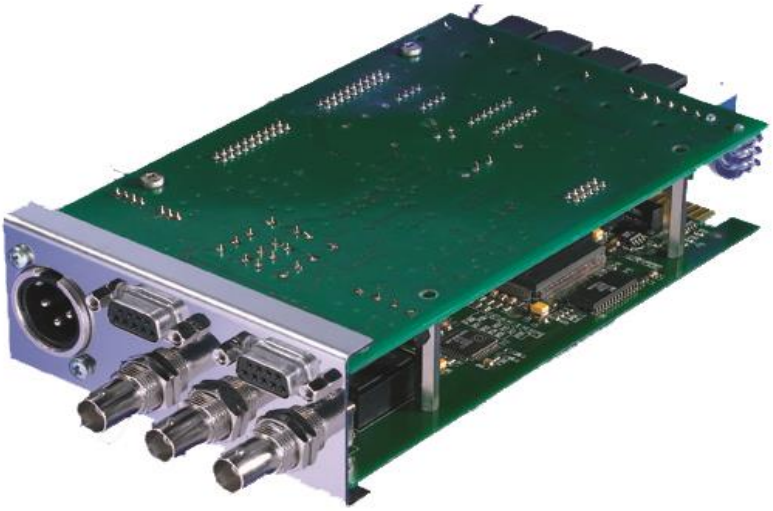
plura®
TIMING SOLUTIONS

Rubidium Series

RUB XT
RUB XV

Digital Video Time Code of the RUBIDIUM SERIES System



Functional Description and Specifications
Supplement to the “Installation & Systems Manual RUBIDIUM SERIES”
Version: 2.8
January 11, 2024

CONTENTS

A1 Revision History

No.	Date	Subject
0.n		Preliminary documents, changes without notice.
1.0	June 20, 2011	First released document.
2.0	June 21, 2012	ATC applications revised.
2.1	June 29, 2012	"Signal description" in chapter "Rear Panel and Connections" revised.
2.2	August 24, 2012	New features: • Jam Sync: Checkbox *Ignore "Read Offset"*. • D-VITC Generator: Checkbox *Only in SD Video*. • ATC Generator: Checkbox *Only in HD Video*. "LTC Generate": drop-down list "gain" revised. Note added at chapter "Option B: Video Bypass Relay".
2.3	December 12, 2012	Power consumption specification corrected. New boards conform to 3G level A and B.
2.4	January 30, 2013	It is possible to selected "MTDoE" as a source of MTD at "Read" tab.
2.5	September 4, 2019	Changed address of Plura Europe GmbH.
2.6	November 6, 2020	Added video propagation delay to specifications.
2.7	December 2, 2020	Re-formatted in new design.
2.8	January 9, 2024	Updated download links and update instructions.

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

https://plurainc.com/products/xt/ or https://plurainc.com/products/xv/.

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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 Rubidium module **XT** or **XV**.

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

1 Modules XT and XV

1.1 Introducing the XT Module

The hardware consists of a high definition digital video channel (SD, HD, 3G), time code in/outputs, serial interfaces as well as some general-purpose interfaces, which may be used for various special applications (GPI in/outputs).

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

Configuration, status monitor etc. identify this module as **XT**. RUB1 version modules visibly show this id on a button at the front panel, RUB3 version modules at the rear panel. The serial number is located on the bottom side of the lower circuit board of each module.

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

- "Hot Swapping", i.e. it is possible to insert or remove a module without interrupting the operation of other modules in this frame.
- Failure relay, connected to the FAIL_A and FAIL_B pins of the **RLC** connector at the rear of the frame.
- RS232 and TC_link (RLC connector) interfaces to have access to the internal bus of the chassis.
- Digital video input, e.g. as the source for reading D-VITC and/or ATC (time code reader) or as genlock input for LTC synchronisation.
- Digital video output (a video signal must be present on the input side), e.g. for character insertion (time code, text) or for D-VITC and/or ATC output.
- LTC input, LTC output.
- Four programmable function keys, lamps and LEDs on the front panel (RUB1 version only).
- Flash memory containing the firmware, so configuration and updates are possible via a PC connection. You can download the latest version of the program from:

  https://plurainc.com/products/xt/.
- Local serial interface, selectable as RS232 or RS422 or RS485. This interface can be used for remote control and for real-time data exchange.
- Four digital in- or outputs and one relay contact may be used in special applications.

There is a nearly unlimited range of applications for which this module can be used. The standard software enables a user to use the basic hardware with the most popularly used functions. More and special customer defined applications can be realised by loading a special software/firmware into the unit.

The modular concept of **RUBIDIUM SERIES** and the programmable parts of this module enhances the flexibility of our system, i.e. two basically identical modules could be used in completely different applications. This can be achieved either, with the same software but with different configurations (e.g. one module serves as time code reader, other module as time code generator), or with different programming of the firmware. See chapter about "Software Tools" to get a description of the configuration/programming of this module.

1.2 Introducing the XV Module

XV offers a high definition digital video channel (SD, HD, 3G) with character inserter and ATC/D-VITC in/output.

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

Configuration, status monitor etc. identify this module as **XV**. RUB1 version modules visibly show this id on a button at the front panel, RUB3 version modules at the rear panel. The serial number is located on the bottom side of the lower circuit board of each module.

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

- "Hot Swapping", i.e. it is possible to insert or remove a module without interrupting the operation of other modules in this frame.
- Failure relay, connected to the FAIL_A and FAIL_B pins of the **RLC** connector at the rear of the frame.
- RS232 and TC_link (RLC connector) interfaces to have access to the internal bus of the chassis.
- Digital video input, e.g. as the source for reading D-VITC and/or ATC (time code reader).
- Digital video output (a video signal must be present on the input side), e.g. for character insertion (time code, text) or for D-VITC and/or ATC output.
- Flash memory containing the firmware, so configuration and updates are possible via a PC connection. You can download the latest version of the program from:

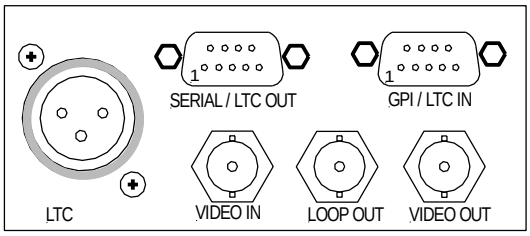
  https://plurainc.com/products/xt/.

There is a nearly unlimited range of applications for which this module can be used. The standard software enables a user to use the basic hardware with the most popularly used functions. More and special customer defined applications can be realised by loading a special software/firmware into the unit.

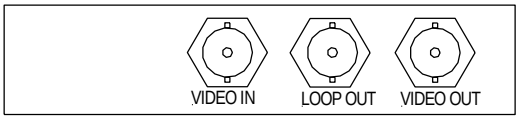
The modular concept of **RUBIDIUM SERIES** and the programmable parts of this module enhances the flexibility of our system, i.e. two basically identical modules could be used in completely different applications. This can be achieved either, with the same software but with different configurations (e.g. one module serves as time code reader, other module as time code generator), or with different programming of the firmware. See chapter about "Software Tools" to get a description of the configuration/programming of this module.

1.3 Rear Panel and Connections

Connections at the XT module

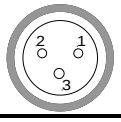


Connections at the XV module



Pin assignments

The LTC connector may be an input or an output:

LTC input 1: GND 2: LTC_IN_A 3: LTC_IN_B	XLR3F female 

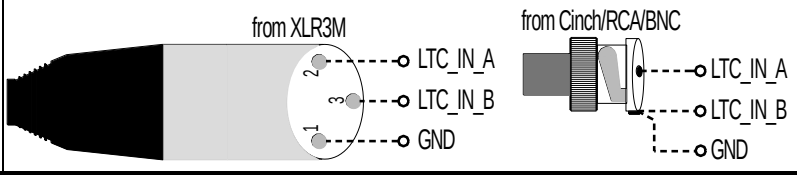
LTC output 1: GND 2: LTC_OUT_A 3: LTC_OUT_B	XLR3M male 

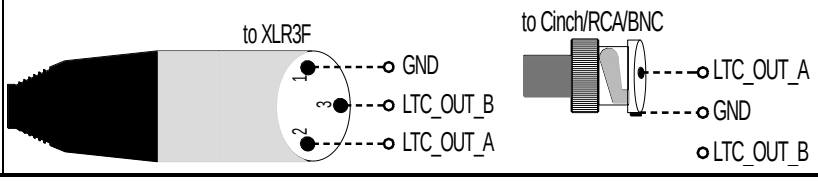
SERIAL/LTC OUT DSUB9F female	1: T-_TxD 2: T+_CTS 3: LTC_OUT_A 4: LTC_OUT_B 5: GND 6: R-_RTS 7: R+_RxD 8: GPI_3 9: GPI_4

GPI/LTC IN DSUB9F female	1: GPI_1 2: GPI_2 3: GPI_3 4: GPI_4 5: GND 6: 24V 7: GPI_5 8: LTC_IN_A 9: LTC_IN_B

Signal descriptions

GND	Signal ground.

LTC_IN_A, LTC_IN_B	LTC (Linear Time Code) input. Connections: balanced signal unbalanced signal 

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

T-_TxD T+_CTS R-_RTS R+_RxD	In- or outputs of the local serial interface. One of the following specifications may be selected during configuration: RS485: signals T- and T+, balanced in/output. RS422: signals T- and T+ = balanced output, signals R- and R+ = balanced input. RS232: TxD = transmit line, unbalanced data output. CTS = clear to send, handshake input. RTS = request to send, handshake output. RxD = receive line, unbalanced data input.

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

GPI_5	Relay contact (normally open). The relay contact shortens this pin to GND.

24V	24 V DC voltage output, 200 mA reversible fused. This output corresponds to the voltage output of the inserted “Power Supply“ module. Please notice the power supply specifications. Using this output please make sure not to exceed the total power rating of the “Power Supply“ module.

1.4 Specifications

Video input VIDEO IN

Format	Serial digital video: • SD, according to SMPTE 259M • HD, according to SMPTE 292M • 3G, according to SMPTE 242M
Connector	BNC (IEC169-8), 75 Ω
Signal level	800 mV ± 10 %
Digital data	8-bit, 10-bit
Equalization	Automatic cable equalization. Tested with Belden 1505F: 270 Mb/s: 0 – 190 m 1.485 Gb/s: 0 – 110 m 3 Gb/s: 0 – 80 m

Video output LOOP OUT

Format	Same as video input
Connector	BNC (IEC169-8), 75 Ω
Signal level	800 mV ± 10 %
DC offset	0.0 V ± 0.5 V
Digital data	10-bit
Propagation delay	SD 50 ns ± 40 ns HD, 3G 25 ns ± 20 ns

Video output VIDEO OUT

Format	Same as video input
Connector	BNC (IEC169-8), 75 Ω
Signal level	800 mV ± 10 %
DC offset	0.0 V ± 0.5 V
Digital data	10-bit
Propagation delay	SD 5.88 µs ± 150 ns HD 2.08 µs ± 20 ns 3G-A 1.04 µs ± 20 ns 3G-B, 50 fps 37.02 µs ± 20 ns (~ 2 lines + 1.5 µs) 3G-B, 60 fps 31.34 µs ± 20 ns (~ 2 lines + 1.5 µs)

Video time codes

D-VITC reader/generator	According to SMPTE 266M-1994
ATC reader/generator	According to SMPTE 12-M-2-2008

LTC input

Format	According to ANSI/SMPTE 12M-1-2008
Connector	Balanced signals LTC_IN_A and LTC_IN_B: • Via 3-pin XLR female (according to IEC 268-1). • Via 2 pins of the 9-pin DSUB female GPI/LTC IN.
Input impedance	18 kΩ
Frame rates	24, 25, 30, 30-Drop
Signal level	100 mV_{p-p} - 5 V_{p-p}
Frequency	1.6 - 2500 frames/s

LTC output

Format	According to ANSI/SMPTE 12M-1-2008
Connector	Balanced signals LTC_OUT_A and LTC_OUT_B: • Via 3-pin XLR male (according to IEC 268-1). • Via 2 pins of 9-pin DSUB female SERIAL/LTC OUT.
Output impedance	< 50 Ω
Frame rates	24, 25, 30, 30-Drop
Signal level	Adjustable 150 mV_{p-p} - 4.9 V_{p-p}

GPI

GPI_1 ... GPI_4: Input specification	Input "Low": -2.0 to +1.0 V Input "High": +3.0 to +24.0 V Impedance: 4.7 kΩ Frequency: 0 - 1 MHz
GPI_1 ... GPI_4: Output specification	Open Collector output of an NPN transistor at 4k7 pull-up resistor (5 VDC). Max. power dissipation: 200 mW. "High" state: 4.3 V (no load). "Low" state: output switched to GND. Max. collector current: 100 mA DC, fused by a 100 mA auto-recovery fuse. Collector-emitter saturation voltage: @100 mA: typ. 200 mV (≤ 600 mV), @10mA: typ. 90 mV (≤ 250 mV). Frequency: 0 - 150 kHz.
GPI_5: SPST-NO relay	Contact resistance: 0.2 Ω Max. switching power: 10 W Max. switching voltage: 175 VDC Max. switching current: 0.5 A Max. transportable current: 0.8 A

24V

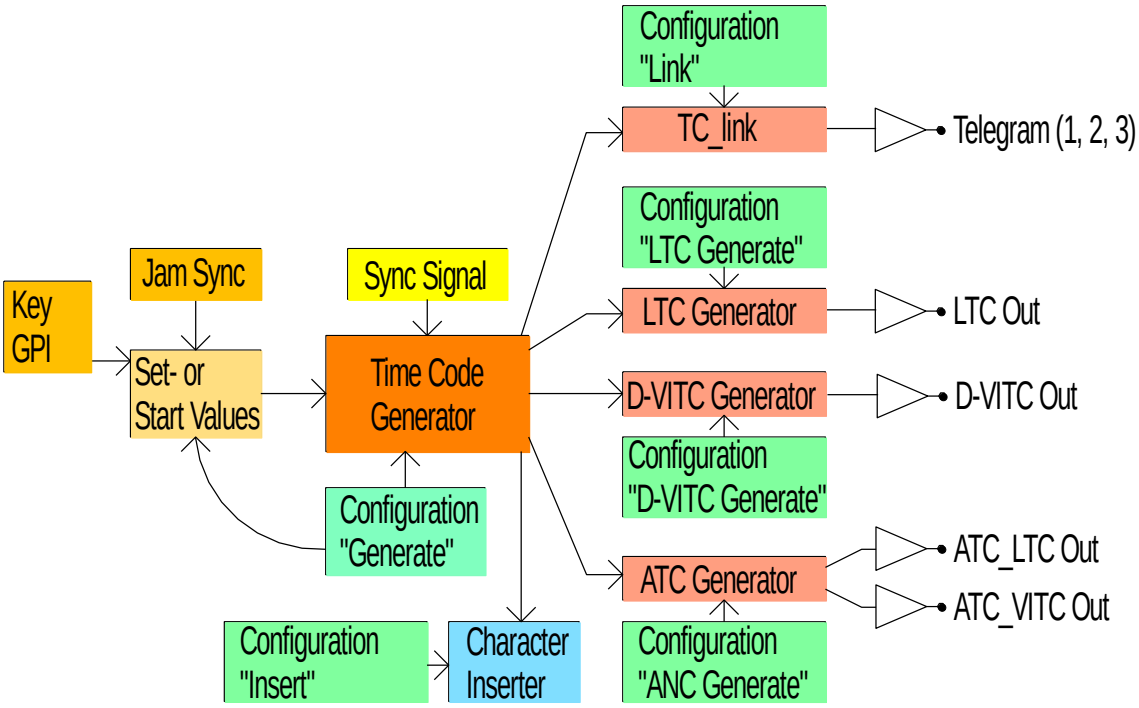
Output of the DC power supply of this module, normally = 24 VDC.	Reversible fused. A continuous current of up to 120 mA can be applied over the whole specified operating temperature range. At an ambient temperature of e.g. 22 °C the output switches to a high-resistance state after a few seconds if a current of 300 mA is applied.

Others

Operating voltage	12 - 30 VDC
Power consumption	XT module: max. 4.7 W XV module: max. 3.0 W
Weight	XT module: 0.4 kg approx. XV module: 0.2 kg approx.
Mechanical XT	2 circuit boards (W x D): 100 x 160 mm / 3.94 x 6.30 inch Rear panel: Rub H1: 103 x 44 mm / 4.06 x 1.73 inch Rub H3: 8HP, 3RU
Mechanical XV	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: 4HP, 3RU
Environmental characteristics, operating	Temperature: 5 °C to 40 °C Relative humidity: 30 % to 85 %, non-condensing
Environmental characteristics, non-operating	Temperature: -10 °C to +60 °C Relative humidity: 5 % to 95 %, non-condensing

1.5 Features

1.5.1 Standard Features of the Time Code Generator



Basically there is one time code generator which outputs the time addresses and the binary groups (user bits) in various time code formats: As LTC, as D-VITC, as ancillary data packets of type ATC_LTC and/or ATC_VITC, or as a telegram of the Rubidium TC_link interface. The data of the generator can be visibly inserted in video windows, of course.

Overview of the basic features:

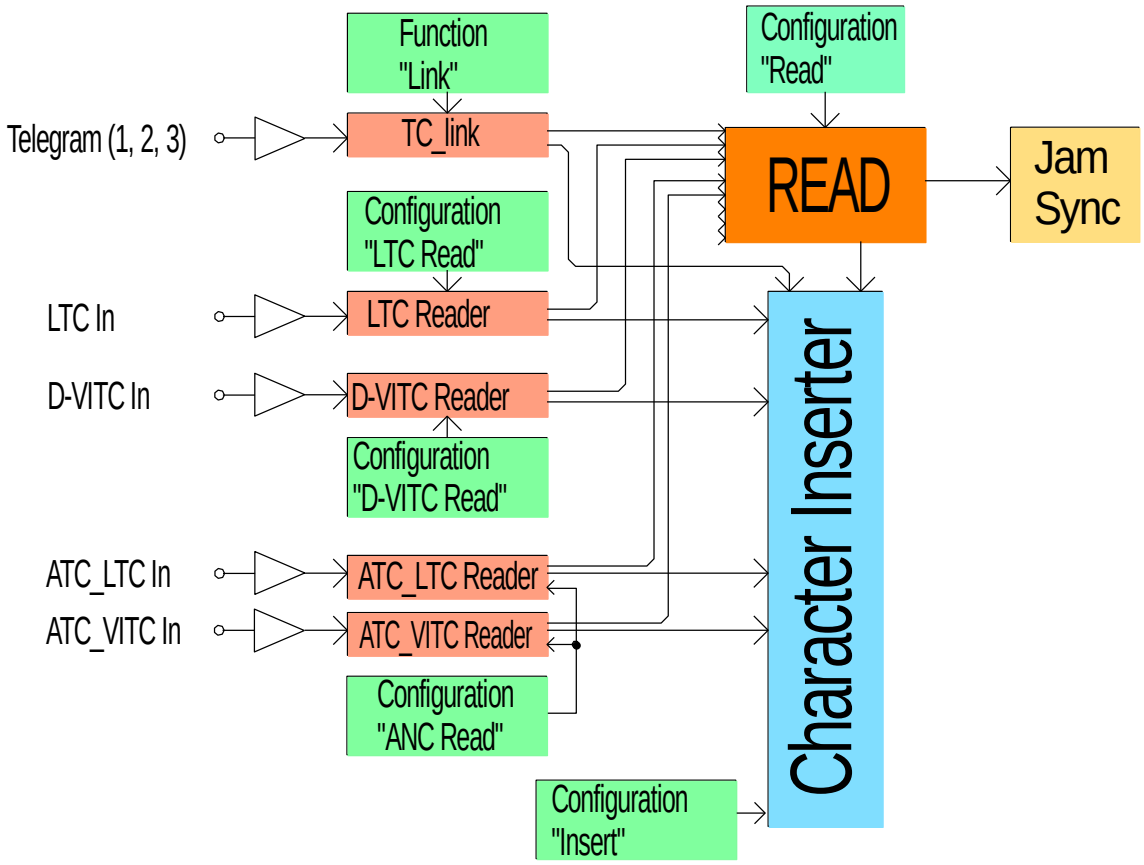
Frame rate	Selectable: 24, 25, 30, 30 Drop.
Genlock mode	Selectable: Internal, video, LTC read, second pulse (PPS).
Start value for the time or the user bits	Settable: Manually via a programmed button/GPI or via a configuration tool or utilizing the Jam Sync function.
LTC output level	Adjustable.
ATC/D-VITC lines	Selectable.
ATC time code	ATC_LTC, ATC_VITC - can individually be enabled/disabled.
Jam Sync application	Various operating modes - see chapter “The Jam Sync Function”.
Video window	Time and user bits can be visibly displayed. Various formats are selectable, as well as size, position ...

A RUB1 version XT module has four programmable LEDs at the front.

The **Gen Sync Status** function for a **LED** indicates the status of the phase and frequency synchronization of the time code generator, depending on the mode of sync selection (for configuration please refer to chapter "Keys: Keys and Lamps, LEDs and GPIs").

Selection at "Generate"	Description of LED Function "Gen Sync Status"
Sync = Internal	LED is permanently off.
Sync = Video	LED lights up during video lock. LED flashes slowly during the fine trim procedure. LED flashes fast if video synchronization is lost.
Sync = LTC Read	LED lights up during source lock (LTC signal at LTC_IN_A, LTC_IN_B). LED flashes slowly during the fine trim procedure. LED flashes fast if LTC synchronization is lost.
Sync = Second Pulse	LED lights up during lock to the external PPS (signal input at GPI_1). LED flashes slowly during the fine trim procedure. LED flashes fast if PPS synchronization is lost.

1.5.2 Standard Features of the Time Code Reader



Each time code format has its own time code reader. Each reader is able to visibly insert the data in a video window. Each reader can – with selectable priority – transfer the data to the "general reader" (Read). The following functions are only available for the "general reader":

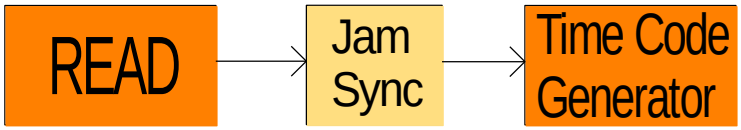
- Jam Sync, i.e. the data transfer of the reader data to the time code generator.
- Decoding the MTD data of the Plura Timer System.
- Decoding a date.

Overview of the basic features:

Frame rate	Selectable: 24, 25, 30, 30 Drop, automatic.
ATC/D-VITC/LTC priority	Selectable.
ATC/D-VITC lines	Selectable.
D-VITC threshold	Settable or automatic.
Decoding MTD data	Selectable for one-time code source.
Decoding a date	Various formats selectable.

1.5.3 Synchronisation by Jam Sync

The **Jam Sync** function transfers time code of the "general reader" to the time code generator. Examples of application are all the different time code converter functions, as there are LTC-to-LTC converter, LTC-to-ATC converter, ATC-to-LTC converter etc.



Use a button or a GPI or a configuration tool to activate this function.

Overview of the basic features:

Which data should be transferred to the time code generator?	Selectable: Only the time addresses Only the binary groups (user bits). Time and user bits. Transfer the time into the user bits. Transfer the user bits into the time addresses.
What should the time code generator do if no time code can be read?	Operating mode selectable: Continuous mode (unlimited flying wheel). Generator stops after a programmed number of frames. After the time code generator has received data from the reader the Jam Sync function will be switched off (single jam).
Is it possible to add or subtract a time offset?	Yes, it is possible to program a "hours:minutes:seconds:frames" offset.

Please refer to chapter **"Jam": The Jam Sync Function** for the details of configuration.

RUB1 version XT modules have programmable LEDs and GPIs.
The **Jam** function for an **LED** or a **GPI** indicates the status of a Jam Sync mode (for configuration please refer to chapter "Keys: Keys and Lamps, LEDs and GPIs").

LED / GPI (lamp)	Description of the LED "Jam" Function
Lights up	The generator accepts the reader data during a continuous Jam Sync.
Flashes slowly	No time code can be read during a continuous Jam Sync.
Flashes fast	"Single Jam" currently is active.
Off	Jam Sync is switched off.

There are several Jam Sync operating modes available. The detailed description of these modes is given here. Except for the "Single Jam" mode all modes will be selected out of the "Mode" drop-down list.

Single Jam

This function will be switched off automatically (Jam Mode = OFF) after the time code generator has once received data from the reader. If - according to the set-up at "Values" - a time transfer has been selected, the time addresses of the generator will be set by the time addresses of the read time code, after that the time will be count continuously. After power-on a Single Jam mode is cleared.

Single Jam can be activated by a click on a button at the configuration tool, or by a programmed key or GPI.

Continuous

Continuous Jam Sync. This mode swaps the generator to a free-running mode if there is no time code input (unlimited flying wheel).

Cont. 1Frame

Jam Sync with one-frame drop-out compensation. This mode forces the generator to stop if there is no time code input for more than one frame and a transfer of time data has been selected.

Cont Wheel

Jam Sync with programmed drop-out compensation. This mode forces the generator to stop if there are no time code input for more than a programmed number of frames and a transfer of time data has been selected.

Start

This mode operates as a one-time Jam Sync. Unlike the "Single Jam" this mode remains active, so with every start-up of the module the one-time transfer occurs. The one-time Jam Sync waits until the generator reaches the **Genlock**, i.e. after power-on the generator has to lock to the selected source signal, after that the data from the read time code will be transferred to the generator.

Convert

In all other Jam Sync operating modes, the generator reads the time code time and only accepts it if the time is plausible and in an ascending continuous order. But with this "converter" function all read values including standing or even non-continuous values directly and exactly will be converted into the requested time code format. If no time code is read, the generator stops.

A time code, which is badly readable or incomplete, will pass these disturbances to the outputted time code.

Example for this application: ATC-to-LTC converter. The ATC of a frozen (still) image or during a single step motion is directly transferred to the generated LTC.

Diff Cont. and **Diff Stop**

Although the Jam Sync function examines the read time values for plausibility and ascending order, it cannot be prevented in all cases that the generated time code has frame jumps. For example, now and then a frame jump occurs if read time code and generated time code are not synchronized to each other. Nevertheless, selecting the Jam Sync function **Diff Cont.** or **Diff Stop** a clean regeneration can be achieved.

In this mode new read time values to be transferred to the generator have to be up-counting. A "reverse" or "still" time code will be ignored. The generator however only

synchronizes to the read time values if the time difference between reader and generator time exceeds an adjustable threshold. The “Diff Cont.” and the “Diff Stop” mode differ in case no reader values are being transferred: At “Diff Cont.” the generator continues to count the time on its own (continuous Jam Sync without flywheel option), at “Diff Stop” the generator stops counting after a programmed number of frames (“Wheel”).

This procedure sets the generator time equal to the read time at the beginning - for example with the start of a video tape. After that dropouts or phase shifting will not lead to a discontinuous time code output. Each time, if – for example after stopping and restarting the tape - again a difference of ≥ threshold occurs, the generator is automatically locked to this new read time code.

This function uses the value of the flywheel (“Wheel”) as the threshold for the difference. The allowed range of values is 2 - 20 frames. If the current value does not lie within this range the threshold will automatically be set to 4 frames.

Please notice the following remarks concerning this procedure and the choice of the threshold:

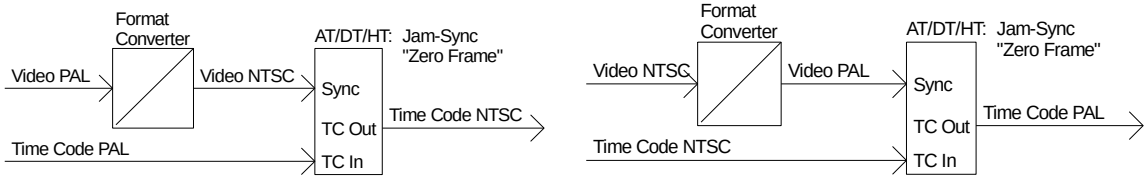
If a time difference greater than the threshold has been detected, the generator accepts the reader values for the next two seconds to get in sync. During this period the incoming time code should stabilize (for example a recorder should reach the normal play speed). If during this period no synchronization has been reached, the generated values compared to the incoming time code now can have any difference up to the threshold value.

If there is no synchronization between the incoming time code and the generated time code, a continuous drift against each other will take place and a time difference will built up. If the difference exceeds the threshold, a "hard" correction takes place. With the "Continuous" Jam Sync function you would have a one frame jump quiet often in this case, with the "Diff" Jam Sync function you would have a jump of the size of the threshold rarely. The more briefly however you choose the production time, the more highly the probability for an error free re-generation, because the difference will not reach the threshold.

Zero Frame

The generator accepts the reader values only if the frame count of the reader values equals to 00. Even if there are different frame rates of reader and generator time code, both time codes will be aligned exactly at the start of each second.

This mode should be selected for a frame rate conversion. In case of a video format conversion (e.g. PAL to NTSC or vice verse) the original time code should be connected to the time code input and the converted video should be connected to the video input of the Rubidium module. Thus, the converted time code will be synchronised to the converted video.



1.5.4 Standard Features of the Video Channel

Video channel	• 8-bit, 10-bit • Bypass • ATC/D-VITC lines insert enabled/disabled • Character insert enabled/disabled

Supported SD Video Standards

Video Format	Scanning Format	Standard	Frame rate, Hz
525/59.94	2:1 Interlace	SMPTE 125M	30/1.001
625/50	2:1 Interlace	ITU-R BT.601	25

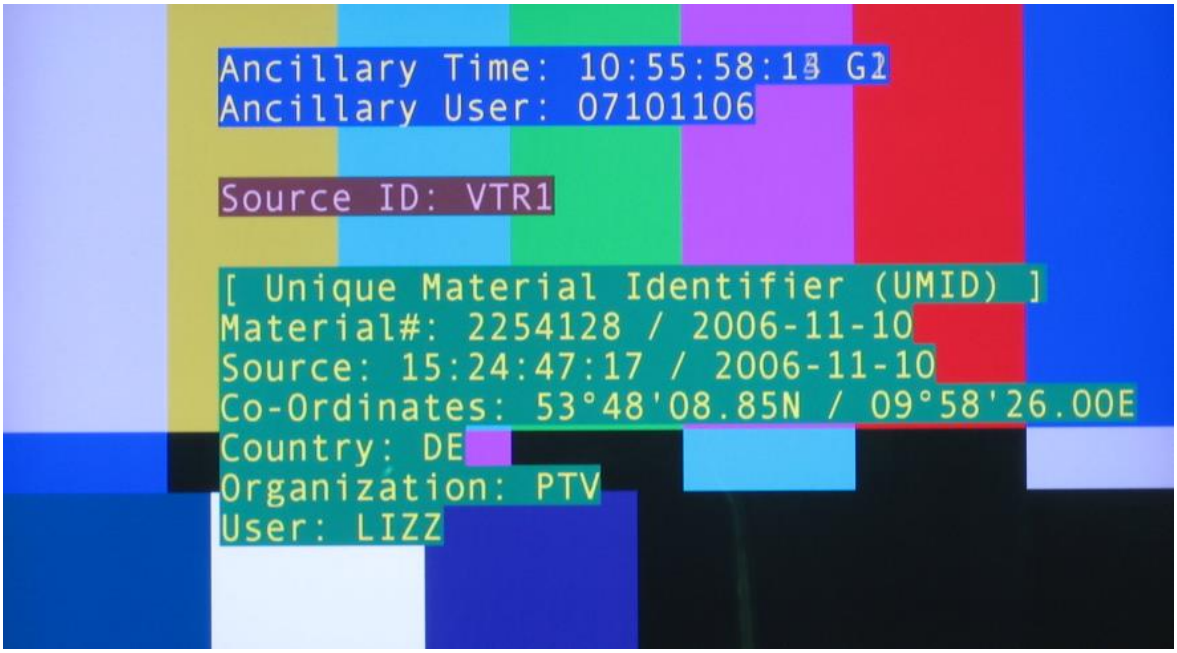
Supported HD Video Standards

Video Format	Scanning Format	Standard	Frame rate, Hz
1280 x 720p/60	1:1 Progressive	SMPTE 296M	60
1280 x 720p/59.94	1:1 Progressive	SMPTE 296M	60/1.001
1280 x 720p/50	1:1 Progressive	SMPTE 296M	50
1280 x 720p/30	1:1 Progressive	SMPTE 296M	30
1280 x 720p/29.97	1:1 Progressive	SMPTE 296M	30/1.001
1280 x 720p/25	1:1 Progressive	SMPTE 296M	25
1280 x 720p/24	1:1 Progressive	SMPTE 296M	24
1280 x 720p/23.98	1:1 Progressive	SMPTE 296M	24/1.001
1920 x 1080i/60	2:1 Interlace	SMPTE 274M	30
1920 x 1080i/59.94	2:1 Interlace	SMPTE 274M	30/1.001
1920 x 1080psf/30	Progressive segmented	SMPTE 274M	30
1920 x 1080psf/29.97	Progressive segmented	SMPTE 274M	30/1.001
1920 x 1080p/60	1:1 Progressive	SMPTE 274M	60
1920 x 1080p/50	1:1 Progressive	SMPTE 274M	50
1920 x 1080p/30	1:1 Progressive	SMPTE 274M	30
1920 x 1080p/29.97	1:1 Progressive	SMPTE 274M	30/1.001
1920 x 1080i/50	2:1 Interlace	SMPTE 274M	25
1920 x 1080psf/25	Progressive segmented	SMPTE 274M	25
1920 x 1080p/25	1:1 Progressive	SMPTE 274M	25
1920 x 1080p/24	1:1 Progressive	SMPTE 274M	24
1920 x 1080p/23.98	1:1 Progressive	SMPTE 274M	24/1.001
1920 x 1080psf/24	Progressive segmented	SMPTE 274M	24
1920 x 1080psf/23.98	Progressive segmented	SMPTE 274M	24/1.001
1920 x 1035i/60	2:1 Interlace	SMPTE 260M	30
1920 x 1035i/59.94	2:1 Interlace	SMPTE 260M	30/1.001

1.5.5 Standard Features of the Character Inserter

Character inserter	• Video windows selectable (time code or text) • Colour selectable • Position selectable • Size selectable • Format selectable

Example of a character insertion:



1.5.6 Other Standard Features

4 illuminated keys at the XT module- RUB1 version only	Programmable functions
4 illuminated keys at the XT module- RUB1 version only	Programmable functions
4 GPIs at the XT module	Programmable functions

For configuration please refer to chapter “Keys: Keys and Lamps, LEDs and GPIs”.

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/xt/.

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

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

Please now execute the following steps:

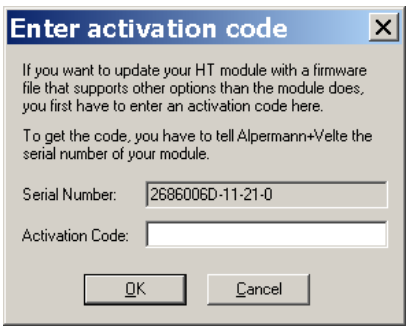
1. Connect your computer to the **PC** connector of that RUBIDIUM frame where the module has been plugged.

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

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

   Switch on the power of all units.

2. Execute "Rubidium Config.exe" on your computer. Select the "Port" according to the interface (USB, RS232) you are using.
3. Select the module (unit 1, 2, 3 ...).
4. Select "Flash Update" in the *File* menu.
5. Open the **.tcf**-file. Standard names:
   "Rubidium XT version.tcf" or "Rubidium XV version.tcf".
   "version " stands for a revision no., e.g. "2.12.8".



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

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

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

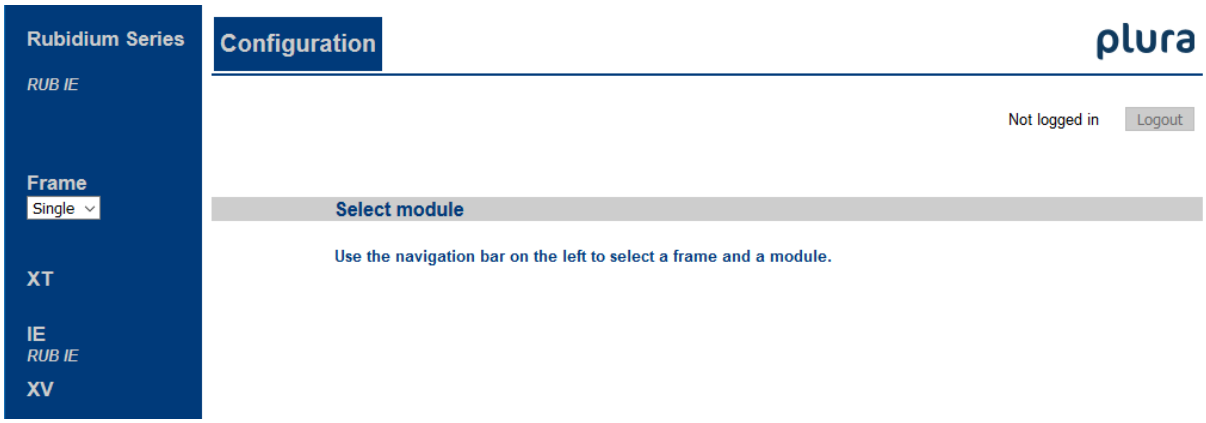
6. Update is finished now. We recommend checking configuration of the module utilizing the "RUBIDIUM CONFIGURATION" program.

During flash update the operation of the module stops!

2 Status Monitor

2.1 Status Monitor by IE Module

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



- Click on **XT** or **XV**, respectively, on the left.
- Click on **Status Monitor** to open the status monitor.

Requirements:

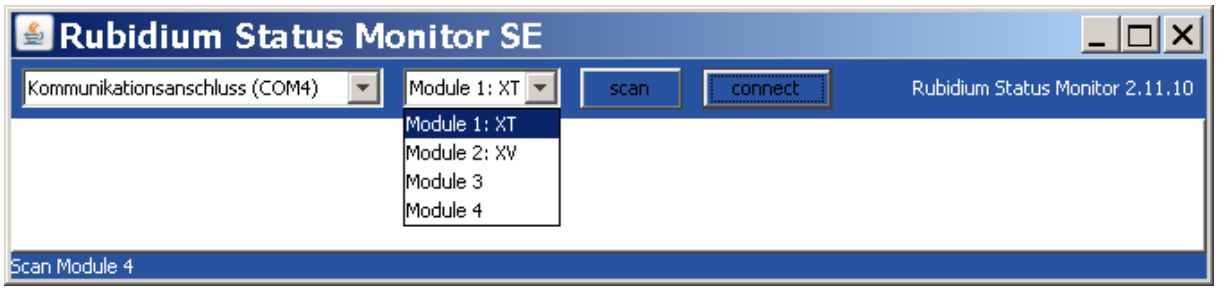
- Please have Java Runtime Environment 1.6.0 or higher installed (for example download at www.java.com).
- Java should be installed as a browser plug-in (a Windows installation will do this automatically if you download Java from the source mentioned above).
- The Status Monitor works with all operating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

2.2 Status Monitor by PC Program

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

https://plurainc.com/products/xt/.

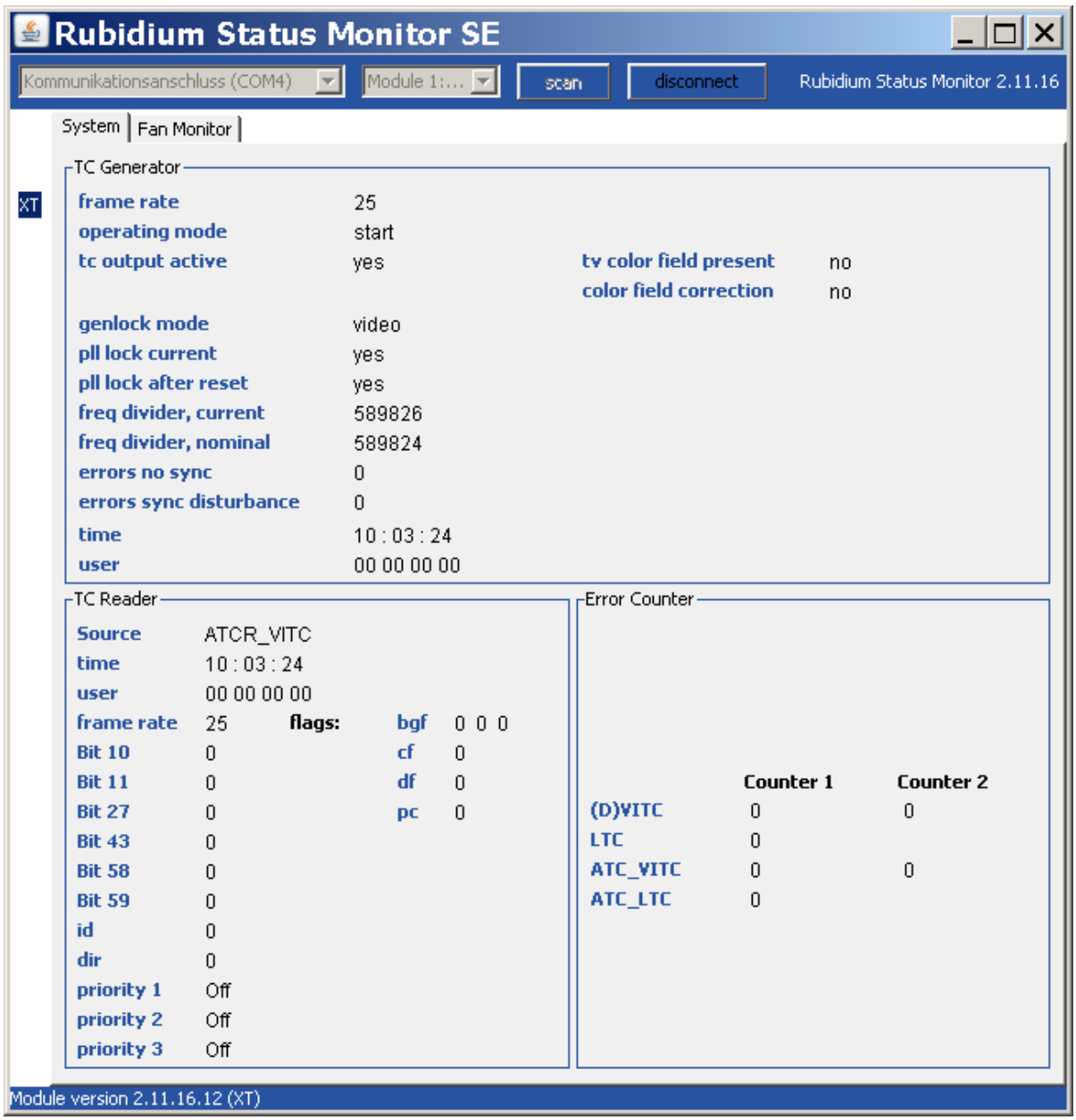
Execute this program, select the COM port or USB connection and press the **scan** button to get a list of the modules plugged to this housing. Select the module and press the **connect** button.



Requirements:

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

2.3 Status “System”: TC Generator and TC Reader



TC Generator: Status and set-up information.

TC Reader: Status and set-up information.

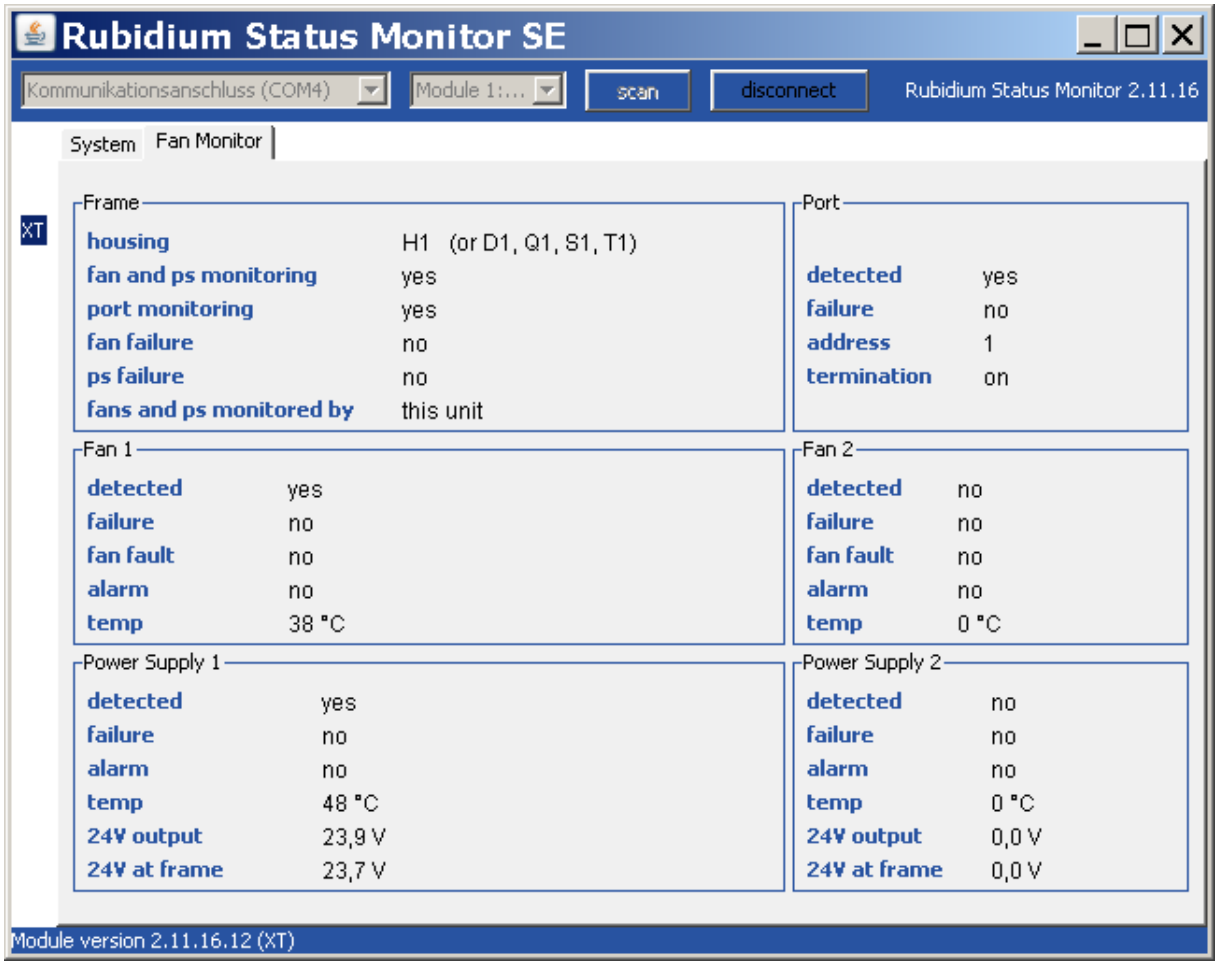
Error Counter: Counting time code reader errors:

	Counter 1	Counter 2
(D)VITC, ATC_VITC	Discontinuity of the VITC time addresses	Error with respect to VITC of 1st and 2nd field
LTC, ATC_LTC	Discontinuity of the LTC time addresses	

Each counter resets to zero if the corresponding time code reader will be disabled completely at the **Functions** page.

2.4 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 this module.



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

3 The Rubidium Configuration Tools

3.1 The Rubidium Configuration PC Program

Please refer to the

"Installation & Systems Manual RUBIDIUM SERIES"

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

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

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

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

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

3.2 The Rubidium Series HTTP Server

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

Please refer to the

"Installation & Systems Manual RUBIDIUM SERIES"

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

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

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

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

Button **Save To Module**:

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

Button **Reload From Module**:

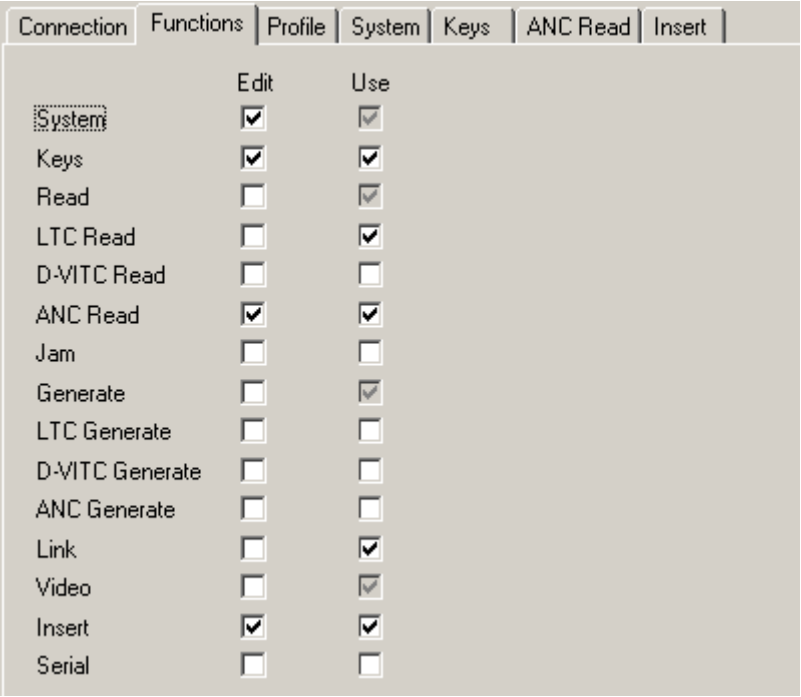
- Click on this button to load the current configuration of the module.

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

3.3 “Functions”

Click on **Functions** to see all applicable tabs/pages listed, and to activate or deactivate tabs/pages.

For example (screen shot of the PC program tab):



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

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

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

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

List of functions:

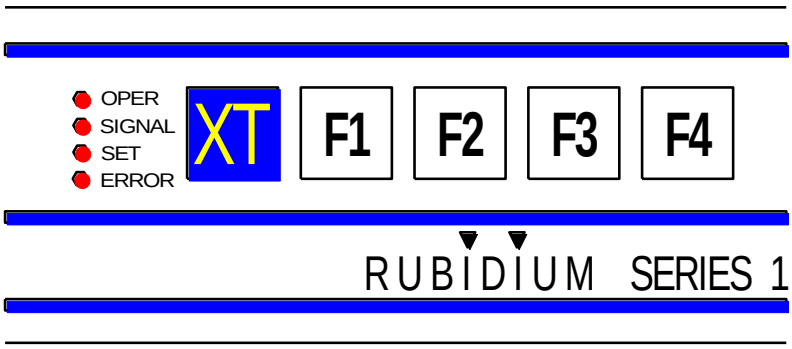
Profile	Store and Load Configurations on the Module (*)
System	Module Identification, Reset, SNMP, Fan Control
Keys	Keys and Lamps, LEDs and GPIs (XT module only)
Read	Configuration of the "General Reader"
LTC Read	LTC Reader Functions (XT module only)
D-VITC Read	D-VITC Reader Functions
ANC Read	Ancillary Data Reader Functions
Jam	The Jam Sync Function
Generate	Basic Set-Up of the Time Code Generator
LTC Generate	LTC Generator Functions (XT module only)
D-VITC Generate	D-VITC Generator Functions
ANC Generate	Ancillary Data Generator Functions
Link	Communication between Modules
Video	Video System and General Set-Up of the Video Channel
Insert	Set-Up of all Video Windows
Serial	Serial Interfaces (XT module only)

(*) refer to "Installation & Systems Manual RUBIDIUM SERIES"

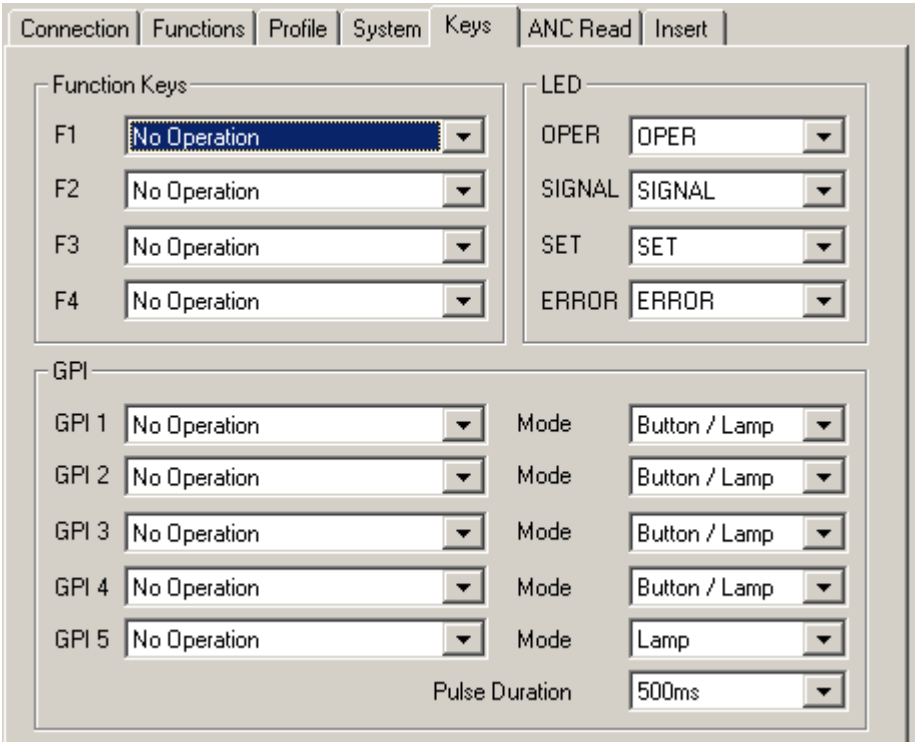
3.4 “Keys”: Keys and Lamps, LEDs and GPIs

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

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



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



Function Keys (and Lamps)

Four keys F1, F2, F3, and F4 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.

This drop-down list is identical to the drop-down list of GPI functions.

Please refer to the document "RUB AT/DT/HT/XT Application: GPI Functions" for a description of the available functions. You can download it from:

https://plurainc.com/products/xt/

GPI

Four GPIs can get a function independently from each other, as an input or as an output. Additionally, the switching characteristic is selectable. GPI 5 always will be an output.

Input: Edge sensitive as a push button or level sensitive as a toggle switch.

Output: Level sensitive as a lamp or a pulse with selectable pulse duration.

Select from the drop-down lists.

Please refer to the document "RUB AT/DT/HT/XT Application: GPI Functions" for a description of the available functions. You can download it from:

https://plurainc.com/products/xt/

LED

Four LEDs (named OPER, SIGNAL, SET and ERROR) can get a function independently from each other. Select a function from the drop-down list.

Available functions:

OPER	Lights up during normal operating mode.
SIGNAL	Lights up as long as time code can be read.
SET	Lights up as long as any PC program (configuration or status monitor program) has established a connection to the module by the PC interface.
ERROR	Indicates an error.
Gen Sync Status	Indicates the status of the phase and frequency synchronization of the time code generator (refer to chapter "Standard Features of the Time Code Generator").
Jam	Indicates the status of the Jam Sync mode (refer to chapter "Synchronization by Jam Sync").
PAL 8	Indicates the status of the colour lock mode (refer to chapter "Standard Features of the Time Code Generator ").
Storing Profile	Lights up shortly after storing a profile.

More functions are optional available.

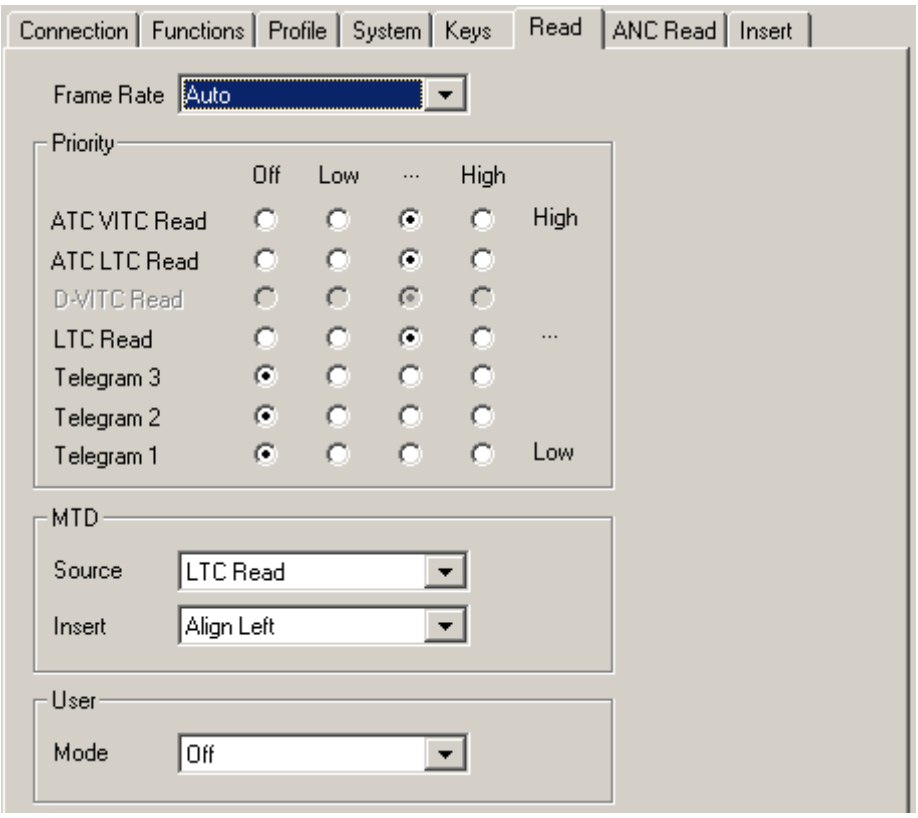
3.5 “Read”: Configuration of the “General Reader”

XT and XV modules are equipped with time code readers for the following time code formats:

LTC (XT module only),
D-VITC,
ATC_LTC and ATC_VITC,
and time code via telegram (1, 2, 3) of the internal Rubidium “TC_link“ interface.

“Read“ is a “general reader” which receives data from the special readers mentioned above. The current values of this general reader can be visibly inserted in a video window and are available for the Jam Sync function. The special readers can be individually switched off or can be assigned with a priority.

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



Frame Rate The frame rate of the incoming time code can be detected automatically or can be fixed to a value. Select the appropriate function from the drop-down list. In case of **Auto,** the frame rate will be set by the frame rate of the special reader.

Priority

All the time code readers can be individually switched off or can be assigned with a priority. In case that more than one reader is active, the priority determines which reader transfers its data to the general reader. If the same priority level has been selected for several readers, a second priority rule will apply corresponding to the list above: The reader at the top of the list has the highest priority.

To use one of the "Telegram" readers activate the **Link** function – see "Link".

MTD

Source In order to visibly insert any MTD timer in a video window, the binary groups (user data) of the time code according to the MTD format have to be decoded. This decoding process can be done for one source only. Select the source (= the special reader) from the drop-down list. You can choose from:

Read	Current time code read with highest priority (see item **Priority**)
LTC Read	LTC time code
D-VITC Read	D-VITC time code
Telegram 1/2/3	Any time code telegram of the selected channel (1 – 3)
MTDoE	MTDoE telegram send from any GT or GL module

Insert There may be one up to six digits of each MTD timer displayed depending on the current count values. The following selection helps you to align the video window on the right or left side of the video screen.
This set-up affects all MTD formats ("**Format = MTD ...**") at the **Insert** function.

Align Left	Left adjusted.
Align Right	Right adjusted.
Fixed Size	Video window fixed to maximal width.

User

If the binary groups (user data) of the time code are of a special format, and a decoding is necessary to get a date or to visibly insert any MTD timer in a video window, the correct format should be selected from the drop-down list.

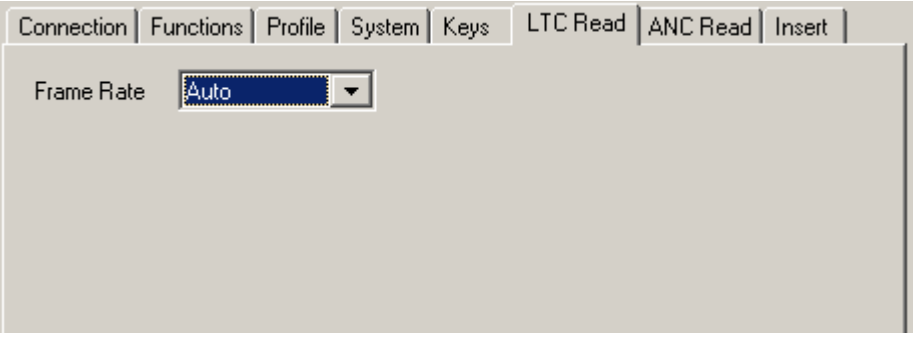
If the binary groups (user data) of the time code are used for MTD data transport, "MTD Data" should be selected. Only this usage of the binary groups allows decoding and inserting any MTD timer.

All other formats are used to transport the date. Decoding and inserting the correct date requires knowing the special format of the binary groups.

3.6 “LTC Read”: LTC Reader Functions

The XT module is equipped with an LTC time code reader.

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

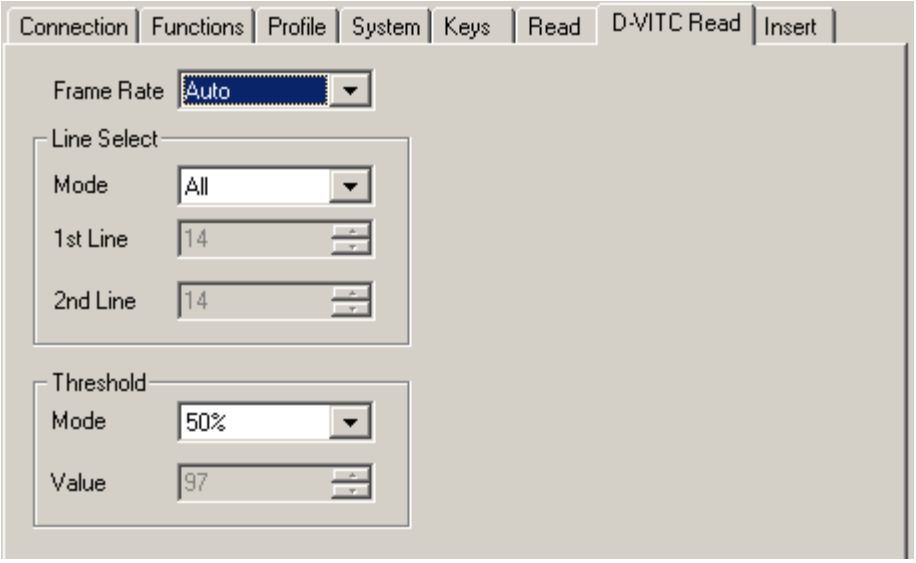


Frame Rate The frame rate of the LTC can be detected automatically or can be fixed to a value. Select the appropriate function from the drop-down list.

3.7 “D-VITC Read”: D-VITC Reader Functions

XT and XV modules are equipped with a D-VITC time code reader.

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



Frame Rate The frame rate of the D-VITC can be detected automatically or can be fixed to a value. Select the appropriate function from the drop-down list.

Line Select

D-VITC reader line selection: The D-VITC of the lowest line within the selected line range (each field) will be read. If this D-VITC carries plausible data, further lines then will be ignored.

Mode	*Off*	No D-VITC will be read.
	Lines	Line range: Only two lines - the “1st Line“ and the “2nd Line“.
	Block	Line range: All lines from “1st Line“ to “2nd Line“ (included).
	All	The whole available line range will be processed automatically.
1st Line	1st line (mode = “Lines“) or start line (mode = “Block“), valid input = 6 - 30.	
2nd Line	2nd line (mode = “Lines“) or last line (mode = “Block“), valid input = 6 - 30.	

Threshold

Select the data threshold. **50%** is the standard (factory) setting.

Mode	*Auto*	Automatic adaptation to the D-VITC data level.
	50 %	Fixed to a 50 % value, based at a nominal video and D-VITC data level.
	Manual	Enter a value manually, e.g. to find out the limits of the threshold values.
Value	If “Mode = Manual” is selected: Enter a value.	

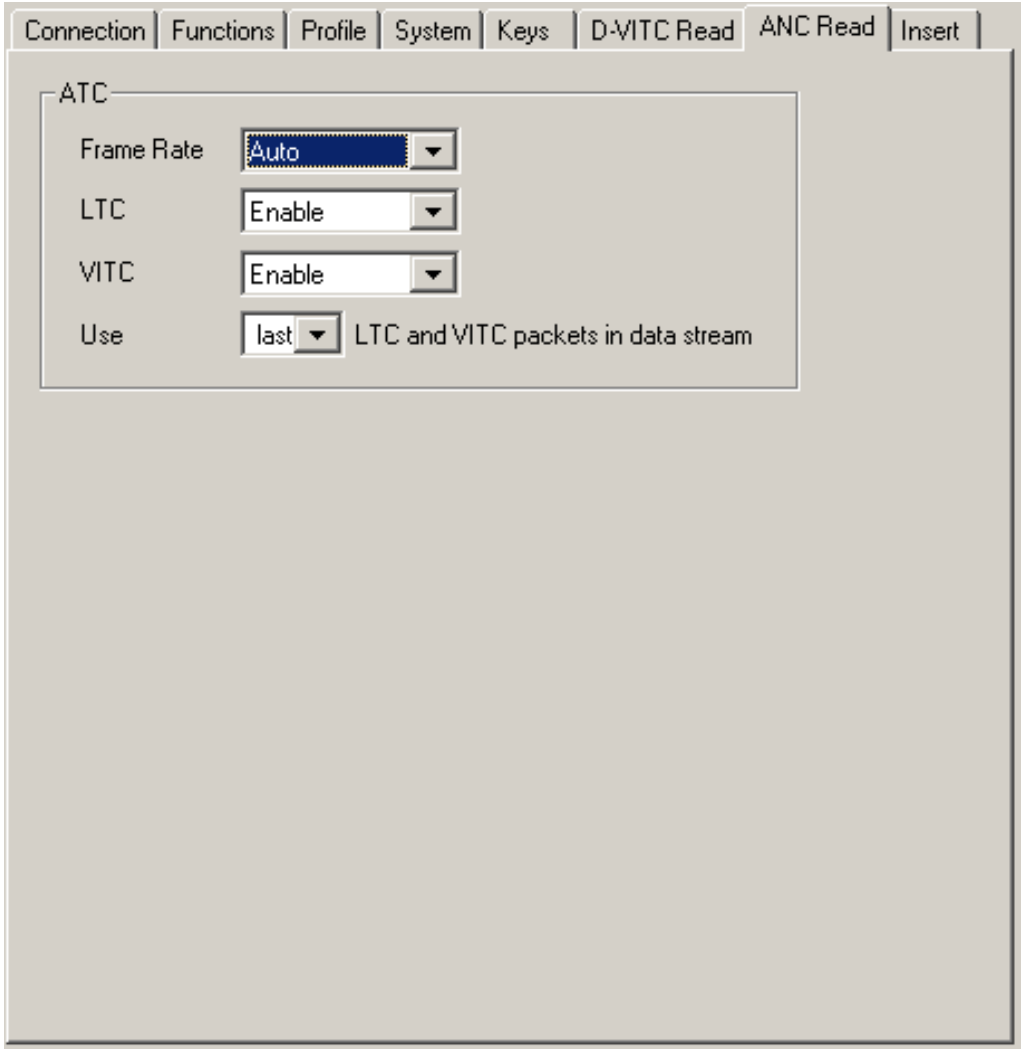
3.8 “ANC Read”: Ancillary Data Reader Functions

XT and XV modules are equipped with an Ancillary Data reader.

The standard firmware uses this functionality to read ATC (Ancillary Time Code) according to SMPTE-12M-2. ATC can be of type ATC_LTC and ATC_VITC.

Other ancillary data packets can be evaluated on request. Please contact Plura.

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



ATC

This configuration enables or disables the individual Ancillary Time Code reader. Time code according to SMPTE 12M-2-2008 will be accepted only (= ATC_LTC and ATC_VITC).

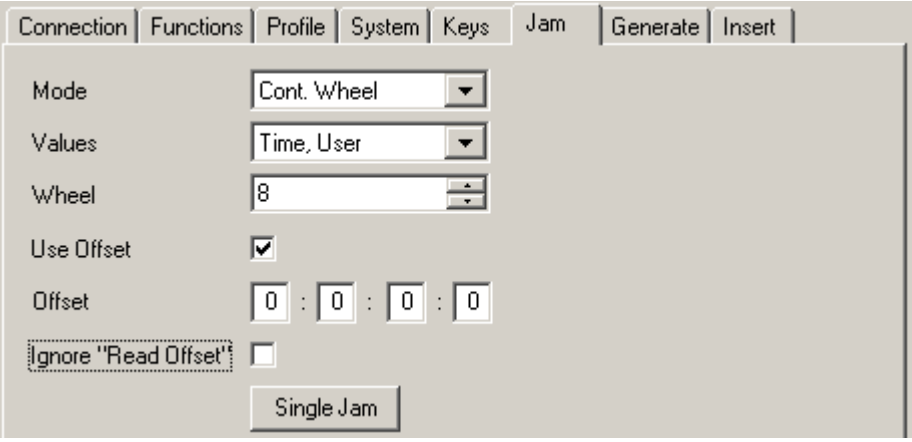
Any disabled reader cannot transfer any data to the general reader ("Read"). For full functionality only those readers should be enabled which really should be used for the present application.

Frame Rate	The frame rate can be detected automatically or can be fixed to a value. Select the appropriate function from the drop-down list.
LTC	***Disable*** or ***Enable*** the ATC_LTC reader.
VITC	***Disable*** or ***Enable*** the ATC_VITC reader.
Use	***last / first***: There may be more than one ATC data packet present. You can choose to accept the first or the last of these data packets. If you just want to check whether there is one data packet or more (with different time code values), you can switch between "last" and "first" and watch the reader insertion for changing values.

3.9 “Jam”: The Jam Sync Function

The **Jam Sync** function transfers time code of the “general reader” (Read) to the generator.

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



Mode

Please refer to chapter “Synchronization by Jam Sync” for a detailed description.	
Off	Jam Sync is switched off.
Continuous	Continuous Jam Sync.
Cont. 1Frame	Jam Sync with one-frame drop-out compensation.
Cont Wheel	Jam Sync with programmed drop-out compensation.
Start	One-time Jam Sync, active after power-on.
Convert	Time code conversion even at “still” time code input.
Diff Cont.	Continuous Jam Sync if time difference exceeds a threshold value. Generator continues to count if time code input fails.
Diff Stop	Jam Sync if time difference exceeds a threshold value. Generator stops counting if time code input fails.
Zero Frame	Jam Sync at frames = 00 of the time code input. Suitable for format conversions.

Values

The Jam Sync treats the time information and the binary groups (user bits) independently:	
Time	Time information of read → time of generator. The content of the binary groups (user bits) of the generated time code is determined by the selection “User Mode” of the generator function.
User	Binary groups of read → binary groups of generator. The time of the generator counts independently from the read time.
Time, User	Time information of read → time of generator, and binary groups of read → binary groups of generator.
Time to User	Time information of read → binary groups of generator. The time of the generator counts independently from the read time.
User to Time	Binary groups of read → time of generator.

Wheel

Number of frames for the drop-out compensation in the “Cont Wheel” mode.

Use Offset

If selected a programmed offset will be added to the time of the reader.

A negative offset can be achieved as follows: subtract the time or the number of frames by which the output should be delayed with respect to the input from 24 hours – considering the current frame rate. Example: for a delay of 10 frames in a 30 frames system the offset should be 23:59:59:20.

Offset

You can program a “hours:minutes:seconds:frames” offset.

Utilizing the PC program, you have to press the **tabulator key** at the PC’s keyboard to store the offset, utilizing the HTTP server press the **Save To Module** button.

Ignore “Read Offset”

This concerns the “Read Offset to 00:00:00:00” and “Read Offset to 10:00:00:00” operation modes switched on by a key or GPI function.

If checked: The generator receives and generates the original reader values, regardless of the “Read Offset” function. If any “Read Offset” operating mode is switched on, the generator values will then be different from the processed reader values.

If not checked: If any “Read Offset” operating mode is switched on, the generator will receive and generate these processed reader values.

The offset which you can enter at this page will be added to the values transferred from the reader – independent from clicking this checkbox or not.

Single Jam

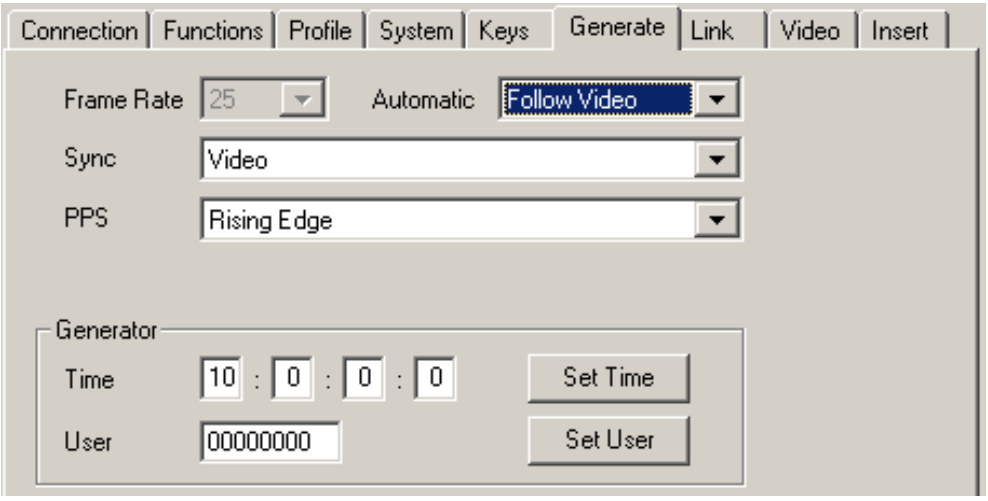
The **Single Jam** will be switched off automatically (Jam Mode = OFF) after the time code generator has once received data from the reader. If - according to the set-up at “Values” - a time transfer has been selected, the time addresses of the generator will be set by the time addresses of the read time code, after that the time will be count continuously. After power-on a Single Jam mode is cleared.

Single Jam can be activated by a click on this button, or by a programmed key or GPI.

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

There is one-time code generator which feeds the different time code outputs – see chapter “Standard Features of the Time Code Generator”. You can adjust the frame rate and the source of the synchronization signal. The time code generator can receive start values manually or by the “Jam Sync” function.

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



Frame Rate Adjust the frame rate of the generator. If you are working in a television surrounding the frame rate has to be selected according to the television signal:

Frame rate	television signal
24	720p/24; 1080p/24
25	625/50 (PAL); 720p/50; 720p/25; 1080i/50; 1080p/25; 1080p/50
30	720p/60; 720p/30; 1080i/60; 1080p/30; 1080p/60
30 df	525/59.94 (NTSC); 720p/59.94; 720p/29.97; 1080i/59.94; 1080p/29.97; 1080p/59.94

Automatic The generator can adapt its frame rate automatically:

Follow Video Frame rate follows the video input. The frame rate can be set automatically to *24*, *25* or *30 df* – but not to *30*.
This requires to setup “System = Auto” at the **Video** tab.

Follow Jam-Sync Frame rate follows the “Read” time code input during a Jam Sync operating mode. The frame rate can be set automatically to 24, 25, 30 or 30 df.

Sync Select the source of the synchronization signal:

Internal Internal reference.
Video Video signal connected to VIDEO IN.
LTC Read External LTC signal connected to LTC IN.
PPS External pulse per second (PPS) connected to GPI_1.

PPS Select the reference edge if **Sync** = "PPS" has been selected:
Rising Edge
Falling Edge

Generator

The time and the binary groups (user bits) can receive start values.

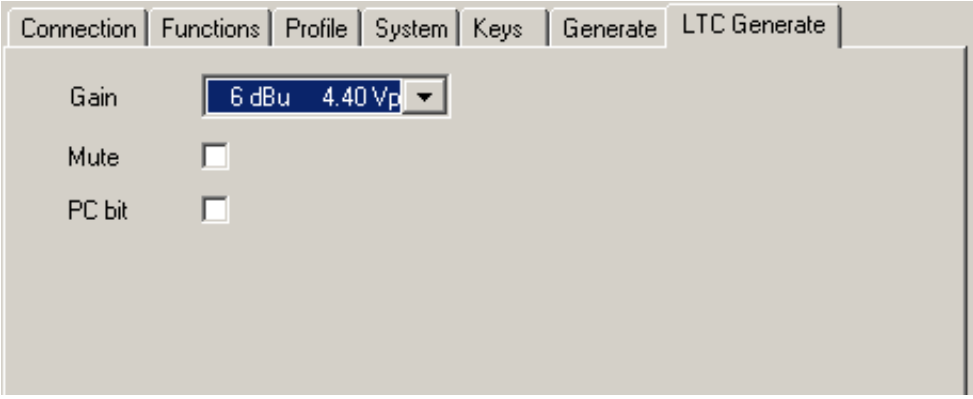
Time Enter a time value: HH:MM:SS:FF. Click on the **Set Time** button to transfer the values to the module.

User "User" denotes the binary groups of the time code. These are 8 digits, values in the range 0 - 9 and A – F will be accepted. Click on the **Set User** button to transfer the values to the module.

3.11 “LTC Generate”: LTC Generator Functions

XT modules can output the data of the time code generator in an LTC format.

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



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

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

Correspondence between balanced use and unbalanced use:

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

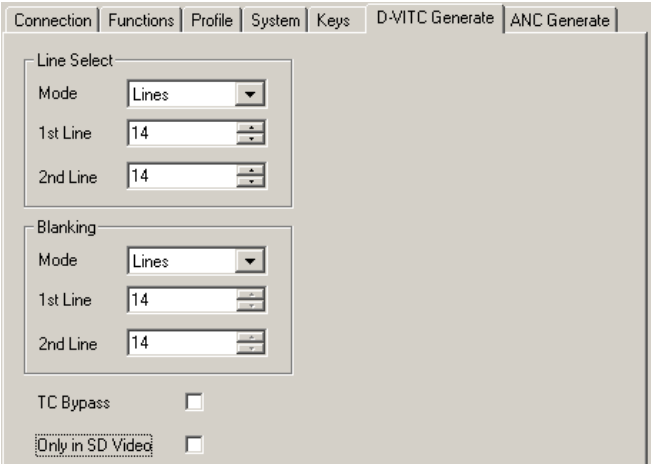
Mute LTC output mute on/off.
This function can be programmed for a key or a GPI input as well.

PC bit If checked: The polarity of the synchronization word of the LTC output will be stabilised. The polarity correction bit is put in a state, so that every 80-bit word contains an even number of logical zeros. The polarity correction bit is bit no. 27 in the 525/60 system, no. 59 in the 625/50 system. Checking this checkbox is helpful if you do some LTC measurements with an oscilloscope.

3.12 “D-VITC Generate”: D-VITC Generator Functions

XT and XV modules can output the data of the time code generator in a D-VITC format.

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



Line Select

Mode	*Off*	No D-VITC will be generated.
	Lines	D-VITC in only two lines: The “1st Line“ and the “2nd Line“.
	Block	D-VITC in all lines from “1st Line“ to “2nd Line“ (included).
1st Line	Select the first line (“Lines“) or the start line (“Block“), valid input = 6 to 30.	
2nd Line	Select the second line (“Lines“) or the last line “Block“), valid input = 6 to 30.	
Note: If “1st Line“ is equal to “2nd Line“, only one D-VITC line will be generated.		

Blanking

Selected lines can be blanked. Typical application is to remove a D-VITC from the video signal. Lines which are selected for blanking and for D-VITC (see “Line Select” above) will be blanked before the D-VITC will be generated.

Mode	*Off*	No blanking.
	Lines	Blanking of two lines: The “1st Line“ and the “2nd Line“.
	Block	Blanking of the lines from “1st Line“ to “2nd Line“ (included).
1st Line	Select the first line (mode = “Lines“) or the start line (mode = “Block“), valid input = 6 to 30.	
2nd Line	Select the second line (mode = “Lines“) or the last line (mode = “Block“), valid input = 6 to 30.	
Note: If “1st Line“ is equal to “2nd Line“, only one line will be blanked.		

TC Bypass

Check it for an automatic D-VITC bypass: New D-VITC will be generated only if no D-VITC is present in the incoming video. If D-VITC is already present, no new D-VITC will be inserted. This feature requires enabling the D-VITC reader as well. Please notice ***3** in the next chapter.

Only in SD Video

There is no specification of D-VITC for HD digital video. It is strongly recommended to check this box if you are working both with SD and HD signals. If checked, the D-VITC generator will be switched off automatically if HD video is detected.

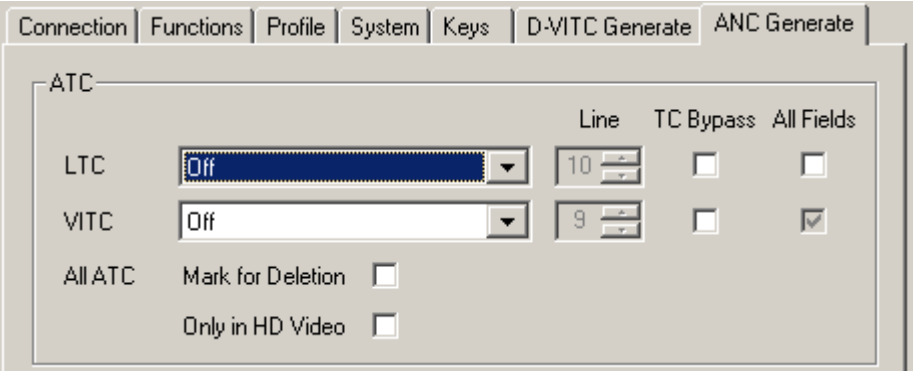
3.13 “ANC Generate”: Ancillary Data Generator Functions

XT and XV modules have an Ancillary Data Generator integrated.

The standard firmware uses this functionality to generate ATC (Ancillary Time Code) according to SMPTE-12M-2. ATC can be of type ATC_LTC and ATC_VITC.

Other ancillary data packets can be generated on request. Please contact Plura.

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



Ancillary data packets may be inserted within the blanking intervals of a digital video signal:

HANC = horizontal ancillary space; VANC = vertical ancillary space.

Please be aware that the available ancillary space depends on the video format.

ATC

LTC/VITC	*Off*	Use this set-up to disable the corresponding ATC generator.
	On (Standard)	Use this set-up to insert the corresponding ATC in recommended lines. ***1**
	VANC	Use this set-up to insert the corresponding ATC in a line of VANC space. Select this line at “Line”. This set-up includes a line correction for HD interlaced video formats. ***1**
	VANC w/o even field correction	Use this set-up to insert the corresponding ATC in a line of VANC space. Select this line at “Line”. There will be no line correction for HD interlaced video formats in this case. ***1**
	HANC	Use this set-up to insert the corresponding ATC in a line of HANC space. Select this line at “Line”. This set-up includes a line correction for HD interlaced video formats. ***1**
	HANC w/o even field correction	Use this set-up to insert the corresponding ATC in a line of HANC space. Selected the line at “Line”. There will be no line correction for HD interlaced video formats in this case. ***1**
	TC Bypass	Check it for an automatic ATC bypass: The corresponding ATC will be generated only if this ATC is <u>not</u> present in the incoming video. If this ATC is already present, no new ATC will be inserted. This feature requires enabling the corresponding ATC reader as well. Please notice ***2** and ***3**.
LTC: All Fields		ATC_LTC will be inserted in the first field of the video. Activating

	"All Fields", the ATC_LTC data packet will be repeated in the second field. ***1**
All ATC Mark for Deletion	Checking this box will mark all ATC data packets for deletion. The data packets are still present and at the same location, but the data content will not be evaluated anymore. The ATC reader of this module receives the data packets independent from this set-up, i.e. this function has an effect on the video output only. The Ancillary Data Generator is able to insert new ATC data packets into this modified data stream.
Only in HD Video	This module can detect SD and HD video formats automatically. If you don't want to generate ATC data packets in SD video, check this box. In this case, the ATC generator will be switched off automatically if SD video is detected.

***1** SMPTE 12M-2 and ITU-R BT.1366-2 standards define the transmission of ancillary time code packets.

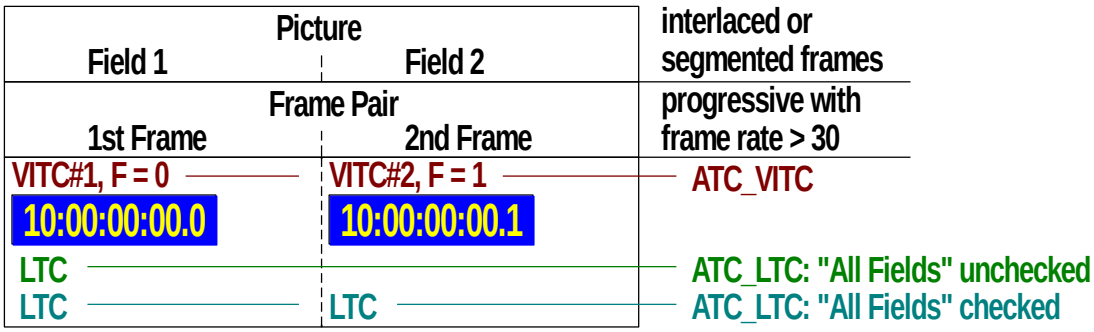
<u>ATC Packet Transmission Rate</u>

VITC (vertical interval time code) is defined as VITC#1 (ATC_VITC1) and VITC#2 (ATC_VITC2). This will be denoted as ATC_VITC for the user. VITC addresses each video field by nature, so it is inserted field-wise and includes a field mark flag ("F").

LTC (linear time code) is defined as ATC_LTC. LTC addresses each video picture by nature (frame rate = picture rate), but ATC packets can be treated as a kind of video time code and can be inserted field-wise. Using the "*All Fields*" set-up, the transmission rate of ATC_LTC can be selected: field-wise or frame-wise.

The following transmission rates are provided depending on video formats:

Interlaced and segmented frames formats, as well as progressive formats with frame rates > 30. In the latter case, pairs of frames are regarded.



Progressive formats with frame rates ≤ 30:

Locations of ATC Data Packets

The preferred locations are based on the vertical interval switching point defined in SMPTE RP 168. Regarding HDTV interlaced and segmented frames video formats, the line specified for switching in the second field differs from the line in the first field. This will be considered using set-ups *"On (Standard)"* as well as *"VANC"* or *"HANC"* for a manual line selection. There will be no line correction using set-ups *"VANC w/o even field correction"* or *"HANC w/o even field correction"*, in these cases ATC packets will be inserted at the same line of both fields.

Basically, ATC may be inserted in HANC or VANC space located within vertical blanking after the line specified for switching and before the beginning of active video. If set-up *"On (Standard)"* is used, ATC will be inserted in the recommended lines with automatic adaption to the video format.

These are the video format-dependent locations of the ATC data packets:

	SD Video			
	SD 525/59.94/I (NTSC)		SD 625/50/I (PAL)	
	1st Field	2nd Field	1st Field	2nd Field
Switching point	10	273 [10]	6	319 [6]
ATC_VITC *"On (Standard)"*	VANC 13	VANC 276 [13]	VANC 9	VANC 322 [9]
ATC_LTC *"On (Standard)"*	VANC 13	VANC 276 [13] if *"All Fields"*	VANC 9	VANC 322 [9] if *"All Fields"*

Apart from using *"On (Standard)"* to set the locations automatically, it is possible to choose the lines manually. For SD video formats there is no difference between *"VANC"* and *"VANC w/o even field correction"* or *"HANC"* and *"HANC w/o even field correction"*. ATC will be inserted in both fields in that line selected at "Line".

	HD Video				
	1125 lines interlaced or segmented frames		1125 / 750 lines progressive with frame rate > 30		1125 / 750 lines progressive with frame rate ≤ 30
	1st Field	2nd Field	1st Frame	2nd Frame	
Switching point	7	569 [6]	7	7	7
ATC_VITC *"On (Standard)"*	HANC 9	HANC 571 [8]	HANC 9	HANC 9	HANC 9
ATC_LTC *"On (Standard)"*	HANC 10	HANC 572 [9] if *"All Fields"*	HANC 10	HANC 10 if *"All Fields"*	HANC 10

Apart from using *"On (Standard)"* to set the locations automatically, it is possible to choose the lines manually. Please be aware of the differences regarding HD interlaced and segmented frames video formats:

"VANC" or *"HANC"*: 1st field: ATC at line number as selected at "Line".
2nd field: ATC one line earlier than selected at "Line".

"VANC w/o even field correction" or *"HANC w/o even field correction"*:
1st and 2nd field: ATC at line number as selected at "Line".

***2** If "TC Bypass" and "Mark for Deletion" both is checked: the "Mark for Deletion" feature will be disabled automatically as long as ATC is detected in the incoming video.

***3** Additionally there is a "TC Bypass" function available programming a key or GPI (function **Keys**). This function differs from the automatic "TC Bypass" function described in this chapter. Enabled via key or GPI, no video time code (D-VITC, ATC) will be generated, even if there is no video time code present in the incoming video. Please refer to the document "RUB AT/DT/HT/XT Application: GPI Functions" for more information about GPI functions. You can download it from:
https://plurainc.com/products/xt/

Please read more about customary applications like generating, regenerating, converting, and deleting ATC at chapter "ATC Time Code Applications".

3.14 “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.

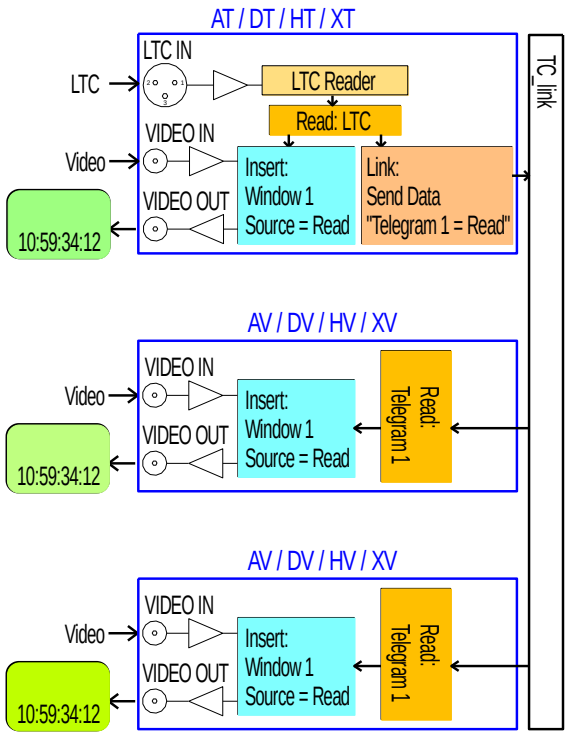
In case that the selected module should transmit data, **Link** selects the channel and the kind of data. The receiving module must select this channel as a reader input (see “Read“).

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

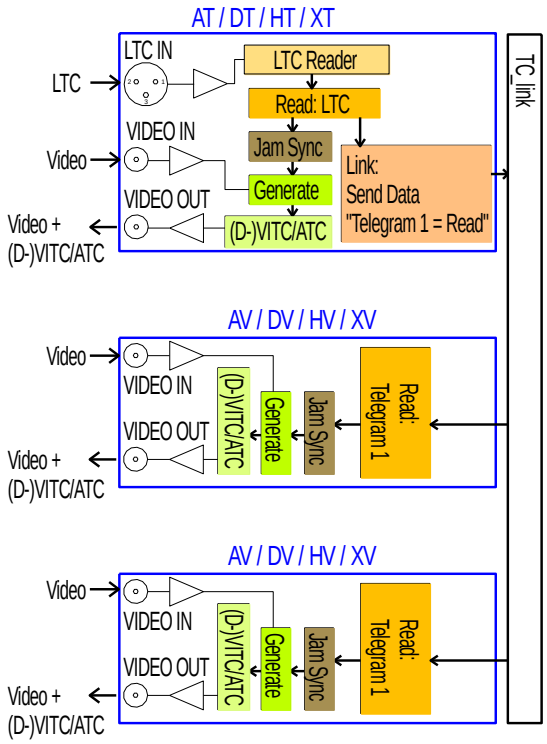
Typical application:

A master LTC time code is, for example, connected to a XT module which reads the time code and distributes it internally to AV/DV/HV/XV modules (as many as you like, in any combination).

Example 1: Time code visibly inserted into different video channels.

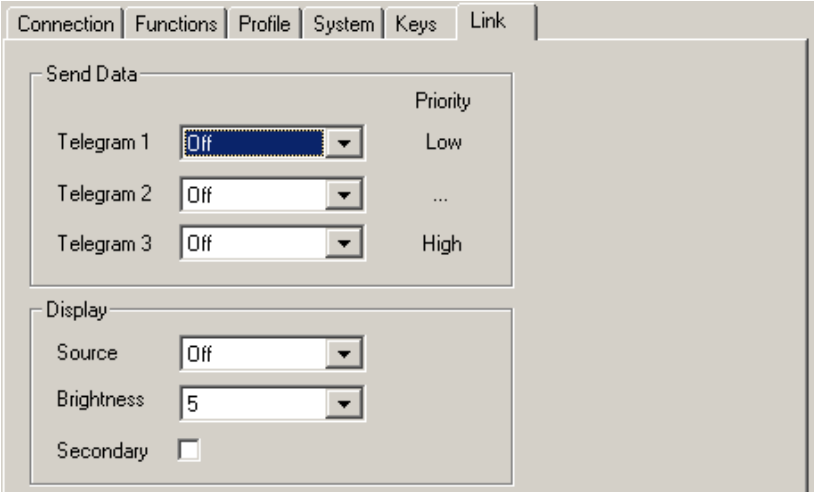


Example 2: Converting LTC into a video time code (VITC, D-VITC, ATC) for different video channels.



Both examples can be combined into a single application.

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



Send Data

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

Off	This channel will not be used to transmit data, data can be received.
Gen	Data of the time code generator, frame wise.
(D-) VITC Gen	Data of the time code generator, field wise with field flag.
Read	"General" reader data ("Read" – dep. on reader selection and priority).
LTC Read	Data of the LTC reader, frame wise.
(D-) VITC Read	Data of the VITC reader, field wise with field flag.

Display

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

Source Select the kind of data:

Off	No data will be sent from this module.
Gen Time	Time of the time code generator.
Gen User	Binary groups (user bits) of the time code generator.
Read Time	Time of the time code reader.
Read User	Binary groups (user bits) of the time code reader.

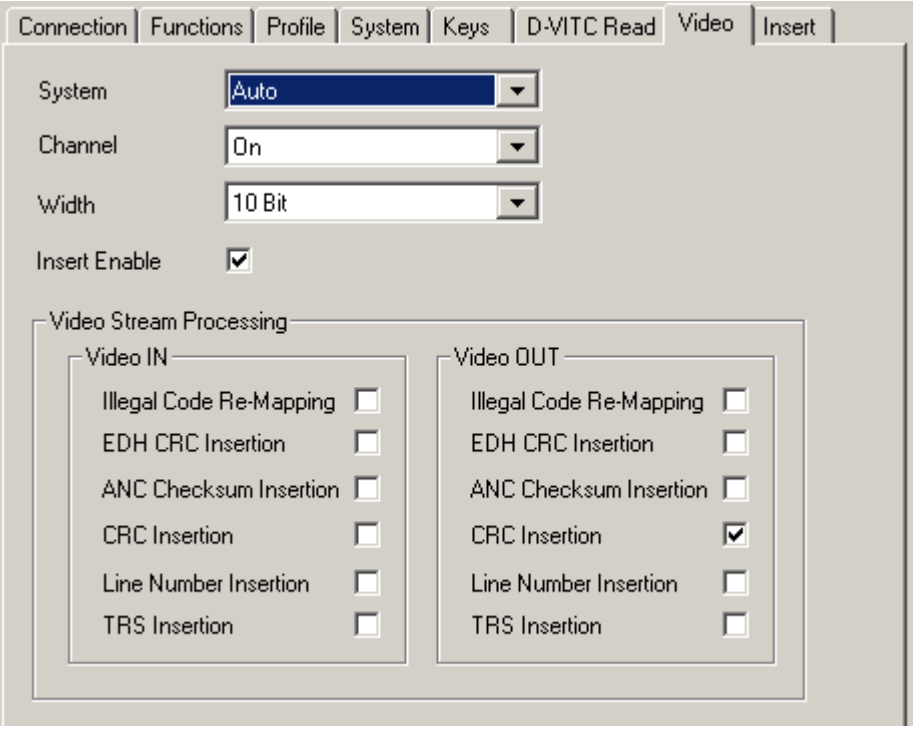
Brightness Adjust the brightness of the LEDs, steps 1 to 7.

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

3.15 “Video”: Video System and General Set-Up of the Video Channel

XT and XV modules are equipped with a high definition serial digital video channel.

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



System Select the video standard:

Auto	Auto-detect of the video standard (recommended). The supported standards are listed in the chapter “Standard Features of the Video Channel”. Please also refer to chapter “Generate ...” for the automatic modes of the frame rate.
Drop-down list	Select the video standard from the drop-down list according to the video connected at the video input.

Channel Set-Up of the video output:

Off	Video output switched off.
On	Normal operation: The video input signal passes through the video channel, signals will be added as programmed (time code, video windows).
Pass Thru	The video input signal passes through the video channel, but the video signal will be left unchanged.
Short Pass Thru	The video input signal will be left unchanged and will be passed to the output with minimum delay.
Relay Bypass	Activates the bypass relay (option B). The video input signal will be passed through the relay straight to the video output.

Width: Format of the serial data words: 8 bits or 10 bits.

Insert Enable: If this checkbox is activated: all video windows which have the "visible" checkbox activated (see "**Insert**") will be inserted in the video signal.

If this checkbox is deactivated: "insert bypass" of the video signal, i.e. all the video windows will be switched off (this does not affect the D-VITC/ATC generator lines). The input to output delay will be left unchanged.

Video Stream Processing

Activate or deactivate some data processing functions – independent for Video IN and Video OUT handling.

In standard applications it is recommended to keep the default setting shown in the screen shot.

Illegal Code Re-Mapping: If activated, remaps all codes of protected values within the active picture: Values between 3FCh and 3FFh will be remapped to 3FBh, values between 000h and 003h will be remapped to 004h. Additionally, 8-bit TRS and ancillary data preambles will be remapped to 10-bit values.

EDH CRC Insertion: The generation of a complete EDH packet ("Error Detection and Handling" according to SMPTE RP 165) can be enabled. Applicable for SD video only.

ANC Checksum Insertion: If activated, checksums for all detected ancillary data packets will be calculated and inserted automatically.

CRC Insertion: If activated, line-based CRC words will be generated and inserted into both the Y and C channels of the data stream (HD mode only).

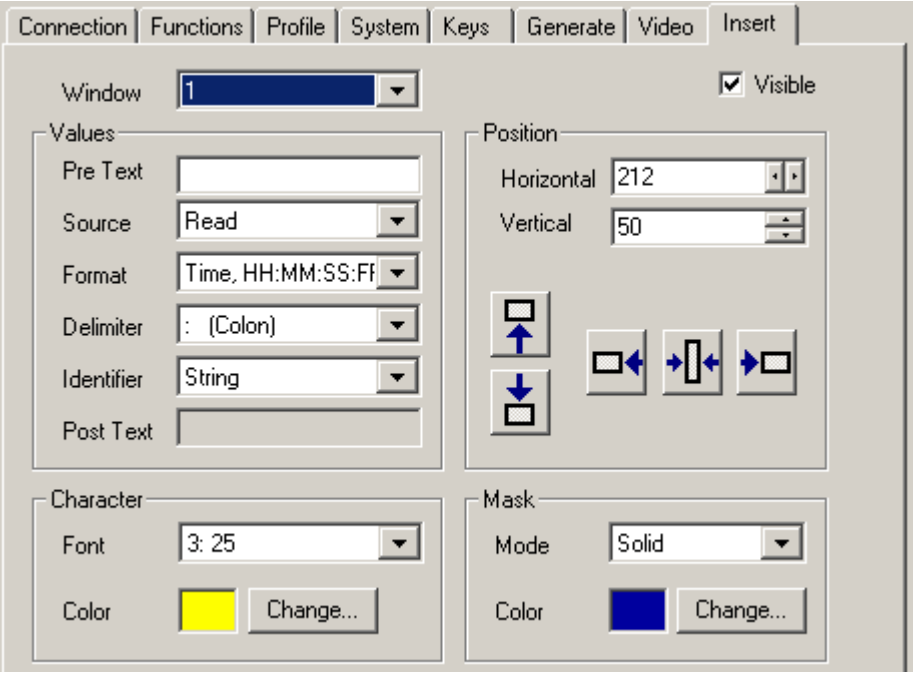
Line Number Insertion: If activated, line numbers will be generated and inserted into both the Y and C channels of the data stream (HD mode only).

TRS Insertion: If activated, 10-bit TRS code words (SAV, EAV) will be generated and inserted into the data stream as required. The video channel supports a flywheel mode. Once synchronization to the incoming data stream has been achieved, the flywheel will maintain synchronization.

3.16 “Insert”: Set-Up of all Video Windows

Each video window can get an individual set-up. It is recommended to connect the video output to a video control monitor so you can verify the changes immediately.

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



Window: Select the video window, all the following set-ups refer to this window.

Visible: Click on the control box to select “visible” (window insertion switched on) or not visible (window insertion switched off).

Values

Pre Text A text can be placed right before the source characters.

Source Select the data source from the drop-down list:

Read Data of the “general reader” (please refer to chapter “Read: Configuration of the General Reader” as well).
The data contain time and binary groups (user bits) of a time code, perhaps a date (configuration “User – Mode“ necessary), perhaps MTD data (configuration “MTD – Source“ necessary).

Generate Data of the internal time code generator. The data contain time and binary groups (user bits), therefore you are free to select

		any "time" or "user" format from the **Format** drop-down list. **Identifier** shows: Letter: G String: G1 or G2 (field indication)
	Reference	Time & date of a "Reference" telegram. The RUBIDIUM module which sends these data has to get the following set-up: At the **Link** function choose "Telegram" (1 or 2 or 3) = "Reference" at the "Send Data" box. Time in a HH:MM:SS format, no frames.
	LTC Read	Data of the LTC reader. The data contain time and binary groups (user bits), therefore you are free to select any "time" or "user" format from the **Format** drop-down list. **Identifier** shows: Letter: L String: LR
	D-VITC Read	Data of the D-VITC reader. The data contain time and binary groups (user bits), therefore you are free to select any "time" or "user" format from the **Format** drop-down list. **Identifier** shows: Letter: V String: VR1 or VR2 (field indication)
	D-VITC Generate	Data of the internal time code generator. The data contain time and binary groups (user bits), therefore you are free to select any "time" or "user" format from the **Format** drop-down list. **Identifier** shows: Letter: V String: VG1 or VG2 (field indication)
	ATC_LTC Read	Data of the ATC_LTC reader. The data contain time and binary groups (user bits), therefore you are free to select any "time" or "user" format from the **Format** drop-down list. **Identifier** shows: Letter: L String: LR
	ATC_VITC Read	Data of the ATC_VITC reader. The data contain time and binary groups (user bits), therefore you are free to select any "time" or "user" format from the **Format** drop-down list. **Identifier** shows: Letter: V String: VR1 or VR2 (field indication)
	Telegram 1 – 3	Time code of a telegram containing time and user bits (binary groups). The RUBIDIUM module which sends these data has to get the following set-up: At the **Link** function choose "Telegram" (1 or 2 or 3) = "Gen" or "Read" or a similar time code format.
	Serial	Data received from the serial interface. This is provided for special applications.
	IRIG-B	Data of an "IRIG-B" telegram. The RUBIDIUM module which sends these data has to get the following set-up: At the **Link** function choose "Telegram" (1 or 2 or 3) = "IRIG-B" at the "Send Data" box. These data contain day of year, hours, minutes, seconds, and 1/10 seconds.
Format	Select the representation of the data from the drop-down list. The **Delimiter** can be selected independently to separate pairs or groups of characters.	
	Text only	This format displays no data of the selected source. At "Pre

Text" or "Post Text" you can enter a text. If "Post Text" has not been used, a source identifier can be displayed choosing "Identifier".

The following formats are provided to display a **time**:

Time, HH:MM:SS:FF	Time of a time code, hours:minutes:seconds:frames.
Time, HH:MM:SS	Time, hours:minutes:seconds.
Time, MM:SS:FF	Time of a time code, minutes:seconds:frames.
Time, HH:MM	Time, hours:minutes.
Time, MMMM:SS	Time, minutes:seconds. Hours will be converted to minutes. Minutes are displayed with four digits, range 0000 – 1439.
Time, MM:SS	Time, minutes:seconds.
Time, SS:FF	Time of a time code, seconds:frames.

User bits (binary groups) of a time code can be presented in following formats:

User, 8 Digits	All eight digits, in a hexadecimal way: 0 – 9, A – F.
User, 6 Digits	The six most significant digits, hexadecimal 0 – 9, A – F.
User, 4 Digits	The four most significant digits, hexadecimal 0 – 9, A – F.
User, 1st Digit	The most significant digit, hexadecimal 0 – 9, A – F.
User, ASCII	If the user bits contain a character set conforming to ASCII, these (four) characters are displayed.

A **date** can be decoded out of two sources: "Source = Reference" or "Source = Read". If "Read" has been selected, the date has to be decoded out of the binary groups of a time code before, so choose the correct date format at "User – Mode" at the **Read** function (please refer to chapter "Read: Configuration of the General Reader"). The following formats are provided:

Date, DD MM YYYY	Day-month-year, with four digits for the year.
Date, MM DD YYYY	Month-day-year, with four digits for the year.
Date, YYYY MM DD	Year-month-day, with four digits for the year.
Date, DD MM YY	Day-month-year, with two digits for the year.
Date, MM DD YY	Month-day-year, with two digits for the year.
Date, YY MM DD	Year-month-day, with two digits for the year.

Please notice the document "RUB AT/DT/HT/XT Application: Read and Insert Time & Date". You can download it from:

https://plurainc.com/products/xt/

MTD Data can be decoded out of one source, which has to be selected from MTD – Source" at the **Read** function (please refer to chapter "Read: Configuration of the General Reader"). The selection at "Insert – Source" has no effect anymore, but it is recommended to select "Read" from the drop-down list. **MTD Data** include different timers, real-time & date, and more. Please choose:

MTD Time A – F	Current value of the selected stop timer A – F.
MTD Time	The local real-time decoded out of the MTD data.
MTD Date	The local date decoded out of the MTD data.
MTD Main 1 – 3	Current value of the selected "Main" time 1 – 3.

Please notice the document "RUB AT/DT/HT/XT Application: Read and Insert MTD Timer". You can download it from:
https://plurainc.com/products/xt/

IRIG-B data can be decoded if you select "Source = IRIG-B":

IRIG-B	Day-of-year:hours:minutes:seconds:1/10. "Day-of-year" is displayed with three digits, range 001 – 366.

Delimiter Select the delimiter from the drop-down list. The delimiter separates pairs or groups of characters according to the selection at "Format".

Identifier You can add a source identifier following the source characters. Select from the drop-down list:

Off	No source identifier.
Letter	One character, e.g. "G" for generator, "R" for reader etc.
String	Two characters plus possibly a field identifier, e.g. "VR1" stays for VITC reader data of the first field.
Frame Pair	First (.0) or second (.1) frame identifier of a frame pair in progressive video formats with 50/60 frames or field identifier in interlaced video formats.

Post Text Instead of an identifier ("Identifier = Off") you can add a text following the source characters.

Position

Horizontal Adjust the horizontal position of the video window in small steps: Enter a number or click on the increment/decrement buttons at the right side of the box.

Vertical Adjust the vertical position of the video window in small steps: Enter a number or click on the increment/decrement buttons at the right side of the box.

Click on these buttons to set the video window at the upper/lower border of the screen. The horizontal position will be left unchanged.

Click on these buttons to set the video window at the most left/centre/most right position of the screen. The vertical position will be left unchanged.

Character

Font Select the character font from the drop-down list. The standard firmware has the following fonts provided:

Font	Roughly maximum No. of characters side by side			Roughly maximum No. of windows one beneath the other		
	SD	720	1080	SD	720	1080
1: 15	56	105	156	28	35	53
2: 20	40	72	110	18	25	38
3: 25	32	58	88	16	19	29
4: 35	24	44	66	10	13	20
5: 45	18	34	50	8	11	16
6: 60	14	26	38	6	8	12
7: 80 (TC only)	10	19	28	4	6	8
8: 105 (TC only)	8	15	22	3	4	7
9: 139 (TC only)	6	11	16	2	3	5

It is possible to create own character fonts. Please refer to the document "Rubidium Series Font Compiler" for details, available at https://plurainc.com/products/xt/.

Color Select the colour of the character insertion. The current colour is indicated. Click on the **Change...** button to change the colour. Refer to the description below for more information.

Mask

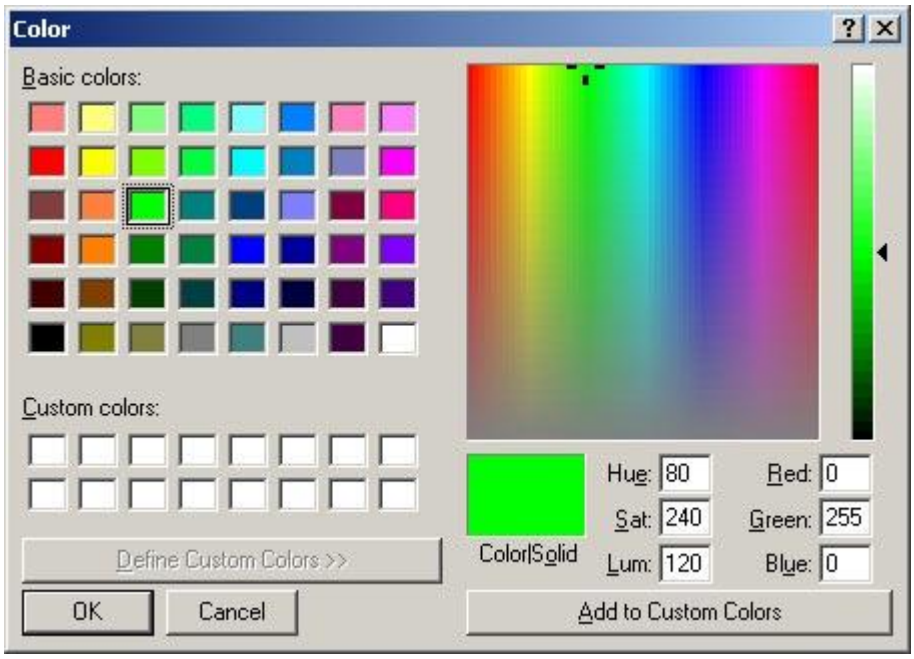
A background mask can be added to the character insertion. Select from the drop-down list:

Mode

Off	No background mask.
Solid	With background mask.
Dimmed	Reducing the luminance of the video signal in the video window area.

Color Select the colour of the background mask ("Mode" = "Solid" only). The current colour is indicated. Click on the **Change...** button to change the colour. Refer to the description below for more information.

Change...: Select the colour of the character insertion or the background mask:



Click on any of the colour boxes to use an already defined colour: "Basic color" or "Custom color".

If you want to define your own colour you can:

- Enter a value in the **Hue**, **Sat**, **Lum** boxes.
- Enter a value in the **Ret**, **Green**, **Blue** boxes.
- Select colour and saturation: use the mouse button to draw the pointer at any place within the colour spectrum. Select brightness: use the mouse button to draw the pointer at any place within the brightness bar.

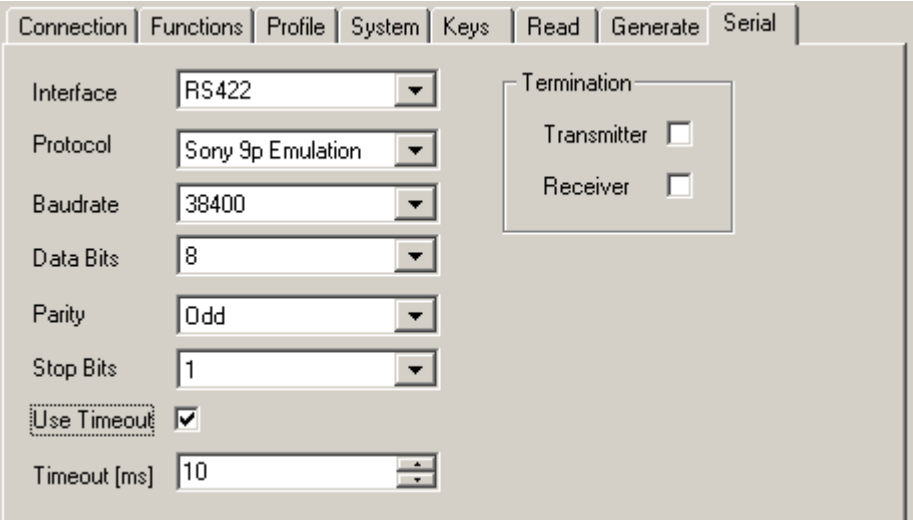
Press the **OK** button at the end.

3.17 “Serial”: Serial Interfaces

The XT module is equipped with a serial interface (in- and output pins at the SERIAL connector). The electrical format could be selected according to RS232 or RS422 or RS485 standard.

Please refer to the document “Rubidium AT/DT/HT/XT Modules: Serial Remote Control“ for details, available at https://plurainc.com/products/xt/.

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



Interface Select the electrical interface

Off	Interface switched off
RS232	Interface according to RS232 standard
RS422	Interface according to RS422 standard
RS485	Interface according to RS485 standard

Protocol Select a data protocol from the drop-down list

Baudrate Choose the baud rate:
2400 / 4800 / 9600 / 19 200 / 38 400 / 57 600 / 115 200

Data Bits *7* or *8* data bits

Parity Select the parity mode

None	Without parity
Even	Even parity bit
Odd	Odd parity bit

Stop Bits *1* or *2* stop bits

Use Timeout A timeout may be used for synchronization.

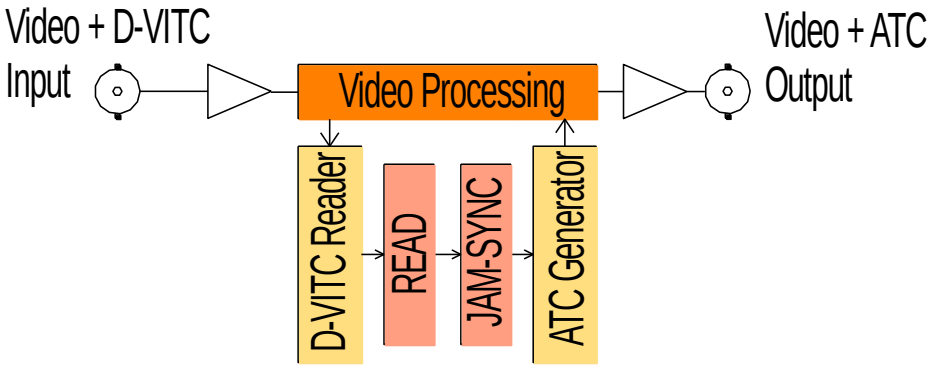
Timeout [ms] Choose a timer value for the timeout counter. Please choose a value suitable to the selected baud rate.

Termination If RS422 has been selected, the transmitter and the receiver can get a termination. If RS485 has been selected, the transmitter can get a termination.

4 Applications

4.1 Various Time Code Converters

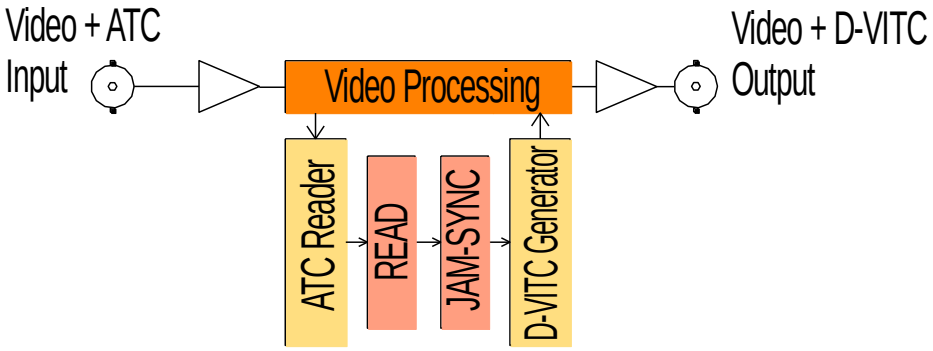
XT/XV application: D-VITC to ATC converter



Please refer to the document "RUB DT/HT/XT Application: D-VITC to ATC Converter" for more information. You can download it from:

https://plurainc.com/products/xt/

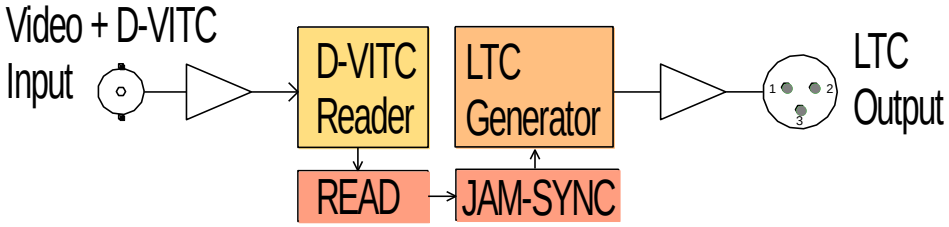
XT/XV application: ATC to D-VITC converter



Please refer to the document "RUB DT/HT/XT Application: ATC to D-VITC Converter" for more information. You can download it from:

https://plurainc.com/products/xt/

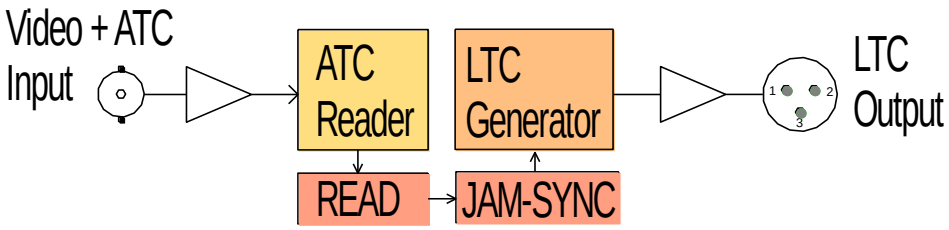
XT application: D-VITC to LTC converter



Please refer to the document "RUB AT/DT/HT/XT Application: VITC to LTC Converter" for more information. You can download it from:

https://plurainc.com/products/xt/

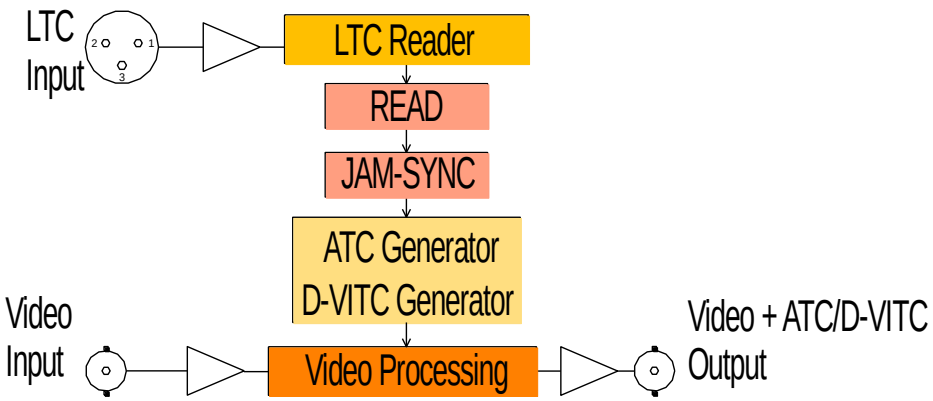
XT application: ATC to LTC converter



Please refer to the document "RUB DT/HT/XT Application: ATC_LTC to LTC Converter" and the document "RUB AT/DT/HT/XT Application: VITC to LTC Converter" for more information. You can download it from:

https://plurainc.com/products/xt/

XT application: LTC to D-VITC/ATC converter



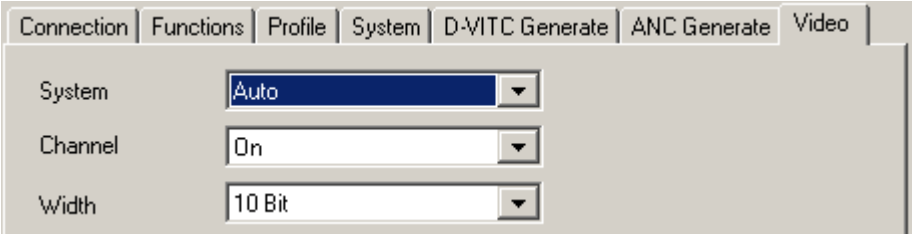
Please refer to the document "RUB AT/DT/HT/XT Application: LTC to VITC Converter" for more information. You can download it from:

https://plurainc.com/products/xt/

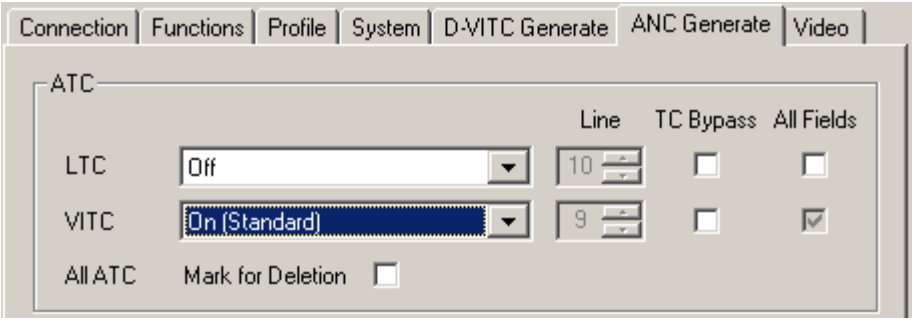
4.2 ATC Time Code Applications

<u>Application: Generate ATC in a mixed SD/HD operating.</u>

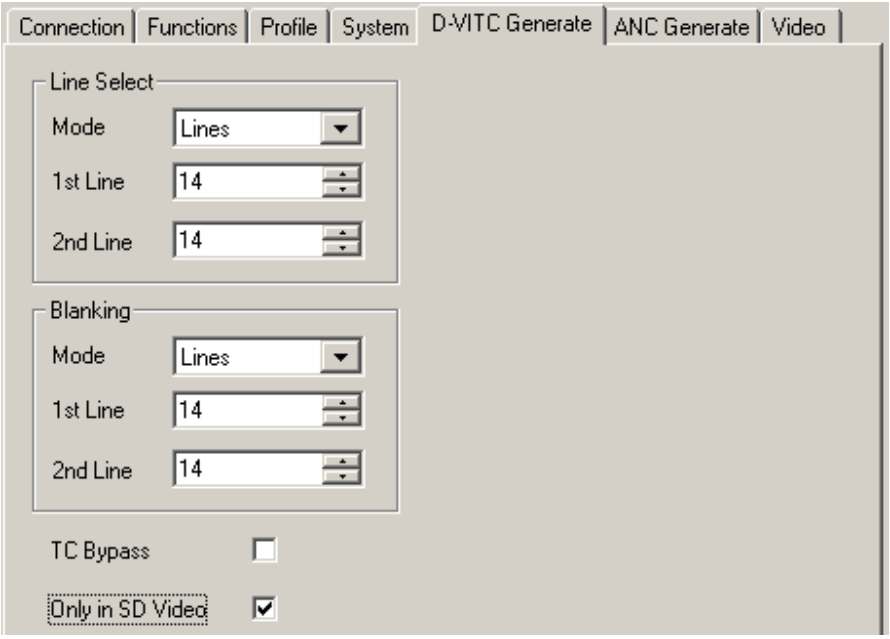
Video set-up: "System = Auto". This enables automatic detection of the video standard.



ANC Generate set-up: Select "On (Standard)" for the type of ATC you want to insert. ATC will be inserted in the recommended lines video format dependent.



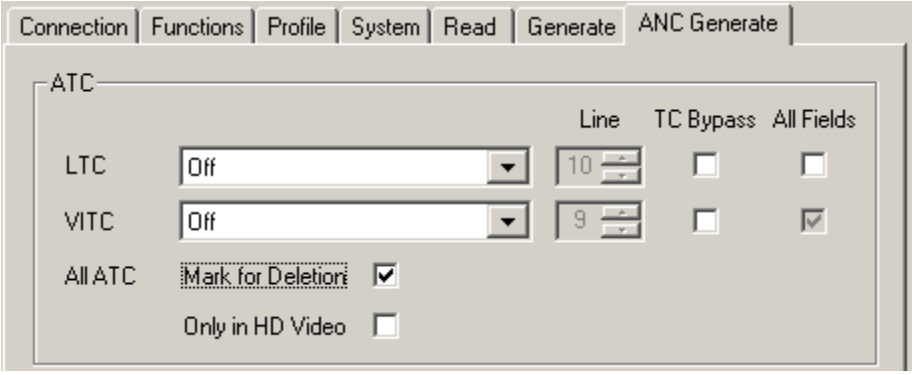
D-VITC Generate set-up: D-VITC is not specified for HD video formats. If you do not need D-VITC for your SD signals, switch off completely the D-VITC generator. If you need D-VITC for SD signals, check "**Only in SD Video**".



Application: Delete all ATC data packets.

ANC Read set-up: no matter.

ANC Generate set-up:

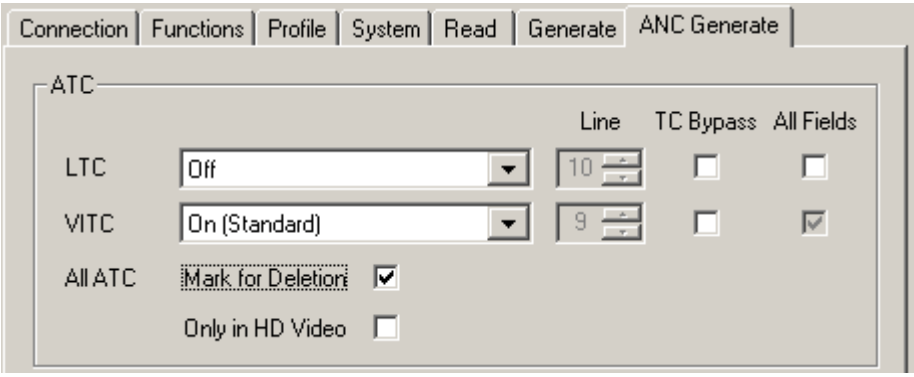


All ATC data packets of the incoming video will be marked for deletion in the outgoing video.

Application: Generate new ATC from a preset value and delete ATC present before.

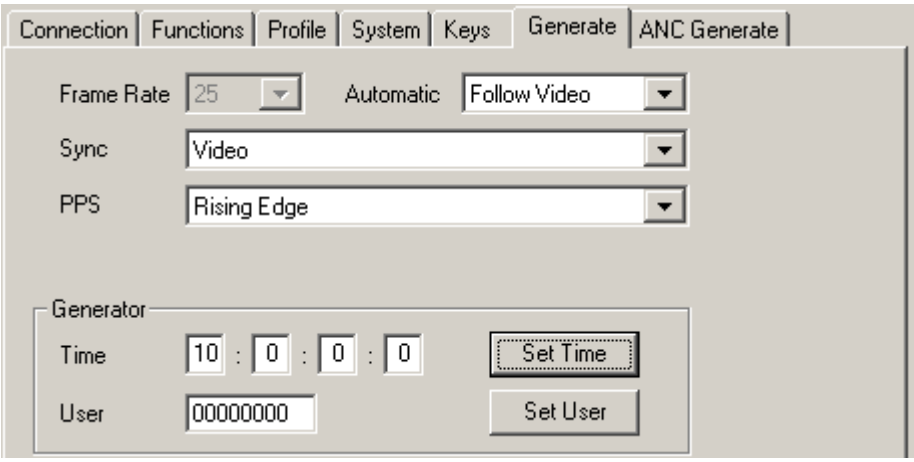
ANC Read set-up: no matter.

ANC Generate set-up: switch on ATC_LTC or ATC_VITC depending on application.



"Jam Sync" should be disabled.

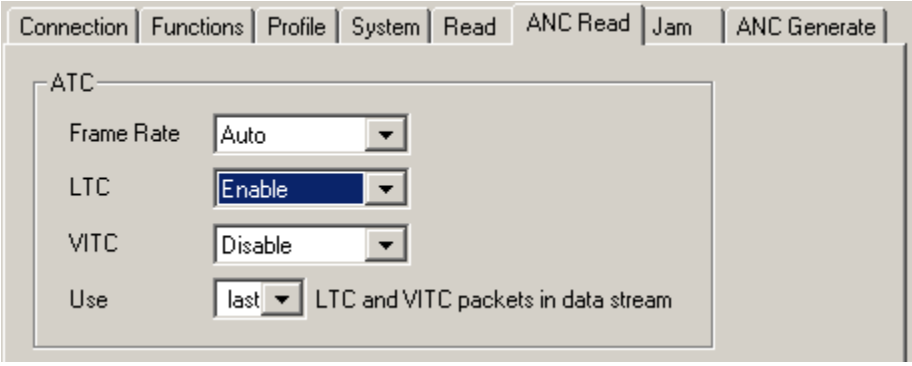
Set and enter your preset value at the "Generate" function. Automatic control is possible using GPI functions, e.g. "Generator Set + Start" or "Generator Reset + Start".



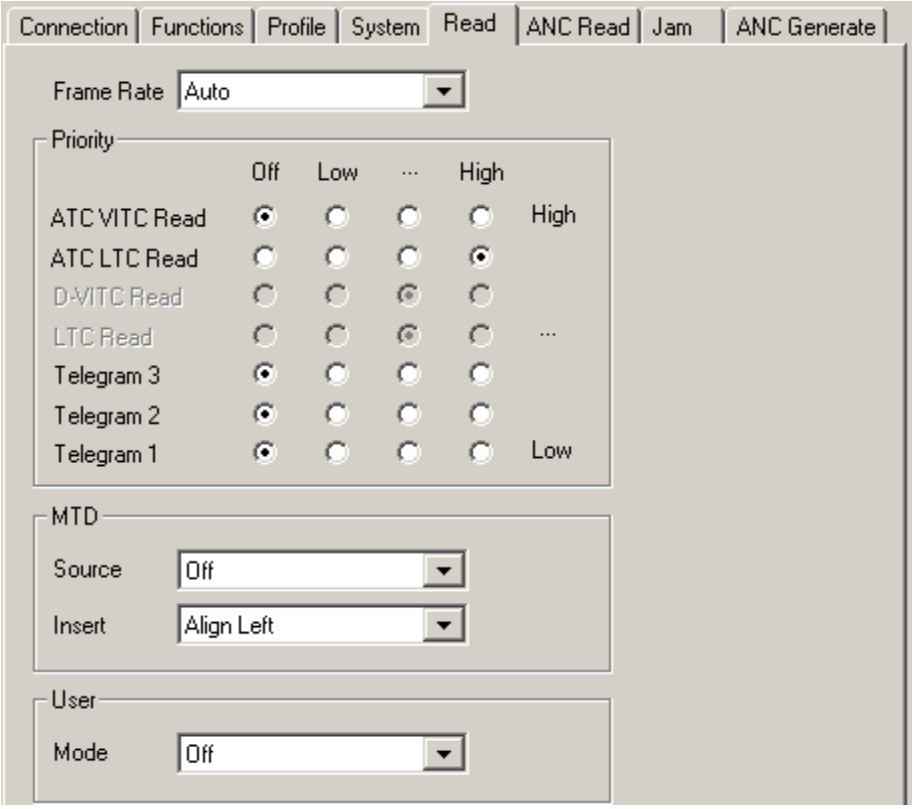
Application: Re-generate an existing ATC in a (new) dedicated line.
Converting ATC_LTC to ATC_VITC or vice verse likewise.

For example: Converting ATC_LTC to ATC_VITC.

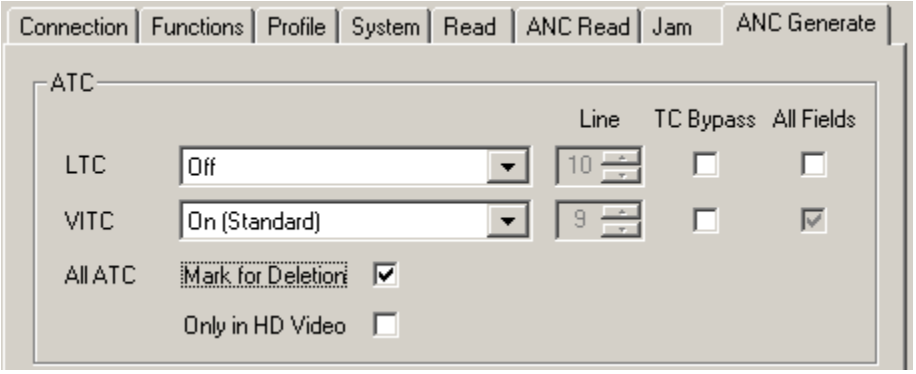
ANC Read set-up: Enable the ATC time code that you want to read.
This example: ATC_LTC.



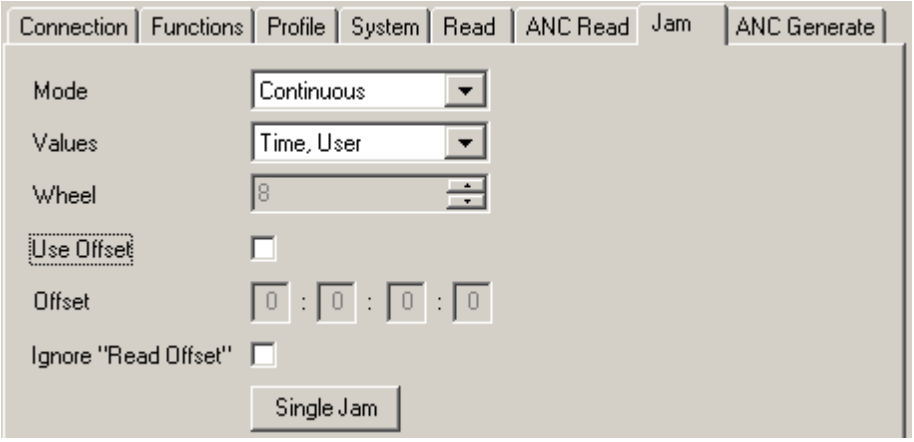
Read set-up: Select that time code which has been enabled at "ANC Read".



ANC Generate set-up: Enable the ATC time code that you want to generate.

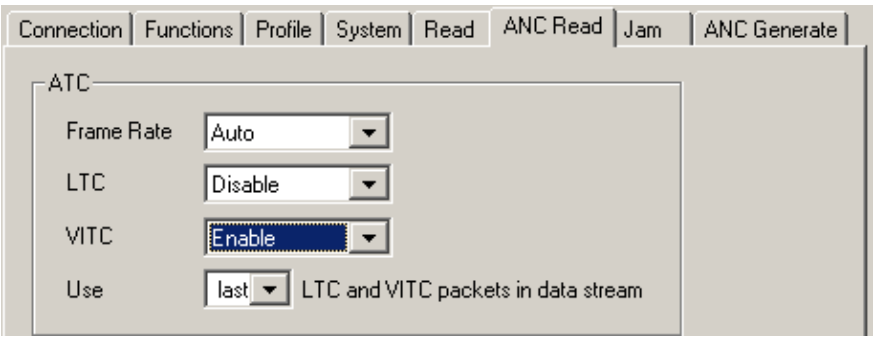


Jam set-up: Switch on the "Jam Sync" function.

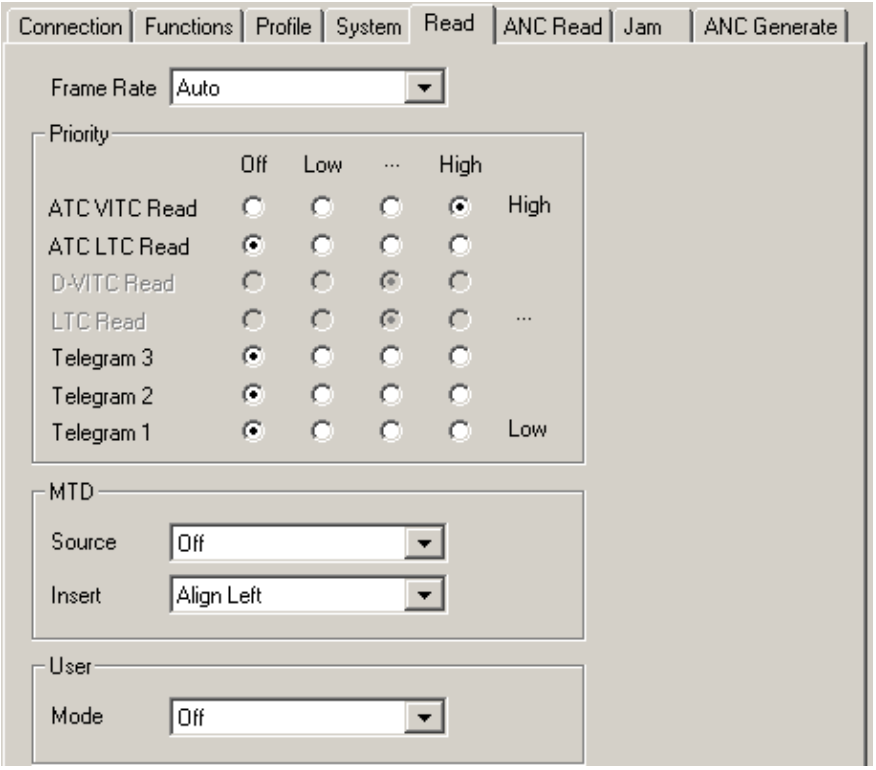


<u>Application: If ATC is present in the incoming video, it should be passed through.</u>
<u>If there is no ATC in the incoming video, new ATC should be generated.</u>

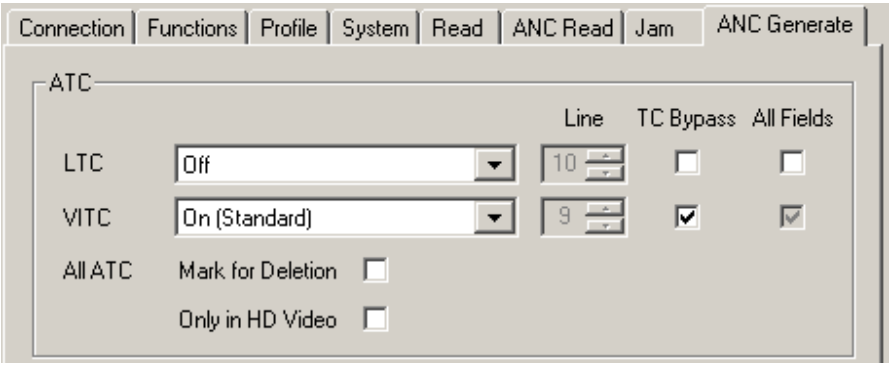
ANC Read set-up: Enable the ATC time code that you want to pass through.
This example: ATC_VITC.



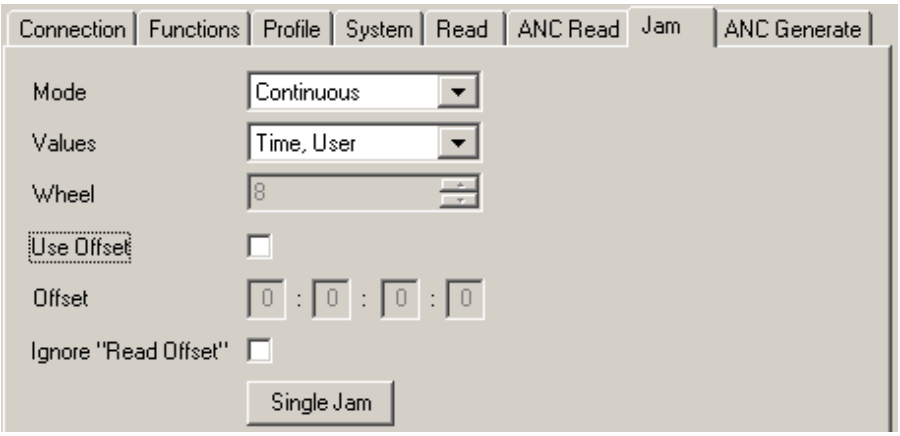
Read set-up: Select that time code which has been enabled at "ANC Read".



ANC Generate set-up: Enable the ATC time code that you want to generate. Check "TC Bypass".

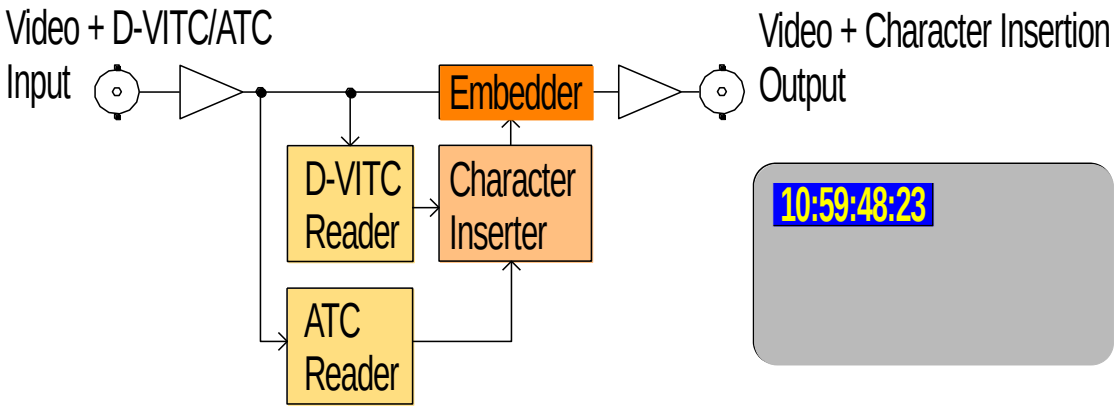


Jam set-up: Switch on the "Jam Sync" function.

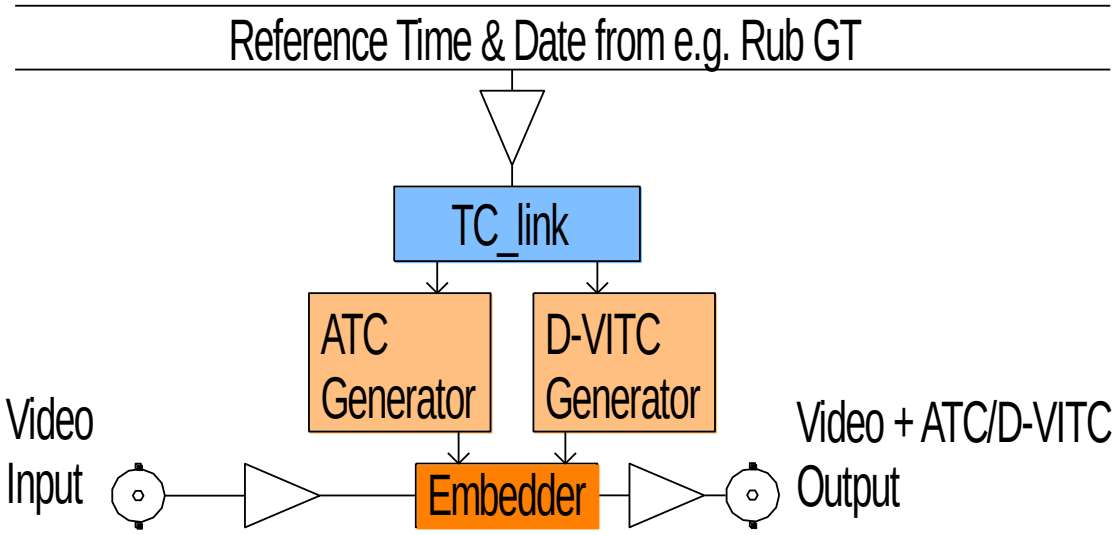


4.3 More Applications

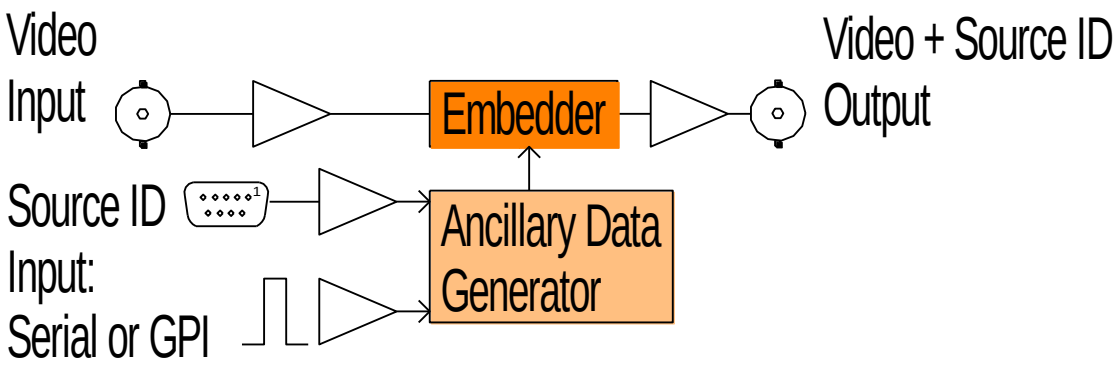
XT/XV Application: D-VITC/ATC Reader/De-embedder and Character Inserter



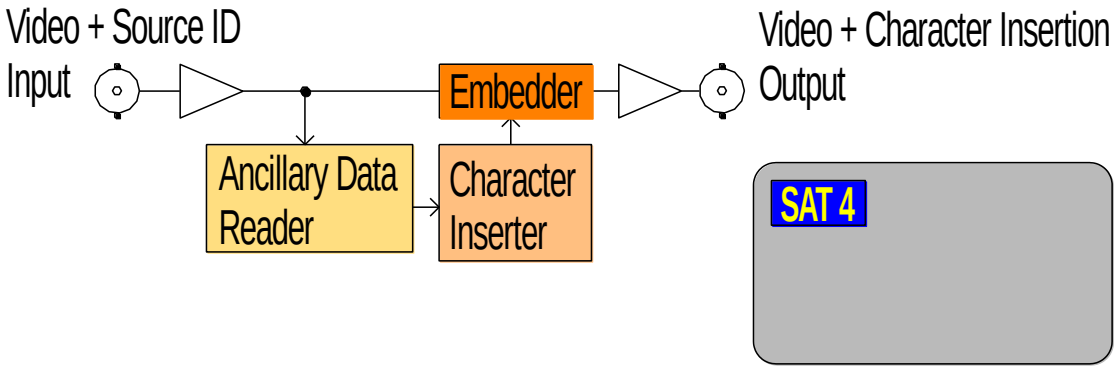
XT/XV Application: Reference ATC/D-VITC Generator



XT Application: Source ID Generator/Embedder



XT/XV Application: Source ID Decoder



5 Options

5.1 Option B: Video Bypass Relay

With this option the module is equipped with a bypass relay:

- The bypass relay appears in the video input to output path, not in the video loop path.
- The main functionality is to maintain the video path even in an event of power failure.

The bypass relay can be switched remote controlled by a GPI function: A function key or one of the GPI inputs can be programmed with the "GPI: Relay Bypass" function. Please refer to the document "RUB AT/DT/HT/XT Application: GPI Functions". You can download it from:

https://plurainc.com/products/xt/

> Note:
> The effect of the bypass relay is similar to that of an additional cable in the video line. It therefore influences the signal quality of the digital data stream.
>
> If you install modules with relay bypass option, we strongly recommend keeping the cable length at video input and video output at minimum.

Technical data of the relay:

Cut-off frequency	3.0 GHz
V.S.W.R.	Maximum 1.4
Insertion loss	≤ 0,6 dB
Impedance	75 Ω
Rated load	1 W 10 mA @ 24 VDC
Max switching current	0.5 A
Max switching voltage	30 V

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