The Synchronization Experts.

MANUAL

IMS-MDU312

Modular Sync. System

November 29, 2023

Meinberg Funkuhren GmbH & Co. KG

Front view (Frontansicht) IMS-MDU312

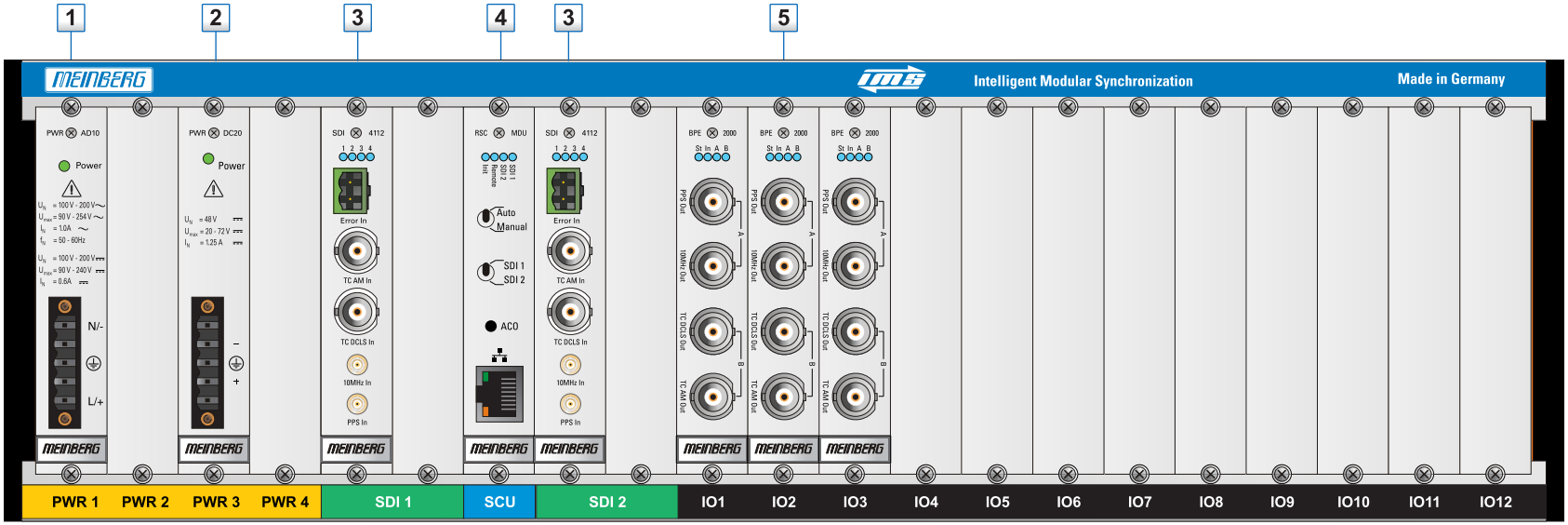
DEUTSCH

1. LED Statusanzeige: Status
   Eingangssignal In 1
   Eingangssignal In 2
   Fehler / Alarm

ENGLISCH

1. LED status Indicators: State (normal operation: green)
   Input Signal In 1
   Input Signal In 2
   Error / Alarm

Rear view (Rückansicht) IMS-MDU312



English

1 PWR-AD10: Power Supply 100 - 240 V AC/DC
2 PWR-DC20: Power Supply 20 - 72 V DC
3 SDI-4112 MDU - Input Card:
external Error Input - 2pin DFK
Time Code Input (AM / DCLS via BNC female)
10MHz / PPS Input (via SMA)
4 RSC-MDU Switch Card with Network Interface
5 BPE-2000: Fixed Outputs -
PPS, 10MHz, TC-DCLS, TC-AM / BNC female

Deutsch

1 PWR-AD10: Netzteil 100 - 240 V AC/DC
2 PWR-DC20: Netzteil 20 - 72 V DC
3 SDI-4112 MDU Eingangskarte:
externer Error In (2pol. DFK)
Time Code Eingänge (AM / DCLS über BNC)
PPS / 10MHz Eingänge (SMA)
4 RSC-MDU Umschaltkarte mit Netzwerkschnittstelle
5 BPE-2000: Feste Augangssignale -
PPS, 10MHz, TC-DCLS, TC-AM / BNC Buchse

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1 Imprint

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2 Copyright and Liability Exclusion

3 Presentation Conventions in this Manual

3.1 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.

3.2 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.

3.3 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.

3.4 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)*

Ground Connection *(symbol definition IEC 60417-5017)*

Protective Earth Connection *(symbol definition IEC 60417-5019)*

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

4 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, set-up, and operation procedure of the device, as well as its removal from service.

Any safety warnings affixed to the device 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 device 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**.

4.1 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!

4.2 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 persons** with a familiarity with relevant national safety standards and regulations,
- **instructed persons** having received suitable instruction from a skilled person 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 **https://www.meinbergglobal.com** or the Meinberg Customer Portal at **https://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 system.

4.3 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 cabinet may be necessary.

If the unit has been brought into the usage area from a cold environment, condensation may develop; in this case, wait until the unit 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.

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.

4.4 Connection of Protective Earth Conductor/Grounding

In order to ensure that the device can be operated safely and to meet the requirements of IEC 62368-1, the device must be correctly connected to the protective earth conductor via the protective earth connection terminal.

If an external ground connection is provided on the housing, it must be connected to the grounding busbar (earthing busbar) for safety reasons before connecting the power supply. Like this, any possible leakage current on the housing is safely discharged to earth.

The screw, washer and toothed lock washer necessary for mounting the grounding cable are located at the grounding point of the housing. A grounding cable is not included in the contents of delivery.

Note: Please use a grounding cable with cross-section $\geq$ 1.5 mm^2, as well as a suitable grounding clamp/lug. Always ensure that the connection is properly crimped!

4.5 Electrical Safety

This Meinberg product is operated at a hazardous voltage.

This system may only be set up and connected by a skilled person, or by an instructed person who has received appropriate technical & safety training from a skilled person.

Custom cables may only be assembled by a qualified electrician.

Never work on cables carrying a live current!

Never use cables or connectors that are visibly damaged or known to be defective! Faulty, defective, or improperly connected shielding, connectors, or cables present a risk of injury or death due to electric shock and may also constitute a fire hazard!

Before operating the device, check that all cables are in good order. Ensure in particular that the cables are undamaged (for example, kinks), that they are not wound too tightly around corners, and that no objects are placed on the cables.

Cables must be laid in such a way that they do not present a tripping hazard.

The power supply should be connected using a short, low-inductance cable. Avoid the use of power strips or extension cables if possible. If the use of such a device is unavoidable, ensure that it is expressly rated for the rated currents of all connected devices.

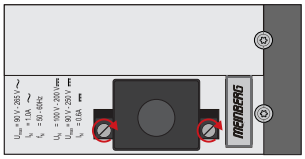
Never connect or disconnect power, data, or signal cables during a thunderstorm! Doing so presents a risk of injury or death, as cables and connectors may conduct very high voltages in the event of a lightning strike!

Device cables must be connected or disconnected in the order specified in the user documentation for the device. Connect all cables only while the device is de-energized before you connect the power supply.

Always pull cable connectors out at **both** ends before performing work on connectors! Improperly connecting or disconnecting this Meinberg system may result in electric shock, possibly resulting in injury or death!

When pulling out a connector, **never** pull on the cable itself! Pulling on the cable may cause the plug to become detached from the connector or cause damage to the connector itself. This presents a risk of direct contact with energized components.

5-Pin MSTB Connector



3-Pin MSTB Connector

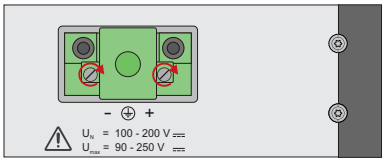


Illustration: Lock screws on an MSTB plug connector; in this case on a LANTIME M320

Ensure that all plug connections are secure. In particular, when using plug connectors with lock screws, ensure that the lock screws are securely tightened. This is especially important for power supply connectors where 3-pin or 5-pin MSTB connectors with lock screws are used (see illustration).

Before the device is connected to the power supply, the device housing must be grounded by connecting a grounding conductor to the grounding terminal of the device.

When installing the device in an electrical enclosure, it must be ensured that adequate clearance is provided, minimum creepage distances to adjacent conductors are maintained, and that there is no risk of short circuits.

Protect the device from the ingress of objects or liquids!

If the device malfunctions or requires servicing (for example, due to damage to the housing, power supply cable, or the ingress of liquids or objects), the power supply may be cut off. In this case, the device must be isolated immediately and physically from all power supplies! The following procedure must be followed in order to correctly and reliably isolate the device:

- Pull the power supply plug from the power source.
- Loosen the locking screws of the MSTB power supply plug on the device and pull it out of the device.
- Contact the person responsible for your electrical infrastructure.
- If your device is connected to one or more uninterruptible power supplies (UPS), the direct power supply connection between the device and the UPS solution must be first be disconnected.

4.5.1 Special Information for Devices with AC Power Supply

This device is a Protection Class 1 device and may only be connected to a grounded outlet (TN system).

For safe operation, the installation must be protected by a fuse rated for currents not exceeding 20 A and equipped with a residual-current circuit breaker in accordance with applicable national standards.

The appliance must only ever be disconnected from the mains power supply via the mains socket and not from the appliance itself.

Make sure that the mains socket on the appliance or the mains socket of the house installation is readily accessible for the user so that the mains cable can be pulled out of the socket in an emergency.

Non-compliant cabling or improperly grounded sockets are an electrical hazard!

Only connect the appliance to a grounded shockproof outlet using a safety-tested mains cable designed for use in the country of operation.

4.5.2 Special Information for Devices with DC Power Supply

In accordance with IEC 62368-1, it must be possible to disconnect the appliance from the supply voltage from a point other than the appliance itself (e.g., from the primary circuit breaker).

The power supply plug may only be fitted or dismantled while the appliance is isolated from the power supply (e.g., disconnected via the primary circuit breaker).

Power supply cables must have adequate fuse protection and have an adequate wire gauge size (1 mm^2 – 2.5 mm^2 / 17 AWG – 13 AWG)

The power supply of the device must have a suitable on-demand disconnection mechanism (i.e., a switch). This disconnection mechanism must be readily accessible in the vicinity of the appliance and marked accordingly as a disconnection mechanism for the appliance.

4.6 Safety when Maintaining and Cleaning the Device

Only use a soft, dry cloth to clean the device.

Never use liquids such as detergents or solvents to clean the device! The ingress of liquids into the device housing may cause short circuits in the electronic circuitry, which in turn can cause a fire or electric shock!

Neither the device nor its individual components may be opened. The device or its components may only be repaired by the manufacturer or by authorized personnel. Improperly performed repairs can put the user at significant risk!

In particular, **never** open a power supply unit or module, as hazardous voltages may be present within the power supply device even after it is isolated from the upstream voltage. If a power supply unit or module is no longer functional (for example due to a defect), it can be returned to Meinberg for repair.

Some components of the device may become very hot during operation. Do not touch these surfaces!

If maintenance work is to be performed on the device and the device housing is still hot, switch off the device beforehand and allow it to cool.

4.7 Battery Safety

The integrated CR2032 lithium battery has a service life of at least 10 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.

Improper handling of the battery may result in the battery exploding or in leakages of flammable or corrosive liquids or gases.

- **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!

5 Important Product Information

5.1 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.

These directives are listed in the EU Declaration of Conformity, appended to this manual as Chapter **11**.

5.2 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.

These statutory instruments are listed in the UK Declaration of Conformity, appended to this manual as Chapter **12**.

5.3 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.

5.4 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 devices 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 modules.
- 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. ESD-proof bags that are crumpled or have holes cannot provide effective protection against electrostatic discharges. ESD-proof 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.

5.5 Disposal

Disposal of Packaging Materials

The packaging materials that we use are fully recyclable:

Material	Used for	Disposal
Polystyrene	Packaging frame/filling material (e.g., polystyrene peanuts)	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. In this case, the shipping costs are to be borne by the customer, while Meinberg will cover the costs for disposal. 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.

6 Modular System IMS-MDU

Meinberg MDU (Multi-Distribution Units) are the simplest and most convenient way to add more buffered timing signal outputs to your distribution rack. MDU systems enable multiplication of input signals coming from an external system such as a LANTIME or a GPS clock with, for example, PPS and 10MHz outputs to be expanded to a large number of output signals of the same type. The 3U / 19-inch MDU basic chassis can compose of a redundant power supply and can be equipped with one or two input modules to allow redundancy of the input signals.

An MDU Input Module (SDI - Signal Distribution Input) can provide up to four inputs via BNC or SMA connectors - with 10 MHz, PPS, TC-AM and TC-DCLS as input signals. An optional alarm relay contact and status LEDs on the front panel show the user whether an input signal, an internal error (in case of a SDI-2101) or an error of the upstream clock (SDI-4112) which can affect output signals has been detected. With a SDI-2101 module, an internal error or a status of the card can be transferred via USB interface.

The IMS-MDU System can be configured with up to 14 Output Signal Modules, each including 4 BNC female connectors (other connector types are available upon request).

For IMS-MDU Systems the following plug-in modules are available divided into below-mentioned categories:

- PWR (Power Supply)
- SDI (Signal Input Modules)
- SCU (Switchover unit for Redundant operation)
- I/O (Output modules)

PWR:
Two PWR slots - they can be equipped with various IMS power supply modules in AC / DC range 100-240 V or low DC 20-72 V. In this way a basic or redundant power supply configuration can be realized.

SDI:
Two slots for SDI Input Signal modules. They have a dual function. By default, they can be attached with two separate systems using different input cards individually or duplicated input signals to facilitate redundant operation. It is also possible to plug a Standard Meinberg Receiver into SDI slots. In this case the receiver generates output signals independently.

SCU:
In redundant operation a RSC (Redundant Switch Controller) card switches to serial interfaces and pulse / frequency outputs of the redundant input card in case of a failure of the active input module. The switching can be perfomed manually or automaticaly. All essential functions of the RSC, such as the actual switching status, alarming and operation mode can be monitored or triggered via a SNMP / Ethernet Interface.

I/O:
Up to 14 output modules can be inserted for individual configuration of the IMS-MDU system.

7 Quick Start Guide for Initial Operation

After a power cable has been connected to the IMS MDU and the RSC switch card has been connected to the network, the installed IMS modules can be configured and monitored by using the software Meinberg Device Manager.

The Meinberg Device Manager software can be downloaded here:

Windows: https://www.meinbergglobal.com/download/utils/windows/mbgdevman_setup.exe
Linux: https://www.meinbergglobal.com/download/utils/linux/mbgdevman.tar.gz

A detailed manual about the Meinberg Device Manager software can be found here:
https://www.meinbergglobal.com/download/docs/manuals/english/meinberg-device-manager.pdf

Configuration via network with Meinberg Device Manager
After starting ***"mbgdevman"***, all devices found in the network will be shown in the main window. By clicking the plus button on the left side of an MDU entry, all installed IMS modules can be displayed. The LED icon indicates the status of the module. After selecting the checkbox, the buttons "Edit Connection Settings" and "Remove Device" are activated in the top left of the window. You can now use the "Edit Connection Settings" button to adjust the connection type (network or serial connection). Here, you can also change the password, that shall be used to connect to a network device (default: "mbg").

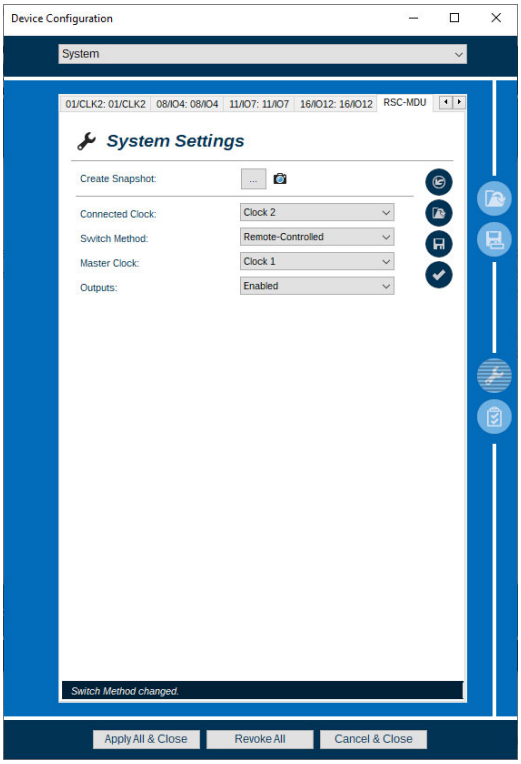
The upper part (center) of the window also contains the buttons "Configure Device(s)" and "Show Device(s) Status". The button "Configure Device(s)" opens the "Device Configuration" window, where all important settings for the selected module(s) can be made:

System Settings

Control Mode: Remote or Manual
Master Clock: Clock 1 / Clock 2
Outputs: enabled / disabled

Network Settings

Hostname
Gateway
DNS Server
Interface (lan0)
DHCP: disabled / enabled (default)
Netmask
VLAN



Button "Show Device(s) Status"
The button "Show Device(s) Status" can be used to access all important status information:

System Status

Control Mode
(Local Auto or Remote)

Master Clock 1 and/or Clock 2 sync
(SDI 1 or SDI 2)

Outputs Enabled (green if active)

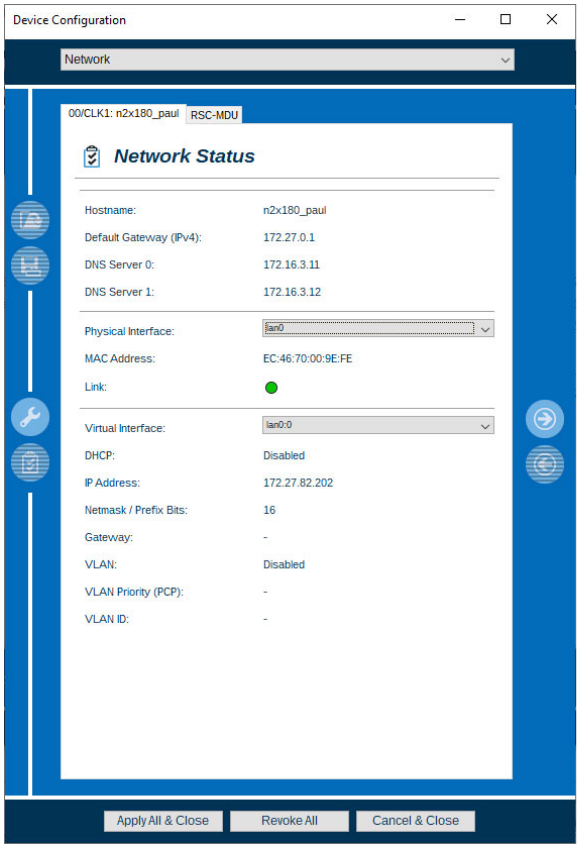
Power Supply 1 and Power Supply 2
(green if voltage is applied)

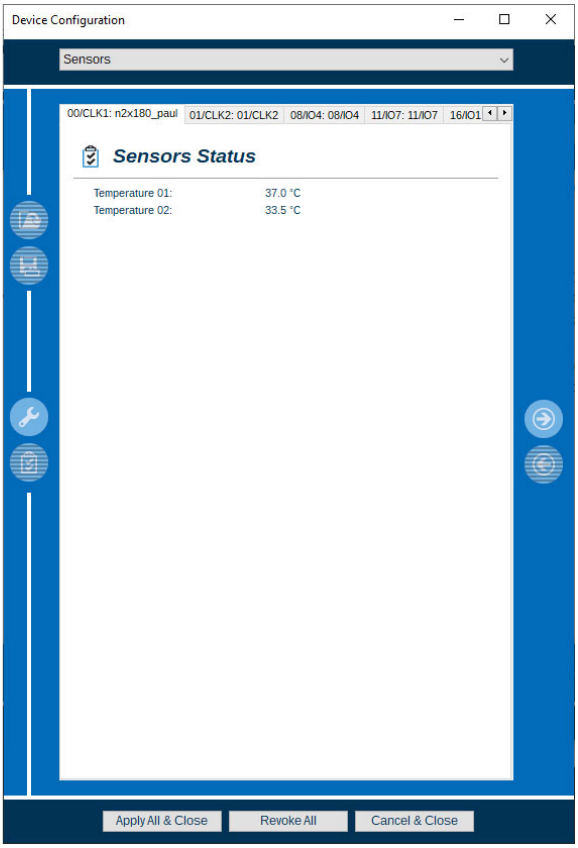
Network Status

Gateway, DNS Server
Mac Address, Link Status, DHCP,
IP - Address, Netmask, VLAN

Sensor Status

Depending on the installed sensors
of the appropriate module(s), i.e.
the operating temperature can
be monitored.



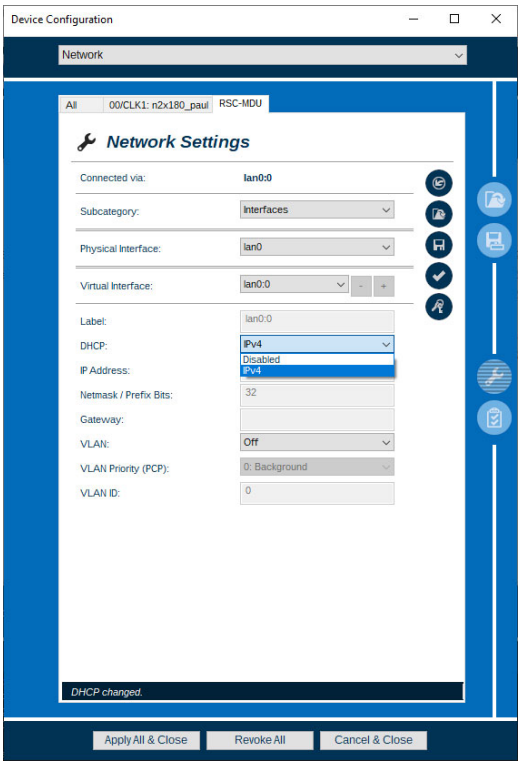


The figure shows the network status and the module sensors (temperature, voltage ...).

Network Settings

To adjust the network parameters of the MDU-RSC, you can open the "Device Configuration" window and select "Network" from the drop-down list at the top. By default, the DHCP service is enabled so that an IP address is assigned automatically. If no DHCP server could be found or no IP address has been assigned via DHCP by any other reason, a fallback IP address 169.254.xxx.yyy will be set automatically (Zeroconf [1]).

If a static IP address shall be assigned, DHCP has to be disabled in this area.



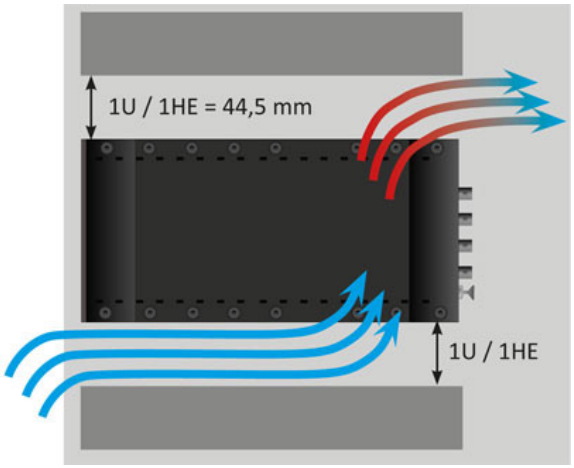
[1] Zeroconf: If a computer configures a link local IP address, it selects an IP address between 169.254.1.0 and 169.254.254.255 by using a random number generator.

8 Attachment: Technical Information

8.1 Technical Specifications IMS-MDU312 BGT Housing

Housing:	Metal 19"Modular chassis, Schroff EUROPAC lab HF Front panel: 3U/84HP (128 mm high / 426 mm wide)
Protection Rating:	IP20
Physical Dimensions:	483 mm wide x 132 mm high x 270 mm deep
Ambient Temperature:	0 ... 50 °C
Storage Temperature:	-20 ... 70 ° C
Humidity:	max. 85% (non-condensing) @ 30 °C

ATTENTION:
Due to potential excessive heat development which may cause an overheating damage during device operation it is necessary to leave space for ventilation of at least 1U height at the top and the bottom of the IMS system.



The figure shows the expected air flow during device in operation with space between devices for ventilation (1U at the bottom and the top).

8.2 Available Modules and Connectors

Name	Type	Signal	Cable
Power Supply:			
PWR-AD10	5pin DFK male	100-240 V AC / 100-200 V DC	5pin MSTB clamp
PWR-DC20	5pin DFK male	20-60 V DC	5pin MSTB clamp
Reference - Synchronization Signals:			
N2X	RJ45	Network NTP / PTP	CAT 5 network cable
TCR	BNC female	TC AM Input 600 mV_{pp} to 8 V_{pp} (Mark)	shielded data line
	BNC female	TC DCLS Input internal series resistance: 220 Ω maximum forward current: 60 mA diode forward voltage: 1.0 V .. 1.3 V	shielded data line
TCR-FO	ST connector	Time Code DC Level Shift In Multimode Fiber: SX - 850 nm	multimode FO-patch cable
SDI-2101	BNC female USB-Type-B	TC AM In / TC DCLS In Configuration	shielded data line
SDI-4112	2pin DFK BNC female SMA	Error-In TC AM In / TC DCLS In PPS In / 10 MHz In	shielded data line
SDI-4505	F-ST F-ST F-ST	Error-In TC AM In / TC DCLS In PPS In / 10 MHz In	multimode FO-patch cable
SDI-5302	2pin DFK BNC female SMA D-SUB9 female	Error-In TC AM In / TC DCLS In PPS In / 10 MHz In Serial time telegram	shielded data line
SDI-7312	2pin DFK 6 x BNC female 1 x D-SUB9 connector	extern. Error Input Time Code AM In and DCLS In, PPS In, 10 MHz In, 2.048 MHz In, Progr. Pulses In ser. Time Telegram In, RS-232	shielded data line
Output Signals:			
BPE	See chapter BPE - Backplane Port Expander		
LNO	4 x BNC female	10 MHz sine Out with internal OCXO	shielded data line

8.3 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 the LANTIME Operating System, the configuration of some IMS modules may be reset to factory defaults!

Information:

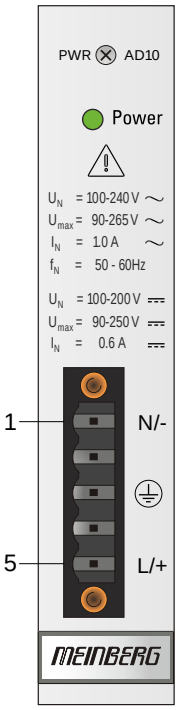
The NTP service and access to the web interface will be unavailable while the CPU is not installed. Management and monitoring functions will also be disabled.

8.4 IMS Module Options

8.4.1 Power Supply 100-240 V AC / 100-200 V DC

Connector Type: 5-pol. DFK

Pin Assignment:
1: N/-
2: not connected
3: PE (Protective Earth)
4: not connected
5: L/+



Input Parameter

Nominal Voltage Range:	U_N	=	100-240 V~ 100-200 V ⎓
Maximum Voltage Range:	U_N	=	90-265 V~ 90-250 V ⎓
Nominal Current:	I_N	=	1.0 A ~ 0.6 A ⎓
Nominal Frequency Range:	f_N	=	50-60Hz
Maximum Frequency Range:	f_{max}	=	47-63Hz

Output Parameter

Maximum Power:	P_{max}	=	50 W
Maximum thermal energy:	E_{therm}	=	180.00 kJ/h (170.61 BTU/h)

Danger!

This equipment is operated at a hazardous voltage.

Danger of death from electric shock!

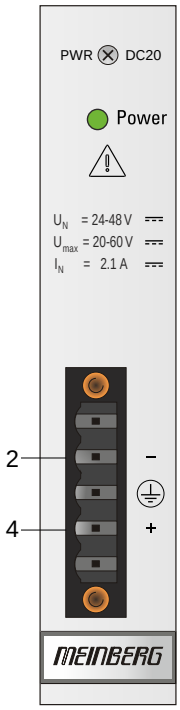
- This device must be connected by qualified personnel (electricians) only.
- Never handle exposed terminals or plugs while the power is on.
- All connectors must provide protection against contact with live parts in the form of a suitable plug body!
- Always ensure that wiring is safe!
- The device must be grounded by means of a connection with a correctly installed protective earth conductor (PE).

8.4.2 Power Supply 20-60 V DC

Connector: 5pin DFK

Pin Assignment:

1: not connected
2: V_{IN} -
3: PE (Protective Earth)
4: V_{IN} +
5: not connected



Input Parameter

Nominal voltage range:	U_N	=	24-48 V ⎓
Maximum voltage range:	U_{max}	=	20-60 V ⎓
Nominal current:	I_N	=	2.1 A

Output Parameter

Maximum power:	P_{max}	=	50 W
Maximum thermal energy:	E_{therm}	=	180.00 kJ/h (170.61 BTU/h)

8.4.3 SDI-N2X - Signal Input Module

- Configuration and montoring with MBGDEVMAN
- PTP Multicast (Power Profile compatible / PTP Unicast (Telecom Profile compatible) / NTP)
- PPO (PPS, PPM, PPH ...),
- IRIG AM, Freq. Synth. sinus outputs
- Generates several different unmodulated IRIG time codes

The Meinberg N2X180 is synchronized by an PTP Grandmaster or by a NTP Server and can be used as reference time source for the IMS MDU. The module provides equipment that requires Freq.Synth/sine, PPOs (PPS, PPM, PPH, Time Code DCLS - IRIG/AFNOR/IEEE1344) or serial time string for synchronization.

The N2X180 operates as an IEEE-1588 slave clock or NTP client in a network.

This converter can synchronize many different systems. Our IEEE-1588 Grandmaster or LANTIME NTP Server, such the LANTIME M1000, can be used as a reliable time source.

In order to support network management systems the N2X180 offers an extensive SNMP Interface, which can be accessed by SNMP V1.

Four Status LEDs:

St (Status):	blue:	during initialisation
	green:	normal operation
In (Init):	red:	no network cable connected (requires a few minutes after connection)
	yellow:	signal is available, not synchronized
	green (blink):	locked to input signal and synchronized but not accurate
	green:	Oscillator is warmed up, internal clock is accurate
Sp (Speed):	out:	no cable connection
	yellow:	10 Mbit
	green:	100 Mbit
Li (Link):	out:	no cable connection
	yellow (blink):	if traffic and 10 Mbit
	green (blink):	if traffic and 100 Mbit

Technical Specifications

Power Consumption: max 5 W

Accuracy of pulse outputs:	PTP:	±100 ns (relative to the used IEEE 1588 Grandmaster Clock, after initial synchronization phase)
	NTP:	±1 ms (relativ to NTP when using a local time server after warm-up period)
Connector:	LAN	RJ-45, 10/100 BaseT
	Duplex Modes:	Half/Full/Autonegotiaton
	Cable:	CAT 5 network cable
Oscillator:	OCXO-SQ (OCXO-MQ/HQ Options are available)	

Network Time Protocol (NTP)

- Up to seven configurable external NTP Time Server
- Min. and max. polling interval (8s – 1024s)
- Standard NTP options (noselect, true, prefer, iburst)

Precision Time Protocol (IEEE 1588)

- UDP/IPv4 (L3) or IEEE802.3 (L2)
- E2E, E2E Hybrid or P2P Delay Mechanism
- PTP Subdomains (0-255)
- Power Profile compatible
- Telecom Profile compatible

8.4.4 SDI-2101 - Signal Input Module

Features SDI-2101

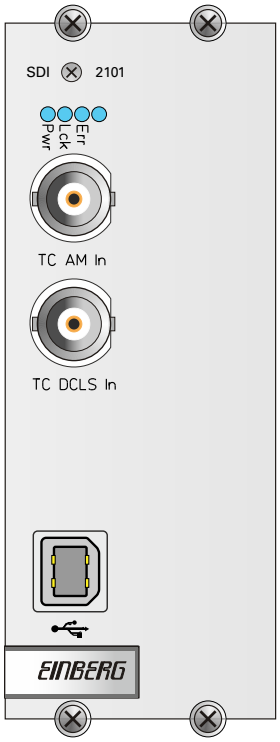
The SDI-2101 serves to receive and decode modulated (AM) and unmodulated (DC Level Shift) IRIG and AFNOR time codes. AM-codes are transmitted by modulating the amplitude of a sine wave carrier, unmodulated codes by variation of the width of pulses.

Automatic gain control within the receive circuit for modulated codes allows decoding of IRIG signals with a carrier amplitude of 600 mVpp to 8 Vpp. The input stage is electrically insulated and has an impedance of 600 Ω, it is accessible via the BNC female connector of the SDI-2101.

The unmodulated time codes must be connected to the TC-DCLS In BNC connector. An onboard optocoupler insulates the internal receive circuit.

MBGMON - Software running on the computer can read out information regarding date, time and status of the IRIG receiver.

The microprocessor system of the SDI-2101 is equipped with a Bootstrap-Loader and a Flash-EPROM. These features enable updating of the onboard software.



8.4.4.1 Functional description

After the received IRIG code has passed a consistency check, the software clock and the battery backed realtime clock of the SDI-2101 are synchronized to the external time reference. If an error in the IRIG telegram is detected, the system clock of the board switches to holdover mode. Drifting of the internal time base is limited to 1 μsec/sec by regulating the onboard quartz of SDI-2101. IRIG code includes day of year information only. The complete date is kept in the battery backed realtime clock and the software clock therefore. The received day of year is compared to this complete date once per second. If the board detects a difference between received and stored date information, the SDI-2101 switches to holdover mode but still synchronizes the internal time base to the received IRIG code.

The internal system clock is always set to the received IRIG time, which might have a local offset to UTC. Only if the SDI-2101 is configured with this offset, Meinberg driver software is able to set the system time of the computer correctly.

IRIG telegrams don't include announcers for the change of time zone (daylight saving on/off) or for the insertion of a leap second. Hence the clock will switch into freewheeling mode in case of such event, and resynchronize afterwards.

8.4.4.2 Time Code Formats

The board SDI-2101 decodes the following formats:

A133:	1000pps, amplitude modulated sine wave signal, 10 kHz carrier frequency BCD time of year, SBS time of day
A132:	1000pps, amplitude modulated sine wave signal, 10 kHz carrier frequency BCD time of year
A003:	1000pps, DC Level Shift pulse width coded, no carrier BCD time of year, SBS time of day
A002:	1000pps, DC Level Shift pulse width coded, no carrier BCD time of year
B123:	100pps, amplitude modulated sine wave signal, 1 kHz carrier frequency BCD time of year, SBS time of day
B122:	100pps, amplitude modulated sine wave signal, 1 kHz carrier frequency BCD time of year
B003:	100pps,DC Level Shift pulse width coded, no carrier BCD time of year, SBS time of day
B002:	100pps, DC Level Shift pulse width coded, no carrier BCD time of year
B007:	100 pps, DCLS Signal, no carrier BCD time-of-year, Year, SBS time-of-day
B006:	100 pps, DCLS Signal, no carrier BCD time-of-year, Year
B127:	100 pps, AM sine wave signal, 1 kHz carrier frequency BCD time-of-year, Year, SBS time-of-day
B126:	100 pps, AM sine wave signal, 1 kHz carrier frequency BCD time-of-year, Year
AFNOR NFS 87-500:	100pps, amplitude modulated sine wave signal, 1 kHz carrier frequency BCD time of year, complete date, SBS time of day
IEEE1344:	Code according to IEEE1344-1995, 100 pps, AM sine wave signal, 1kHz carrier frequency, BCD time-of-year, SBS time-of-day, IEEE1344 extensions for date, timezone, daylight saving and leap second in control functions (CF) segment.
C37.118	Like IEEE1344 - with turned sign bit for UTC-Offset37.118

The board SDI-2101 can't be used to decode amplitude modulated and DC Level Shift signals simultaneously. Depending on the selected code, only the signal at the corresponding BNC-connector is decoded.

8.4.4.3 USB Interface

The SDI-2101 contains an USB interface which is used for the communication and parameterization of the device with the monitoring software MBGMON. The system software can also be updated via the USB interface.

Configuration of SDI-2101
The selection of the IRIG code and a possible offset of the received IRIG time to UTC must be set up by the monitor software via the USB interface. If the selected IRIG telegram does not support the complete date (only the day of year 1...366), then you have set the date, which have to be stored in the real-time clock of the board, by using the MBGMON software.

If the time zone of the received IRIG code is not UTC, the local offset to UTC must be configured to ensure correct function of the driver software. If the local time zone is MEZ for example, the board must be set to a local offset of "+60min" (MEZ= UTC + 1 h).

8.4.4.4 Technical specification SDI-2101

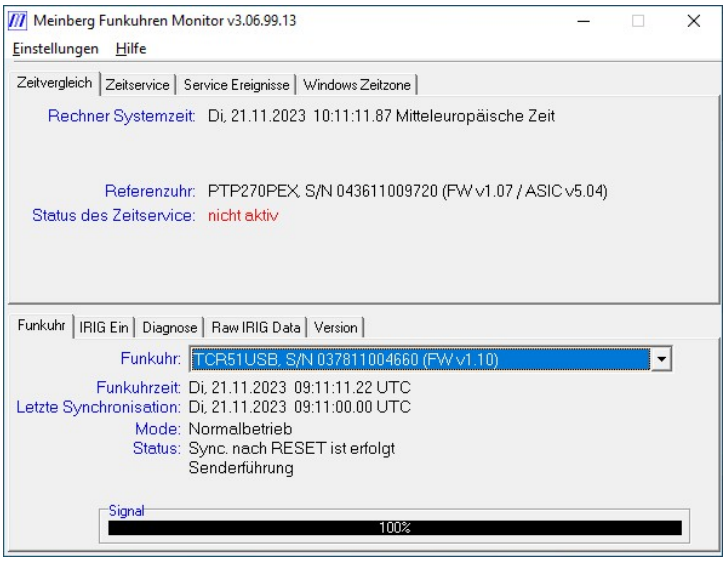
Receiver Input:	AM-input (BNC female): insulated by a transformer impedance settable 50 Ω input signal: 600 mV_{pp} to 8 V_{pp} (Mark) other ranges on request DC Level Shift input (BNC female): insulated by optocoupler internal series resistance: 220 Ω maximum forward current: 50 mA diode forward voltage: 1.0 V...1.3 V
Decoding:	Decoding of the following telegrams possible: IRIG-A133 / A132 / A003 / A002 IRIG-B123 / B122 / B003 / B002 / B007 / B006 / B127 / B126 AFNOR NFS 87-500, IEEE1344, C37.118
Accuracy of Time Base:	+/-5 μsec compared to IRIG reference marker
Required Accuracy of Time Code Source:	+/- 100 ppm
Holdover Mode:	Automatic switching to crystal time base accuracy approximately 1E-6 if decoder has been synchronous for more than 1h
Backup-Battery:	If the power supply fails, an onboard realtime clock keeps time and date information. The realtime clock can work with the Backup Battery for approximately 5 days. Important system parameters are stored in the RAM of the system
Reliability of Operation:	Microprocessor supervisory circuit provides watch-dog timer, power supply monitoring and backup-battery switchover. Software watchdog monitors correct program flow and generates a reset in case of error detection
Initialization:	Software and realtime clock can be set by the USB monitor program
Interface:	USB 1.1 Type B connection
Power Requirements:	+5 V, @ 80 mA
Ambient Temperature:	0 ... 50° C
Humidity:	max. 85 %

8.4.4.5 Setting Up the SDI-2101 for Use

This chapter explains how to set up a SDI-2101 for use using the Meinberg Monitor utility MbgMon. Each of the subsequent subchapters provides detailed explanations of basic and specific configuration processes.

You can download the software from our website and install it on your PC:
https://www.meinbergglobal.com/english/sw/#win

If your computer is running Windows 7 or later, the MBGMON program must be started as "**Admin**". To do this, please right-click on the program icon and select "Run as Administrator".

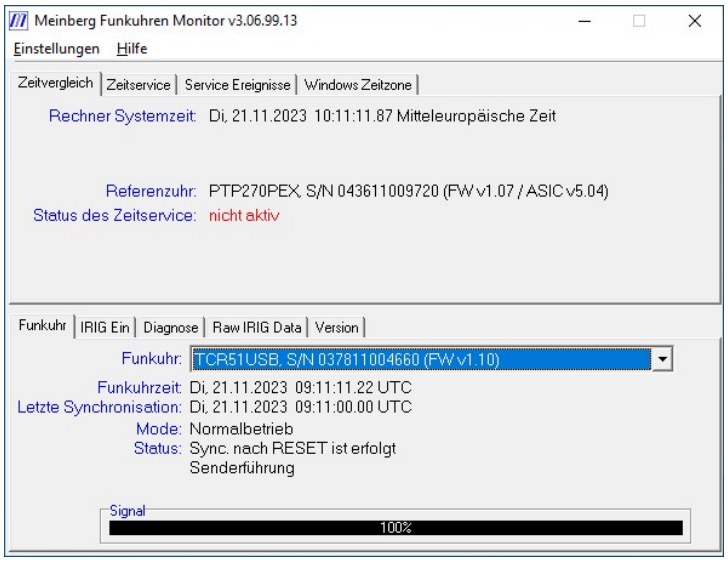


8.4.4.6 SDI-2101 Configuration

Information:

The SDI-2101 is set to factory settings before delivery and is therefore unconfigured.

Some basic configurations must be carried out at the beginning so that the SDI-2101 synchronizes properly using the timecode reference signal. The specific configurations of the inputs and outputs are described in more detail later in this chapter.



1. Selection of the Reference Clock

In common, the connected SDI-2101 is automatically detected by the program and selected as the reference time source. If, for example, a Meinberg PCI card is also installed in the PC, it may be necessary to select the desired clock manually.

Important!

The SDI-2101 is based on the Meinberg TCR-USB time code reader. Therefore, the SDI-2101 reports with the identifier "TCR51USB".

First click on the "Reference Clock" tab at the bottom of the MBGMON program and select the SDI-2101 from the drop-down menu.

This is initially in an "unsynchronized" state (**Mode:** Free Run), as the time information from the reference clock has not yet been decoded by the SDI-2101.

The status LEDs show the following pattern:

Fail	red
Tele.	green
Data	green (decoding is performed)
Init	off

Overview of Status Information

The possible status information of the selected reference (e.g. SDI) is described in more detail here.

Reference Time:	The current received IRIG time of the selected reference module.
Last Synchronization:	The time of the last synchronization.

Mode:	The current status of the reference module.
Normal Operation	The SDI-2101 has synchronized to a valid IRIG signal
No received Signal	No valid IRIG signal detected
Free-running	The SDI-2101 runs freely on a crystal basis

Status:	Sync after RESET has been performed at least once.
Transmitter Guidance	Valid IRIG signal is detected.
Radio-controlled clock runs freely on a quartz basis	No valid IRIG signal detected.

2. Selection of the Time Code

Click the "IRIG ON" tab and then select the IRIG signal fed in by the reference system from the drop-down menu.

Information:

Meinberg generally recommends IEEE1344 as a reference signal for the synchronisation of time code modules and systems, as this provides additional UTC offset and leap second information, among other things.

Visit the Meinberg Knowledge Base for detailed information on IRIG Time Code Basics.

https://kb.meinbergglobal.com/kb/irig_time_code_basics#ieee_code_extensions.

In order for the SDI-2101 to be able to analyse all the time code telegram information received from the reference system, both the IRIG code sent by the reference system and the corresponding IRIG input of the SDI-2101 must be set identically.

Example:
If the reference system outputs the DCLS time code format **IEEE1344** (DCLS), the SDI-2101 must be configured so that the IRIG code **IEEE1344** can be evaluated via the "TC IN" DC connection of the SDI-2101.

---

3. Adjusting the Offset

It is recommended to use the UTC time base as the reception and transmission standard for time code signals.

Unlike when using the IRIG code IEEE1344 as a reference signal, where the "IRIG offset to UTC" is already included in the transmitted data as information (see info box on previous page), an offset must be entered manually for compensation with B006/B007, for example.

Setting the IRIG Time Offset to UTC

The time zone of the reference system and the receiver (e.g. SDI-2101) is UTC.

IRIG-Code	Offset
IEEE1344	Transmission of the offset (automatic)
B006/B007	00:00

However, if the reference system itself does not output the time code with UTC, but with a local time offset (e.g. CET), this offset must be compensated for. This is necessary to ensure correct synchronisation of the SDI-2101.

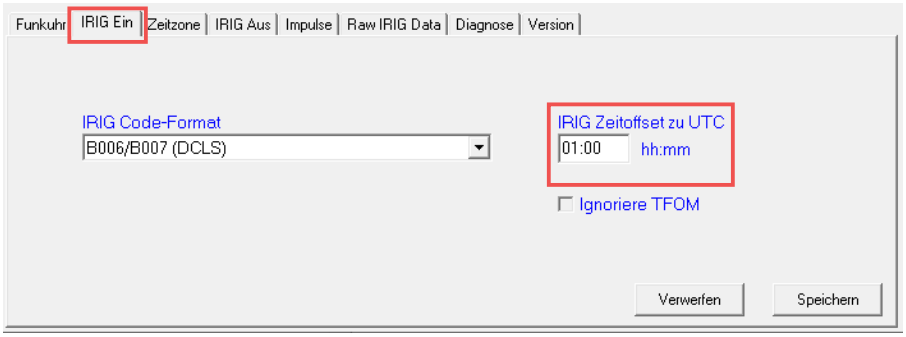
Caution!

In the input signal, the summer/winter time change (start/end of DST) causes a time jump in the derived UTC time, i.e. also in the computer system time.

Meinberg therefore recommends the use of IEEE codes for the synchronisation of time code modules and systems, as these contain both a UTC/UTC offset and an announcement bit, which is set within 59 seconds before the summer/winter time change and thus prevents a time jump.

In this example, the SDI-2101 must be set to the local time offset '+00:60 min' (CET = UTC + 1 h).

IRIG-Code	Offset
IEEE1344	Transmission of the offset (automatic)
B006/B007	01:00 (hh:mm)



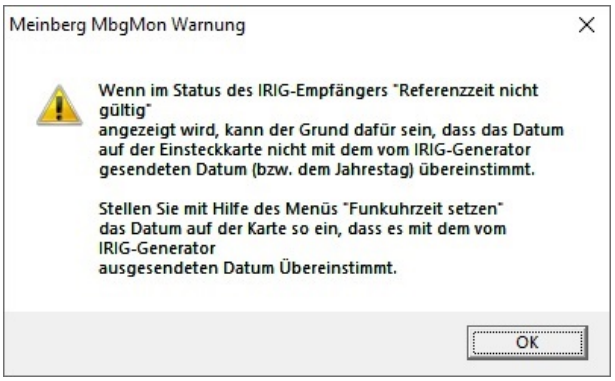
The status LEDs show the following pattern:

Fail	off
Tele.	green
Data	green
Init	off

4. Manual Setting of the SDI-2101 System Time

If the power supply to the SDI-2101 is interrupted, the Real Time Clock (RTC), which stores the date and time, is still supplied with power for approx. five days by the built-in gold cap. However, if the SDI-2101 remains without a power supply for longer, the RTC will provide an incorrect date or time when it is switched on again (see screenshot). This can have serious consequences for running applications.

To correct this, at least the date and ideally the date and time must be set correctly.



1. Click on "Settings" and then on "Set reference clock time".

2. Set the current date and time by pressing the "Transfer PC time to device" button so that the date and approximate time are set on the SDI-2101.

8.4.4.7 Setting the SDI-2101 as Time Reference

Once the configuration is complete, the SDI-2101 is usually automatically selected as the reference source for the connected computer. If this is not the case, go to Settings –> Reference time and select the SDI-2101 to use it for synchronising the computer.

Starting the Time Service

Once all necessary IRIG settings have been performed, the time service can be started.

This is done by clicking on the "Setup" menu and selecting "Start time service". This will cause the previously selected reference clock to be used to synchronize the computer time.

Status Information

The "Time Adjustment" tab provides some basic information about the computer system time and reference source time (i.e., that of the SDI-2101), as well as the current time difference between the two.

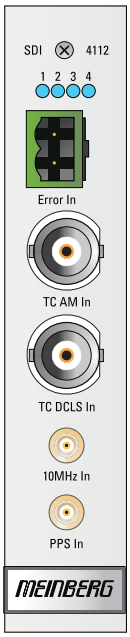
Reference Clock: The reference clock selected for synchronization of the computer.

Status of Time Service: *Active*
The reference clock is currently providing the time to the computer.
Disabled
The time service has been stopped or has not yet been started.
Waiting for reference time...
The time service has been started, but there is no functional connection with the clock (yet).

System Time Set: The time information that was last used by the SDI-2101 to set the computer time by the SDI-2101.

Corrected Offset: The corrected offset between the computer time and the SDI-2101 reference time of the SDI-2101.

8.4.5 SDI-4112 - Signal Input Module



Technical Spezifications SDI-4112:

Signal Inputs:	Error Input, via 2pin DFK connector, to connect to an existing error relays output (e.g. LANTIME M300...) (+ 5V current) 2 x BNC female - Time Code AM and DCLS In 2 x SMA female - PPS and 10MHz sine In
Current Consumption:	5 V +- 5%, @400 mA
Ambient Temperature:	0 ... 50°C / 32 ... 122°F
Humidity:	Max. 85%

Received Time Codes

Time Code modulated input, SMA connector, isolated by transformer

Insulation voltage:	3000 VDC
Input impedance:	50 Ohm, 600 Ohm, 5 kOhm Internally selectable by jumper (default 600 Ohm)
Input signal:	600mV to 8 V (Mark, peak-to-peak)

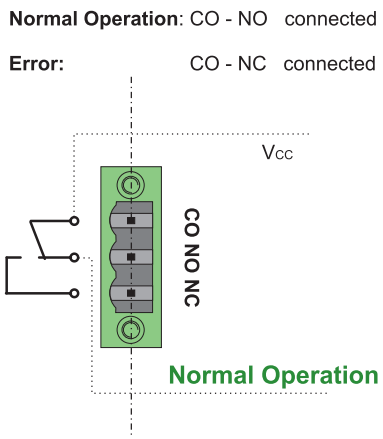
Time Code unmodulated input, BNC connector, isolated by opto-coupler

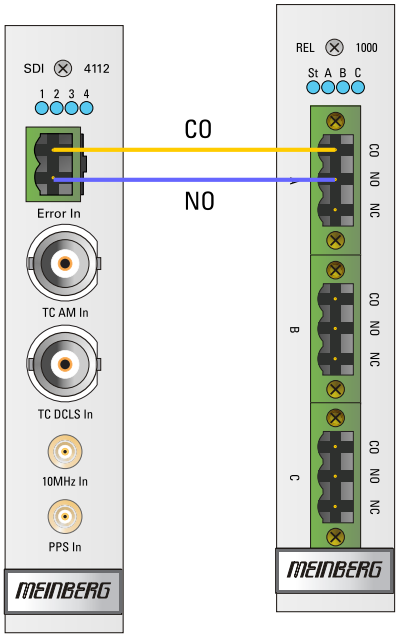
Insulation voltage:	3750 Vrms
Internal series resistor:	330 Ohm,
Max. input current:	25 mA
Diode forward voltage:	1.0 V...1.3 V

Pulse- and Frequency Input Signals

10 MHz sine Input:	sine (1.5 Vpp - 5 Vpp), female SMA connector
PPS Input:	TTL, active high, female SMA connector

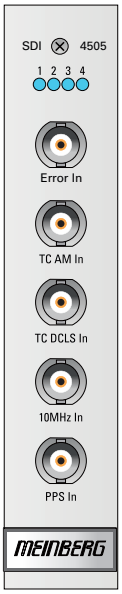
Connection scheme:
REL-1000 Clock 1 -> SDI-4112 External Error Input





8.4.6 SDI-4505 - Fiber Optical Input Module

The SDI is a signal input card for MDU systems. It distributes the signals, which are provided to the five fiber optic inputs. The SDI module is available for all MDU systems.



Technical Specifications SDI-4505:

Environmental

Operating temperature:	0 °C to 50 °C
Storage temperature:	- 20 °C to + 75 °C
Relative humidity:	max. 85 %, non-condensing

Power

Operating voltage:	+5 V DC
Power consumption:	240 mA

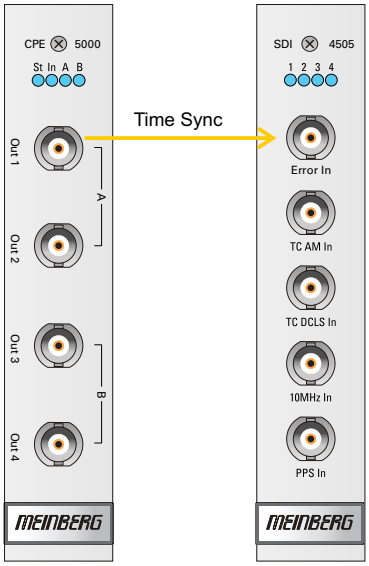
Connectors

5 x F-ST fiber optical connectors

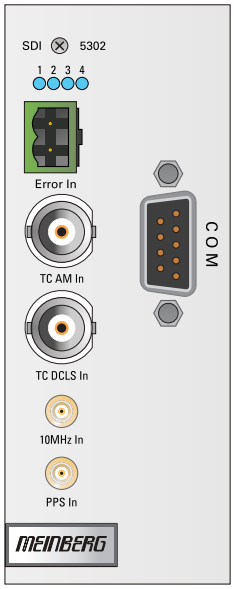
Fiber type:	Multi mode GI 50/125 μm or GI 62,5/125 μm
Wave length:	850 nm
Optical input level:	$\geq$ 3 μW

Signal inputs

Error Input
TC AM
TC DCLS
10 MHz
PPS



8.4.7 SDI-5302 - Signal Input Module



Technical Spezifications SDI-5302:

Signal Inputs: Error Input, via 2pin DFK connector, to connect to an existing error relays output (e.g. LANTIME M300...) (+ 5V current)
2 x BNC female - Time Code AM and DCLS In
2 x SMA female - PPS and 10MHz sine In
1 x Serial Time Telegram RS232 In, D-SUB9 connector
Assignment: Pin 3: RxD; Pin 5: GND
Time Telegram: Uni Erlangen
19200 Baud / 8N1 / per second

Current Consumption: 5 V +- 5%, @400 mA

Ambient Temperature: 0 ... 50°C / 32 ... 122°F

Humidity: Max. 85%

Received Time Codes

Time Code modulated input, SMA connector, isolated by transformer

Insulation voltage:	3000 VDC
Input impedance:	50 Ohm, 600 Ohm, 5 kOhm Internally selectable by jumper (default 600 Ohm)
Input signal:	600mV to 8 V (Mark, peak-to-peak)

Time Code unmodulated input, BNC connector, isolated by opto-coupler

Insulation voltage:	3750 Vrms
Internal series resistor:	330 Ohm,
Max. input current:	25 mA
Diode forward voltage:	1.0 V...1.3 V

Pulse- and Frequency Input Signals

10 MHz sine Input:	sine (1.5 Vpp - 5 Vpp), female SMA connector
PPS Input:	TTL, active high, female SMA connector

8.4.8 Assignment of the DIP Switch

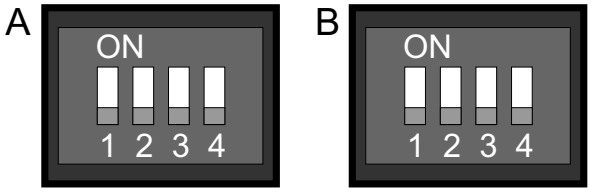
SDI-4112, SDI-4505 und SDI-5302, SDI-7312 Modules
The monitoring of the input signals can be set with the DIP switch block.

Operating Modes

If the switches (e.g. 1 - 5 from DIP 10pin.) are ON, all inputs of the module will be monitored. If, for example, no IRIG time code is connected via the assigned BNC female connector, the switches 2 and 3 should be set to position OFF, otherwise the LED 3 indicates a fault status.

Switch	Signal	LED	if "ON"
1 :	Error	LED 3 + 4	(flashes red)
2 :	TC-AM	LED 3	(red)
3 :	TC-DCLS	LED 3	(red)
4 :	10 MHz	LED 4	(red)
5 :	PPS	LED 4	(red)

DIP-switch SDI7312



Switch	Signal	LED	if "ON"
A1 :	Error	LED 3 + 4	(flashed red)
A2 :	TC-AM	LED 3	(red)
A3 :	TC-DCLS	LED 3	(red)
A4 :	10 MHz	LED 4	(red)
B1 :	PPS	LED 4	(red)
B2 :	PP	LED 4	(red)
B3 :	2048kHz	LED 3	(red)
B4 :	serial	LED 4	(red)

Hints for LIU Telecom Modules:
If only LIU modules (T1 / E1 Telecom output signals) are used in an IMS MDU chassis, only the 10MHz input must be connected to the SDI input module. Correspondingly, the DIP switch block needs to be set "on": Switch 1 and 4 (DIP 10pol.) or switch A1 and A4 (DIP 4pol.).

8.4.9 TCR Clock - Time Code Reader and Generator

The IMS - TCR180 serves to decode and generate modulated (AM) and unmodulated (DC Level Shift) IRIG-A/B/G, AFNOR, C37.118 or IEEE1344 time codes. AM-codes are transmitted by modulating the amplitude of a sine wave carrier, unmodulated codes by variation of the width of pulses.

As standard the clock module TCR180 is equipped with a OCXO-SQ (Oven Controlled Xtal Oscillator) as master oscillator to provide a high accuracy in holdover mode of ± 1E-8. Optionally an OCXO-MQ or OCXO-HQ is available for better accuracy.

Receiver:
Automatic gain control within the receive circuit for modulated codes allows decoding of IRIG-A/B/G, AFNOR, C37.118 or IEEE1344 signals with a carrier amplitude of 600 mV_{pp} to 8 V_{pp}. The input stage is electrically insulated and has an impedance of either 50 Ω, 600 Ω or 5 kΩ, selectable by a jumper.

DC Level Shift Input insulated by optocoupler with internal series resistance of 220 Ω.

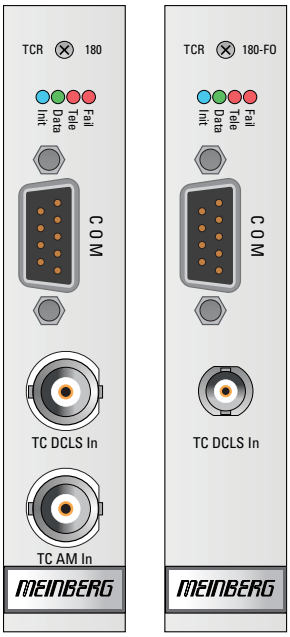


Figure right: TCR-180 and TCR-180-FO with ST connector multimode fiber (SX - 850 nm) for TC-DCLS input signal.

LED Indicators

Init	blue:	while the receiver passes the initialization phase
	off:	Oscillator not warmed up
	green:	the internal timing of the TCR180 is synchronized to the received time code (Lock)
Data	green:	correct time code detected
	red:	no correct time code detected
	yellow:	TCR180 synchronized by external source (MRS)
	yellow/green (flashing):	Holdover mode (MRS), IRIG Code available
	yellow/red (flashing):	Holdover mode (MRS), IRIG Code not available
Tele	green:	telegramm consistent
	red:	telegramm inconsistent
	yellow (flashing):	Jitter too large
Fail	red:	the internal timing of the TCR180 is in holdover mode
	off:	the internal timing of the TCR180 is synchronized to the received time code (Lock)

Generator:
The generator of TCR180 is capable of producing time codes in IRIG-A/B/G, AFNOR, C37.118 or IEEE1344 format. The codes are available as modulated (3 V_{pp} /1 V_{pp} into 50 Ω) and unmodulated (DC Level Shift) signals (TTL into 50 Ω and RS-422).

Regarding time code and its offset to UTC, the receiver and the generator can be configured independantly. Thus TCR180 can be used for code conversion.

Key Features

- IRIG Generator
- 4 programmable Pulse Outputs
- Frequency Synthesizer
- Battery Type CR2032

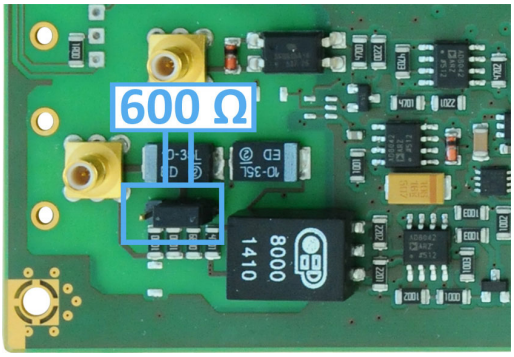


Figure 1: Jumper Settings: 600 Ω

Technical Specifications

Receiver Input

AM-input (BNC-connector):	insulated by a transformer impedance settable 50 Ω, 600 Ω, 5 kΩ 600 mV_{PP} to 8 V_{PP} (Mark)

Input Signal

DC Level Shift input:	insulated by photocoupler internal series resistance: 220 Ω maximum forward current: 60 mA diode forward voltage: 1.0 V...1.3 V

Decoding

Decoding of the following telegrams possible:	IRIG-A132 / A133 / A002 / A003 IRIG-B123 / B122 / / B126 / B127 / B002 / B003 / B006 / B007 IRIG-G142 / G146 / G002 / G006 AFNOR NFS 87-500 C37.118 IEEE1344

Accuracy of Time Base

Required Accuracy of Time Code Source:	max 100 μsec Jitter / offset 1E-5

Holdover Mode
Automatic switching
to crystal time base — accuracy approximately 1E-8
if decoder has been synchronous for more than 1h

Backup Battery
If the power supply fails, an onboard realtime clock keeps time and date information important system parameters are stored in the RAM of the system lifetime of the Lithium battery at least 10 years

Generator Outputs
Modulated output: — unbalanced sine carrier, 1 kHz
3 V_{PP} (MARK), 1 V_{PP} (SPACE) into 50 Ω

unmodulated outputs(DCLS):
TTL into 50 Ω, RS-422

Pulse Outputs
Four programmable outputs, TTL level
Default settings: active only 'if sync'

PPO_0 - PPO_3: — Idle (not active)
Timer
Single Shot
Pulse Per Second, Per Minute, Per Hour (PPS, PPM, PPH)
DCF77 Marks
Time Sync
DCLS Time Code
Synthesizer Frequency

Accuracy of Pulses
Better than ± 1 µsec after synchronization and 20 minutes of operation

Serial Port
Configurable RS-232 interface

Baudrates: — 300 Bd...115200 Bd
Framing: — 7E2, 8N1, 8N2, 8E1, 7N2, 7E1, 801
Mode of operation: — string per second
string per minute
string on request

Time telegram: — Meinberg Standard, Uni Erlangen, SAT, Meinberg Capture, ION, Computime, SPA, RACAL

Capture Inputs
Triggered by falling TTL slope

Pulse repetition time: — 1.5 msec min.
Resolution: — 800 nsec

Master Oscillator
OCXO-SQ (Oven Controlled Oscillator)

Accuracy compared to IRIG-reference:	sync. and 20 min. of operation: ± 5E-9 first 20 min. after sync.: ± 1E-8
	accuracy of oscillator: holdover, 1 day: ± 1E-7 holdover, 1 year: ± 1E-6
	short term stability: ≤ 10 sec, synchronized: ± 2E-9 ≤ 10 sec, holdover: ± 5E-9
	temperature dependant drift: holdover: ± 1E-6

Frequency Synthesizer

Output frequency:	fixed - 2.048MHz
Accuracy: 1/8 Hz to 10 kHz: 10 kHz to 10 MHz:	like system accuracy Phase synchronous to pulse per second deviation of frequency < 0.0047 Hz
Synthesizer Outputs:	TTL into 50 Ω sine wave 1.5 Vrms output impedance 200 Ω

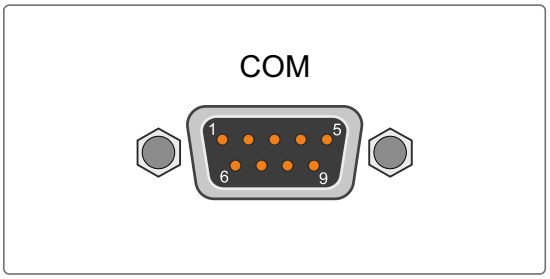
Pulse Outputs

Pulse per second (PPS):	TTL- and RS-232 level positive pulse, pulse duration 200 msec
Pulse per minute (PPM):	TTL level positive pulse, pulse duration 200 msec
Power Requirement:	power supplies provided via VG Connector - 5 V 450 mA
Dimension:	Euro card, 100mm x 160mm, 1.5mm Epoxy
Ambient Temperature:	0 ... 50°C
Humidity:	max. 85 %

Pin Assignment of the DSUB9 Connectors (male):

Pin 2: RxD
Pin 3: TxD
Pin 5: GND

Synchronization with PPS + String:
Pin 1: PPS
Pin 2: RxD



8.4.10 SPT Switch Card

Theory of operation

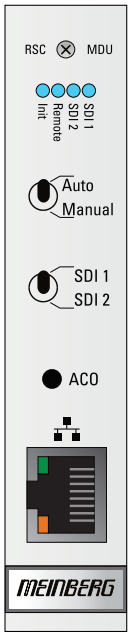
The input signals of the "SDI-1" slot are connected with the SPT-MDU to the I/O slots. In addition, the SPT-MDU monitors the state of the power supplies via two LEDs in the front panel. Another LED indicates the state of the System (Alarm).

LED Indicators

Status:	blue:	while the receiver passes through the initialization phase
	green:	normal operation
Alarm:	green:	normal operation
	red:	no signal or signal faulty
PSU 1/2:	*State of power supplies*	
	green:	normal operation
	red:	supply faulty or not connected

8.4.11 RSC Switch Card

Theory of operation
The RSC- Redundant Switch Control card controls the switchover of the input modules in redundant systems with two SDI units. The RSC is used to switchover the pulse and frequency outputs between the two input modules. The controls of the switchcard allow the selection of different modes in which the RSC operates. The status LEDs indicate which SDI is selected as master and the current operating state of the switching module.



Switch Position "Auto/Manual"
This switch selects between automatic and manual mode. In the manual mode the module's internal selection logic is overridden and the current system for signal generation can only be selected manually by the switch SDI 1 / SDI 2. In the manual mode outputs are always enabled, regardless of the synchronization state of the input module.

Switch Position "Auto"
The selection of the input reference is done by an internal switch-logic of the RSC. The selection of the active system based on the TIME_SYNC signals which are provided by the input module. The TIME_SYNC signals are indicate the synchronization of the clocks.

To avoid unnecessary changeovers in case of repeatedly occurring free run operations of one system, the master/backup order is changed with each changeover. For example, let's suppose the current master system looses its synchronization. Then a changeover is performed to the synchronous slave system and thus the former slave system becomes the new master. No changeover is done if both systems are asynchronous. In this case the current state stays the same.

Important: To ensure an automatic switchover the remote function should be disabled (see next chapter "Remote Monitoring over LAN Interface").

Switch Position "SDI 1 / SDI 2"
Selects the active clock system in manual mode which has no effect in automatic mode.

Starting of Operation
A network interface is available for the initial start of operation and configuration of the system (see chapter Quick Start Guide for Initial Operation)

8.4.11.1 RSC180: DIP Switches

The various modes of the board can also be configured using onboard DIP switches.

Configuration Using DIP Switches

SW	NAME	Description
1	DIS_ENA	Enables / disables signals if both clocks are out of sync
2	DIS_MAN	Enables / disables manual override via front panel controls
3	DIS_REM	Enables / disables remote mode
4	FUNCTION	RSC board functionality: either in an IMS system or as LAN interface
5	Reserve	
6	Reserve	
7	Reserve	
8	DIS_MST	Enables / disables "Priority Master" clock selection
9	Clk1_Clk2	Selects Master Clock 1 or Clock 2 based on priority
10	EN_CLK	Activates the clock with a sync event after reset (only if DIP 1 is ON).

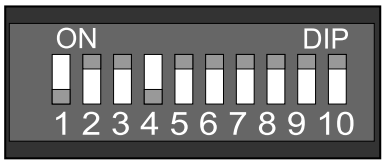


Figure: DIP Switches on RSC180

Description of DIP_SW positions:

Switch 1 Positions:
(0) OFF: If both clocks are out of sync, all output signals are disabled.
(1) ON: Even if both clocks are out of sync, outputs remain enabled on one of the clocks.

Switch 2 Positions:
(0) OFF: Front panel control functions enabled.
(1) ON: Front panel control functions disabled.

Switch 3 Positions:
(0) OFF: Remote control enabled.
(1) ON: Remote control disabled.

Switch 4 Positions:
(0) OFF: The RSC board is used in an IMS system.
(1) ON: LAN interface is enabled for configuration and monitoring.

Switch 5-7 Reserves.

Switch 8 Positions:
(0) OFF: "Priority Master" mode is disabled.
(1) ON: "Priority Master" mode is enabled.

If Switch 8 is ON:
Switch 9 Positions:
(0) OFF: The "Priority Master" is Clock 2.
(1) ON: The "Priority Master" is Clock 1.

If Switch 1 is ON:
Switch 10 Positions:
(0) OFF: One clock is always enabled, even if out of sync.
(1) ON: A clock is only enabled after the first sync event following a reset.

8.4.11.2 SNMPv1 Management and Monitoring

The status of clocks can be automatically monitored via SNMP v1 and traps sent when a problem is detected or changes in the operation of RSC180 occur. To activate SNMP functionality, the following two MIB files should be used:

MBG-SNMP-ROOT-MIB.mib and *MBG-RSC180V3.mib* where all Meinberg RSC board OIDs for management and monitoring are defined. For a detailed overview of RSC SNMP objects and traps with corresponding descriptions, please refer to the RSC180V3 MIB file.

The IP Address for the Trap receiver can be configured using an SNMP command snmpset.
snmpset -v1 -c public <IP Address of the RSC board> MBG-SNMP-RSC180-MIB::mbgTrapIPAddress.0 a "<IP Address of the trap receiver>"

"mbgTrapIPAddress" is the read-write MIB object to set the receiver IP-address.

Configuration example:
```
snmpset -v1 -c public 172.16.75.200 MBG-SNMP-RSC180-MIB::mbgTrapIPAddress.0
a "172.16.100.197"
```

The Write-Community should be defined as "public".

8.4.12 REL1000: Error Relay Module

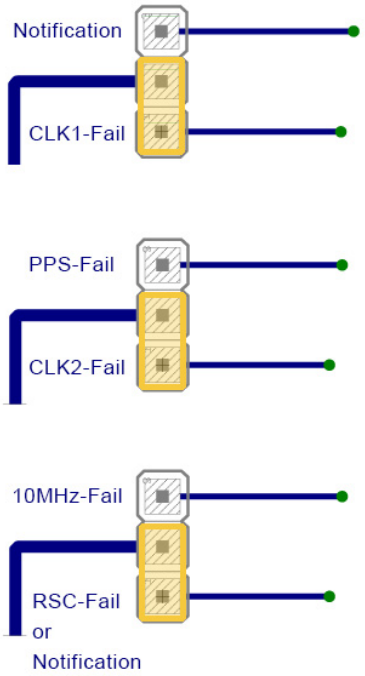
The REL1000 error relay module can be switched by various operating states (e.g.: Clock Not Sync). If the internal hardware clock is running synchronous to the source, the relay is switched to NO (Normaly Open) mode. In case of an error, the relay switches to NC (Normaly Closed) mode.

Depending on the hardware configuration of the IMS system, i.e. redundant with RSC module and two integrated reference clocks or with SPT module and only one reference clock, different relay states can be switched.

In redundant operation, the two clocks and the changeover unit are monitored as standard (CLK1 - relay A, CLK2 - relay B, RSC - relay C). This jumper setting is supplied per default in redundant systems.

Possible configurations of Error Output:
Relay A: Clock 1 / Notification Events → Relays
Relay B: Clock 2 / PPS
Relay C: RSC / 10 MHz / Notification Events → Relay

In redundant mode, the jumpers on the REL1000 are set as shown below:

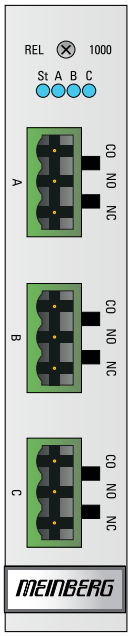


State of LED Indicators:

Initialisation Phase:
St: blue
A: off
B: off
C: off

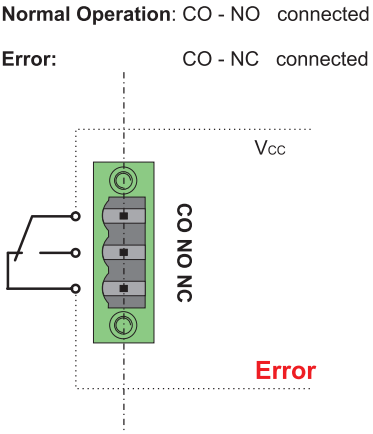
Boot Phase:
St: blue
A: 1s red, 1s yellow, 1s green, 1s off
B: 1s red, 1s yellow, 1s green, 1s off
C: 1s red, 1s yellow, 1s green, 1s off

Normal Operation Mode:
St: green (Status)
A: green, red in case of error (Clock 1)
B: green, red in case of error (Clock 2)
C: green, red in case of error (Notification Event)



Technical Specification ERROR Relays:

Switching Voltage:	220 V DC_{max} / 250 V AC_{max}	
Switching Load:	60 W_{max} /62.5 VA_{max}	
UL/CSA:	0.3 A	125 V AC
	0.3 A	110 V DC
	1 A	30 V DC
Response Time:	ca.3 ms	



8.4.13 BPE - Backplane Port Expander

Output Signals: fixed:
10 MHz, PPS, IRIG DCLS, IRIG AM, 2.048 MHz,
PPOs (selectable via receiver)

Power Requirements: 5 V +-5%, 150 mA / BNC
5 V +-5%, 150 mA / FO

Status Indicators

LED St:	BPE status
LED In:	Status of the backplane's output signals
LED A:	BPE status - output signals (1 + 2)
LED B:	BPE status - output signals (3 + 4)

Initialisation: LED St: blue until USB is configured
LED In - LED B: off until USB is configured

USB is configured: LED St: blue
LED In - LED B:
0,5 sec. red -> 0,5 sec. yellow ->
0,5 sec. green -> 0,5 sec. off

Normal Operation: LED St. + LED In: green
LED A: green, if the desired signal is present
on output 1 and output 2
LED B: green, if the desired signal is present
on output 3 and output 4

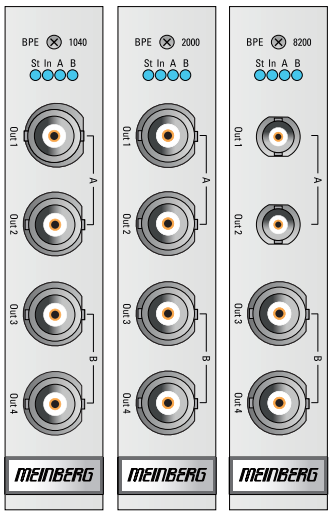


Fig. right: BPE signal outputs
BPE-1040 with 4 x BNC (Out 1 - Out 4) and
BPE-2000 with 4 x BNC (Out 1 - Out 4) and
BPE-8200 with 2 x BNC (Out 1/2) und 2 x ST FO

8.4.13.1 Available BPE Modules

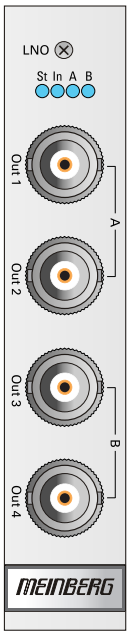
BPE Type	Connectors	Signal Outputs
BPE-1040	4x BNC female	Out 1 - Out 4: TC AM
BPE-2000	4x BNC female	Out 1: PPS, Out 2: 10 MHz Out 3: TC DCLS, Out 4: TC AM
BPE-2010	4x BNC female	Out 1 - Out 4: PPS
BPE-2020	4x BNC female	Out 1 - Out 4: 10 MHz
BPE-2030	4x BNC female	Out 1 - Out 4: TC DCLS
BPE-2080	4x BNC female	Out 1 - Out 4: 2.048 MHz
BPE-2530	4x DFK / PhotoMos 1x BNC female	PP 1 - PP 4: TC DCLS TC AM
BPE-3014	2x D-SUB9	TC DCLS / RS-422
BPE-3082	2x D-SUB9	4x 2048 kHz sine
BPE-5010	4x FO / ST	PPS
BPE-5020	4x FO / ST	10 MHz
BPE-5030	4x FO / ST	TC DCLS

8.4.14 LNO - Sine Wave Outputs with low Phase Noise

The LNO180 is a 10 MHz (5 MHz option) generator card, which provides sine signals with low phase noise to 4 external outputs. The card has a microprocessor system, which monitors the output signals and generates status signals for the upper-level management system accordingly.

Function of Operation
The card has a high quality oscillator, which is locked to an external 10 MHz signal. The microprocessor monitors the lock status of the PLL and the warm up phase of the oscillator. It activates the outputs only after the phase is locked. This condition is signalized by all LEDs switched from green to red. In the phase locked state the output levels of the four outputs are monitored and in case of a failure signalized by an associated red LED.

Technical Specifications:



Interface: 4x sine outputs - 10 MHz or 5 MHz

Output Level: 5 dBm +/- 1 dBm at 50Ω
(8 dBm or 12 dBm output level option available)

Warm-up time: < 3 @ 25 °C within accuracy of < +-1 x 10^{-7}

Harmonics: -60 dBc

Phase Noise:

LNO180 OCXO-SQ

1 Hz	-80 dBc/Hz
10 Hz	-100 dBc/Hz
100 Hz	-130 dBc/Hz
1 kHz	-140 dBc/Hz
10 kHz	-150 dBc/Hz

LNO180 OCXO-MQ

1 Hz	-85 dBc/Hz
10 Hz	-110 dBc/Hz
100 Hz	-135 dBc/Hz
1 kHz	-143 dBc/Hz
10 kHz	-155 dBc/Hz

LNO180 OCXO-HQ

1 Hz	-93 dBc/Hz
10 Hz	-126 dBc/Hz
100 Hz	-140 dBc/Hz
1 kHz	-145 dBc/Hz
10 kHz	-165 dBc/Hz

5 MHz Option:

LNO180/5 OCXO-MQ

1 Hz	-88 dBc/Hz
10 Hz	-115 dBc/Hz
100 Hz	-132 dBc/Hz
1 kHz	-145 dBc/Hz
10 kHz	-158 dBc/H

Quartz Filter: Bandwidth 1 kHz

Power Supply:	5 dBm	+5V @ 550 mA (steady state), +5V @ 670 mA (warm up)
	12 dBm:	+5V @ 970 mA (steady state), +5V @ 620 mA (warm up)

LED Status Indicators:

All LEDs red	Outputs disabled PLL not locked, OCXO in warm up phase
	10 MHz reference not available Quality of the reference signal is not sufficient
All LEDs green:	Normal operation, outputs activated
Associated LED red:	defect output or short circuit during normal operation

9 Update of the System Software

If it is ever necessary to copy an updated version of the system firmware to the device, this can be done via the serial interface COM 0 without opening the housing of the device. The new firmware version can easily be loaded onto the system using the Meinberg monitoring software "Meinberg Device Manager".

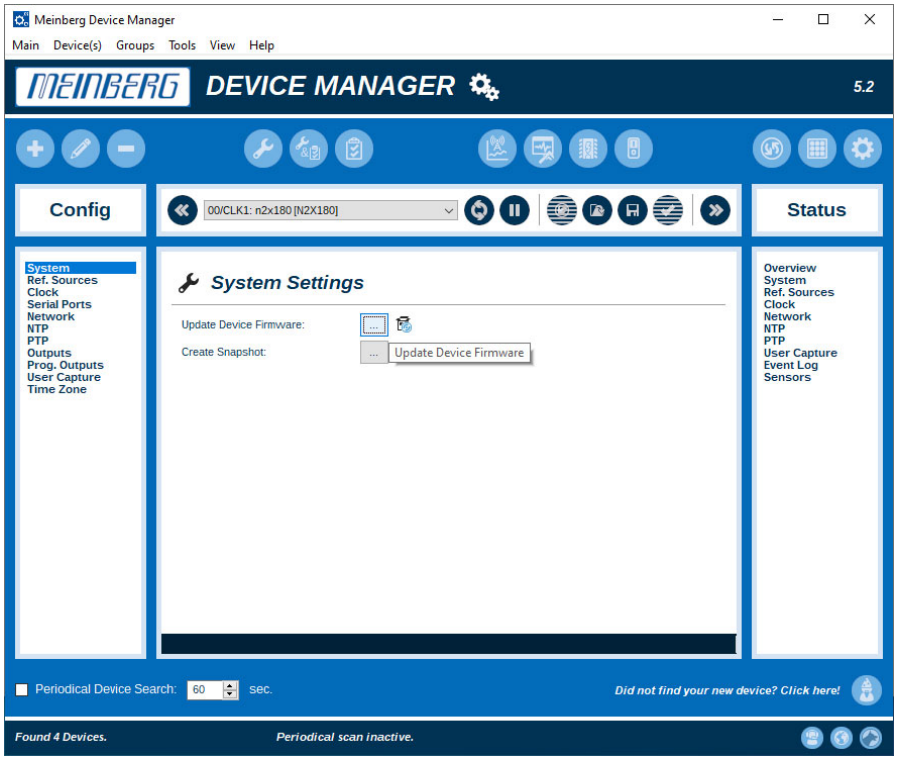


Figure: With the button **Update Device Firmware** *a current firmware version can be loaded on the module.*

You can find the software and the "Meinberg Device Manager" documentation as download on our website: https://www.meinbergglobal.com/english/sw/mbg-devman.htm

Create Snapshot
It is possible to save the current configuration of the module as a text file (zip format). In case of operating problems you can send this file to the MEINBERG support team.

Note:
You may need a "Serial to USB Converter" to connect the system with your PC. This converter is not included in the scope of delivery.

10 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.

11 Declaration of Conformity for Operation in the European Union

Konformitätserklärung
Doc ID: IMS-MDU312-November 29, 2023

Hersteller *Manufacturer*	Meinberg Funkuhren GmbH & Co. KG Lange Wand 9, D-31812 Bad Pyrmont

erklärt in alleiniger Verantwortung, dass das Produkt,
declares under its sole responsibility, that the product

Produktbezeichnung *Product Designation*	**IMS-MDU312**

auf das sich diese Erklärung bezieht, mit den folgenden Normen und Richtlinien übereinstimmt:
to which this declaration relates is in conformity with the following standards and provisions of the directives:

EMV – Richtlinie *EMC Directive* 2014/30/EU	EN 61000-6-2:2019 EN IEC 61000-6-3:2021 EN 55035:2017/A11:2020 EN 55032:2015 + AC:2016 + A11:2020 + A1:2020
Niederspannungsrichtlinie *Low-voltage Directive* 2014/35/EU	EN IEC 62368-1:2020 + A11:2020
RoHS – Richtlinie *RoHS Directive* 2011/65/EU + 2015/863/EU	EN IEC 63000:2018

Bad Pyrmont, November 29, 2023

Stephan Meinberg
Production Manager

12 Declaration of Conformity for Operation in the United Kingdom

UK Declaration of Conformity

Doc ID: IMS-MDU312-November 29, 2023

Manufacturer	Meinberg Funkuhren GmbH & Co. KG Lange Wand 9 31812 Bad Pyrmont Germany

declares that the product

Product Designation	**IMS-MDU312**

to which this declaration relates, is in conformity with the following standards and provisions of the following regulations under British law:

Electromagnetic Compatibility Regulations 2016 (as amended) *SI 2016/1091*	EN IEC 61000-6-2:2019 EN IEC 61000-6-3:2021 EN 55035:2017/A11:2020 EN 55032:2015 + AC:2016 + A11:2020 + A1:2020
Electrical Equipment (Safety) Regulations 2016 (as amended) *SI 2016/1101*	EN IEC 62368-1:2020/A11:2020
The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 (as amended) *SI 2012/3032*	EN IEC 63000:2018

Bad Pyrmont, Germany, dated November 29, 2023

S. Meinberg

Stephan Meinberg
Production Manager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