



The Synchronization Experts.



## MANUAL

IMS-MDU312

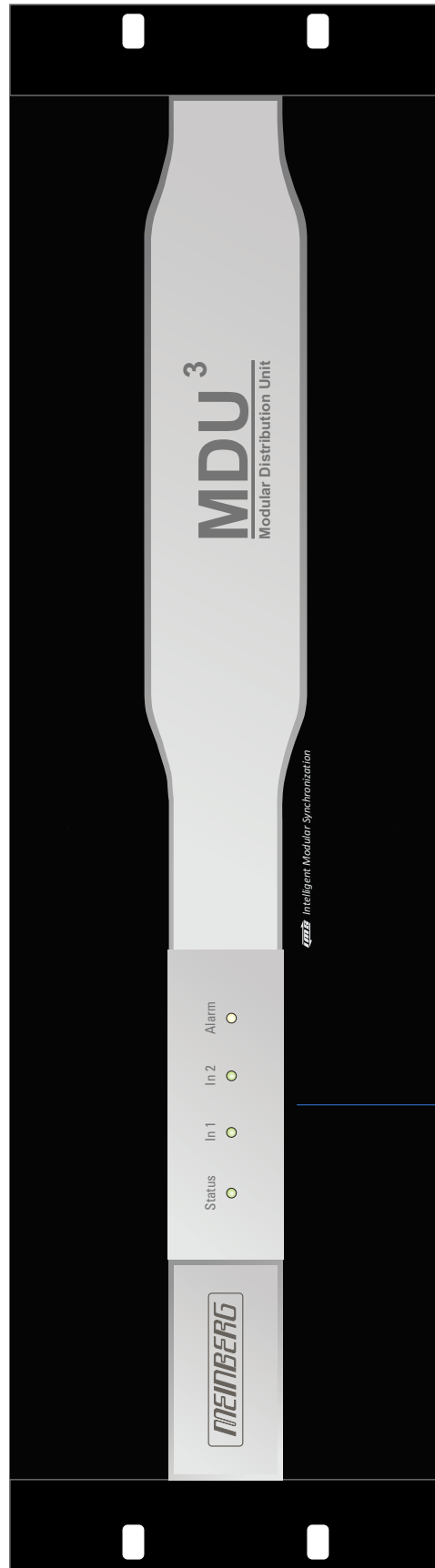
Modular Sync. System

3rd March 2021

Meinberg Funkuhren GmbH & Co. KG



# Front view (Frontansicht) IMS-MDU312



## DEUTSCH

### 1. LED Statusanzeige:

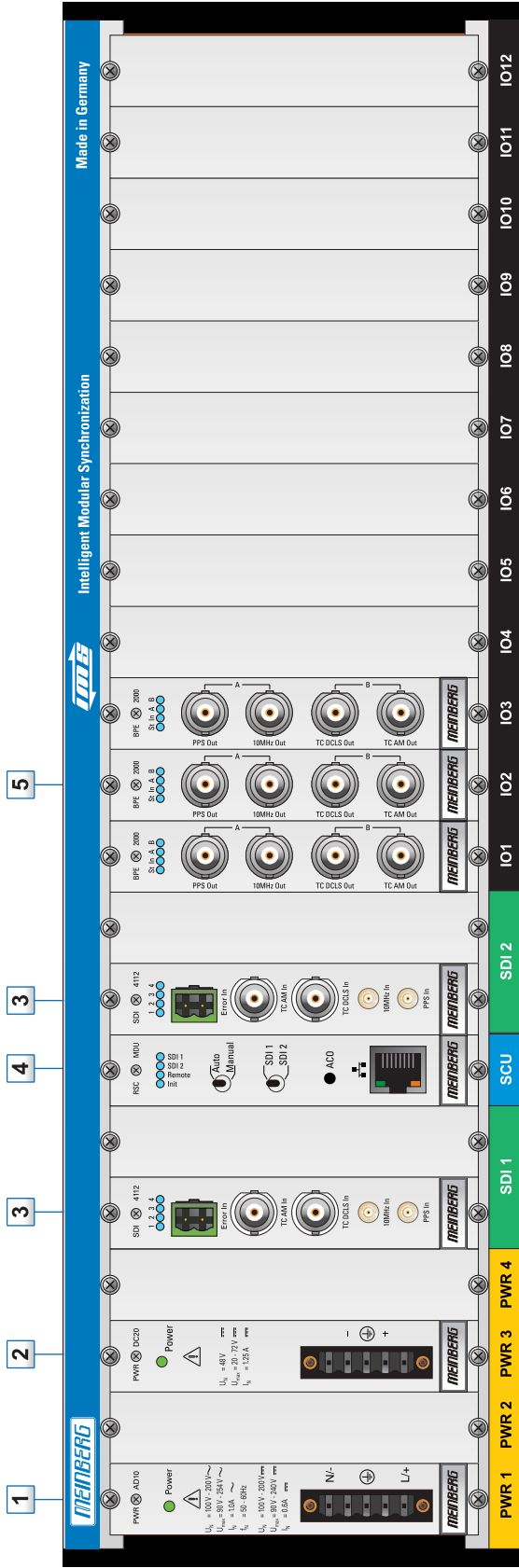
Status  
Eingangssignal In 1  
Eingangssignal In 2  
Fehler / Alarm

## 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 Ausgangssignale -  
PPS, 10MHz, TC-DCLS, TC-AM / BNC Buchse

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# 1 Imprint

**Meinberg Funkuhren GmbH & Co. KG**  
Lange Wand 9, 31812 Bad Pyrmont / Germany

Phone: + 49 (0) 52 81 / 93 09 - 0

Fax: + 49 (0) 52 81 / 93 09 - 230

Internet: <https://www.meinbergglobal.com>

Mail: [info@meinberg.de](mailto:info@meinberg.de)

Date: 03.03.2021

## 2 Important Safety Information

### 2.1 Important Safety Instructions and Protective Measures

The following safety instructions must be respected in all operating and installation phases of the device. Non-observance of safety instructions, or rather special warnings and operating instructions in product manuals, violates safety standards, manufacturer instructions and proper usage of the device. Meinberg Funkuhren shall not be responsible for any damage arising due to non-observance of these regulations.



Depending on your device or the installed options some information is not valid for your device.



The device satisfies the requirements of the following EU regulations: EMC-Directive, Low Voltage Directive, RoHS Directive and - if applicable - the Radio Equipment Directive.

If a procedure is marked with the following signal words, you may only continue, if you have understood and fulfilled all requirements. In this documentation dangers and indications are classified and illustrated as follows:



#### **DANGER!**

The signal word indicates an imminently hazardous situation with a high risk level . This notice draws attention to an operating procedure or similar proceedings, of which a non-observance may result in serious personal injury or death .



#### **WARNING!**

The signal word indicates a hazard with a medium risk gradient . This notice draws attention to an operating procedure, a procedure or the like which, if not followed, can lead to serious injuries , possibly resulting in death .



#### **CAUTION!**

The signal word indicates a hazard with a low risk gradient . This notice draws attention to an operating procedure, a procedure or the like which, if not followed, can lead to minor injuries .















#### **ATTENTION!**

This notice draws attention to an operating procedure, a procedure or the like which, if not followed, can cause damage to the product or loss of important data .

## 2.2 Used Symbols

The following symbols and pictograms are used in this manual. To illustrate the source of danger, pictograms are used, which can occur in all hazard classes.

Symbol	Beschreibung / Description
	IEC 60417-5031 Gleichstrom / <i>Direct current</i>
	IEC 60417-5032 Wechselstrom / <i>Alternating current</i>
	IEC 60417-5017 Erdungsanschluss / <i>Earth (ground) terminal</i>
	IEC 60417-5019 Schutzleiteranschluss / <i>Protective earth (ground) terminal</i>
	ISO 7000-0434A Vorsicht / <i>Caution</i>
	IEC 60417-6042 Vorsicht, Risiko eines elektrischen Schlages / <i>Caution, risk of electric shock</i>
	IEC 60417-5041 Vorsicht, heiße Oberfläche / <i>Caution, hot surface</i>
	IEC 60417-6056 Vorsicht, Gefährlich sich bewegende Teile / <i>Caution, moving fan blades</i>
	IEC 60417-6172 Trennen Sie alle Netzstecker / <i>Disconnection, all power plugs</i>
	IEC 60417-5134 Elektrostatisch gefährdete Bauteile / <i>Electrostatic Sensitive Devices</i>
	IEC 60417-6222 Information generell / <i>Information general</i>
	2012/19/EU Dieses Produkt fällt unter die B2B Kategorie. Zur Entsorgung muss es an den Hersteller übergeben werden. <i>This product is handled as a B2B category product. In order to secure a WEEE compliant waste disposal it has to be returned to the manufacturer.</i>



The manuals for a product are included in the scope of delivery of the device on a USB stick. The manuals can also be obtained via the Internet. Enter [www.meinbergglobal.com](http://www.meinbergglobal.com) into your browser, then enter the corresponding device name in the search field at the top.



This manual contains important safety instructions for the installation and operation of the device. Please read this manual completely before using the unit.

This device may only be used for the purpose described in this manual. In particular, the given limits of the device must be observed. The safety of the installation in which the unit is integrated is the responsibility of the installer!

Non-observance of these instructions can lead to a reduction in the safety of this device!

Please keep this manual in a safe place.

This manual is intended exclusively for electricians or persons trained by an electrician who are familiar with the applicable national standards and safety rules. Installation, commissioning and operation of this device may only be carried out by qualified personnel.

## 2.3 Security during Installation



### WARNING!

#### Preparing for Commissioning

This built-in unit, has been designed and examined according to the requirements of the standard IEC 62368-1 "Audio/video, information and communication technology equipment - Part 1: Safety requirements".

When the built-in unit is used in a terminal (e.g., housing cabinet), additional requirements according to Standard IEC 62368-1 must be observed and complied with. In particular, the general requirements and the safety of electrical equipment (such as IEC, VDE, DIN, ANSI) as well as the applicable national standards are to be observed.

The device has been developed for use in the industrial sector as well as in residential areas and can only be used in such environments. For environments with higher levels of soiling, additional measures, e.g. Installation in an air-conditioned control cabinet required.

#### Transport, Unpacking, Installation

If the unit is brought into the operating room from a cold environment, condensation may occur, wait until the unit is temperature-controlled and absolutely dry before operating it.

When unpacking, setting up, and before operating the equipment, be sure to read the information on the hardware installation and the specifications of the equipment. These include, for example, dimensions, electrical characteristics, and necessary ambient and climatic conditions, etc.

The fire protection must be ensured in the installed state.

For mounting, the housing must not be damaged. No holes may be drilled in the housing.

For safety reasons, the device with the highest mass should be installed in the lowest position of the rack. Other devices must be placed from the bottom to the top.

The device must be protected against mechanical stress such as vibration or shock.



#### Connecting Data Cables

During a thunderstorm, data transmission lines must not be connected or disconnected (risk of lightning).

When wiring the devices, the cables must be connected or disconnected in the order of the arrangement described in the user documentation accompanying the device. Always attach all cables to the plug during connection and removal. Never pull the cable itself. Pulling the cable can cause the cables to disconnect from the plug.

Install the cables in way that they do not constitute a hazard (danger of tripping) and are not damaged, i.e. kinked.

#### Connecting Power Supply

This equipment is operated at a hazardous voltage. Non-observance of the safety instructions in this manual may result in serious personal injury or property damage.

Before connecting to the power supply, a grounding cable must be connected to the earth connection of the device.

Before operation, check that all cables and lines work properly and are undamaged. Pay particular attention to the facts that the cables do not have kinks or that they are not too short around corners, and no objects are placed on the cables. Also make sure that all connections are secure.

Faulty shielding or cabling will endanger your health (electrical shock) and may destroy other equipment.

Ensure that all necessary safety precautions have been taken. Make all connections to a unit before turning on the power. Observe the safety instructions on the device (see safety symbols).

The metal housing of the device is grounded. It must be ensured that enough air and creepage distances to neighboring voltage-carrying parts are provided during assembly in the control cabinet and no short circuits are caused.

In the case of malfunctions or servicing (e.g. in the event of a damaged housing or power cable or when fluids or foreign objects enter), the current flow can be interrupted. Questions about the house installation, need to be clarified with your house administration.

The power supply should be connected with a short, low-inductance line.

AC Power Supply	DC Power Supply
<ul style="list-style-type: none"> <li>• The device is a device of protection class 1 and may only be connected to a grounded outlet (TN system).</li> <li>• For safe operation, the device must be protected by an installation fuse of max. 16 A and equipped with a residual current circuit breaker in accordance with the applicable national standards.</li> <li>• The unit must always be disconnected from the mains and not from the appliance.</li> <li>• Devices with mains plugs are equipped with a safety-tested mains cable of the country of use and may only be connected to a grounded shockproof socket, otherwise electric shock may occur.</li> <li>• Make sure that the mains socket on the appliance or the mains socket of the house installation is freely accessible to the user so that the mains cable can be pulled out of the socket in case of emergency.</li> </ul>	<ul style="list-style-type: none"> <li>• Outside the assembly group the device must be disconnectable from the power supply in accordance with the provisions of IEC 62368-1 (e.g. by the primary line protection).</li> <li>• Installation and disassembly of the power supply plug is only permitted if the assembly group is switched off (e.g. by the primary line protection).</li> <li>• The supply lines must be adequately secured and dimensioned.</li> </ul> <p style="text-align: center;"><i>Connection Cross Section:</i>  <math>1\text{ mm}^2 - 2.5\text{ mm}^2</math>  17 AWG – 13 AWG</p> <ul style="list-style-type: none"> <li>• The device must be supplied with a suitable disconnecter (switch). The separation device must be easily accessible, placed near the device and marked as a separation device for the unit.</li> </ul>

## 2.4 Protective Conductor- / Ground-Terminal



### ATTENTION!



In order to ensure safe operation 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 earth connection is provided on the housing, it must be connected to the equipotential bonding rail (grounding rail). The mounting parts (without cable) are not included in the scope of delivery.

#### Note:

Please use a grounding cable  $\geq 1.5 \text{ mm}^2$   
Always pay attention to a correct crimp connection!

## 2.5 Safety during Operation



### WARNING!

#### Avoiding Short-Circuits

Make sure not to get any objects or liquids inside the unit. Electric shock or short circuit could result.

#### Ventilation Slots

Make sure that the ventilation slots are not covered or dusty, as there is a danger of overheating during operation. Disturbances during operation can result.

#### Normal Operation

The normal operation and the observance of the EMC limits (electromagnetic compatibility) are only ensured if the housing cover is properly installed and when the doors are closed (cooling, fire protection, shielding against electrical, magnetic and electromagnetic fields).



#### Switch off in fault / service case

By switching off, the devices are not disconnected from the power supply. In the event of a fault or service case, the devices must be immediately disconnected from all power supplies.

#### Follow the steps below:

- Switch off the device
- Disconnect all power plugs
- Inform the service
- Devices that are connected via one or more uninterruptible power supplies (UPS) remain operational even when the UPS power cord is disconnected. Therefore, you must put the UPS out of operation according to the documentation of the corresponding user documentation.

## 2.6 Safety during Maintenance



### WARNING!

When you are expanding the device, use only device parts that are approved for the system. Non-observance may result in injury to the EMC or safety standards and cause malfunction of the device.

If device parts, which are released for the system, are extended or removed there may be a risk of injury in the area of the hands, due to the pull-out forces (approx. 60 N).

The service informs you which device parts may be installed.

The device must not be opened, repairs to the device may only be carried out by the manufacturer or by authorized personnel. Improper repairs can result in considerable danger to the user (electric shock, fire hazard).

Unauthorized opening of the device or of individual parts of the device can also lead to considerable risks for the user and result in a loss of warranty as well as an exclusion of liability.



- Danger due to moving parts - keep away from moving parts.



- Device parts can become very hot during operation. Do not touch these surfaces! If necessary, switch off the unit before installing or removing any equipment, and allow it to cool down.

## 2.7 Cleaning and Care



### ATTENTION!

Do not wet clean the appliance! Penetrating water can cause considerable dangers to the user (e.g., electric shock).

Liquid can destroy the electronics of the device! Liquid penetrates into the housing of the device and can cause a short circuit of the electronics.

Only clean with a soft, dry cloth. Never use solvents or cleaners.

## 2.8 Prevention of ESD Damage



### ATTENTION!

The designation ESD (Electrostatic Sensitive Devices) refers to measures which are used to protect electrostatically endangered components from electrostatic discharge and thus to prevent destruction. Systems and assemblies with electrostatically endangered components usually have the following characteristics:



### Indicator for assemblies with electrostatic endangered components

The following measures protect electrostatically endangered components from destruction:

#### Prepare removal and installation of assemblies

Unload yourself (for example, by touching a grounded object) before touching assemblies.

Ensure that you wear a grounding strap on the wrist when working with such assemblies, which you attach to an unpainted, non-conductive metal part of the system.

Use only tools and devices that are free from static electricity.

#### Transporting Assemblies

Assemblies may only be touched at the edge. Do not touch any pins or conductors on assemblies.

#### Installing and Removing Assemblies

Do not touch persons who are not grounded while removing or installing components. This could result in a loss of grounding protection from your electrostatic discharge.

#### Storing Assemblies

Always keep assemblies in ESD protective covers. These protective covers must be undamaged. ESD protective covers, which are extremely wrinkled or even have holes, no longer protect against electrostatic discharge.

ESD protective covers must not be low-resistance and metallically conductive if a lithium battery is installed on the assembly.

## 2.9 Return of Electrical and Electronic Equipment



### ATTENTION!

**WEEE Directive on Waste Electrical and Electronic Equipment 2012/19 / EU**  
(WEEE Waste Electrical and Electronic Equipment)

#### Separate Collection

Product Category: According to the device types listed in the WEEE Directive, Appendix 1, this product is classified as an IT and communication device.



This product meets the labeling requirements of the WEEE Directive. The product symbol on the left indicates that this electronic product must not be disposed of in domestic waste.

#### Return and Collection Systems

For returning your old equipment, please use the country-specific return and collection systems available to you or contact Meinberg.

The withdrawal may be refused in the case of waste equipment which presents a risk to human health or safety due to contamination during use.

#### Return of used Batteries

Batteries marked with one of the following symbols may not be disposed of together with the household waste according to the EU Directive.



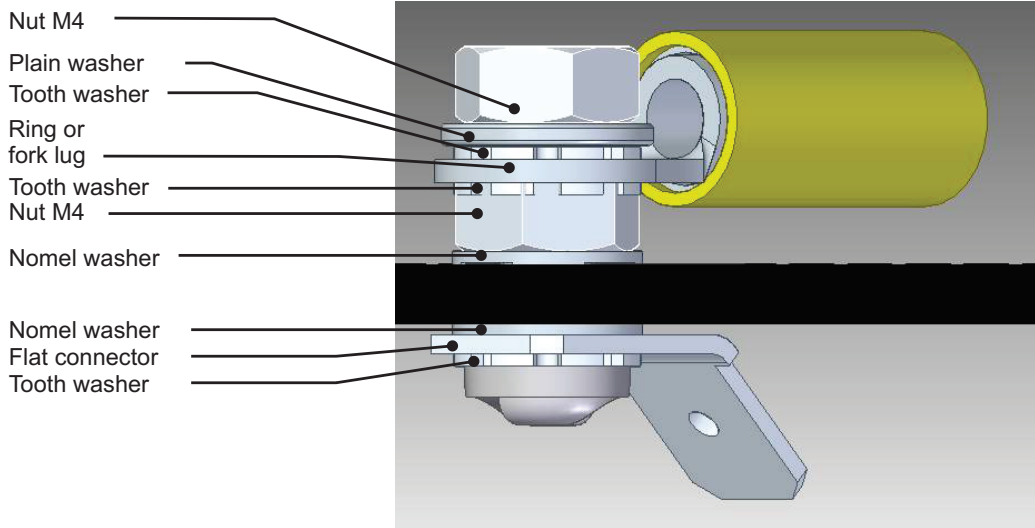
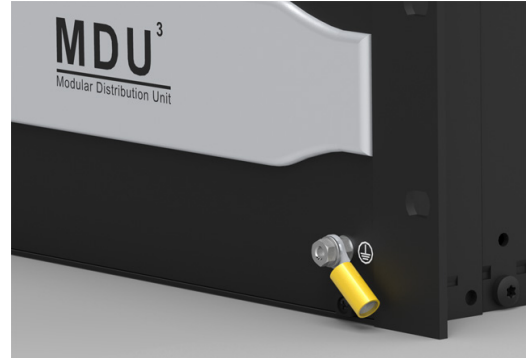
## 2.10 Grounding connection IMS-MDU312



**Note:**

To ensure a safe operation and to fulfil the requirements in accordance with DIN EN 60950, the system must be correctly connected to an equipotential grounding bus. On the front panel of the system a grounding connector is provided.

The mounting components (without a cable) are included.



**Note:**

Use a grounding cable with  $\geq 1,5\text{mm}^2$   
Please ensure a correct crimp connection!

## 3 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 performed manually or automatically. 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.

# 4 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/utills/windows/mbgdevman\\_setup.exe](https://www.meinbergglobal.com/download/utills/windows/mbgdevman_setup.exe)
- Linux:** <https://www.meinbergglobal.com/download/utills/linux/mbgdevman.tar.gz>



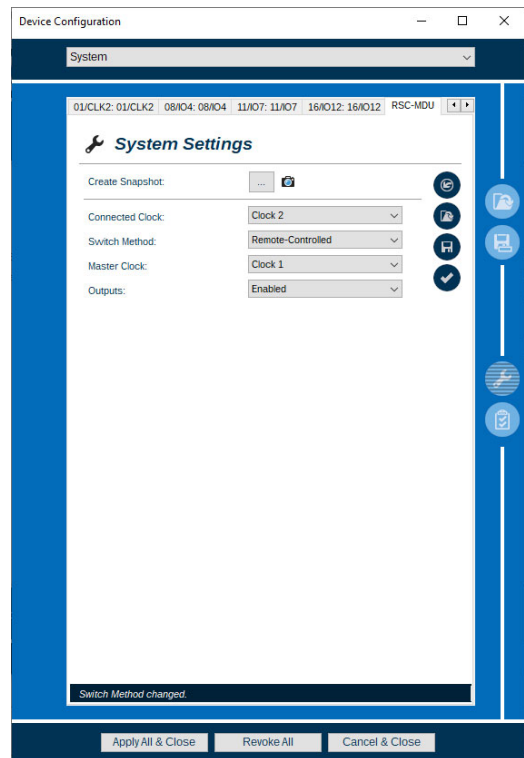
## Configuration via network with Meinberg Device Manager

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



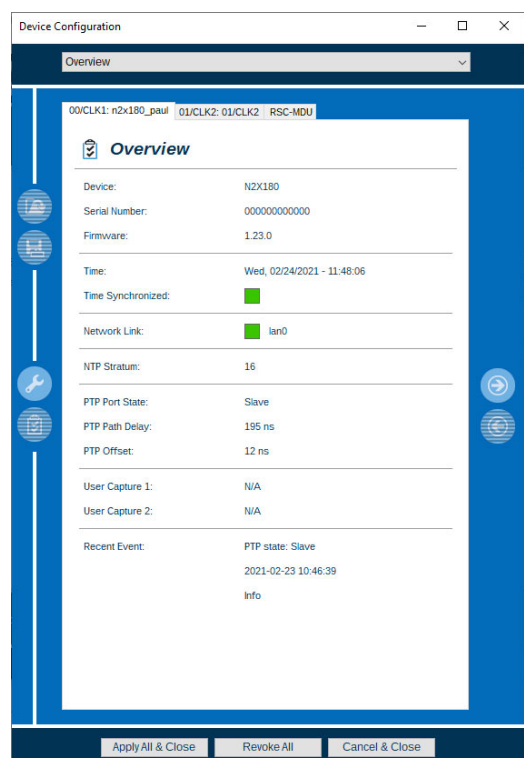
**Button "Show Device(s) Status"**

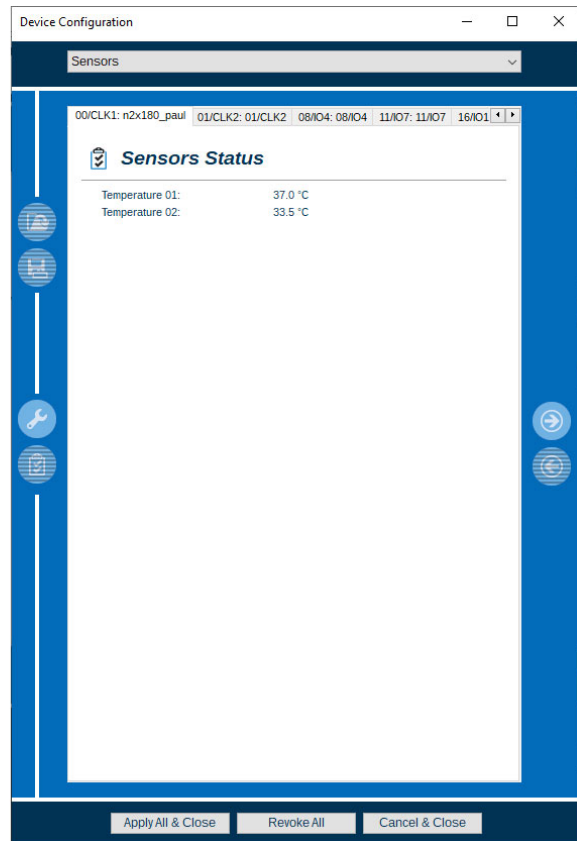
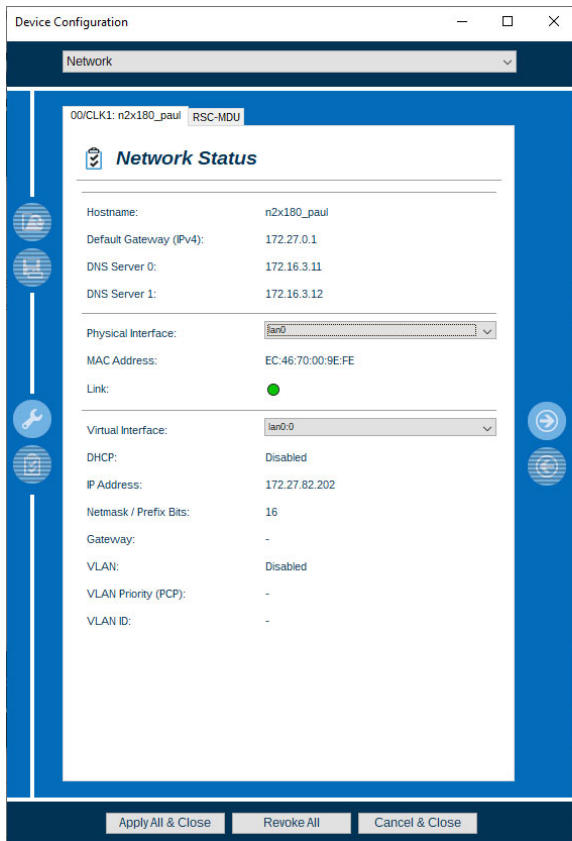
The button "Show Device(s) Status" can be used to access all important status information:

**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.



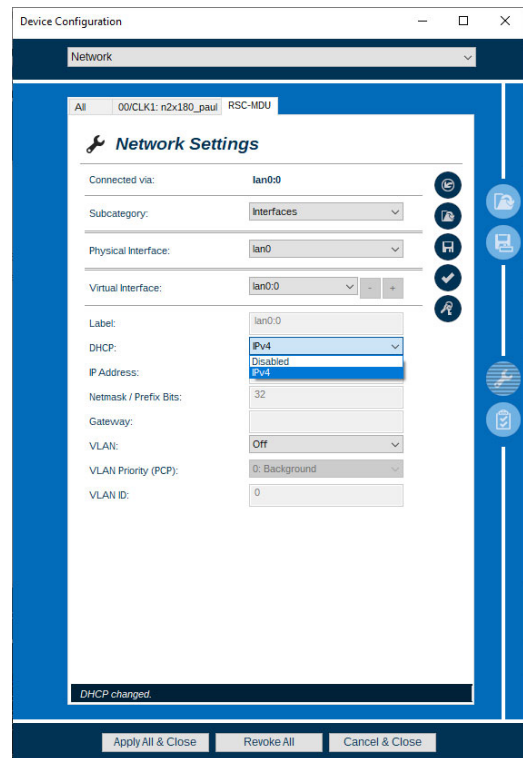


The figure shows the network status and the module sensors (temperature, voltage ...).

### 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 <sup>1</sup>).

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



<sup>1</sup>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.

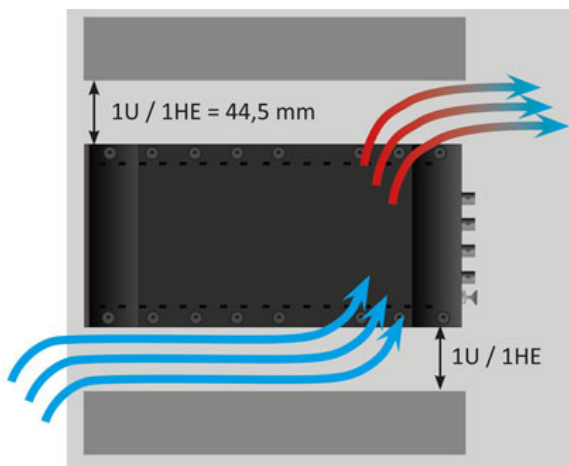
## 5 Attachment: Technical Information

### 5.1 Technical Specifications IMS-MDU312 BGT Housing

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

## 5.2 Available Modules and Connectors

Name	Type	Signal	Cable
<b>Power Supply:</b>			
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
<b>Reference - Synchronization Signals:</b>			
N2X	RJ45	Network NTP / PTP	CAT 5 network cable
TCR	BNC female	TC AM Input 600 mV <sub>pp</sub> to 8 V <sub>pp</sub> (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-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
<b>Output Signals:</b>			
BPE	See chapter <a href="#">BPE - Backplane Port Expander</a>		
LNO	4 x BNC female	10 MHz sine Out with internal OCXO	shielded data line
LIU	See chapter <a href="#">LIU - Line Interface Unit</a>		

### 5.3 Important Hints for hot-pluggable IMS Modules

The following points should be strictly observed when replacing IMS modules during operation. Not all IMS modules are fully hot-pluggable. Of course, it is not possible to replace a power supply unit of a non-redundant system without first having installed a second power source in operational mode.

The following applies to the individual IMS slots:

<b>PWR:</b>	"hot swappable"	If you operate your system with only one power supply, a second power supply must be installed before removing/replacing it to keep your system functioning.
<b>I/O, ESI and MRI Slots:</b>	"hot plugable".	
<b>CLK1, CLK2:</b>	"hot plugable"	Afer the exchange or the installation of a clock module a rescan of the reference clocks (Rescan Refclocks) must be executed in the web interface menu "System".
<b>CPU:</b>	"hot plugable"	The NTP service and access to the web interface are interrupted while the CPU is disconnected. Also the management and monitoring functions are no longer available.
<b>RSC/SPT:</b>	"hot plugable"	The switching function or the distribution of generated signals is interrupted while the RSC/SPT is disconnected.



## 5.4 IMS Module Options

### 5.4.1 Power Supply 100-240 V AC / 100-200 V DC

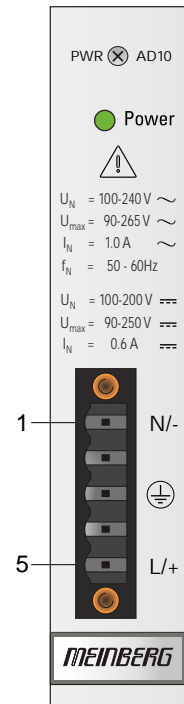
Connector Type:	5-pol. DFK
Pin Assignment:	1: N/- 2: not connected 3: PE (Protective Earth) 4: not connected 5: L/+

#### Input Parameter

Nominal Voltage Range:	$U_N$	=	100-240 V $\sim$ 100-200 V $\equiv$
Maximum Voltage Range:	$U_N$	=	90-265 V $\sim$ 90-250 V $\equiv$
Nominal Current:	$I_N$	=	1.0 A $\sim$ 0.6 A $\equiv$
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)



#### WARNING!

This equipment is operated at a hazardous voltage.



#### Danger to life due to electrical shock!

- Only qualified personnel (electricians) may connect the device.
- Never work with open terminals and plugs while the power is on.
- All connectors must be protected against touching live parts with a suitable plug housing!
- Note: Always ensure safe wiring!
- Important: The device must be connected to a proper grounding (PE).

## 5.4.2 Power Supply 20-60 V DC

<b>Connector:</b>	5pin DFK
<b>Pin Assignment:</b>	1: not connected
	2: $V_{IN-}$
	3: PE (Protective Earth)
	4: $V_{IN+}$
	5: not connected

### Input Parameter

Nominal voltage range:  $U_N = 24-48\text{ V} \text{ ---}$

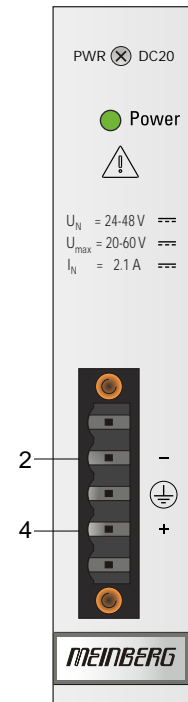
Maximum voltage range:  $U_{max} = 20-60\text{ V} \text{ ---}$

Nominal current:  $I_N = 2.1\text{ A}$

### Output Parameter

Maximum power:  $P_{max} = 50\text{ W}$

Maximum thermal energy:  $E_{therm} = 180.00\text{ kJ/h (170.61 BTU/h)}$



### 5.4.3 SDI-N2X - Signal Input Module

- Configuration and monitoring 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.

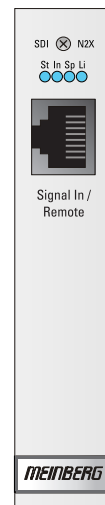
The N2X180 operates as an IEEE-1588 slave clock or NTP client in a network.

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:

<b>St (Status):</b>	blue:	during initialisation
	green:	normal operation
<b>In (Init):</b>	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
<b>Sp (Speed):</b>	out:	no cable connection
	yellow:	10 Mbit
	green:	100 Mbit
<b>Li (Link):</b>	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:	$\pm 100$ ns (relative to the used IEEE 1588 Grandmaster Clock, after initial synchronization phase)
NTP:	$\pm 1$ 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

## 5.4.4 SDI-4112 - Signal Input Module

### Technical Specifications 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,

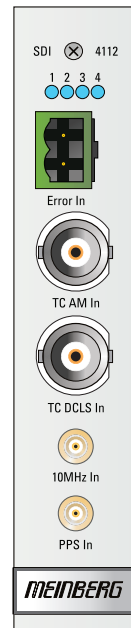
Max. input current: 25 mA

Diode forward voltage: 1.0 V...1.3 V

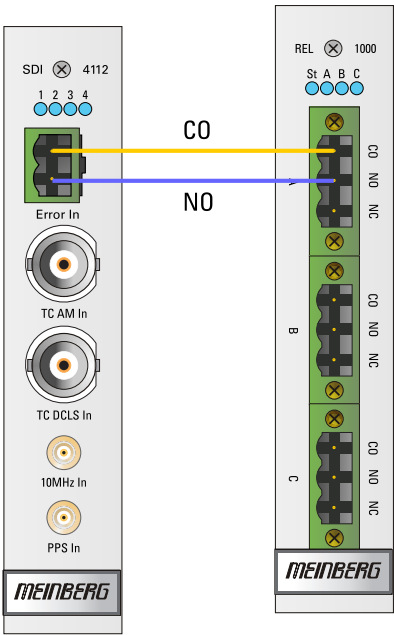
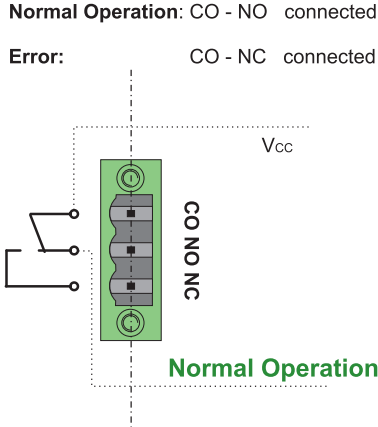
### Pulse- and Frequency Input Signals

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



### 5.4.5 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.

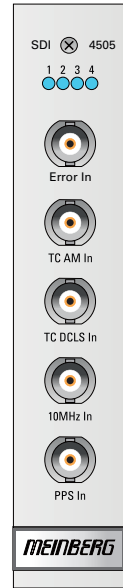
#### Technical Specifications SDI-4505:

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

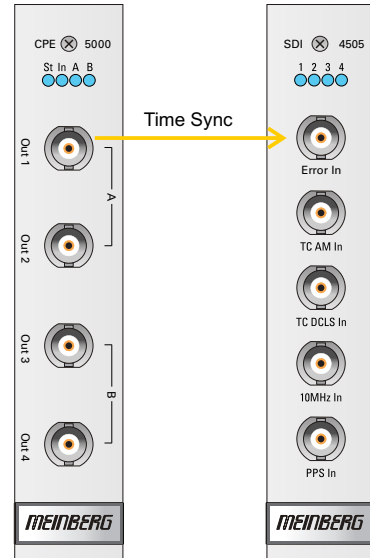
**5 x F-ST fiber optical connectors**

Fiber type: Multi mode GI 50/125 μm or GI 62,5/125 μm

Wave length: 850 nm  
 Optical input level: ≥ 3 μW

Signal inputs

- Error Input
- TC AM
- TC DCLS
- 10 MHz
- PPS



## 5.4.6 SDI-5302 - Signal Input Module

### Technical Specifications 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,

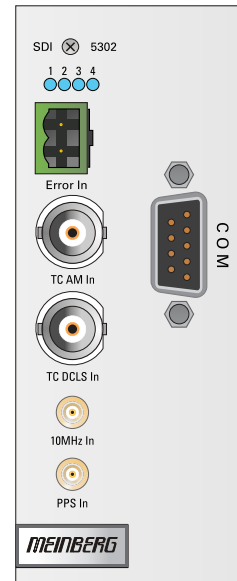
Max. input current: 25 mA

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





### 5.4.7 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.

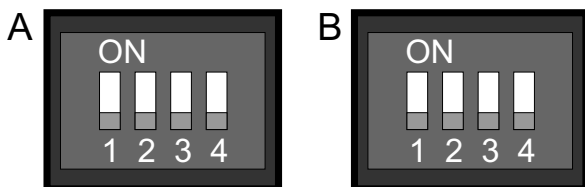
#### Operating Modes

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.).

## 5.4.8 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.

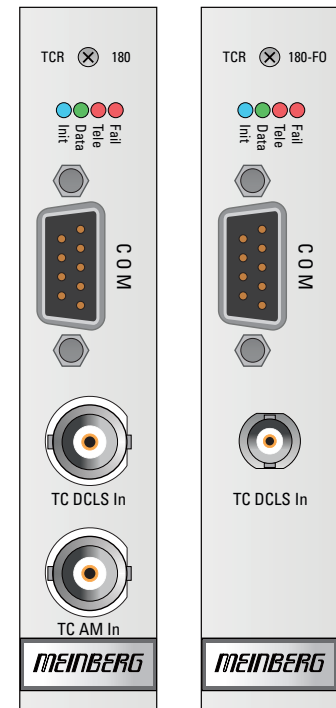
As standard the clock module TCR180 is equipped with a OCXO-SQ (Oven Controlled Xtal Oscillator) as master oscillator to provide a high accuracy in holdover mode of  $\pm 1E-8$ . Optionally an OCXO-MQ or OCXO-HQ is available for better accuracy.

### 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  $600\text{ mV}_{pp}$  to  $8\text{ V}_{pp}$ . The input stage is electrically insulated and has an impedance of either  $50\ \Omega$ ,  $600\ \Omega$  or  $5\text{ k}\Omega$ , selectable by a jumper.

DC Level Shift Input insulated by optocoupler with internal series resistance of  $220\ \Omega$ .

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



### LED Indicators

<b>Init</b>	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)
<b>Data</b>	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
<b>Tele</b>	yellow/red (flashing):	Holdover mode (MRS), IRIG Code not available
	green:	telegram consistent
	red:	telegram inconsistent
<b>Fail</b>	yellow (flashing):	Jitter too large
	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  $50 \Omega$ ) and unmodulated (DC Level Shift) signals (TTL into  $50 \Omega$  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

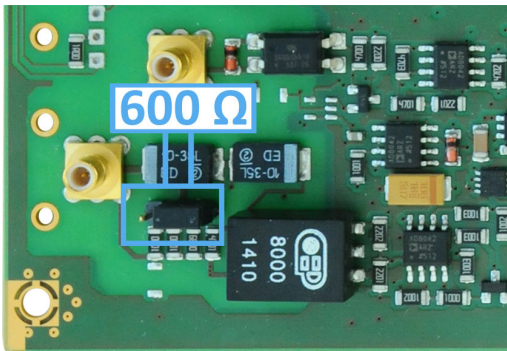


Figure 1: Jumper Settings:  $600 \Omega$

**Technical Specifications**

**Receiver Input**

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

**Input Signal**

DC Level Shift input: insulated by photocoupler  
 internal series resistance:  $220 \Omega$   
 maximum forward current:  $60 mA$   
 diode forward voltage:  $1.0 V \dots 1.3 V$

**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:  $max 100 \mu sec$  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  $50 \Omega$

unmodulated outputs(DCLS):  
TTL into  $50 \Omega$ , 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  $\pm 1 \mu\text{sec}$  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:  $\pm 5E-9$   
first 20 min. after sync.:  $\pm 1E-8$

accuracy of oscillator:  
holdover, 1 day:  $\pm 1E-7$   
holdover, 1 year:  $\pm 1E-6$

short term stability:  
 $\leq 10$  sec, synchronized:  $\pm 2E-9$   
 $\leq 10$  sec, holdover:  $\pm 5E-9$

temperature dependant drift:  
holdover:  $\pm 1E-6$

**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  $50 \Omega$   
sine wave 1.5 Vrms  
output impedance  $200 \Omega$

**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:**

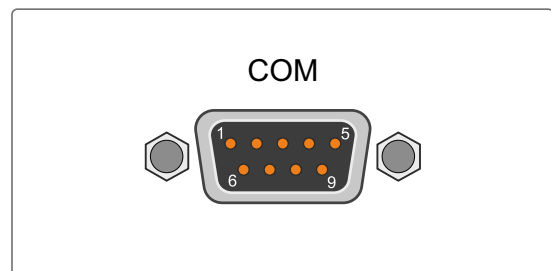
max. 85 %

**Pin Assignment of the DSUB9 Connectors (male):**

Ptin 2: RxD  
Ptin 3: TxD  
Ptin 5: GND

Synchronization with PPS + String:

Ptin 1: PPS  
Ptin 2: RxD



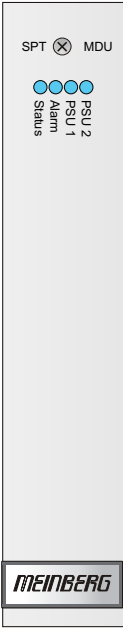
### 5.4.9 SPT Switch Card

#### 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



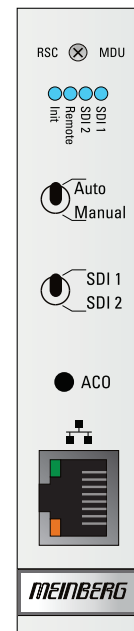
## 5.4.10 RSC Switch Card

### 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 loses 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](#))

### 5.4.10.1 RSC180 - DIP Switch

Various modes of the board can be additionally configured by an on-board DIP-Switch.

#### Configuration of a DIP-Switch

SW	NAME	Description
1	DIS_ENA	enable / disable activation of signals if both clocks are async
2	DIS_MAN	enable / disable a manual override by front panel switches
3	DIS_REM	enable / disable the remote control
4	FUNCTION	RSC board functionality: either in an IMS system or LAN interface is activated
5	Reserve	
6	Reserve	
7	Reserve	
8	DIS_MST	enables / disables the priority master clk selection
9	Clk1_Clk2	selects between the priority master clk 1 or clk 2
10	EN_CLK	activates the clock with a sync event after reset (only if DIP 1 is ON).



Figure: DIP-Switch of RSC180

#### Description of DIP\_SW positions:

Switch No. 1. Positions:

- (0) OFF: In the case that both clock are async, all output signals are disabled.
- (1) ON: Even if both clocks are async, outputs are activated from one of the clocks.

Switch No. 2. Positions:

- (0) OFF: Front panel switch functions activated.
- (1) ON: Front panel switch functions disabled.

Switch No. 3. Positions:

- (0) OFF: Remote control activated.
- (1) ON: Remote control disabled.

Switch No. 4. Positions:

- (0) OFF: The RSC board is used in an IMS system.
- (1) ON: LAN Interface is activated.

Switch No. 5-7 Reserves.

Switch No. 8. Positions:

- (0) OFF: The Priority master mode is disabled.
- (1) ON: Priority master mode is enabled.



IF Switch No. 8 is ON:

Switch No. 9. Positions:

- (0) OFF: The Priority master is clock 1.
- (1) ON: The Priority master is clock 2.

IF Switch No. 1 is ON:

Switch No. 10. Positions:

- (0) OFF: Even async, one clock is always enabled.
- (1) ON: A clock is enabled after the first sync event since a reset.

### 5.4.10.2 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".

### 5.4.11 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.

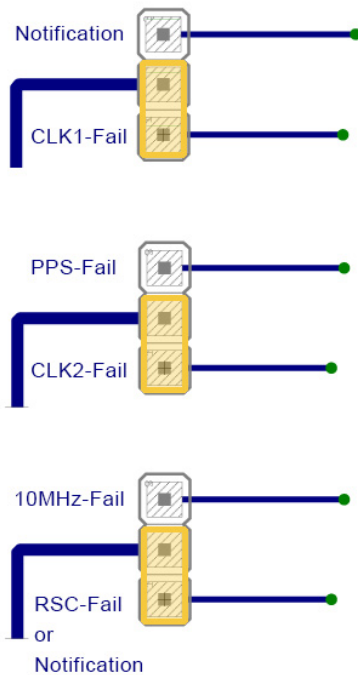
Depending on the hardware configuration of the IMS system, i.e. redundant with RSC module and two integrated reference clocks or with SPT module and only one reference clock, different relay states can be switched.

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:**

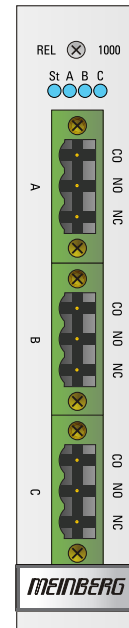
St: blue  
 A: off  
 B: off  
 C: off

**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<sub>max</sub> / 250 V AC<sub>max</sub>

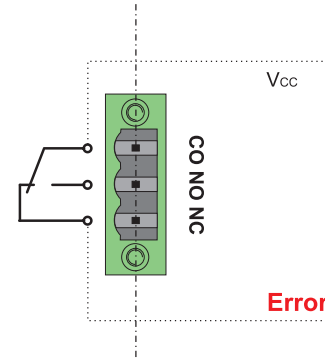
Switching Load: 60 W<sub>max</sub> / 62.5 VA<sub>max</sub>

UL/CSA: 0.3 A 125 V AC  
 0.3 A 110 V DC  
 1 A 30 V DC

Response Time: ca.3 ms

**Normal Operation:** CO - NO connected

**Error:** CO - NC connected



### 5.4.12 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

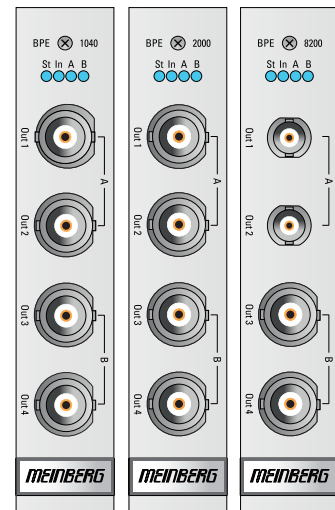
**Status Indicators**

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

**5.4.12.1 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

**BPE-8000 - Switchable Backplane Port Expander**

BPE Module	Connectors	Signal Outputs
BPE-8000	4x BNC female	TTL
BPE-8100	4x ST	Fiber Optic - Multimode
BPE-8200	2x ST, 2x BNC female	2x Fiber Optic - Multimode, 2x TTL
BPE-8300	4x ST	Fiber Optic - Singlemode
BPE-8400	2x ST, 2x BNC female	2x Fiber Optic - Singlemode, 2x TTL
BPE-8500	4x ST	2x Fiber Optic - Multimode, 2x Fiber Optic - Singlemode
BPE-8600	4x BNC female	2048 kHz (ITU G.703-15 - 75 $\Omega$ unbalanced) *
BPE-8700	4x BNC female	3x TTL, 1x Modulated Time Code - TC-AM **

\* Fixed outputs, no signal selection possible.

\*\* BNC sockets Out 1 - Out 3 are freely programmable, Out 4 is permanently set to TC AM.

### 5.4.12.2 Configuring an BPE-8000 expansion card with Meinberg Device Manager

Via the Meinberg Device Manager software, the following signals can be distributed to the BNC connectors (TTL) or fiber optical connectors (ST) according to your choice: PPS, 10 MHz, Time Code DCLS, 2048 kHz and programmable pulse outputs PP 1 - PP 4 of the upstream reference source.



Figure: Meinberg Device Manager menu "Config → I/O Ports Settings"

With the programmable pulse outputs, each output channel of the pulse generator (IMS receiver) can now also be switched through to all available connectors of the BPE (for example PP 1 to Out 1 - Out 4 of the BPE).

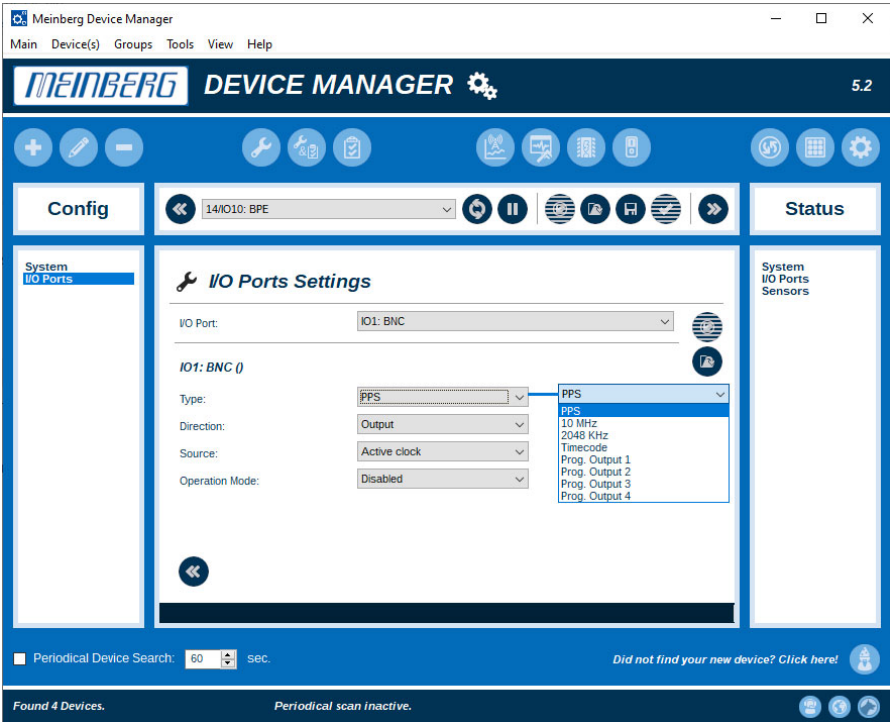


Figure: selection of available signals



### 5.4.13 LIU - Line Interface Unit

Input signal: 2.048 MHz reference clock, TTL level

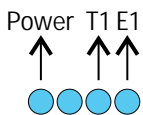
Clock: T1 - 1.544 MHz  
E1 - 2.048 MHz

BITS: T1 - 1.544 MBit/s  
E1 - 2.048 MBit/s

Outputs: balanced - RJ45 jack - 120 Ω (Clock)  
unbalanced - BNC connector 75 Ω (Bits)

Short term stability and Accuracy: depends on oscillator of the reference clock  
 OCXO-SQ:  $\pm 5 \cdot 10^{-10}$   
 OCXO-MQ:  $\pm 2 \cdot 10^{-10}$   
 OCXO-HQ:  $\pm 5 \cdot 10^{-12}$   
 OCXO-DHQ:  $\pm 2 \cdot 10^{-12}$   
 Rubidium:  $\pm 2 \cdot 10^{-11}$

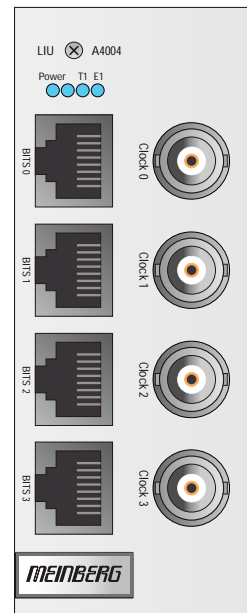
#### LED Indicators



Power: Init blue during initialisation, green in normal operation mode

T1: green selected mode T1  
 red: output disabled  
 yellow: signal quality unknown

E1: green selected mode E1  
 red: output disabled  
 yellow: signal quality unknown

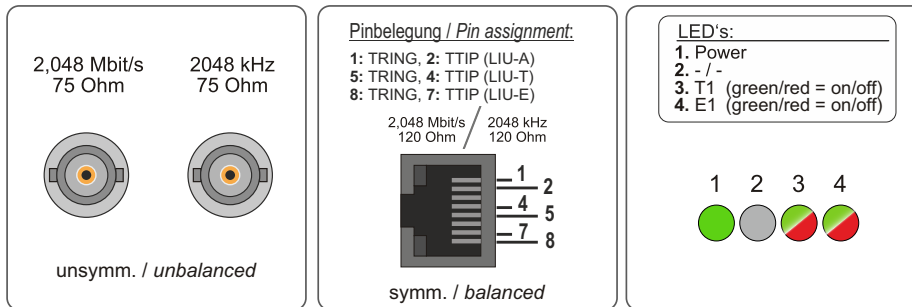


### 5.4.13.1 IMS-LIU Telecom Output Signals

The board LIU (Line Interface Unit) was designed to convert the GNSS-locked standard frequency of a pre-connected Meinberg satellite controlled clock (GPS or GPS/GLONASS/Galileo/BeiDou) into several timing signals that can be used for various synchronization or measurement tasks.

Typical applications are:

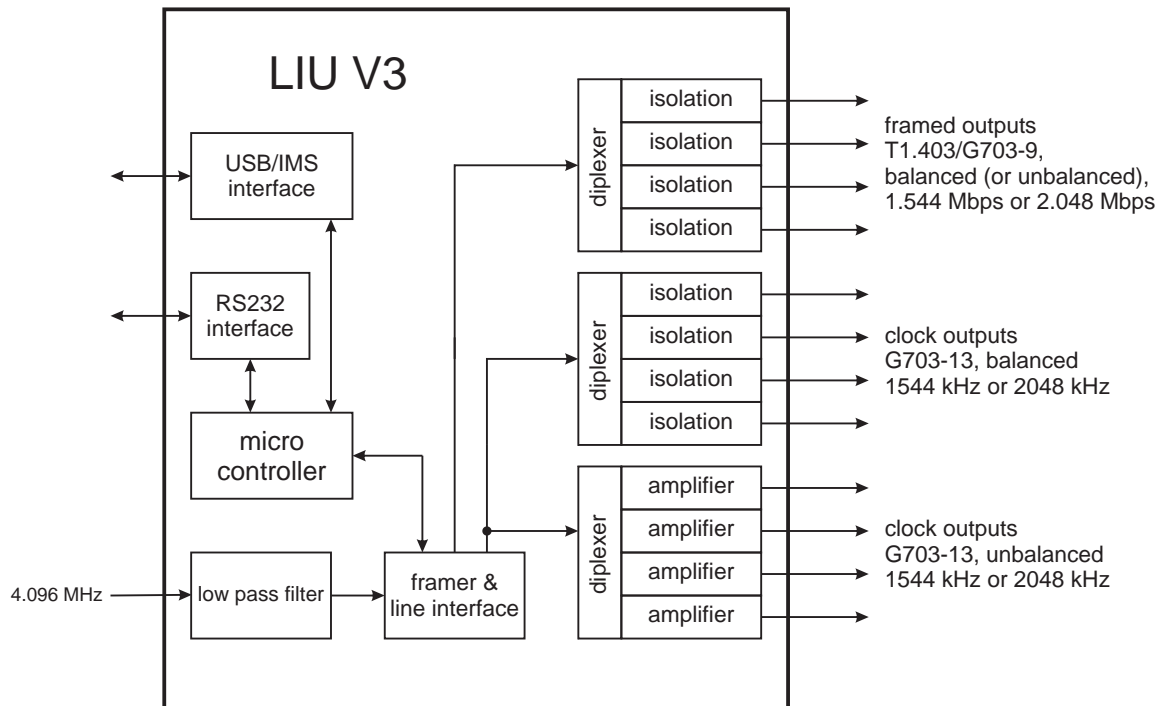
- Measurement and test of synchronization quality of Telecom networks
- Calibration and synchronization of laboratory equipment
- Test of synchronization of radio transmitters / base stations (GSM / CDMA / UMTS / DAB / DVB)



There are two separate signal paths on the board LIU. One is for providing the standard frequencies, the second path is for generation of the "telecom-signals". All output signals have high accuracy and stability because they are derived from the internal receiver's disciplined standard frequencies generated by the pre-connected satellite clock. Depending on the oscillator option of the internal receiver, the accuracies which are described in chapter LIU - Line Interface Unit can be achieved.

### 5.4.13.2 Block Diagram LIU

The following block diagram illustrates the functional principle of the board LIU:



### 5.4.13.3 Telecom Signals

These signals can be divided into two groups: the "clock" outputs and the "framed" outputs, that are provided by a framer and line interface device on the board LIU. All clock signals needed for generation of the 'telecom outputs' are derived from a 2048 kHz reference clock, which is generated by a frequency synthesizer on the preconnected GPS- or GLN-clock. This synthesizer is phase locked to the PPS signal and frequency locked to the master oscillator of the clock.

The module LIU is able to generate signals for the American T1- or the European E1-system. The mode of operation can be configured via the web interface of the IMS management module (LAN-CPU).

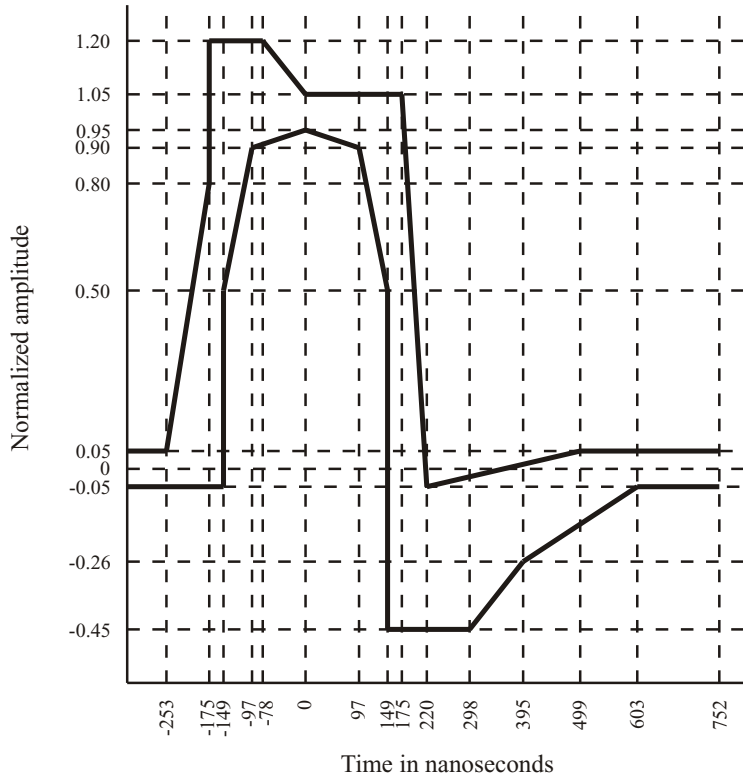
The clock outputs are standard frequencies of either 1544 kHz (T1) or 2048 kHz (E1). Four unbalanced and four balanced outputs according to ITU-T G703-13 (CCITT recommendation "Physical/electrical characteristics of hierarchical digital interfaces") are available via BNC female and RJ45 connectors.

The "framed" outputs are consisting of data signals known from digital telephony, which are distributed by using a special frame structure (EFS Framing Mode - Extended Superframe). As a synchronization unit, LIU only generates a "framed all ones" signal (data byte 0xFF hex) with a transmission speed of either 1544 kBits (T1) or 2048 kBit/s (E1). Four outputs according to ANSI T.403 (T1-mode) or ITU-T G703-9 (E1-mode) are available either unbalanced via BNC connectors or balanced via RJ45 connectors. Two different line codes used for error correction are known for the transmission of framed signals. The board LIU generates B8ZS- (in T1-mode) or HDB3-coded (in E1-mode) output signals by standard.

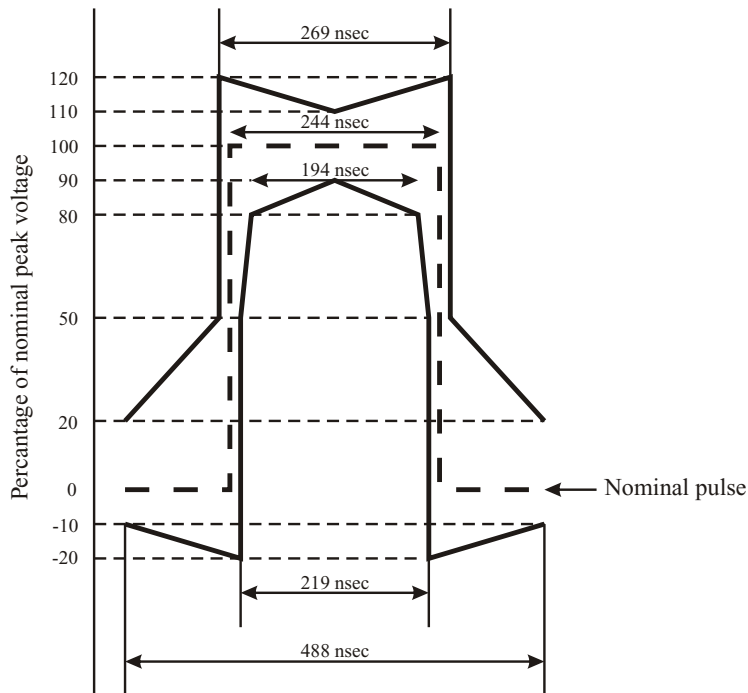
5.4.13.4 Pulse templates

The following pulse templates are required by ANSI (T1-mode) and CCITT (E1-mode) for output signals in telecom applications. The board LIU meets these recommendations.

T1 (T.403):



E1 (G.703):



### 5.4.13.5 LIU - Configuration Samples

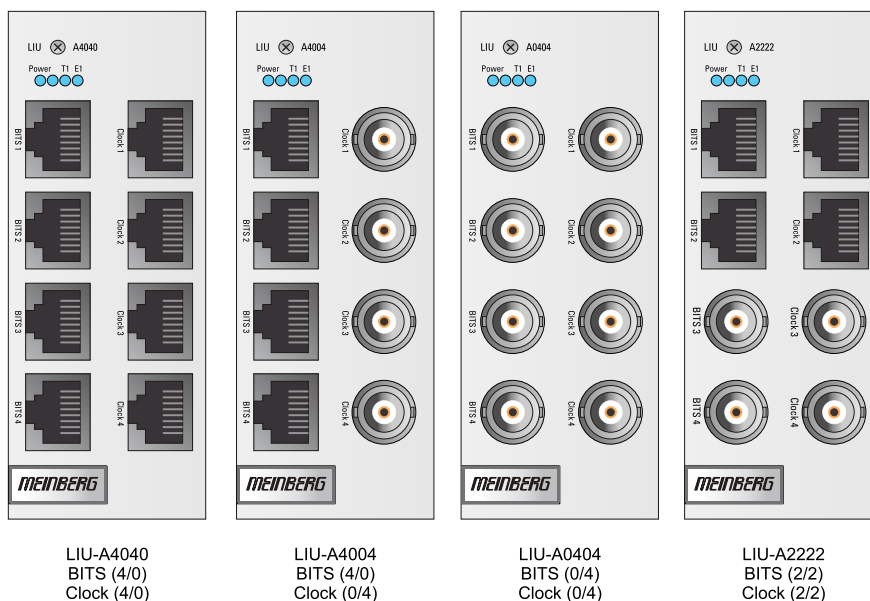
The Line Interface Unit (LIU) is available in two different sizes and different output / connector options. All outputs of a module can be operate in either the E1 or T1 in mode. Signal output settings can be done during operation via the web interface. The selected mode is indicated by the LEDs in the retainer plate.

#### Signal Types

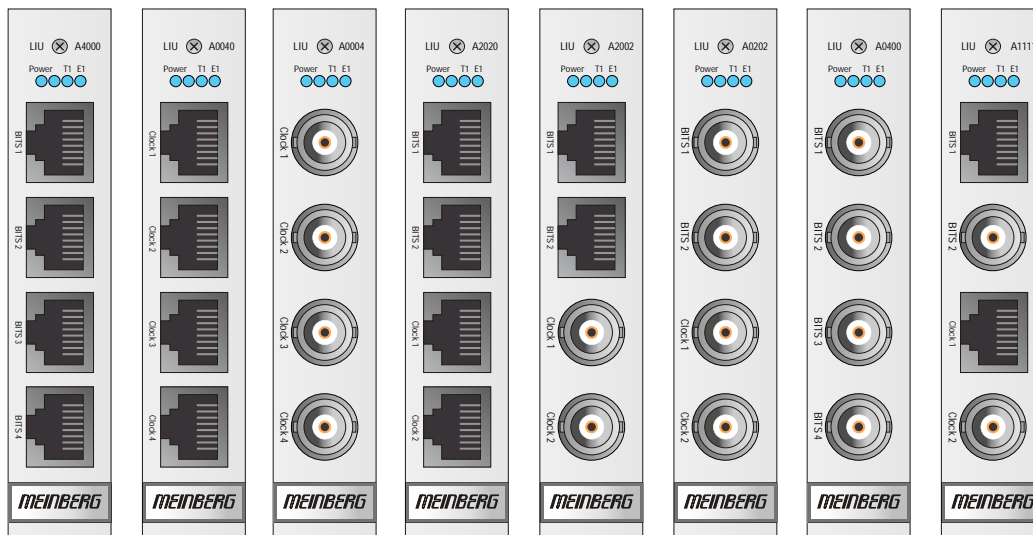
- 2048 kHz (E1 mode) or 1.544 MHz (T1 mode), G.703, 120  $\Omega$ , balanced, RJ45 socket
- 2048 kHz (E1 mode) or 1.544 MHz (T1 mode), G.703, 75  $\Omega$ , unbalanced, BNC connector
- 2048 kBit/s (E1 mode) or 1.544 MBit/s (T1 mode), 120  $\Omega$ , balanced, RJ45 socket
- 2048 kBit/s (E1 mode) or 1.544 MBit/s (T1 mode), 75  $\Omega$ , unbalanced, BNC connector

### 5.4.13.6 Overview - LIU Modules for IMS Systems

LIU Model	Size	Signal (bal./unbal.)	Connectors
LIU-A4040	8TE	BITS (4/0) Clock (4/0)	4 x RJ45 4 x RJ45
LIU-A4004	8TE	BITS (4/0) Clock (0/4)	4 x RJ45 4 x BNC
LIU-A0404	8TE	BITS (0/4) Clock (0/4)	4 x BNC 4 x BNC
LIU-A0044	8TE	Clock (4/0) Clock (0/4)	4 x RJ45 4 x BNC
LIU-A2222	8TE	BITS (2/2) Clock (2/2)	2 x RJ45, 2 x BNC 2 x RJ45, 2 x BNC



LIU Model	Size	Signal (bal./unbal.)	Connectors
LIU-A4000	4TE	BITS (4/0)	4 x RJ45
LIU-A0040	4TE	Clock (4/0)	4 x RJ45
LIU-A0004	4TE	Clock (0/4)	4 x BNC
LIU-A2020	4TE	BITS (2/0) Clock (2/0)	2 x RJ45 2 x RJ45
LIU-A2002	4TE	BITS (2/0) Clock (0/2)	2 x RJ45 2 x BNC
LIU-A0202	4TE	BITS (0/2) Clock (0/2)	2 x BNC 2 x BNC
LIU-A0400	4TE	BITS (0/4)	4 x BNC
LIU-A1111	4TE	BITS (1/1) Clock (1/1)	1 x RJ45, 1 x BNC 1 x RJ45, 1 x BNC



LIU-A4000 BITS (4/0)  
 LIU-A0040 Clock (4/0)  
 LIU-A0004 Clock (0/4)  
 LIU-A2020 BITS (2/0)  
 Clock (2/0)  
 LIU-A2002 BITS (2/0)  
 Clock (0/2)  
 LIU\_A0202 BITS (0/2)  
 Clock (0/2)  
 LIU\_A0400 BITS (0/4)  
 LIU-A1111 BITS (1/1)  
 Clock (1/1)

### 5.4.13.7 LIU Configuration with Meinberg Device Manager

#### GPIO

With the drop-down list "GPIO" the available output signals of the LIU can be configured:

- BITS Out or
- Fixed Freq. Out

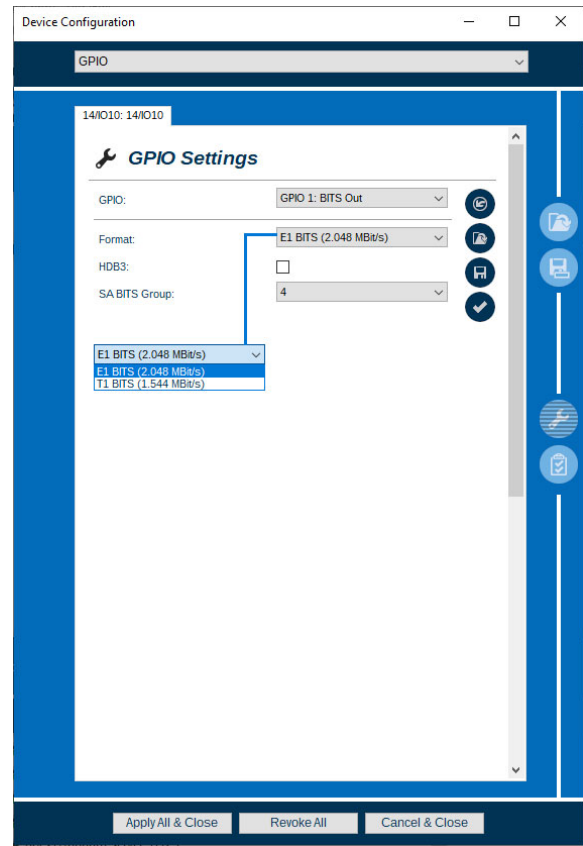
#### Drop-Down List Format

In this list, either E1 or T1 mode can be selected for the outputs. The selected mode is the same for all outputs.

#### E1 or T1?

E1 is the european equivalent to T1. T1 is the North American term whereas E1 is a European term for digital transmission. The data rate of E1 is about 2 Mbit/second. It has 32 channels at the speed of 64 Kbit/second. 2 channels among 32 are already reserved. One channel is used for signaling while the other is used for controlling. The difference between T1 and E1 lies in the number of channels here.

T1 is a digital carrier signal that transmits the DS - 1 signal. It has a data rate of about 1.544 Mbit/second. It contains 24 digital channels and therefore requires a device that has a digital connection.



#### Sa Bits

ITU-T Recommendations allow for bits Sa4 to Sa8 to be used in specific point-to-point applications (e.g. transcoder equipment) within national borders. When these bits are not used and on links crossing an international border they should be set to 1.

The Sa4 bit may be used as a message-based data link for operation, maintenance and performance monitoring. The SSM Bit (Synchronization Status Message) can be selected in the Web GUI for clock quality information. Sa4 is selected as per default.



### 5.4.14 LNO - 10 MHz Sinus Output Module

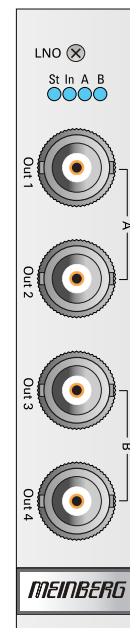
The LNO180 is a 10 MHz generator card, which provides sine signals with low phase noise to 4 external outputs. The card has a microprocessor system, which monitors the output signals and generates status signals for the upper-level management system accordingly.

#### 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:

Frequency Input:	10 MHz, sine ( $1V_{pp}$ min.) or TTL																					
Output Level:	5 dBm +/- 1 dBm at 50Ω Option: LNO-12dB with 12 dBm output level																					
Warm-up time:	< 3 @ 25 °C within accuracy of < +/-1 x 10 <sup>-7</sup>																					
Electrical Connectors:	BNC female																					
Harmonics:	-60 dBc																					
Phase Noise:	<table border="0"> <tr> <td>OCXO SQ</td> <td></td> </tr> <tr> <td>1 Hz</td> <td>-70 dBc/Hz</td> </tr> <tr> <td>10 Hz</td> <td>-105 dBc/Hz</td> </tr> <tr> <td>100 Hz</td> <td>-125 dBc/Hz</td> </tr> <tr> <td>1 kHz</td> <td>-140 dBc/Hz</td> </tr> <tr> <td>OCXO HQ:</td> <td></td> </tr> <tr> <td>1 Hz</td> <td>&lt; -85 dBc/Hz</td> </tr> <tr> <td>10 Hz</td> <td>&lt; -115 dBc/Hz</td> </tr> <tr> <td>100 Hz</td> <td>&lt; -130 dBc/Hz</td> </tr> <tr> <td>1 kHz</td> <td>&lt; -140 dBc/Hz</td> </tr> </table>		OCXO SQ		1 Hz	-70 dBc/Hz	10 Hz	-105 dBc/Hz	100 Hz	-125 dBc/Hz	1 kHz	-140 dBc/Hz	OCXO HQ:		1 Hz	< -85 dBc/Hz	10 Hz	< -115 dBc/Hz	100 Hz	< -130 dBc/Hz	1 kHz	< -140 dBc/Hz
OCXO SQ																						
1 Hz	-70 dBc/Hz																					
10 Hz	-105 dBc/Hz																					
100 Hz	-125 dBc/Hz																					
1 kHz	-140 dBc/Hz																					
OCXO HQ:																						
1 Hz	< -85 dBc/Hz																					
10 Hz	< -115 dBc/Hz																					
100 Hz	< -130 dBc/Hz																					
1 kHz	< -140 dBc/Hz																					
Terminal Connector:	96-pin VG-rail DIN 41612																					
Power Supply:	<table border="0"> <tr> <td>5 dBm</td> <td>+5V @ 550 mA (steady state),</td> </tr> <tr> <td></td> <td>+5V @ 670 mA (warm up)</td> </tr> <tr> <td>12 dBm:</td> <td>+5V @ 970 mA (steady state),</td> </tr> <tr> <td></td> <td>+5V @ 620 mA (warm up)</td> </tr> </table>		5 dBm	+5V @ 550 mA (steady state),		+5V @ 670 mA (warm up)	12 dBm:	+5V @ 970 mA (steady state),		+5V @ 620 mA (warm up)												
5 dBm	+5V @ 550 mA (steady state),																					
	+5V @ 670 mA (warm up)																					
12 dBm:	+5V @ 970 mA (steady state),																					
	+5V @ 620 mA (warm up)																					
Quartz Filter:	Bandwidth 1 kHz																					
Ambient Temperature:	0 ... 50 °C / 32 ... 122 °F																					
Storage Temperature:	-20 ... 70 °C / -4 ... 158 °F																					
Humidity:	max 85%																					



**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

## 6 Update of the System Software

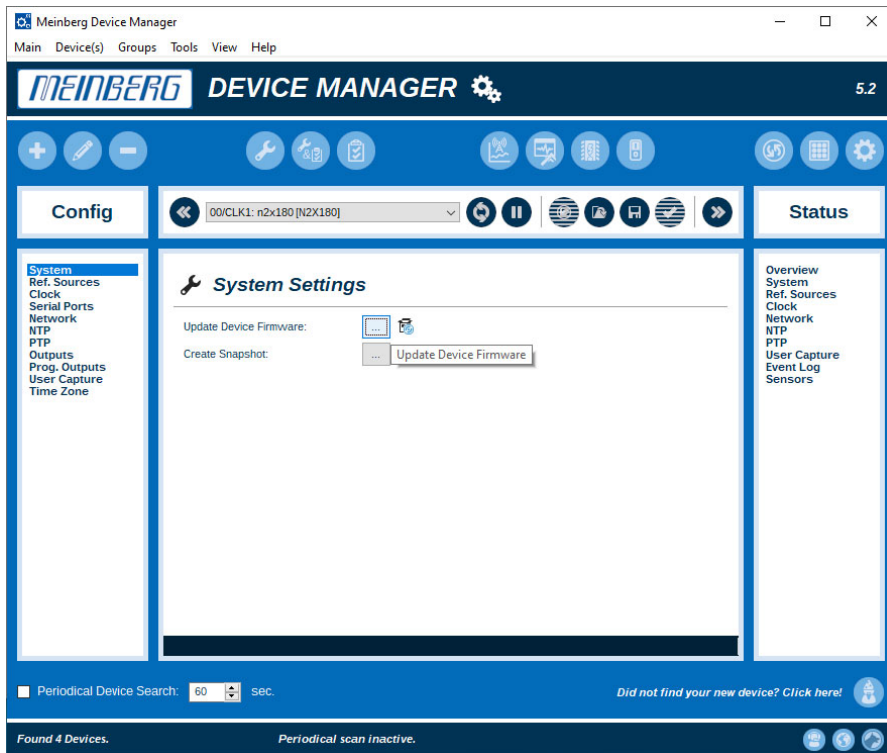


Figure: With the button **Flash Device Firmware** a current firmware version can be loaded on the module.

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".

You can find the software and the "Meinberg Device Manager" documentation on the included USB stick or 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.

## 7 RoHS and WEEE

### Compliance with EU Directive 2011/65/EU (RoHS)

We hereby declare that this product is conform to the European Directive 2011/65/EU and its delegated directive 2015/863/EU "Restrictions of Hazardous Substances in Electrical and Electronic Equipment". We ensure that electrical and electronic products sold in the EU do not contain lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyls (PBBs), and polybrominated diphenyl ethers (PBDEs), Bis (2-ethylhexyl)phthalat (DEHP), Benzylbutylphthalat (BBP), Dibutylphthalat (DBP), Diisobutylphthalat (DIBP), above the legal threshold.

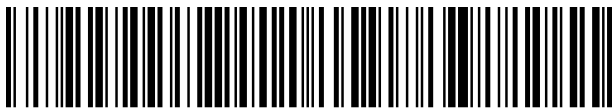


### WEEE status of the product

This product is handled as a B2B (Business to Business) category product. In order to secure a WEEE compliant waste disposal it has to be returned to the manufacturer. Any transportation expenses for returning this product (at its end of life) have to be incurred by the end user, whereas Meinberg will bear the costs for the waste disposal itself.







IMS-MDU312\_QSG\_030321