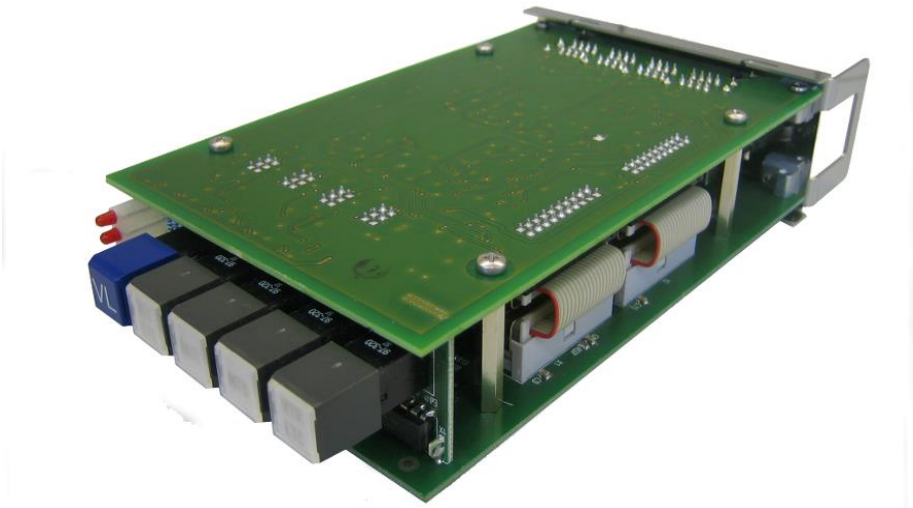
plura

TIMING SOLUTIONS

Rubidium Series

RUB VL

LTC Distribution and LTC Multiplexing/De-Multiplexing Module



Functional Description and Specifications
Supplement to the “Installation & Systems Manual RUBIDIUM SERIES”
Version: 4.7
January 11, 2024

CONTENTS

A1 Revision History

No.	Date	Subject
0.n		Preliminary documents, changes without notice.
1.0	March 15, 2006	First released document.
1.1	March 30, 2006	Internal jumper, RS422 or RS485 selection.
2.0	December 15, 2006	Revised.
2.1	June 04, 2007	Interface: Two new protocols. Pulse: One new protocol. GPI specifications: Revised.
2.2	November 27, 2007	Interface: Two new protocols.
2.3	December 18, 2007	Interface: Two new protocols. Interface: If a protocol includes an address it is now possible to choose an address value. Revised.
3.0	January 12, 2009	New hardware board 03. TELEGRAM signals now at 24 V. Revised.
3.1	October 06, 2009	New Impulse Telegram output modes. New serial output protocols. Secondary address made available. Revised.
3.2	February 22, 2010	Revised. Function "Link" added.
3.3	April 30, 2010	Revised.
3.4	May 11, 2011	More information about cable lengths connecting analogue clocks.
4.0	June 06, 2011	Completely revised.
4.1	June 27, 2011	Interface: Two new protocols.
4.2	August 03, 2011	New output modes available: MTD Main 1 – 3.
4.3	January 26, 2012	Interface: New protocols.
4.4	September 24, 2012	New hardware version with new location of jumpers – chapter "RS422 Output or RS485(MTD) Distribution". "VL Output": drop-down list "gain" revised.
4.5	September 3, 2019	Changed address of Plura Europe GmbH.
4.6	December 3, 2020	Re-formatted in new design.
4.7	January 9, 2024	Updated download links and update instructions.

Due to constant product development the features of this module are subject to change. The current functional description always refers to the current software and the current configuration tool.

You can download the latest version of the standard software from

https://plurainc.com/products/vl/.

Please be sure to use the latest configuration program after having done an update. You can download the latest version from the address above.

A2 Copyright

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A3 General Remarks

This manual is a supplement to the "Installation & Systems Manual RUBIDIUM SERIES". Please read the below listed chapters of the "Installation & Systems Manual RUBIDIUM SERIES", as these chapters are necessary for the safe and proper use of the Rubidium module "VL".

- A3 Warranty,
- A4 Unpacking/Shipping/Repackaging Information,
- A5 Safety Instructions,
- A6 Certifications & Compliances,
- Plug-In a Module,
- Remove a Module.

1 Module “VL”

1.1 General Description

The VL module is a signal distribution and amplifier with two separate LTC readers and four independent LTC generators, four RS232 and RS4222 outputs and four output stages for impulse telegram. All output signals are phase-locked to the LTC reference input.

LTC time and user bits (binary groups) can be read, processed and converted. The independent outputs can be set up individually and can generate the processed/converted input data with various output formats. For example, the Plura LTC(MTD) can be decoded and converted to various output formats, so that external devices can display the individual stop timers or time zone data. Impulse telegram outputs are available to control Plura analogue clocks.

A **PC** or the **RUB IE** module is required for the configuration of this module.

The front panel label **VL** visibly identifies where each module is located. The serial number is located on the bottom side of the lower circuit board of each module.

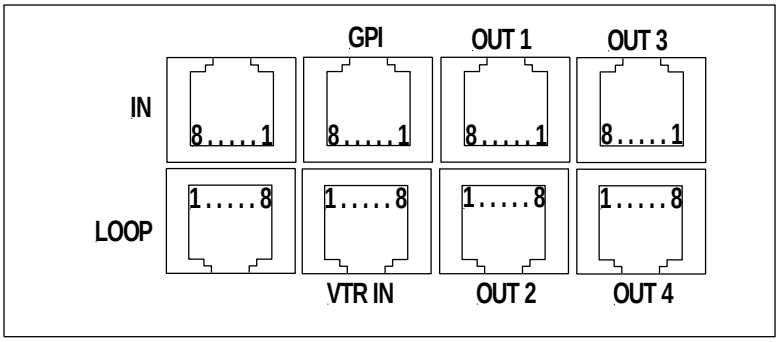
The standard hardware of this module has all of the following key features:

- “Hot Swapping“, i.e. it is possible to insert or remove a module without interrupting the operation of other modules in this frame.
- Failure relay, connected to the FAIL_A and FAIL_B pins of the **RLC** connector at the rear of the frame.
- RS232 and TC_link (RLC connector) interfaces to have access to the internal bus of the chassis.
- Four programmable function keys, lamps and LEDs on the front panel (RUB1 version only).
- Flash memory containing the firmware, so configuration and updates are possible via a PC connection. You can download the latest version of the program from:

  https://plurainc.com/products/vl/.

- Two LTC readers.
- Four LTC generators.
- Four RS422 and four RS232 outputs.
- Four output stages for impulse telegrams, e.g. for controlling analogue clocks.
- Four programmable input or output GPI’s (General Purpose Interfaces) designed for customer specific applications.

1.2 Rear Panel and Connectors



Pin assignments

IN RJ45 jack	LOOP RJ45 jack
1: RS485_TRA_IN 2: RS485_TRB_IN 3: LTC_REF_ A 6: LTC_REF_ B 4: GND 5: n.c. 7: n.c. 8: n.c.	1: RS485_TRA_IN 2: RS485_TRB_IN 3: LTC_REF_ A 6: LTC_REF _B 4: GND 5: n.c. 7: n.c. 8: n.c.

GPI RJ45 jack	VTR IN RJ45 jack
1: GND 2: GPI_1 3: GND 6: GPI_2 4: GND 5: GPI_3 7: GND 8: GPI_4	1: n.c. 2: n.c. 3: LTC_ VTR _A 6: LTC_ VTR _B 4: GND 5: n.c. 7: n.c. 8: n.c.

OUT 1 OUT 2 OUT 3 OUT 4 RJ45 jacks	1: RS422_T- or RS485_TRA_OUT – select by jumper 2: RS422_T+ or RS485_TRB_OUT – select by jumper 3: LTC_ OUT _A 6: LTC_ OUT _B 4: GND 5: TELEGRAM OUT 7: RS232_TxD 8: VCC12_OUT

Signal descriptions

GND	Signal ground.

RS485_TRA_IN RS485_TRB_IN	Balanced in- or outputs of an RS485 serial interface as the source signal, hard wired between IN and LOOP connectors.

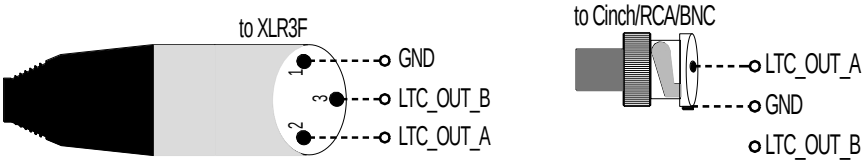
LTC_REF_A, LTC_REF_B LTC_VTR_A, LTC_VTR_B	Balanced LTC (Linear Time Code) inputs.

GPI_1 … GPI_4	General Purpose Interface, may be used as input or output for digital signals according to application.

RS485_TRA_OUT RS485_TRB_OUT	Balanced in- or outputs of an RS485 serial interface. A transceiver decouples these signals from the source signals.

RS422_T-/T+	Balanced RS422 output.

RS232_TxD	RS232 output.

LTC_OUT_A LTC_OUT_B	Balanced LTC (Linear Time Code) output. Connections: balanced use unbalanced use 

TELEGRAM OUT	Output of an impulse telegram, nominal level ≈ 12 V (Version 01 and 02) and ≈ 23 V (Version 03) without load. The TELEGRAM OUT, VCC12_OUT and GND lines are used to control analogue clocks of the Plura MTD system with a 4-wire interface. TELEGRAM OUT and GND only are used to control analogue clocks of the Plura MTD system with a 2-wire interface.

VCC12_OUT	12 VDC voltage output, 500 mA reversible fused (each output line), used as the power supply for analogue clocks of the Plura MTD system.
⚠	Using VCC12_OUT output, please make sure not to exceed the total power rating of the “Power Supply“ module.

1.3 Specifications

Input LTC reference (signals LTC_REF_A/LTC_REF_B at RJ45 IN)

Format	According to ANSI/SMPTE 12M-1-2008, balanced signals
Input impedance	18 kΩ
Signal level	100 mV_{p-p} - 5 V_{p-p}, auto-ranging
Frequency	19 - 33 frames/s

Input VTR LTC (signals LTC_VTR_A/LTC_VTR_B at RJ45 VTR IN)

Format	According to ANSI/SMPTE 12M-1-2008, balanced signals
Input impedance	18 kΩ
Signal level	100 mV_{p-p} - 5 V_{p-p}, auto-ranging
Frequency	1.6 - 2500 frames/s

LTC Output

Format	According to ANSI/SMPTE 12M-1-2008, balanced signals
Output impedance	< 50 Ω
Signal level	Adjustable: balanced use: from –17 dBu/0,31 V_{p-p} to +13 dBu/9,8 V_{p-p} unbalanced use: from –23 dBu/0,16 V_{p-p} to +7 dBu/4,9 V_{p-p}

RS422 Output

Format (electrical)	According to TIA/EIA-422 standard
Baud rates	Selectable 2400 to 115200 bps

RS232 Output

Format (electrical)	According to EIA/TIA-232 standard
Baud rates	Selectable 2400 to 115200 bps

TELEGRAM OUT

Signal	Output of an impulse telegram, nominal level ≈ 12 V (Version 01 and 02) and ≈ 23 V (Version 03) without load.
Maximum current	Fused by a 200 mA auto-recovery fuse each output stage. A continuous current of up to 120 mA can be applied over the whole specified operating temperature range.

GPI_1, GPI_2, GPI_3, GPI_4

Input specification	Input "Low": -15.0 to +0.7 V Input "High": +2.0 to +15.0 V Impedance: ≈ 24 kΩ Frequency: 0 - 1 kHz
Output specification	Open Collector output of an NPN Darlington transistor. Internal 33k pull-up resistor. Max. power dissipation: 250 mW. "High" state: 2.4 V (no load). For higher switching levels an external pull-up to a positive power source of less than or equal to 24 VDC is needed, typically 1 kΩ if connected to an external +5 VDC power source. "Low" state: output switched to GND. Max. collector current: 200 mA DC, not fused. Collector-emitter saturation voltage: @20mA: typ. 0.72 V (≤ 0.85 V) @100mA: typ. 0.9 V (≤ 1.1 V) Frequency: 0 - 1 kHz.

Others

Operating voltage	15 - 30 VDC
Power consumption	Maximum 3.0 W (without load at the VCC12_OUT pins)
Weight	0.4 kg approx.
Dimensions	Standard circuit board (W x D): 100 x 160 mm/3.94 x 6.30 inch Rear panel: Rub H1: 103 x 44 mm / 4.06 x 1.73 inch Rub H3: 8HP, 3RU
Environmental characteristics, operating	Temperature: 5 °C to 40 °C Relative humidity: 30 % to 85 %, non-condensing
Environmental characteristics, non-operating	Temperature: -10 °C to +60 °C Relative humidity: 5 % to 95 %, non-condensing

1.4 Functional Overview

The standard functions of the module are:

- Reading and decoding LTC.
- Generating LTC: As "refresh" of the read LTC,
  as read LTC time + offset,
  or as decoded MTD time.
- Sending RS232 and RS422 time and date information (for PCs, UMDs, video walls …).

Two different time offsets (± HH:MM:SS:FF) can be programmed. These can be added or subtracted from the time information of the read LTCs (LTC_REF and LTC_VTR):

LTC_REF ± OFFSET1, LTC_REF ± OFFSET2, LTC_VTR ± OFFSET1, LTC_VTR ± OFFSET2.

This way VL generates four time bases internally which are synchronized to the external LTC_REF. With an offset = 00:00:00:00 the read time information will be regenerated frame accurately.

Furthermore, two independent free running counters are available as additional time references. These counters can receive start values utilizing one of the configuration tools. These counters can be controlled by external Start/Stop/Reset/Set signals.

If the module receives an LTC of the LTC(MTD) format, the following data of the LTC(MTD) will be decoded: Timers A – F, real-time & date.

If the module receives an LTC which contains any known date format, this date can be decoded.

Thus, different time information is available which can be generated as LTC time addresses, LTC user bits, serial data strings in selectable protocols, and impulse telegrams to feed analogue clocks. Any date encoded in the binary groups of the LTC input can be decoded and converted into any binary group format of the outgoing LTC.

Proper decoding of the input data and conversion to any output signal requires a configuration of the module utilizing one of the configuration tools:

1. For a proper decoding of LTC input data, the respective input format of the LTC must be selected (see chapter "Configuration of the LTC Inputs").
2. Each output connector (OUT1 to OUT4) comprises LTC, serial interfaces, and an impulse telegram. Each output signal can receive an individual set-up (see chapter "Configuration of the Outputs").

PC programs are available for free: Configuration of the module = **RubidiumConfig.exe**, status monitor = **RubStatSE.exe**.

The RUBIDIUM SERIES HTTP server, located in the **Rub IE** module, enables the configuration of the module and offers a status monitor as well.

1.5 RS422 Output or RS485(MTD) Distribution

Each output connector (OUT1 to OUT4) offers either an RS422 output or an RS485(MTD) distribution at its pins 1 and 2:

RS422 output, signals RS422_T-, RS422_T+:

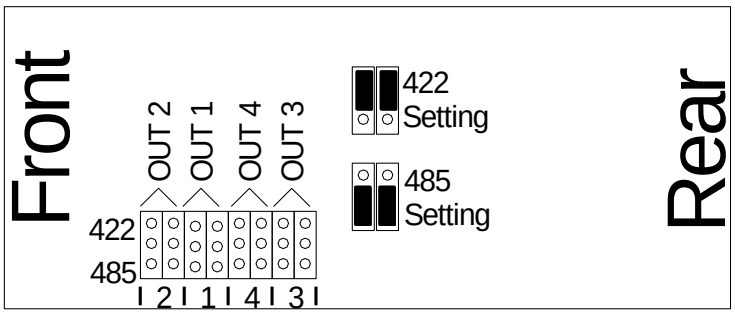
Serial data output, configuration by settings at "Interface" at the **VL Output** function of a configuration tool. Data string is identical to the RS232 output.

RS485(MTD) distribution, signals RS485_TRA_OUT, RS485_TRB_OUT :

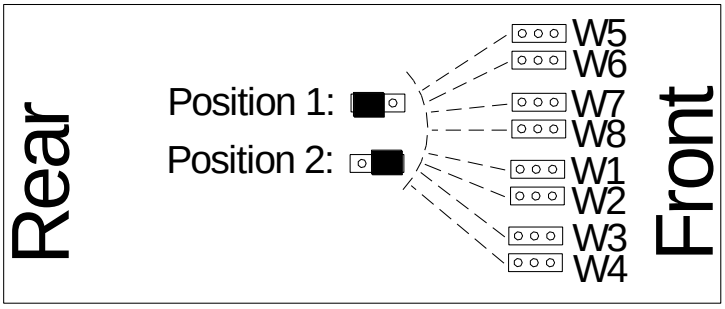
RS485 bus of the MTD Timer System, signals will be received/transmitted from/to the RS485 at RJ45 IN and LOOP jack, whereas each RS485 at the RJ45 OUT jacks is electrical decoupled from all other RS485 signals.

Select by **jumpers** located at the upper board of the VL module.

Jumper setting at latest version delivered since September 2012:



Jumper setting at version delivered before September 2012:



Position 1 = RS422
Position 2 = RS485(MTD)

OUT 1: W1 + W2
OUT 2: W3 + W4
OUT 3: W5 + W6
OUT 4: W7 + W8

1.6 Software Update

Software updates require a (Windows operating system) computer and the "RUBIDIUM CONFIGURATION" program.

Important: Please make sure to always use the latest version of the program. You can download it from:

https://plurainc.com/products/vl/

Please check the **PC** connector at your RUBIDIUM housing: there is an USB or RS232 (with a DSUB9 connector) interface installed. You now need the same interface at your computer.

The new firmware should already be stored as a **.tcf** file at your computer.

Please now execute the following steps:

1. Connect your computer to the **PC** connector of that RUBIDIUM frame where the module has been plugged.

   In case of an RS232 interface: Use a straight (1:1) connection between the **PC** connector at the RUBIDIUM frame and the RS232 of the computer.

   In case of an USB interface: Use a USB A-B cable between your computer and the RUBIDIUM frame.

   Switch on the power of all units.
2. Execute "Rubidium Config.exe" on your computer. Select the "Port" according to the interface (USB, RS232) you are using.
3. Select the module (unit 1, 2, 3 ...).
4. Select "Flash Update" in the *File* menu.
5. Open the **.tcf**-file. Standard name: "Rubidium VL version.tcf".
   "version" stands for a revision no., e.g. 2.12.27.

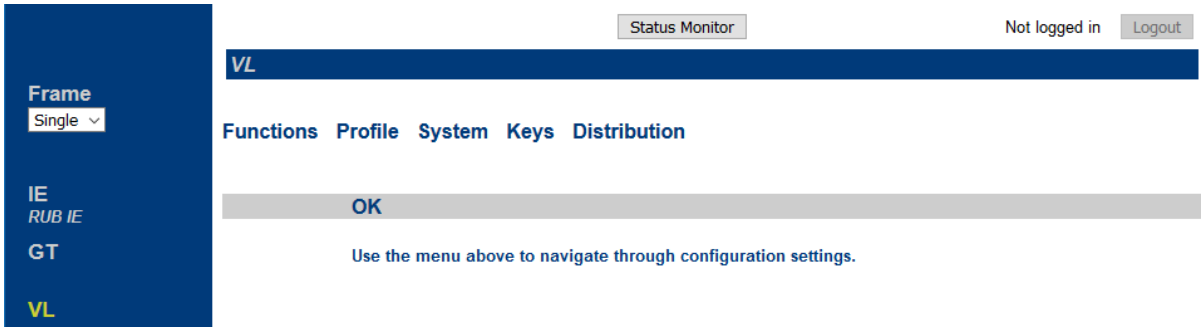
   Click the OK button, update starts. Click the OK button at the end.
6. Update is finished now. We recommend checking module's configuration utilizing the "RUBIDIUM CONFIGURATION" program.

During the flash update the operation of the module stops!

2 Status Monitor

2.1 Status Monitor by the IE Module

The RUBIDIUM SERIES HTTP server, located in the **RUB IE** module, offers a status monitor. Please refer to the "Functional Descriptions and Specifications IE" manual for a detailed description of how to access the RUBIDIUM SERIES system and how to open the RUBIDIUM homepage.



- Click on **VL** on the left.
- Click on the button **Status Monitor** to open the "VL" status monitor.

Requirements:

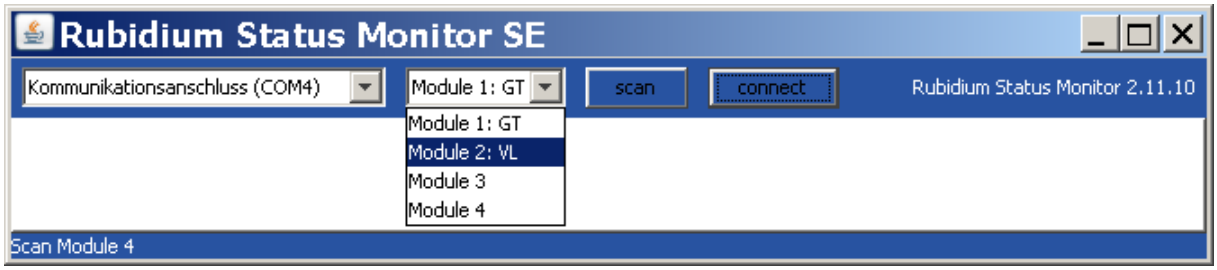
- Please have Java Runtime Environment 1.6.0 or higher installed (for example download at www.java.com).
- Java should be installed as a browser plug-in (a Windows installation will do this automatically if you download Java from the source mentioned above).
- The Status Monitor works with all operating systems which support Java.

2.2 Status Monitor by a PC Program

The PC program **RubStatSE.exe** uses the **PC** interface (RS232 or USB) of the RUBIDIUM housing. This program is part of the "Rubidium Series, config software" packet you can download at:

https://plurainc.com/products/vl/.

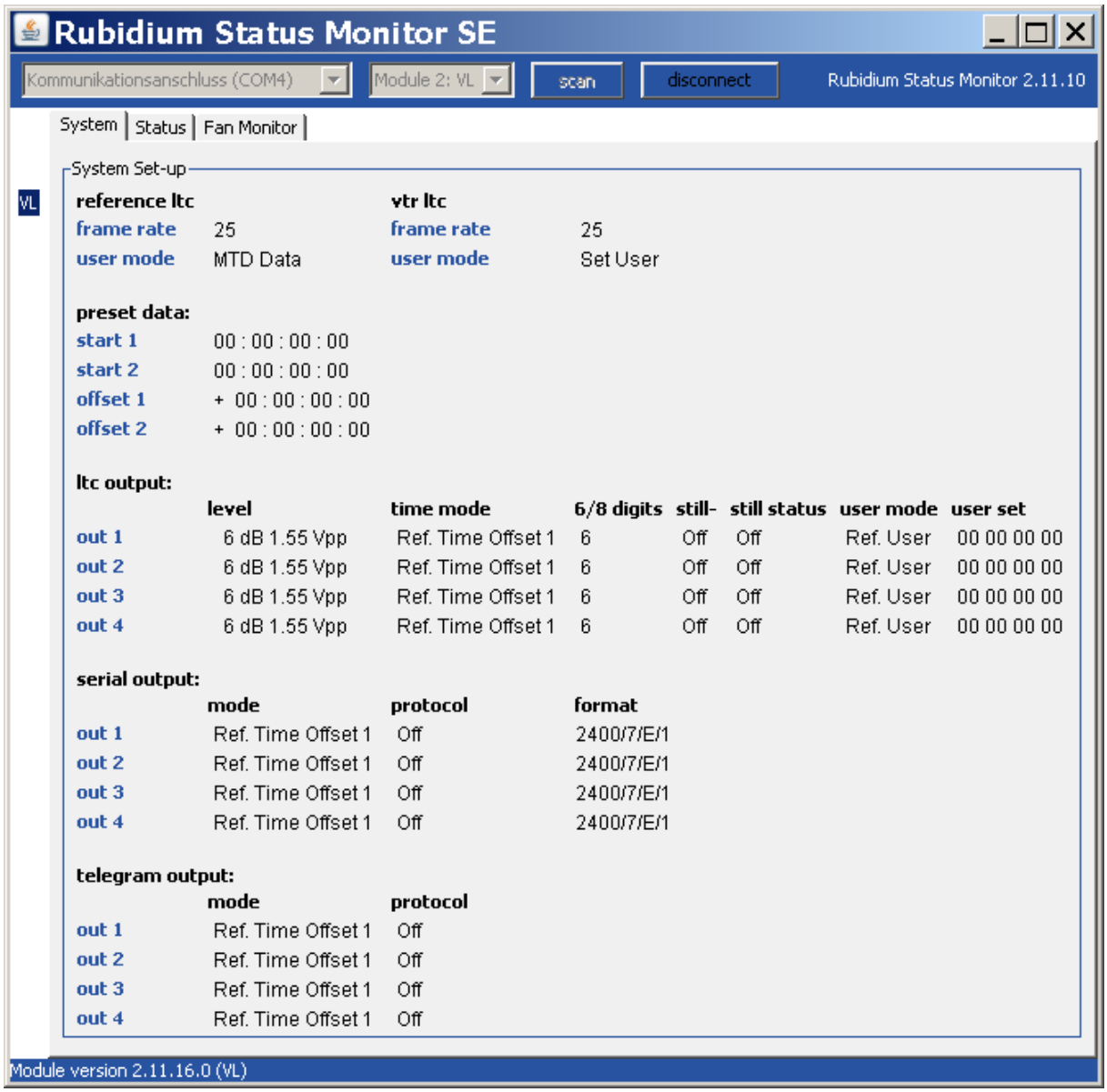
Execute this program, select the COM port or USB connection and press the **scan** button to get a list of the modules plugged to this housing. Select the module and press the **connect** button.



Requirements:

- Please have Java Runtime Environment 1.6.0 or higher installed (for example download at www.java.com).
- For a Windows operating system: Please follow the description of **RubStatSE_Readme.txt**.
- For a Linux operating system: Available on request.

2.3 System Status



The **System** page of the status monitor allows verifying the configuration of the inputs and outputs.

Additionally, the "**still status**" indicates whether a "frozen" LTC output is currently being generated.

2.4 Signal Status

The **Status** page of the status monitor shows all the relevant status information.

ltc input

signal	"Yes" if a signal can be read. "No" if no signal can be read. This status is similar to the function of the lamp "REF LTC" and "VTR LTC", resp.
time	Time information (HH:MM:SS) of the read LTC.
user	User bits of the read LTC.
date source	Source for decoding the date: "reference ltc" or "vtr ltc" – depending on configuration (see chapter „Configuration of the LTC Inputs").
ltc(mtd) source	Source for decoding the MTD data: "reference ltc" or "vtr ltc" – depending on configuration (see chapter „ Configuration of the LTC Inputs ").

ltc decoded data

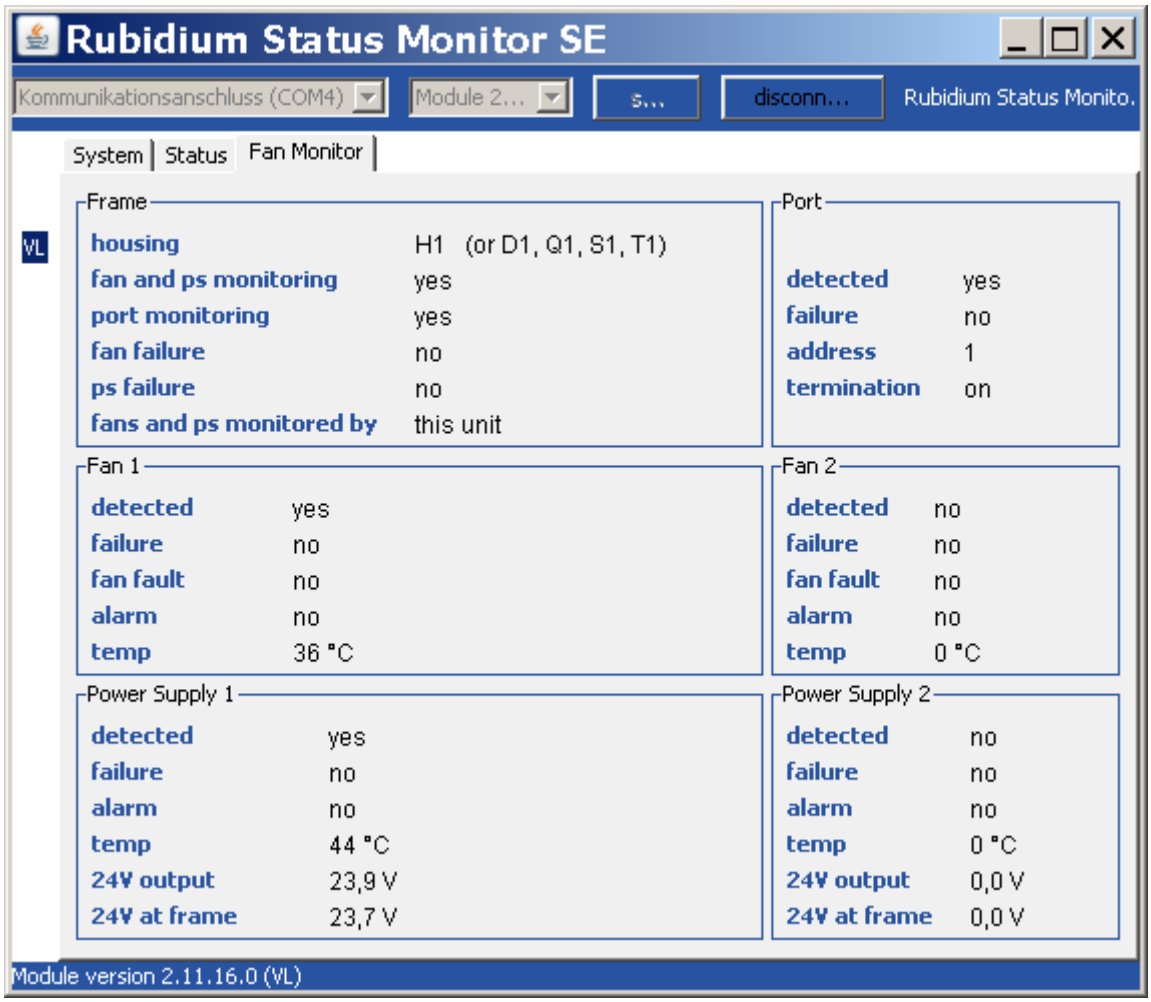
date	If a valid date can be decoded, the date will be shown. "invalid" will be shown if no valid date is present.
ltc(mtd)	"valid" will be shown if LTC of the LTC(MTD) format can be decoded. "invalid" will be shown if no LTC(MTD) is present.
time A … time F real time	Timer A – F and real-time are shown as decoded out of the MTD data. These data will be valid only if "ltc(mtd) = valid" is shown. <u>Note:</u> Displaying the MTD data serves for a quick check only and may not be compared with the time representation of an MTD display. MTD displays evaluate status information which influences the time representation. The status monitor neglects this information. For example: "Negative" stop timer values will be shown as positive values (24:00:00 – stop timer). Furthermore, the time accuracy of the MTD timer values at the status monitor is less than one second.

ltc output lock status

pll lock current	All LTC outputs are synchronized to the LTC at input IN (LTC_REF). A "yes" or "no" indicates the actual status of this phase synchronization.
pll lock after reset	A "yes" or "no" indicates whether VL has been synchronized at least once after power has turned on.
freq. divider, current	Information for service purposes: Current value of the frequency divider for the internal frame clock.
freq. divider, nominal	Information for service purposes: Nominal value of the frequency divider for the internal frame clock.
errors no sync	Error counter: Number of sync signal failures.
errors sync disturbance	Error counter: Number of sync signal disturbances.

2.5 Status of Fan and Power Supplies

This module – as all configurable RUBIDIUM modules – is able to monitor the fan and power supplies which are plugged to the same housing as “VL”.



Please refer to the document “Installation & Systems Manual RUBIDIUM SERIES” for a detailed description.

3 The Rubidium Configuration Tools

3.1 The Rubidium Configuration PC Program

Please refer to the

"Installation & Systems Manual RUBIDIUM SERIES"

for a general description of this program and how to install it. In this document please notice the following subchapters:

- Overview
- Installation
- Connection to RUBIDIUM SERIES Chassis
- Starting the Program
- Store, Load and Update the Configuration on your PC
- The "Profile" Tab: Store and Load Configurations on the Module

The program RUBIDIUM CONFIGURATION uses various tab cards. With one click on the button **Configure** all available and currently activated tabs of this specific module are displayed.

Any changes at a tab will immediately be stored at the module. If you enter a number or a text press the **tabulator key** at the PC's keyboard afterwards.

3.2 The Rubidium Series HTTP Server

The RUBIDIUM SERIES HTTP server is located in the **RUB IE** module. A 10/100Base-T Ethernet connection and a web browser allow accessing the RUBIDIUM system.

Please refer to the

"Installation & Systems Manual RUBIDIUM SERIES"

for a functional overview and for an installation description of this program. You will find the chapter "The RUBIDIUM SERIES HTTP Server" and its subchapters:

- Overview, Connecting the IE Module
- IP Configuration, the Rubidium Homepage
- Access to a RUBIDIUM SERIES Module
- The "Profile" Page: Store and Load Configurations on the Module or on the PC

As soon as a communication to a single module has been established, the **Configuration** page gives a list of all links to those pages which are actually enabled for a configuration.

Changes at a page will not be stored at the module automatically. At the bottom of each page there are two buttons which should be used to store or load the module's configuration:

Button **Save To Module**:

- Click on this button to transfer all settings on this page to the module.

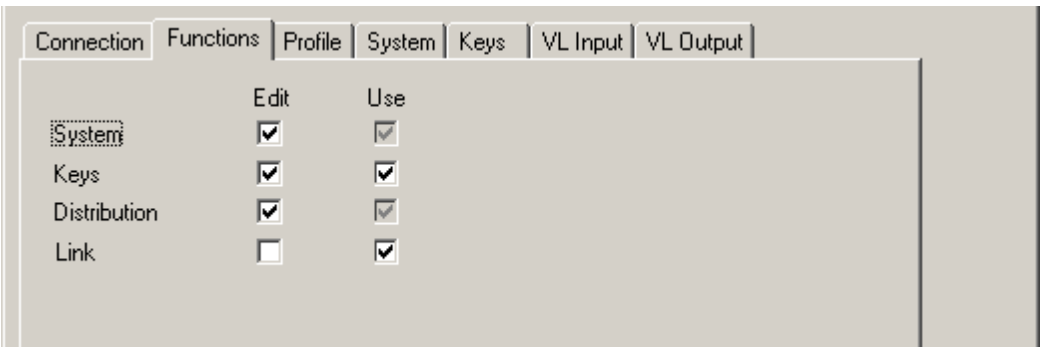
Button **Reload From Module**:

- Click on this button to load the current configuration of the module.

VL	Every time you click on the blue button which indicates the module under configuration a **Reload** will be done automatically.

3.3 “Functions“

Click on **Functions** to see all applicable tabs/pages listed, and to activate or deactivate tabs/pages. For example (screen shot of the PC program tab):



A tab/page reflects a function of the module. The columns **Edit** and **Use** determine whether the function in the module is activated/deactivated and whether user configuration of that specific function is allowed or not.

Click on the applicable **Edit** and/or **Use** check boxes to activate/deactivate a function:

Edit	**Use**	
		Function is deactivated, the tab/page is not visible.
√	√	Function is activated, the tab/page is visible and configurable.
	√	Function is activated but the tab/page not visible and therefore not configurable.

- We suggest that you deactivate the **Use** check boxes of all functions you are presently not using.
- We suggest that you deactivate the **Edit** check boxes of all functions you are presently not configuring. That avoids unintentional operating and malfunctions.

List of functions:

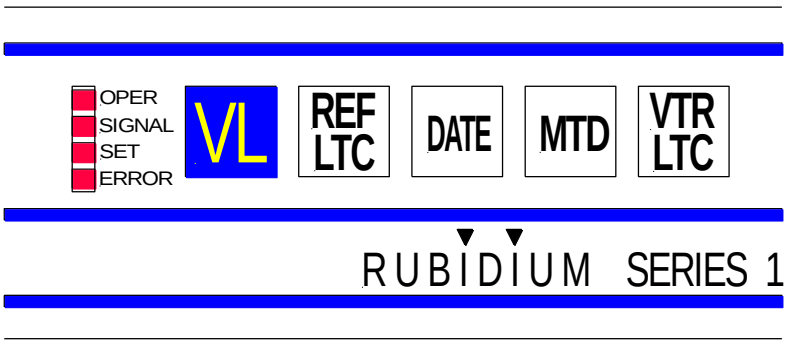
Profile	Store and Load Configurations on the Module (*)
System	Identification, Reset, SNMP, Fan Control
Keys	Keys and Lamps, LEDs and GPIs
VL Input	Configuration of the LTC Inputs
VL Output	Configuration of the Outputs
Link	Communication between Modules

(*) refer to “Installation & Systems Manual RUBIDIUM SERIES”

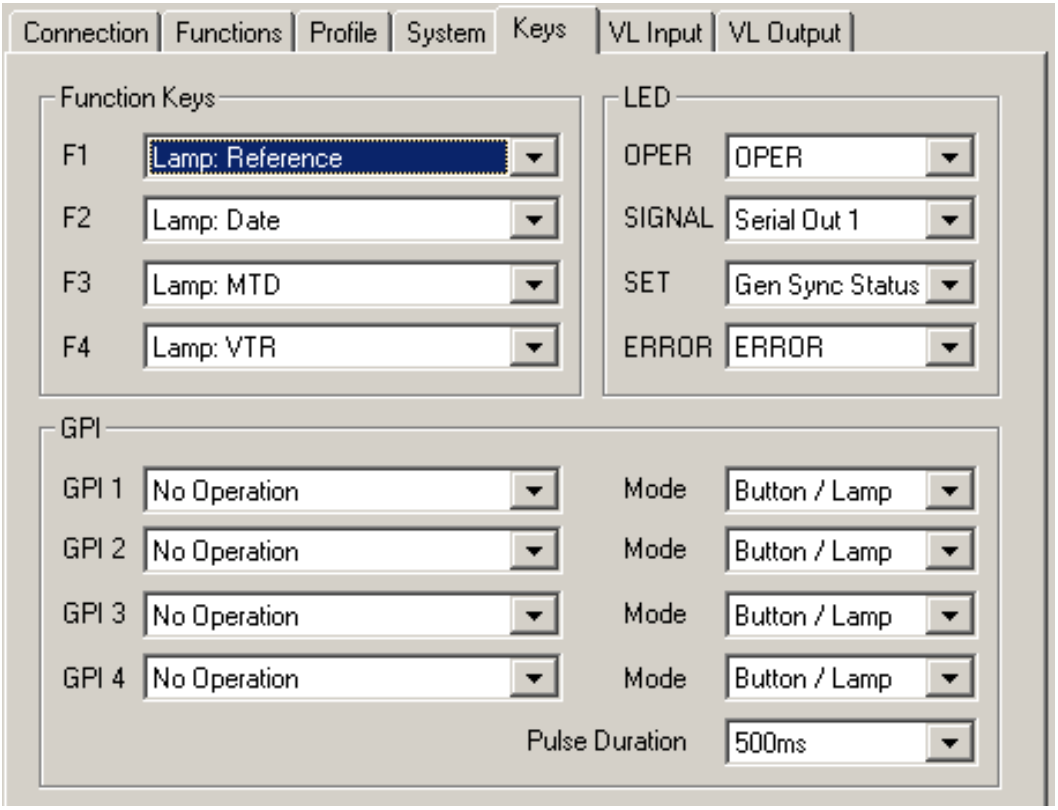
3.4 “Keys“: Keys, Lamps, LEDs and GPIs

The module has four GPIs (General Purpose Interface), the RUB1 module additionally has four illuminated buttons (keys and lamps) and four LEDs (Light Emitting Diodes). Basically, the functions of these in- and outputs are programmable.

Some functions presented by the configuration tool maybe assigned to special options, and therefore are not applicable with the standard firmware. For further information please contact ***Plura***.



Configuration (example shows a screen shot of the PC program tab):



The following functions for the **keys** are provided for this module:

Function	**Descriptions**
Start 1/2 Stop 1/2 Reset 1/2 Set 1/2	Two independent free running counters are available as additional time references. These counters can receive start values utilizing one of the configuration tools. These counters can be controlled by Start/Stop/Reset/Set signals.
Load Profile...	Load a previously saved configuration. Example: Assign the "*Load Profile 1*" function to F3 and the "*Load Profile 2*" function to F4. Now setup all other functions according to your first application. Store the whole configuration as "Profile **1**" utilizing the "*Store Profile*" function at the **Profile** tab. Now setup your second application but keep the F3 and F4 functions of the first application. Store the whole configuration as "Profile **2**". Now it is possible to switch between both configurations pressing the F3 and F4 keys.

The following functions for the **lamps** are provided for this module:

Function	**Descriptions**	**Recommended Lamp**
Reference	Lights up if LTC is present at input "IN".	F1: REF LTC
Date	Lights up if a valid date can be decoded.	F2: DATE
MTD	Lights up if LTC of LTC(MTD) format can be decoded.	F3: MTD
VTR	Lights up if LTC is present at input "VTR IN".	F4: VTR LTC

The following functions for the **LEDs** are provided for this module:

Function	**Descriptions**	**Recommended LED**
OPER	Lights up during normal operating mode.	OPER
Serial Out 1 Serial Out 2 Serial Out 3 Serial Out 4	Flashes once per second when a serial data string is being sent at the respective output.	SIGNAL
Pulse Out 1 Pulse Out 2 Pulse Out 3 Pulse Out 4	Flashes every time a pulse telegram is being sent at the respective output.	SIGNAL
Gen Sync Status	All LTC outputs are synchronized to the LTC at input "IN". With this function the LED shows the status of the frequency and the phase synchronization: LED lights up = Synchronized. LED flashes slowly = Fine tuning. LED flashes fast = Synchronization has failed.	SET
Error	Lights up shortly as soon as an error has been detected.	ERROR

The following functions for the **GPIs** are provided for this module:

GPI as input
All functions which are provided for **keys** are available for GPI as well – see description above. Assigning one of these functions switches the GPI to input mode.

GPI as output
All functions which are provided for **lamps** are available for GPI as well – see description above. Assigning one of these functions switches the GPI to output mode.

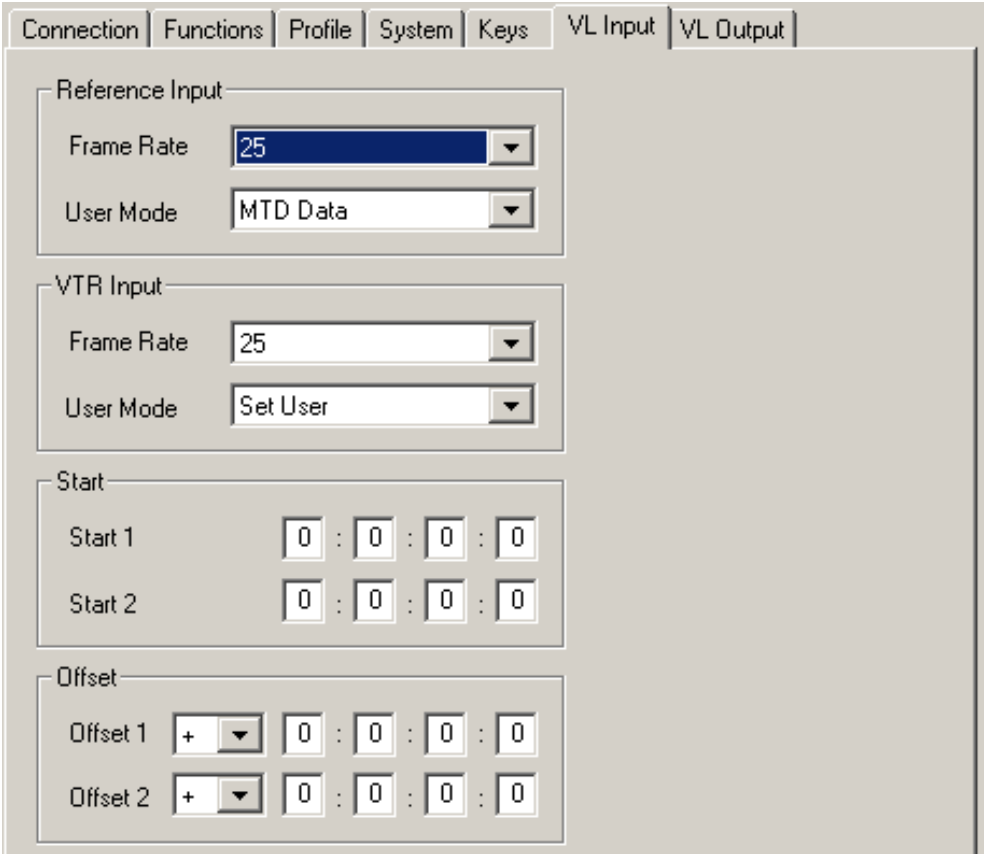
Additionally, the output characteristic is selectable:

Drop-down list at **Mode**	Description
Button/Lamp	Statically, active "Low" [recommended]
Inv. Button/Lamp	Statically, active "High"
Switch/On Pulse	Pulse, active "Low"; pulse width selectable from 100 ms to 2 s. Pulse will be generated at event entry.
Inv. Switch/Off Pulse	Pulse, active "High"; pulse width selectable from 100 ms to 2 s. Pulse will be generated at the end of the event.

Pulse Duration The pulse width is selectable as 100 ms, 200 ms, 500 ms, 1 s, 2 s. This selection refers to all GPI outputs set to a pulse mode.

3.5 “VL Input“: Configuration of the LTC Inputs

Configuration (example shows a screen shot of the PC program tab):



The settings at ‘Reference Input’ refer to the LTC input at connector IN (LTC_REF).
The settings at ‘VTR Input’ refer to the LTC input at connector VTR IN (LTC_VTR).

Frame Rate

The frame rate of the LTC must be selected correctly.

Because the LTC at connector IN (LTC_REF) synchronizes the LTC outputs, all LTC outputs automatically get the same frame rate as what is set at ‚Reference Input‘!

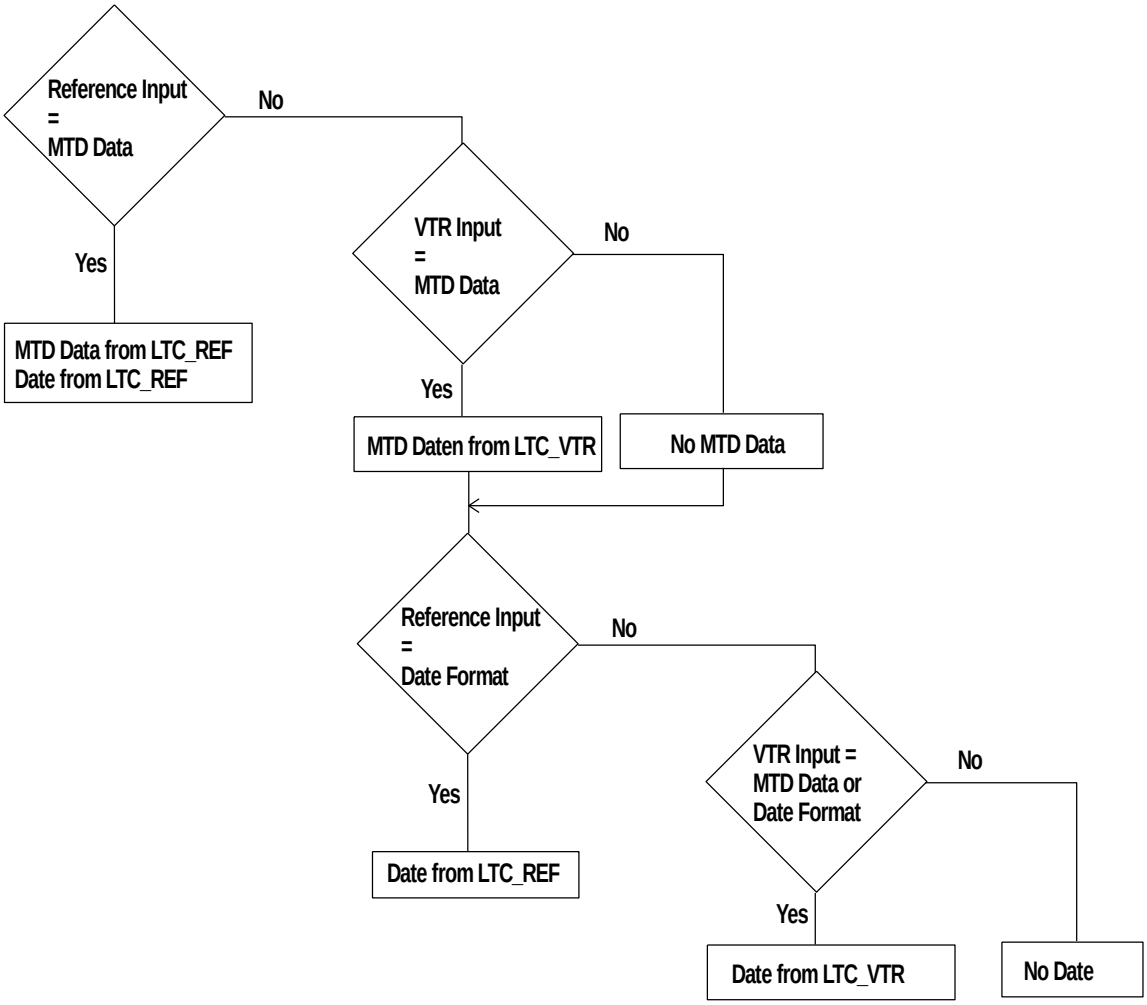
User Mode

The usage of the LTC’s user bits (Binary Groups) can be selected from the drop-down list:

User Mode	Description
Set User	No specified format. No date can be decoded.
MTD Data	There is LTC with an LTC(MTD) format connected. The timers A – F, the MTD real-time and the date can be decoded.
Date: UU.DD.MM.YY … SMPTE 309M: MJD	14 different formats are available to decode a date.
MTD Timer	Reserved. Neither MTD data nor a date can be decoded.

Decoding of a date and of LTC(MTD) data can only be done once in each case. The following priority rules are valid for both of the LTC inputs:

1. If 'Reference Input' has been set to "User Mode = MTD Data", all the MTD data and the date will be decoded from the LTC at input **IN**.
2. If 'VTR Input' has been set to "User Mode = MTD Data", all the MTD data will be decoded from the LTC at input **VTR IN**.
3. If 'Reference Input' has been set to "User Mode = ... (any date format)", the date will be decoded from the LTC at input **IN**.
4. If 'VTR Input' has been set to "User Mode = MTD data or ... (any date format)", the date will be decoded from the LTC at input **VTR IN**.



Start

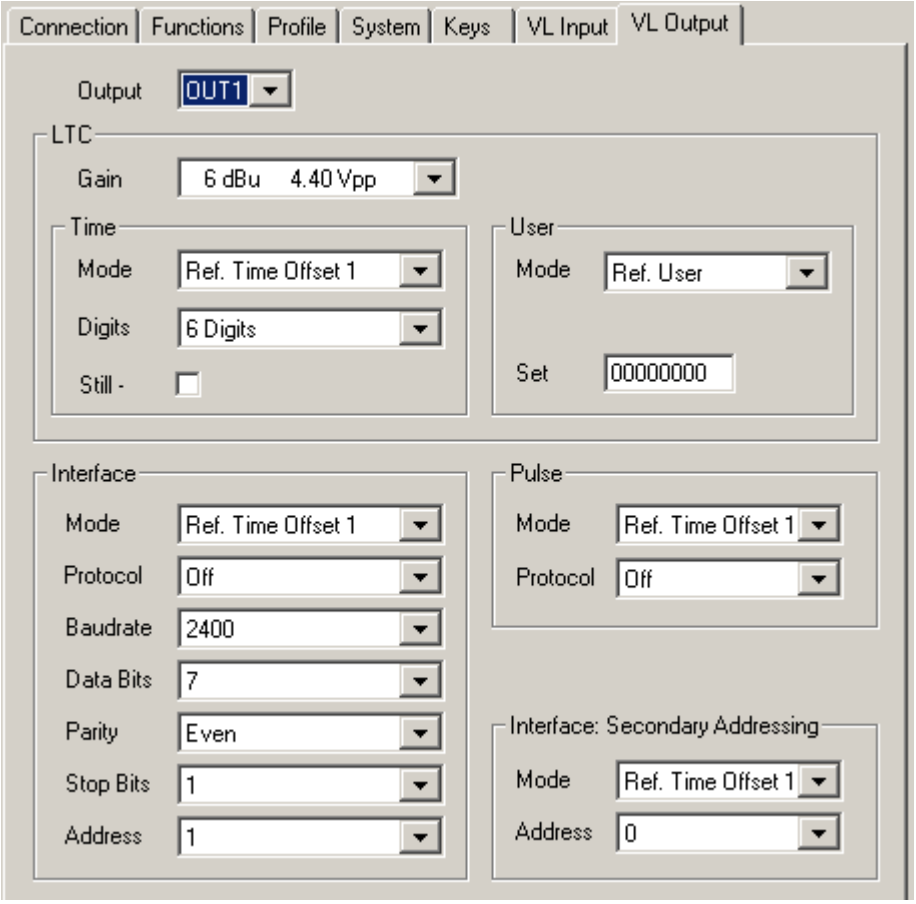
Input of a start value (HH:MM:SS:FF) for a free running counter.

Offset

Input of a time offset (± HH:MM:SS:FF).

3.6 “VL Output”: Configuration of the Outputs

Configuration (example shows a screen shot of the PC program tab):



Output

Four LTC outputs, four serial interfaces and four impulse outputs are available. Each output can individually be programmed. First step of the configuration will be to select the channel number (Output = OUT1 … OUT4). Now you can set-up the LTC, serial interface, and impulse telegram outputs.

LTC – Gain Select the output level from the drop-down list.

The values in this list refer to a use of balanced signals for output and input, i.e. V_{PP} (= peak-to-peak value) will be the difference between LTC_OUT_A and LTC_OUT_B. V_{PP} will be half of the indicated value if unbalanced signals are used, i.e. the peak-to-peak value of the single LTC_OUT_A or LTC_OUT_B signal.

Correspondence between balanced use and unbalanced use:

Use of balanced signals	Use of unbalanced signals
+12 dBu / 8.7 V_{PP}	+6 dBu / 4.4 V_{PP}
+6 dBu / 4.4 V_{PP}	0 dBu / 2.2 V_{PP}
0 dBu / 2.2 V_{PP}	–6 dBu / 1.1 V_{PP}
–6 dBu / 1.1 V_{PP}	–12 dBu / 0.55 V_{PP}

LTC - Time	Settings which affect the time addresses of the LTC.
Mode	Selection of a decoded time (see table at the end of this chapter).
Digits	Six or eight digits can be selected. This set-up is relevant only if at "mode" one of the MTD timers A - F or MTD Main 1 – 3 has been selected and this timer is counting down. If a display or a similar device reads this LTC and displays the time without frames (e.g. HH:MM:SS), the '6 digits' mode should be selected. If this device displays the time with frames, the '8 digits' mode should be selected. The correct choice ensures that the down-counting time at the display reaches 0 synchronous with the original MTD time. For example: MTD timer counting down from 1s to 0s: MTD Timer / VL LTC '6 Digits' / Display HH:MM:SS / Display MM:SS:FF 00:00:01 / 00:00:01:00 / 00:00:01 / 00:01:00 00:00:00 / 00:00:00:24 / 00:00:00 / 00:00:24 MTD Timer / VL LTC '8 Digits' / Display HH:MM:SS / Display MM:SS:FF 00:00:01 / 00:00:00:01 / 00:00:00 / 00:00:01 00:00:00 / 00:00:00:00 / 00:00:00 / 00:00:00
Still -	Usually an LTC reader compensates the decoding delay of one frame by adding one frame to the current value being indicated. Some readers can switch off this compensation automatically receiving a "still" LTC, this ensures a frame accurate value while the LTC time stands still. If the LTC is connected to a display or a similar device which utilizes this compensations mechanism, do not click "Still –", otherwise "Still –" should be clicked. Example: Standing LTC time = 01:02:03:04 VL LTC with "Still –" / Display with compensation / Display without compensation 01:02:03:03 / 01:02:03:03 / 01:02:03:04 VL LTC without "Still –" / Display with compensation / Display without compensation 01:02:03:04 / 01:02:03:04 / 01:02:03:05
LTC - User	Settings which affect the user bits (Binary Groups) of the LTC.
Mode	Selection of a decoded time or various date or user formats (see table at the end of this chapter).
Set	Set a fixed value for the user bits, for example an 8-digits number or a text with four characters. Allowed are numbers 0 – 9 and letters A – F. These user bits will be generated if "User Mode = Set" has been selected.

Interface **(RS232 and RS422 of the same channel transmit identical data)**

Mode	Selection of a decoded time (see table at the end of this chapter).
Protocol	Selection of a data string. Notes: h_{10},h_1,m_{10},m_1,s_{10},s_1,f_{10},f_1 = ASCII numbers of hours, minutes, seconds, and frames – tens und units. <ADDR> ASCII address (30h – 39h) – see below. **–** These protocols can transmit a minus sign. The minus sign replaces the tens of hours. **8** These protocols require 8 data bits. **S** or **F** Transmission every second (=**S**) or every frame (=**F**).
	Off — No data to transmit.
– S	ASCII Seconds — $h_{10}h_1$:$m_{10}m_1$:$s_{10}s_1$<CR>
– F	ASCII Frames — $h_{10}h_1$:$m_{10}m_1$:$s_{10}s_1$.$f_{10}f_1$<CR>
– S	BFE — <STX><ADDR>$h_{10}h_1$:$m_{10}m_1$:$s_{10}s_1$<ETX>
– S	LOUTH — <STX><ADDR><E>$h_{10}h_1m_{10}m_1s_{10}s_1$<ETX> <STX><ADDR><D><ETX>
8 – S	OMNIBUS/TSL — <HEADER><00h>$h_{10}h_1$:$m_{10}m_1$:s_{10}s [<HEADER> = 80h + address (00h – 09h) – see below]
– S	DIS-11 HH.MM.SS — <STX><ADDR><14h><20h><20h><20h><20h> $h_{10}h_1$.$m_{10}m_1$.$s_{10}s_1$<ETX>
– F	DIS-11 MM.SS.FF — <STX><ADDR><14h><20h><20h><20h><20h> $m_{10}m_1$.$s_{10}s_1$.$f_{10}f_1$<ETX>
– S	DIS-6 HH.MM.SS — <STX><ADDR><14h>$h_{10}h_1$.$m_{10}m_1$.$s_{10}s_1$<ETX>
– F	DIS-6 MM.SS.FF — <STX><ADDR><14h>$m_{10}m_1$.$s_{10}s_1$.$f_{10}f_1$<ETX>
– S	NEWP HH.MM.SS — <STX><ADDR><14h>$h_{10}h_1$.$m_{10}m_1$.$s_{10}s_1$<CR><ETX>
– F	NEWP MM.SS.FF — <STX><ADDR><14h> $m_{10}m_1$.$s_{10}s_1$.$f_{10}f_1$<CR><ETX>
S	Meinberg Std. — Time & date (mode = Ref. Time Offset1)
8 S	NMEA $GPRMC — Time & date (mode = Ref. Time Offset1)
8 S	NMEA $GPGGA — Time & date (mode = Ref. Time Offset1)
8 S	NMEA $GPZDA — Time & date (mode = Ref. Time Offset1)
– S	MaMu „T“ — <T>$h_{10}h_1$:$m_{10}m_1$:$s_{10}s_1$<CR>
– S	MaMu „t“ — <t>$h_{10}h_1$:$m_{10}m_1$:$s_{10}s_1$<CR>
S	Wharton F1 — Time & date (mode = Ref. Time Offset1)
S	Wharton F1+Status — Time & date (mode = Ref. Time Offset1)
S	Wharton F2 — Time & date (mode = Ref. Time Offset1)
Baud rate	Select: 2400/4800/9600/19200/38400/57600/115200. A baud rate ≥ 9600 should be selected if a data string is sent every frame!
Data Bits	Number of data bits: 7 or 8 (some protocols require 8, see above).
Parity	Parity bit: None/Even/Odd.
Stop Bits	Number of stop bits: 1 or 2.
Address	Enter an address (0 – 9) for protocols which include <ADDR> - see above.

Interface: Secondary Addressing

With protocols including an address it is possible to send a second data string on the same interface line with time information independent from the first data string. Select the "Mode" (the time information) and the "Address" different from the selection above. The receiving device decides upon the address which time has to be displayed.

Mode	Selection of a decoded time (see table at the end of this chapter).
Address	Select the secondary address out of 0 – 9. Selection = 0 switches off the second data string.

The secondary data string will be sent only if a baud rate of ≥ 9600 and a protocol with an address byte have been selected.

Pulse **(Output TELEGRAM)**

Mode	Selection of a decoded time (see table at the end of this chapter).	
Protocol	Selection of an impulse telegram:	
	Off	No pulses, output = "Low".
	DCF	DCF77 impulse telegram, output positive going impulses, e.g. suitable for Plura analogue clocks with 3-wire or 4-wire interface.
	DCF inverted	DCF77 impulse telegram, inverted, output negative going impulses, e.g. suitable for Plura analogue clocks with 2-wire interface.
	DC	No pulses, output = "High".
	PPS	200 ms positive going pulses every second, no DCF77 bit coding.
	PPS inverted	200 ms negative going pulses every second, no DCF77 bit coding.

Table of available output modes:

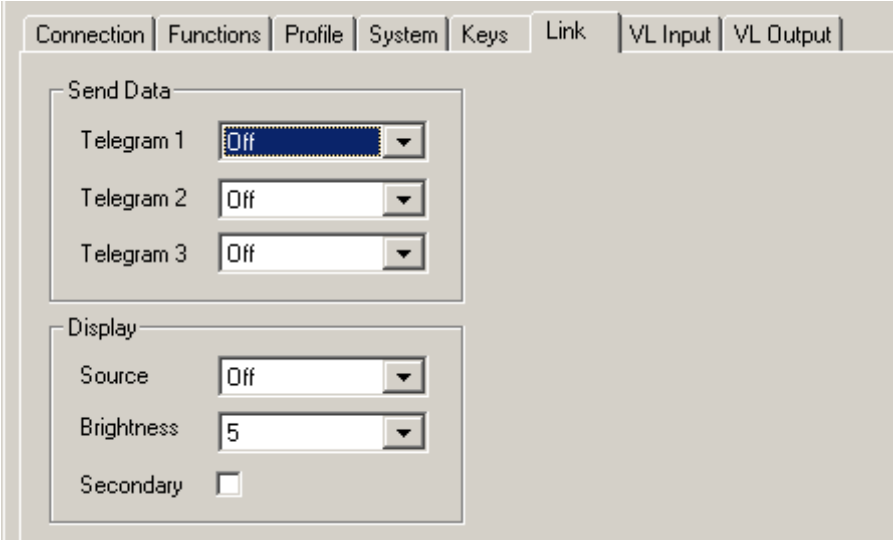
	Selection for LTC Time, LTC User, Interface, and Pulse
Ref. Time Offset 1 Ref. Time Offset 2 VTR Time Offset 1 VTR Time Offset 2	Time of the LTC at input IN (LTC_REF) and/or VTR IN (LTC_VTR) ± offset. Frame compensation method will be applied: If offset = 00:00:00:00, the read time will be regenerated frame accurate.
Start 1 Start 2	Time of the first/second free running counter. These counters can be controlled via an external Start/Stop/Reset/Set signal.
MTD Timer A MTD Timer B MTD Timer C MTD Timer D MTD Timer E MTD Timer F	Timer decoded out of an LTC(MTD), for e.g. a stopwatch or a specific time zone. The MTD lamp lights up to indicated that an LTC(MTD) has been detected. The "6 digits" or "8 digits" set-up has to be considered!
MTD Realtime	"Real-Time" decoded out of an LTC(MTD).
MTD Main 1 MTD Main 2 MTD Main 3	"Main 1" decoded out of an LTC(MTD). "Main 2" decoded out of an LTC(MTD). "Main 3" decoded out of an LTC(MTD).
	Other optional selections for the LTC User
Set	Fixed values, independent of the values of a read LTC.
Ref. User VTR User	The user bits of the read LTC (LTC_REF) and/or VTR IN (LTC_VTR) are regenerated 1:1. Frame compensation is not possible, i.e. a change of the user bits develops a delay of two frames.
UU DD MM YY BBC DD MM YY YY YY MM DD UU UU YY MM DD UY YM MD DU DD MM YY UU MM DD YY UU UU MM DD YY 309M: YYMMDD 309M: MJD	Various date formats are available. DD = Day, MM = Month, YY = Year. The UU described fields, that are not being used for the date, get the value as set up at the "Set" menu. Example: Date = 31.12.2006, Set User = AB1234CD, result to be generated: Format "UU DD MM YY": "AB 31 12 06". Format "YY MM DD UU": "06 12 31 CD". The lamp **DATE** lights up indicating that a valid date can be decoded.

3.7 “Link”: Communication between Modules

Link uses the Rubidium internal *TC_link* interface to transmit data. This interface is shared by all the modules in one frame, and via the **RLC** connector it is possible to link further modules at different frames.

In case that the module should transmit data, **Link** selects the channel and the kind of data.

Configuration (example shows a screen shot of the PC program tab):



Send Data

Three channels have been provided: **Telegram 1**, **Telegram 2**, **Telegram 3**.
For each channel select the kind of data which should be sent:

Off	This channel will not be used to transmit data, data can be received.
Reference	Time code of the LTC at input IN (LTC_REF).
VTR	Time code of the LTC at input VTR IN (LTC_VTR).

Display

Sending data to the RUBIDIUM **D1** display:

Source Select the kind of data:

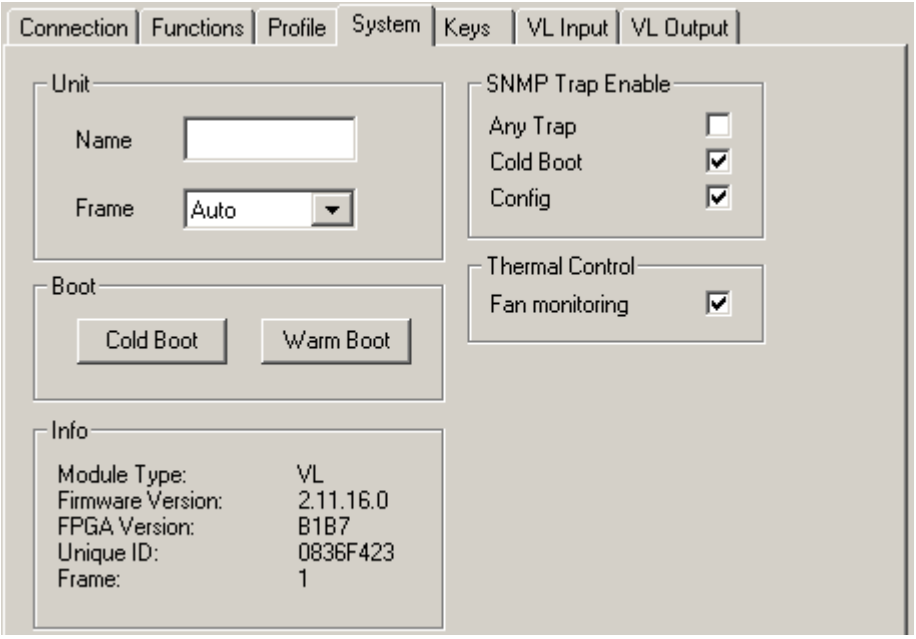
Off	No data will be sent from this module.
Reference Time	Time of the LTC at input IN (LTC_REF).
Reference User	Binary groups (user bits) of the LTC at input IN (LTC_REF).
VTR Time	Time of the LTC at input VTR IN (LTC_VTR).
VTR User	Binary groups (user bits) of the LTC at input VTR IN (LTC_VTR).

Brightness Adjust the brightness of the LEDs, steps 1 to 7.

Secondary Address the “secondary“ display instead of the “primary“ display.

3.8 “System“: Identification, Reset, SNMP, Fan Control

Configuration (example shows a screen shot of the PC program tab):



Unit

Name:	The connected module can get a name. You may enter, change, or verify this name at this window.
Frame:	Modules in a network can be uniquely identified by a frame number and the module’s position within the frame. In a single frame system, you may select “Single” or “Auto” at this set-up. If a system is built-up of more than one frame, each frame has to receive a unique address (adjusted at the fan module). If you select “Auto”, the module will request this frame number automatically and will show it on the info box. Likewise, it is possible to select a frame number manually.

Boot

Cold Boot:	Do a cold boot of the module.
Warm Boot:	Do a warm boot of the module.

Info

Displays module’s status information.

SNMP Trap Enable

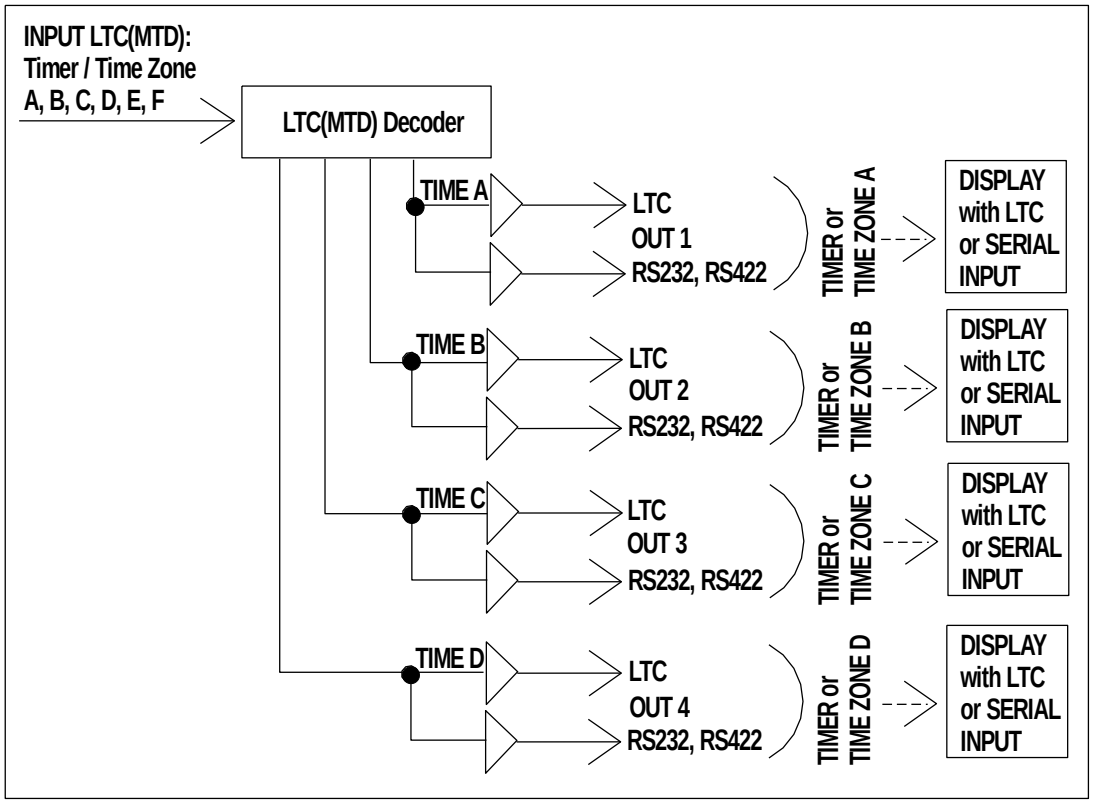
Activate the “Any Trap” check box to enable the SNMP functionality in general. If not checked, this module will not send any SNMP traps.
The individual traps can be enabled/disabled by a click on the corresponding check box.
Please notice the chapter “Alarms by SNMP Traps” as well.

Thermal Control

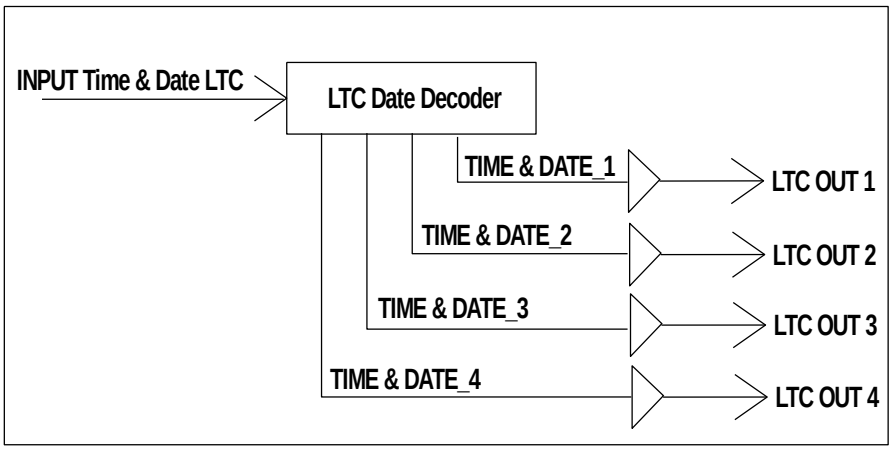
At least one module of each frame should have the fan monitoring activated. This enables the power supply monitoring – for power supplies within this frame - as well.

4 Typical Applications

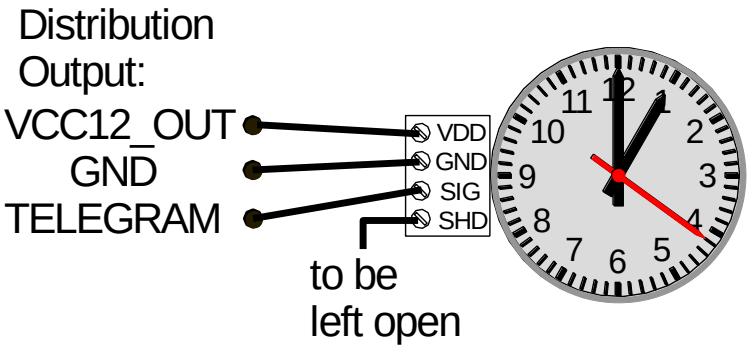
4.1 LTC(MTD): Timer or Time Zone Decoder



4.2 Real-Time LTC: Format Conversion of Date



4.3 Connecting 3-Wire or 4-Wire Interface Analogue Clocks



Every slave clock requires <=11 mA at >= 6 V. To calculate the maximum cable length the output voltage, cross section, specific resistance and number of clocks have to be involved. For radial arrangement of copper cables with a cross section of 0.22 mm² and an output voltage of 12 V, the following cable lengths are possible for each output stage:

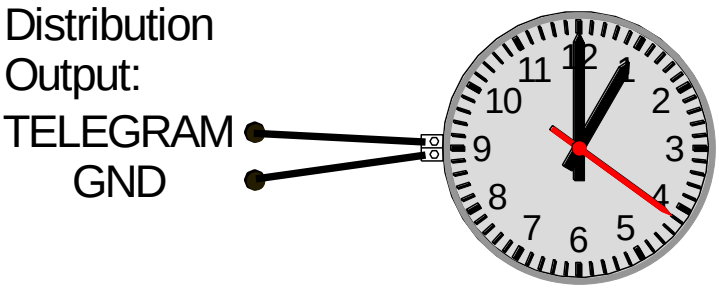
No. of clocks	**1**	**2**	**5**	**10**	**20**	**30**
Length (m)	3500	1750	700	350	175	117

The maximum count of clocks is limited by a 500 mA fuse to 45 clocks each output stage. A continuous current of up to 330 mA can be applied over the whole specified operating temperature range. At an ambient temperature of e.g. 22°C the output switches to a high-resistance state after a few seconds if a current of 1000 mA is applied.

The 3-wire or 4-wire interface requires TELEGRAM output with **positive-going** pulses.

Select **DCF** at "Pulse – Protocol".

4.4 Connecting 2-Wire Interface Analogue Clocks

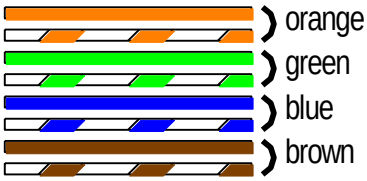


The following specifications are not applicable to SC Series clocks! Please read next chapter.

A maximum of 12 clocks can be connected to each output stage to guarantee a faultless operation over the whole specified temperature range. The following table shows standard values of maximum cable length calculated for a typical copper material:

Cross section [mm²]	0.141	0.205	0.324	0.519
	Example: AWG26-7/34	Example: AWG24 solid bar	Example: AWG22 solid bar	Example: AWG20 solid bar
Length [m] 12 clocks	275	400	630	830
Length [m] 10 clocks	350	510	800	1060
Length [m] 8 clocks	460	670	1070	1410
Length [m] 6 clocks	650	950	1500	1980

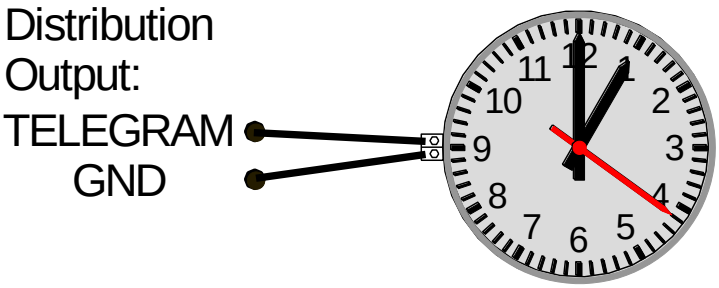
CAT (network) cables contain four pairs of wires. The wires of a pair are twisted together. The wires could conform to AWG24 or AWG26. It is possible to enlarge the cross section or to reduce the number of clocks per line by using several pairs of the cable. A pair can be identified by the colour: Solid colour wire + white and colour striped wire.



The 2-wire interface requires TELEGRAM output with **negative-going** pulses:

Select **DCF inverted** at “Pulse – Protocol”.

4.5 Connecting the 2-Wire Interface to SC306T

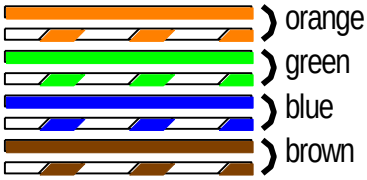


Each output stage of VL is capable of driving **two** studio clocks. The VL module must receive power from a **24 VDC** power supply.

It is recommended not to exceed the following cable lengths dependent on the number of studio clocks (1 or 2) connected:

Cross section [mm²]	type of wire	length [m]	
		1 Clock	2 Clocks
0.205	AWG24 solid bar	165	45
0.280	J-Y(ST)Y ..x2x0.6	225	60
0.324	AWG22 solid bar	260	70
0.500	J-Y(ST)Y ..x2x0.8	410	100
0.519	AWG20 solid bar	430	110

Note: Network CAT5 cables use AWG24 or AWG26 wires, please check. It is not recommended to use conductors with cross sections less than 0.2 mm² (AWG24/1). AWG26-7/34 wires have a cross section of 0.141 mm². CAT cables contain four pairs of wires. The wires of a pair are twisted together. It is possible to enlarge the cross section or to reduce the number of clocks per line by using several pairs of the cable. A pair can be identified by the colour: Solid colour wire + white and colour striped wire.



The 2-wire interface requires TELEGRAM output with **negative-going** pulses:

Select **DCF inverted** at "Pulse – Protocol".

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