



SETUP GUIDE

IMS-TCR180

Hot-Plug Module

Meinberg Funkuhren GmbH & Co. KG

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1 Imprint and Legal Information

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3 Change Log

Version	Datum	Änderungsnotiz
1.0	06/03/2021	Initial version
1.01	12/17/2021	Addition of change log & troubleshooting chapter, minor corrections
1.2	04/30/2024	Support for IRIG G-codes removed (output and input signals)
1.3	07/10/2025	Add module options IMS-TCR-FO (MMF - multi mode and SMF - single mode)

4 Presentation Conventions in this Manual

4.1 Conventions for the Presentation of Critical Safety Warnings

Warnings are indicated with the following warning boxes, using the following signal words, colors, and symbols:



Caution!

This signal word indicates a hazard with a **low risk level**. Such a notice refers to a procedure or other action that may result in **minor injury** if not observed or if improperly performed.



Warning!

This signal word indicates a hazard with a **medium risk level**. Such a notice refers to a procedure or other action that may result in **serious injury** or even **death** if not observed or if improperly performed.



Danger!

This signal word indicates a hazard with a **high risk level**. Such a notice refers to a procedure or other action that will very likely result in **serious injury** or even **death** if not observed or if improperly performed.

4.2 Secondary Symbols Used in Safety Warnings

Some warning boxes may feature a secondary symbol that emphasizes the defining nature of a hazard or risk.



The presence of an "electrical hazard" symbol is indicative of a risk of electric shock or lightning strike.



The presence of a "fall hazard" symbol is indicative of a risk of falling when performing work at height.



This "laser hazard" symbol is indicative of a risk relating to laser radiation.

4.3 Conventions for the Presentation of Other Important Information

Beyond the above safety-related warning boxes, the following warning and information boxes are also used to indicate risks of product damage, data loss, and information security breaches, and also to provide general information for the sake of clarity, convenience, and optimum operation:



Important!

Warnings of risks of product damage, data loss, and also information security risks are indicated with this type of warning box.



Information:

Additional information that may be relevant for improving efficiency or avoiding confusion or misunderstandings is provided in this form.

4.4 Generally Applicable Symbols

The following symbols and pictograms are also used in a broader context in this manual and on the product.



The presence of the "ESD" symbol is indicative of a risk of product damage caused by electrostatic discharge.



Direct Current (DC) (symbol definition IEC 60417-5031)



Alternating Current (AC) (symbol definition IEC 60417-5032)



Grounding Terminal (symbol definition IEC 60417-5017)



Protective Earth Connection (symbol definition IEC 60417-5019)



Disconnect All Power Connectors (symbol definition IEC 60417-6172)

5 Important Safety Information

The safety information provided in this chapter as well as specific safety warnings provided at relevant points in this manual must be observed during every installation and operation procedure of the device, as well as its removal from service.

Any safety information affixed to the product itself must also be observed.



Any failure to observe this safety information, these safety warnings, and other safety-critical operating instructions in the product documentation, or any other improper usage of the product may result in unpredictable behavior from the product, and may result in injury or death.

Depending on your specific device configuration and installed options, some safety information may not be applicable to your device.

Meinberg accepts no responsibility for injury or death arising from a failure to observe the safety information, warnings, and safety-critical instructions provided in the product documentation.

It is the responsibility of the operator to ensure that the product is safely and properly used.

Should you require additional assistance or advice on safety-related matters for your product, Meinberg's Technical Support team will be happy to assist you at any time. Simply send a mail to **techsupport@meinberg.de**.

5.1 Appropriate Usage



The device must only be used appropriately in accordance with the specifications of the product documentation! Appropriate usage is defined exclusively by this manual as well as any other relevant documentation provided directly by Meinberg.

Appropriate usage includes in particular compliance with specified limits! The device's operating parameters must never exceed or fall below these limits!

5.2 Product Documentation

The information in this manual is intended for readers with an appropriate degree of safety awareness.

The following are deemed to possess such an appropriate degree of safety awareness:

- skilled personnel with a familiarity with relevant national safety standards and regulations,
- **instructed personnel** having received suitable instruction from skilled personnel on relevant national safety standards and regulations.



Read the product manual carefully and completely before you set the product up for use.

If any of the safety information in the product documentation is unclear for you, do **not** continue with the set-up or operation of the device!

Safety standards and regulations change on a regular basis and Meinberg updates the corresponding safety information and warnings to reflect these changes. It is therefore recommended to regularly visit the Meinberg website at thtps://www.meinbergglobal.com or the Meinberg Customer Portal at thtps://meinberg.support to download up-to-date manuals.

Please keep all product documentation, including this manual, in a safe place in a digital or printed format to ensure that it is always easily accessible.

Meinberg's Technical Support team is also always available at
☐ techsupport@meinberg.de if you require additional assistance or advice on safety aspects of your Meinberg product.

5.3 Safety During Installation

This rack-mounted device has been designed and tested in accordance with the requirements of the standard IEC 62368-1 (*Audio/Video, Information and Communication Technology Equipment—Part 1: Safety Requirements*). Where the rack-mounted device is to be installed in a larger unit (such as an electrical enclosure), additional requirements in the IEC 62368-1 standard may apply that must be observed and complied with. General requirements regarding the safety of electrical equipment (such as IEC, VDE, DIN, ANSI) and applicable national standards must be observed in particular.

The device has been developed for use in industrial or commercial environments and may only be used in such environments. In environments at risk of high environmental conductivity ("high pollution degree" according to IEC 60664-1), additional measures such as installation of the device in an air-conditioned electrical enclosure may be necessary.

If the appliance has been brought into the usage area from a cold environment, moisture may develop as a result of condensation; in this case, wait until the appliance has adjusted to the temperature and is completely dry before setting it up.



When unpacking & setting up the equipment, and before operating it, be sure to read the information on installing the hardware and the specifications of the device. These include in particular dimensions, electrical characteristics, and necessary environmental conditions.

Fire safety standards must be upheld with the device in its installed state—never block or obstruct ventilation openings and/or the intakes or openings of active cooling solutions.

The device with the highest mass should be installed at the lowest position in the rack in order to position the center of gravity of the rack as a whole as low as possible and minimize the risk of the rack tipping over. Further devices should be installed from the bottom, working your way up.

The device must be protected against mechanical & physical stresses such as vibration or shock.

Never drill holes into the device to mount it! If you are experiencing difficulties with rack installation, contact Meinberg's Technical Support team for assistance!

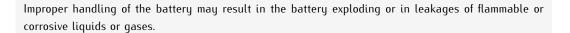
Inspect the device housing before installation. The device housing must be free of any damage when it is installed.

5.4 Battery Safety

The integrated CR2032 lithium battery has a service life of at least ten years.

Should it be necessary to replace the battery, please note the following:

- The battery may only be replaced by the same type or a comparable type recommended by the manufacturer.
- The battery may only be replaced by the manufacturer or authorized personnel.
- The battery must not be exposed to air pressure levels outside of the limits specified by the manufacturer.



- Never short-circuit the battery!
- Never attempt to recharge the battery!
- Never throw the battery in a fire or dispose of it in an oven!
- Never dispose of the battery in a mechanical shredder!



6 Important Product Information

6.1 CE Marking

This product bears the CE mark as is required to introduce the product into the EU Single Market.



The use of this mark is a declaration that the product is compliant with all requirements of the EU directives effective and applicable as at the time of manufacture of the product.

6.2 UKCA Marking

This product bears the British UKCA mark as is required to introduce the product into the United Kingdom (excluding Northern Ireland, where the CE marking remains valid).



The use of this mark is a declaration that the product is in conformity with all requirements of the UK statutory instruments applicable and effective as at the time of manufacture of the product.

6.3 Ensuring the Optimum Operation of Your Device

- Ensure that ventilation slots are not obscured or blocked by dust, or else heat may build up inside the
 device. While the system is designed to shut down safely and automatically in the event of temperature
 limits being exceeded, the risk of malfunctions and product damage following overheating cannot be
 entirely eliminated.
- The device is only deemed to be appropriately used and EMC limits (electromagnetic compatibility) are only deemed to be complied with while the device housing is fully assembled in order to ensure that requirements pertaining to cooling, fire safety, electrical shielding and (electro)magnetic shielding are upheld.

6.4 Maintenance and Modifications



Important!

Before performing any maintenance work on or authorized modification to your Meinberg system, we recommend making a backup of any stored configuration data (e.g., to a USB flash drive from the Web Interface).

6.4.1 Replacing the Battery

Your device's clock module is fitted with a lithium battery (type CR2032) that is used to locally storage almanac data and sustain operation of the real-time clock (RTC) in the reference clock.

This battery has a life of at least ten years. However, if the device exhibits the following unexpected behaviors, the voltage of the battery may have dropped below 3 V, and the battery will need to be replaced:

- The reference clock has the wrong date or wrong time when the system is started.
- The reference clock repeatedly starts in Cold Boot mode (i.e., upon starting, the system has no ephemeris data saved whatsoever, resulting in the synchronization process taking a very long time due to the need to rediscover all of the visible satellites).
- Some configuration options relating to the reference clock are lost every time the system is restarted.

In this case, you should not replace the battery on your own. Please contact the Meinberg Technical Support team, who will provide you with precise guidance on how to perform the replacement.

6.5 Prevention of ESD Damage



An ESDS device (electrostatic discharge-sensitive device) is any device at risk of damage or malfunction due to electrostatic discharge (ESD) and thus requires special measures to prevent such damage or malfunction. Systems and modules with ESDS components usually bear this symbol.

Precautionary measures should be taken to protect ESDS components from damage and malfunction.

- Before removing or installing a module, ground your body first (for example, by touching a grounded object) before touching ESDS components.
- Ensure that you wear a grounding strap on your wrist when handling such ESDS components. This strap must in turn be attached to an uncoated, non-conductive metal part of the system.
- Use only tools and equipment that are free of static electricity.
- Ensure that your clothing is suitable for the handling of ESDS components. In particular, do not wear garments that are susceptible to electrostatic discharges (wool, polyester). Ensure that your shoes enable a low-resistance path for electrostatic charges to dissipate to the ground.
- Only touch or hold ESDS components by the edges. Never touch any pins or conductors on the ESDS components.
- When removing or installing ESDS components, avoid coming into contact with persons who are not grounded. Such contact may compromise your connection with the grounding conductor and thus also compromise the ESDS component's protection from any static charges you may be carrying.
- Always store ESDS components in ESD-proof 'antistatic' bags. These bags must not be damaged in
 any way. Antistatic bags that are crumpled or have holes cannot provide effective protection against
 electrostatic discharges. Antistatic bags must have a sufficient electrical resistance and must not be made
 of conductive metals if the ESDS component has a lithium battery fitted on it.

6.6 Disposal

Disposal of Packaging Materials



The packaging materials that we use are fully recyclable:

Material	Use for	Disposal
Polystyrene	Packaging frame/filling material	Recycling Depot
PE-LD (Low-density polyethylene)	Accessories packaging, bubble wrap	Recycling Depot
Cardboard	Shipping packaging, accessories packaging	Paper Recycling

For information on the proper disposal of packaging materials in your specific country, please inquire with your local waste disposal company or authority.

Disposal of the Device



This product falls under the labeling obligations of the Waste Electrical and Electronic Equipment Directive 2012/19/EU ("WEEE Directive") and thus bears this WEEE symbol. The presence of this symbol indicates that this electronic product may only be disposed of in accordance with the following provisions.



Important!

Do not dispose of the product or batteries via the household waste. Inquire with your local waste disposal company or authority on how to best dispose of the product or battery if necessary.

This product is considered to be a "B2B" product for the purposes of the WEEE Directive and is also classified as "IT and Telecommunications Equipment" in accordance with Annex I of the Directive.

It can be returned to Meinberg for disposal. Any transportation expenses for returning this product (at end-of-life) must be covered by the end user, while Meinberg will bear the costs for the waste disposal itself. If you wish for Meinberg to handle disposal for you, please get in touch with us. Otherwise, please use the return and collection systems provided within your country to ensure that your device is disposed of in a compliant fashion to protect the environment and conserve valuable resources.

Disposal of Batteries

Please consult your local waste disposal regulations for information on the correct disposal of batteries as hazardous waste.

7 Introduction

This Setup Guide is a systematically structured guideline to assist you with the initial set-up of your Meinberg product.

The IMS-TCR180 receiver module is used to decode and generate modulated (AM) and unmodulated (DC level-shift) IRIG-A/B, AFNOR, C37.118, and IEEE1344-formatted time codes. Time codes are transmitted by modulating the amplitude of a sinusoidal carrier wave, while unmodulated codes are transferred by modulating the pulse width of a TTL signal.

As standard, the TCR180 clock module is equipped with an OCXO-SQ (Oven-Controlled Xtal Oscillator) which serves as the master oscillator to ensure high accuracy of \pm 1x10⁻⁸ during holdover mode. An optional OCXO-HQ or OCXO-DHQ oscillator is available for higher accuracy.

Functionality:

The automatic gain control within the modulated code receiver circuit allows IRIG-A/B, AFNOR, C37.118, or IEEE1344 signals to be decoded with a carrier amplitude of 600 mV_{pp} to 8 V_{pp} .

The input stage is electrically isolated and has an impedance of either 50 Ω , 600 Ω (default) or 5 k Ω , selectable using a jumper (see \rightarrow Chapter 10.2, "Adjusting Input Impedance") on the board.

The DC level-shift input is electrically isolated using an optocoupler with an internal series resistance of 220 Ω .

Features

- IRIG Generator
- 4 Programmable Pulse Outputs
- Frequency Synthesizer

The LANTIME OS Firmware manual provides a complete description of all configuration and status monitoring options for your Meinberg product.

Download LTOS7 Firmware manual:

thttp://www.mbg.link/doce-fw-ltos

Compatibility

The IMS-TCR180 is an IMS module that is compatible with the following systems in the IMS product family and can be used in the following slots.

System Compatibility - IMS TCR180

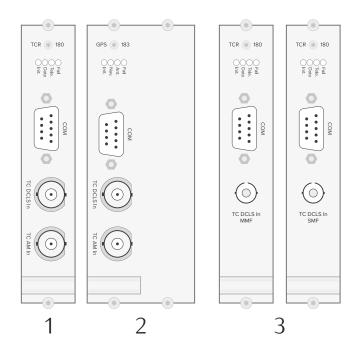
IMS System	M500	M1000	M1000 S	M2000 S	M3000	M3000 S	M4000
Compatible	∅	\odot	⊘	⊘	\odot	⊘	⊘

Slot Compatibility - IMS TCR180

IMS Slot	PWR	CLK	CPU	MRI	ESI	I/O
Compatible	×	⊗	×	\bigotimes	×	×

8 IMS-TCR180 Models

There are several models of the IMS-TCR180 that each vary in terms of the connectors and interfaces provided. The sizes relate to the widths of the faceplates and not the number of actual interface slots of your IMS LANTIME system.



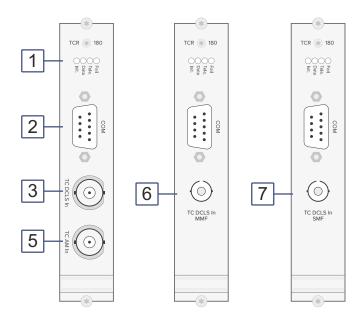
No.	Module	Size	Connectors/Interfaces	Supported Oscillators ¹
1	Standard	1 Slot	2x BNC (TC-In AM/DCLS)	OCXO-SQ, OCXO-HQ
2	TCR/DHQ	2 Slots ²	2x BNC (TC-In AM/DCLS), 1x COM	OCXO-DHQ
3	TCR/FO	1 Slot	1x F-ST (TC-In DCLS ³), 1x COM	OCXO-SQ, OCXO-HQ

Refer to Chapter 14.1, "Technical Specifications: Oscillators" for more information on the oscillator specifications.

Installing an IMS-GPS183 module with a two-slot faceplate in an M500, M1000, or M1000S IMS system will result in the adjacent slot (I/O, MRI, or Clock) being obscured and thus unavailable for another IMS module. Please note this when ordering a new IMS system or additional modules for your IMS system.

³ The fiber optic timecode input is available as a multimode or singlemode connection. Only DCLS timecodes can be used with fiber optic inputs.

9 Module Connectors and Indicators IMS-TCR180





Information:

The numbering above relates to the corresponding subsection in this chapter.

9.1 IMS-TCR180 - Status LEDs

The LEDs indicate the following status conditions:.

"Init" LED:

Blue: Initialization phase of TCR180
Off: Oscillator not warmed up
Green: Oscillator warmed up

"Data" LED:

Shows status after initialization

Green: IRIG receiver has received a valid code at the input Red: IRIG receiver has not received a valid code at the input Yellow: TCR180 is synchronized against an external source (MRS)

Yellow/green (flashing): Holdover mode (MRS), IRIG code available Yellow/red (flashing): Holdover mode (MRS), IRIG code not available

"Tele" LED:

Green: Telegram consistent
Red: Telegram not consistent

Yellow (flashing): Jitter too high

"Fail" LED:

Red: Clock is running on oscillator (holdover mode)
Off: Synchronized by the received IRIG code

9.2 COMx Timestring - RS-232

Data Transfer Method: Serial

Baud Rate/Framing: 19200 / 8N1 (Default)

Time String Format: Meinberg Standard (Default)

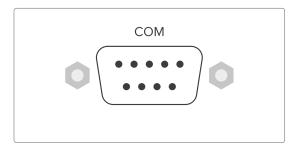
Pin Layout:

Pin 2: RxD (receive)
Pin 3: TxD (transmit)
Pin 5: GND (ground)

Connector Type: D-Sub Male 9-Pin

Cable: Data Cable (Shielded)

PC Connector 1:1



Synchronization using PPS + String:

Pin 1: PPS
Signal Type: TTL

Pulse Length: \geq 5 μ s (Active High).

Pin 2: String

The following time strings can be used:

- NMEA RMC
- NMEA ZDA
- Meinberg Standard
- Uni Erlangen

9.3 DCLS Timecode Input

Input Signal: DCLS Timecode,

Pulse-Width Modulated

(e.g., IRIG-B00x)

Timecode Signals: B002/003, B006/007

A006/A007 IEEE 1344 C37.118

AFNOR NFS 87-500

Insulation Voltage: 3750 V_{rms}

Typical Input Voltage: 5 V =

Max. Input Current: 60 mA

Internal Series Resistor: Diode current limited to 330 Ω

Connector Type: BNC, Female, Insulated

(on device)

Cable Type: Coaxial Cable, Shielded

9.4 AM Timecode Input

Connector Type:: BNC, Female, Insulated

(on device)

Input Signal: AM Timecode (Amplitude-

Modulated Sine-Wave Signal)

Signal Level: $800 \text{ mV}_{pp} - 8 \text{ V}_{pp}$

Input Impedance: 600 Ω or 50 Ω

Internally selectable by jumper

(Default 600 Ω)

Timecode Signals: B122/123, B126/127,

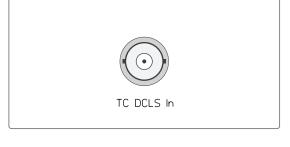
A132/A133, A136/137,

IEEE 1344, C37.118,

AFNOR NFS 87-500

Insulation Voltage: 3000 V DC

Cable Type: Coaxial Cable, Shielded





9.5 Time Code DCLS (unmodulated) Input

Input Signal: Time code DCLS, pulse width modulated.

(e.g. IRIG-B00x)

Input Type: Fiber Optic (FO), Multimode

Time code signals: B002/003, B006/007

IEEE1344 C37.118

AFNOR NFS 87-500

Wave length: 850 nm

Min. input power: $3 \mu W$

Connection type: ST connector.

Fiber type: GI 50/125 μ m or

 $62.5/125~\mu\mathrm{m}$ gradient fiber



Information:

To ensure that the signal is processed reliably, the input signal power should not fall below the specified value.

9.6 Fiber-Optic DCLS Timecode Input (Single-Mode)

Input Type: Fiber-Optic (FOS), Single-Mode

Wavelength: 1310 nm

Input Level: min. -30 dBm (1 μ W)

ST, Female **Connector Type:**

(on device)

Cable: E9/125 μ m monomode fiber

(ST/UPC or ST/PC)

DCLS Timecode, Input Signal:

Pulse-Width Modulated

(e.g., IRIG-B00x)

B002, B003, B006, B007, G002, Timecode Signals:

> G006, IEEE 1344, C37.118, **AFNOR NFS 87-500**



Information:

To ensure that the signal is processed reliably, the input signal power should not fall below the specified value.



TC DCLS

10 Before you start

10.1 Contents of Delivery

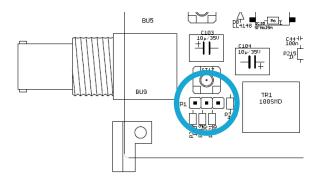
Check that the product has not been damaged in transit. If the product is damaged or fails to operate upon installation, please contact Meinberg immediately. Only the recipient (the person or company receiving the system) may file claims or complaints against the forwarder for damage caused in transit.

Meinberg recommends that you keep the original packaging materials in case the product needs to be shipped or transported again at a later date.

10.2 Adjusting Input Impedance

Time code specifications do not specify values for modulated codes, neither in relation to the output impedance of the transmitter, nor to the input impedance of the time code receiver.

This has resulted in time code component manufacturers selecting arbitrary values, which in turn means that not all devices are compatible with one another. For example, if the time code generator has a large output impedance and the time code receiver has a low input impedance, the signal level at the receiver input may be too low to read. This is why the IMS-TCR180 has been equipped with an input impedance jumper, which can be used to adjust the module to a variety of systems and can be set to one of three impedance values: $50~\Omega$, $600~\Omega$ oder $5~\mathrm{k}\Omega$.



The image below shows the various possible jumper positions with the corresponding input impedance values:



Note: The IMS-TCR180 is shipped with the jumper set to 600 Ω .

11 System Installation

11.1 Important Information Regarding Hot-Pluggable IMS Modules

The following information should be strictly observed when replacing IMS modules during operation. Not all IMS modules are fully hot-pluggable. For example, it is naturally not possible to replace a power supply unit in a system without PSU redundancy without first having installed a second power supply unit while the system is in operation.

The following rules apply for the individual IMS slots:

PWR Slot: "Hot-Swappable" If you operate your system with only one power

supply unit, a second power supply unit must be installed before removing or replacing it in order to

keep your system operational.

I/O, ESI, and MRI

Slots:

"Hot-Pluggable"

CLK1, CLK2 Slots: "Hot-Pluggable" When a clock module is replaced or installed, it is

important to rescan the reference clocks ("Rescan Refclocks") in the "System" menu of the Web

Interface.

RSC/SPT Slots: "Hot-Pluggable" It will not be possible for your IMS system to

switch between signal generators while the

RSC/SPT is not installed.

CPU Slot: "Not Hot-Pluggable" Before the CPU is removed, the IMS system must

be powered down.

Please note that after powering on and rebooting LTOS, the configuration of some IMS modules may

be reset to factory defaults!



Information:

The NTP service and access to the Web Interface will be unavailable while the CPU is not installed. Management and monitoring functions will also be disabled.

11.2 Installation and Removal of Hot-Pluggable IMS Modules

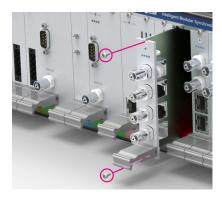
A Torx screwdriver is required (T8 x 60) to remove and install IMS modules.



Important!

Take note of the safety information provided in → Chapter 5, "Important Safety Information"!

Removing a Module







Locations of fixture screws in a 1U IMS system

- 1. Remove the two marked Torx screws from the module faceplate.
- 2. Pull the module carefully out of the guide rail. Note that the module will be securely seated in the connector block inside the chassis—a certain amount of force must be applied to release the module. Once the module has been detached from the connector block on the system backplane, the module can be easily pulled out.
- 3. If the removed module is not to be replaced with another module, a suitable one-slot or two-slot 'placeholder' faceplate should be fitted using the two Torx screws in order to cover this space.

Installing a Module

- To replace a module, remove the installed module in accordance with the guide "Removing a Module" on the previous page. Otherwise, remove the two Torx screws from the cover plate of the unused slot. We recommend keeping the cover plate in a safe place for later use.
- 2. Insert the module correctly into the two guide rails of the system chassis. If it cannot be inserted with reasonably minimal effort, it is possible that the module is not properly seated in the guide rails. In this case, you should pull the module out and try again. **Do not use excessive force when pushing the module in!** Failure to heed this instruction may result in damage to the module and/or chassis.
- 3. Once the module has reached the connector block of the system backplane, a little more effort will be required to insert the module into the connector block. Ensure that the module is locked securely into place and that the faceplate of the module is flush with that of the adjacent modules or cover plates.
- 4. Insert and tighten the two Torx screws with a max. torque of 0.6 Nm.

The installed module is now ready to be set up for use.

11.3 Use of Coaxial Cable as Signal Conductor

The TCR180 module provides two BNC connectors for providing time code signals to synchronize the system.

Your system must be connected to the TCR180 signal inputs using coaxial cable with the proper characteristic impedance and adequate shielding.

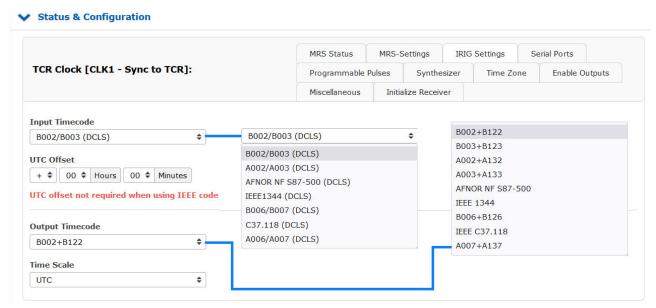
A mismatched cable impedance will result in signal distortion, while poor shielding can cause signal interference.

12 Configuration and Status Monitoring

This chapter explains how to set the IMS-TCR180 up for use via the Web Interface.

12.1 IRIG Settings

In the "Clock" menu of the web interface, both the timecode used to synchronize the IMS-TCR180 and the timecode to be provided via output modules can be set.



Open the "Clock" menu, the "Status & Configuration" submenu and select the "IRIG Settings" TAB.

Parameters to be configured

Input Code:

Select the input code to which the module should synchronize

UTC Offset:

If the applied timecode is impinged with a constant time offset to UTC, this time offset must be configured here, so that the clock can convert the received time to UTC.

Output code:

If the system has direct TC output options, you can set the parameters in this menu section.

The time code output options can be set via this menu (for redundant receiver configurations via the switchover card menu).



Information:

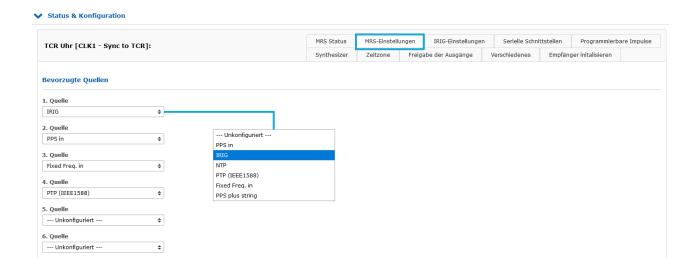
The time codes for the signal outputs can be provided, for example, by a BPE module of the 2000 series, which has time code outputs.

Time Scale:

The output of the selected time code can be done with UTC or the local time. When "LOCAL TIME" is used, it refers to the configuration of the menu point "Time zone".

12.2 MRS Settings

In order to use the timecode signal fed in via the IMS-TCR180 to synchronize the system, it first needs to be selected as a prioritized reference source.

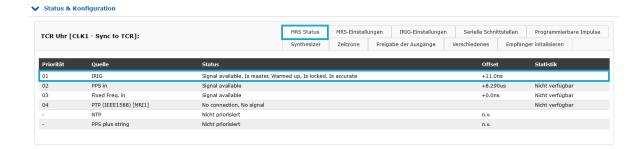


Open the menu "Clock" -> " $Status\ & Configuration$ " and select the "MRS Settings" TAB.

Now select IRIG from the drop down menu of the 1st source.



12.3 MRS Status



Open the menu "Clock" -> "Status & Configuration" and select the "MRS Status" TAB.

The TAB MRS Status provides an overview of the most important parameters of all previously configured MRS sources. Among other things, the current status and offset of the reference signal can be read.

13 Troubleshooting

Our Technical Support team will be pleased to help you with any problems that you may be having with your Meinberg IMS-TCR180. However, before you contact our Technical Support team, it is advisable to read this chapter through first to see if your problem might be more quickly resolved with one of the solutions below.

Problem	Possible Causes	Possible Solutions
The module is not detected by the base IMS unit.	The module may not have been properly inserted into the slot.	Ensure that the module is properly aligned with the guide rails inside the IMS unit; the module must lock securely into the socket at the back. The metal plate of the module should be perfectly flush with the metal plates of the other slots and the screws should be straight.
	Your IMS device's firmware may not be up to date.	Using the instructions in the chapter "Firmware Updates" in your IMS device manual, check whether the latest version of the LANTIME OS Firmware is installed, and install the latest version if necessary.
Even though a valid signal is connected, the TCR180 reference clock is unable to synchronize. The "Data" and "Tele." LEDs are red.	The incoming time code signal does not match the time code expected according to the module configuration. The TFOM value is not sufficient. (IEEE 1344 & C37.118 only)	Ensure that the AM and DCLS time code signal cables are connected to the accordingly labeled module connectors. When connecting a DCLS signal (for example), check that TC-DCLS time codes are also configured in the "Clock" menu of the Web Interface.

14 Technical Appendix

14.1 Technical Specifications: Oscillators

	ocxo-sq	OCXO-HQ	OCXO-DHQ
Short-Term Stability (where t = 1 second)	5 × 10 ⁻¹⁰	5 × 10 ⁻¹²	2 × 10 ⁻¹²
Pulse-per-Second Accuracy	< ± 50 ns	< ± 50 ns	< ± 50 ns
Phase Noise	1 Hz: -70 dBc/Hz 10 Hz: -105 dBc/Hz 100 Hz: -125 dBc/Hz 1kHz: -140 dBc/Hz	1 Hz: -85 dBc/Hz 10 Hz: -115 dBc/Hz 100 Hz: -130 dBc/Hz 1kHz: -140 dBc/Hz	1 Hz: -80 dBc/Hz 10 Hz: -110 dBc/Hz 100 Hz: -125 dBc/Hz 1kHz: -135 dBc/Hz
Frequency Accuracy in Free-Run Mode (1 Day)	± 5 × 10 ⁻⁹ ± 50 mHz	± 5 × 10 ⁻¹⁰ ± 5 mHz	± 1 × 10 ⁻¹⁰ ± 1 mHz
Frequency Accuracy in Free-Run Mode (1 Year)	± 2 × 10 ⁻⁷ ± 2 Hz	± 5 × 10 ⁻⁸ ± 0.5 Hz	± 1 × 10 ⁻⁸ ± 0.1 Hz
Frequency Accuracy with GPS Synchronization (Average over 24 Hours)	± 1 × 10 ⁻¹¹	± 1 × 10 ⁻¹²	± 1 × 10 ⁻¹²
Time-of-Day Accuracy in Free-Run Mode (1 Day)	± 65 μs	± 10 µs	± 4.5 μs
Time-of-Day Accuracy in Free-Run Mode (7 Days)	± 9.2 ms	± 1.0 ms	± 204 μs
Time-of-Day Accuracy in Free-Run Mode (30 Days)	± 120 ms	± 16 ms	± 3.3 ms
Time-of-Day Accuracy in Free-Run Mode (1 Year)	± 4.7 s	± 788 ms	± 158 ms
Temperature–Dependent Drift $\pm 1 \times 10^{-7}$ in Free–Run Mode $(-10~^{\circ}\text{C to }70~^{\circ}\text{C})$		± 1 × 10 ⁻⁸ (5 °C to 70 °C)	± 2 × 10 ⁻¹⁰ (5 °C to 70 °C)

14.2 MRS Functionality

When the system is powered up or rebooted, the oscillator will initially run solely off the internal oscillator ("free-run mode"). As soon as one of the available reference sources has been synchronized and validated, there will be an initial "hard" adjustment of the internal time (main oscillator). The oscillator from that point will then only be adjusted in very small steps.

The following reference time sources can be used, depending on the system (optional):

GNSS GPS / GLONASS / Galileo / BeiDou satellite receivers

DCF77 time signal transmitter (AM, PZF), DCF77 signal generator (AM only)

NTP External NTP servers (up to seven different servers configurable)
PTP (IEEE 1588) PTP master for clock synchronization (M500 and M900 only)

Timecode DCLS oder AM timecode (e.g., IRIG, AFNOR)

PPS in Pulse-per-second (PPS)
PPS plus String PPS + serial time string
Fixed Freq. In 10 MHz frequency input

If more than one reference clock is available and synchronized, the clock with the highest priority (the "master") is used to discipline the internal oscillator.

If the master becomes unavailable, the next reference clock in the order of priority is selected. The reference clock will briefly lose synchronization during this process until it has resynchronized with the new source.

If a reference clock with a higher priority becomes synchronized, it will always be selected as the "master".

Fixed Offset

A fixed offset relative to the reference time can be defined for every reference clock, allowing for known and constant deviations of a reference clock to be accounted and compensated for. When using a GNSS reference source, it is not possible to define a fixed offset—deviations can only be accounted for here indirectly via the specification of the antenna cable length.

Precision

This parameter dictates the fundamental accuracy of this reference source. When switching between different time sources, this value and the accuracy of the oscillator is used to calculate the holdover time, which is the delay until the actual changeover. If the "precision" value is zero, the system will switch to the next reference clock in the order of priority immediately. Otherwise, the delay is calculated as:

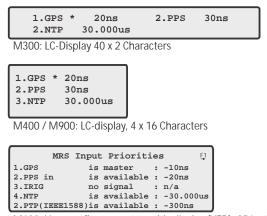
(precision of next reference) | (precision of current master) * constant [s]

The parameter "constant" depends on the quality of the internal oscillator.

Example: The external pulse-per-second signal (PPS) is the current master. An IRIG timecode source is the next reference clock in the order of priority. If the master is lost, the system will switch to the IRIG input (TCR). The PPS has a configured accuracy of 100 ns, while the TCR is set as 10 μ s accurate. Applying the above formula, a holdover time of 19 minutes is calculated (10000 ns / 100 ns * 11.4). The "MRS Input Priorities" shows the remaining and total holdover time next to the master clock. The holdover time will always be recalculated if the reference clock is lost again.

The internal NTP server does not have any direct interface with the external reference clocks and derives its time exclusively from the oscillator of the GNSS/MRS unit. The oscillator is only disciplined directly by this unit. The external NTP time servers are configured via the internal NTP server as "servers" using the "noselect" option so that time deviations relative to the external NTP time servers can be calculated. These offsets are then periodically sent to the GNSS/MRS module.

The current status of all active reference clocks can be obtained from the display, which shows the current master (marked with a "*" or in plain text) and its current status (availability). The display also shows the current time deviation relative to the internal clock:



M600: Vacuum fluorescent graphic display (VFD), 256 x 64 dots

The PTP timestamping unit is queried every 10 seconds (regardless of the broadcast interval of the PTP master). The external NTP servers are queried every 64 seconds. These values are used to calculate the time deviations. Of the maximum seven external NTP services, the one with the lowest jitter (NTP: filter error) is selected upon each calculation.

IMPORTANT: Whenever the LANTIME/MRS is powered up or restarted, the difference in the time between the internal clock and the external NTP or PTP server must not exceed 1000 seconds. If it does, the internal clock will need to be set manually or synchronized with the GNSS reference.

14.3 Overview of Programmable Signals

Meinberg systems with programmable pulse outputs provide the following signal options; the actual range of available signal options will vary from system to system:

Idle

Selecting "Idle" allows individual programmable outputs to be disabled individually.

Timer

In "Timer" mode, the output simulates a timer with a fixed daily schedule. It is possible to configure three switch-on and three switch-off times for each day and each output. In order to set a timer, both the switch-on time ("ON") and the corresponding switch-off time ("OFF") must be set. If the switch-on time is later than the switch-off time, the switching scheduler will interpret this to mean that the switch-off time is on the next day, which will keep the signal enabled through midnight.

Thus, if a program was set with a switch-on time of 23:45:00 and a switch-off time of 0:30:00, this would cause the output to be enabled on day n at 11:45 p.m., and then to be disabled on day n+1 at 12:30 a.m. If any of these three programs are to be left disabled, simply enter the same times into the "ON" and "OFF" fields. The "Signal" selector specifies the active state for the timer periods. Selecting "Normal" will put the output in a low state outside of switch-on periods and in a high state during switch-on periods ("active high"). Conversely, selecting "Inverted" will place the output in a high state outside of switch-on periods and in a low state during switch-on periods ("active low").

Single Shot

"Single Shot" mode generates a single pulse of defined length once per day. The time of day when the pulse is to be generated can be set via the "Time" value. The value "Length" allows the pulse length to be set in 10 ms increments and may be any value in the range of 10 ms to 10000 ms (10 seconds). Entries that are not multiples of 10 ms will be rounded down.

Cyclic Pulse

"Cyclic Pulse" mode is used to generate cyclically repeating pulses. The time between two pulses is defined, and this value must always be provided in hours, minutes, and seconds. It is important to note that the pulse train is always synchronized with 0:00.00 local time, so that the first pulse on any given day will always be output at midnight, and is repeated at the specified cycle interval henceforth. Thus, if a cycle duration of 2s is specified, this will result in pulses being triggered at 0:00.00, 0:00.02, 0:00.04 and so on. While it is possible to set any cycle time between 0 and 24 hours, these repetitions are usually only useful if the time between pulses is always the same. For example, if a cycle time of 1:45.00 is set, this will output pulses at intervals of 6300 seconds. However, between the last pulse of any given day and the pulse at midnight on the following day, there will be an interval of just 4500 seconds.

Pulse-per-Second, Pulse-per-Minute, Pulse-per-Hour

These three modes generate pulses of defined length once per second, once per minute, or once per hour respectively. The configuration options for all three modes are the same. The value "Pulse Length" specifies the length of the pulse and can be between 10 ms and 10000 ms (10 seconds).

DCF77 Marks

In "DCF77 Marks" mode the selected output simulates the time string transmitted by the German DCF77 time code transmitter. The output pulses are the 100 ms and 200 ms pulses (logical 0/1) typical for the DCF77 code. The absence of the 59-second mark is used to signal that the next minute will begin with the following

second mark.

DCF77-like M59

Sends a 500 ms pulse at the 59-second mark.

The "Timeout" field can be used to enter how many minutes the system should wait while in free-run mode before DCF77 simulation is suspended. Entering 0 here will disable the timeout function, so that the DCF77 simulation will continue running perpetually until manually disabled.

Position OK, Time Sync, All Sync

There are three different modes available for outputting the synchronization status of the clock. The "Position OK" mode outputs a signal whenever the GNSS receiver is receiving enough satellites to determine its position.

In "Time Sync" mode, a signal is only output as long as the clock's internal timebase is synchronized to the GNSS reference. The "All Sync" mode requires both of the above states to be true—for a signal to be passed through the output, there must be sufficient satellites for positioning, and the internal timebase must be synchronized to the reference constellation's timebase.

DCLS Timecode

DC level shift timecode. The timecode output here is configured in the "Clock" \rightarrow "IRIG Settings" section of the Web Interface.

1 MHz Frequency, 5 MHz Frequency, 10 MHz Frequency

These modes are used to output a fixed frequency of 1, 5, or 10 MHz respectively, using a PPS signal as an absolute phase reference (i.e., the falling edge of the signal is synchronized with the rising edge of the PPS signal).

Synthesizer Frequency

This mode is used to output a custom frequency, which is defined using the "Clock" \rightarrow "Synthesizer" section of the Web Interface.

Time Slots per Minute

This mode divides each minute up into a number of equal time slots, which can be individually enabled during those seconds of each minute. For example, if six time slots are selected, the user can set whether a signal should be output during the 0–10-second, 10–20 second, 20–30 second, 30–40 second, 40–50 second, and 50–60 second slots. If only the 10-20 second slot is selected, a signal will only be output between 10 and 20 seconds of each minute and disabled outside of that.

PTTI 1PPS

This mode is used to pass a PPS signal of 20 μ s pulse width through the output.

14.4 General Information about Timecode

The need to transmit encoded time information became a topic of some importance as early as the 1950s. The U.S. space program in particular was a key driver of advancement in this field, using timecode information to correlate different sets of measurements. However, the formats and usage of these signals were defined arbitrarily at the whims of the specific users, which resulted in the development of hundreds of different timecode formats, some of which were standardized by the "Inter Range Instrumentation Group" (IRIG) in the early 1960s. These standardized timecode formats are referred to as "IRIG Timecodes" today.

In addition to these general-purpose time signals, there are other codes in use designed for specific applications, among them NASA36, XR3, or 2137. The IMS-TCR180, however, limits itself to the output of IRIG-A, IRIG-B, AFNOR NF S87-500, and IEEE 1344 formats, as well as IEEE C37.118, the successor to IEEE 1344.

The AFNOR timecode is a variant of the IRIG-B format that uses the available "control functions" segment of the IRIG timecode to supply full date information.

Visit our website for more detailed information about IRIG and other timecodes: https://www.meinbergglobal.com/english/info/irig.htm

14.4.1 Description of IRIG Timecodes

Each IRIG timecode format is denoted by an alphabetical character followed by a three-digit number sequence as specified in IRIG Standard 200-04. Each character in a timecode format designation has the following meaning:

Character	Bit Rate	A B E G	1000 pps 100 pps 10 pps 10000 pps
1 st Character	Pulse Wave	0	DC Level Shift (DCLS), pulse-width modulated
		1	Sine-wave carrier, amplitude-modulated
2 nd Character	Carrier Frequency	0	No carrier (DC Level Shift)
		1	100 Hz, time resolution 10 ms
		2	1 kHz, time resolution 1 ms
		3	10 kHz, time resolution 100 μ s
3 rd Character	String Content	0	BCD ^(TOY) , CF, SBS
	3	1	BCD _(TOY) , CF
		2	BCD _(TOY)
		3	BCD(TOY), SBS
		4	BCD(TOY), BCD(YEAR), CF, SBS
		5	BCD(TOY), BCD(YEAR), SBS
		6	BCD(TOY), BCD(YEAR)
		7	BCD(TOY), BCD(YEAR), SBS

BCD: Time and day-of-year in BCD format CF: Control Functions (for unspecified use)

SBS: Number of seconds in the day since midnight (binary)

In addition to the original IRIG standards, there are other specifications issued by other bodies that define specific extensions.

AFNOR: Code according to NF S87-500, 100 pps, AM sine-wave signal,

1 kHz carrier frequency, BCD time-of-year, complete date,

SBS time-of-day, signal level specified by standard.

IEEE 1344: Code according to IEEE 1344-1995, 100 pps, AM sine-wave signal, 1 kHz carrier frequency,

BCD time-of-year, SBS time-of-day, IEEE 1344 extensions for date,

time zone, Daylight Saving Time, and leap seconds in Control Functions (CF) segment.

(See also table "Structure of CF Segment in IEEE 1344 Code")

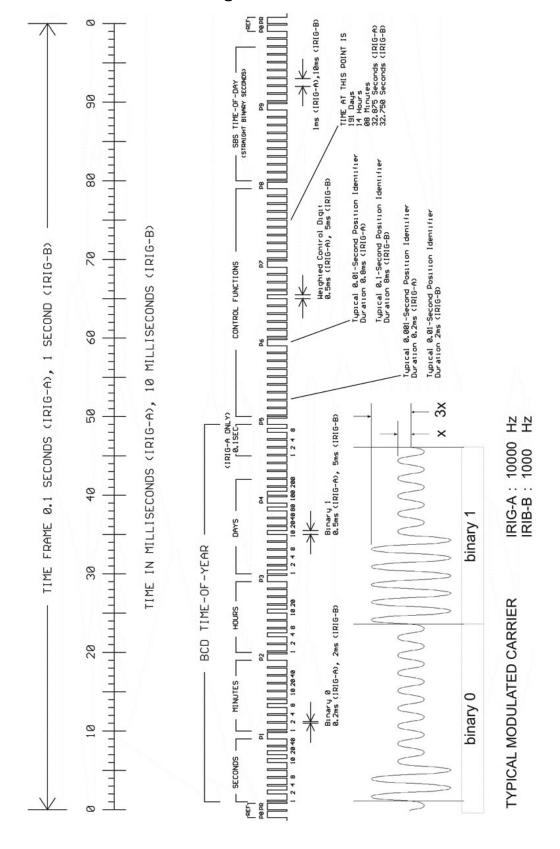
IEEE C37.118: Identical to IEEE 1344, but with UTC offset +/- sign bit reversed

NASA 36: 100 pps, AM sine-wave signal, 1 kHz carrier frequency,

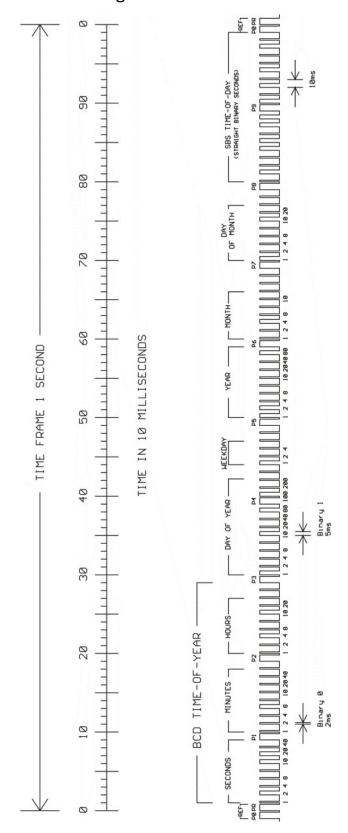
Time Resolution: 10 ms (DCLS), 1 ms (AM carrier)

BCD time-of-year: 30 bits – seconds, minutes, hours, and days

14.4.2 Timecode Format According to IRIG Standard



14.4.3 Timecode Format According to AFNOR Standard



15 Your Opinion Matters to Us

This user manual is intended to assist you in the preparation, use, and care of your Meinberg product, and provides important information for configuration and status monitoring.

Be a part of the ongoing improvement of the information contained in this manual. Please contact our Technical Support team if you have any suggestions for improvements or technical questions that are relevant to the manual.

Meinberg - Technical Support

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16 RoHS Conformity

Conformity with EU Directive 2011/65/EU (RoHS)

We hereby declare that this product is compliant with the European Union Directive 2011/65/EU and its delegated directive 2015/863/EU "Restrictions of Hazardous Substances in Electrical and Electronic Equipment" and that no impermissible substances are present in our products pursuant to these Directives.

We warrant that our electrical and electronic products sold in the EU do not contain lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyls (PBBs), polybrominated diphenyl ethers (PBDEs), bis(2-ethylhexyl)phthalat (DEHP), benzyl butyl phthalate (BBP), dibutyl phthalate (DBP), or diisobutyl phthalate (DIBP) above the legal limits.

