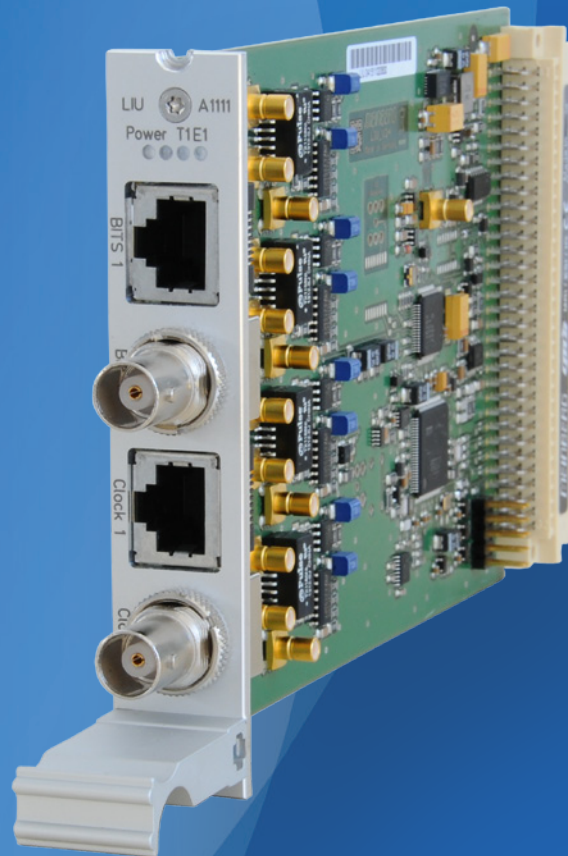




LIU - Line Interface Unit

Generation of reference clocks for synchronization tasks



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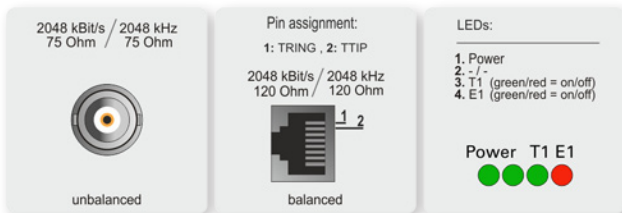
The module LIU (Line Interface Unit) generates different reference clock pulses which are derived from the GNSS-locked master oscillator of a preconnected satellite receiver. The output signals are available with high accuracy and stability therefore.

IMS-LIU Telecom Output Signals

The board LIU (Line Interface Unit) was designed to convert the GNSS-locked standard frequency of a preconnected Meinberg satellite controlled clock 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 preconnected satellite clock. Depending on the oscillator option of the internal receiver, the following accuracies can be achieved:

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 GNSS clock. This synthesizer is phase locked to the PPS signal and frequency locked to the master oscillator of the clock.

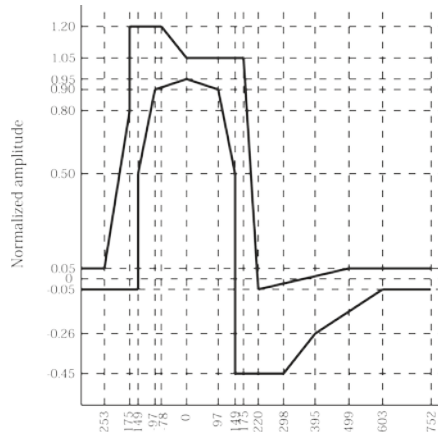
The module LIU is able to generate signals for the American T1- or the European E1-system. The mode of operation can be configured via the web interface of the IMS management module (LAN-CPU). The clock outputs are standard frequencies of either 1544 kHz (T1) or 2048 kHz (E1). Four unbalanced and four 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.

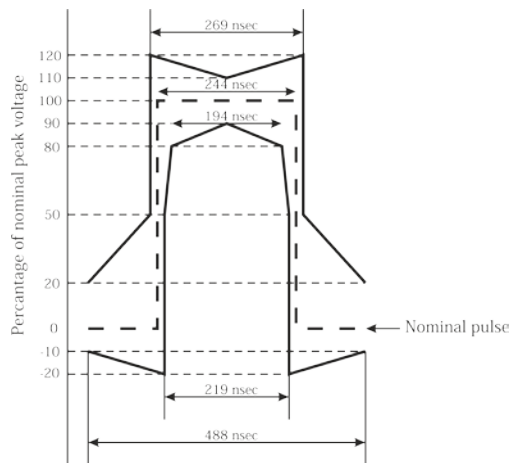
Pulse templates

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):



Configuration Samples

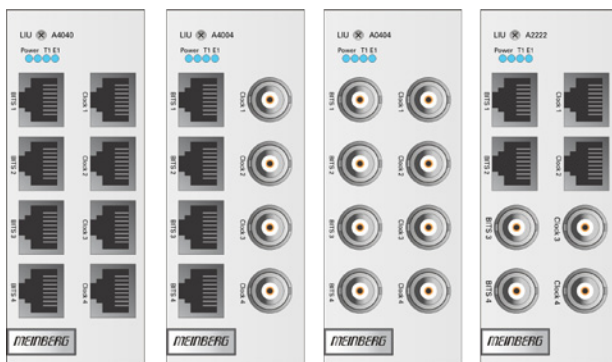
The Line Interface Unit (LIU) is available in two different sizes and different output / connector options. All outputs of a module can be operate in either the E1 or T1 in mode. Signal output settings can be done during operation via the web interface. The selected mode is indicated by the LEDs in the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

Overview - LIU Modules for IMS Systems

LIU Model	Size	Signal (balanced/unbalanced)	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



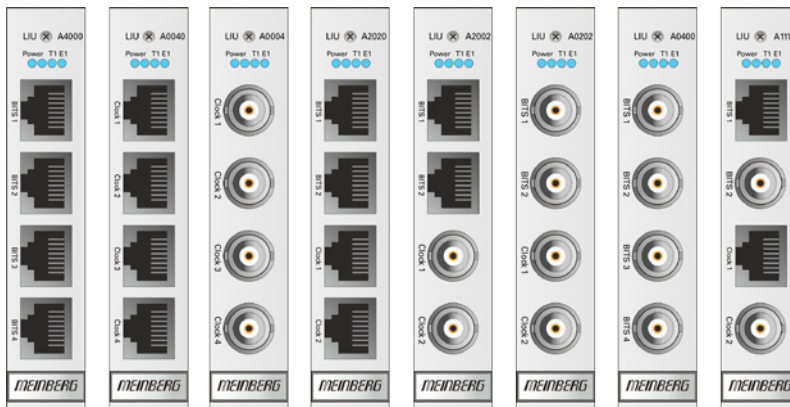
LIU-A4040
BITS (4/0)
Clock (4/0)

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 (balanced/unbalanced)	Connectors
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-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)

Control elements

E1- or T1-generator, settable by web interface

Accuracy of frequency outputs

The accuracy of the generated output signals depends on the master oscillator of the preconnected GNSS-satellite controlled clock. The following options are available (short term stability with GNSS-synchronization):

- OCXO MQ $\pm 2 \cdot 10^{-10}$
- OCXO HQ $\pm 5 \cdot 10^{-12}$
- Rubidium $\pm 2 \cdot 10^{-12}$

Interface

Clock Outputs: 2048 kHz (E1-mode) or 1544 kHz (T1-mode)
 G.703, 75 Ohm, unbalanced
 2048 kHz (E1-mode) or 1544 kHz (T1-mode)
 G.703, 120 Ohm, balanced

Framed Outputs: 2048 kBit/s (E1-mode) or 1544 kBit/s (T1-mode),
 75 Ohm, unbalanced or
 2048 kBit/s (E1-mode) or 1544 kBit/s (T1-mode),
 120 Ohm, balanced

Output Pulses: according to G.703 (E1-mode)
 or T1.403 (T1-Mode)

Line Coding: HDB3 (E1-mode) or B8ZS (T1-mode)

Electrical Connectors: 96-pin VG-rail DIN 41612

Power Supply: +5 V DC

Current Consumption: 5 V +-5%, 450 mA

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

Humidity: Max. 85%

Warranty: Three-Year Warranty

RoHS-Status of the Product:

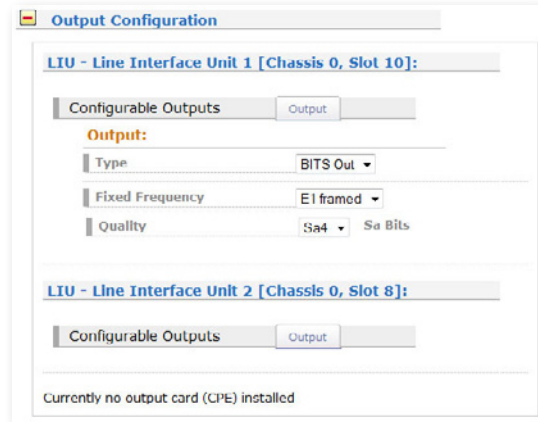
This product is fully RoHS compliant

WEEE status of the Product:

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. 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.

LIU Conguration via Web Interface

Output Configuration of a LIU module (Line Interface Unit):



In this menu you 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 64Kbit/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. 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.



Figure: LIU modules in 3HE IMS chassis with balanced Clock and BITS outputs (RJ45 connectors)