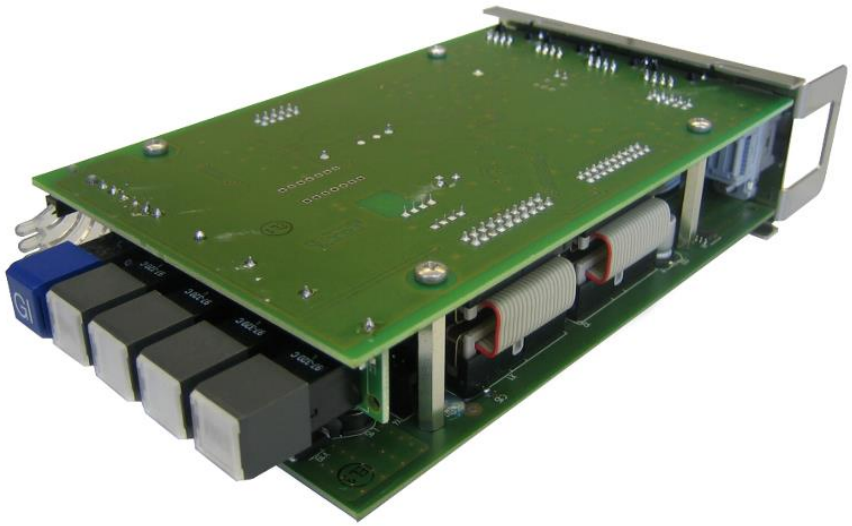
plura

TIMING SOLUTIONS

Rubidium Series

RUB GI

Master IRIG-B Generator
LTC to IRIG-B Converter



Functional Description and Specifications
Supplement to the “Installation & Systems Manual RUBIDIUM SERIES”
Version: 3.4
December 2, 2020

CONTENT

A1 Revision History

No.	Date	Subject
0.n		Preliminary documents, changes without notice.
1.0	November 11, 2005	First released document.
2.0	January 05, 2007	- GPI specifications changed. - Revised.
2.1	March 30, 2007	- Remark about a battery inside. - Introducing module's version 2.
3.0	August 11, 2011	Completely revised.
3.1	June 29, 2012	"Signal description" in chapter "Rear Panel and Connections" revised.
3.2	August 29, 2019	Changed address of Plura Europe GmbH.
3.3	November 4, 2019	Fixed NMEA baud rate to 4800.
3.4	November 30, 2020	Re-formatted in new design.

The latest document describes the functions of the latest module's software. You can download the latest software version from:

https://www.plurainc.com.

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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 “GI”.

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

A4 Remarks about a Battery inside

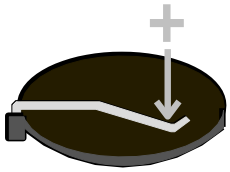
This module has a lithium primary battery (button cell) inside to supply power to a real-time chip even if the module has been switched off.

Battery Use Warnings

CAUTION: Danger of explosion if battery is incorrectly placed. Replace only with the same or equivalent type recommended by the manufacturer. Discard used batteries according to the manufacturer's instructions.

Battery Replacement Procedure

1. Remove the module from the frame as described in the related chapter of "Installation & Systems Manual RUBIDIUM SERIES".
2. You can easily locate the battery which is placed in a battery holder. Have a replacement of same or equivalent type ready.
3. The battery can easily pull out of the battery holder using a small screwdriver.
4. Insert the new battery. The '+' on the battery must be oriented in the holder matching the '+' on the holder ('+' = up):



5. Plug-in the module as described in the related chapter of "Installation & Systems Manual RUBIDIUM SERIES".

Information for end-users for a separate collection of waste batteries

1. In order to prevent waste batteries from being discarded in such a way as to pollute the environment, waste batteries should be collected and recycled. End-users shall make use of the local or national battery collection scheme. As an alternative your distributor takes back waste batteries originally delivered with this module.
2. Symbol for batteries:

= "separate collection" for all batteries.

Batteries containing mercury, cadmium, or lead, are marked with the chemical symbol for the metal concerned: Hg, Cd or Pb. This symbol will be printed beneath the symbol shown.

1 Module GI

1.1 Overview

The hardware consists of an IRIG-B generator, time & date reference in/outputs as well as some general-purpose interfaces (GPI) which may be used for various applications. The module outputs various real-time signals: IRIG-B, impulse time telegram, serial data strings with time & date information. All output signals are locked to the external real-time reference.

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

Configuration, status monitor etc. identify this module as **GI**. RUB1 version modules visibly show this id on a button at the front panel, RUB3 version modules at the rear panel. 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.
- IRIG-B output.
- 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:

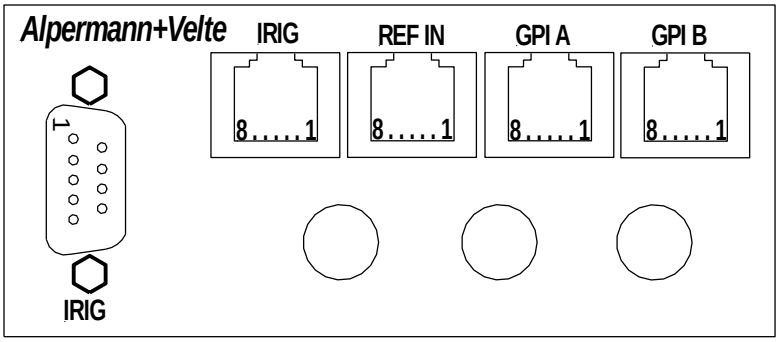
  http://www.plurainc.com.
- Real-time reference input signals (PPS, time and date data string), real-time output signals (time telegram, time and date data string).
- Two digital in- or outputs (GPI) may be used in special applications.

1.2 Remark to Different Versions of Modules

Starting in the second quarter of 2007 a new release of GI modules (version 2) will be shipped. Hardware and firmware are not full compatible to version 1 modules. The new version will deliver enhanced functionality. Version 2 will be down compatible to version 1.

The RUBIDIUM configuration tools indicate the version at the "System" tab.
Example: "Module Type = GI" or „Module Type = GI (v2)".

1.3 Rear Panel and Connections



Pin assignments

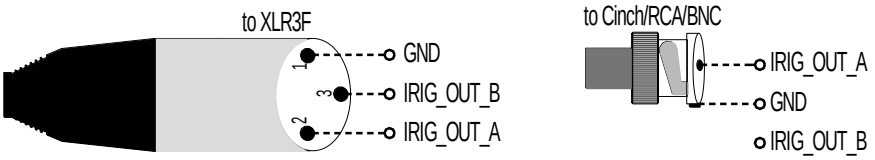
IRIG DSUB9F female	IRIG RJ45 jack
1: RS422 TA- 2: RS422 TB+ 3: IRIG_OUT_A 4: IRIG_OUT_B 5: GND 6: not connected 7: DRVSEL 8: SERIAL OUT 9: TELEGRAM OUT	1: RS422 TA- 2: RS422 TB+ 3: IRIG_OUT_A 6: IRIG_OUT_B 4: GND 5: DRVSEL 7: SERIAL OUT 8: TELEGRAM OUT

REF IN RJ45 jack	1: PPS IN 2: RXD IN 3: REF_IN_A 6: REF_IN_B 4: GND 5: VCC24G_OUT 7: GND 8: VCC5G_OUT

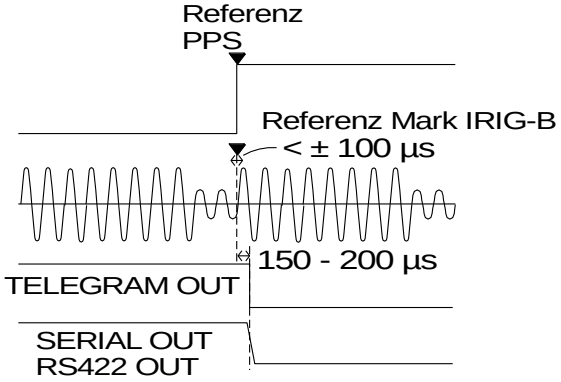
GPI A / GPI B RJ45 jack	1: GPI_1 2: GPI_2 3: REF_IN_A 6: REF_IN_B 4: GND 5: VCC24B_IN 7: LTC_IN_A 8: LTC_IN_B

Signal descriptions

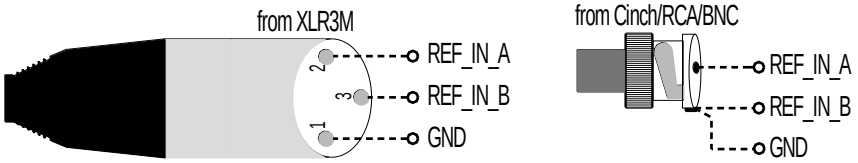
RS422 TA- RS422 TB+	Output of an RS422 serial interface. Transmits time & date of the internal clock once a second. Standard format: Meinberg Standard Time String 19200/7/E/2. Timing with respect to the IRIG-B output same as SERIAL OUT.

IRIG_OUT_A IRIG_OUT_B	Balanced IRIG-B output. Connections: balanced use unbalanced use 

DRVSEL	Input according to the GPI input specification. This pin should be left unconnected if this module is not used in a redundant system. In a redundant system, this pin is controlled by the analyser/switcher unit (RUB SI): DRVSEL unconnected or "High": This module operates in "Primary" mode with full functionality. DRVSEL "Low" or connected to GND: This module operates in "Back-Up" mode with restricted functionality. For example, no telegrams will be sent via internal TC_link interface. The current operating mode is indicated at the status monitor.

SERIAL OUT TELEGRAM OUT	Outputs according to the GPI output specification – but without a pull-up resistor. Outputs are intended to be connected to the RUB VD input – in case of a redundant system looped through the RUB SI module. These outputs are not able to drive signal inputs of other devices. SERIAL OUT transmits time & date of the internal clock once a second. Standard format: Meinberg Standard Time String 2400/7/E/2. TELEGRAM OUT transmits a second pulse telegram. Timing: 

	Inputs according to the GPI input specification.
PPS IN	PPS IN accepts a second pulse.
RXD IN	RXD IN accepts a serial data string with time & date information.

REF_IN_A REF_IN_B	Balanced inputs for an optional LTC or IRIG_B time & date reference: Option **L**: LTC input. Option **I**: IRIG-B input. Connections: balanced signal unbalanced signal 

LTC_IN_A LTC_IN_B	Optional balanced LTC (Linear Time Code) input (not used).

GPI_1 GPI_2	Two GPI (General Purpose Interface) contacts may be used as input or output for digital signals according to application. Programmable function.

VCC24G_OUT	24 VDC voltage output, 200 mA reversible fused. The output voltage will be delivered from the inserted “Power Supply“ module (please notice the power supply specifications) or from the VCC24B_IN pin.
VCC5G_OUT	5 VDC voltage output, 300 mA reversible fused.
⚠	Using VCC24G_OUT and/or VCC5G_OUT output please make sure not to exceed the total power rating of the “Power Supply“ module.
VCC24B_IN	Back-up voltage input, which supplies voltage to this module and to the VCC24G_OUT pin. This input is reverse voltage protected by a diode.

GND	Signal ground.

1.4 Specifications

IRIG-B Output

Format	IRIG-B: Amplitude modulated 1 kHz carrier signal, balanced. IRIG-B 123 or IRIG-B 127 according to IRIG STANDARD 200-04; AFNOR time code according to AFNOR NF S 87-500.
Connector	Balanced signals IRIG_OUT_A and IRIG_OUT_B, via 2 pins of the IRIG connectors (DSUB9 female and RJ45 jack)
Output impedance	< 50 Ω
Signal level	Adjustable 1.5 V_{p-p} to 4.8 V_{p-p} (“mark” amplitude)

REF_IN_A / REF_IN_B for IRIG-B real-time reference input (option **I**)

Accepted formats	Amplitude modulated carrier signal with 1 kHz carrier frequency. IRIG-B123 or IRIG-B 127 according to IRIG STANDARD 200-98; AFNOR time code according to NF S 87-500.
Connector	Balanced signals REF_IN_A and REF_IN_B, via 2 pins of connector REF IN or GPI A or GPI B (RJ45 jack)
Input	Balanced or unbalanced signal. Input impedance: 680 Ω “Mark“ amplitude: 1 Vpp to 8 Vpp “Space“ amplitude: 0.5 Vpp to 4 Vpp Mark-to-Space ratio: 2:1 to 6:1

REF_IN_A / REF_IN_B for LTC real-time reference input (option **L**)

Format	According to SMPTE 12M-1-2008
Connector	Balanced signals REF_IN_A and REF_IN_B, via 2 pins of connector REF IN or GPI A or GPI B (RJ45 jack)
Input impedance	18 kΩ
Signal level	100 mV_{p-p} to 5 V_{p-p}, auto-ranging
Frequency	25 frames/s

Free run accuracy (concerning IRIG output, internal clock, and all signals dependent on this)

TCXO	Tracking accuracy – after loss of sync signal: Sync = PPS: ± 5.0 ppm (0.4 s/day) Sync = IRIG-B: ± 5.0 ppm (0.4 s/day) [option **I**] Sync = LTC: ± 25 ppm (2 s/day) [option **L**] Temperature stability: ± 1 ppm (2.6 seconds in 30 days) Aging: typical ± 1 ppm each year. Adjustable for service

Battery:

Type	3.00 V Lithium, 135 - 230 mAh, Ø 20 mm, H 2.0 - 3.5 mm
Lifetime	≥ 6 years (135 mAh), ≥ 10 years (230 mAh)
Storage	Preferable storage temperature 15 °C to 20 °C. Avoid large temperature changes and direct sunlight. At higher temperature the electrical performance may be reduced. Temperatures below -10 °C could result in damage to the battery.

GPI

Input specification for signals GPI_1, GPI_2, DRVSEL, PPS IN, RXD IN	Input "Low": -2.0 to +0.7 V [GPI_1, GPI_2] -12.0 to +0.7 V [DRVSEL] -24.0 to +0.7 V [PPS IN, RXD IN] Input "High": +2.0 to +24.0 V Impedance: 4.7 kΩ [GPI_1, GPI_2, DRVSEL] ≈24 kΩ [PPS IN, RXD IN] Frequency: 0 - 1 MHz
Output specification for signals GPI_1, GPI_2, SERIAL OUT (no Pull-Up), TELEGRAM OUT (no Pull-Up)	Open Collector output of an NPN transistor at 4k7 pull-up resistor (3.3 VDC). Max. power dissipation: 200 mW. "High" state: 2.7 V (no load). "Low" state: Output switched to GND. Max. collector current: 100 mA DC, fused by a 100 mA auto-recovery fuse. Collector-emitter saturation voltage: @100 mA: typ. 200 mV (≤ 600 mV), @10mA: typ. 90 mV (≤ 250 mV). Frequency: 0 - 150 kHz.

VCC24G_OUT

Output of the DC power supply of this module, normally = 24 VDC	Reversible fused. A continuous current of up to 120 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 400 mA is applied.

VCC5G_OUT

Output of the internal 5 VDC	Reversible fused. A continuous current of up to 200 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 600 mA is applied.

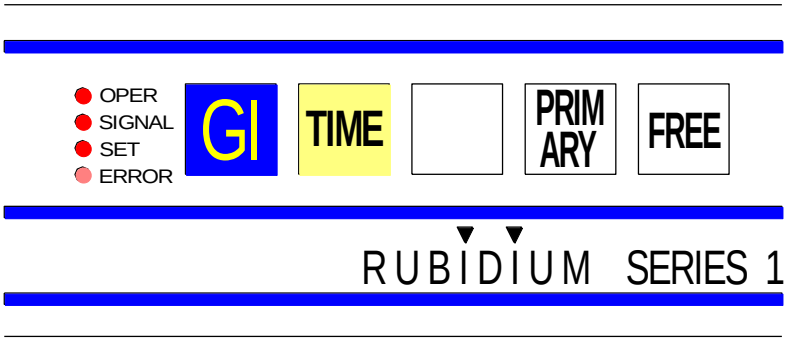
Others

Operating voltage	12 - 30 VDC
Power consumption	5.0 W maximum (without any load at VCC24G_OUT and VCC5G_OUT)
Weight	≈ 0.4 kg
Mechanical	2 circuit boards (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 *These conditions do not apply to the battery – please refer to the specifications of the battery!*

1.5 Features

1.5.1 Basic Set-Ups

There are two main operating modes: TIME and FREE (see next chapters). You can switch between these modes utilizing function keys (RUB1 version only), programmable GPI inputs, or one of the configuration tools.



Independent from the main operating mode, the IRIG format and level can be adjusted utilising the "Generate" tab of one of the configuration tools (see "Software Tools"):

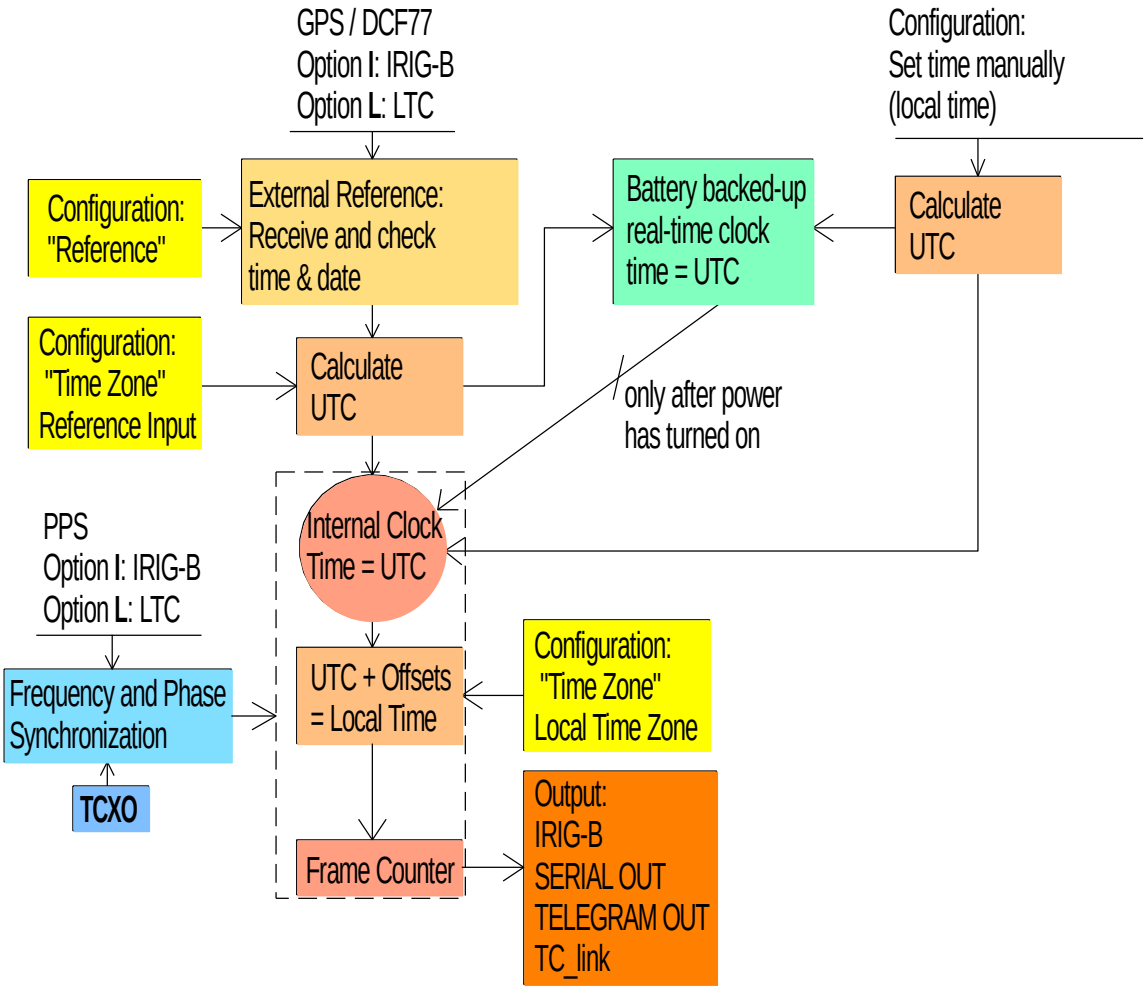
IRIG: Format	Select the format of the IRIG-B output: **IRIG-B 123** The time code word consists of BCD hours, minutes, seconds and day-of-year, plus seconds-of-day weighted in straight binary seconds (SBS) notation. The control function bits are all set to zero. There is no information about the current year. **IRIG-B 127** The time code word consists of BCD hours, minutes, seconds and day-of-year, plus seconds-of-day weighted in straight binary seconds (SBS) notation. The control function bits contain units and tens of the current year; all further control bits are set to zero. **AFNOR NF S 87-500** The time code word consists of BCD hours, minutes, seconds and day-of-year, plus seconds-of-day weighted in straight binary seconds (SBS) notation. BCD date is inserted according to specification: Day, month, year and day-of-week.
IRIG: Level	The output level can be adjusted.

Without option **I** or option **L**, the IRIG output will be phase locked to the PPS input signal. If no PPS is available, the output is free-running based on the internal temperature compensated oscillator.

With option **I**, the IRIG output will be phase locked to the IRIG input signal.

With option **L** the IRIG output will be phase locked to the LTC input signal.

1.5.2 Main Operating Mode TIME



After the power has turned on, the module always starts with this operating mode.

Manually switching to this mode – if main operating mode FREE has been selected before – can be done utilizing a function key (RUB1 version only) or GPI input assigned with the "Operating Mode Time" function or utilizing one of the configuration tools.

The **UTC** (Universal Time Coordinated) forms the internal time base. The UTC is calculated from the real-time reference input ± offsets selected by configuration.

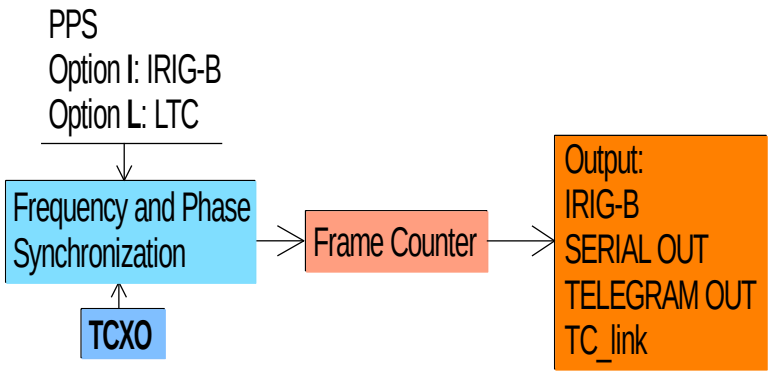
The time of the output signals corresponds to the **Local Time Zone**. The local time is calculated from UTC ± offsets selected by configuration.

This set-up is done utilizing the "Reference" and "Time Zone" tabs of the Rubidium configuration tools.

Time & date of the internal clock will be set by:

- the built-in battery backed-up real-time clock, if there is no external reference available after power has turned on;
- the external reference at period intervals as programmed by configuration;
- the "Set Real-Time" function utilising the "Generate" tab of one of the configuration tools.

1.5.3 Main Operating Mode FREE



Manually switching to this mode can be done utilizing a function key (RUB1 version only) or GPI input assigned with the "Operating Mode Free" function or utilizing one of the configuration tools.

The time is continued by a free-running frame counter. If you switch from TIME to FREE mode, no time discontinuity will occur, the free-running counter just continues to count the current time addresses. The FREE operating mode offers no way to interrupt or change the counting. The frequency and phase synchronization work same way as in TIME operating mode.

This mode can be used if a legal time discontinuity – caused be a leap second or a DST switching – should be shifted to a moment defined by the operator.

Example: Press the FREE button before a DST switching of the local time zone will occur. Now the time code output will just count the time continuously, whereas the internal clock will execute a DST switching. At a suitable moment, the TIME button should be pressed to synchronize again to the local time zone.

1.5.4 Time Leaps

1.5.4.1 Leap Second

UTC is the worldwide real-time reference. Occasionally, UTC will be corrected introducing a leap second. It is not possible to predict a leap second; the leap second is determined by the IERS (International Earth Rotation and Reference Systems Service) and will be announced at the Bulletin C (services.iers@obspm.fr). Basically, it could be a positive or negative adjustment of the UTC time scale, but - up to now – one second has been added always. UTC forms the time base of all local time zones. If UTC time jumps, the time of a local time zone will jump same way.

How does a leap second affect the time of the output signals?

1. If the time of the external real-time reference jumps, the time of the output signals will jump at the very moment when this module updates its internal clock with time & date of external reference. This update occurs periodically according to configuration, normally once a day at a user selectable hour (please refer to "Mode of Local Time Zone Synchronisation" at chapter "Reference: Synchronization to a Time & Date Reference").
2. If the data of the connected real-time reference announces a leap second, this module will be able to execute the time jump simultaneously with the external reference if one of the following conditions applies:

   A: Checkbox "After Leap Second of Reference Input" is checked.

   B: The periodic update has been set to "Every second".

   Please refer to chapter "Reference: Synchronization to a Time & Date Reference".

   In these cases, this module is able to calculate the leap second in advance. The minute will then receive an additional 60th second.

   The sequence of the generated real-time signals (time, date [day/month/year]) then will be for example:

Local time zone = UTC	Local time zone = UTC + one hour	Local time zone = UTC – 01:30
23:59:58, 31/12/05 23:59:59, 31/12/05 23:59:60, 31/12/05 00:00:00, 01/01/06 …	00:59:58, 01/01/06 00:59:59, 01/01/06 00:59:60, 01/01/06 01:00:00, 01/01/06 …	22:29:58, 31/12/05 22:29:59, 31/12/05 22:29:60, 31/12/05 22:30:00, 31/12/05 …

1.5.4.2 DST Switching

A Daylight-Saving Time (DST) switching of the output signals occurs automatically under the following conditions:

1. The automatic mode has been selected:
   "Local Time Zone = Auto + Reference Check" at "Time Zone and DST-Mode", please refer to chapter "Reference: Synchronization to a Time & Date Reference".
   Likewise, start and end of DST must have been adjusted correctly, please refer to chapter "Time Zone: Time Zone Adjustment".

   This DST switching only occurs at a full hour of local time. An announcement is set one hour prior to switching; this status is contained in signals RS422, SERIAL OUT, and TELEGRAM OUT.

   This DST switching affects signal outputs according to the example below.

2. The local time zone follows the time zone of the real-time reference. Adjustment:
   "Local Time Zone = Same as Reference Input" at "Time Zone and DST-Mode", please refer to chapter "Reference: Synchronization to a Time & Date Reference".
   The real-time reference must transmit a time zone with DST switching.

   If the time of the external real-time reference jumps, the time of the output signals will jump at the very moment when this module updates its internal clock with time & date of external reference. This update occurs periodically according to configuration, normally once a day at a user selectable hour (please refer to "Mode of Local Time Zone Synchronisation" at chapter "Reference: Synchronization to a Time & Date Reference")

   If the data of the connected real-time reference announces a DST switching, this module will be able to execute the time jump simultaneously with the external reference if one of the following conditions applies:

   A: Checkbox "After DST Switching of Reference Input" is checked.

   B: The periodic update has been set to "Every second".

   Please refer to chapter "Reference: Synchronization to a Time & Date Reference".

   This DST switching affects signal outputs according to the example below.

If this module does the DST switching of the local time zone automatically, the sequence of the generated real-time signals (time, date [day/month/year]) then will be for example:

Start of DST	End of DST
01:59:58, 28/03/04 01:59:59, 28/03/04 03:00:00, 28/03/04 03:00:01, 28/03/04 …	02:59:58, 31/10/04 02:59:59, 31/10/04 02:00:00, 31/10/04 02:00:01, 31/10/04 …

1.6 Software Update

Software updates require a (windows operating system) computer and the "RUBIDIUM CONFIGURATION" program. You can download the latest version of the program from:

https://www.plurainc.com.

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:

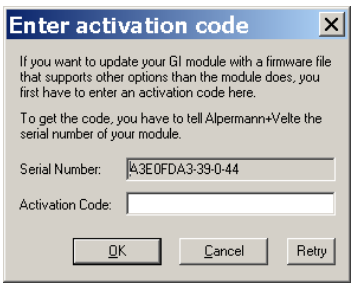
1. Connect your computer to the **PC** connector of that RUBIDIUM frame where the module has been plugged.

   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. If you are sure about the hardware version of the module, you can omit this step. Otherwise click button *Configure* and verify the version at the "System" tab in the info box. Example: "Module Type = GI" or "Module Type = GI (v2)". Click button *Disconnect*.
5. Select "Flash Update" in the *File* menu.
6. Open the **.tcf**-file. Standard names:
   "Rubidium GI version.tcf" or "Rubidium GI (v2) version.tcf".
   "version " stands for a revision no., e.g. "2.11.16".



In case of changing the options of the module the flash update stops and a request appears. Update can be done only after entering an activation code.

Please write down the serial number shown at your screen and request an activation code from Plura company. Now start the update process again.

   Press OK to start the update. At the end press OK again.

7. Update is finished now. We recommend checking configuration of the module utilizing the "RUBIDIUM CONFIGURATION" program.

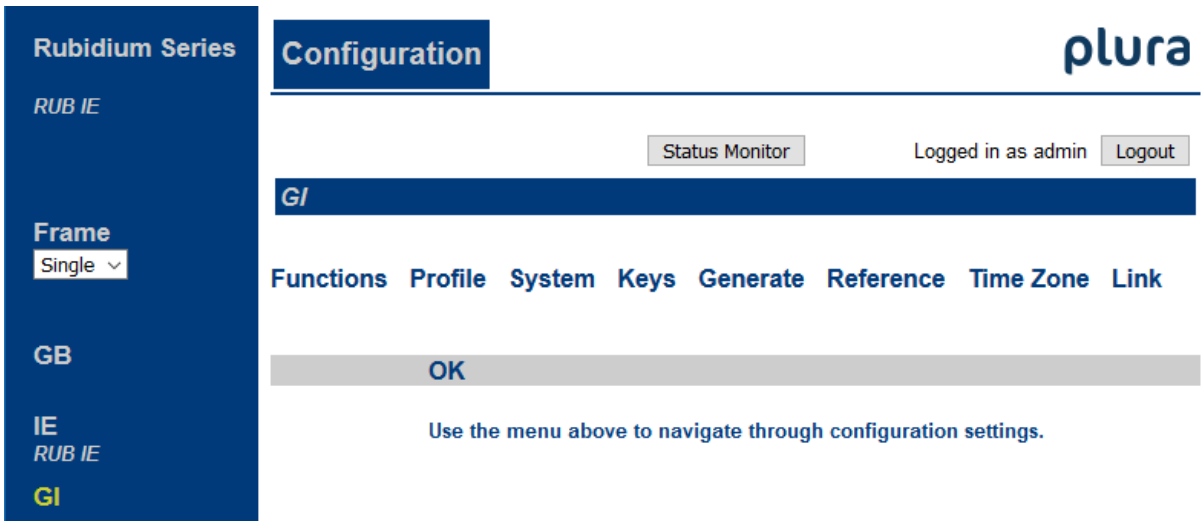
During flash update the operation of the module stops!

2 Status Monitor

2.1 Status Monitor by 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.

- At the RUBIDIUM homepage click on "Configuration" to open the **Configuration** page.



- Click on the blue button of type **GI**.
- Click on the button **Monitoring** to open the status monitor.

Requirements:

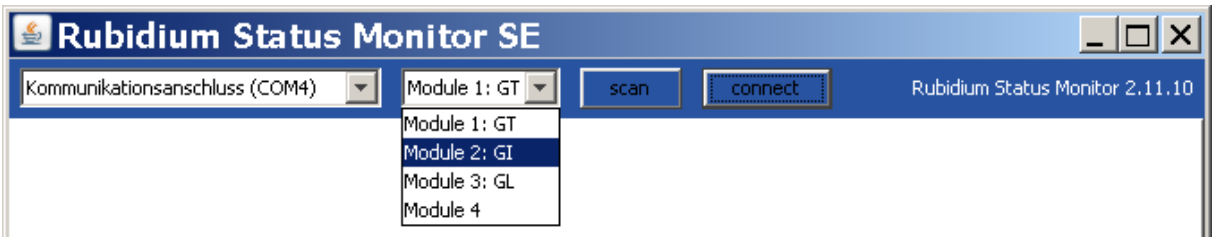
- Please have Java Runtime Environment 1.6.0 or higher installed (for example download at www.java.com).
- Java should be installed as a browser plug-in (a Windows installation will do this automatically if you download Java from the source mentioned above).
- The Status Monitor works with all operating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

2.2 Status Monitor by 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://www.plurainc.com.

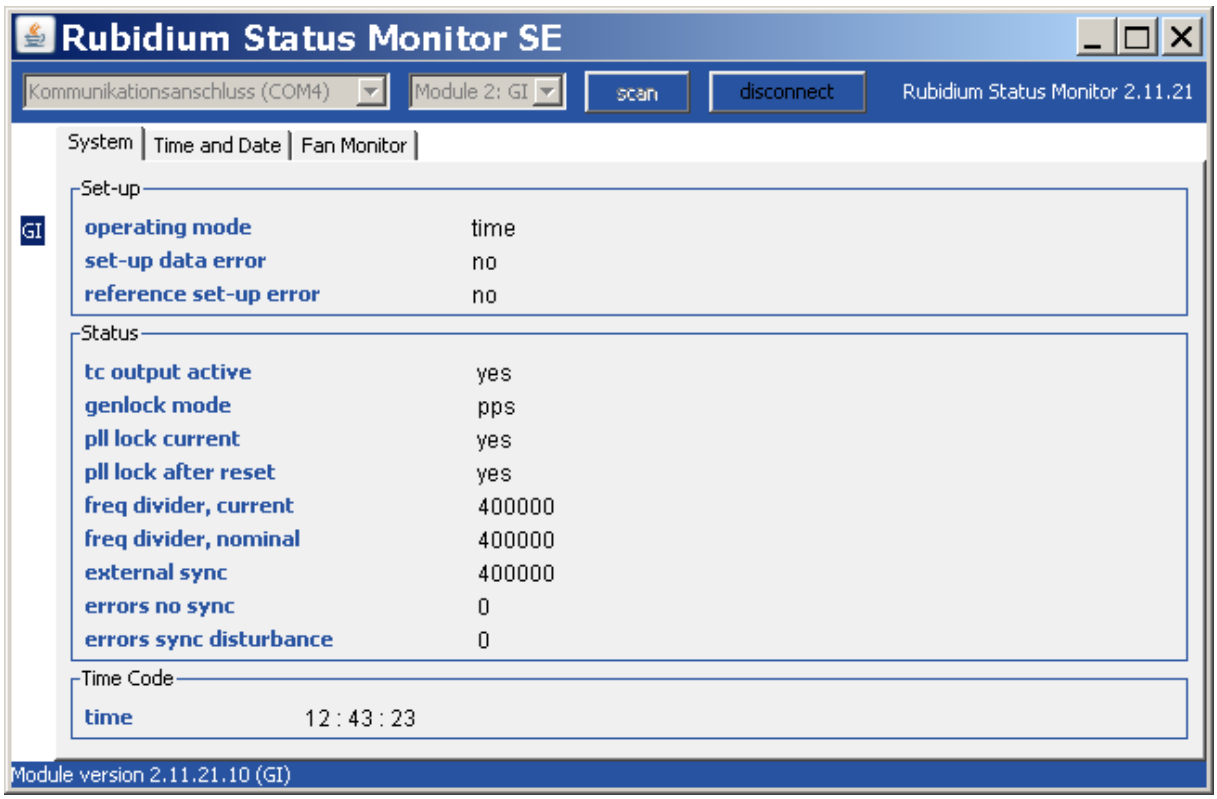
Execute this program, select the COM port or USB connection and press the **scan** button to get a list of the modules plugged to this housing. Select the module and press the **connect** button.



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 Status “System“



Set-up

operating mode	Indicates the current main operating mode.
set-up data error	Indicates any error produced by an incorrect general set-up.
reference set-up error	Indicates any error produced by an incorrect set-up at “Reference“ or “Time Zone“ function.

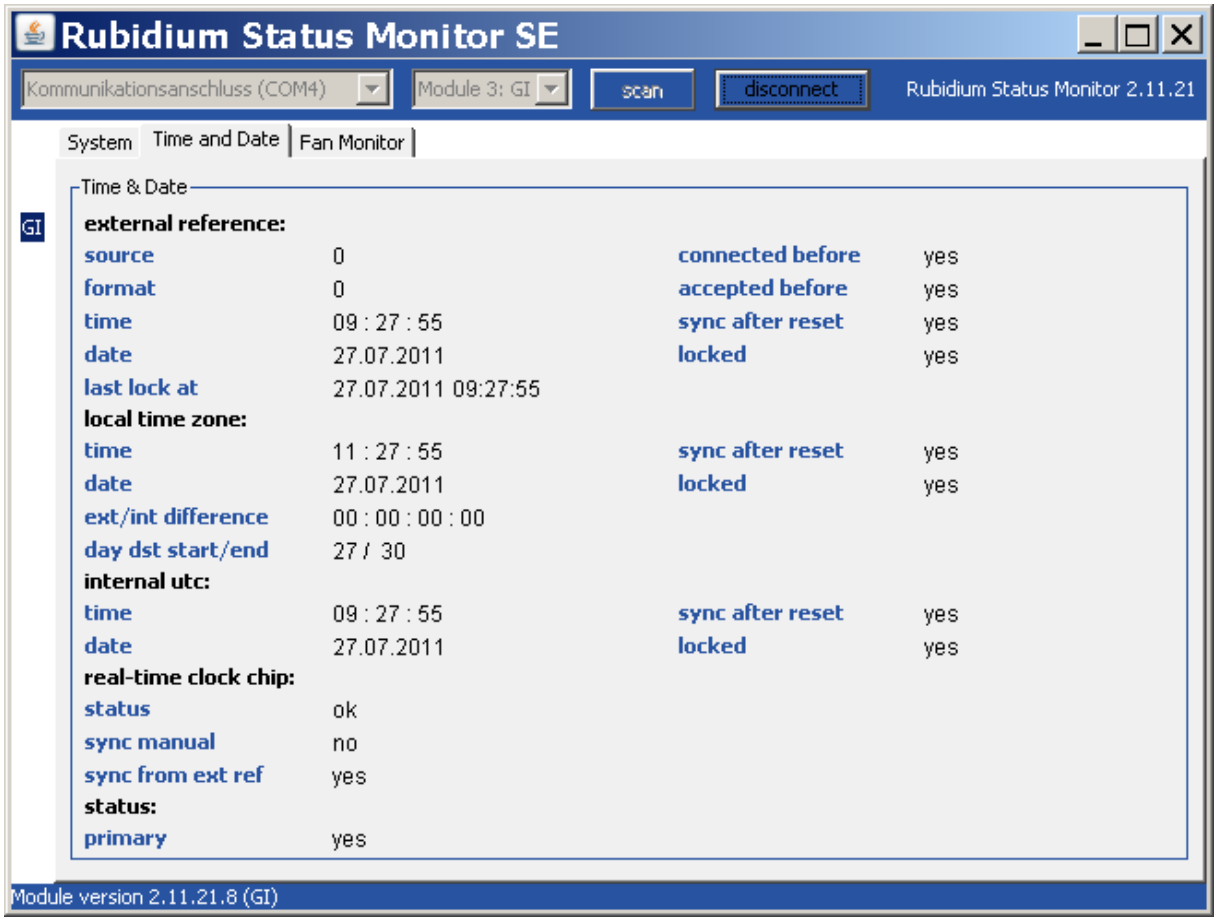
Status

tc output active	= "yes", if outputs are in the active state. After power has turned on, the outputs became active as soon as the internal clock is set manually or by external real-time reference and the phase and frequency synchronisation has been established, but not later than 100 seconds for a standard module or 20 seconds for GI with option **I** or option **L**.
genlock mode	"pps" for a standard module and GI with option **I**, "external ltc" for GI with option **L**.
pll lock current	= "yes", if the phase and frequency synchronisation is currently in a "lock" state; = "no" otherwise.
pll lock after reset	= "yes", if the phase and frequency synchronisation has reached the "lock" state once before; = "no" otherwise.
freq devider, current	Indicates the current tuning of the internal oscillator.
freq devider, nominal	Indicates the nominal tuning value of the internal oscillator.
external sync	Indicates the reference tuning value of the internal oscillator. This value has been gained from the external real-time reference.
errors no sync	Counter of failures of the external sync source, 0 - 9999.
errors sync disturbance	Counter of disturbances of the external sync source, 0 - 9999.

Time Code

time	The currently generated time, HH:M:SS. This time display should not be used for a precise comparison of time, because this display may be delayed up to one second due to internal data transfer.

2.4 Status “Time and Date“



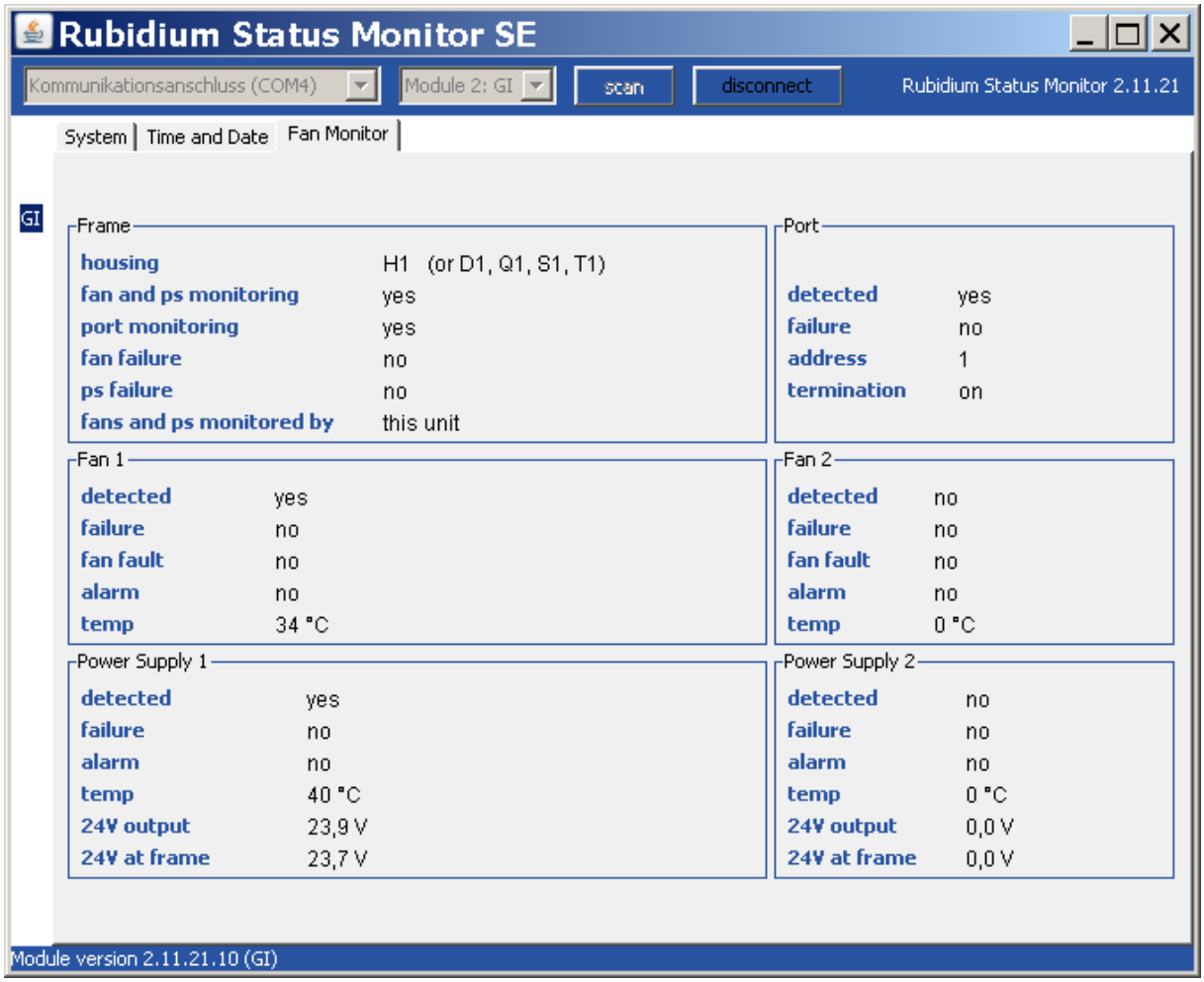
Time & Date

external reference:	Status information about the connected external real-time reference.
source	Identifies the type of real-time reference: 0 = Signals “PPS IN“ + “RXD IN“ (serial data string). 1 = Signals REF_INA/REF_IN_B = LTC; GI with option **L**. 2 = Signals REF_INA/REF_IN_B = IRIG-B; GI with option **I**.
format	Identifies the selected real-time reference format. This digit corresponds to the index of the selected item of the drop-down list at “Reference“ – “Format“.
time	Time of the connected real-time reference.
date	Date of the connected real-time reference.
Note:	Time and date shown at this place are converted to UTC in case of: GI with option **L**: If “Format = 15“. GI with option **I**: If “Reference Input = AUTO“.
last lock at	Time and date of the moment when at last the “locked” status has been received.
connected before	= “yes“, as soon as data of an external reference has been received – without a check of plausibility. This status returns to “no“ every time the main operating mode TIME is switched on.
accepted before	= “yes“, as soon as valid time & date data of an external real-time

	reference has been received once. This status returns to "no" every time the main operating mode TIME is switched on.
sync after reset	This status is part of the data of the external real-time reference: "yes", as soon as the reference source (GPS or DCF77 receiver) could have been synchronised to the antenna signal at least once after power-on.
locked	This status is part of the data of the external real-time reference: "yes", if the external reference currently is synchronised.
local time zone:	Status information about time & date of the output signals.
time	Generated time of the local time zone.
date	Generated date of the local time zone.
ext/int difference	Time difference between the generated time and time of the external real-time reference which has been converted to local time.
day dst start/end	DST switching is based on a fixed algorithm (please refer to chapter "Time Zone: Time Zone Adjustment"). The month of a switching is set by configuration; the day has to be calculated with respect to the current year. The result is displayed for control purposes. Example for year 2011: Start of DST at last Sunday of March = 27th; end of DST at last Sunday of October = 30th.
sync after reset	Status of internal clock: "yes", as soon as the internal clock has been set by external reference or manually after power has turned on.
locked	Status of internal clock: "yes", if internal clock has high precision. This requires an update within the last 24 hours with time & date of external reference which is in "lock" state at that moment.
internal utc:	Status of internal time base (calculated time zone = UTC).
time	Current time of the calculated UTC.
date	Current date of the calculated UTC.
sync after reset	Same as status "sync after reset" at "local time zone".
locked	Same as status "locked" at "local time zone".
real-time clock chip:	Status of built-in battery backed-up real-time clock.
status	The module checks the data content of the real-time clock after the power has turned on. "ok" will be displayed if the test passes.
sync manual	= "yes", if the real-time clock has been set manually.
sync from ext. ref	= „yes", if the real-time clock has been set by external reference.
status:	Other status information.
primary	Feedback about a "primary" mode (unit operates with full functionality) or "back-up" mode (unit operates with restricted functionality). This status is set by the DRVSEL input normally connected to the analyser/switcher unit (RUB SI) in a redundant system.

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 "GI".



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 access to 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**:

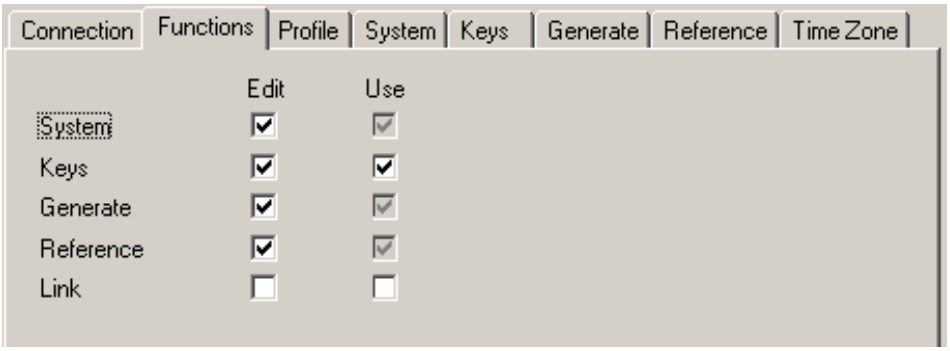
- Click on this button to load the current configuration of the module.

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

List of functions:

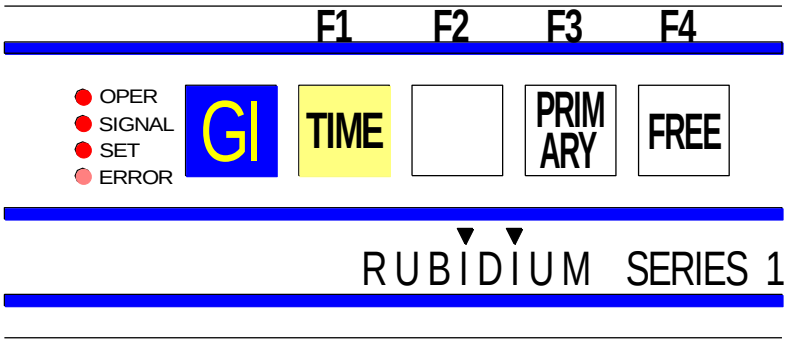
Profile	Store and Load Configurations on the Module (*)
System	Module Identification, Reset, SNMP, Fan Control
Keys	Keys and Lamps, LEDs and GPIs
Generate	Basic Set-Up of the Time Code Generator
Reference	Synchronization to a Time and Date Reference
Time Zone	Time Zone Adjustment - opens together with “Reference”
Link	Communication between Modules

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

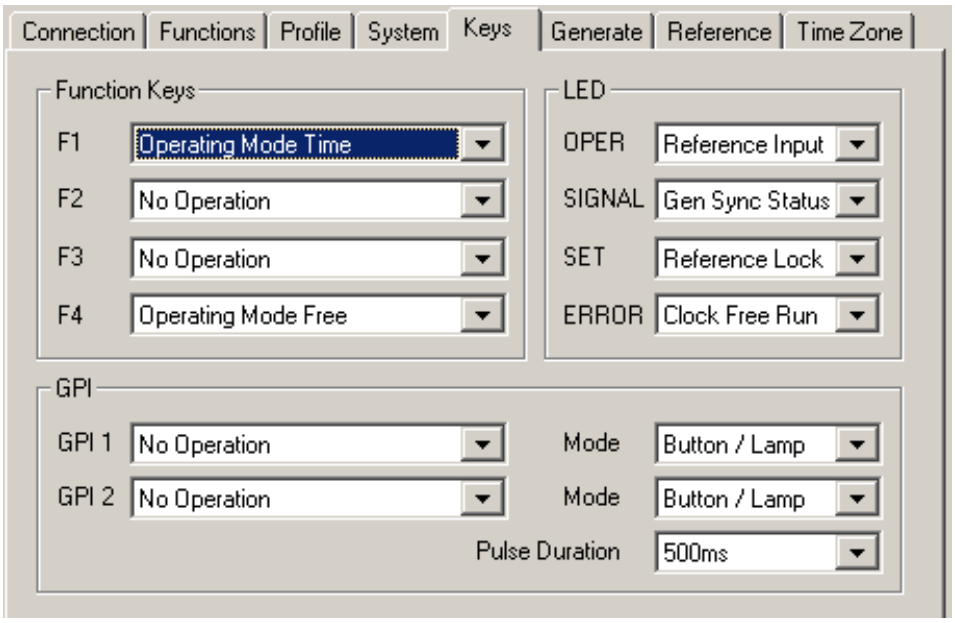
3.4 “Keys”: Keys and Lamps, LEDs and GPIs

The module has two GPIs (General Purpose Interface), the RUB1 version 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):



Function Keys (and Lamps)

RUB1 version modules offer four keys F1, F2, F3, and F4. They can get a function independently from each other. Select a function from the drop-down list. This selects the function of the lamps as well. Please refer to table below for description.

GPI

GPI 1 and GPI 2 can get a function independently from each other, as an input or as an output. Additionally, the switching characteristic is selectable. Select mode and function from drop-down lists. Please refer to table below for description of the functions.

GPI used as input:

Use drop-down list "Mode" to select the switching characteristic as a "Button" or "Switch":

Button / Lamp	Trigger at falling edge ("High" → "Low")
Inv. Button / Lamp	Trigger at rising edge ("Low" → "High")
Switch	Level sensitive: "Low" = active, "High" = inactive
Inv. Switch	Level sensitive: "High" = active, "Low"= inactive

GPI used as output:

Use drop-down list "Mode" to select the switching characteristic as a "Lamp" or "Pulse":

Lamp	Active "Low".
Inv. Lamp	Active "High".
Pulse	Active "Low". The pulse duration is selectable (one selection for all GPIs).
Inv. Pulse	Active "High". The pulse duration is selectable (one selection for all GPIs).

Table of functions for keys, lamps, and GPI:

Function	**Description**	**Recommended key**	**Preferred GPI set-up**
No Operation	Key/lamp/GPI without function.		
Operating Mode Time	Switch to main operating mode TIME. The lamp in the key gives a feedback.	F1: TIME	Input as "Button"
Operating Mode Free	Switch to main operating mode FREE. The lamp in the key gives a feedback.	F4: FREE	Input as "Button"
Load Profile ...	Load a profile which has been stored in the non-volatile memory of the module.		Input as "Button"
Lamp: Primary Generator	Lampe on: "Primary". Lamp off: "Back-Up". During "Primary" mode, full functionality is given; during "Back-Up" only restricted functionality. This mode is set by DRVSEL input which is driven by the connected changeover unit (RUB SI) in a redundant system.	F3: PRIMARY	Output as "Lamp"
-- General -- Lamp ...	More feedback for service purposes.		

LED

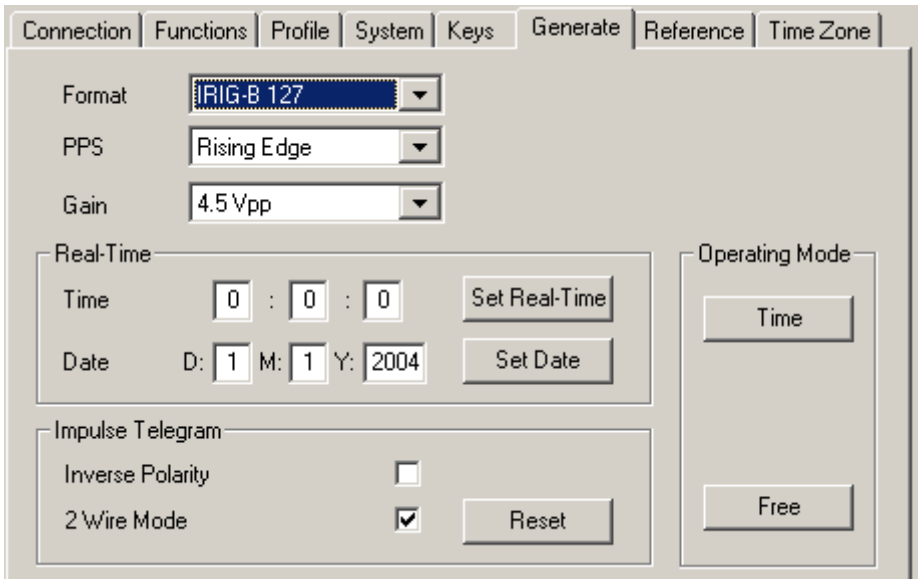
RUB1 version modules offer four LEDs (named OPER, SIGNAL, SET, and ERROR) which can get a function independently from each other. The following features are suitable for this module:

Name (in a drop-down list)	**Functional description**	**Preferred LED**
Reference Input	LED lights up, if the module is operating. LED flashes once a second, if valid time & date can be decoded out of the real-time reference input.	OPER
Gen Sync Status	The real-time output signals are frequency and phase locked to the connected reference signal. Normally, the PPS signal will be used for sync. Option **I** uses the IRIG-B input, option **L** the LTC input. This function indicates the status of synchronization: On: Locked. Slowly flashing: Fine trim procedure. Fast flashing: Synchronization is lost.	SIGNAL
Reference Lock	The data of the real-time reference input may contain status information about the time precision. On: Status = "Lock". Slowly flashing: Status = "Lock after Reset". Off: Status = "Unknown" or "Unlock".	SET
Clock Free Run	LED indicates the precision of the internal clock. Off: Internal clock with high precision. Within the last 24 hours, there was an update with the external real-time reference, which has been in "Lock" state. Flashes: No precise time & date update since at least 24 hours. Either the external real-time reference indicated no "Lock" state during last update, or the periodic update is switched off by configuration, or no valid time & date has been received within this period. On: Internal clock has not received time & date of external real-time reference yet.	ERROR
Primary	Same function as "Primary Generator" described at the "Table of functions for keys, lamps, and GPI".	

3.5 “Generate”: Basic Set-Up of the Time Code Generator

Some basic set-ups are valid for all ‘main operating modes’ of the generator.

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



Format Select the format of the IRIG-B output:

IRIG-B 123: The time code word consists of BCD hours, minutes, seconds and day-of-year, plus seconds-of-day weighted in straight binary seconds (SBS) notation. The control function bits are all set to zero. There is no information about the current year.

IRIG-B 127: The time code word consists of BCD hours, minutes, seconds and day-of-year, plus seconds-of-day weighted in straight binary seconds (SBS) notation. The control function bits contain units and tens of the current year; all further control bits are set to zero.

AFNOR NF S 87-500: The time code word consists of BCD hours, minutes, seconds and day-of-year, plus seconds-of-day weighted in straight binary seconds (SBS) notation. BCD date is inserted according to specification: Day, month, year and day-of-week.

PPS Select the reference edge of the PPS:
Rising Edge.
Falling Edge.

Normally, “rising edge” should be selected.
This selection has no effect for GI with option **L** or GI with option **I**.

Gain The output level can be adjusted, range 1.5 Vpp to 4.8 Vpp. Value refers to the “mark” amplitude of the output without load.

Real-Time

You can set time and date of the internal clock. This should be done if there is no external real-time reference.

Time	Enter a time (HH:MM:SS). This preset value will be stored in the module. Press the **Set Real-Time** button to transfer this time to the internal clock.
Date	Enter day (D), month (M) and year (Y). This preset value will be stored in the module. Press the **Set Date** button to transfer this date to the internal clock.

Impulse Telegram

The TELEGRAM OUT signal transmits an impulse telegram (Open-Collector output). This output connected to the RUB **VD** distribution amplifier synchronizes analogue clocks.

Inverse Polarity	Checkbox checked: Negative going impulses. Checkbox unchecked: Positive going impulses. Negative going impulses: Suitable to synchronize analogue clocks with a 4-wire interface via RUB **VD** distribution amplifier and in case of GI with option **M**. Positive going impulses: Suitable to synchronize analogue clocks with a 2-wire interface via RUB **VD** distribution amplifier.
2 Wire Mode	Analogue clocks with a 2-wire interface can be forced to adjust to a new time zone by a RESET. If this checkbox is activated, the module automatically generates this RESET after a time zone change, e.g. after a DST switching.
Reset	In case the "2 Wire Mode" checkbox has been activated, a click on this button forces the analogue clocks to execute the adjustment procedure.

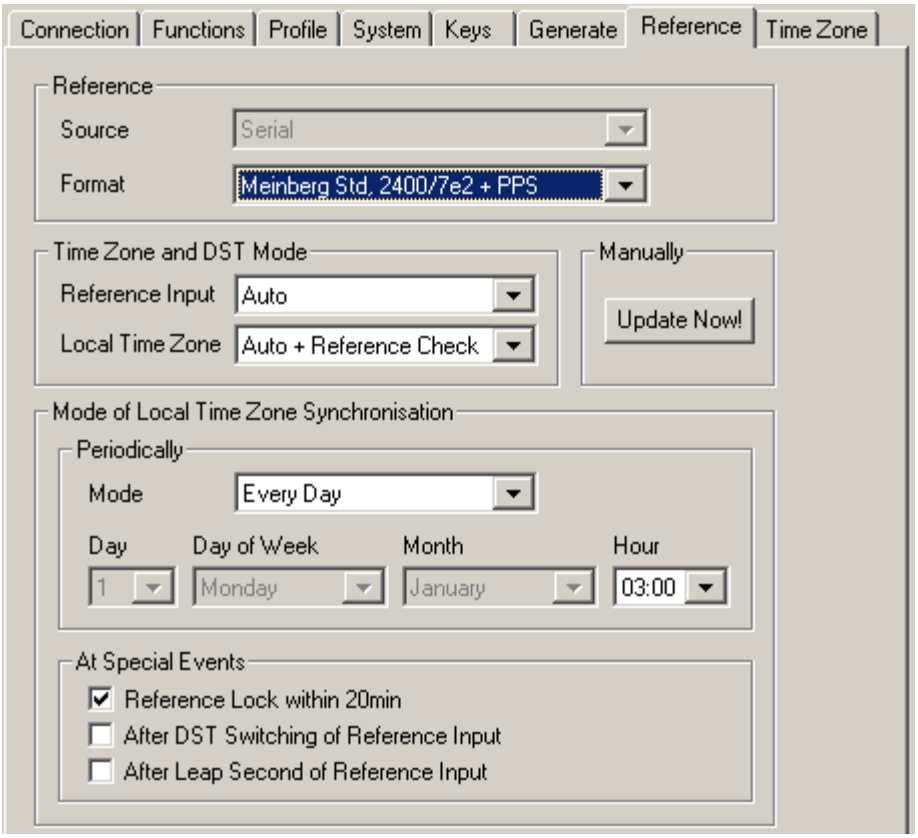
Operating Mode

The buttons **Time** and **Free** enable to switch the main operating mode.

3.6 "Reference": Synchronization to a Time & Date Reference

An external real-time source can be accepted as time & date reference.

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



Reference

Select the signal source and the data format:

Source: Indicates the suitable source. For a standard module no selection is possible, the source has been fixed.
GI without options: *Serial* = Serial interface with a time & date data string.
GI with option **L**: *LTC*.
GI with option **I**: *IRIG*.

Format: Select from drop-down list according to the connected source.
GI without options: Select the serial data protocol.

"Meinberg Std 2400/7e2 + PPS"	e.g. GPS 10 MHz.
"NMEA $GPRMC 4800/8n1 + PPS"	e.g. GPS16, GPS17.
"Meinberg Uni 2400/7e2 + PPS"	service purpose only.
"Wharton Status 2400/7e2 + PPS"	e.g. Wharton clocks.

GI with option **L**: It is essential to read the document "Option L: Time & Date Reference via External LTC"!

GI with option **I**: It is essential to read the document "Option I: RUB GT/GL/GI with IRIG-B Input"!

Time Zone and DST Mode (DST = Daylight Saving Time)

Define the time zone of the real-time reference and the local time zone of the internal clock.

Reference Input: The module uses UTC as an internal time base. The following settings and the settings **Offset Reference Input** at the **Time Zone** tab are needed to convert the data of the real-time reference input into UTC.

AUTO: Time, date and status data of the signal input indicate the time zone of the real-time reference. The real-time reference may utilize DST. "Offset from UTC" and "DST Bias" at **Time Zone** are taken into consideration.

UTC: The time zone of the real-time reference does not utilize DST, the 'UTC' status will be set for internal use. "Offset from UTC" at **Time Zone** is taken into consideration!

Standard Time Only: The time zone of the real-time reference does not utilize DST, the 'Standard Time' status will be set for internal use. "Offset from UTC" at **Time Zone** is taken into consideration.

Daylight Saving Time Only: The time zone of the real-time reference does not switch to DST, the 'DST' status will be set for internal use. "Offset from UTC" and "DST Bias" at **Time Zone** are taken into consideration.

GI with option **L**: It is essential to read the document "Option L: Time & Date Reference via External LTC"!

GI with option **I**: It is essential to read the document "Option I: RUB GT/GL/GI with IRIG-B Input"!

Local Time Zone: These settings refer to the local time zone status of the internal clock and to the priority of reference time versus local time at the moment of synchronization.

Auto + Reference Check: The local time zone utilizes DST; the switching occurs automatically according to the settings at **Time Zone**. At the moment of synchronization (according to the "Periodically" setting at **Mode of Local Time Zone Synchronization**) the time of the reference may not differ more than one minute from the expected time value.

UTC + Reference Check: The local time zone does not utilize DST, the 'UTC' status will be set for internal use. "Offset from UTC" at **Time Zone** is taken into consideration! At the moment of synchronization (according to the "Periodically" setting at **Mode of Local Time Zone Synchronization**) the time of the reference may not differ more than one minute from the expected time value.

UTC: The local time zone does not utilize DST, the 'UTC' status will be set for internal use. "Offset from UTC" at **Time Zone** is taken into consideration!

Standard Time Only: The local time zone does not utilize DST, the 'Standard Time' status will be set for internal use. "Offset from UTC" at **Time Zone** is taken into consideration.

Daylight Saving Time Only: The local time zone does not switch to DST, the 'DST' status will be set for internal use. "Offset from UTC" and "DST Bias" at **Time Zone** is taken into consideration.

Same As Reference Input: The local time zone follows the status of the real-time reference input (UTC, Standard Time, DST). A DST switching of the local time zone only occurs if the time zone of the real-time reference switches. "Offset from UTC" and "DST Bias" at **Time Zone** are taken into consideration.

Manual

Press the **Update Now!** button to let all changes at this function immediately get effective for the internal calculations and the output signals of the module. Pressing this button forces a manual update of the internal clock with the real-time reference input.

Mode of Local Time Zone Synchronization

Periodically

The internal clock updates periodically with the time & date reference according to the following programming:

Mode

Off	No periodically update.
Every Second	Update every second.
Every Day	Update once a day, at the selected **Hour**.
Every Week	Update once a week, at the selected **Day of Week** and **Hour**.
Every Month	Update once a month, at the selected **Day** and **Hour**.
Every Year	Update once a year, at the selected **Month** and **Day** and **Hour**.

Settings **Day**, **Day of Week**, **Month** and **Hour** become active dependent on the "Mode" selection.

At Special Events

Additionally, to the moments selected at **Periodically,** the internal clock can update with the time & date reference at special events according to the following programming:

Reference Lock within 20 min: Due to the nature of some real-time sources it may last some minutes after power has turned on until a "Lock" status will be indicated. The module can be set to monitor this status for a 20 minutes period after power-on, and as soon as "Lock" has been detected the time code updates with this locked time of the real-time reference. There is a risk of generating a frame discontinuity caused by this update. If you don't need this feature, deactivate this checkbox. The "Lock" status has to be part of the status data received from the real-time reference.

After DST Switching of Reference Input: Activate this checkbox to force an additional update if the real-time reference switches the time zone (start or end of DST). The DST switching has to be announced in the status data of the reference input.

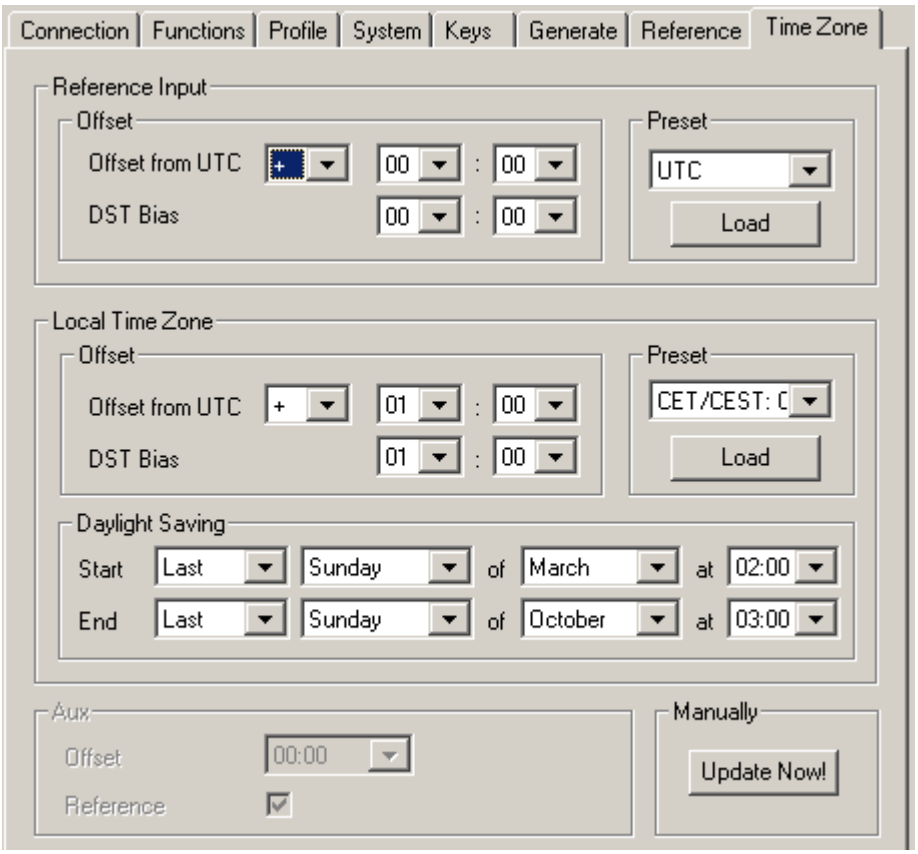
Please refer to chapter "Time Leaps – DST Switching" as well.

After Leap Second of Reference Input: Activate this checkbox to force an additional update if the real-time reference will be corrected through a leap second. The leap second adjustment has to be announced in the status data of the real-time reference input.

Please refer to chapter "Time Leaps – Leap Second" as well.

3.7 “Time Zone”: Time Zone Adjustment

Select the time zone of the reference and the local time zone.
Configuration (example shows a screen shot of the PC program tab):



Reference Input **(DST = Daylight Saving Time)**

This module uses UTC as an internal time base.

The following settings and the settings **Reference Input** at the **Reference** tab are needed to convert the data of the real-time reference input into UTC.

Preset

You can select the time zone of the real-time reference from the drop-down list. With a click on the button **Load**, the settings **Offset from UTC** and **DST Bias** will be entered automatically.

Offset

Offset from UTC Enter sign and hours/minutes offset with respect to UTC.

DST Bias Enter DST correction value in case the real-time reference has a DST period. Most of the cases the correction value will be one hour.

Local Time Zone **(DST = Daylight Saving Time)**

This module generates a local time zone. The following settings are used to calculate the local time zone from the internal UTC time base.

Preset

You can select the local time zone from the drop-down list. With a click on the button **Load**, the settings **Offset from UTC**, **DST Bias** and **Daylight Saving** will be entered automatically.

Offset

Offset from UTC Enter sign and hours/minutes offset with respect to UTC.

DST Bias Enter the DST correction value in case the local time zone has a DST period. Most of the cases the correction value will be one hour.

Daylight Saving

The local time zone may have a Daylight-Saving Time (DST). These settings determine the moments of switching on and off the DST, referenced to the local time.

Start Using these inputs (e.g. last Sunday of March at 2 o'clock), start of DST for the current year will be calculated.

End Using these inputs (e.g. last Sunday of October at 3 o'clock), end of DST for the current year will be calculated.

Aux

Reserved.

Manual

Press the **Update Now!** button to let all changes at this function immediately get effective for the internal calculations and the output signals of the module. Pressing this button forces a manual update of the internal clock with the real-time reference input.

3.8 “Link”: Communication between Modules

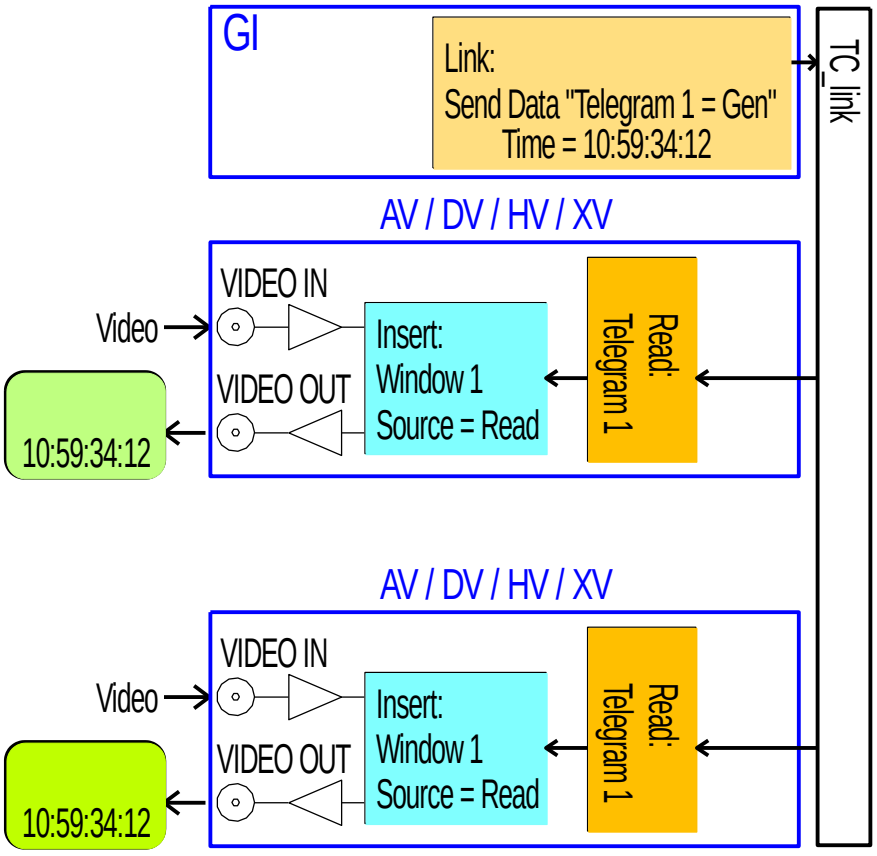
Link uses the Rubidium internal TC_link interface to transmit or receive data. This interface is shared by all the modules in one frame, and via the **RLC** connector it is possible to link further modules at different frames.

In case that the selected module should transmit data, **Link** selects the channel and the kind of data. The receiving module must select this channel as a reader input.

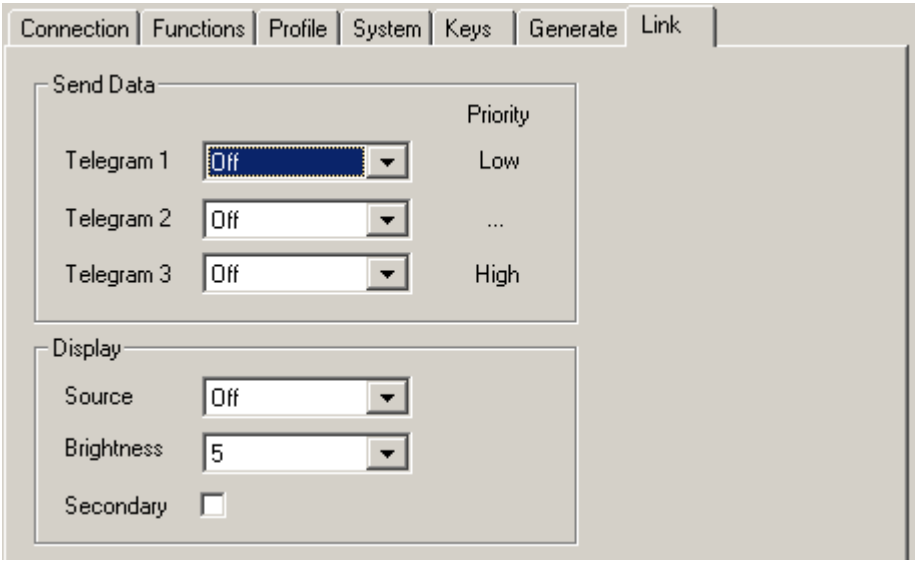
In case that the selected module should receive data, the **Link** function has to be activated (**Use**), and the selected channel (“Telegram” 1 or 2 or 3) has to be switched off.

Typical application:

The generated time & date can be distributed internally to AV/DV/HV/XV modules (as many as you like, in any combination).



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.
Gen	Time & date of the local time zone will be sent "frame wise", i.e. with 25 frames per second. Time has a HH:MM:SS:Frames format, with "Frames" counting 00 to 24. So called "User Data" convey the date in a "Date + Status" format as it is used by RUB GT and RUB GL time code generators. RUBIDIUM modules like AT/DT/HT/XT and AV/DV/HV/XV are able to receive and decode this telegram.
Reference	Time & date of the internal UTC will be sent once per second. For example, the RUB IE module with option N (NTP server) is able to receive and decode this telegram.

Display

Sending data to the RUBIDIUM **D1** or **Q1** display:

Source Select the kind of data:

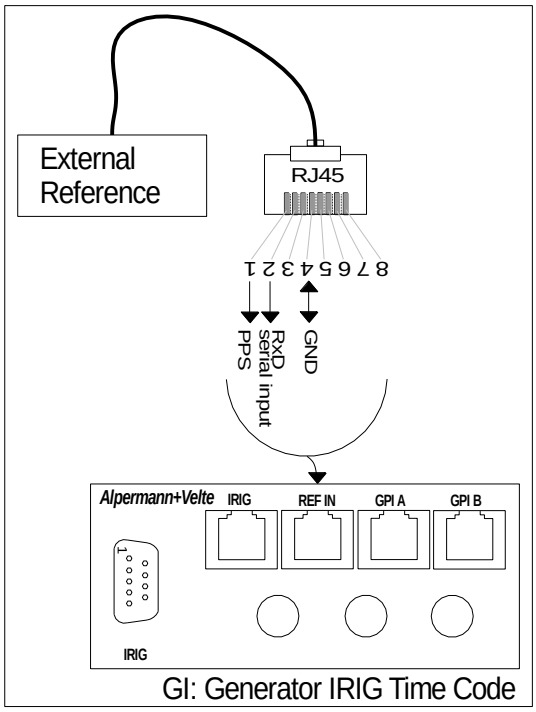
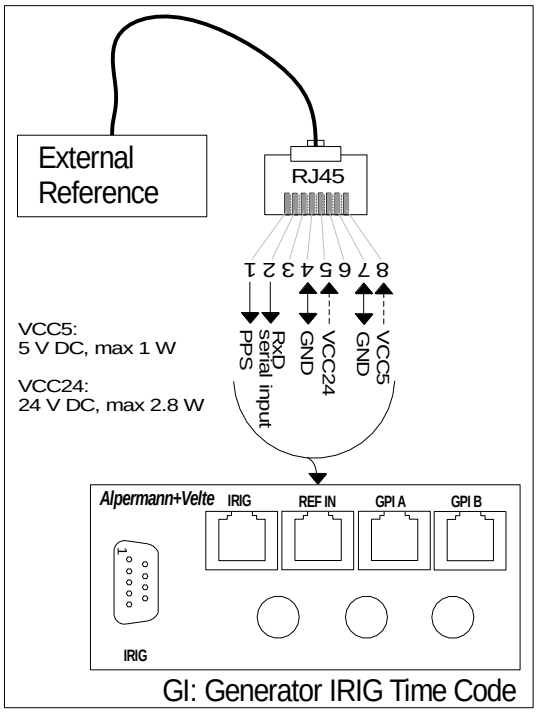
Off	No data will be sent from this module.
Gen	Time of the local time zone in a HH:MM:SS:Frames format, with "Frames" counting 00 to 24.
Reference	Time of the local time zone in a HH:MM:SS format.

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

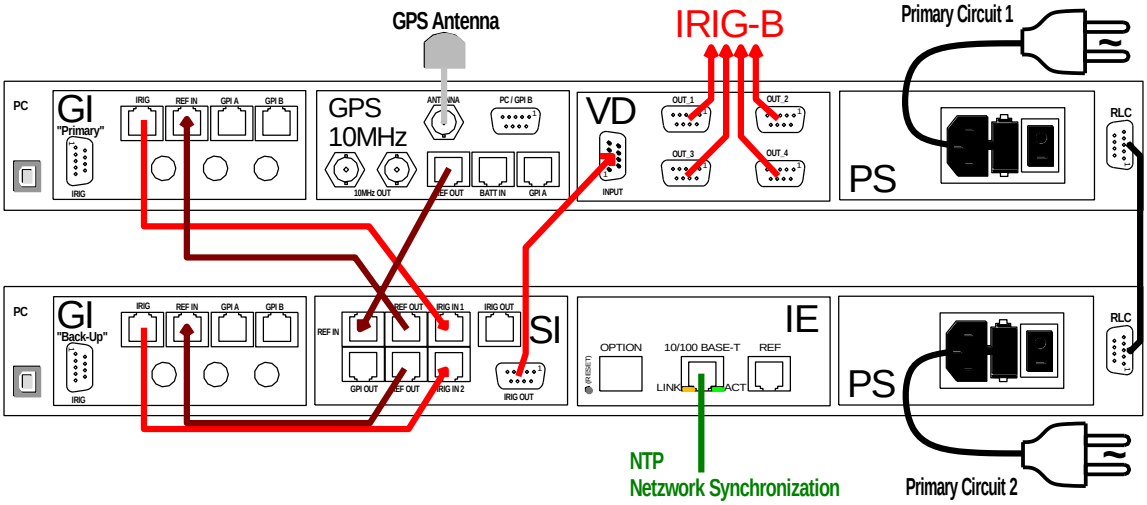
Secondary Address the "secondary" display instead of the "primary" display.

4 Applications and Options

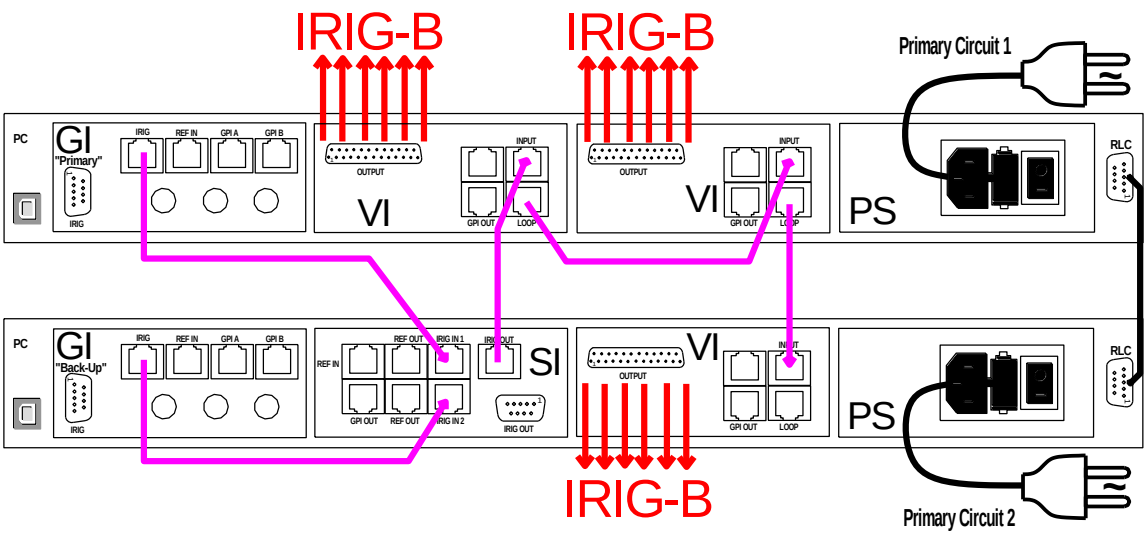
4.1 Standard Input for a Time & Date Reference

Real-time reference signals: PPS and serial data. External real-time reference as a stand-alone unit.	Real-time reference signals: PPS and serial data. External real-time reference receives power from the GI module.
	

4.2 Redundant IRIG-B Reference System



4.3 Example of 1:18 IRIG-B Distribution



4.4 Available Options

Documents describing the following options are available at:
https://www.plurainc.com.

4.4.1 Option L: Time & Date Reference via External LTC

With this option the module receives a time & date reference via an external LTC signal. The standard input for a time & date reference will no longer be available, so no GPS or DCF77 receiver can be connected. This option can be combined with further options, but not with option "I".

Please read the document "Option L: Time & Date Reference via External LTC" for a detailed description.

4.4.2 Option I: IRIG-B to Time Code Converter

With this option the module receives a time & date reference via an IRIG-B signal. The standard input for a time & date reference will no longer be available, so no GPS or DCF77 receiver can be connected. This option can be combined with further options, but not with option "L".

Please read the document "Option I: RUB GT/GL/GI with IRIG-B Input" for a detailed description.

4.4.3 Option M: "Master" Output to Control Analogue Clocks

With this option a distribution amplifier supplies the analogue clocks of the Plura system with power as well as with time data. This option can be combined with further options.

Please read the document "Option M: RUBIDIUM GT/GL/GI with Master Output" for a detailed description.

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