MANUAL

IMS-MDU
Modular Sync. System

8th May 2019
Meinberg Funkuhren GmbH & Co. KG
**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
**English**

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

**Deutsch**

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

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Date: 2017-01-04
2 Safety instructions for building-in equipment

This building-in equipment has been designed and tested in accordance with the requirements of Standard IEC60950-1 "Safety of Information Technology Equipment, including Electrical Business Equipment".

During installation of the building-in equipment in an end application (i.e. rack) additional requirements in accordance with Standard IEC60950-1 have to be taken into account.

NOTE: First attach the case to protective earth - before you connect the IMS-MDU with the power line (see chapter Grounding connection IMS-MDU).

General Safety instructions

- The building-in equipment has been evaluated for use in office environment (pollution degree 2) and may be only used in this environment. For use in rooms with a higher pollution degree more stringent requirements are applicable.
- The equipment/building-in equipment was evaluated for use in a maximum ambient temperature of 50°C.
- The building-in equipment may not be opened.
- Protection against fire must be assured in the end application.
- The ventilation opening may not be covered.

For AC Supply 100-240 V AC

- The building-in equipment is a class 1 - equipment and must be connected to an earthed outlet (TN Power System).
- For safe operation the building-in equipment must be protected by max 16 A fuse in the power installation system.
- Disconnection of the equipment from mains is done by pulling the mains plug at the outlet. Don’t use the connector at the module for disconnection from mains.

For DC Supply 100-200 V DC

- The device can be disconnected outside the unit in accordance with the regulations as in EN 60950 (e.g. through primary side line protection).
- Assembling and disassembling of the power connector is only allowed if the device is disconnected from power supply (e.g. through primary side line protection).
- All feed lines are sufficiently protected and dimensioned.

Fuse: T3A
Connector Diameter: 1 mm² - 2,5 mm² / 17 AWG - 13 AWG

Date: 8th May 2019
2 Safety instructions for building-in equipment

2.1 Additional Safety Hints

This manual contains important information for the installation and operation of this device as well as for your safety. Make sure to read carefully before installing and commissioning the device.

Certain operating conditions may require the observance of additional safety regulations not covered by this manual. Nonobservance of this manual will lead to a significant abatement of the security provided by this device. Security of the facility where this product is integrated lies in the responsibility of the installer.

The device must be used only for purpose named in this manual, any other use especially operation above the limits specified in this document is considered as improper use.

Keep all documents provided with the device for later reference.

This manual is exclusively for qualified electricians or by a qualified electrician trained personnel who are familiar with the applicable national standards and specifications, in particular for the construction of high voltage devices.

2.2 Supply Voltage

WARNING!

This device is powered by a dangerous voltage. Nonobservance of the safety instructions of this manual may lead to serious damage to persons and property and to danger to life! Installation, commissioning, maintenance and operation of this device are to be carried out by qualified personnel only.

The general safety instructions and standards (e.g. IEC, DIN, VDE, EN) for installation and work with high voltage equipment as well as the respective national standards and laws must be observed.

NONOBSERVANCE MAY LEAD TO SERIOUS DAMAGE TO PERSONS AND PROPERTY AND TO DANGER TO LIFE!

The device may not be opened. Repair services may only be carried out by the manufacturer.

Supply lines for this device must be equipped via an appropriate switch that must be mounted close to the device and must be marked as a mains switch for the device.

To ensure safe operation supply mains connected to this device must be equipped with a fuse and a fault-current circuit breaker according to the applicable national standards for safe operation.

The device must be connected to a protective earth with low grounding resistance according to the applicable national rules.
2.3 Cabling

WARNING!
DANGER TO LIFE BY ELECTRICAL SHOCK! NO LIVE WORKING!
Wiring or any other work done the connectors particularly when connectors are opened may never be carried out
when the installation is energized. All connectors must be covered to prevent from accidental contact to life parts.

ALWAYS ENSURE A PROPER INSTALLATION!

2.4 Grounding connection IMS-MDU

Note:
To ensure a safe operation and to fulfil the require-
ments in accordance with DIN EN 60950, the sys-
"tem 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 in-
cluded.

Note:
Use a grounding cable with >= 1,5mm²
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/utils/windows/mbgdevman_setup.exe
Linux: https://www.meinbergglobal.com/download/utils/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 1).

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

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1Zeroconf: 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-MDU BGT Housing

Housing: Metal 19" Modular chassis, Schroff EURO PAC 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).
### 5.2 Available Modules and Connectors

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Signal</th>
<th>Cable</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Power Supply:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PWR-AD10</td>
<td>5pin DFK male</td>
<td>100-240 V AC / 100-200 V DC</td>
<td>5pin MSTB clamp</td>
</tr>
<tr>
<td>PWR-DC20</td>
<td>5pin DFK male</td>
<td>20-60 V DC</td>
<td>5pin MSTB clamp</td>
</tr>
<tr>
<td><strong>Reference - Synchronization Signals:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N2X</td>
<td>RJ45</td>
<td>Network NTP / PTP</td>
<td>CAT 5 network cable</td>
</tr>
<tr>
<td>TCR</td>
<td>BNC female</td>
<td>TC AM Input 600 mV_pp to 8 V_pp (Mark)</td>
<td>shielded data line</td>
</tr>
<tr>
<td></td>
<td>BNC female</td>
<td>TC DCLS Input</td>
<td>shielded data line</td>
</tr>
<tr>
<td></td>
<td></td>
<td>internal series resistance: 220 Ω</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>maximum forward current: 60 mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>diode forward voltage: 1.0 V..1.3 V</td>
<td></td>
</tr>
<tr>
<td>TCR-FO</td>
<td>ST connector</td>
<td>Time Code DC Level Shift</td>
<td>Multimode FO-patch cable</td>
</tr>
<tr>
<td>SDI-4112</td>
<td>2pin DFK</td>
<td>Error-In</td>
<td>shielded data line</td>
</tr>
<tr>
<td></td>
<td>BNC</td>
<td>TC AM In / TC DCLS In</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SMA</td>
<td>PPS In / 10MHz In</td>
<td></td>
</tr>
<tr>
<td>SDI-4505</td>
<td>F-ST</td>
<td>Error-In</td>
<td>multimode FO-patch cable</td>
</tr>
<tr>
<td></td>
<td>F-ST</td>
<td>TC AM In / TC DCLS In</td>
<td></td>
</tr>
<tr>
<td></td>
<td>F-ST</td>
<td>PPS In / 10MHz In</td>
<td></td>
</tr>
<tr>
<td>SDI-5302</td>
<td>2pin DFK</td>
<td>Error-In</td>
<td>shielded data line</td>
</tr>
<tr>
<td></td>
<td>BNC</td>
<td>TC AM In / TC DCLS In</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SMA</td>
<td>PPS In / 10MHz In</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D-SUB9 female</td>
<td>Serial time telegram</td>
<td></td>
</tr>
<tr>
<td>SDI-7312</td>
<td>2pin DFK</td>
<td>extern. Error Input Time Code AM In and DCLS In,</td>
<td>shielded data line</td>
</tr>
<tr>
<td></td>
<td>6 x BNC female</td>
<td>PPS In, 10MHz In, 2.048MHz In, Progr. Pulses In</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 x D-SUB9 connector. Time Telegram In, RS232</td>
<td></td>
</tr>
</tbody>
</table>

**Output Signals:**

- **BPE**: See chapter BPE - Backplane Port Expander
- **LNO**: 4 x BNC 10MHz sine Out with internal OCXO shielded data line
- **LIU**: See chapter LIU - Line Interface Unit
- **SCG-U**: 4 x BNC female audio frequencies shielded data line
- **SCG-B**: 25pin connector DARS, IEC 60958-4 format shielded data line
- **VSG**: 4 x BNC female video frequencies shielded data line
5.3 IMS Module Options

5.3.1 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

<table>
<thead>
<tr>
<th>Nominal Voltage Range:</th>
<th>$U_{N} = 100-240 \text{ V} \sim$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$100-200 \text{ V} = $</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Maximum Voltage Range:</th>
<th>$U_{N} = 90-265 \text{ V} \sim$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$90-250 \text{ V} = $</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Nominal Current:</th>
<th>$I_{N} = 1.0 \text{ A} \sim$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$0.6 \text{ A} = $</td>
</tr>
</tbody>
</table>

| Nominal Frequency Range:| $f_{N} = 50-60\text{Hz}$         |

| Maximum Frequency Range:| $f_{\text{max}} = 47-63\text{Hz}$ |

Output Parameter

<table>
<thead>
<tr>
<th>Maximum Power:</th>
<th>$P_{\text{max}} = 50 \text{ W}$</th>
</tr>
</thead>
</table>

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

**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).
5.3.2 Power Supply 20-60 V DC

Connector: 5pin DFK

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

### Input Parameter

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal voltage range:</td>
<td>( U_N = 24-48 \text{ V} )</td>
</tr>
<tr>
<td>Maximum voltage range:</td>
<td>( U_{\text{max}} = 20-60 \text{ V} )</td>
</tr>
<tr>
<td>Nominal current:</td>
<td>( I_N = 2.1 \text{ A} )</td>
</tr>
</tbody>
</table>

### Output Parameter

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum power:</td>
<td>( P_{\text{max}} = 50 \text{ W} )</td>
</tr>
<tr>
<td>Maximum thermal energy:</td>
<td>( P_{\text{therm}} = 180.00 \text{ kJ/h (170.61 BTU/h)} )</td>
</tr>
</tbody>
</table>
5.3.3 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:

**St (Status):**
- blue: during initialisation
- green: normal operation

**In (Init):**
- red: no network cable connected
- 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 (relative to NTP when using a local time server after warm-up period)

Connector:
- LAN: RJ-45, 10/100 BaseT
- Duplex Modes: Half/Full/Autonegotiation
- 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
5.3.4 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...)
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
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

**Normal Operation:** CO - NO connected

**Error:** CO - NC connected

![Diagram showing connection scheme and normal operation with CO and NO pins connected in different states.](image-url)
5.3.5 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 Gl 50/125 μm or Gl 62,5/125 μm
- Wave length: 850 nm
- Optical input level: ≥ 3 μW

**Signal inputs**
- Error Input
- TC AM
- TC DCLS
- 10 MHz
- PPS

**Error In**
- SDI 4505
- CPE 5000

**Out**
- Out 1
- Out 2
- Out 3
- Out 4

**Time Sync**
- SDI 4505
- CPE 5000
5.3.6 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
5.3.7 Assignment of the DIP Switch
SDI-4112, SDI-4505 und SDI-5302 Modules
The monitoring of the input signals can be set with the DIP switch block. The figure on the right shows the switches 1 - 5 in ON position, in this case all inputs of the board are 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.

<table>
<thead>
<tr>
<th>DIP</th>
<th>Signal</th>
<th>LED</th>
<th>if &quot;ON&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Error</td>
<td>LED 3 + 4</td>
<td>(flashes red)</td>
</tr>
<tr>
<td>2</td>
<td>TC-AM</td>
<td>LED 3</td>
<td>(red)</td>
</tr>
<tr>
<td>3</td>
<td>TC-DCLS</td>
<td>LED 3</td>
<td>(red)</td>
</tr>
<tr>
<td>4</td>
<td>10 MHz</td>
<td>LED 4</td>
<td>(red)</td>
</tr>
<tr>
<td>5</td>
<td>1PPS</td>
<td>LED 4</td>
<td>(red)</td>
</tr>
</tbody>
</table>

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 must also be set: DIP 1 and DIP 4 = "on".
5.3.8 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 ± 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\text{pp} / 1 V\text{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 independently. Thus TCR180 can be used for code conversion.

Key Features

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

![Jumper Settings: 600 \, \Omega](image)

Technical Specifications

Receiver Input

AM-input (BNC-connector): insulated by a transformer
impedance settable 50 \, \Omega, 600 \, \Omega, 5 \, k\Omega
600 mV\text{pp} to 8 V\text{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...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 \text{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 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: \( \pm 5 \times 10^{-9} \)
  first 20 min. after sync.: \( \pm 1 \times 10^{-8} \)

Accuracy of oscillator:
  holdover, 1 day: \( \pm 1 \times 10^{-7} \)
  holdover, 1 year: \( \pm 1 \times 10^{-6} \)

Short term stability:
  \( \leq 10 \text{ sec}, \text{synchronized}: \pm 2 \times 10^{-9} \)
  \( \leq 10 \text{ sec}, \text{holdover}: \pm 5 \times 10^{-9} \)

Temperature dependant drift:
  holdover: \( \pm 1 \times 10^{-6} \)

Frequency Synthesizer
Output frequency: fixed \( \sim 2.048 \text{MHz} \)

Accuracy:
  like system accuracy

1/8 Hz to 10 kHz:
  Phase synchronous to pulse per second
  deviation of frequency \( < 0.0047 \) Hz

10 kHz to 10 MHz:
  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 \( \ldots \) 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
5.3.9 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
5.3.10 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 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)
### 5.3.10.1 RSC180 - DIP Switch

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

#### Configuration of a DIP-Switch

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

![Figure: DIP-Switch of RSC180](image)

#### 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.
5.3.10.2 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".
5.3.11 REL1000: Error Relay Module

The REL1000 error relay output is connected to the TTL TIME_SYNC output of the reference clock (GPS, GLONASS ...). If the internal reference clock has been synchronized by its source, the relay will switch to mode "NO" (Normally Open). In error case the relay switches to mode "NC" (Normally Closed).

If the system isn’t equipped with a second clock and RSC switch unit, the relay can be switched by 10MHz or PPS to monitor these signals.

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

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

Please note: The REL1000 can only be used for the IMS system M500 in the following jumper setting:

IMS-M500:
Relais A: Clock 1
Relais B: PPS
Relais C: 10MHz
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
5.3.12 BPE - Backplane Port Expander

**Output Signals:**
- **fixed:**
  - 10MHz, 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

*Figure right: BPE Frontend*

4TE - BPE-2000 with 4 x BNC (Out 1 - Out 4) and  
8TE - BPE-2180 with 8 x BNC (Out 1.1 - Out 4.2)
### 5.3.12.1 Available BPE Modules

<table>
<thead>
<tr>
<th>BPE Type</th>
<th>Connectors</th>
<th>Signals</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPE-1040</td>
<td>4 x BNC female</td>
<td>Out 1 - Out 4: TC AM</td>
<td>4HP</td>
</tr>
<tr>
<td>BPE-2000</td>
<td>4 x BNC female</td>
<td>Out 1: PPS, Out 2: 10MHz</td>
<td>4HP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Out 3: TC DCLS, Out 4: TC AM</td>
<td></td>
</tr>
<tr>
<td>BPE-2010</td>
<td>4 x BNC female</td>
<td>Out 1 - Out 4: PPS</td>
<td>4HP</td>
</tr>
<tr>
<td>BPE-2020</td>
<td>4 x BNC female</td>
<td>Out 1 - Out 4: 10MHz</td>
<td>4HP</td>
</tr>
<tr>
<td>BPE-2030</td>
<td>4 x BNC female</td>
<td>Out 1 - Out 4: TC DCLS</td>
<td>4HP</td>
</tr>
<tr>
<td>BPE-2080</td>
<td>4 x BNC female</td>
<td>Out 1 - Out 4: 2,048MHz</td>
<td>4HP</td>
</tr>
<tr>
<td>BPE-2110</td>
<td>8 x BNC female</td>
<td>Out 1.1 - Out 4.2: PPS</td>
<td>8HP</td>
</tr>
<tr>
<td>BPE-2120</td>
<td>8 x BNC female</td>
<td>Out 1.1 - Out 4.2: 10MHz</td>
<td>8HP</td>
</tr>
<tr>
<td>BPE-2180</td>
<td>8 x BNC female</td>
<td>Out 1.1 - Out 4.2: 2,048MHz</td>
<td>8HP</td>
</tr>
<tr>
<td>BPE-2530</td>
<td>4 x DFK / PhotoMos</td>
<td>PP 1 - PP 4: TC DCLS</td>
<td>4HP</td>
</tr>
<tr>
<td></td>
<td>1 x BNC female</td>
<td>TC AM</td>
<td></td>
</tr>
<tr>
<td>BPE-3014</td>
<td>2 x D-SUB9</td>
<td>TC DCLS / RS422</td>
<td>4HP</td>
</tr>
<tr>
<td>BPE-3082</td>
<td>4 x D-SUB9</td>
<td>2,048MHz Sinus</td>
<td>8TE</td>
</tr>
<tr>
<td>BPE-3424</td>
<td>4 x D-SUB9</td>
<td>TC DCLS / RS422</td>
<td>8HP</td>
</tr>
<tr>
<td>BPE-5010</td>
<td>4 x FO / ST</td>
<td>PPS</td>
<td>4TE</td>
</tr>
<tr>
<td>BPE-5020</td>
<td>4 x FO / ST</td>
<td>10MHz</td>
<td>4HP</td>
</tr>
<tr>
<td>BPE-5030</td>
<td>4 x FO / ST</td>
<td>TC DCLS</td>
<td>4HP</td>
</tr>
</tbody>
</table>
5.3.13 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 T1 E1

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
5.3.13.1 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.
5.3.13.2 Blockdiagram LIU

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

These signals can be devided 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 OxFF 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.
5.3.13.4 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):**

![Diagram of T1 pulse template](image)

**E1 (G.703):**

![Diagram of E1 pulse template](image)
5.3.13.5 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 Ω, balanced, RJ45 socket
- 2048 kHz (E1 mode) or 1.544 MHz (T1 mode), G.703, 75 Ω, unbalanced, BNC connector
- 2048 kBit/s (E1 mode) or 1.544 MBit/s (T1 mode), 120 Ω, balanced, RJ45 socket
- 2048 kBit/s (E1 mode) or 1.544 MBit/s (T1 mode), 75 Ω, unbalanced, BNC connector

5.3.13.6 Overview - LIU Modules for IMS Systems

<table>
<thead>
<tr>
<th>LIU Model</th>
<th>Size</th>
<th>Signal (bal./unbal.)</th>
<th>Connectors</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIU-A4040</td>
<td>8TE</td>
<td>BITS (4/0)</td>
<td>4 x RJ45, 4 x RJ45</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clock (4/0)</td>
<td></td>
</tr>
<tr>
<td>LIU-A4004</td>
<td>8TE</td>
<td>BITS (4/0)</td>
<td>4 x RJ45</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clock (0/4)</td>
<td></td>
</tr>
<tr>
<td>LIU-A0404</td>
<td>8TE</td>
<td>BITS (0/4)</td>
<td>4 x BNC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clock (0/4)</td>
<td></td>
</tr>
<tr>
<td>LIU-A0044</td>
<td>8TE</td>
<td>Clock (4/0)</td>
<td>4 x RJ45, 4 x BNC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clock (0/4)</td>
<td></td>
</tr>
<tr>
<td>LIU-A2222</td>
<td>8TE</td>
<td>BITS (2/2)</td>
<td>2 x RJ45, 2 x BNC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clock (2/2)</td>
<td></td>
</tr>
</tbody>
</table>

Date: 8th May 2019 IMS-MDU
<table>
<thead>
<tr>
<th>LIU Model</th>
<th>Size</th>
<th>Signal (bal./unbal.)</th>
<th>Connectors</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIU-A0040</td>
<td>4TE</td>
<td>Clock (4/0)</td>
<td>4 x RJ45</td>
</tr>
<tr>
<td>LIU-A0004</td>
<td>4TE</td>
<td>Clock (0/4)</td>
<td>4 x BNC</td>
</tr>
<tr>
<td>LIU-A2020</td>
<td>4TE</td>
<td>BITS (2/0) Clock (2/0)</td>
<td>2 x RJ45, 2 x RJ45</td>
</tr>
<tr>
<td>LIU-A2002</td>
<td>4TE</td>
<td>BITS (2/0) Clock (0/2)</td>
<td>2 x RJ45, 2 x BNC</td>
</tr>
<tr>
<td>LIU-A0400</td>
<td>4TE</td>
<td>BITS (0/4)</td>
<td>4 x BNC</td>
</tr>
<tr>
<td>LIU-A1111</td>
<td>4TE</td>
<td>BITS (1/1) Clock (1/1)</td>
<td>1 x RJ45, 1 x BNC</td>
</tr>
</tbody>
</table>

![Diagram of LIU configurations](image-url)
5.3.13.7 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.
5.3.14 LNO - 10MHz Sinus Output Module

The LNO180 is a 10MHz 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 10MHz 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 signaled 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 signaled by an associated red LED.

Technical Specifications:

Frequency Input: 10 MHz, sine (1V 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^-7

Electrical Connectors: BNC female

LED Status Indicators:

All LEDs red: Outputs disabled
PLL not locked,
OCXO in warm up phase
10MHz 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
5.3.15 SCG-U: Studio Clock Generator

Add-On module for generating various audio frequencies (12kHz, 32kHz, 44.1kHz, 48kHz, 64kHz, 88.2kHz and 96kHz), with only one 10MHz input clock, for studio applications. The SCG Module provides four outputs with different frequencies.

The SCG provides a wide range of programmable word clock rates between 24Hz – 12.288MHz.

Technical Specifications:

- **Outputs:** 4 x BNC (2.5V TTL into 75 Ohm) outputs with configureable frequencies
- **Input Signal:** 10MHz, sinewave or square pulse
- **Current Consumption:** 5 V +- 5%, @400 mA
- **Ambient Temperature:** 0 .. 50°C / 32 .. 122°F
- **Humidity:** 85% max.
5.3.15.1 SCG-U: Configuration via mbgdevman

If the SCG-U operates in an IMS system, the module can be easily configured via the web interface then. In the "IO Configuration" menu each output frequency can be adjusted separately. In the figure on the right the following value is set: Output 1 → 48kHz / 1 (1).

Overview Configuration SCG-U Sound Clock Generator Outputs 1-4

<table>
<thead>
<tr>
<th>GPIO 1 - 4:</th>
<th>Studio Clock Out</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enabled:</td>
<td>Disabled or</td>
</tr>
</tbody>
</table>
<pre><code>           | Enabled          |
</code></pre>
<p>| Base Frequency: | 32kHz           |
| 44.1kHz          |
| 48kHz            |
| Scale:      | 1/8 to 256       |</p>

(1) Example: (see figure above)

Frequency Out 1 (#0) = Base Frequency * Scale
Frequency Out 1 (#0) = 48 kHz * 1

Frequency Out 3 = 48 kHz
5.3.16 SCG-B: Studio Clock Generator Balanced

The IMS-MDU is an additional card for generating 'Digital Audio Reference Signals' for studio applications. The 25pin D-Sub female connector provides four DARS outputs, which can be configured via the web interface.

Technical Specifications:

Outputs: 1 x 25pin female connector, 4 x DARS, IEC 60958-4 format resolution 24bits, sampling frequency 48kHz transformer-balanced

Input Signals: 10MHz (sine wave or square pulse), 1PPS, Time String

Power Consumption: 5 V +/- 5%, @400 mA

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

Humidity: max. 85%

Pin Assignment of the 25pin D-SUB female connector

DARS 1  Hot 1  Pin 18  
         Cold 1  Pin 6  
         GND 1  Pin 19  

DARS 2  Hot 2  Pin 4  
         Cold 2  Pin 17  
         GND 2  Pin 5  

DARS 3  Hot 3  Pin 15  
         Cold 3  Pin 3  
         GND 3  Pin 16  

DARS 4  Hot 4  Pin 1  
         Cold 4  Pin 14  
         GND 4  Pin 2  

Digital Out
5.3.16.1 SCG-B: Configuration with mbgdevman

If the SCG-B is used in an IMS MDU system you can easily configure the Studio Clock Generator with the monitoring and management software mbgdevman.

In the menu "Device Configuration → GPIO" you can set the output on DARS for every output of the SCG-B. The four available outputs can optionally be switched off.
5.3.17 VSG - Video Sync Generator

The VSG is a video signal reference for Studio Equipment with four BNC outputs. The Module generates 1x bi-level sync (Black Burst) and 1x Tri-Level Sync and 2x Sync Signals (H-Sync, V-Sync, .. ). The LANTIME Web Interface can be used for output signal configuration and to query the state of the VSG.

Functionality
The board is synchronized by an external 10MHz signal. It generates configurable video signals in different formats. The generated signals have a phase reference to 1PPS.

Generated Signals:

SMPTE standards:  
- PAL Blackburst  
- NTSC Blackburst  
- 720p/50Hz (SMPTE296M3)  
- 1080i/25Hz (SMPTE274M6)  
- 720p/59.94Hz (SMPTE296M1)  
- 1080i/29.97Hz (SMPTE274M7)  
- V-, H-, Frame-Sync for HD and SD formats

Status Info:  
- ST: Status of VSG  
- In: Status of reference input  
- A: Status Out 1 + 2  
- B: Status Out 3 + 4

Electrical Connectors:  
- 96-pin VG-rail DIN 41612

Power Consumption:  
- 5 V +- 5%, 250 mA

BNC Connectors:  
- 2x BNC female, unbalanced, 300 mVpp @ 75Ω  
- 2x BNC female, unbalanced, 2.5 V TTL @ 75Ω

Ambient Temperature:  
- 0 .. 55°C

Humidity:  
- Max. 85%
### 5.3.17.1 VSG Configuration with mbgdevman

If the VSG operates in an IMS system, the module can be easily configured via the web interface then.

#### Overview Configuration

**VSG Video Sync Generator Outputs 1-4**

**Output 1**

<table>
<thead>
<tr>
<th><strong>Output Type:</strong></th>
<th>Video Out</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Epoch:</strong></td>
<td>TAI</td>
</tr>
<tr>
<td></td>
<td>UTC</td>
</tr>
<tr>
<td></td>
<td>GPS</td>
</tr>
<tr>
<td><strong>Format:</strong></td>
<td>720p 50Hz</td>
</tr>
<tr>
<td></td>
<td>1080i 25Hz</td>
</tr>
<tr>
<td></td>
<td>720p 59.94Hz</td>
</tr>
<tr>
<td></td>
<td>1080i 59.94Hz</td>
</tr>
<tr>
<td><strong>Phase Offset:</strong></td>
<td>[Offset Value]</td>
</tr>
</tbody>
</table>

**Output 2:**

<table>
<thead>
<tr>
<th><strong>Output Type:</strong></th>
<th>Video Out</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Epoch:</strong></td>
<td>like Output 1</td>
</tr>
<tr>
<td><strong>Format:</strong></td>
<td>NTSC</td>
</tr>
<tr>
<td></td>
<td>PAL</td>
</tr>
<tr>
<td><strong>Phase Offset:</strong></td>
<td>[Offset Value]</td>
</tr>
</tbody>
</table>
### Output 3

<table>
<thead>
<tr>
<th>Output Type:</th>
<th>Video Sync Out</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal Type:</td>
<td>SD H-Sync</td>
</tr>
<tr>
<td></td>
<td>SD V-Sync</td>
</tr>
<tr>
<td></td>
<td>SD Frame</td>
</tr>
<tr>
<td></td>
<td>HD H-Sync</td>
</tr>
<tr>
<td></td>
<td>HD V-Sync</td>
</tr>
<tr>
<td></td>
<td>HD Frame</td>
</tr>
<tr>
<td></td>
<td>HD Blank</td>
</tr>
</tbody>
</table>

### Output 4

<table>
<thead>
<tr>
<th>Output Type:</th>
<th>Video Sync Out</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal Type:</td>
<td>DARS</td>
</tr>
</tbody>
</table>
# 6 Declaration of Conformity

**Konformitätserklärung**

Doc ID: IMS-MDU-2017-01-04

**Hersteller**

Meinberg Funkuhren GmbH & Co. KG

Manufacturer

Lange Wand 9, D-31812 Bad Pyrmont

erklärt in alleiniger Verantwortung, dass das Produkt,

declares under its sole responsibility, that the product

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:

<table>
<thead>
<tr>
<th>Normen und Richtlinien</th>
<th>Normen und Richtlinien</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMV – Richtlinie</td>
<td>DIN EN 61000-6-2:2005</td>
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<td>DIN EN 55032:2012</td>
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<tr>
<td></td>
<td>DIN EN 55024:2010</td>
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<tr>
<td>2014/30/EU</td>
<td></td>
</tr>
<tr>
<td>Low-voltage Directive</td>
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<tr>
<td>2014/35/EU</td>
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</tr>
<tr>
<td>RoHS – Richtlinie</td>
<td>DIN EN 50581:2012</td>
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<tr>
<td>RoHS – Directive</td>
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<tr>
<td>2011/65/EU</td>
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</tr>
</tbody>
</table>

Bad Pyrmont, den 2017-01-04

[Signature]

Günter Meinberg
Managing Director