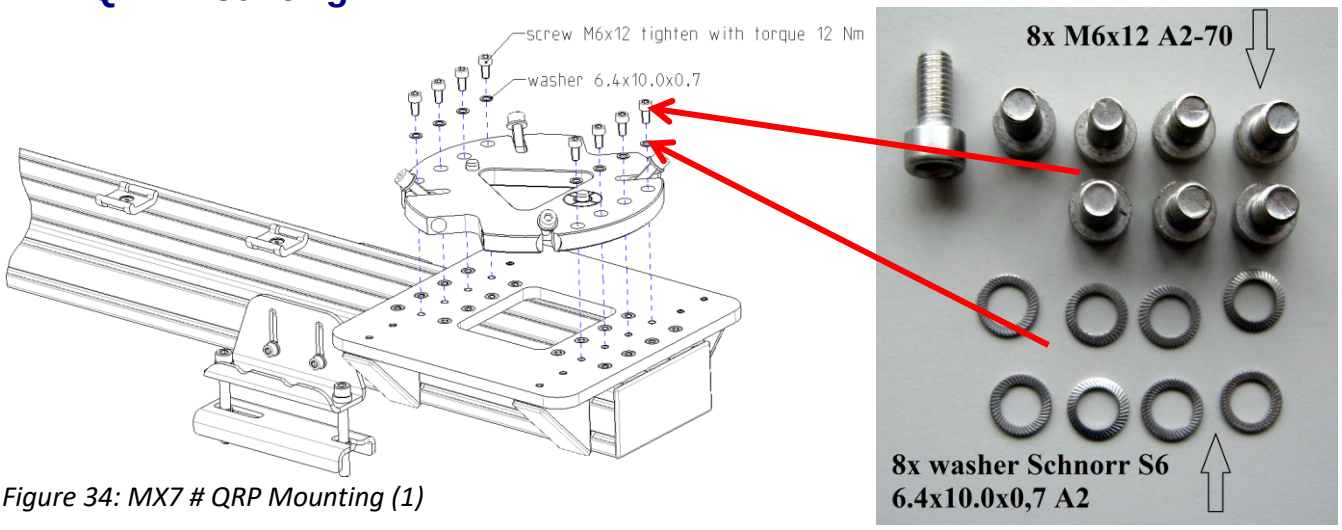
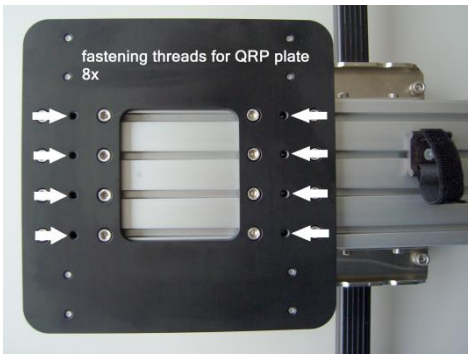


Figure 34: MX7 # QRP Mounting (1)

The Quick Release Plate will be fixed on the Mounting Plate QRP MX7 by the eight screws and washers belonging to the MX7 Quick Release Plate.
The torque for these screws must be 12 Nm.



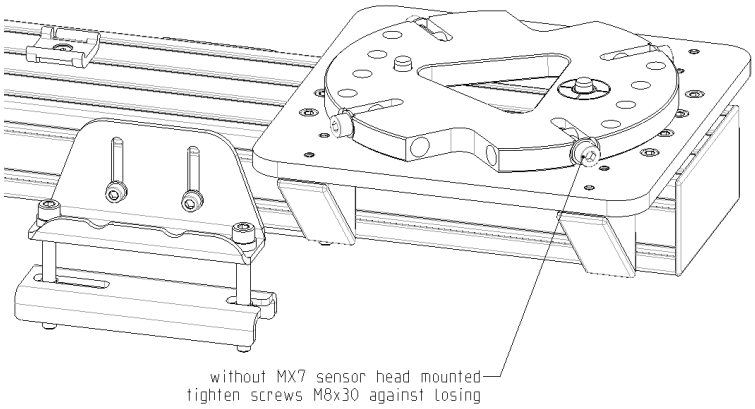
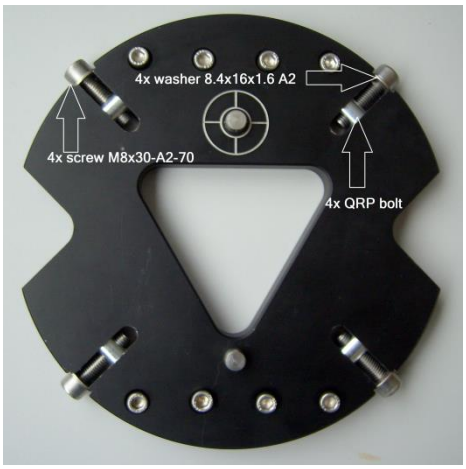
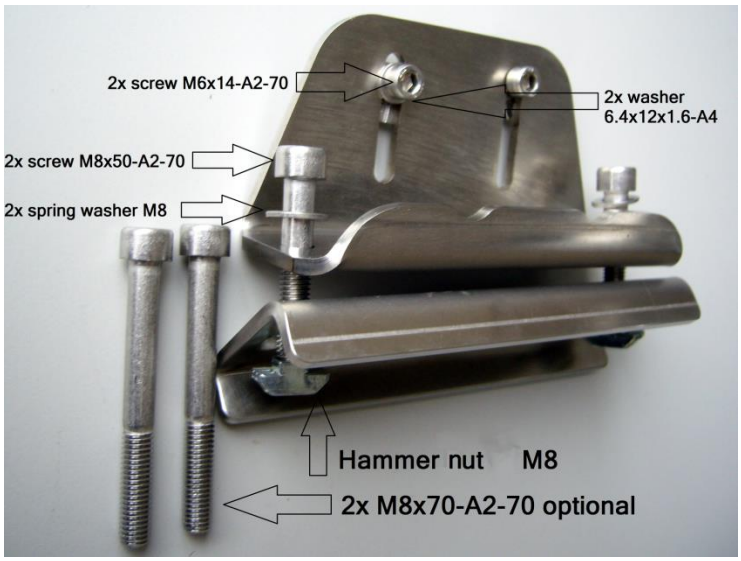


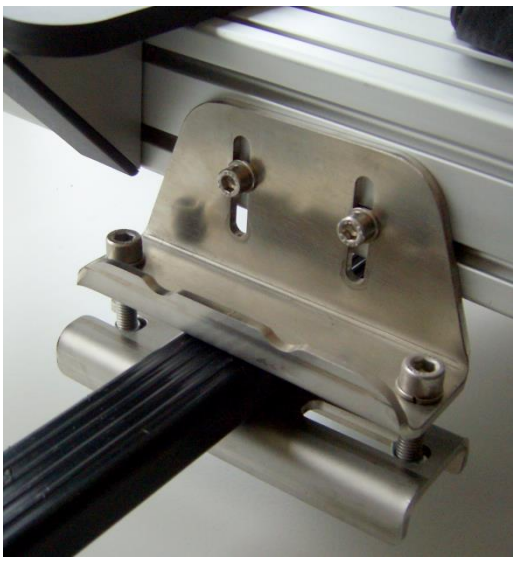
Figure 35: MX7 # QRP Mounting (2)



Use the four screws integrated in the Quick Release Plate to fix the Sensor Head to the Quick Release Plate.
Therefore loosen the screws and swing them into the Sensor Head and tighten them that the Sensor Head is well fixed.
The torque of these screws must be 14 Nm. These four screws must be checked during operation from time to time.

MX7 Roof Rack Mounting





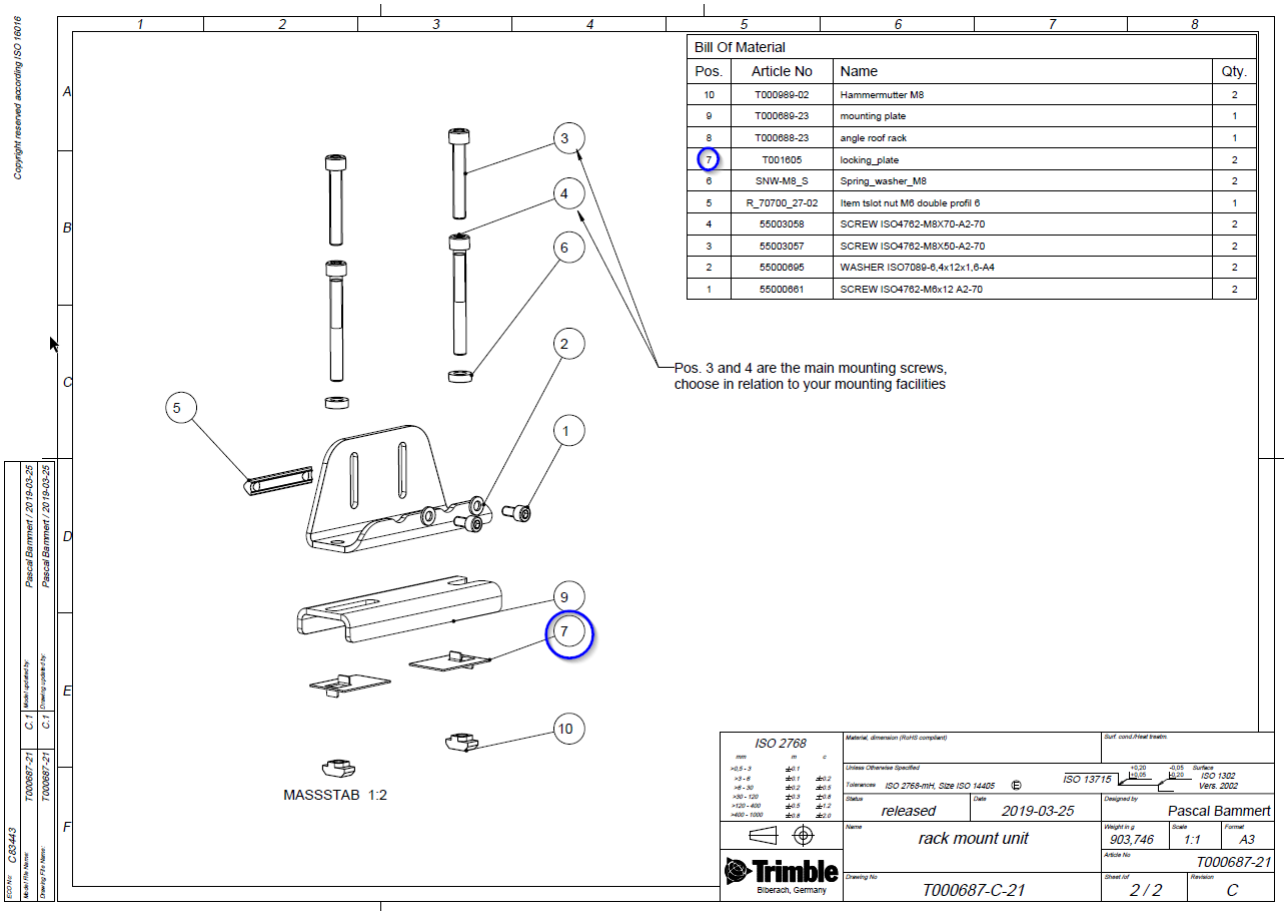


Figure 36: MX7 # Roof Rack mounting

Table of Figures