



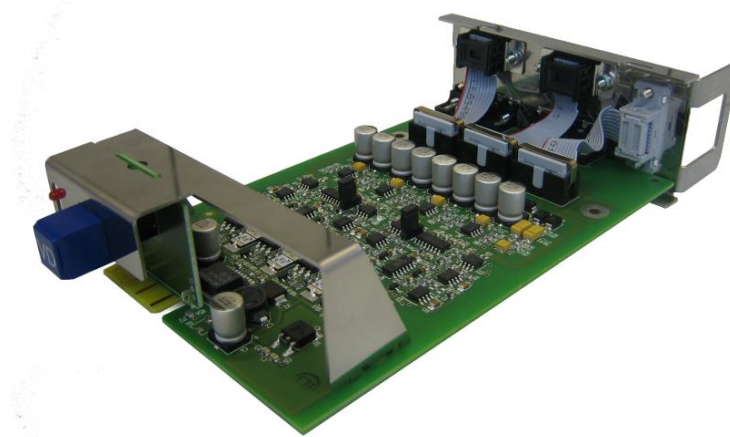
TIMING SOLUTIONS

Rubidium Series



RUB VD

Distribution Amplifier for LTC or IRIG-B Signals and for Signals of the Plura MTD System



Functional Description and Specifications
Supplement to the "Installation & Systems Manual RUBIDIUM SERIES"
Version: 3.2
December 2, 2020





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A1 Revision History

No.	Date	Subject
0.n		Preliminary documents, changes without notice.
1.0	January 05, 2005	First released document.
2.0	May 03, 2005	One standard type.
2.1	July 08, 2005	Chapter 1.4.4: wrong pin-out for RS232 signals.
2.2	December 15, 2006	Revised.
2.3	June 25, 2007	Describes hardware version 1 and modified version 2.
2.4	August 21, 2007	"Example of Using the RS232" revised.
2.5	September 19, 2007	More details to internal jumpers and TELEGRAM OUT signal.
2.6	October 17, 2008	Chapter 1.4.1: Remark added to correct/incorrect connection of VD.
2.7	April 14, 2010	Revised.
2.8	March 25, 2011	Connecting analogue clocks revised.
2.9	May 11, 2011	More information about cable lengths connecting analogue clocks.
3.0	July 19, 2011	IRIG-B applications.
3.1	September 3, 2019	Changed address of Plura Europe GmbH.
3.2	December 2, 2020	Re-formatted in new design.

A2 Copyright

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A3 General Remarks

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

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



1 Module VD

1.1 Description

This module is a distribution amplifier for those signals delivered from any central MTD generator (RUB **GT** module) at the **MTD** connector as well as for signals generated from the Master IRIG-B Generator RUBIDIUM **GI**.

These signals are:	<u>RUB GT</u>	<u>RUB GI</u>
	RS485	RS422
	LTC	IRIG-B
	SERIAL	SERIAL
	TELEGRAM	TELEGRAM

Four independent output stages are provided for each signal input.

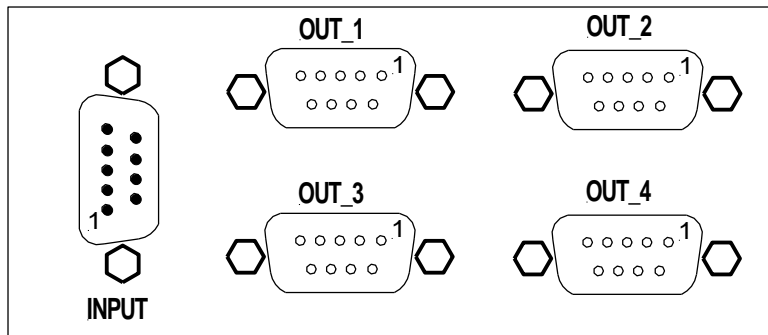
There is no initial set-up or configuration of this module possible; it is not addressable via the PC connector. The front panel label **VD** visibly identifies where this module is located. The serial number is located on the bottom side of the circuit board of this module.

Survey of the basic features:

- RS485/RS422 distribution amplifier.
- LTC or IRIG-B distribution amplifier.
- RS232 and RS422 distribution amplifier for serial input data string (SERIAL).
- Impulse telegram distribution amplifier: Signal outputs to control analogue clocks (TELEGRAM).
- "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.
- Red LED (OPER) at the front indicates that the module is operating (RUB1 version only).



1.2 Rear Panel and Connections



Pin assignments


INPUT DSUB9M male	
GT System	GI System
1: RS485_TRA_IN	RS422 RA-
2: RS485_TRB_IN	RS422 RB+
3: LTC_IN_A	IRIG_IN_A
4: LTC_IN_B	IRIG_IN_B
5: GND	GND
6: not connected	not connected
7: not connected	not connected
8: SERIAL IN	SERIAL IN
9: TELEGRAM IN	TELEGRAM IN

OUT_1 and OUT_2 DSUB9F female	OUT_3 and OUT_4 DSUB9F female
GT System	GI System
1: RS485_TRA_OUT	RS422 TA-
2: RS485_TRB_OUT or RS232 TxD	RS422 TB+ or RS232 TxD
3: LTC_OUT_A	IRIG_OUT_A
4: LTC_OUT_B	IRIG_OUT_B
5: GND	GND
6: RS422 T-	RS422 T-
7: RS422 T+	RS422 T+
8: TELEGRAM OUT	TELEGRAM OUT
9: VCC12_OUT	VCC12_OUT

Any connector plugged to OUT_1 – OUT_4 should have wired only those pins really used for the given application. Please notice chapter “Applications”.



Signal descriptions

GND	Signal ground.
RS485_TRA_IN/ RS422 RA- RS485_TRB_IN/ RS422 RB+	Balanced in- or outputs of an RS485 serial interface as source signal. Can be used as RS422 input as well.
RS485_TRA_OUT/ RS422 TA- RS485_TRB_OUT/ RS422 TB+	Balanced in- or outputs of an RS485 serial interface. A transceiver decouples these signals from the source signals. Can be used as RS422 outputs as well.
LTC_IN_A/IRIG_IN_A LTC_IN_B/IRIG_IN_B	Balanced signal input, for LTC (Linear Time Code) or IRIG-B signals.
LTC_OUT_A/IRIG_OUT_A LTC_OUT_B/IRIG_OUT_B	Balanced signal outputs, for LTC (Linear Time Code) or IRIG-B signals.
SERIAL IN	TTL input. SERIAL IN receives a serial data string with time and date information (reference time) each second. This input signal may be distributed as RS232 or RS422 signal.
TELEGRAM IN	TTL input. TELEGRAM IN receives an impulse telegram. Four output stages are provided to amplify and distribute this input signal, the outputs are the TELEGRAM OUT lines.
RS232 TxD	Outputs the SERIAL IN signal with RS232 levels.
RS422 T-/T+	Outputs the SERIAL IN signal as balanced RS422 signal.
TELEGRAM OUT	Output stage of the TELEGRAM IN signal amplifier, nominal level $\approx 12\text{ V}$ (Version 1) / $\approx 23\text{ V}$ (Version 2) without load. The TELEGRAM OUT, VCC12_OUT and GND lines are used to control analogue clocks of the Plura MTD system with a 4-wire interface. TELEGRAM OUT and GND only are used to control analogue clocks of the Plura MTD system with a 2-wire interface.
VCC12_OUT	12 VDC voltage output, 500 mA reversible fused (each output line), used as the power supply for analogue clocks of the Plura MTD system with a 4-wire interface.
	Using the VCC12_OUT output please make sure not to exceed the total power rating of the "Power Supply" module used for this frame.



1.3 Specifications

LTC/IRIG-B input

Connector	Balanced signals: LTC_IN_A/LTC_IN_B or IRIG_IN_A/IRIG_IN_B. In case of an unbalanced signal input connect to LTC_IN_A/IRIG_IN_A and let LTC_IN_B/IRIG_IN_B unconnected.
Input impedance	18 k Ω
Signal level	100 mV _{p-p} – 5 V _{p-p} , auto-ranging
Frequency	0 – 100 kHz

LTC/IRIG-B Output

Connector	Balanced signals: LTC_OUT_A/LTC_OUT_B or IRIG_OUT_A/IRIG_OUT_B. For an unbalanced application connect LTC_OUT_A/IRIG_OUT_A and let LTC_OUT_B/IRIG_OUT_B unconnected.
Output impedance	< 50 Ω
Gain	1 \pm 1 %

TELEGRAM OUT

Signal	Output stage of the TELEGRAM IN signal amplifier. Second impulse telegram. Nominal level \approx 12 V (Version 1) / \approx 23 V (Version 2) without load.
Maximum current	Fused by a 200 mA auto-recovery fuse each output stage. A continuous current of up to 120 mA can be applied over the whole specified operating temperature range.

VCC12_OUT

Signal	12 VDC voltage output.
Maximum current	Fused by a 500 mA auto-recovery fuse each output stage. A continuous current of up to 330 mA can be applied over the whole specified operating temperature range.

Others

Operating voltage	Nominal value: 24 VDC
Power consumption (without any load)	Hardware version 1: max. 1.6 W Hardware version 2: max. 2.1 W
Weight	0.2 kg approx.
Dimensions	Standard circuit board (W x D): 100 x 160 mm/3.94 x 6.30 inch Rear panel: Rub H1: 103 x 44 mm / 4.06 x 1.73 inch Rub H3: 8HP, 3RU
Environmental characteristics, operating	Temperature: 5 $^{\circ}$ C to 40 $^{\circ}$ C Relative humidity: 30 % to 85 %, non-condensing
Environmental characteristics, non-operating	Temperature: -10 $^{\circ}$ C to +60 $^{\circ}$ C Relative humidity: 5 % to 95 %, non-condensing



1.4 Applications

1.4.1 Distribution Amplifier for RS485, LTC, RS232, RS422 and for Analogue Clock Signals in the RUB GT System

Balanced RS485 signals:

Each line has its own transceiver, i.e. the signals for example at connector OUT_1 are decoupled from the source signals at connector INPUT as well as from the signals at connector OUT_2, OUT_3 and OUT_4.

Balanced LTC signals:

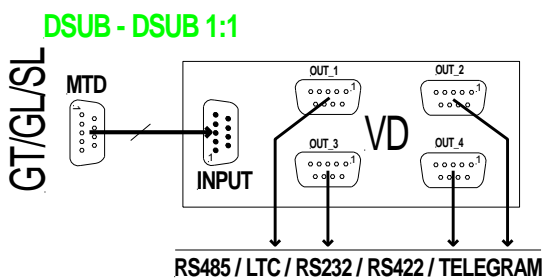
Each line has its own output stage, i.e. the signals for example at connector OUT_1 are decoupled from the source signals at connector INPUT as well as from the signals at connectors OUT_2, OUT_3 and OUT_4.

Output signals RS232 Tx/D, RS422 T-/T+ and TELEGRAM OUT:

Each line has its own output stage, i.e. a signal output is decoupled from the corresponding source signal at connector INPUT as well as from same output signal at a different output connector.

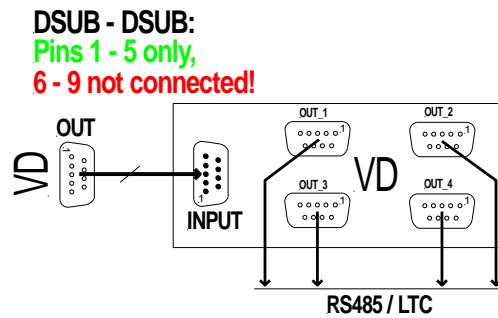
Yes

VD distributes the signals coming from GT/SL



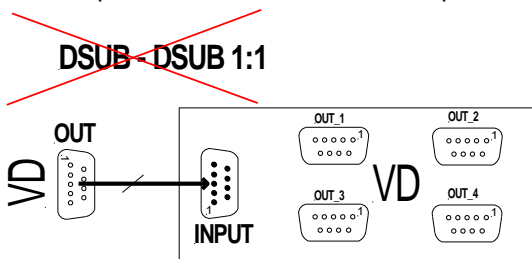
Yes

Daisy chain of VDs for LTC and/or RS485 signals



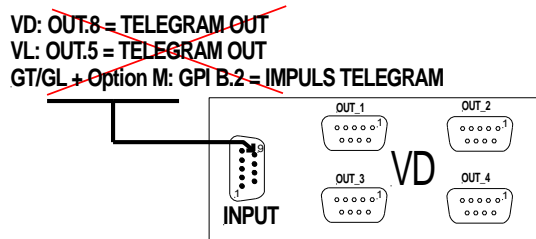
No

VD output 1:1 connected to VD input

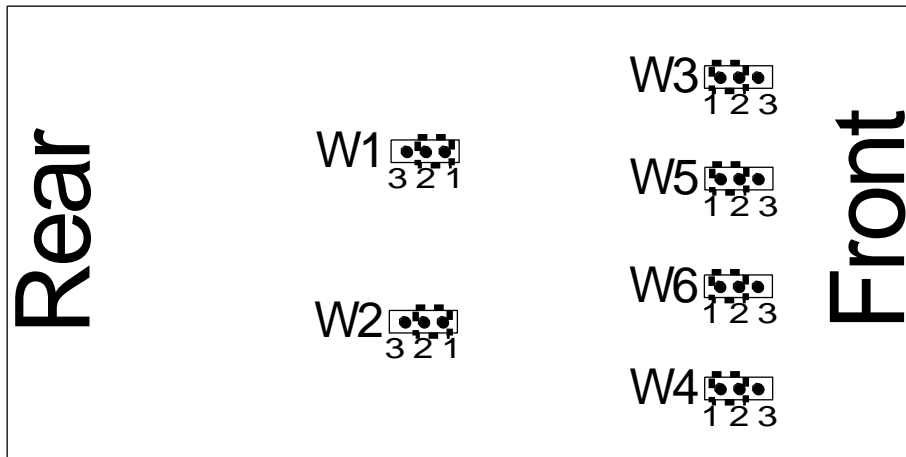


No

Analogue Clock Output connected to VD input



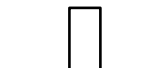

1.4.2 Internal Jumper: RS232 Output Signal and Polarity of TELEGRAM OUT



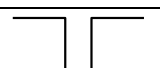
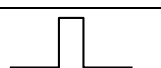
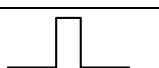
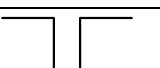
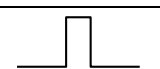


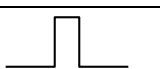
Hardware version 1 only has W1 and W2 assembled.

	Position 1 - 2	Position 2 - 3
W1	OUT_1, Pin 2 = RS485_TRB_OUT	OUT_1, Pin 2 = RS232 TxD
W2	OUT_2, Pin 2 = RS485_TRB_OUT	OUT_2, Pin 2 = RS232 TxD
W3	OUT_3, Pin 8: TELEGRAM inverted	OUT_3, Pin 8: TELEGRAM not inverted
W4	OUT_4, Pin 8: TELEGRAM inverted	OUT_4, Pin 8: TELEGRAM not inverted
W5	OUT_1, Pin 8: TELEGRAM inverted	OUT_1, Pin 8: TELEGRAM not inverted
W6	OUT_2, Pin 8: TELEGRAM inverted	OUT_2, Pin 8: TELEGRAM not inverted

Please notice the following rule for choosing the correct TELEGRAM OUT polarity:

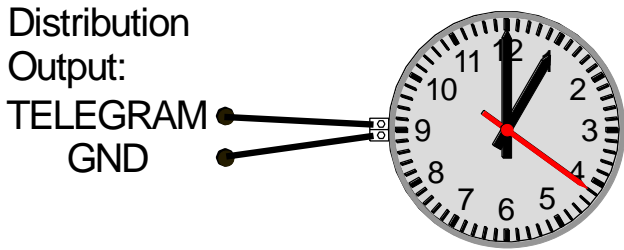
<p>Analogue clocks with a 4-wire interface require TELEGRAM with positive-going pulses!</p> 	<p>Analogue clocks with a 2-wire interface require TELEGRAM with negative-going pulses!</p> 
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With hardware version 2 the polarity of each output may be selected independently.

GT configuration	GT: TELEGRAM OUT	VD Version 1: TELEGRAM OUT	VD Version 2: Jumper at position 1-2	VD Version 2: Jumper at position 2-3
"Inverse Polarity" checked				
"Inverse Polarity" not checked				



1.4.3 Connecting Analogue Clocks with a 2-Wire Interface

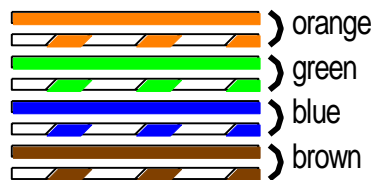


The following specifications are not applicable to SC Series clocks! Please read next chapter.

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

Cross section [mm ²]	0.141	0.205	0.324	0.519
	Example: AWG26-7/34	Example: AWG24 solid bar	Example: AWG22 solid bar	Example: AWG20 solid bar
Length [m] 12 clocks	275	400	630	830
Length [m] 10 clocks	350	510	800	1060
Length [m] 8 clocks	460	670	1070	1410
Length [m] 6 clocks	650	950	1500	1980

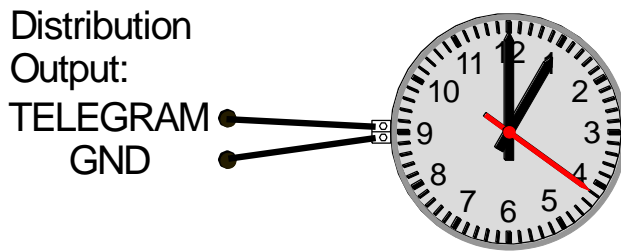
CAT (network) cables contain four pairs of wires. The wires of a pair are twisted together. The wires could conform to AWG24 or AWG26. It is possible to enlarge the cross section or to reduce the number of clocks per line by using several pairs of the cable. A pair can be identified by the colour: Solid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



The 2-wire interface requires TELEGRAM OUT with **negative-going** pulses.



1.4.4 Connecting the 2-Wire Interface to SC306T

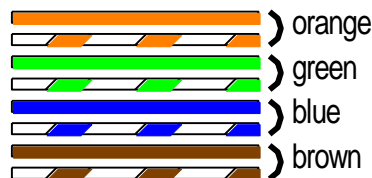


Each output stage of VD is capable of driving **two** studio clocks. The VD module must receive power from a **24 VDC** power supply.

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

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

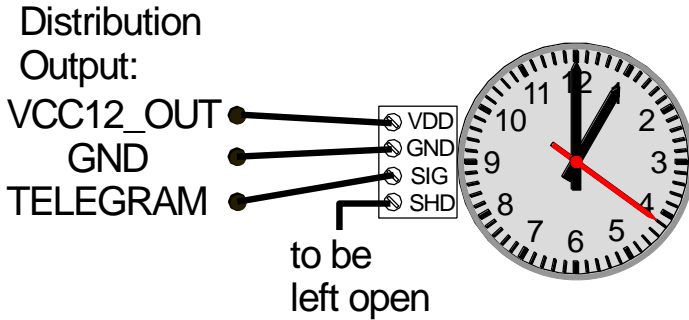
Note: Network CAT5 cables use AWG24 or AWG26 wires, please check. It is not recommended to use conductors with cross sections less than 0.2 mm² (AWG24/1). AWG26-7/34 wires have a cross section of 0.141 mm². CAT cables contain four pairs of wires. The wires of a pair are twisted together. It is possible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



The 2-wire interface requires TELEGRAM OUT with **negative-going** pulses.



1.4.5 Connecting Analogue Clocks with a 4-Wire Interface



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

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

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

The 4-wire interface requires TELEGRAM OUT with **positive-going** pulses.

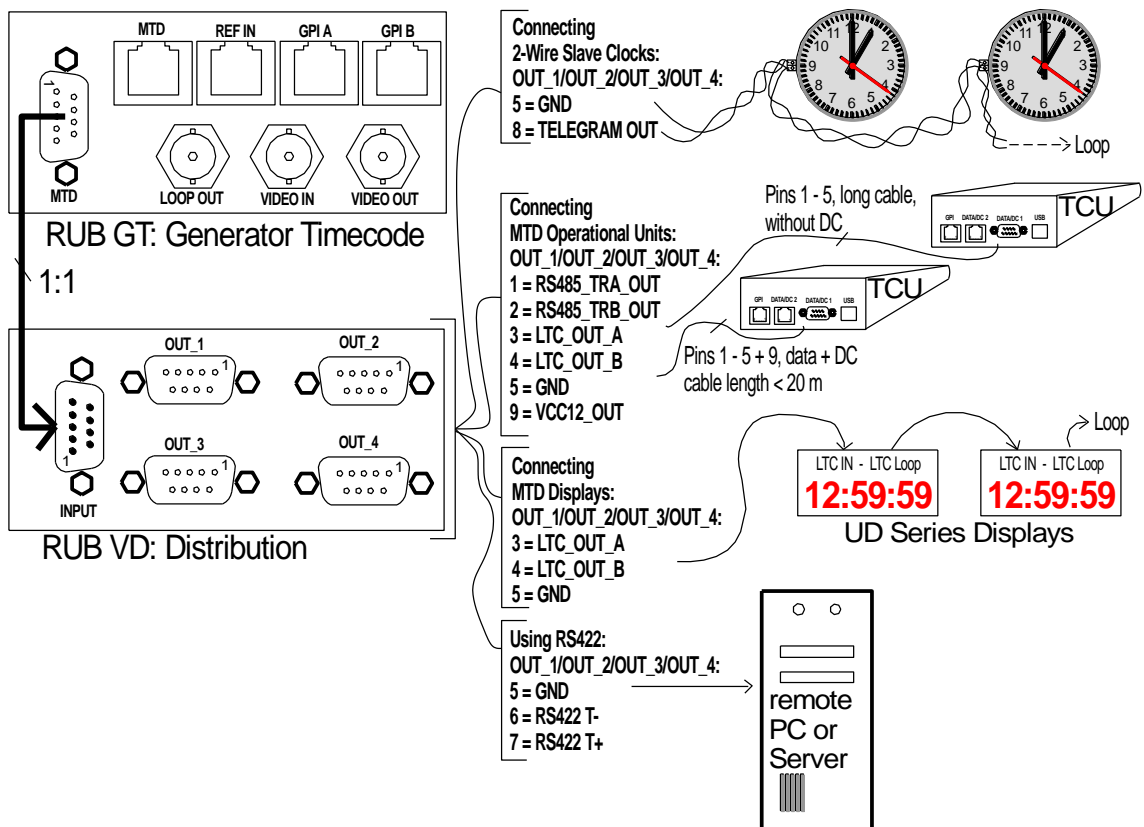


1.4.6 Fourfold RS485, LTC, RS422 and Analogue Clock Signals

The pin assignments at connectors OUT_1, OUT_2, OUT_3 and OUT_4 are identical, the internal jumpers are set to position 1 (default position):

- | |
|------------------|
| 1: RS485_TRA_OUT |
| 2: RS485_TRB_OUT |
| 3: LTC_OUT_A |
| 4: LTC_OUT_B |
| 5: GND |
| 6: RS422 T- |
| 7: RS422 T+ |
| 8: TELEGRAM OUT |
| 9: VCC12_OUT |

Example:

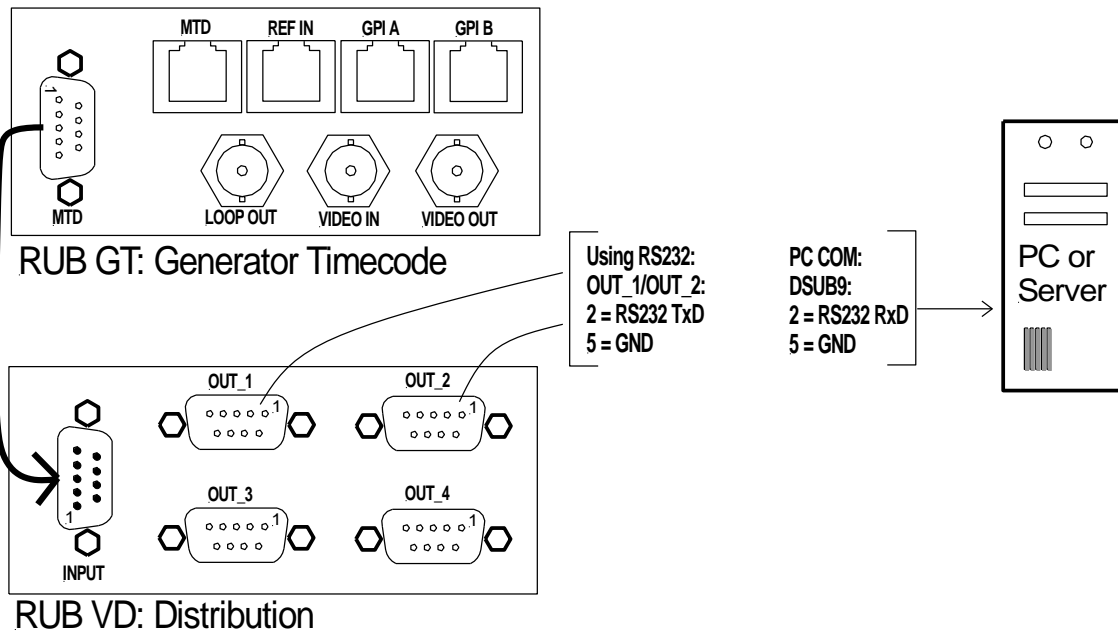


1.4.7 Example of Using the RS232

The internal jumpers are set to position 2, pin assignment at connectors OUT_1, OUT_2, OUT_3 and OUT_4:

OUT_1:	OUT_2:	OUT_3:	OUT_4:
1: (RS485_TRA_OUT)	1: (RS485_TRA_OUT)	1: RS485_TRA_OUT	1: RS485_TRA_OUT
2: RS232 TxD	2: RS232 TxD	2: RS485_TRB_OUT	2: RS485_TRB_OUT
3: LTC_OUT_A	3: LTC_OUT_A	3: LTC_OUT_A	3: LTC_OUT_A
4: LTC_OUT_B	4: LTC_OUT_B	4: LTC_OUT_B	4: LTC_OUT_B
5: GND	5: GND	5: GND	5: GND
6: RS422 T-	6: RS422 T-	6: RS422 T-	6: RS422 T-
7: RS422 T+	7: RS422 T+	7: RS422 T+	7: RS422 T+
8: TELEGRAM OUT	8: TELEGRAM OUT	8: TELEGRAM OUT	8: TELEGRAM OUT
9: VCC12_OUT	9: VCC12_OUT	9: VCC12_OUT	9: VCC12_OUT

Example:



RUB GT transmits with every new second a serial data string (time/date) if the internal clock has a valid time and a valid date. Standard format: **Meinberg Standard Time String**, with the fixed parameters 2400/7/E/2. The VD module converts this data string into the electrical RS232 format (and in parallel into the electrical RS422 format as well).

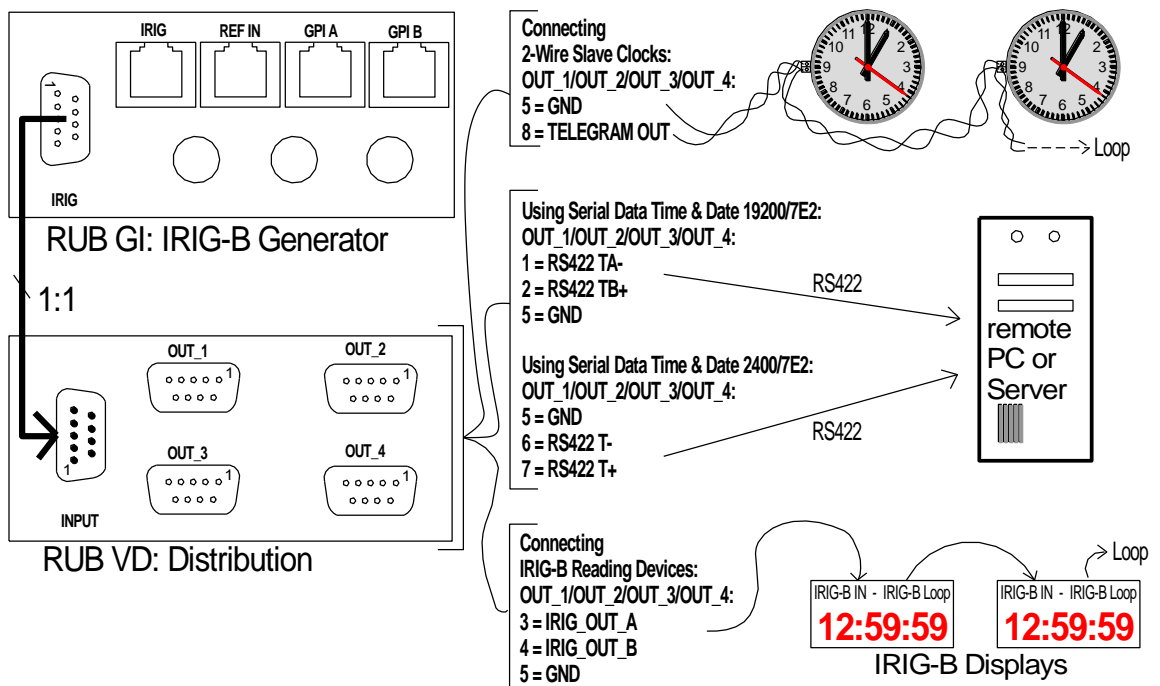


1.4.8 Distribution Amplifier for IRIG-B and Other Signals of the RUB GI System

The pin assignments at connectors OUT_1, OUT_2, OUT_3 and OUT_4 are identical, the internal jumpers are set to position 1 (default position):

- 1: RS422 TA-
- 2: RS422 TB+
- 3: IRIG_OUT_A
- 4: IRIG_OUT_B
- 5: GND
- 6: RS422 T-
- 7: RS422 T+
- 8: TELEGRAM OUT
- 9: VCC12_OUT

Example:



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