MANUAL

IMS-LIU Setup Guide

Hot-Plug Module

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Meinberg Funkuhren GmbH & Co. KG

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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

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2 Safety Instructions for hot pluggable Modules

Check before every maintenance work on the system:

- If a data backup is required?
- Is a backup required, verify the data recovery which is done by this backup.
- Make sure to avoid any static discharge while working – use a grounding cable and/or antistatic gloves during installation and removal of hot pluggable components.
- If you are replacing a hot pluggable power supply, unplug the power cable prior to removing the module from the case.
- Never open a power supply. In power supplies dangerous voltages can still remain even after disconnection from the power supply. Always send power supplies back to the manufacturer for maintenance.

Exchange of hot–swap components

- Ensure that components which will be replaced during operation, always be treated with the utmost care. Avoid contact with live components.
- Electrostatic discharge can damage electronic components. For this reason, ensure protection against electrostatic discharges by wearing anti–static shoes while working with the system.
- Take care when removing and installing the hot–plug modules. Always work with the utmost caution. Touch the modules only at the edges.
- Place the module out of the box or after removal from the system with the component side to the top on a grounded and static–free surface.
- Storage of an IMS module must be done in a dry place.
- Installation or removal from hot–swap components only by authorized personnel!

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 opteration 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! Installtion, 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 manufaturer.

Supply lines for this decice 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 decice 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.
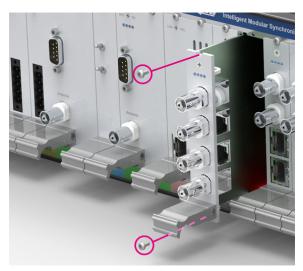
ALWAYS ENSURE A PROPER INSTALLATION!

3 Replacement or Installation of a Hot-pluggable IMS Module

If the system is supplied with an antenna and antenna cable, it is advisable to first mount the antenna in a suitable location (see chapter Antenna Mounting) and lay the antenna cable.

Please use a Torx screwdriver (T8 x 60) for removal and installation of the module.

1. Follow the safety instructions at the beginning of this manual!

1. Remove the two marked Torx screws from the module holder plate or the cover plate of the empty slot.

2. (Only for an already built-in module) Pull the module carefully out of the holding rail. Note that the module is firmly anchored in the connector block of the housing. You need a certain amount of force to release the module from this link. Once the connection to the connector block of the system's backplane is loosened, the module can be easily pulled out.

3. When installing the new IMS module, please ensure that the board is correctly inserted into the two guide rails of the system housing. Non-observance can cause damage to the module and the chassis. Make sure that the module is securely locked into the connector block before you fasten the two screws.

4. Now you can put the installed module into operation.

Attachment points of an 1U IMS system

3.1 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:

PWR:	"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.
I/O, ESI and MRI Slots:	"hot swappable".	
CLK1, CLK2:	"hot swappable"	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".
CPU:	"hot swappable"	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.
RSC/SPT:	"hot swappable"	The switching function or the distribution of generated signals is interrupted while the RSC/SPT is disconnected.

4 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

LED Indicators

Power T1 E1

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

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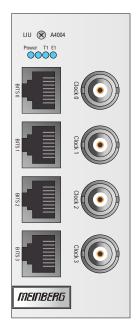   red: output disabled
            yellow: signal quality unknown

E1:   green   selected mode E1
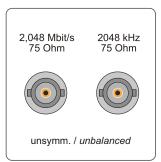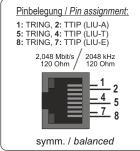   red: output disabled
            yellow: signal quality unknown
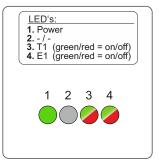
4.1 IMS-LIU Telecom Output Signals

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)
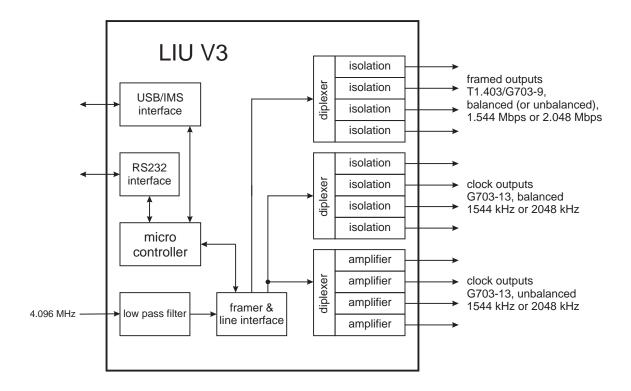

There are two separate signal paths on the board LIU. One is for providing the standard frequencies, the second path is for generation of the "telecom-signals". All output signals have high accuracy and stability because they are derived from the internal receiver's disciplined standard frequencies generated 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.

4.2 Block Diagram LIU

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

4.3 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).
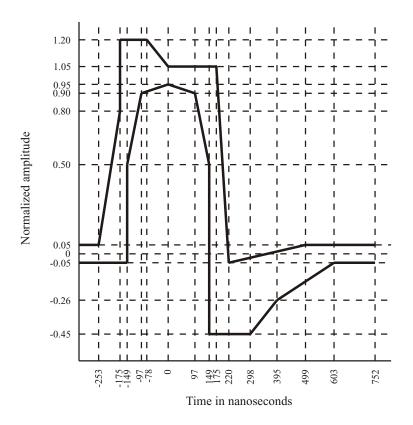
The clock outputs are standard frequencies of either 1544 kHz (T1) or 2048 kHz (E1). Four unbalanced and four balanced outputs according to ITU-T G703-13 (CCITT recommendation "Physical/electrical characteristics of hierarchical digital interfaces") are available via BNC female and RJ45 connectors.

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 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.
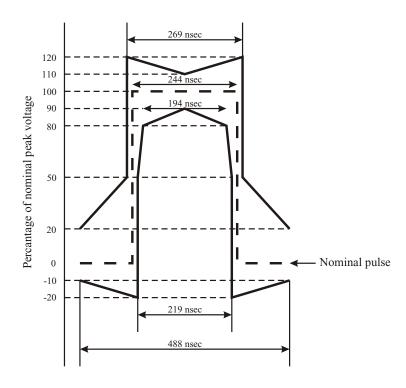
4.4 Pulse templates

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):
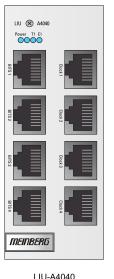
4.5 LIU – Configuration Samples

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

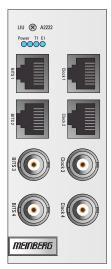## 4.5.1 Overview – LIU Modules for IMS Systems

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-A4040
BITS (4/0)
Clock (4/0)

LIU-A4004
BITS (4/0)
Clock (0/4)

LIU-A0404
BITS (0/4)
Clock (0/4)

LIU-A2222
BITS (2/2)
Clock (2/2)

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)
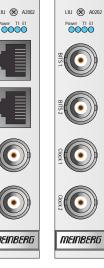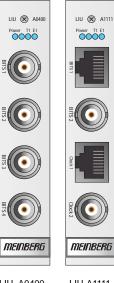
LIU-A0004
Clock (0/4)

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)

4.6 IMS - LIU Configuration

E1/T1 – generator available with 4 or 8 outputs
Generation of reference clocks for synchronization tasks. The module LIU (Line Interface Unit) generates different reference clock pulses which are derived from the GPS-locked master oscillator of a preconnected GPS clock. The output signals are available with high accuracy and stability therefore.
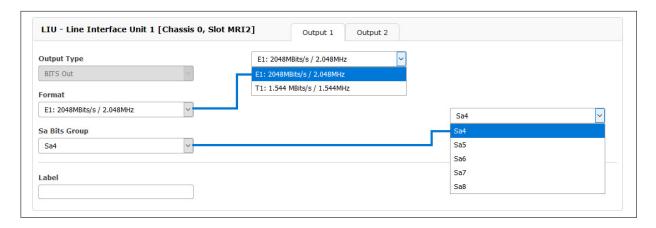

Figure: Configuration of the LIU module via the web interface menu "IO Config → Outputs Configuration"

Output Type

Clock Outputs:	2.048 MHz (E1-mode) or 1.544 MHz (T1-mode), G.703, 75 Ohm, unbalanced or 2.048 MHz (E1-mode) or 1.544 MHz (T1-mode), G.703, 120 Ohm, balanced.
BITS	framed outputs with SSM/BOC support: 2.048 Mbit/s (E1-mode) or 1.544 Mbit/s (T1-mode), 75 Ohm unbalanced or 2.048 MPs (E1-mode) or 1.544 Mbit/s (T1-mode), 120 Ohm, balanced.
Format	E1 framed (2.048 kBit) or T1 framed (1.544 kBit)
Quality	Sa Bit group location of SSM QL bits

With the pull-down menu "Output Configuration" the available outputs of the I/O slots can be configured:

Output Configuration of a LIU module (Line Interface Unit):
In this menu one can select between E1 or T1 mode for the LIU outputs. The selected mode is the same for all outputs.

T1 or E1?
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.

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.

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.

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 default.

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