plura

TIMING SOLUTIONS

Rubidium Series

RUB GNS 10

GPS/GLONASS/QZSS Satellite Receiver Module Time & Date Reference Reference Frequency Output for Synchronisation Tasks

Functional Description and Specifications
Supplement to the “Installation & Systems Manual RUBIDIUM SERIES”
Version: 1.5
January 11, 2024

CONTENTS

A1 Revision History

No.	Date	Subject
0.n		Preliminary documents, changes without notice.
1.0	February 19, 2015	First released document.
1.1	September 25, 2015	Added 200 Hz output frequency, added PPS input delay setting.
1.2	September 4, 2019	Changed address of Plura Europe GmbH.
1.3	December 2, 2020	Re-formatted in new design.
1.4	November 8, 2023	Added ANTG weight.
1.5	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/gns10/

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 RUB modules:

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

1 Introducing GNS 10 MHz

1.1 Overview

The GNS 10 MHz module is a highly reliable and accurate multi-GNSS receiver and master clock. The built-in receiver accepts signals worldwide from GPS (US system), from GLONASS (Russian system), from Galileo (European system, still under development), as well as from QZSS (Japanese system), and from the satellite-based augmentation systems (SBAS) WAAS, EGNOS, and MSAS.

Accurate time is provided by a precise PPS (pulse per second) output, serial time & date protocols, and optionally an IRIG-B time code output. Various GNSS disciplined frequency outputs are available: 10 MHz sine waves and programmable square waves.

The GNS 10 MHz module's versatility makes it ideally suited for time and frequency synchronisation tasks:

- Time and frequency reference in broadcast facilities, e.g. to slave video sync and time code generators.
- Synchronizing networks and computers.
- Master signal generator (phase and frequency) for various applications in industry, research, and measurement.

Especially, the GNS 10 MHz module optionally provides a 2nd antenna input for a 2nd GNSS receiver. This greatly improves the availability of GNSS signals on the one hand; on the other hand, it gives a redundancy on antenna and receiver.

A **PC** or one of the RUB Ethernet modules (**RUB IE** or **RUB PM**) is required for set-up.

GPS 10 MHz is provided for the RUB1 system (19", 1 RU). A button on the front panel visibly identifies this module. The serial number is located on the bottom side of the printed circuit board.

Overview of the most important module-specific functions:

- Multi-GNSS receiver: GPS (US system), GLONASS (Russian system), Galileo (European system, still under development), QZSS (Japanese system), satellite-based augmentation systems (SBAS) WAAS, EGNOS, and MSAS.
- Precision timekeeping via high stability OCXO.
- GNSS disciplined frequency outputs: 10 MHz sine waves, PPS (pulse per second), programmable square waves.
- RS232 communication ports for time & date and status output.
- GPIO: trigger inputs/outputs with sub-microsecond resolution.
- Four programmable function keys, lamps and LEDs on the front panel.
- Backup power input.
- Optional: IRIG-B output.

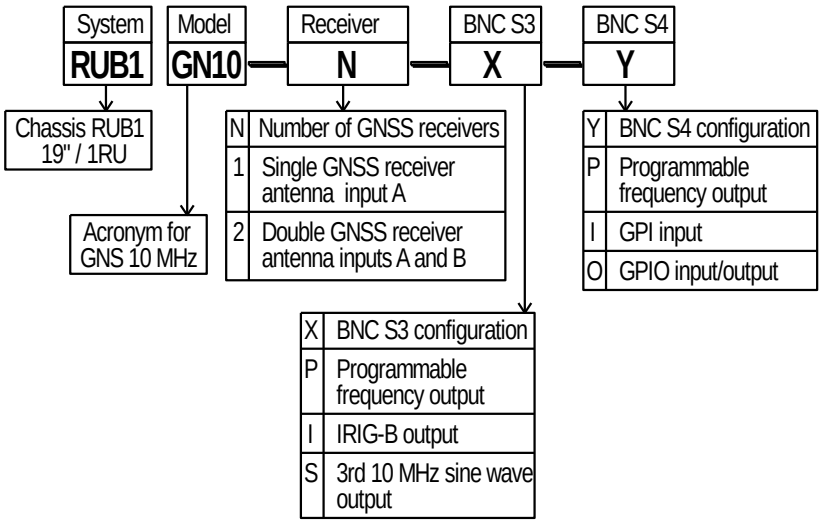
Overview of the most important functions within a RUBIDIUM system:

- "Hot Swapping", i.e. it is possible to insert or remove a module without interrupting the operation of other modules in this frame.
- Alarm feature via failure relay: contacts of the relay connected to the FAIL_A and FAIL_B pins of the **RLC** connector at the rear of the frame.
- RS232 and TC_link interfaces to have access to the internal bus of the chassis:
  - RS232 enables access to the module via USB using the RS232/USB converter of the chassis. The PC programs "Rubidium Config" (configuration) and "RubStatSE" (status monitor) are provided for this interface.
  - TC_link will be connected to the RLC DSUB of the chassis. This interface enables, on the one hand, communication to modules located in different chassis and, on the other hand, access to the module via internet browser – provided any RUB Ethernet module (**RUB IE** or **RUB PM**) is part of the system. Via internet browser it is possible to open the configuration pages as well as the status monitor.
- Flash memory containing the firmware, so updates are possible via USB. You can download the latest version of the program from: https://plurainc.com/products/gns10/.
- SNMP functionality if any RUB Ethernet module (**RUB IE** or **RUB PM**) with SNMP option is part of the system.

1.2 Versions and Product Ordering IDs

There are different variants of the GNS 10 MHz module available. This will help you to find the best solution for your application with regard to wiring and signal availability.

You can order in this way: **RUB1 GNS10–N–X–Y**.

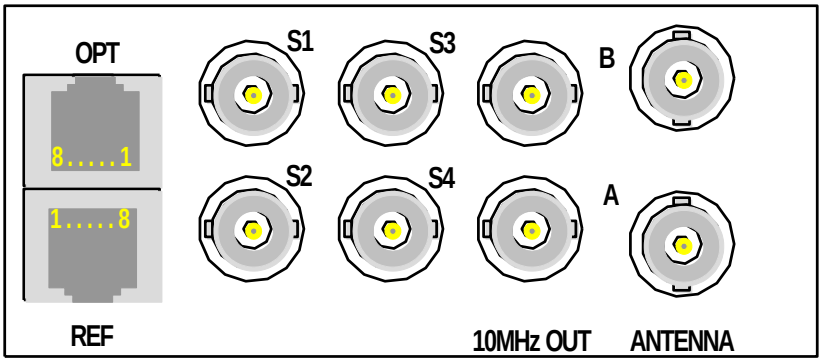


Furthermore, additional signal outputs can be provided at the RJ45 **REF** connector:

- PPS output at Pin 3: PPS_2 OUT.
- 10 MHz output at Pin 6: 10 MHz sine wave 1 Vpp @ 75 Ω.

Please refer to chapter "Rear Panel and Connections" for more information.

1.3 Rear Panel and Connections



RJ45 OPT	RJ45 REF
1: GPIO (IN/OUT)	1: PPS_1 OUT
2: TXD_2 (RS232 OUT)	2: TXD_1 (RS232 OUT)
3: RXD_2 (RS232 IN)	3: n. c. (optional: PPS_2 OUT)
4: GND / V_{BACKUP} –	4: GND
5: GND / V_{BACKUP} –	5: n. c.
6: GPI (IN)	6: n. c. (optional: 10 MHz sine wave output1 Vpp @ 75 Ω)
7: V_{BACKUP} +	7: RXD_1 (RS232 IN)
8: V_{BACKUP} +	8: n. c.

S1, S2	2 x BNC, 50 Ω. Square wave outputs, frequencies individual programmable.
S3	BNC 50 Ω. Configuration (please note Product Ordering IDs below): P (standard) = Square wave output, frequency programmable. I (option) = IRIG-B output. S (option) = 10 MHz output, same signal as at BNCs 10 MHz OUT.
S4	BNC 50 Ω. Configuration (please note Product Ordering IDs below): P (standard) = Square wave output, frequency programmable. I (option) = GPI input (in parallel to RJ45 OPT, pin 6). O (option) = GPIO input/output (in parallel to RJ45 OPT, pin 1).
10 MHz OUT	2 x BNC 50 Ω. 10 MHz sine wave outputs, adjustable level 6/8/10/12 dBm.
ANTENNA	Antenna input, BNC 50 Ω. Antenna operating voltage (5 VDC) on centre conductor. Position A (lower): antenna input for 1st GNSS receiver. Position B (upper): optional antenna input for 2nd GNSS receiver.

1.4 Specifications

GNSS Receiver

Receiver type	50-channel u-blox 6 engine GPS/QZSS L1 C/A GLONASS L1 FDMA SBAS: WAAS, EGNOS, MDAS		
Dynamic platform model	Stationary (antenna must be stationary)		
Time-to-first-fix		GPS	GLONASS
	Cold start	29 s	36 s
	Warm start	28 s	25 s
	Hot start	1 s	2 s
Sensitivity		GPS	GLONASS
	Tracking & Navigation	-162 dBm	-158 dBm
	Cold start	-148 dBm	-138 dBm
	Warm start	-148 dBm	-145 dBm
	Hot start	-155 dBm	-153 dBm
Navigation update rate		GPS	GLONASS
		2 Hz	2 Hz
Horizontal position accuracy		GPS	GLONASS
		2.5 m	4 m

Antenna requirements

Antenna type	Active timing antenna
Operating voltage	5 VDC, or range V_{MIN}–V_{MAX} with $V_{MIN} \leq 5$ V and $V_{MAX} \geq 5$ V
Operating current	≤ 50 mA
Gain minimum/maximum	15 dB / 50 dB
Total noise figure	< 3 dB
Frequency band covering	1575–1606 MHz, if GLONASS reception required
⚠	Do not connect or disconnect the antenna when the module is powered!

Accuracy of the frequency outputs

Warm-up time	3–5 minutes
Short term stability (τ = 1s)	$\pm 5 \cdot 10^{-12}$
PPS accuracy during LOCK	< ±100 ns
Stability during LOCK	$\pm 1 \cdot 10^{-12}$ (24 hours average)
Hold-over stability (after ≥ 24 hours continuous LOCK and almost constant temperature)	4 hours: < ±1 µs / $\pm 7 \cdot 10^{-11}$ 24 hours: ≤ ±10 µs / $\pm 1.2 \cdot 10^{-10}$
Stability vs. temperature	$\pm 2 \cdot 10^{-9}$ (over specified range of environmental temperature)
Oscillator aging	$\pm 3 \cdot 10^{-8}$ / year

10 MHz Continuous Wave (sine wave output)

Phase noise	1 Hz < -100 dBc/Hz 10 Hz < -130 dBc/Hz 100 Hz < -150 dBc/Hz 1 kHz < -155 dBc/Hz 10 kHz < -160 dBc/Hz
Level at BNC 50 Ω	Identical level at all outputs, adjustable to (±10 %): dBm Vpp @ 50 Ω Vpp without termination 6 1.3 2.8 8 1.6 3.6 10 2.0 4.5 12 2.5 5.7
Level at RJ45 REF	1 Vpp @ 75 Ω (±10 %) [optional available at pin 6]

PPS (output)

Connector	RJ45 REF, pin 1 Optional: RJ45 REF, pin 3 Programmable/configurable: BNC S1, S2, S3, S4
Pulse width (active high)	Adjustable: 0.1 / 1.0 / 10 / 100 ms
Output characteristics	Output impedance: 50 Ω Signal level: 5.0 V ±2 % (no load) 4.5 V ±2 % @ 600 Ω 2.1 V ±2 % @ 50 Ω Slew rate (rising edge): > 0.2 V/ns
Accuracy	Refer to "Accuracy of the frequency outputs"

Square wave signals (output)

Connector	Programmable/configurable: BNC S1, S2, S3, S4
Frequencies	Individual programmable 0.1 / 1 / 10 / 100 kHz as well as 1 / 2 / 5 / 10 MHz as well as any frequency of table 1 or alternatively table 2 Table 1: 119.88 Hz (120/1.001); 120.00 Hz; 239.76 Hz (240/1.001); 240.00 Hz; 1.920 MHz; 3.840 MHz Table 2: 127.87 Hz (128/1.001); 128.00 Hz; 255.74 Hz (256/1.001); 256.00 Hz; 2.048 MHz; 4.096 MHz
Output characteristics	Output impedance: 50 Ω Signal level: 5.0 V ±2 % (no load) 4.5 V ±2 % @ 600 Ω 2.1 V ±2 % @ 50 Ω Slew rate (rising edge): > 0.2 V/ns Duty cycle: 50/50 % (±1 %) except 2 MHz: 40/60 % (±1 %)
Accuracy	Refer to "Accuracy of the frequency outputs"

GPIO

Connector	RJ45 OPT, Pin 1 BNC S4 with product ordering RUB1 GNS10–(N)–(X)–**O**
Input specification	Input "Low": -8.0 to +0.5 V Input "High": +1.9 to +15.0 V Impedance: ≥ 10 kΩ
Input features	Event trigger #2: accurate to within ±200 ns of internal clock
Output specification	Open Collector output of an NPN transistor at 10 kΩ pull-up resistor. Maximum power dissipation: 200 mW. "High" state: 3.8 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. 300 mV (≤ 1 V) @10 mA: typ. 100 mV (≤ 250 mV)
Output features	Alarm indication

GPI

Connector	RJ45 OPT, Pin 6 BNC S4 with product ordering RUB1 GNS10–(N)–(X)–**I**
Input specification	Input "Low": -2.0 to +0.9 V Input "High": +2.3 to +12.0 V Impedance: > 10 kΩ
Input features	• Event trigger #1: accurate to within ±10 ns of internal clock. • PPS input for synchronization to an external source.

Serial Interfaces: TXD_1 and TXD_2; RXD_1 and RXD_2

Electrical format	RS232
Parameters	Individual programmable for each input and output (RXD_1, TXD_1, RXD_2, TXD_2): Baud rate: 2400/4800/9600/19200/38400/57600/115200 Data bits: 7, 8 Parity: none, even, odd Stop bits: 1, 2
RXD_1 features	• Service
TXD_1 features	• UTC time & date output once per second. • Time stamp output of a trigger event. • Service.
RXD_2 features	• UTC time & date input during synchronization to an external source.
TXD_2 features	• UTC time & date output once per second. • Time stamp output of a trigger event. • Service.

Backup Power Supply

Connector	RJ45 OPT: pins 4 and 5 = V_{BACKUP} – (GND) pins 7 and 8 = V_{BACKUP} + (16–30 VDC)
Power requirements	8 W

RTC: Buffered Real-Time Clock

Kind of buffering and buffering time	Capacitor; ≥ 7 days typical
Accuracy of clock	±2.0 ppm over +5 °C to +40 °C [173 ms per day] ±3.5 ppm over -10 °C to +60 °C Accuracy will be measured periodically and indicated at the status monitor (please refer to chapter "Status Monitor").
RTC features	Sets time & date of the internal clock after warm-up if no other time & date source is available.

Electrical, Mechanical, and Environmental Characteristics

Power consumption	8 W maximum during warm-up 5 W typical during normal operation		
Weight	≈ 0.35 kg		
Dimensions	Circuit board:	100 (W) x 160 (D) mm	
	RUB1 rear panel:	103 x 44 mm / 4.06 x 1.73 inch	
Environmental		Operating	Non-operating
	Temperature:	+5 °C to +40 °C	-10 °C to +60 °C
	Relative humidity: (non-condensing)	30 % to 85 %	5 % to 95 %

1.5 Features

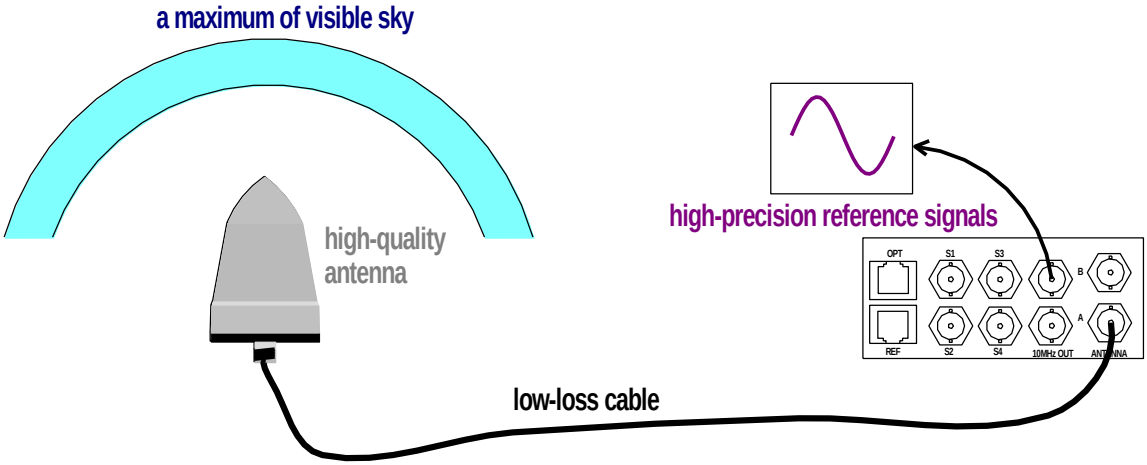
1.5.1 GNSS used as Timing Reference

The term "Global Navigation Satellite System" (GNSS) combines the satellite navigation systems which already exist and which are still under development, as there are GPS (US system), GLONASS (Russian system), Galileo (European system, still under development), as well as QZSS (Japanese system), and satellite based augmentation systems (SBAS) WAAS, EGNOS, and MSAS. The GNS 10 MHz module uses a receiver which is able to receive and evaluate signals from all the mentioned systems, provided an appropriate antenna is connected.

The receiver is capable of receiving multiple satellites in parallel, even from different satellite systems. GPS and GLONASS satellites are not stationary but circle round the globe, thus the number of satellites in view varies. The antenna must be installed outdoors where an unobstructed view of the sky exists.

The GNS 10 MHz module uses GNSS as a timing reference. The satellites carry an atomic clock on board. Each satellite periodically transmits a signal that includes its position, the time of the clock, and the unique identification code of the satellite. The receiver converts these signals to UTC (Universal Time Coordinated). This UTC sets and synchronizes the internal clock of the GNS 10 MHz module. A high-precision oven-controlled oscillator (OCXO) is the fundamental part of the internal clock. Its frequency will be disciplined continuously by the atomic clocks of the satellites, thus compensating the aging of the oscillator.

Accuracy depends on many factors. Accuracy of time requires accuracy of position. The receiver has to use three satellites to reach a degraded navigation ("2D position fix"). Minimum four satellites must be available to calculate a complete solution including the height ("3D position fix"). As a rule of thumb, the position should be known with an accuracy of better than 1 m for a timing accuracy in the order of nanoseconds. Furthermore, accuracy depends on quality of the antenna and antenna cable, on satellite constellation and ionosphere activities. These factors let the accuracy vary with time. The GNS 10 MHz module performs long-term measurements, and with the aid of sophisticated algorithms the OCXO will be synchronized in order to compensate the signal fluctuations of the receiver.



1.5.2 Time & Date Output

The GNS 10 MHz module outputs a precise pulse per second (PPS) and a RS232 data string once per second. Both these signals are commonly used as the time & date reference for various applications.

PPS

The **leading edge** of the PPS OUT pulse always is defined to be the timing reference.
This pulse is available: at pin 1 of connector RJ45 **REF** (= PPS_1 OUT),
optionally at pin 3 of connector RJ45 **REF** (= PPS_2 OUT),
programmable at BNCs **S1** and **S2**,
at BNC **S3** with product ordering RUB1 GNS10–(N)–**P**–(Y),
at BNC **S4** with product ordering RUB1 GNS10–(N)–(Y)–**P**.

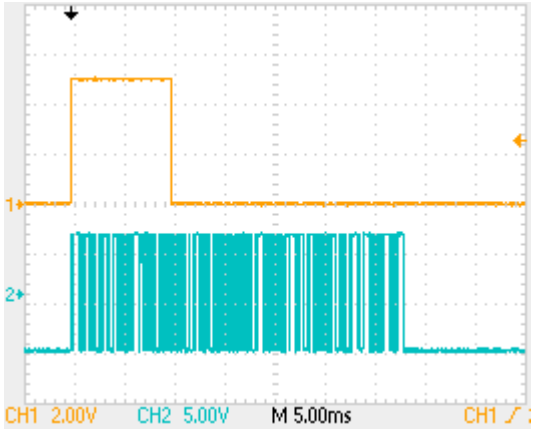
The pulse width is adjustable to 0.1 / 1.0 / 10 / 100 ms.

Time, Date, and Status Information

There is a RS232 data string available containing time, date, and status information. Time & date corresponds to the **UTC** time zone. The data refers to the leading edge of the preceding PPS.
This data string is available: at pin 2 of connector RJ45 **REF** (= TXD_1),
at pin 2 of connector RJ45 **OPT** (= TXD_2).

Both TXD outputs can individually be configured with respect to data protocol and serial interface parameters. For more information please refer to chapter "Serial Interfaces: Programming the Serial Interfaces".

Example: PPS (yellow, active high, pulse width 10 ms) and TXD_1 (blue, 9600 baud)



1.5.3 Reference Frequency Output

The GNS 10 MHz module outputs precise reference frequencies for various applications. These frequencies are derived from the high stability internal 10 MHz OCXO (Oven Controlled Crystal Oscillator).

Operating in mode "Sync Mode = GNSS...", the atomic clocks of the satellites continuously discipline the OCXO, thus compensating the aging of the oscillator.
Operating in mode "Sync Mode = External", same compensation occurs with respect to the external PPS.

10 MHz Sine Wave

Available at 2 x BNC 50 Ω. Level adjustable to 6/8/10/12 dBm.

Available at BNC **S3** with product ordering RUB1 GNS10–(N)–**S**–(Y).

Optional available at connector RJ45 **REF**, pin 6. Level will be fixed to 1 Vpp @ 75 Ω (±10 %).

Square Wave Signals

Available at BNC **S1** and **S2**,
at BNC **S3** with product ordering RUB1 GNS10–(N)–**P**–(Y),
at BNC **S4** with product ordering RUB1 GNS10–(N)–(X)– **P**.

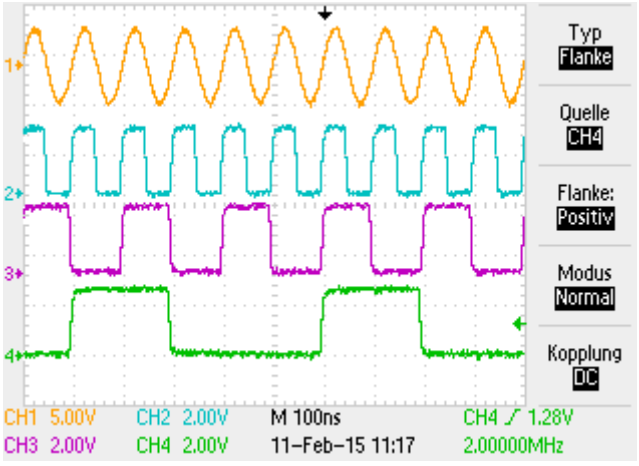
Each output can receive an individual set-up:

PPS or 0.1 / 1 / 10 / 100 kHz or 1 / 2 / 5 / 10 MHz,
as well as any frequency of table 1 or alternatively table 2:

Table 1	Table 2
119.88 Hz (120/1.001)	127.87 Hz (128/1.001)
120.00 Hz	128.00 Hz
239.76 Hz (240/1.001)	255.74 Hz (256/1.001)
240.00 Hz	256.00 Hz
1.920 MHz	2.048 MHz
3.840 MHz	4.096 MHz

Duty cycle of each frequency except PPS and 2 MHz: 50/50 % (±1 %).
Duty cycle of 2 MHz: 40/60 % (±1 %).

Example: 10 MHz Sine Wave, 10 MHz Square Wave, 5 MHz, 2 MHz



1.5.4 Capture of Trigger Events

The GNS 10 MHz module offers two inputs for time stamping of trigger events. A time stamp will be indicated at the status monitor and can be sent as a serial data string. The repetition rate is about ≈< 0.5 s, thus the time delay between two triggers at the same input should be ≥ 0.5 s.

Input GPI

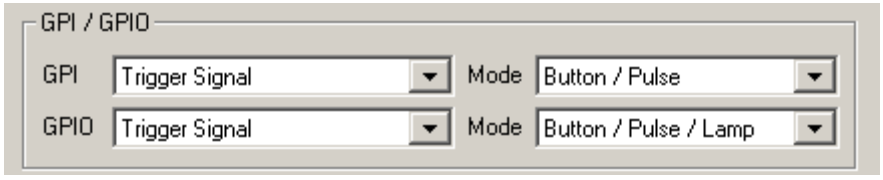
Pin 6 at connector RJ45 OPT.
Alternatively (in parallel): BNC S4 with product ordering RUB1 GNS10–(N)–(X)–**I**.
This input allows a resolution to within **±10 ns** of internal clock.

Input GPIO

Pin 1 at connector RJ45 OPT.
Alternatively (in parallel): BNC S4 with product ordering RUB1 GNS10–(N)–(X)–**O**.
This input allows a resolution to within **±200 ns** of internal clock.

Configuration

At the **Keys** configuration page:



Mode = Button/Pulse: rising edge triggered.
Mode = Inv. Button/Pulse: falling edge triggered.

⚠	During operating mode "Sync Mode = External" the GPI input will be used for the external PPS and will not be available for the "Trigger Signal" feature.

Time Stamp at the Status Monitor

Time Stamp as a Serial Data String

TXD_1 at connector RJ45 REF as well as TXD_2 at connector RJ45 OPT can be configured to output time stamp data. The data string consists of 35 ASCII characters:

GPI data string = #1: <STX>E1:T:hh:mm:ss.ssssssss D:dd.mm.yy<ETX>

GPIO data string = #2: <STX>E2:T:hh:mm:ss.ssssssss D:dd.mm.yy<ETX>

Configuration: at the **Serial Interfaces** configuration page:

Mode (TXD_1 and/or TXD_2) = "Event: Time+Date".

Transmit of a GPI time stamp will be preferably at TXD_1, transmit of a GPIO time stamp will be preferably at TXD_2. If GPI and GPIO as well as TXD_1 and TXD_2 will be used for the time stamp feature, TXD_1 outputs GPI time stamps only and TXD_2 outputs GPIO time stamps only. If only one transmit line is used (TXD_1 or TXD_2), each time stamp automatically will be transmitted on the selected output.

1.5.5 Power-Up Sequence

---------- Self-Test ----------

All LEDs and lamps will shortly light up. This procedure will last about five seconds. All outputs are disabled.

---------- Warm-Up ----------

The high stability internal 10 MHz OCXO will perform best at a specific temperature of its oven. The time to reach this temperature depends on the ambient temperature. GNS 10 MHz measures the ambient temperature and calculates the amount of time until the frequency stability reaches < 1 ppm. Now the 10 MHz sine wave signals will be enabled. This procedure will last 24 s at minimum, 120 s at maximum. Typical delay at room temperature will be 60 s to 80 s.

---------- Data Reception ----------

The GNS 10 MHz module waits for valid external signals before internal signals will be ready for output. PPS on the one hand and time & date at the other hand will be treated different.

PPS: GNS 10 MHz expects a valid PPS signal. As soon as the external PPS has been accepted, the internal PPS will receive a hard setting to be in phase with the external PPS. Afterwards, PPS and all square wave signals will be enabled. Under normal condition, this procedure will last 20 s at maximum (subsequent to the warm-up).

If there wasn't any valid PPS signal detected 90 s after self-test, the buffered real-time clock will be checked. If this clock is valid (backup voltage is still above threshold), this real-time clock sets the internal clock and the outputs will be enabled. If the real-time clock is not valid, PPS and all square wave signals will be enabled 255 s after self-test.

Time & date: GNS 10 MHz expects a valid data string containing time & date. As soon as the data string has been accepted, the internal clock will be set and valid. Now the time can be continued automatically. Time & date output will be enabled not before the output of a PPS signal.

Just as it is for the PPS, the data of the real-time clock will set the internal clock 90 s after self-test, if this clock is valid and no external data are available. If the real-time clock is not valid, then the GNS 10 MHz module does not have any information about time & date, and there will be no data string enabled.

In any event, PPS output will be ready with a delay depending on the scenario. Time & date output, however, requires setting the internal clock, if necessary, by a manual entry.

---------- Normal Operating Mode ----------

Once enabled, each output will keep enabled; i. e. there is no automatic switch-off. Outputs can be disabled manually by configuration.

In case a 2nd receiver is installed and operating mode "Sync Mode = GNSS Automatic" has been selected, an automatic change-over may happen regarding the use of synchronization signals. This change-over will only has an effect on internal signals, but no effect on output signals.

If a difference of > 655 µs between internal and external PPS has been detected, and this difference passes the check on validity, the internal PPS (= PPS output signal) will receive a hard setting to be in phase with the external PPS. This may happen for example if first synchronization used the buffered real-time clock, and later on valid GNSS signals are available.

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/gns10/

Please check the **PC** connector (looking at the rear: on the left side) 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.

If you first plug to USB a driver has to be installed (driver available from the address above).

The new firmware should already be stored as a **.tcf** file at your computer. Standard name: "Rubidium GNS v.vv.vvv.tcf" (v.vv.vvv stands for a revision number, e.g. 2.14.20).

Please now execute the following steps:

1. Connect your computer to the **PC** connector of that RUBIDIUM frame where the module has been plugged. If the **PC** connector is used for any other purpose, please disconnect it.

   RS232 interface: Straight (1:1) connection between **PC** connector at the RUBIDIUM frame and RS232 of the computer.

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

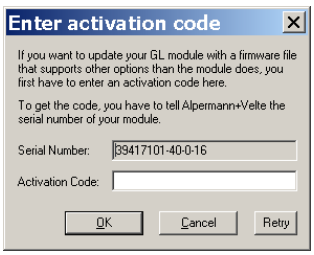
   Switch on the power of all units.

2. Execute "Rubidium Config" on your computer. Open the "*Port*" dropdown list and 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 (upper line of the window).

5. Open the **.tcf** file and click *OK* to start the flash update.



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. Now start the update process again.

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

6. Update is finished now. We recommend checking module's configuration.

During the flash update the operation of the module stops!

2 Installation

2.1 Choice of Antenna

Please notice chapter "Specifications" for antenna requirements. Below, two types of antennas will be described which have passed many tests and fulfil the requirement of multi GNSS reception as well as excellent performance.

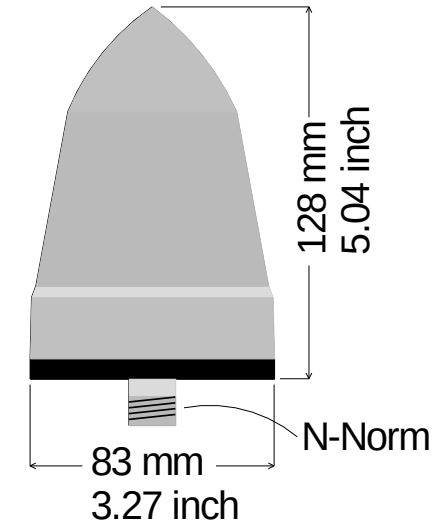
2.1.1 Pole Mount GNSS Antenna with Integrated Lighting Protection

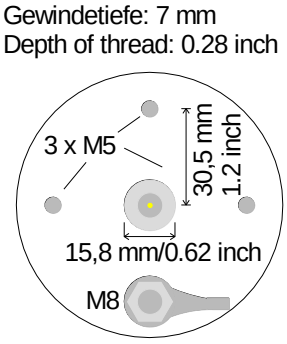
Product ordering: **ANTG**

Specifications

Antenna type	GPSGL-TMG-SPI-40NCB
Operating voltage	3.3–9.0 VDC
Operating current	< 40 mA
Amplifier gain	40 dB ±4 dB @ GPS; 38 dB ±4 dB @ GLONASS
Frequency band	1575.42 ±10 MHZ; 1602–1615 MHz
Temperature range	-40 °C to +85 °C
Antenna cable connector	N, female
Weight	≈ 0.35 kg

Mechanical





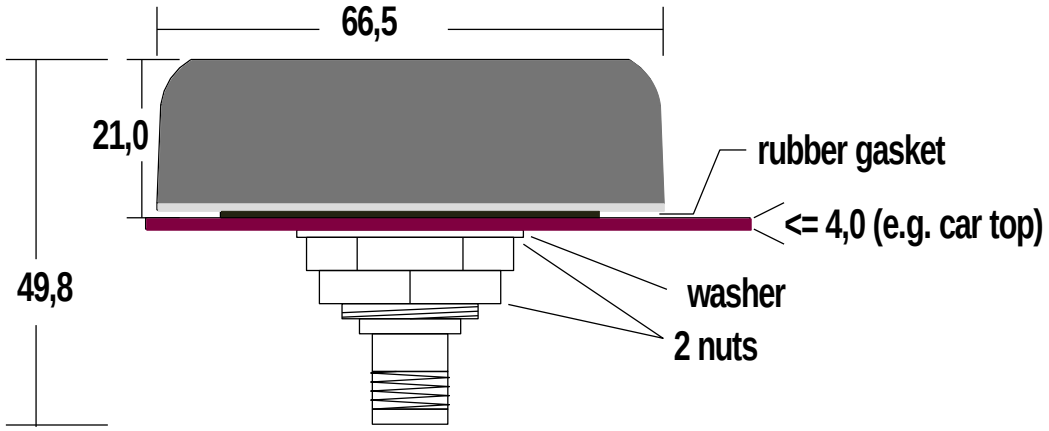
2.1.2 Low Profile GNSS Timing Antenna

Product ordering: **ANTGLP**

Specifications

Antenna type	TW3440
Operating voltage	2.5–16 VDC
Operating current	21 mA typical
Amplifier gain	≥ 40 dB
Frequency band	1575,42 to 1606 MHz
Temperature range	-40 °C to +85 °C
Antenna cable connector	TNC, female
Weight	≈ 0.14 kg

Mechanical [Dimensions in mm]



2.2 Antenna Installation

The GLONASS and GPS satellites are not stationary but circle round the globe in a period of about 12 hours. The antenna must be installed outdoors where an unobstructed view of the sky exists. Rooftops generally make good locations due to clear overhead sky with views to the horizon, allowing the antenna unit to see and track the maximum number of satellites throughout the day. Installations with obstructed views may prove operational but may experience reduced reception quality and the inability to simultaneously track the maximum number of satellites.

In addition to clear sky coverage, select a site which would not allow the antenna unit to become buried in drifted or accumulated snow.

When installing multiple antennas, we recommend separating them by at least 1 m.

When installing the antenna near other transmission antennas, we recommend separating it in height by at least 3 m.

2.3 The Antenna Cable

Use only a high quality 50 Ω coaxial cable from well known manufactures, with low loss and high frequency.

The choice of the cable strongly depends on the length needed for your application. More length means higher signal loss. The longer the cable, the lower should be the loss of the cable, and this means enhanced quality.

Additionally, bending radius, outer diameter, and weight may be of interest for your installation.

One method to find a suitable cable is to compare amplifier gains (antenna amplifier, in-line amplifier, minimum gain at receiver input) with attenuations of all parts between antenna and receiver (lightning arrestor, cable, coupler plugs).

We start with a minimum recommended gain at receiver input of **+15 dB**. Any higher value will be welcome.

Our recommended antennas have **+40 dB** at output. If you use a different type, please find the amplifier gain at the specifications.

No more attenuation than the difference (our example: 40 – 15 = **+25 dB**) is allowed by all parts between antenna and receiver. Cable specifications give you attenuation [dB/100 m] at different frequencies. GPS/Galileo works at L1 C/A 1575,42 MHz frequency, GLONASS works at up to 1610 MHz. Attenuation has to refer to this frequency band (you have to interpolate if this frequency range is not listed).

If longer cables than 100 m are needed, use an in-line amplifier. In-line amplifier usually have a gain of **+15–25 dB**, this will enable much longer cables. Install an in-line amplifier as close to the antenna as possible.

Example of typical cables:

{These are guiding values; they will vary between different manufacturers}

	RG174/U 7805R	RG58/U 7806A	H155	RG213/U 8267	LMR-240	RG8/X 7808A	RG8 LMR-400	LMR-600
Cable Ø [mm]	2.8	4.95	5.4	10.3	6.1	6.1	10.3	12.5
Bending radius [mm]	6.35	25.0	35	127	63.5	63.5	101.6	38.1
Weight [kg/km]	14.9	30	38	157	53	53.6	100	200
Delay [ns/m]	4.569	5.054	4.118	5.054	3.971	3.879	3.924	3.834
Attenuation [dB/100m] 1610 MHz	89.96	46.75	39.81	34.25	33.57	31.06	17.46	11.34
Length of cable (→) at dB attenuation (↓):								
6	6.7	12.8	15.1	17.5	17.9	19.3	34.4	52.9
8	8.9	17.1	20.1	23.4	23.8	25.8	45.8	70.5
10	11.1	21.4	25.1	29.2	29.8	32.2	57.3	88.2
12	13.3	25.7	30.1	35.0	35.7	38.6	68.7	105.8
14	15.6	29.9	35.2	40.9	41.7	45.1	80.2	123.5
16	17.8	34.2	40.2	46.7	47.7	51.5	91.6	141.1
18	20.0	38.5	45.2	52.6	53.6	58.0	103.1	158.7
20	22.2	42.8	50.2	58.4	59.6	64.4	114.5	176.4
22	24.5	47.1	55.3	64.2	65.5	70.8	126.0	194.0
24	26.7	51.3	60.3	70.1	71.5	77.3	137.5	211.6

Example of application:

50 m cable length is needed.
Attenuation should be ≤ 20 dB.
Find value "20" at first column at "Length of cable at dB attenuation". This row gives you the maximum length of each cable type. You can use for example H155 cable. Any type of cable in the columns further to the right will do even better.

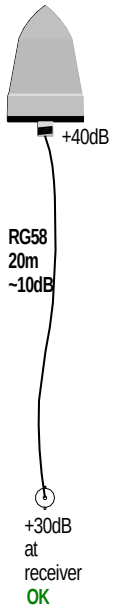
"Delay [ns/m]" indicates the propagation delay caused by each meter of cable. The GNS 10 MHz module is able to compensate delays. Calculate the delay and then enter this value at the **Timing** configuration page. This is especially important if you install multiple antennas/receivers with different cable types or lengths.

Example: 50 m cable LMR-240 → delay = 50 x 3,971 = 198,55 ns → ≈ 200 ns.

Entry at "Antenna Delay": **20** (x 10 ns).

Recommendations for typical cable lengths:

Example:



Length needed	Type of cable
≤ 30 m	RG58U or H155
20–35 m	H155
30–40 m	LMR-240 or RG8/X
35–50 m	RG8/X
50–80 m	LMR-400 or in-line amplifier + H155
70–100 m	LMR-600 or in-line amplifier + RG8/X
100–180 m	In-line amplifier + LMR-400
160–280 m	In-line amplifier + LMR-600

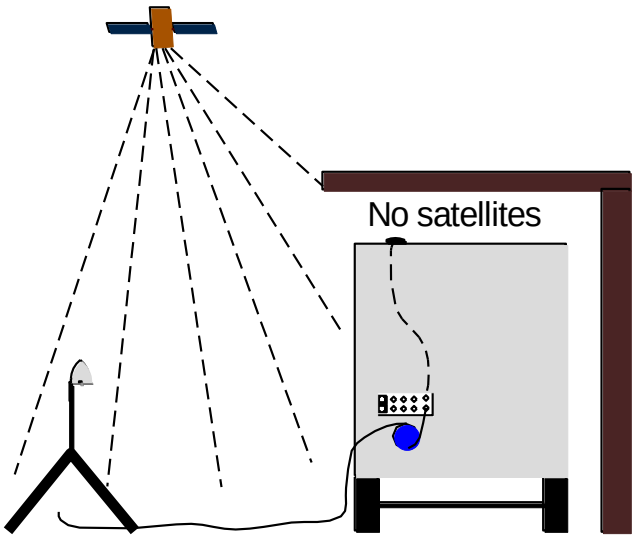
Example:

The cable transports the power for the antenna. Please make sure that there is no short-circuit between the inner and outer conductor of the cable!

2.4 RUB GNS10-2: Double Receiver Assembly

This option enables the following features:

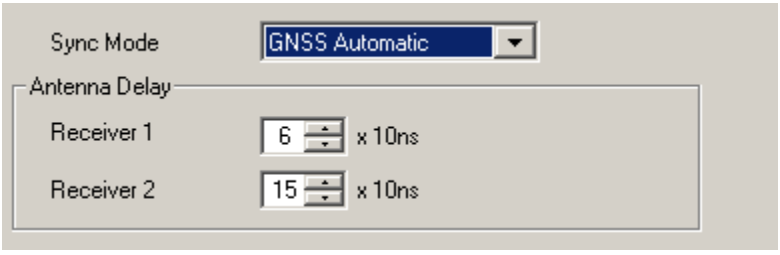
- It greatly improves the availability of GNSS signals.
- It gives redundancy on antenna and receiver.
- It solves the problem on OB van installations, when a fixed mounted antenna is blocked by a hall ceiling or by surrounding buildings. The 2nd antenna with a long cable can be placed to a position with a clear view to the sky. The 2nd receiver will now see satellites and will deliver stable output signals.



⚠	It is recommended to have both antennas connected permanently!

The GNS 10 MHz module permanently monitors both receivers and automatically uses the signals of the receiver with best reception quality.

Configuration: select "Sync Mode = GNSS Automatic" at the **Timing** configuration page.



If cable lengths are different, calculate the propagation delays and enter the results at the "Antenna Delay" entry. For more information please refer to chapter "The Antenna Cable".

3 Status Monitor

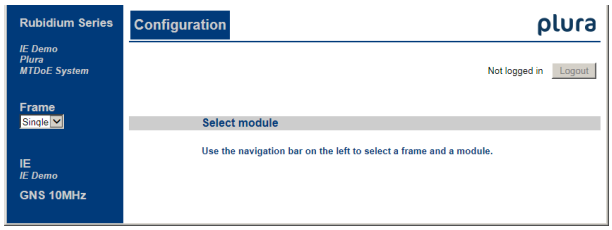
3.1 Status Monitor by the Ethernet Module

The RUBIDIUM SERIES HTTP server, which is located in the Ethernet module (**RUB IE** or **RUB PM**), offers a status monitor.

Please refer to the '*Functional Descriptions and Specifications RUB Ethernet*' manual for a detailed description of the RUB Ethernet module and how to access a RUBIDIUM module.

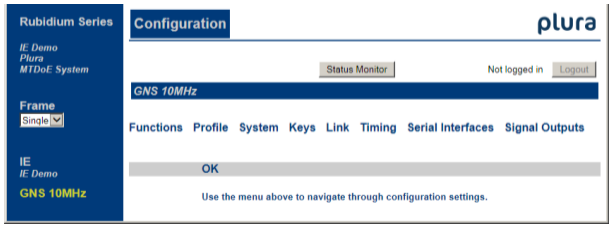
Start an Internet Browser and type in the IP address of the Ethernet Module.

If GNS 10 MHz does not appear in the bar on the left, you have to enter the correct address of the chassis at the **Frame** entry.



Click **GNS 10 MHz** to access the GNS 10 MHz module.

Click the Status Monitor button to open the status monitor. It is not necessary to perform a **LOGIN**.



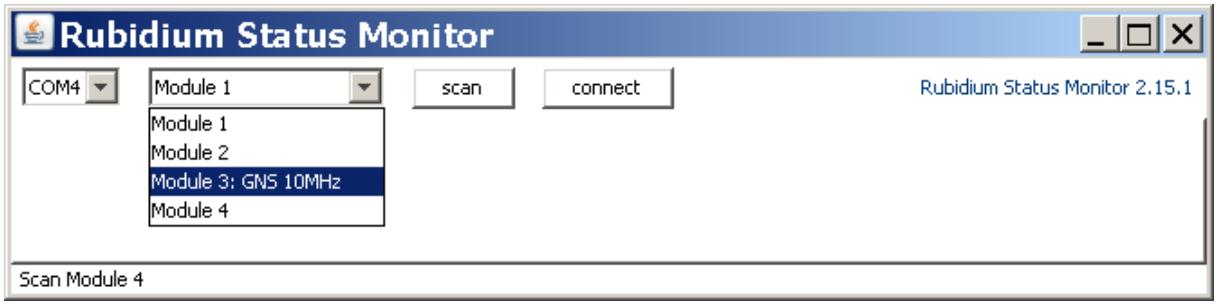
Requirements:

- Please have Java Runtime Environment 1.6.0 ("Java 6") 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.

3.2 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 Configuration and Status Monitor PC Programs*" packet you can download at https://plurainc.com/products/gns10/.

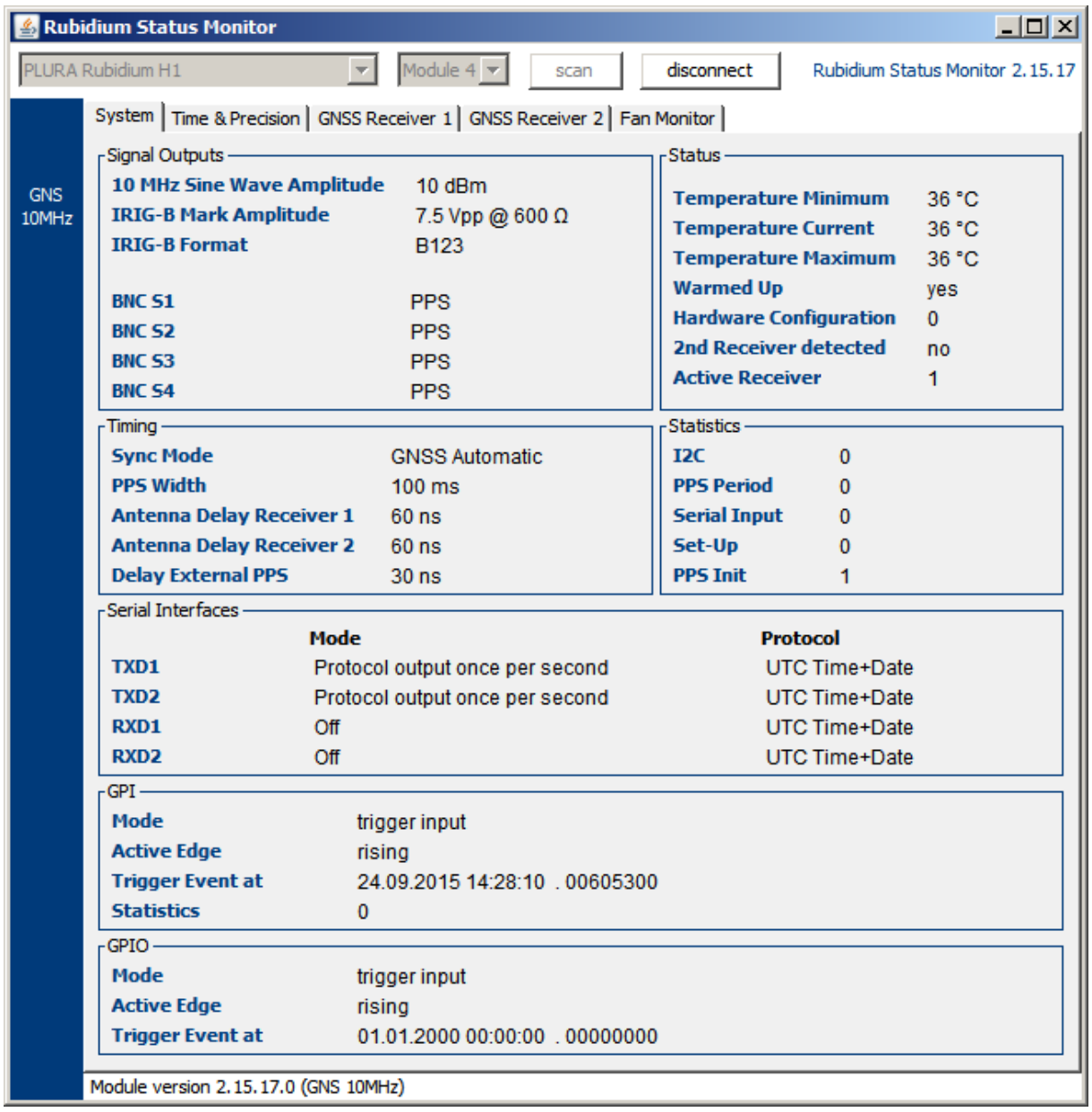
Execute this program, select the COM port or USB connection and press the **scan** button to get a list of the modules plugged to this housing. Select the module and press the **connect** button.



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.

3.3 Status: System



Signal Outputs {Feedback on current set-up}		**Status**	
10 MHz Sine Wave Amplitude	Output level	Temperature Minimum	
IRIG-B Mark Amplitude	Output level	Temperature Current	
IRIG-B Format	Selected format	Temperature Maximum	
		Warmed Up	yes/no
BNC S1	Programming of output BNC S1	Hardware Configuration	0
BNC S2	Programming of output BNC S2	2nd Receiver detected	yes/no
BNC S3	Programming of output BNC S3	Active Receiver	1/2
BNC S4	Programming of output BNC S4		

Timing {Feedback on current set-up}	**Statistics** {Service purposes only}

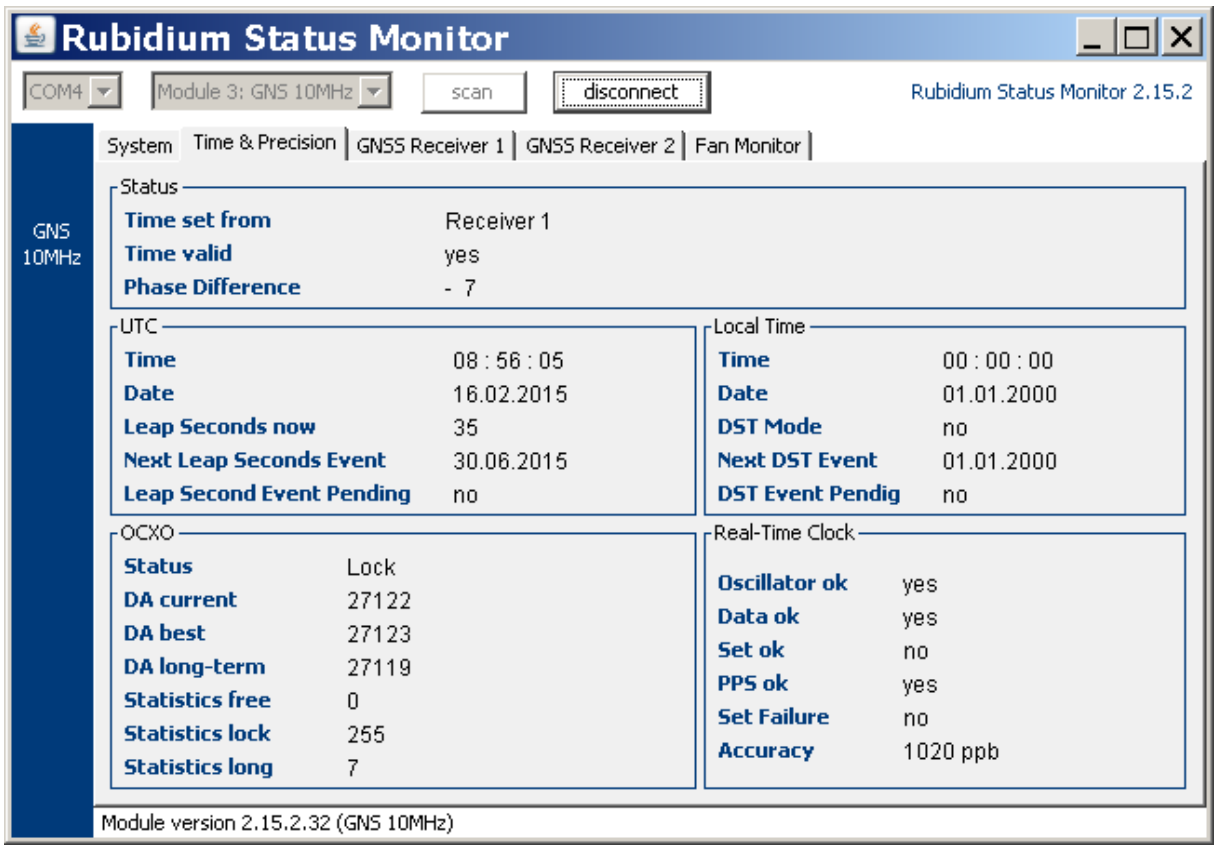
Sync Mode	Current operating mode	I2C
PPS Width	Selected width of PPS	PPS Period
Antenna Delay Receiver 1	Propagation delay at antenna input A	Serial Input
Antenna Delay Receiver 2	Propagation delay at antenna input B	Set-Up
Delay External PPS	Delay of external PPS	PPS Init

Serial Interfaces	{Feedback on current set-up}
Mode	**Protocol**
TXD1	
TXD2	
RXD1	
RXD2	

GPI	
Mode	Configuration of GPI mode
Active Edge	Selected active edge
Trigger Event at	Indication of last trigger event: Day.Month.Year HH:MM:SS.nnnnnnnn
Statistics	{Service purposes only}

GPIO	
Mode	Configuration of GPIO mode
Active Edge	Selected active edge
Trigger Event at	Indication of last trigger event: Day.Month.Year HH:MM:SS.nnnnnnnn

3.4 Status: Time & Precision

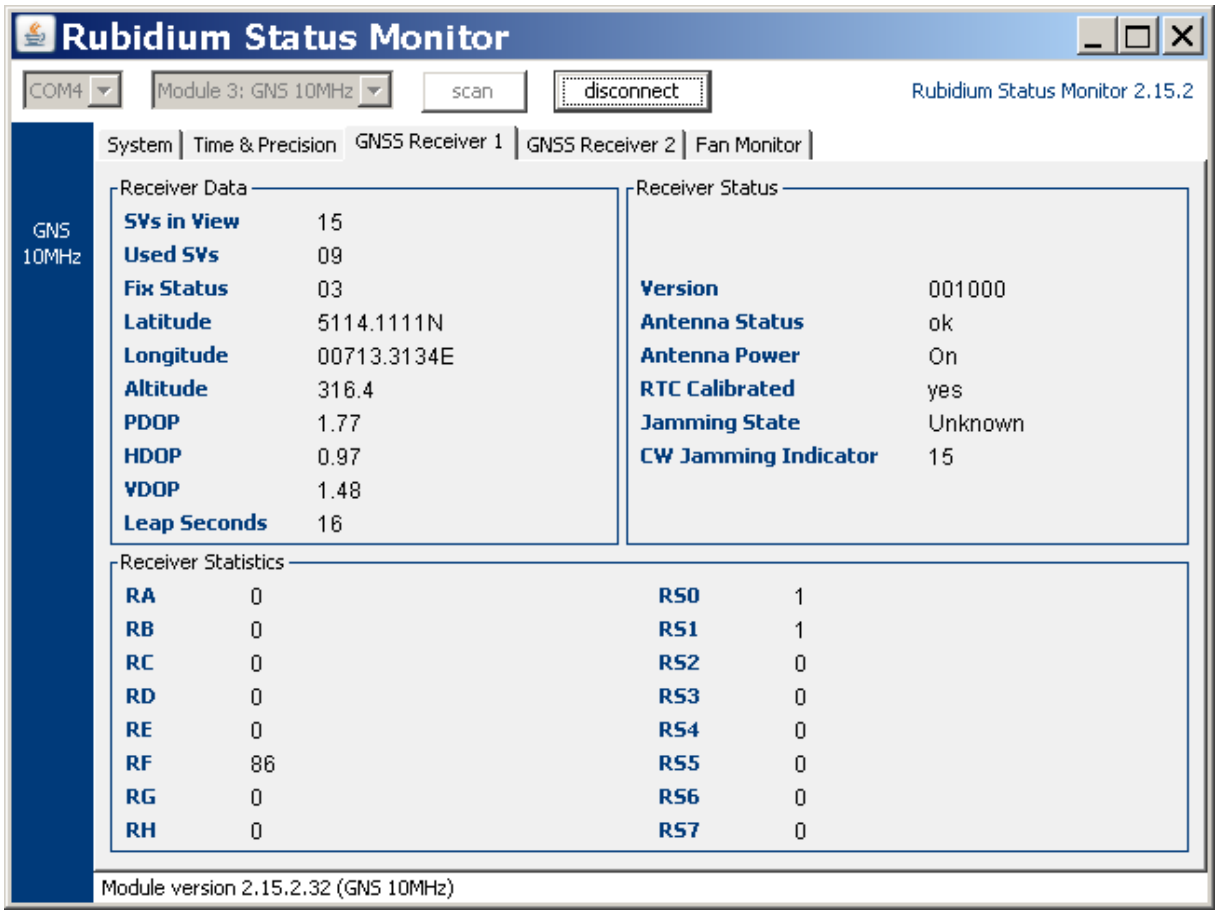


Status		
Time set from	None/Receiver 1/Receiver 2/External/RTC/manual {Identifies the source which has last set the internal clock}	
Time valid	yes/no	{If 'yes', then internal clock has been set and time & date outputs are enabled}
Phase Difference	+/-	{Phase difference (x 10 ns) between internal PPS and PPS of reference}

UTC	{Actual data of internal clock}	**Local Time**
Time	Current time, time zone = UTC	{Future use}
Date	Current date, time zone = UTC	Time
Leap Seconds now	Current number of leap seconds TAI–UTC	Date
Next Leap Seconds Event	Date when next leap second event occurs	DST Mode
Leap Second Event Pending	'yes' during last hour before leap second event	Next DST Event
		DST Event Pending

OCXO	{Actual state of the high-precision oscillator}	**Real-Time Clock**
Status	Warm-Up / Free / Free Adjust / Free Long-Term / Adjust / Maximum Adjust / Lock	Oscillator ok
DA current	{Service purposes only}	Data ok
DA best	{Service purposes only}	Set ok
DA long-term	{Service purposes only}	PPS ok
Statistics	{Service purposes only}	Set Failure
		Accuracy

3.5 Status: GNSS Receiver 1/2



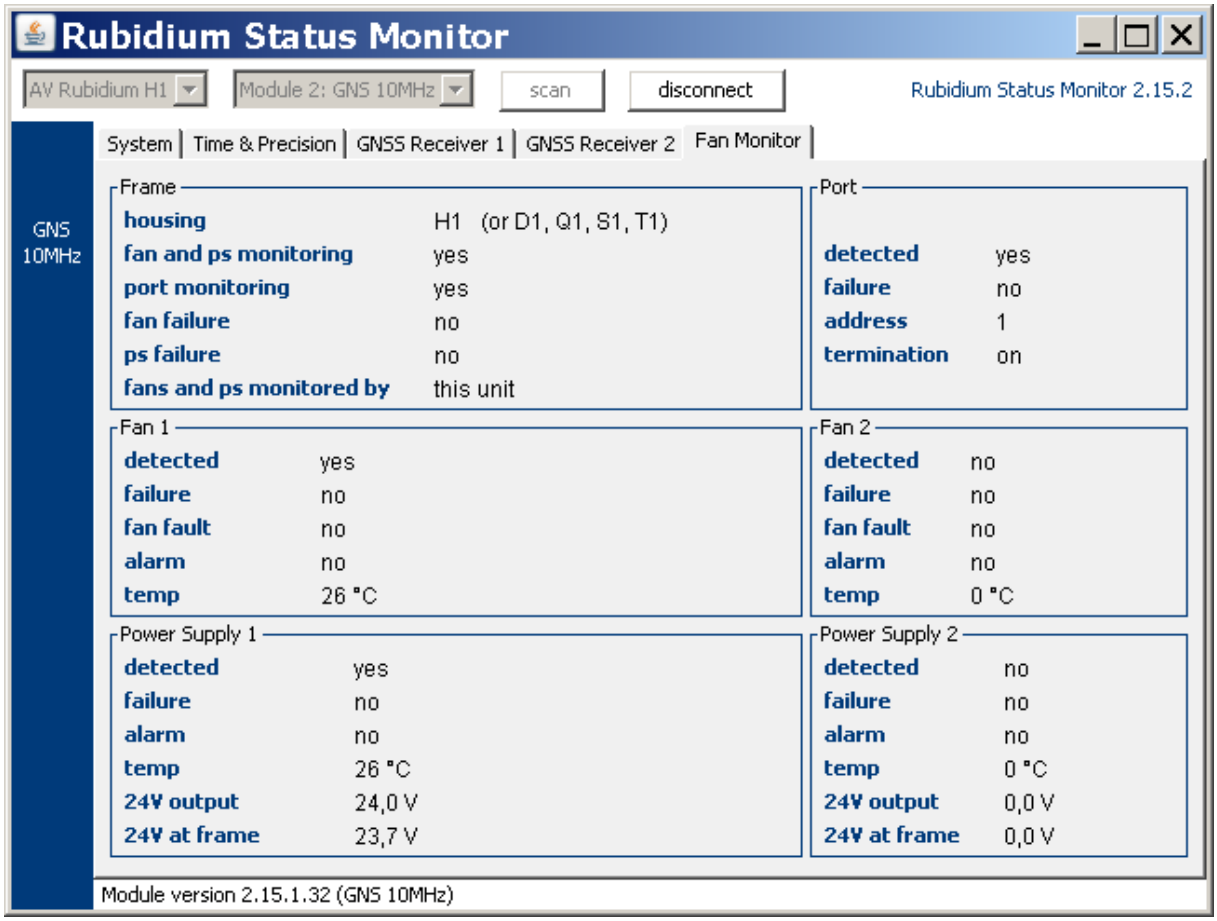
Receiver Data	{Display of data which directly come from the receiver}
SVs in View	Number of visible satellites with an elevation of ≥ 5 ° at the current constellation
Used SVs	Number of satellites currently used for navigation
Fix Status	State of position fix: 1 = fix not available 2 = 2D fix (minimum 3 satellites) 3 = 3D fix (minimum 4 satellites)
Latitude	Latitude
Longitude	Longitude
Altitude	Altitude, mean sea level
PDOP	Position dilution of precision = $(HDOP^2 + VDOP^2)^{1/2}$ 1–2 excellent 2–5 good 5–10 moderate 10–20 fair > 20 poor
HDOP	Horizontal dilution of precision
VDOP	Vertical dilution of precision
Leap Seconds	Leap seconds of the GPS time

Receiver Status	{Service purposes only}

Receiver Statistics	{Service purposes only}

3.6 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 **GPS 10 MHz**.



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

4 The Rubidium Configuration Tools

4.1 The Rubidium Configuration PC Program

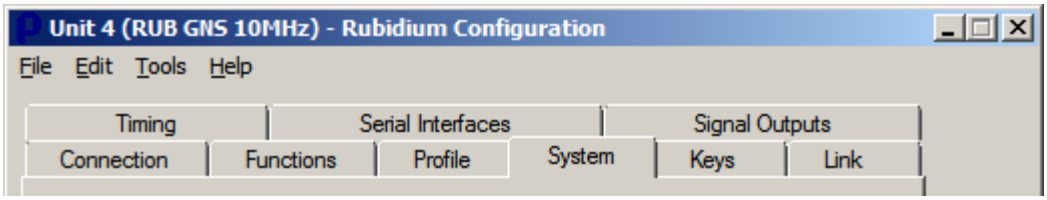
Please refer to the

'Installation & Systems Manual RUBIDIUM SERIES'

for a general description of this program and how to install it. In this document please notice the chapter *'The Rubidium Configuration PC Program'* and its 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 computer's keyboard afterwards.

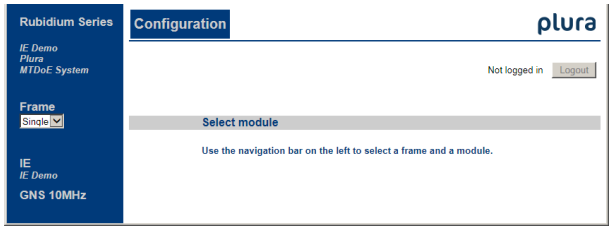
4.2 The Rubidium Series HTTP Server

The RUBIDIUM SERIES HTTP server, which is located in the Ethernet module (**RUB IE** or **RUB PM**), offers a status monitor.

Please refer to the '*Functional Descriptions and Specifications RUB Ethernet*' manual for a detailed description of the RUB Ethernet module and how to access a RUBIDIUM module.

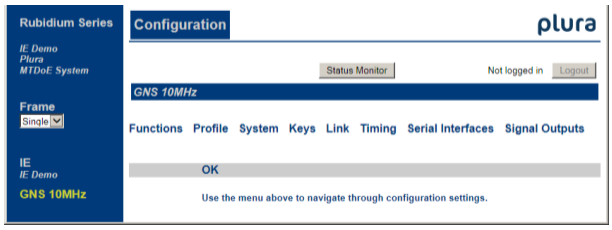
Start an Internet Browser and type in the IP address of the Ethernet Module.

If GNS 10 MHz does not appear in the bar on the left, you have to enter the correct address of the chassis at the **Frame** entry.



Click **GNS 10 MHz** to access the GNS 10 MHz module.

A horizontal menu appears which shows a list of all configuration pages which are currently available. With a click on one of these entries of the menu a configuration page will be opened where you can see and change parameters. If it is the first time that you try to open a configuration page, you have to pass the **LOGIN**.



Changes on a parameter will not be stored automatically. At the bottom of each page there are two buttons which should be used to transfer the parameters:

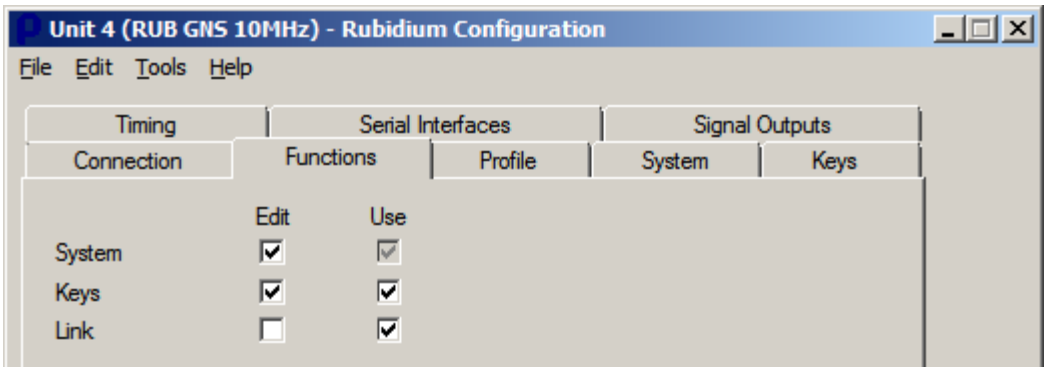
Save To Module: Click this button to store the changes on the module.

Reload From Module: Click this button to refresh the configuration page.

4.3 “Functions“: Functions of the Module

The configuration page **Functions** indicates the complete range of functions. It is possible to individually switch on or off functions.

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



The **Edit** and **Use** checkboxes define the state of a function:

Edit	**Use**	State of a function
		Function disabled; corresponding configuration page not available.
√	√	Function enabled; corresponding configuration page available.
	√	Function enabled; corresponding configuration page not available. This avoids any unintentional operating.

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

Functions **Profile**, **Timing**, **Serial Interfaces** and **Signal Outputs** cannot be switched off.

Function **System** cannot be switched off completely, i.e. the corresponding **Use** checkbox is inoperable.

Attention using the Browser:

Changes on any parameter will not be transferred to the module automatically. Click “**Save To Module**” to store the changes at this configuration page to the module.

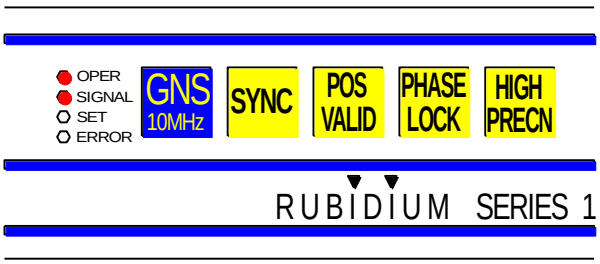
List of functions:

Profile	Store and Load Set-Ups (*)
System	Name, Boot, Info, Fan, SNMP
Keys	Keys and Lamps, LEDs and GPI/GPIO
Timing	Operating Parameters of Synchronization
Signal Outputs	Level and Frequencies
Serial Interfaces	Programming the Serial Interfaces
Link	Communication between Modules

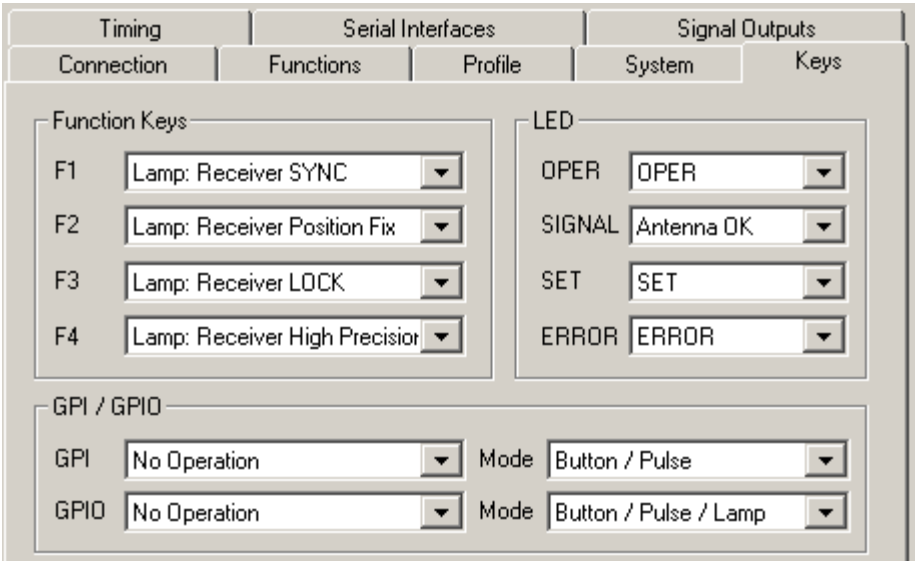
(*) refer to ‘*Installation & Systems Manual RUBIDIUM SERIES*’

4.4 “Keys“: Keys and Lamps, LEDs and GPI/GPIO

RUB1 version modules have four illuminated buttons (keys and lamps) and four LEDs (Light Emitting Diodes). Additionally, one GPI (input) and one GPIO (input or output) are available. Basically, the functions of these in- and outputs are programmable.



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



Function Keys (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. The following functions are especially provided for this module:

Lamp: Receiver SYNC	Feedback: Time & date has been set, either from received signals (GNSS receiver, external source), buffered real-time clock, or manual.
Lamp: Receiver Position Fix	Feedback: The receiver which currently is active has a 3D position fix.
Lamp: Receiver LOCK	Feedback: OCXO is synchronised in frequency and phase.
Lamp: Receiver High Precision	Feedback: OCXO has reached high precision after a sufficient time of continuous LOCK.

LED

RUB1 version modules offer four LEDs (named OPER, SIGNAL, SET, and ERROR) which can get a function independently from each other. Select a function from the drop-down list. The following functions are especially provided for this module:

OPER	Lights up, if the module is operating.
Antenna OK	Lights up, if the module detects that an antenna has been connected.

GPI

GPI is a highly accurate timing input. The following functions are especially provided for this module:

PPS	Input of a precise PPS signal if "Sync Mode = External" is selected.
Trigger Signal	Edge sensitive trigger input to generate a time stamp.

Select the active edge with **Mode**:

Button/Pulse	positive/rising edge
Inv. Button/Pulse	negative/falling edge

GPIO

GPIO can be used as input or output. The following functions are especially provided for this module:

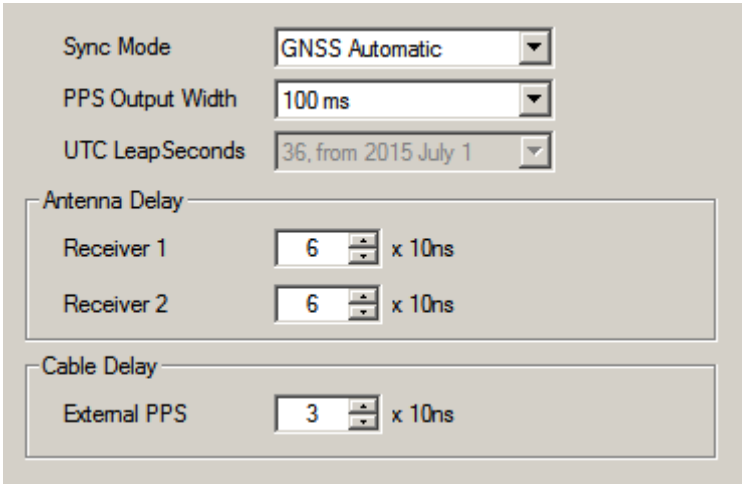
Alarm	GPIO as output. Output switches to the active state in case of an alarm. Alarm conditions: • Failure of the frequency and phase synchronization. • GNSS receiver Position Fix failure.
Trigger Signal	GPIO as input. Edge sensitive trigger input to generate a time stamp.

Select the active state or active edge with **Mode**:

Button/Pulse/Lamp	Output: active low Input: positive/rising edge
Inv. Button/Pulse/Lamp	Output: active high Input: negative/falling edge

4.5 “Timing“: Operating Parameters of Synchronization

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



Sync Mode

GNSS Automatic The signals of the GNSS receiver are used for frequency and phase synchronization of the internal clock. If two receivers are installed, there will be an automatic change-over to the receiver with best reception quality.

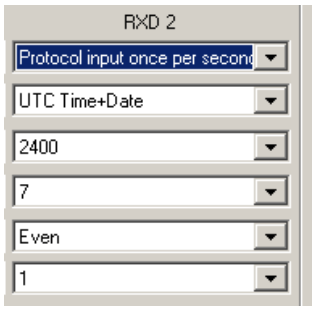
GNSS Receiver 1 only Only signals of GNSS receiver 1 (antenna at connector A) will be used for synchronization. Even in the case of a failure there will be no change-over.

GNSS Receiver 2 only Only signals of GNSS receiver 2 (antenna at connector B) will be used for synchronization. Even in the case of a failure there will be no change-over.

External: RxD_2 + PPS Alternatively, the signals of an external source can be used for frequency and phase synchronization of the internal clock.

This requires connecting a very stable and precise PPS to GPI. GPI will automatically be set into mode “PPS“.

A serial data string containing time & date should be connected to RXD_2. RXD_2 has to receive a complete set-up in a way that all parameters conform to the external data string. Example:



External: RLC + PPS For special applications it’s possible to receive an external real-time over TC_Link.

PPS Width PPS is always an active high signal.
Select the pulse width: 0.1 / 1.0 / 10 / 100 ms

UTC Leap Seconds The GNS 10 MHz module receives the number of leap seconds from the GNSS receiver. As soon as this information has been accepted this entry will be greyed out, a manual input no longer is possible. After a leap second event a manual entry may be necessary if no GNSS signals are available or the leap second information is missing (for example at "Sync Mode = External").

Note: Enter the UTC leap seconds (TAI–UTC), not the GPS leap seconds.

Antenna Delay

There is a certain propagation delay with each meter of the antenna cable. Compensating this delay increases the absolute accuracy and makes PPS signals comparable.

This is especially recommended in an installation with several antennas/receivers and different types or lengths of cables.

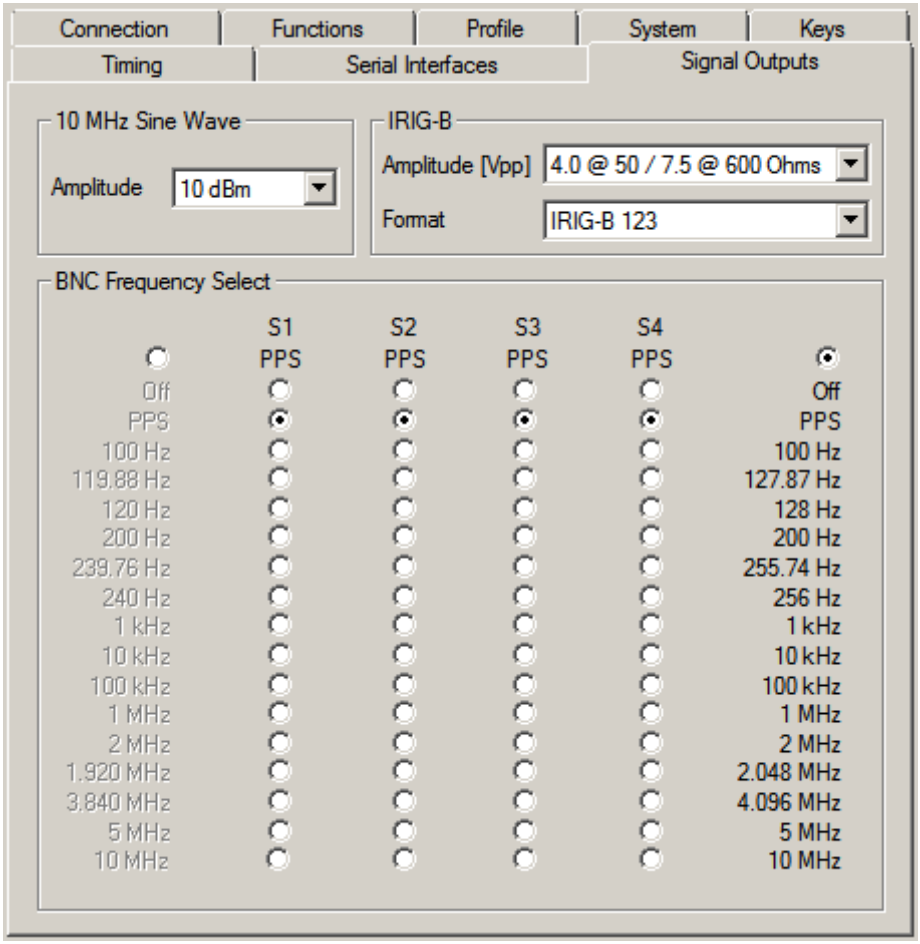
Please refer to chapter "The Antenna Cable".

Cable Delay

This setting compensates the timing of an external PPS if it is shifted against the actual start of seconds.

4.6 “Signal Outputs“: Levels and Frequencies

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



10 MHz Sine Wave

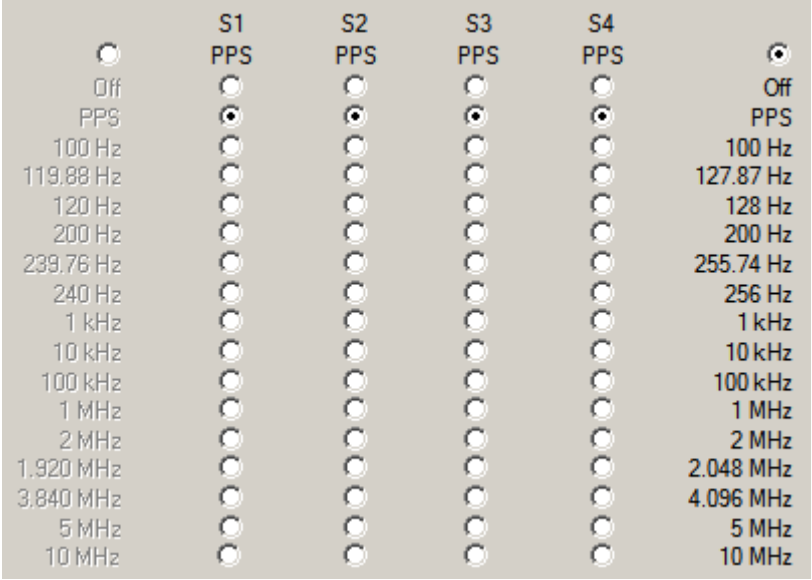
Amplitude Level at BNC 50 Ω	Identical level at all outputs, adjustable to (±10 %): dBm — Vpp @ 50 Ω — Vpp without termination 6 — 1.3 — 2.8 8 — 1.6 — 3.6 10 — 2.0 — 4.5 12 — 2.5 — 5.7

IRIG-B

Amplitude Level at BNC 50 Ω (optional) Level refers to “Mark“ amplitude	2.5 Vpp @ 50 Ω / 4.6 Vpp @ 600 Ω 3.1 Vpp @ 50 Ω / 5.8 Vpp @ 600 Ω 4.0 Vpp @ 50 Ω / 7.5 Vpp @ 600 Ω 5.0 Vpp @ 50 Ω / 9.1 Vpp @ 600 Ω
Format	IRIG-B 120 – IRIG-B 121 – IRIG-B 122 – IRIG-B 123 IRIG-B 124 – IRIG-B 125 – IRIG-B 126 – IRIG-B 127

BNC Frequency Select

Each output S1, S2, S3, and S4 can receive an individual set-up.
The second row indicates what has been selected.
Click the radio button to enable either the list to the left or the list to the right.



The following signals are can be selected on both lists:

PPS or 0.1 / 0.2 / 1 / 10 / 100 kHz or 1 / 2 / 5/ 10 MHz,

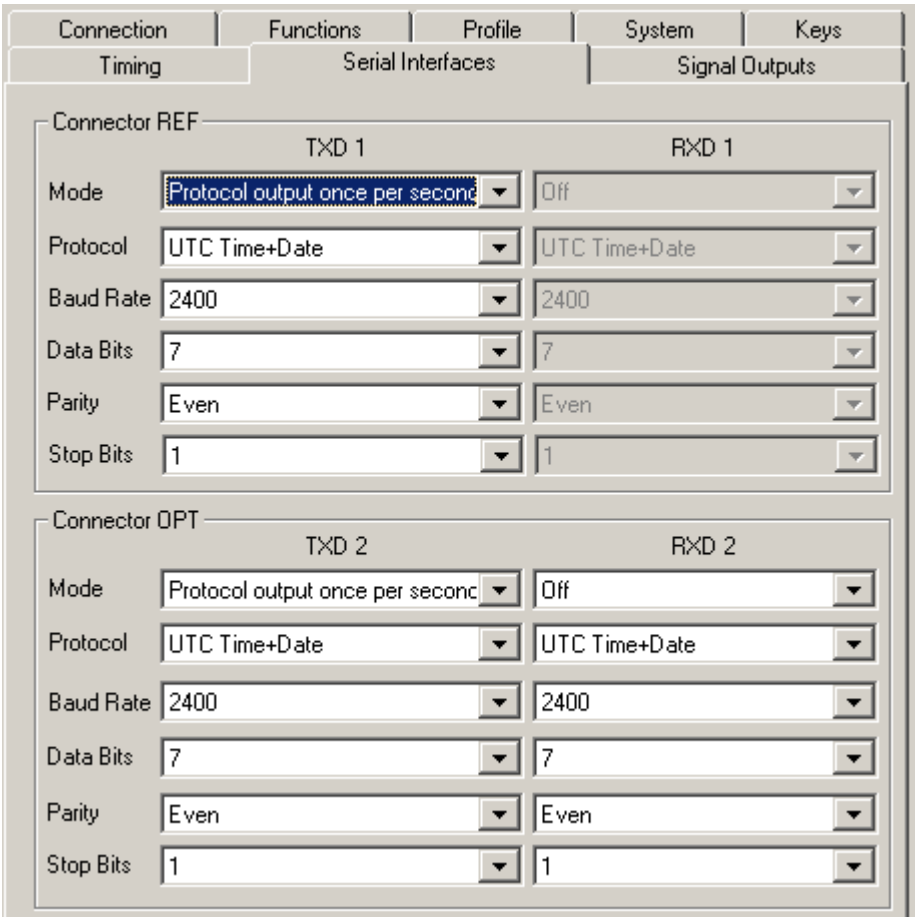
Alternatively, you can select:

List to the left	List to the right
119.88 Hz (120/1.001)	127.87 Hz (128/1.001)
120.00 Hz	128.00 Hz
239.76 Hz (240/1.001)	255.74 Hz (256/1.001)
240.00 Hz	256.00 Hz
1.920 MHz	2.048 MHz
3.840 MHz	4.096 MHz

4.7 “Serial Interfaces“: Programming the Serial Interfaces

The GNS 10 MHz module offers two transmit lines (TXD_1 and TXD_2) and two receive lines (RXD_1 and RXD_2). Each line can be configured individually. The electrical format conforms to RS232.

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



Connector REF TXD_1 and RXD_1

	TXD_1	RXD_1
Mode	**Off**: Transmit line disabled. **Protocol Output once per second**: A data string containing time, date, and status information will be sent once per second (please also notice chapter “Time & Date Output“). Select the data string at **Protocol**. **Event Time + Date**: With GPI or GPIO in mode “Trigger Signal”, a time stamp will be transmitted after an event (please refer to chapter “Capture of Trigger Events“). **Bypass Receiver 1**: For service purposes only. **Bypass Receiver 2**: For service purposes only.	{future use}

	TXD_1	RXD_1
Protocol	UTC Time + Date UTC Time + Date + Leap Seconds → *Protocol description below* ←	
Baud Rate	2 400, 4 800, 9 600, 19 200, 38 400, 57 600, 115 200	
Data Bits	7, 8	
Parity	None, Even, Odd	
Stop Bits	1, 2	

Connector OPT TXD_2 und RXD_2

	TXD_2	RXD_2
Mode	**Off**: Transmit line disabled. **Protocol Output once per second**: A data string containing time, date, and status information will be sent once per second (please also notice chapter "Time & Date Output"). Select the data string at **Protocol**. **Event Time + Date**: With GPI or GPIO in mode "Trigger Signal", a time stamp will be transmitted after an event (please refer to chapter "Capture of Trigger Events"). **Bypass Receiver 1**: For service purposes only. **Bypass Receiver 2**: For service purposes only.	**Off**: Receive line disabled. **Protocol Input once per second**: A data string is expected once per second containing time, date, and status information. Select the data string at **Protocol**. This feature requires to select "Sync Mode = External", i. e. PPS and serial data string of an external source is used for synchronization instead of signals from the GNSS receiver.
Protocol	UTC Time + Date UTC Time + Date + Leap Seconds → *Protocol description below* ←	
Baud Rate	2 400, 4 800, 9 600, 19 200, 38 400, 57 600, 115 200	
Data Bits	7, 8	
Parity	None, Even, Odd	
Stop Bits	1, 2	

The "UTC Time + Date " data protocol

32 characters of ASCII format: <STX>D:01.01.98;T:4;U:14.15.41;*uvxy*<ETX>

STX	start of text	$02
D:	followed by the date	day.month.year
;		$3B
T:	followed by the day of week	1-7, 1 = Monday
;		$3B
U:	followed by the time	hours.minutes.seconds A leap second is transferred as second = 60
;		$3B
u	status of time & date	"Sync Mode = GNSS Receiver": # ($23) time of internal clock is not yet precise ' ' ($20) time of internal clock is precise "Sync Mode = External": The received status will be passed
v	SYNC and LOCK	"Sync Mode = GNSS Receiver": * ($2A) SYNC or LOCK not yet reached ' ' ($20) SYNC and LOCK "Sync Mode = External": The received status will be passed
x	time zone indicator	U = UTC
y	announcement of a leap second event	A = announcement of a leap second event during the hour preceding the event ' ' = no announcement
ETX	end of text	$03

The "UTC Time + Date + Leap Seconds" data protocol

36 characters of ASCII format: <STX>D:01.01.11;T:4;U:14.15.41;*uvxy;lll*<ETX>

32 characters of this data protocol conforms to the "UTC Time + Date". There are four additional characters shown in red:

;		$3B
lll	UTC leap seconds	Number of UTC leap seconds, for example 035 at 17.02.2015

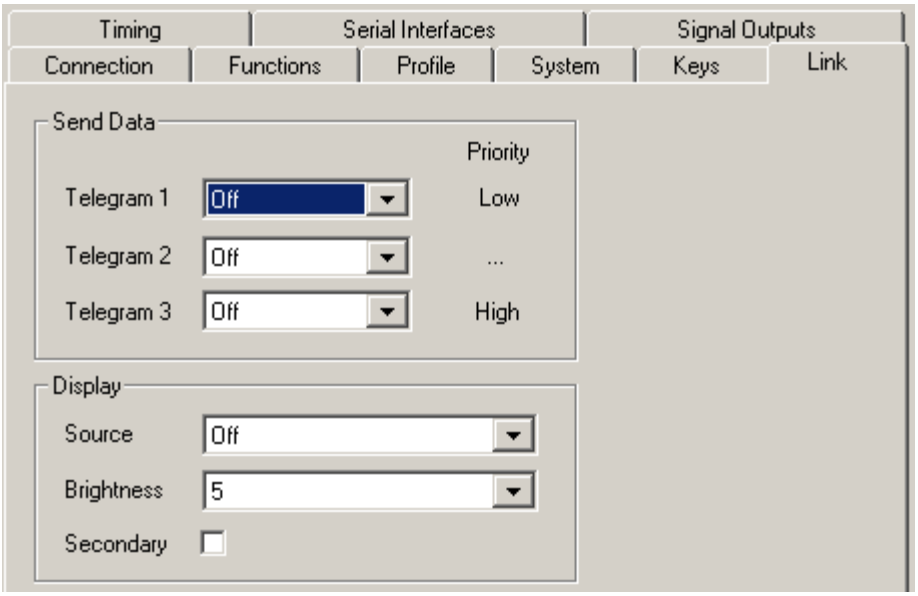
4.8 “Link”: Communication between Modules

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.

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



Send Data

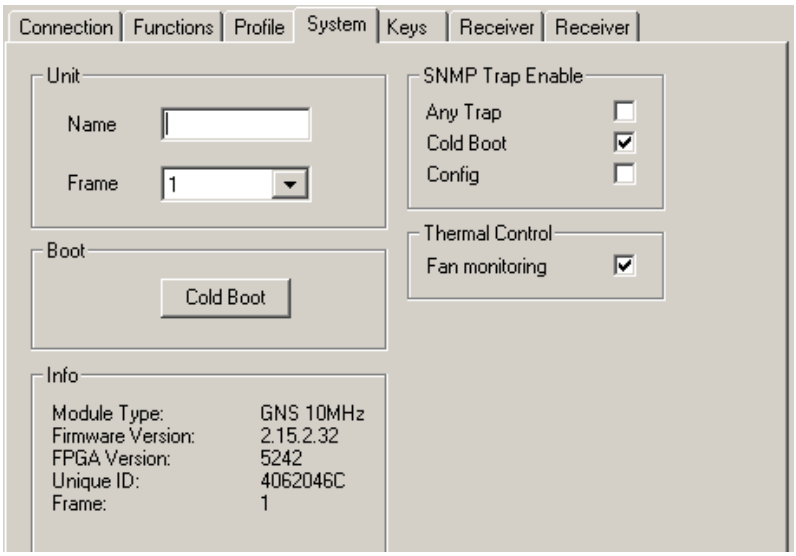
Three channels (**Telegram 1 - 3**) have been provided to transmit data in a time code format. For each channel a function can be selected from the drop-down list:	
Off	This channel will not be used to transmit data, data can be received.
Reference	This channel transfers time and date (UTC).

Display

Adjust the parameters controlling the display of a RUBIDIUM **D1** or **Q1** chassis.		
Source	Select the kind of data to be sent and displayed:	
	Off	No data will be sent from this module.
	Real-Time	Time of the reference (UTC) in a HH:MM:SS format.
	Date	Date of the reference (UTC) in a Day.Month.Year format.
Brightness	Adjust the brightness of the LEDs, steps 1 to 7.	
Secondary	Address the ‘secondary’ display instead of the ‘primary’ display.	

4.9 “System“: Name, Boot, Info, Fan, SNMP

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	Clicking this button enables a restart of the module. At first a window appears with the message that the operation of the module will stop during restart. Click **ok** to do the restart.

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.

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.

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