



TIMING SOLUTIONS

Rubidium Series



RUB GT-L
RUB GI-L

Time & Date Reference via External LTC

Supplement to the “Functional Description & Specifications” of Module RUB GT or RUB GI
Option “L”
Version: 4.2
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A1 Revision History

No.	Date	Subject
1.0	October 07, 2005	First released document.
1.1	March 06, 2007	<ul style="list-style-type: none"> • New LTC input format: "Time + Local Date". • Revised.
1.2	October 11, 2007	Revised.
2.0	November 20, 2009	This option now is available for GL modules.
3.0	July 27, 2011	This option is applicable for GI modules as well. Completely revised.
4.0	May 10, 2013	New variant "6".
4.1	August 26, 2019	Changed address of Plura Europe GmbH.
4.2	November 30, 2020	Re-formatted in new design.

A2 Copyright

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A3 General Remarks

This manual is a supplement to the "Functional Description & Specifications" of module GT or GI. It describes a special function of the GT/GI module realized by an optional firmware. A module with this special option may have not all the functions as there are in a standard module.

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

<https://www.plurainc.com>.



1 General Description

With this option the module receives a time & date reference via an externally connected LTC signal. The time zone of the reference input is selectable. Time & date synchronises the internal clock of the module.

If main operating mode TIME is selected, the time of the output signals is precisely synchronized with external LTC reference. The time zone of the output signals (= local time zone) is adjustable by selecting offsets and Daylight-Saving Time.

RUB GT:

The output signals can be phase locked to external LTC reference or to an analogue video/black-burst signal. In case of external LTC reference, the phase of the LTC output signal is in coincidence with the phase of LTC input. In case of video/black-burst signal, the time code output (LTC and VITC) will be phase-locked to the video/black-burst source. Select the mode of synchronisation utilizing the 'Generate' function of one of the RUBIDIUM configuration tools.

RUB GI:

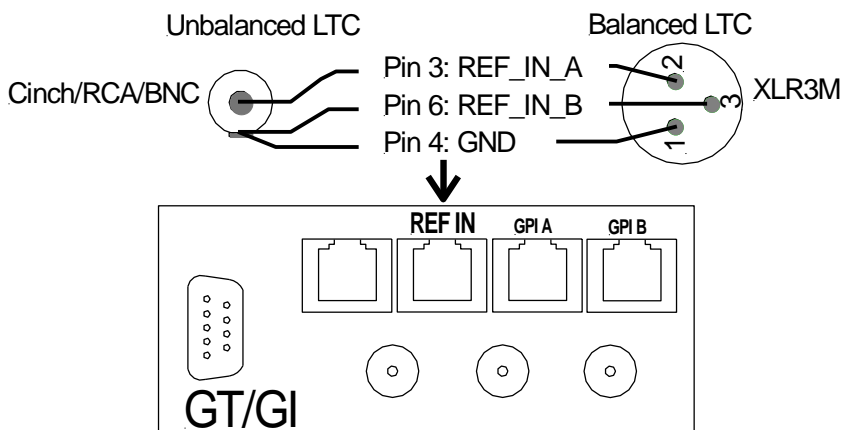
The output signals are phase synchronized to the external LTC reference. The beginning of an IRIG frame is in coincidence with the beginning of frame 0 of the LTC input.

Remark: GI currently accepts LTC with frame rate = 25 only!

2 Specifications and Connections

REF_IN_A / REF_IN_B for LTC reference input

Format	According to SMPTE 12M-1-2008
Input impedance	18 k Ω
Signal level	100 mV _{p-p} to 5 V _{p-p} , auto-ranging
Frequency	GT: 24/25/29,97/30 frames/s; GI: 25 frames/s



3 Time Zone of Reference Input and Local Time Zone of Output Signals

The RUBIDIUM module uses the UTC for internal time base. The UTC is calculated: Reference input time ± selected offsets to UTC (see chapter 'Set-Ups'). For full functionality this calculated UTC must correspond to the real UTC.

This chapter presents the following variants (DST = time zone with Daylight Saving Time switching):

Variant	External LTC (Reference)	Generated Local Time Zone
1	<ul style="list-style-type: none"> • Without DST, i.e. UTC or a fixed offset to UTC. • Known format of the date (see chapter 5). 	<ul style="list-style-type: none"> • Any time zone selectable.
2	<ul style="list-style-type: none"> • With DST. • Date format = "Date + Status". 	<ul style="list-style-type: none"> • Any time zone selectable.
3	<ul style="list-style-type: none"> • With DST. • Date format not equal to "Date + Status". 	<ul style="list-style-type: none"> • Time zone same as reference.
4	<ul style="list-style-type: none"> • With DST. • Date format not equal to "Date + Status". 	<ul style="list-style-type: none"> • Time zone different from reference. • No full functionality!
5	<ul style="list-style-type: none"> • Without DST, i.e. UTC or a fixed offset to UTC. • Date format not known (not listed in chapter 5). 	<ul style="list-style-type: none"> • Any time zone selectable.
6	<ul style="list-style-type: none"> • With DST. • Date format not equal to "Date + Status". 	<ul style="list-style-type: none"> • Time zone = UTC.



- **Variant 1:** The reference LTC input runs with UTC or with a fixed offset to UTC (so **no** Daylight-Saving Time [DST] switching occurs with the reference time). A date can be decoded out of the binary groups (user bits) of the reference LTC.

Set-up:

Function Time Zone	Function Reference
Select offsets for "Reference Input". Select offsets for "Local Time Zone".	"Reference Format": Choose the correct format of the date so that the date can be decoded properly. "Reference Input = UTC". "Local Time Zone = Auto + Reference Check", if local time zone has DST, else "Local Time Zone = UTC + Reference Check".

Because now the internal UTC time base can be calculated correctly, the local time zone of the output signals is freely selectable.

- **Variant 2:** The reference LTC input runs at a local time zone **with** Daylight Saving Time switching and the LTC input **uses the "Date + Status" user format** of a GM-TTT, RUB GT or similar time code generator.

Set-up:

Function Time Zone	Function Reference
Select offsets for "Reference Input". Select offsets for "Local Time Zone".	"Reference Format = Date + Status". "Reference Input = Auto". "Local Time Zone = Auto + Reference Check", if local time zone has DST, else "Local Time Zone = UTC + Reference Check".

This format of the reference LTC includes status bits to indicate the current time zone (DST yes/no), so the internal UTC time base can be calculated correctly. The local time zone of the output signals is freely selectable.



- Variant 3:** The reference LTC input runs at a local time zone **with** Daylight Saving Time switching and the LTC input uses **not** the **"Date + Status" user format** of a GM-TTT, RUB GT or similar time code generator. The local time code of the output signals should correspond to the time zone of the reference input (output follows input).

Set-up:

Function Time Zone	Function Reference
Select offsets for "Reference Input" = UTC (all offsets must be 00).	"Reference Format = Time + Local Date". "Reference Input = UTC".
Select offsets for "Local Time Zone".	"Local Time Zone = Auto + Reference Check". "Reference Lock within 20 min" must be activated!

In this case the local time zone has to be selected properly, so that it corresponds to the time zone of the reference LTC input. Now the internal UTC time base can be calculated correctly.

The RUBIDIUM module reads the date from the internal battery buffered real-time chip. This date can be changed or set utilizing the "Set Date" function at the 'Generate' tab of one of the RUBIDIUM configuration tools.

- Variant 4:** The reference LTC input runs at a local time zone **with** Daylight Saving Time switching and the LTC input uses **not** the **"Date + Status" user format** of a GM-TTT, RUB GT or similar time code generator, and the local time zone of the output signals **does not** correspond to the time zone of the reference input.

Set-up:

Function Time Zone	Function Reference
Select offsets for "Reference Input" = UTC (all offsets 00).	"Reference Format = Time only". "Reference Input = UTC".
Select offsets for "Local Time Zone": Only the "Offset from UTC" will be taken into account.	"Local Time Zone = Same As Reference Input".

The RUBIDIUM module reads the date from the internal battery buffered real-time chip. This date can be changed or set utilizing the "Set Date" function at the 'Generate' tab of one of the RUBIDIUM configuration tools.

In this case the internal UTC time base **cannot** be calculated correctly. The local time zone of the output signals follows the reference LTC input, regarding any DST switching.

The functionality is restricted: The RUBIDIUM module cannot work as the time source for NTP, it further cannot calculate time zones for the MTD timer applications.



- **Variant 5:** The reference LTC input runs with UTC or with a fixed offset to UTC (so **no** Daylight-Saving Time [DST] switching occurs with the reference time). A date cannot be decoded out of the binary groups (user bits) of the reference LTC.

Set-up:

Function Time Zone	Function Reference
Select offsets for "Reference Input". Select offsets for "Local Time Zone".	"Reference Format = Time only". "Reference Input = UTC". "Local Time Zone = Auto + Reference Check", if local time zone has DST, else "Local Time Zone = UTC + Reference Check".

The RUBIDIUM module reads the date from the internal battery buffered real-time chip. This date can be changed or set utilizing the "Set Date" function at the 'Generate' tab of one of the RUBIDIUM configuration tools.

Because now the internal UTC time base can be calculated correctly, the local time zone of the output signals is freely selectable.

- **Variant 6:** The reference LTC input runs at a local time zone **with** Daylight Saving Time switching and the LTC input uses **not** the "**Date + Status**" **user format** of a GM-TTT, RUB GT or similar time code generator. The local time code of the output signals should correspond to the UTC.

Set-up:

Function Time Zone	Function Reference
Select offsets for "Reference Input" = UTC (all offsets must be 00). Select all parameters for "Local Time Zone" corresponding to the time zone of the reference LTC.	"Reference Format = UTC + Local Date". "Reference Input = UTC". "Local Time Zone = Auto + Reference Check". "Reference Lock within 20 min" must be activated!

In this case all parameters of the local time zone have to be selected according to the time zone of the reference LTC. Now the internal UTC time base can be calculated correctly.

The RUBIDIUM module reads the date from the internal battery buffered real-time chip. If you change or set the date utilizing the "Set Date" function at the 'Generate' tab of one of the RUBIDIUM configuration tools, the set value has to correspond to the current date of the local time zone (= date of reference LTC).

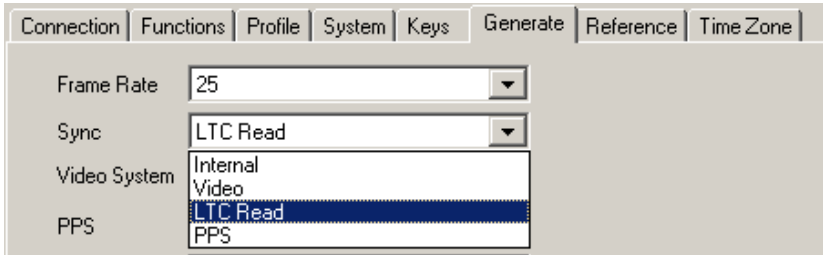


4 Set-Ups

The following guide describes the most important set-ups and enables you to find the configuration for your special environment. This example shows screen shots of the PC program tabs.

RUB GT modules only: The set-up of the **phase synchronisation** is done utilizing the 'Generate' function of a Rubidium Configuration Tool:

At "Sync": Select **Video** or **LTC Read**

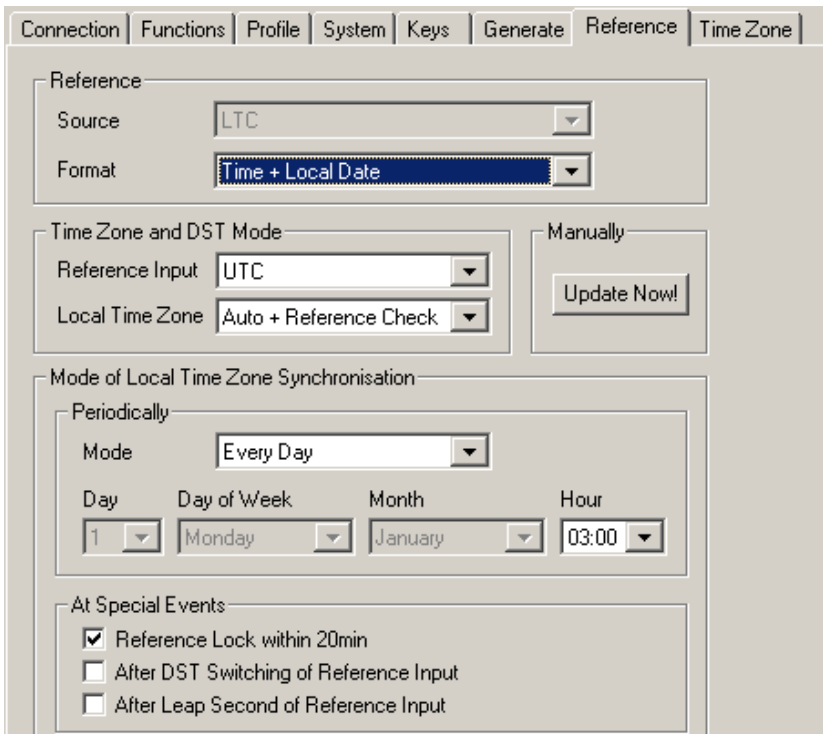


Basically, it is recommended to select "Sync = Video" working in a television surrounding!

The reference LTC should carry **time and date** information. The RUBIDIUM module accepts several date formats. Select the correct format of your reference LTC and the "Time Zone and DST Mode" utilizing the 'Reference' page of a Rubidium Configuration Tool (*please notice chapter 3 for detailed description*):

At "Format": Select from the drop-down list (refer to chapter "Date Formats").

At "Time Zone and DST Mode": Select **Auto + Reference Check** or **UTC + Reference Check** or **Same As Reference Input**.



The time zone of the reference input may be different to the local time zone of the output signals (*please notice chapter 3 for time zone set-up*).

Select the offsets to UTC at the 'Time Zone' page of a Rubidium Configuration Tool:

The screenshot displays the 'Time Zone' configuration page of the Rubidium Configuration Tool. The interface is organized into several sections:

- Reference Input:** Includes an 'Offset' section with a flag selector (EU), 'Offset from UTC' (00:00), and 'DST Bias' (00:00). A 'Preset' dropdown is set to 'UTC' with a 'Load' button.
- Local Time Zone:** Includes an 'Offset' section with a sign selector (+), 'Offset from UTC' (01:00), and 'DST Bias' (01:00). A 'Preset' dropdown is set to 'CET/CEST: C' with a 'Load' button.
- Daylight Saving:** Shows 'Start' as 'Last Sunday of March at 02:00' and 'End' as 'Last Sunday of October at 03:00'.
- Aux:** Shows 'Offset' as 00:00 and 'Reference' checked.
- Manually:** Contains an 'Update Now!' button.



5 Date Formats

The following date formats can be decoded out of the binary groups (user bits) of the LTC. The binary groups will be denoted as BG1 to BG8, and they are paired in the following way:

BG8/7 = "Hour", BG6/5 = "Minute", BG4/3 = "Second", BG2/1 = "Frame".

A "U" in the following description marks a binary group which will be ignored for the decoding process. DD denotes the day, MM the month, YY the year – all BCD coded.

Date: UU.DD.MM.YY

BCD coded date: Day.Month.Year (BG6/5 . BG4/3 . BG2/1). The year is coded with two digits.

Date+ Status

BCD coded date: Day.Month.Year (BG6/5 . BG4/3 . BG2/1). The year is coded with two digits. BG8/7 ("Hour") indicates a status:

<u>Bit(s)</u>	<u>BG7 ("Units of Hour"):</u>
0	= 1: Indicates that the time of the time code is locked to a real-time reference.
1+2	= time zone: Bit 2 Bit 1
	0 0 = UTC
	0 1 = Standard Time
	1 0 = Daylight Saving Time
3	= 1: Announcement of start/end of a Daylight-Saving Time, one hour before switching.
<u>Bit(s)</u>	<u>BG8 ("tens of Hour"):</u>
0	= 1: Announcement of a leap second, one hour before switching.
1	Century bit, should be set to 0.
2	not used, should be set to 0.
3	not used, should be set to 0.

BBC

Date coded according to the "EBU Technical Information I29-1995" (so-called BBC format). The date is BCD-coded and assigned to the binary groups as follows:

BG1	Reserved	All bits = 0
BG2	Units of the day	4 bits, LSB = bit 12
BG3	Units of the month	4 bits, LSB = bit 20
BG4	Tens of the day	2 bits, LSB = bit 28
	Tens of the month	1 bit = Bit 30, bit 31 = 0
BG5	Reserved	All bits = 0
BG6	Units of the year	4 bits, LSB = bit 44
BG7	Reserved	All bits = 0
BG8	Tens of the year	4 bits, LSB = bit 60



Date:DD.MM.YY.YY

BCD coded date: Day = BG8/7 ("Hour"), Month = BG6/5 ("Minute"), Year = BG4...1 ("Second" + "Frame"). The year is coded with four digits.

Date: YY.MM.DD.UU**Date: UU.YY.MM.DD****Date: UY.YM.MD.DU****Date: DD.MM.YY.UU****Date: MM.DD.YY.UU****Date: UU.MM.DD.YY**

There are several date formats selectable similar to the „Date: UU.DD.MM.YY“ format. Please refer to this table for a survey:

	BG8/7	BG6/5	BG4/3	BG2/1
UU.DD.MM.YY	U U	DD	M M	YY
Date + Status	S S	DD	M M	YY
DD.MM.YY.YY	DD	M M	YY	YY
YY.MM.DD.UU	YY	M M	DD	U U
UU.YY.MM.DD	U U	YY	M M	DD
UY.YM.MD.DU	U Y	Y M	M D	D U
DD.MM.YY.UU	DD	M M	YY	U U
MM.DD.YY.UU	M M	DD	YY	U U
UU.MM.DD.YY	U U	M M	DD	YY

TVE

The date format conforms to a "TVE" specification:

- The arrangement of day, month and year conforms to the "UY.YM.MD.DU" format.
- BG1 gets an appointment code = \$8, BG8 gets a check sum = bit-wise complement of the sum (modulo-16) of BG1 to BG7.
- Additionally, the binary group flag BGF2 is set to 1.

AUXOFFS

Coding of date and a time offset, conforming to LEITCH CSD-5300 format with Auxiliary Offset. The binary groups are used for the date as described under "BBC". Additionally, an offset is encoded in 30-minute increments. 6 bits in binary form are split into two 3-bit groups and are inserted into the reserved binary groups BG5 and BG7:

BG5	Offset, 3 lower bits	3 bits, LSB = bit 36
BG7	Offset, 3 upper bits	3 bits, LSB = bit 52

This allows an offset in the positive direction of up to 23 hours 30 minutes, or 47 half hour steps (101111 in 6-bits binary form). Devices decoding these bits add this offset to the time information of the time code. The date coded in the binary groups is not coupled with that offset, i.e. the date changes at 24 o'clock of the time information of the time code.



SMPTE 309M: YYYYMMDD

The SMPTE 309M-1999 standard specifies a coding technique for the transmission of date and time zone information in the binary groups of the time code. Selecting this format GT decodes the time zone information and expects the date in the YY.MM.DD format.

SMPTE 309M: MJD

The SMPTE 309M-1999 standard specifies a coding technique for the transmission of date and time zone information in the binary groups of the time code. Selecting this format GT decodes the time zone information and expects the date in the "Modified Julian Date" format.

Time only**Time + Local Date**

No date will be decoded out of the time code. GT reads the date from the internal battery buffered real-time chip.

6 Quick Verification

If the RUBIDIUM module accepts the time & date input, the LED OPER flashes every second – provided this LED has received the standard set-up (= "Reference Input").





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