Functional Description and Specifications

Version: 1.2

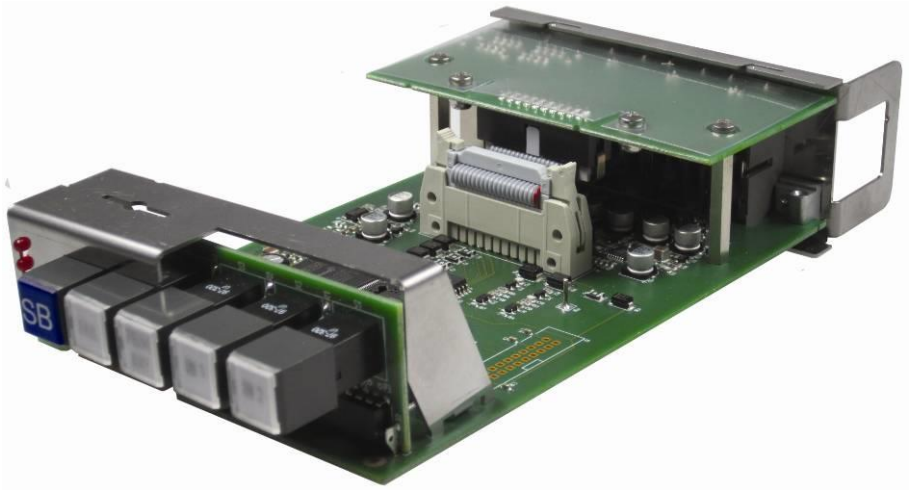
June 19, 2020

RUB SB

Monitoring and Changeover Module for Analogue Video Sync Signals Black Burst – Tri-Level – VITC

Monitor for Real-Time Synchronization

Supplement to the “Installation & Systems Manual RUBIDIUM SERIES”



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A1 Revision History

No.	Date	Subject
0.n		Preliminary documents, changes without notice.
1.0	May 7, 2013	First released document.
1.1	September 3, 2019	Changed address of Plura Europe GmbH.
1.2	November 4, 2019	Fixed NMEA baud rate to 4800.

Due to constant product development the features of this module are subject to change. The current functional description always refers to the current software and the current configuration tool.

You can download the latest version of the standard software from

https://www.plurainc.com.

Please be sure to use the latest configuration program after having done an update. You can download the latest version from the address above.

A2 Copyright

Printed in Germany.

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A3 General Remarks

This manual is a supplement to the '*Installation & Systems Manual RUBIDIUM SERIES*'. Please read the below listed chapters of the '*Installation & Systems Manual RUBIDIUM SERIES*', as these chapters are necessary for the safe and proper use of RUB modules:

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

1 Module SB

1.1 General Description

This module can compare and contrast two sources of analogue video sync signals for differences and real-time behaviour. Each source may consist of one or two signals, black burst or tri-level, even mixed. If a black burst signal with VITC is connected, the VITC will be monitored as well. Both sources should generate identical signals. In the event of a failure, **SB** automatically switches to the other faultless source.

The **SB** module forms the central part of a redundant video sync system and/or redundant VITC generator system, especially in a real-time application. Errors and failures of video or VITC signals, any disturbances of real-time reference signals, time differences between the sources, all these will be detected and can be indicated at a status monitor.

A **PC** or one of the RUB Ethernet modules (**RUB IE** or **RUB PM**) is required to configure this module.

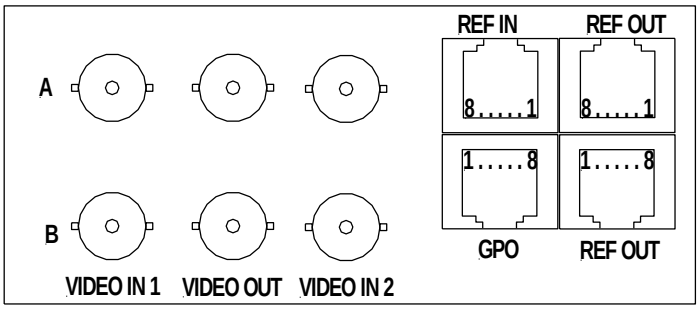
A front panel label **SB** visibly identifies RUB1 version modules. RUB3 version modules have this label at the rear plate. A serial number is located on the bottom side of the lower circuit board of each module.

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.
- 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://www.plurainc.com.
- 2 x 2 analogue video inputs with VITC readers. Video and VITC signals are monitored.
- Inputs for signals of a real-time reference: *PPS*, *time & date data string*, *10 MHz signal*. These signals are monitored and will be used for various measurements.
- 1 x 2 signal distribution of *PPS* and *time & date data string*.
- Changeover regarding the video signals utilizing latching relays.
- Alarm outputs indicating failures and warnings: lamps and LEDs (RUB1 version only), GPOs, SNMP traps, and entries in the log file of an Ethernet module.

1.2 Rear Panel and Connections



	VIDEO IN 1	VIDEO OUT	VIDEO IN 2
A	BNC (IEC169-8), 75Ω	BNC (IEC169-8), 75Ω	BNC (IEC169-8), 75Ω
B	BNC (IEC169-8), 75Ω	BNC (IEC169-8), 75Ω	BNC (IEC169-8), 75Ω

Pin assignments

REF IN RJ45 jack	REF OUT 2 x RJ45 jack	GPO RJ45 jack
1: PPS IN 2: RXD IN 3: Opt_IN 4: GND 5: VCC24G_OUT 6: 10 MHz IN 7: GND IN 8: VCC5G_OUT	1: PPS OUT 2: TXD OUT 3: Opt_OUT 4: GND 5: VCC24G_IN 6: n.c. 7: GND OUT 8: VCC5G_IN	1: GND 2: GPO_1 5: GPO_3 6: GPO_2 8: GPO_4 3: XCP 4: XCC 7: XCS

Signal descriptions

GND	Signal ground.

VIDEO IN 1 VIDEO IN 2	Analogue video signal inputs, black burst or tri-level.

VIDEO OUT	Analogue video signal outputs, switched via relay to the corresponding video input (A or B). Video outputs should be terminated in 75 Ω.

PPS IN	Pulse per second, input. Time mark of a real-time reference.
PPS OUT	Pulse per second, output. Hard wired to PPS IN.

RXD IN	Serial data string, input. Signal of a real-time reference.
TXD OUT	Serial data string, output. Hard wired to RXD IN.

Opt_IN Opt_OUT	Hard wired pins for optional use.

10 MHz IN	10 MHz continuous wave input. Default termination = 75 Ω, could be altered to 50 Ω as an option.

VCC24G_OUT	24 VDC voltage output, 200 mA reversible fused. This output voltage will be delivered from the power supply module in use (please notice the power supply specifications), or from the VCC24G_IN pin.
	Using VCC24G_OUT output please make sure not to exceed the total power rating of the power supply module.
VCC24G_IN	Hard wired with VCC24G_OUT signal.

GND IN/GND OUT	These signals are just hard wired.

VCC5G_IN/VCC5G_OUT	These signals are just hard wired.

GPO_1 … GPO_4	Output signals, indicating failures, warnings, or status.

XCP, XCC, XCS	Spare contacts at one of the latching relays for optional usage. Switching occurs in parallel the video changeover. XCC: Common XCP: Primary XCS: Secondary/Back-up

1.3 Specifications

Video inputs

Connector	BNC (IEC169-8), 75 Ω			
Signal level		Minimum	Nominal	Maximum
	Bi-level sync amplitude from synchronizing to blanking level	0.14 V_{PP}	0.30 V_{PP}	0.61 V_{PP}
	Tri-level sync amplitude from negative to positive peak	0.28 V_{PP}	0.60 V_{PP}	1.22 V_{PP}
DC offset	≤ ± 2,5 V			
Formats	Analogue video signals:			

Format	Standard	Sync
PAL 625/50	ITU-R BT.470-7	Bi-Level
NTSC 525/59.94	ITU-R BT.470-7, SMPTE 170M	Bi-Level
HDTV 720p23.98	SMPTE 296M-8	Tri-Level
HDTV 720p24	SMPTE 296M-7	Tri-Level
HDTV 720p25	SMPTE 296M-6	Tri-Level
HDTV 720p29.97	SMPTE 296M-5	Tri-Level
HDTV 720p30	SMPTE 296M-4	Tri-Level
HDTV 720p50	SMPTE 296M-3	Tri-Level
HDTV 720p59.94	SMPTE 296M-2	Tri-Level
HDTV 720p60	SMPTE 296M-1	Tri-Level
HDTV 1035i59.94 or psf29.97	SMPTE 240M	Tri-Level
HDTV 1035i60 or psf30	SMPTE 240M	Tri-Level
HDTV 1080psf23.98	ITU-R BT.709-5	Tri-Level
HDTV 1080psf24	ITU-R BT.709-5	Tri-Level
HDTV 1080i50 or psf25	SMPTE 274M-6	Tri-Level
HDTV 1080i59.94 or psf29.97	SMPTE 274M-5	Tri-Level
HDTV 1080i60 or psf30	SMPTE 274M-4	Tri-Level
HDTV 1080p23.98	SMPTE 274M-11	Tri-Level
HDTV 1080p24	SMPTE 274M-10	Tri-Level
HDTV 1080p25	SMPTE 274M-9	Tri-Level
HDTV 1080p29.97	SMPTE 274M-8	Tri-Level
HDTV 1080p30	SMPTE 274M-7	Tri-Level
HDTV 625p/50	ITU-R BT.1358-1	Bi-Level
HDTV 525p/59.94	ITU-R BT.1358-1	Bi-Level

VITC Reader

Signal level		Minimum	Nominal	Maximum
	From blanking level to logical one	400 mV_{PP}	500 – 600 mV_{PP}	1200 mV_{PP}
	From blanking level to logical zero	-25 mV_{PP}	0 – 25 mV_{PP}	200 mV_{PP}
VITC format	According to ANSI/SMPTE 12M-1-2008, ITU-R BR.780-2			

Measurement accuracy

Accuracy of time measurements	± 1 µs

10 MHz In

Connector	RJ45 REF IN, pin 6
Termination	Default = 75 Ω, could be altered to 50 Ω as an option
DC offset	≤ ± 2.5 V
Frequency range	0 – 33 MHz
Amplitude	sinusoidal, 0.6 – 3.0 V_{PP} (0 – 13 dBm)
Valid signal	10 MHz ± 3 %

PPS IN

Connector	RJ45 REF IN, pin 1
Characteristic	Typical input signal: 5 V impulse Input impedance: ≈ 100 kΩ Input "low": -2.0 to +2.0 V Input "high": +3.0 to +12.0 V Frequency range: 0 – 17 MHz
Valid signal	1 Hz ± 3 %

RXD IN

Connector	RJ45 REF IN, pin 2
Characteristic	Typical input signal: RS232 Input impedance: ≥ 40 kΩ Input "low": -15.0 to +2.0 V Input "high": +3.0 to +15.0 V Frequency range: 0 – 4 MHz
Valid signal	RS232 serial data of a valid protocol

GPO_1, GPO_2, GPO_3, GPO_4

Output specification	Open Collector output of an NPN transistor. Maximum power dissipation: 125 mW per output. "High" state: External pull-up needed to a positive power source of ≤ 24 VDC. Examples: ≥ 2.2 kΩ @ +5 V, ≥ 4.7 kΩ @ +12 V, ≥ 12 kΩ @ +24 V. "Low" state: Output switched to GND. Max. collector current: 100 mA DC, fused (auto-recovery). Collector-emitter saturation voltage: @ 20 mA: typ. 0.72 V (≤ 0.85 V) @ 100 mA: typ. 0.90 V (≤ 1.10 V) Frequency: 0 – 1 kHz.

VCC24G_OUT

Output of the DC power supply of this module, 23.8 VDC nominal	Reversible fused. A continuous current of up to 120 mA can be applied over the whole specified operating temperature range. At an ambient temperature of e.g. 22 °C the output switches to a high-resistance state after a few seconds if a current of 400 mA is applied.

XCP, XCC, XCS

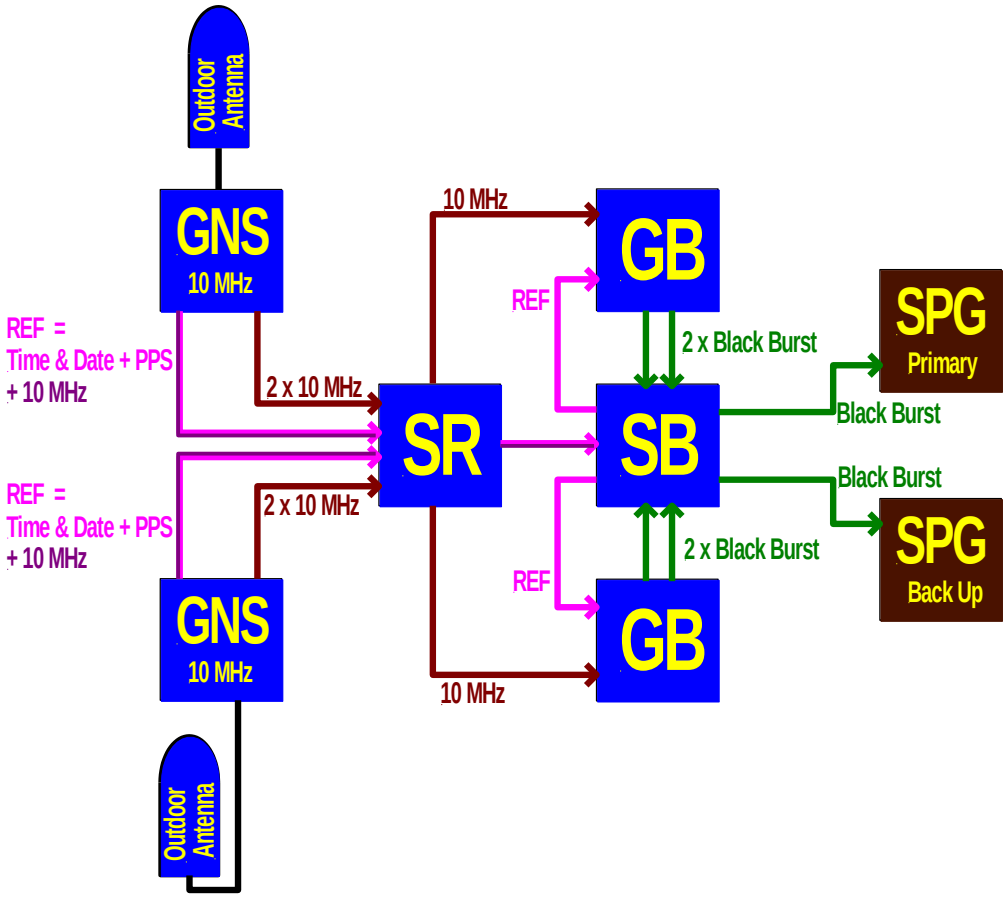
Spare contacts of the latching relay	Contact resistance: ≤ 75 mΩ Max. switching voltage: 48 V	Max. switching current: 2 A Max. transportable current: 2 A

Others

Operating voltage	12 – 30 VDC
Power consumption	1.5 W at maximum
Weight	≈ 0.3 kg
Dimensions	Standard circuit board (W x D): 100 x 160 mm/3.94 x 6.30 inch Rear panel: RUB1: 103 x 44 mm / 4.06 x 1.73 inch RUB3: 8 HP, 3 RU
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

1.4 Typical Application Diagram

Redundant Video Sync System



1.5 Software Update

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

https://www.plurainc.com.

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

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

Please now execute the following steps:

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

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

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

   Switch on the power of all units.

2. Execute "Rubidium Config.exe" on your computer. Select the "Port" according to the interface (USB, RS232) you are using.
3. Select the module (unit 1, 2, 3 ...).
4. Select "Flash Update" in the *File* menu.
5. Open the **.tcf**-file. Standard name: "Rubidium SB version.tcf".
   "version" stands for a revision no., e.g. 2.13.10.

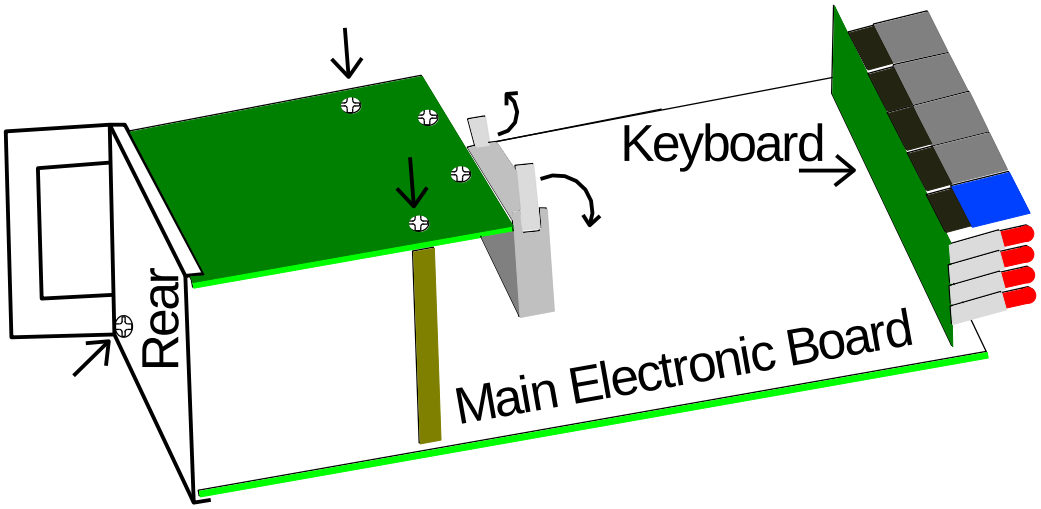
   Click the OK button, update starts. Click the OK button at the end.
6. Update is finished now. We recommend checking module's configuration utilizing the "RUBIDIUM CONFIGURATION" program.

During the flash update the operation of the module stops!
The changeover relays remain in their last position, so the signal flow of the connected signals will not be affected.

1.6 Electronic Part Exchange

The hardware of this module comprises the following printed circuit boards: The main electronic board at the bottom layer, the keyboard at RUB1 version modules which is fixed to the main electronic board by soldered pins, and the rear panel board which is attached to the main electronic board by screws.

The rear panel board with its connectors and the latching relay consists of "mechanical" parts, so there is a good chance that a damage of the module concerns the electronic part only. The following exchange procedure removes the main electronic board and the keyboard without interrupting the signal output. No cable should be disconnected.



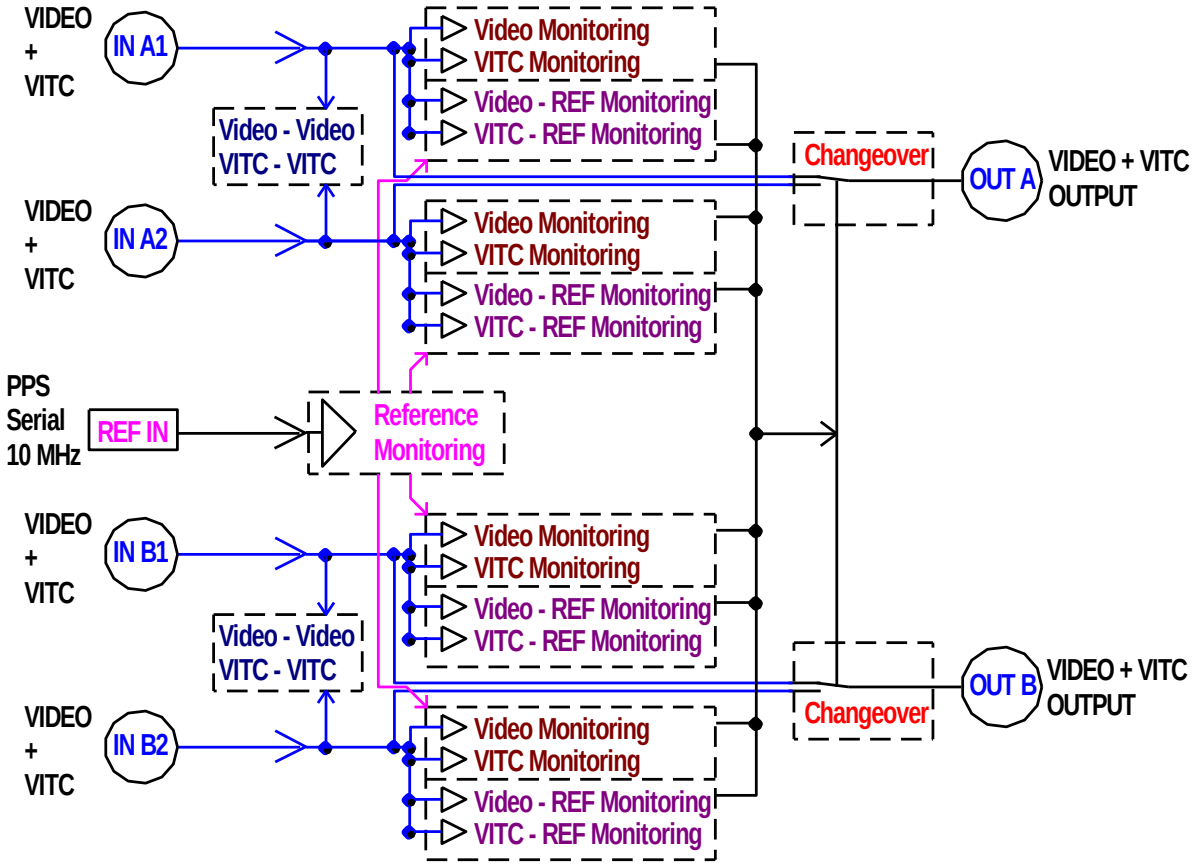
1. Arrangement:
   Contact your local dealer or Plura to order the main electronic board and the keyboard for a replacement. It is essential that you have as much information ready as possible: Serial number of the module, software version number, set-up and configuration. This will help to ensure that you are getting a direct replacement, even regarding the set-up values – which are stored in a non-volatile memory located at the main electronic board.
2. Preparation:
   Have a screwdriver for recessed-head screws ready.
3. Removal:
   Do not switch off the power. Do not disconnect cables. Follow the procedure described in the chapter '*Remove a Module*' of the '*Installation & Systems Manual RUBIDIUM SERIES*' to pull the module out of the slot. Observe precautions for handling electrostatic-sensitive devices.
4. Dismantle:
   Unscrew only the three screws as shown in the figure above: Two screws at the rear plate and one screw at the rear panel board. Release the levers of the IDC connector and pull out the 20-way ribbon cable. Now the main electronic board and the keyboard can completely be removed.
5. Reassemble:
   In principle follow the procedure in the reverse order.

2 Operating Description

2.1 Functional Overview

2.1.1 Basic Functions

- Monitoring and fault analysis of the video inputs; changeover in an event of a failure.
- Monitoring and fault analysis of the VITC inputs; changeover in an event of a failure.
- Measurement and monitoring the phase difference and drift between the video signals.
- Measurement and monitoring the time difference between the VITC signals
- Monitoring the signals of a real-time reference.
- Measurement and monitoring the phase difference and drift of the video signals against the real-time reference.
- Measurement and monitoring the time difference of the VITC signals against the real-time reference.



PC programs are available for free: Configuration of the module = **RubidiumConfig.exe**, status monitor = **RubStatSE.exe**.

The RUBIDIUM SERIES HTTP server, located in the Ethernet module (**RUB IE** or **RUB PM**) enables the configuration of the module and offers a status monitor as well.

2.1.2 Overview of Error Indications and Alarms in General

This module detects errors on video and VITC signals, on signals of the real-time reference, or on the module itself after a self-test.

Basically, each individual error will be represented by a status, an error counter, and an indication of a failure. The indication of a failure can be disabled. If not disabled, special alarms can be raised in case of an error. This gives the user the possibility to select individual errors for an alarm indication.

Furthermore, two overall counters are giving a quick overview:

- The "overall errors" counter shows the sum of all individual errors. A count value of > 0 indicates that at least one error has been detected.
- The "overall failures" counter shows the sum of all individual failures, i.e. all those errors with the failure indication not disabled. A count value of > 0 indicates that at least one failure has been detected.

You can see all the individual errors and both overall counters at the status monitor. Please open the status monitor to investigate the source of an error.

→ Chapter '*Overview of Error Indications at the Status Monitor*'.
→ Chapter '*Status Monitor*'.

RUB1 modules, i.e. modules plugged to a 1 RU chassis, indicate errors by the ERROR LED and failures by the FAIL lamp (in the default configuration):

- The LED in the "Switcher Error" function lights up as long as the 'overall errors' counter has a count value > 0.
- The lamp/key in the "Fail" function lights up as long as the 'overall failures' counter has a count value > 0.

GPO alarms can indicate failures and warnings:

→ Chapter '*Alarms by GPO*'.

SNMP Traps can indicate failures and warnings.

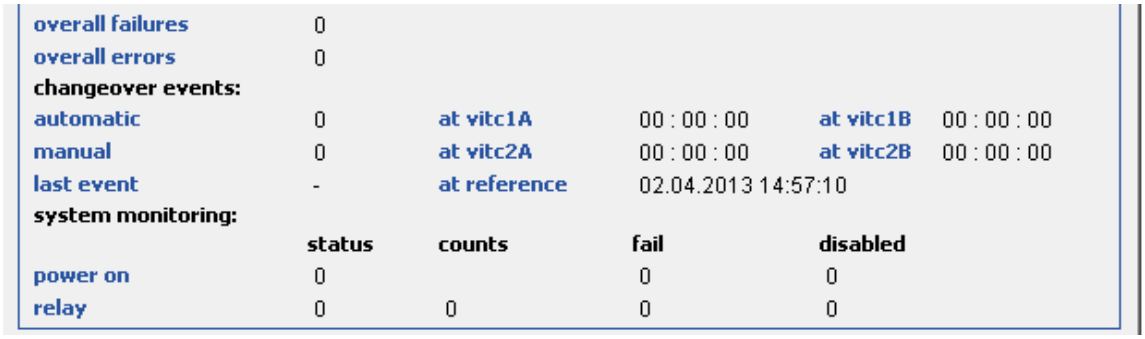
→ Chapter '*Alarms by SNMP Traps*'.

Entries in the log file of an Ethernet module can indicate failures and warnings.

→ Chapter '*Entries in the Log File of an Ethernet Module*'.

2.1.3 Overview of Error Indications at the Status Monitor

The **System** page of the status monitor shows the "overall failures" counter, the "overall errors" counter, and the individual errors of the system:



overall failures	0				
overall errors	0				
changeover events:					
automatic	0	at vitc1A	00 : 00 : 00	at vitc1B	00 : 00 : 00
manual	0	at vitc2A	00 : 00 : 00	at vitc2B	00 : 00 : 00
last event	-	at reference	02.04.2013 14:57:10		
system monitoring:					
	status	counts	fail	disabled	
power on	0		0	0	
relay	0	0	0	0	

The **Video A** page shows individual errors with respect to video signals at **IN1 A** and **IN2 A**.
The **Video B** page shows individual errors with respect to video signals at **IN1 B** and **IN2 B**.
The **VITC A** page shows individual errors with respect to VITC at **IN1 A** and **IN2 A**.
The **VITC B** page shows individual errors with respect to VITC at **IN1 B** and **IN2 B**.
The **Reference** page shows individual errors with respect to the real-time reference signals.

Any entry on a red background at the status monitor indicates an error:

	status	counts	fail	status	counts	fail	disabled
changeover & monitoring:							
timeout	1	2	1	0	0	0	0

Please refer to the following chapters for a detailed description of the individual errors:

→ Chapter '*Video Monitoring*'.
→ Chapter '*VITC Monitoring*'.
→ Chapter '*Real-Time Reference Monitoring*'.
→ Chapter '*Self-Test*'.

Basically, the following happens in case of an error:

status Indicates the error status at this very moment: Error yes (1) or no (0).
The status resets to 0 if this individual error has disappeared.

counts Counter counts up with every new error. Some counter counts up to 255, others up to 65,535. A count value > 0 indicates that there has been an error even if the status currently indicates no error.
Simultaneously, the 'overall errors' counter counts up.

fail Indicates the individual fail status at this very moment: Fail yes (1) or no (0). The fail indication can be disabled. The fail indication corresponds to the status indication if 'fail' has not been disabled. A fail can raise special alarms.
Simultaneously, the 'overall failures' counter counts up.

disabled The fail indication of this individual error can be disabled. If disabled, no fail will be indicated, and no special alarm will be given in case of an error.

2.1.4 Error Reset

The following error indications and alarms are self-resettable (reset, if no errors are present):

- The individual **status bits at the status monitor**.
- GPO programmed as **Signal 1 Failure**,
  Signal 2 Failure,
  Signal 1 Warning,
  Signal 2 Warning.

The following error indications remain as long as the overall counters have count values > 0:

'overall errors'> 0	'overall failures'> 0
• LED (ERROR) in the **Switcher Error** function. • GPO programmed as **System Error**. • SNMP trap **System Error**.	• Lamp (FAIL) in the **Fail** function. • GPO programmed as **System Failure**. • SNMP trap **System Failure**.

A reset of these counters and – at the same time – a reset of all individual error counters can be done by:

Keystroke

RUB1 modules, i.e. modules plugged to a 1 RU chassis, offer four programmable keys. The following functions are provided for a reset:

Function	Description	Recommended Key
Clear	Resets all error counters to zero.	F1: FAIL
Reset All	Complete reset of error counters and status.	F1: FAIL

It is recommended to assign the „Reset All" function to the FAIL key.

Configuration

Utilizing one of the configuration tools, a complete reset of error counters and status can be done clicking the "Error Reset" button at the **Switcher** page.

2.2 Video Monitoring

This module monitors 2 x 2 video signals.

Signals at input **A** (IN1 A, IN2 A) are checked and compared with each other, same way signals at input **B** (IN1 B, IN2 B) are checked and compared with each other. Comparing signals requires the same video format of these signals: IN1 A and IN2 A must have the same format; IN1 B and IN2 B must have the same format.

Signals at input **A** are treated completely separately from signals at input **B**. The status monitor therefore offers a **Video A** and a **Video B** page.

2.2.1 The Epoch Method

The frequency of a video signal depends on the video format, but it is always a known and fixed frequency. If the phase (e.g. the start of a picture) is known at a particular point in time, the phase can be calculated for any points in time in the past or future. You only have to know the relationship to the particular point in time. If this point in time (called "epoch") and the phase of reference signals are defined as a standard, all sync generators applying this method only need a precise real-time reference to generate sync signals which are aligned to each other.

SB is able to measure the phase of the video signal as well as the colour sequence against a real-time reference according to the epoch method. Currently (April 2013) the SMPTE working group defines this point in time (= SMPTE Epoch) as 00:00:00 January 1, 1970, TAI (Temps Atomique International). For example, this point in time corresponds to the start of the 1st field of the colour frame sequence of an analogue video reference signal.

This measurement requires the following signals of a real-time reference: a precise PPS (pulse per second), a data protocol which includes time, date, and the amount of leap seconds. Please refer to chapter '*Real-Time Reference Monitoring*'.

There are two classes of video formats which will be treated differently:

Video formats with frame rates of 24, 25, 30, 48, 50, or 60: The reference mark of the PPS should coincide with a start of a picture. The phase difference of the video signal against the PPS will be measured every second (video/pps phase). Verifying the colour sequence of a PAL 625/50 video occurs in a four seconds interval.

All other video formats will be called 1.001 formats, because the frame rates are 24/1.001, 25/1.001, 30/1.001, 48/1.001, 50/1.001, or 60/1.001. The phase difference as well as the colour sequence of an NTSC 525/59.94 format will be measured in a 1001 seconds interval. If the preconditions for a real-time reference as mentioned above are fulfilled, the 1001 epoch count at the **Reference** page of the status monitor will count upwards. Next measurement will take place when this counter reaches 1000 and then resets to zero.

2.2.2 Measurements and Error Detections Comparing Signals IN1 with IN2

Video 1 - Video 2

video detected	yes			
video1 - video2 phase difference	4 µs	valid		
video1 - video2 phase difference max	4 µs			
video1 - video2 drift	0 fields	valid		
video1 - video2 drift max	0 fields			
	status	**counts**	**fail**	**disabled**
video1 - video2 phase difference	0	0	0	1
video1 - video2 drift	0	0	0	1

video detected = *'yes'*, if once a valid video signal at either input has been detected. This is a precondition for a possible changeover event.

Phase difference and drift between video signals at IN1 and IN2:

video1 – video2 phase difference Phase difference (µs, no sign) between both video signals. A *'valid'/'invalid'* flag indicates whether the displayed value is valid or not. *'valid'* will be indicated if video signals of identical format are connected and the warm-up phase of 4.5 minutes has passed.

video1 – video2 phase difference max Maximum value of phase difference measured since power has turned on, or since last error reset. This value can reach a half-period of the video picture at maximum, corresponding to a field in case of interlaced formats.

video1 – video2 drift Drift of the video signals against each other, i.e. the variation of phase difference in time. This is measured in 1/10 fields for interlaced formats, and in 1/10 frames for progressive formats. A *'valid'/'invalid'* flag indicates whether the displayed value is valid or not. *'valid'* will be indicated if the phase difference is valid and the drift measurement has not stopped.

video1 – video2 drift max Maximum value of drift measured since power has turned on, or since last error reset, or since last re-start of the drift measurement. In case the drift equals or exceeds limit video/video drift three consecutive measurements, an error will be counted, the measurement will stop, and some seconds later the drift measurement starts anew. The threshold value limit video/video drift can be set in the range of 1 – 20 fields/frames.

Error video1 – video2 phase difference will be indicated if the phase difference equals or exceeds limit video/video phase three consecutive measurements. This threshold value can be set in the range of 1 – 20 ms.

Error video1 – video2 drift will be indicated if the drift equals or exceeds limit video/video drift three consecutive measurements. This threshold value can be set in the range of 1 – 20 fields/frames.

Chapter *'Overview of Error Indications at the Status Monitor'* describes the meaning of **status**, **counts**, **fail**, and **disabled**.

2.2.3 Measurements and Error Detections on each Video Signal

Video Signals

	IN 1			IN 2			
format	PAL			PAL			
cf ident pulse	yes			yes			
cf epoch aligned	yes			yes			
video/pps phase	4 µs valid			0 µs valid			
video/pps phase max	4 µs			0 µs			
video/pps drift	0 fields valid			0 fields valid			
video/pps drift max	0 fields			0 fields			
	IN 1			**IN 2**			
	status	**counts**	**fail**	**status**	**counts**	**fail**	**disabled**
changeover & monitoring:							
timeout	0	0	0	0	0	0	0
format	0	0	0	0	0	0	0
video/pps drift fail	0	0	0	0	0	0	1
monitoring:							
video/pps phase	0	0	0	0	0	0	0
video/pps drift error	0	0	0	0	0	0	0
video field	0	0	0	0	0	0	1

format The video format will be detected automatically. All valid formats are shown at chapter '*Specifications*'.

Colour sequence:

Some video formats include a white pulse which identifies the colour field 1. cf ident pulse indicates that this pulse is present. Pulse width should be 11 µs at least. cf epoch aligned indicates that this pulse is aligned according to the epoch method (please refer to chapter '*The Epoch Method*').

cf ident pulse PAL 625/50: '*yes*' indicates that a white pulse at the 1st field of line 7 has been detected and that this pulse repeats in an 8-field interval.

NTSC 525/59.94: '*yes*' indicates that a white pulse at the 1st field of line 10 has been detected and that this pulse repeats in a 4-field interval.

cf epoch aligned '*yes*' if the white pulse is aligned according to the epoch method.

Phase difference and drift between video and PPS:

video/pps phase Phase difference (µs, no sign) between video and the PPS (pulse per second) of a real-time reference. A '*valid*'/'*invalid*' flag indicates whether the displayed value is valid or not.

If a video format with an even frame rate is connected, '*valid*' will be indicated if a valid video signal and a valid PPS signal are connected.

For all other video formats (1.001 formats) the phase difference will be measured according to the epoch method in a 1001 seconds interval (please refer to chapter '*The Epoch Method*').

video/pps phase max Maximum value of phase difference measured since power has turned on, or since last error reset. This value can reach a half-period of the video picture at maximum, corresponding to a field in case of interlaced formats.

video/pps drift Drift of the video signal against the PPS, i.e. the variation of phase difference in time. This is measured in 1/10 fields for interlaced formats, and in 1/10 frames for progressive formats. A *'valid'/'invalid'* flag indicates whether the displayed value is valid or not. *'valid'* will be indicated if the phase difference is valid and the drift measurement has not stopped.

video/pps drift max Maximum value of drift measured since power has turned on, or since last error reset, or since last re-start of the drift measurement.

The video/pps drift measurement helps you to verify that the video signal is locked to a real-time reference. There are two threshold values provided:

limit video/pps drift error: This threshold value can be set in the range of 1 – 10 fields/frames. In case the drift equals or exceeds this limit three consecutive measurements, a minor error will be counted, and a 'warning' can be raised. The operator should now find the source of this drift.

limit video/pps drift fail: This threshold value can be set in the range of 11 – 99 fields/frames. In case the drift equals or exceeds this limit three consecutive measurements, a major error will be counted, the measurement will stop, and some seconds later the drift measurement starts anew. This will repeat periodically as long as the drift has not been eliminated. This error can force a changeover.

Errors which can force a changeover:

timeout Signal loss: no video signal has been detected since 140 ms.

format Wrong video format: video format is unknown, or it does not correspond to the format selected at set-up.

video/pps drift fail Drift ≥ limit video/pps drift fail → major error (see above).

Errors which are not relevant for a changeover:

video/pps phase Phase difference: the phase difference between video and the PPS equals or exceeds limit video/pps phase three consecutive measurements. The threshold value limit video/pps phase can be set in the range of 1 – 20 ms.

video/pps drift error Drift ≥ limit video/pps drift error → minor error (see above).

video field 1st field and 2nd field: the internal sync separation detects a field pulse error. In case of interlaced video formats 1st field and 2nd field must be alternating. In case of progressive video formats, no alternating fields should be detected.

2.2.4 Consequences of Errors

Errors can be divided into the following groups:

Error resulting from comparing two video signals (IN1 A with IN2 A, IN1 B with IN2 B): 'video1 – video2 phase difference' and 'video1 – video2 drift'.

Major error of a video signal: 'timeout', 'format', 'video/pps drift fail'.

Minor error of a video signal: 'video/pps phase', 'video/pps drift error', 'video field'.

Each error has the following consequences:

- Indication of an error at the status monitor ('*status*' = 1).
- Error counter counts one up (maximum value of '*counts*' = 255).
- Counter 'overall errors' counts one up.
- LED programmed as 'Switcher Error' lights up (RUB1 version modules).
- GPO programmed as 'System Error' becomes active.
- SNMP trap 'System Error' will be sent.

Each error has additional the following consequences if the corresponding '**disable**' checkbox has not been checked:

- Indication of a failure at the status monitor ('*fail*' = 1).
- Counter 'overall failures' counts one up.
- Lamp programmed as 'Fail' lights up (RUB1 version modules).
- GPO programmed as 'System Failure' becomes active.
- SNMP trap 'System Failure' will be sent.
- The log file of an Ethernet module receives an entry.

→ Chapter '*Alarms by GPO*'.
→ Chapter '*Alarms by SNMP Traps*'.
→ Chapter '*Entries in the Log File of an Ethernet Module*'.

Individual errors at the video inputs can be divided into major errors (*failures*) and minor errors (*warnings*). Any major error can force a changeover. All these individual errors can have additional consequences if the corresponding '**disable**' checkbox has not been checked:

Major errors: 'timeout', 'format', 'video/pps drift fail'.

- GPO programmed as 'Signal 1 Failure' due to errors at IN1 A or IN1 B.
- GPO programmed as 'Signal 2 Failure' due to errors at IN2 A or IN2 B.
- SNMP trap 'Signal 1 Failure' due to errors at IN1 A or IN1 B.
- SNMP trap 'Signal 2 Failure' due to errors at IN2 A or IN2 B.

Minor errors: 'video/pps phase', 'video/pps drift error', 'video field'.

- GPO programmed as 'Signal 1 Warning' due to errors at IN1 A or IN1 B.
- GPO programmed as 'Signal 2 Warning' due to errors at IN2 A or IN2 B.
- SNMP trap 'Signal 1 Warning' due to errors at IN1 A or IN1 B.
- SNMP trap 'Signal 2 Warning' due to errors at IN2 A or IN2 B.

This table shows all the individual errors and their consequences:

		Individual Errors							
				Major Errors			Minor Errors		
		video1 - video2 phase difference	video1 - video2 drift	timeout	format	video/pps drift fail	video/pps phase	video/pps drift error	video field
Status Monitor	status Sets bit to 1	yes	yes	yes	yes	yes	yes	yes	yes
	counts Counts + 1	yes	yes	yes	yes	yes	yes	yes	yes
	overall errors Counts + 1	yes	yes	yes	yes	yes	yes	yes	yes
	fail Sets bit to 1	yes*	yes*	yes*	yes*	yes*	yes*	yes*	yes*
	overall failures Counts + 1	yes*	yes*	yes*	yes*	yes*	yes*	yes*	yes*
LED and Lamp	LED function Switcher Error LED (ERROR) lights up	yes	yes	yes	yes	yes	yes	yes	yes
	Lamp function Fail Lamp (FAIL) lights up	yes*	yes*	yes*	yes*	yes*	yes*	yes*	yes*
GPO Functions	Signal 1 Failure (GPO_1) Signal 2 Failure (GPO_2)	no	no	yes*	yes*	yes*	no	no	no
	Signal 1 Warning (GPO_3) Signal 2 Warning (GPO_4)	no	no	no	no	no	yes*	yes*	yes*
	System Error (if 'overall errors' > 0)	yes	yes	yes	yes	yes	yes	yes	yes
	System Failure (if 'overall failures' > 0)	yes*	yes*	yes*	yes*	yes*	yes*	yes*	yes*
SNMP Traps	System Error (if 'overall errors' > 0)	yes	yes	yes	yes	yes	yes	yes	yes
	System Failure (if 'overall failures' > 0)	yes*	yes*	yes*	yes*	yes*	yes*	yes*	yes*
	Signal 1 Failure Signal 2 Failure	no	no	yes*	yes*	yes*	no	no	no
	Signal 1 Warning Signal 2 Warning	no	no	no	no	no	yes*	yes*	yes*
Log	Event SB	yes*	yes*	yes*	yes*	yes*	yes*	yes*	yes*

yes*: '*yes*' under the condition that the corresponding '**disable**' checkbox has <u>not</u> been checked, i.e. the status monitor shows '*disabled*' = 0.

2.3 VITC Monitoring

PAL 625/50 or NTSC 525/59.94 video signals can have a VITC time code embedded. This time code will be read and checked.

VITC signals at input **A** (IN1 A, IN2 A) are checked and compared with each other, same way VITC signals at input **B** (IN1 B, IN2 B) are checked and compared with each other. Comparing VITC signals requires the same video format of these signals: IN1 A and IN2 A must have the same video format; IN1 B and IN2 B must have the same video format.

VITC signals at input **A** are treated completely separately from VITC signals at input **B**. The status monitor therefore offers a **VITC A** and a **VITC B** page.

2.3.1 Measurements and Error Detections Comparing VITC IN1 with IN2

VITC 1 - VITC 2

vitc detected			yes	
vitc1 - vitc2 difference	- 00 : 00 : 00 : 00	0,0 fields	valid	
vitc1 - vitc2 difference max	+ 00 : 00 : 00 : 00	0,0 fields		
	status	**counts**	**fail**	**disabled**
vitc1 - vitc2 difference	0	0	0	0

vitc detected = *'yes'*, if once a valid VITC signal at either input has been detected. This is a precondition for a possible changeover event.

Time difference between VITC signals at IN1 and IN2:

vitc1 – vitc2 difference Time difference (HH:MM:SS:FF and 1/10 fields). A "+" sign means: VITC IN1 time is equal or ahead of VITC IN2 time. A *'valid'/'invalid'* flag indicates whether the displayed value is valid or not. *'valid'* will be indicated if both video channels have VITC and the video signals have identical format.

vitc1 – vitc2 difference max Maximum value of time difference measured since power has turned on, or since last error reset.

Error vitc1 – vitc2 difference will be indicated if the VITC time difference equals or exceeds limit vitc/vitc three consecutive measurements. This threshold value can be set in the range of 1 – 15 frames.

Chapter *'Overview of Error Indications at the Status Monitor'* describes the meaning of **status**, **counts**, **fail**, and **disabled**.

2.3.2 Measurements and Error Detections on each VITC Signal

VITC Signals

	IN 1			IN 2			
frame rate	25			25			
time	13 : 16 : 39			13 : 16 : 39			
user	05 04 04 13			05 04 04 13			
bits	30			10			
cf time address	ok			-			
vitc/ref difference	+ 00 : 00 : 00 : 00 0,0 fields valid			+ 00 : 00 : 00 : 00 0,0 fields valid			
vitc/ref difference max	- 00 : 00 : 00 : 00 0,0 fields			+ 00 : 00 : 00 : 00 0,0 fields			
	IN 1			**IN 2**			
	status	**counts**	**fail**	**status**	**counts**	**fail**	**disabled**
changeover & monitoring:							
timeout	0	0	0	0	0	0	0
frame rate	0	0	0	0	0	0	0
sequence	0	0	0	0	0	0	0
vitc/ref fail	0	0	0	0	0	0	0
monitoring:							
vitc/ref error	0	0	0	0	0	0	0
field 2 time address	0	0	0	0	0	0	1
vitc field flag	0	0	0	0	0	0	1
vitc/video field	0	0	0	0	0	0	1
current sequence	-	0	-	-	0	-	

frame rate The displayed frame rate corresponds to the picture rate of the video signal and can be *24*, *25*, *30*, or *30 drop*.

time Time address of the VITC word. This display may be delayed up to one second.

user User data (binary groups) of the VITC word.

bits Six flag bits of the VITC word, combined to one BCD number.

cf time address If a valid white pulse identifying the colour sequence of the video has been detected (cf ident pulse = yes), and if the colour frame bit of the VITC word is set, the time address should bear a predictable relationship with the colour sequence. '*ok*' indicates that this check has passed.

Time difference between VITC signal and real-time reference:

vitc/ref difference Time difference (HH:MM:SS:FF and 1/10 fields). A "+" sign means: VITC time is equal or ahead of real-time reference. A '*valid*'/'*invalid*' flag indicates whether the displayed value is valid or not. '*valid*' will be indicated if valid signals of a real-time reference as well as a valid VITC word have been detected.

The rising edge of the PPS will be the time reference mark of the real-time reference; the start of the 1st field of the video will be the time reference mark of the VITC.

The time difference will be measured in a one second interval. Regarding 1.001 video formats, the time difference will change permanently. Example for NTSC 525/59.94: each second the video signal will have a drift of minus one millisecond, this results in a shift of approximately 0.06 fields per second.

It is common practice that the time zone of the real-time reference may be different

from the time zone of the VITC time code, e.g. real-time reference = UTC and VITC time code = local time zone. In order that this time difference will not be treated as an error, the comparison of these two times can be programmed (please refer to chapter '"Switcher": *Set-Up of General Parameters*' → set-up of the '*Reference Compare*' parameter).

vitc/ref difference max Maximum value of time difference measured since power has turned on, or since last error reset.

The vitc/ref difference measurement helps you to verify that the VITC transports a real-time. There are two threshold values provided:

limit vitc/ref error: This threshold value can be set in the range of 1 – 9 frames. In case the time difference equals or exceeds this limit three consecutive measurements, a minor error will be counted, and a 'warning' can be raised. The operator should now find the source of this difference.

limit vitc/ref fail: This threshold value can be set in the range of 10 – 59 frames. In case the time difference equals or exceeds this limit three consecutive measurements, a major error will be counted. This error can force a changeover.

Errors which can force a changeover:

timeout Signal loss: no VITC signal has been detected since 140 ms.

frame rate Wrong frame rate: the sequence of the VITC time addresses does not correspond to the frame rate of the video.

sequence Multiple breaks: the VITC reader detects multiple breaks or time discontinuities over a longer time interval.

vitc/ref fail Time difference ≥ limit vitc/ref fail → major error (see above).

Errors which are not relevant for a changeover:

vitc/ref error Time difference ≥ limit vitc/ref error → minor error (see above).

field 2 time address 1st field and 2nd field time address: VITC should be inserted at the 1st field and the 2nd field of the video signal. An error will be indicated if the time address of the 2nd field is not identical to the time address of the 1st field.

vitc field flag VITC field flag: VITC should be inserted at the 1st field and the 2nd field of the video signal. The field flag bit within the VITC data word should be set to '0' at the 1st field and to '1' at the 2nd field. An error will be indicated if this bit is not set according to this rule.

vitc/video field Field indication: VITC should be inserted at the 1st field and the 2nd field of the video signal. The field flag bit within the VITC data word should be set to '0' at the 1st field and to '1' at the 2nd field. At the same time, an internal sync separation circuit generates a field indication of the video signal. Both field indications should denote the same field. Any mismatch leads to this error indication.

current sequence Time discontinuity: a time jump has been detected while checking the VITC time address (HH:MM:SS). This error will be indicated even at a valid time discontinuity in case of a leap second or a DST switching of a local time zone.

2.3.3 Consequences of VITC Errors

Errors can be divided into the following four groups:

Error resulting from comparing two VITC signals (IN1 A with IN2 A, IN1 B with IN2 B): 'vitc1 – vitc2 difference'.

Major errors: 'timeout', 'frame rate', 'sequence', 'vitc/ref fail'.

Minor errors: 'vitc/ref error', 'field 2 time address', 'vitc field flag', 'vitc/video field'.

The 'current sequence' error.

Each error has the following consequences:

- Indication of an error at the status monitor ('*status*' = 1).
- Error counter counts one up (maximum value of '*counts*' = 255).
- Counter 'overall errors' counts one up.
- LED programmed as 'Switcher Error' lights up (RUB1 version modules).
- GPO programmed as 'System Error' becomes active.
- SNMP trap 'System Error' will be sent.

Each error except 'current sequence' has additional the following consequences if the corresponding '**disable**' checkbox has not been checked:

- Indication of a failure at the status monitor ('*fail*' = 1).
- Counter 'overall failures' counts one up.
- Lamp programmed as 'Fail' lights up (RUB1 version modules).
- GPO programmed as 'System Failure' becomes active.
- SNMP trap 'System Failure' will be sent.
- The log file of an Ethernet module receives an entry.

Each 'current sequence' error produces an entry in the log file of an Ethernet module.

→ Chapter '*Alarms by GPO*'.
→ Chapter '*Alarms by SNMP Traps*'.
→ Chapter '*Entries in the Log File of an Ethernet Module*'.

Individual errors at the VITC signals can be divided into major errors (*failures*) and minor errors (*warnings*). Any major error can force a changeover. All these individual errors can raise special alarms if the corresponding '**disable**' checkbox has not been checked:

Major errors: 'timeout', 'frame rate', 'sequence', 'vitc/ref fail'.

- GPO programmed as 'Signal 1 Failure' due to errors at IN1 A or IN1 B.
- GPO programmed as 'Signal 2 Failure' due to errors at IN2 A or IN2 B.
- SNMP trap 'Signal 1 Failure' due to errors at IN1 A or IN1 B.
- SNMP trap 'Signal 2 Failure' due to errors at IN2 A or IN2 B.

Minor errors: 'vitc/ref error', 'field 2 time address', 'vitc field flag', 'vitc/video field'.

- GPO programmed as 'Signal 1 Warning' due to errors at IN1 A or IN1 B.
- GPO programmed as 'Signal 2 Warning' due to errors at IN2 A or IN2 B.
- SNMP trap 'Signal 1 Warning' due to errors at IN1 A or IN1 B.
- SNMP trap 'Signal 2 Warning' due to errors at IN2 A or IN2 B.

This table shows all the individual errors and their consequences:

		Individual Errors									
			Major Errors				Minor Errors				
		vitc1 - vitc2 difference	timeout	frame rate	sequence	vitc/ref fail	vitc/ref error	field 2 time address	vitc field flag	vitc/video field	current sequence
Status Monitor	status Sets bit to 1	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
	counts Counts + 1	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
	overall errors Counts + 1	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
	fail Sets bit to 1	yes*	yes*	yes*	yes*	yes*	yes*	yes*	yes*	yes*	no
	overall failures Counts + 1	yes*	yes*	yes*	yes*	yes*	yes*	yes*	yes*	yes*	no
LED and Lamp	LED function Switcher Error LED (ERROR) lights up	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
	Lamp function Fail Lamp (FAIL) lights up	yes*	yes*	yes*	yes*	yes*	yes*	yes*	yes*	yes*	no
GPO Functions	Signal 1 Failure (GPO_1) Signal 2 Failure (GPO_2)	no	yes*	yes*	yes*	yes*	no	no	no	no	no
	Signal 1 Warning (GPO_3) Signal 2 Warning (GPO_4)	no	no	no	no	no	yes*	yes*	yes*	yes*	no
	System Error (if 'overall errors' > 0)	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
	System Failure (if 'overall failures' > 0)	yes*	yes*	yes*	yes*	yes*	yes*	yes*	yes*	yes*	no
SNMP Traps	System Error (if 'overall errors' > 0)	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
	System Failure (if 'overall failures' > 0)	yes*	yes*	yes*	yes*	yes*	yes*	yes*	yes*	yes*	no
	Signal 1 Failure Signal 2 Failure	no	yes*	yes*	yes*	yes*	no	no	no	no	no
	Signal 1 Warning Signal 2 Warning	no	no	no	no	no	yes*	yes*	yes*	yes*	no
Log	Event SB	yes*	yes*	yes*	yes*	yes*	yes*	yes*	yes*	yes*	yes

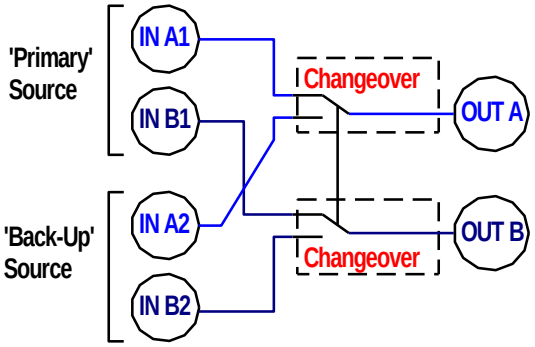
yes*: '*yes*' under the condition that the corresponding '**disable**' checkbox has not been checked, i.e. the status monitor shows '*disabled*' = 0.

2.4 Video/VITC Changeover

SB monitors video and VITC of two sources. Each source can deliver two signals (A, B).

With the default set-up ('Factory Settings'), the module operates in the **automatic mode**, i.e. in case of any major fault of the active source a changeover will occur to the other source.

Latching relays are used to switch the source signals, so the signal path does not change if the module loses power.



Utilizing one of the configuration tools, you can choose an **automatic** or **manual** changeover operating mode: '*Changeover = Automatic*' or '*Changeover = Manual*' (please refer to chapter *"Switcher": Set-Up of General Parameters*).

RUB1 modules offer keys which enable to do a manual changeover at either operating mode. Two functions are provided (please refer to chapter *"Keys": Keys and Lamps, LEDs and GPO*):

- 'Changeover to Primary': Changeover to the primary source *IN 1*. This is the recommended function, because it avoids any unintentional changeover to the back-up source.
- 'Changeover Toggle': Changeover between sources *IN 1* ↔ *IN 2*.

Difference between *automatic* and *manual* operating mode:

	Automatic	**Manual**
Automatic changeover	Enabled	Disabled
Function of a key: 'Changeover Toggle' or 'Changeover to Primary'	Failure and error status checked before a manual changeover: Changeover only, if the currently inactive source has not more failures than the currently active source.	Changeover forced by a keystroke occurs regardless of any errors or failures.

In the automatic mode, the module tries to output "good" signals while avoiding any unnecessary changeover. This leads to a sophisticated changeover characteristic. All the major errors will be considered. In brief, a changeover to the back-up signal occurs if the primary input

- has major errors and the back-up not,
- has a 'timeout' error regarding video or VITC, and the back-up not.

Changeover from the back-up to the primary source works in the same way.

The changeover characteristic can be modified by setting the '*disabled*' bit for individual major errors. An error which is not enabled to become a failure will be ignored for the changeover. This allows you to adapt the changeover characteristic to your application.

2.5 Real-Time Reference Monitoring

2.5.1 Overview

The inputs PPS IN, RXD IN, and 10 MHz IN at the REF IN connector are provided to connect signals of a real-time reference. Signals PPS IN and RXD IN are hard wired to both the REF OUT connectors allowing a 1 to 2 distribution.

PPS IN 'Pulse Per Second' input, electrical - for example - a TTL pulse (see chapter '*Specifications*'). Positive edge = Time reference mark.

RXD IN Serial data string, electrical - for example - RS232 (see chapter '*Specifications*'). Select the appropriate data protocol at entry '*Reference Format*' at the **Switcher** set-up. For example, the following GPS units require the following protocols:

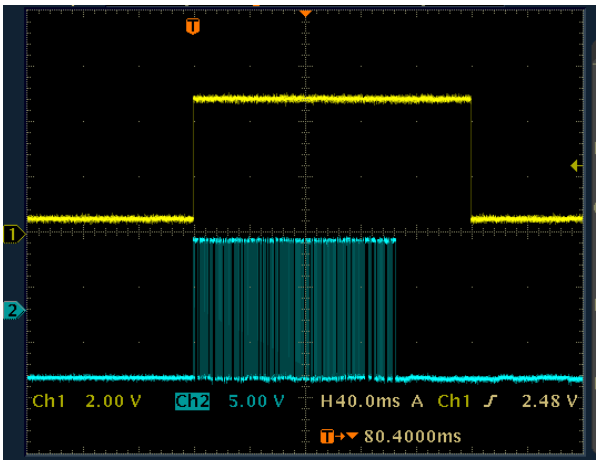
GPS 10 MHz, GLS 10 MHz: *Meinberg Std 2400/7e2 + PPS*

GPS16, GPS17, GPS35: *NMEA $GPRMC 4800/8n1 + PPS*

SB is able to measure the phase of the video signal as well as the colour sequence against a real-time reference according to the **epoch method** (please refer to chapter '*The Epoch Method*'). This measurement requires a data protocol which includes time, date, and the amount of leap seconds. Plura RUB modules GPS 10 MHz and GLS 10 MHz send this protocol if '*Meinberg GPS*' has been selected. **SB** can automatically detect this protocol if '*Reference Format = Meinberg Std*' has been selected at the **Switcher** set-up.

10 MHz IN 10 MHz continuous wave input. A 10 MHz signal is used for a frequency synchronization of various devices, e.g. of video sync generators (SPG).

Example: PPS IN (yellow)
RXD IN (blue)



These signals are used to verify that video and VITC signals are locked to a real-time reference. Regarding the video signals, the phase and the drift will be measured relative to the PPS signal; regarding the VITC signals, the difference of the VITC time address against the real-time will be measured – with PPS as the time reference mark.

This monitoring requires faultless real-time reference signals. For example, the serial data string has to be synchronized to the PPS.

Usually the time & date, which will be decoded from the RXD signal, correspond the UTC time zone. This information will be the time base of the following events:

- 'last event': Time of last manual or automatic changeover, or time of last error reset.
- Time of an entry to the log file of an Ethernet module – this requires enabling the 'Reference Telegram' (please refer to chapter '*"Link": Communication between Modules*').

An LED (e.g. SET – RUB1 modules only) programmed as 'Switcher Set' lights up if the module receives valid signals (PPS IN and RXD IN).

2.5.2 Measurements and Error Detections

Reference

time	11 : 23 : 59	limit reference sync loss error	10 h
date	15.04.2013	limit pps/10 MHz drift error	10 µs
sync after reset	yes		
locked	yes	pps detected	yes
last lock at	15.04.2013 11:23:59	10 MHz detected	yes
time since last lock	0 min	pps/10 MHz drift valid	valid
max time since last lock	0 min	pps/10 MHz drift status	run
1001 epoch count	988	pps/10 MHz drift current	0,0 µs
		pps/10 MHz drift max (wait)	0,1 µs
		pps/10 MHz drift max (run)	0,1 µs

	status	counts	fail	disabled
10 MHz	0	0	0	1
pps timeout	0	0	0	1
pps timing	0	0	0	1
pps/10 MHz drift	0	0	0	1
serial timing/timeout	0	0	0	1
serial sequence	0	0	0	1
sync loss error	0	0	0	1

(This chapter describes measurement results and error indications. Please refer to chapter '*Status of the Real-Time Reference*' for a description of status indications.)

Monitoring the synchronization of the real-time reference:

Status information within the serial protocol indicates whether the real-time reference source (usually a GPS or DCF77 receiver) currently is synchronized: status 'locked'.

sync after reset 'locked = yes' has been received at least once after turning the power on.

locked Current status: 'locked = yes' or 'locked = no'.

last lock at Time & date of the moment when at last 'locked = yes' has been received. This moment corresponds to current time & date if 'locked = yes' is indicated now.

time since last lock Length of time (minutes) since status indicates 'locked = no'. Maximum value = 65,535 minutes (≈ 45.5 days).

max time since last lock Maximum value of 'time since last lock'.

Drift between 10 MHz and PPS:

Any faultless real-time synchronization requires that there is no drift between the 10 MHz signal and the PPS signal – apart from a warm-up period.

pps/10 MHz drift valid *'valid'* will be indicated if the drift measurement currently is active. *'invalid'* will be indicated if either PPS or 10 MHz is lost, or if the measurement yields incorrect data.

pps/10 MHz drift status There are two periods of drift measurements:
The '**wait**' phase starts after turning the power on and lasts 30 minutes approximately. If the source of the real-time reference has been switched on at the same time, a drift may occur due to the warm-up phase of the oscillator and due to the initial synchronization process (e.g. position fix of a GPS receiver).
The '**run**' phase succeeds the '**wait**' phase and remains until **SB** will be switched off. During this phase no or only a marginal drift should occur.

pps/10 MHz drift current Current value of drift. Maximum value = 6,553.4 µs.

pps/10 MHz drift max (wait) Maximum value measured during the '**wait**' phase. No limiting value will be considered during this phase.

pps/10 MHz drift max (run) Maximum value measured during the '**run**' phase. This phase takes limit pps/10 MHz drift error into account. This limiting value can be set in the range of 1 – 256 µs.

Errors:

10 MHz Signal loss at the 10 MHz input.

pps timeout Signal loss at the PPS IN input: no valid PPS detected since 1.6 s.

pps timing PPS signal disturbance: the interval between two consecutive PPS signals does not correspond to one second.

pps/10 MHz drift Drift between PPS and 10 MHz ≥ limit pps/10 MHz drift error. This limit can be set in the range of 1 – 256 µs. In case the drift equals or exceeds this limit three consecutive measurements, an error will be counted, the measurement will stop, and some seconds later the drift measurement starts anew. This will repeat periodically as long as the drift has not been eliminated.

serial timing/timeout Serial data string at RXD IN either is lost or is not synchronized with the PPS signal.

serial sequence A time discontinuity has been detected while checking the time & date information of the serial data string. This leads to an error even at a valid time discontinuity in case of a leap second or a DST switching if a local time zone has been selected as reference.

sync loss error Real-time reference no longer synchronized: time since last lock ≥ limit reference sync loss error (see 'Monitoring the synchronization of the real-time reference' above). The limiting value limit reference sync loss error can be set in the range of 1 – 100 hours.

2.5.3 Consequences of Real-Time Reference Errors

Each error has the following consequences:

- Indication of an error at the status monitor (‘*status*’ = 1).
- Error counter counts one up (maximum value of ‘*counts*’ = 65,535).
- Counter ‘overall errors’ counts one up.
- LED programmed as ‘Switcher Error’ lights up (RUB1 version modules).
- GPO programmed as ‘System Error’ becomes active.
- SNMP trap ‘System Error’ will be sent.

Each error has additional the following consequences if the corresponding ‘**disable**’ checkbox has not been checked:

- Indication of a failure at the status monitor (‘*fail*’ = 1).
- Counter ‘overall failures’ counts one up.
- Lamp programmed as ‘Fail’ lights up (RUB1 version modules).
- GPO programmed as ‘System Failure’ becomes active.
- SNMP trap ‘System Failure’ will be sent.
- The log file of an Ethernet module receives an entry.

→ Chapter ‘*Alarms by GPO*’.
→ Chapter ‘*Alarms by SNMP Traps*’.
→ Chapter ‘*Entries in the Log File of an Ethernet Module*’.

This table shows all the individual errors and their consequences:

			10 MHz	pps timeout	pps timing	pps/10 MHz drift	serial timing/timeout	serial sequence	sync loss error
Status Monitor	status	sets bit to 1	yes	yes	yes	yes	yes	yes	yes
	counts	counts + 1	yes	yes	yes	yes	yes	yes	yes
	overall errors	counts + 1	yes	yes	yes	yes	yes	yes	yes
	fail	sets bit to 1	yes*	yes*	yes*	yes*	yes*	yes*	yes*
	overall failures	counts + 1	yes*	yes*	yes*	yes*	yes*	yes*	yes*
LEDs Lamps	LED function	Switcher Error LED (ERROR) lights up	yes	yes	yes	yes	yes	yes	yes
	Lamp function	Fail Lamp (FAIL) lights up	yes*	yes*	yes*	yes*	yes*	yes*	yes*
GPO	System Error	(if "overall errors" > 0)	yes	yes	yes	yes	yes	yes	yes
	System Failure	(if "overall failures" > 0)	yes*	yes*	yes*	yes*	yes*	yes*	yes*
SNMP	System Error	(if "overall errors" > 0)	yes	yes	yes	yes	yes	yes	yes
	System Failure	(if "overall failures" > 0)	yes*	yes*	yes*	yes*	yes*	yes*	yes*
Log	Event SB		yes*	yes*	yes*	yes*	yes*	yes*	yes*

yes*: ‘*yes*’ under the condition that the corresponding ‘**disable**’ checkbox has not been checked, i.e. the status monitor shows ‘*disabled*’ = 0.

2.6 Self-Test

Apart from checking the video and VITC signals and the signals of the real-time reference, the module performs a self-test.

The following errors will be indicated at the **System** page of the status monitor:

system monitoring:	status	counts	fail	disabled
power on	0		0	0
relay	0	0	0	0

Chapter *'Overview of Error Indications at the Status Monitor'* describes the meaning of **status**, **counts**, **fail**, and **disabled**.

'power on': After the power has turned on, the non-volatile data will be checked for plausibility, for example regarding the set-up of the module. In case of any implausibility, a 'power on' error will be indicated.

'relay': The latching relays can be monitored through internal sense signals. If any sense signal does not correspond to the intended switching position, a 'relay' error will be indicated.

Each error has the following consequences:

- Indication of an error at the status monitor ('*status*' = 1).
- In case of error 'relay': Error counter counts one up (maximum value of '*counts*' = 65,535).
- Counter 'overall errors' counts one up.
- LED programmed as 'Switcher Error' lights up (RUB1 version modules).
- GPO programmed as 'System Error' becomes active.
- SNMP trap 'System Error' will be sent.

Each error has additional the following consequences if the corresponding '**disable**' checkbox has not been checked:

- Indication of a failure at the status monitor ('*fail*' = 1).
- Counter 'overall failures' counts one up.
- Lamp programmed as 'Fail' lights up (RUB1 version modules).
- GPO programmed as 'System Failure' becomes active.
- SNMP trap 'System Failure' will be sent.
- The log file of an Ethernet module receives an entry.

→ Chapter *'Alarms by GPO'*.
→ Chapter *'Alarms by SNMP Traps'*.
→ Chapter *'Entries in the Log File of an Ethernet Module'*.

This table shows all the individual errors and their consequences:

				power on	relay
Status Monitor	status	sets bit to 1		yes	yes
	counts	counts + 1		no	yes
	overall errors	counts + 1		yes	yes
	fail	sets bit to 1		yes*	yes*
	overall failures	counts + 1		yes*	yes*
LED Lamp	LED function	Switcher Error	LED (ERROR) lights up	yes	yes
	Lamp function	Fail	Lamp (FAIL) lights up	yes*	yes*
GPO	System Error	(if "overall errors" > 0)		yes	yes
	System Failure	(if "overall failures" > 0)		yes*	yes*
SNMP	System Error	(if "overall errors" > 0)		yes	yes
	System Failure	(if "overall failures" > 0)		yes*	yes*
Log	Event SB			yes*	yes*

yes*: '*yes*' under the condition that the corresponding '**disable**' checkbox has not been checked, i.e. the status monitor shows '*disabled*' = 0.

2.7 Alarms

2.7.1 Overview and Suggestions for Installation

In order to get aware of a problem, the module could periodically be checked (status monitor, LEDs, lamps, log file of the Ethernet module), or the module could be integrated into a management and control system via GPO and/or SNMP.

These are the suggestions for using the GPO and SNMP features.

The usage of the **Signal 1/2 Failure** and **Signal 1/2 Warning** alarms offers the advantage that the problem directly can be related to source *VIDEO IN 1* or *VIDEO IN 2*. Additionally, it is possible to distinguish between failures (major errors) and warnings (minor errors). These alarms indicate real problems of the video or within the VITC data; none of these alarms should be raised in a video/VITC system during normal 24 hours operation. A warning indicates a situation which may lead to a major problem if no interaction will take place.
In case of a GPO connection, these advantages are given only if the GPO outputs are connected separately to inputs of an alarm management system.
If only these alarms are considered, all errors related to signal comparison (as there are video – video phase and drift, VITC – VITC time difference) as well as the errors with respect to the real-time reference and self-test will be missed.

A complete monitoring can be realized using only one type of alarm: **System Error** or **System Failure**. In case of an alarm, the cause of the alarm can be found quickly utilizing the status monitor.

System Error: This alarm offers monitoring with highest sensibility. Every error will raise this alarm. There is no way to disable any individual failure indication. Even a valid (VITC or reference) time discontinuity in case of a leap second or a DST switching of a local time zone raises an alarm ('current sequence' or 'serial sequence' error).

System Failure: Basically, this alarm combines all failures. The 'current sequence' error will not be a failure. Only those errors which are enabled to indicate a failure can raise an alarm. So, your configuration determines which of the video/VITC errors, errors with respect to the real-time reference, and errors with respect to the self-test, are considered for sending an alarm. No alarm will be raised in case of a valid time jump. If an **SR** module is part of the system to monitor the real-time reference, all failure indications for the real-time reference can be disabled at the **SB** module.

The **Signal 1/2 Failure** and **Signal 1/2 Warning** alarms will become inactive automatically as soon as the individual errors have disappeared. The **System Error** and **System Failure** alarms remain active until a manual reset of the error counters.

Using GPO outputs requires a proper configuration (→ chapter '*Alarms by GPO Outputs*') and – of course – a proper cabling.

Using SNMP traps requires a proper configuration (→ chapter '*Alarms by SNMP Traps*') and an Ethernet module (**RUB IE** or **RUB PM**) as part of this RUBIDIUM system.

2.7.2 Alarms by GPO Outputs

The module has four GPOs (General Purpose Outputs). Basically, the functions of these outputs are programmable utilizing the **Keys** function of one of the configuration tools.
(→ Chapter '*The Rubidium Configuration Tools*' → '*"Keys": Keys and Lamps, LEDs and GPOs*')

The following functions for the GPOs are provided to indicate errors and failures:

Signal 1 Failure Recommended GPO: **GPO_1**
Signal 2 Failure Recommended GPO: **GPO_2**

Active, as long as there is any major video or VITC error at *VIDEO IN 1* or *VIDEO IN 2* respectively. In detail, this GPO becomes active if one of the following errors has occurred and has been enabled to indicate a failure (checkbox '**disable**' not checked):

VIDEO	VITC
timeout	timeout
format	frame rate
video/pps drift fail	sequence
	vitc/ref fail

Detailed error description in chapters '*Video Monitoring*' and '*VITC Monitoring*'.

Signal 1 Warning Recommended GPO: **GPO_3**
Signal 2 Warning Recommended GPO: **GPO_4**

Active, as long as there is any minor video or VITC error at *VIDEO IN 1* or *VIDEO IN 2* respectively. In detail, this GPO becomes active if one of the following errors has occurred and has been enabled to indicate a failure (checkbox '**disable**' not checked):

VIDEO	VITC
video/pps phase	vitc/ref error
video/pps drift error	field 2 time address
video field	vitc field flag
	vitc/video field

Detailed error description in chapters '*Video Monitoring*' and '*VITC Monitoring*'.

System Error

Active, as long as the "overall errors" counter has a count value > 0.

The error indication cannot be disabled, so this GPO becomes active in case of any error, i.e. video/VITC errors, errors with respect to the real-time reference, and errors with respect to the self-test.

System Failure

Active, as long as the "overall failures" counter has a count value > 0.

Apart from the 'current sequence' error, all other individual errors can raise this alarm provided this error has been enabled to indicate a failure (checkbox '**disable**' not checked). Depending on this set-up, video/VITC errors, errors with respect to the real-time reference, and errors with respect to the self-test, can activate this GPO output.

More GPO functions: → Chapter '*"Keys": Keys and Lamps, LEDs and GPOs*'.

2.7.3 Alarms by SNMP Traps

SNMP functionality for a RUBIDIUM system requires the installation of an Ethernet module (**RUB IE** or **RUB PM**) with option **S** (SNMP).

Utilizing one of the configuration tools, the SNMP traps can be enabled and disabled at the **System** page (please refer to chapter '*"System": Identification, Reset, SNMP, Fan Control*'). The "Any Trap" checkbox in general controls the SNMP traps functionality. Furthermore, there are checkboxes corresponding to all the individual traps.

Recommended configuration: Check the 'Any Trap' and 'System Failure' checkboxes.

This chapter describes all the alarm functions for traps. The following feature is valid for all these traps: As long as the alarm condition is present, traps will be repeated in an 8 hours interval.

Signal 1 Failure / Signal 2 Failure Check the '*Signal Failure*' checkbox

Trap will be sent as long as there is any major video or VITC error at *VIDEO IN 1* or *VIDEO IN 2* respectively. In detail, this trap will be sent if one of the following errors has occurred and has been enabled to indicate a failure (checkbox '**disable**' not checked):

VIDEO	VITC
timeout	timeout
format	frame rate
video/pps drift fail	sequence
	vitc/ref fail

Detailed error description in chapters '*Video Monitoring*' and '*VITC Monitoring*'.

Signal 1 Warning / Signal 2 Warning Check the '*Signal Warning*' checkbox

Trap will be sent as long as there is any minor video or VITC error at *VIDEO IN 1* or *VIDEO IN 2* respectively. In detail, this trap will be sent if one of the following errors has occurred and has been enabled to indicate a failure (checkbox '**disable**' not checked):

VIDEO	VITC
video/pps phase	vitc/ref error
video/pps drift error	field 2 time address
video field	vitc field flag
	vitc/video field

Detailed error description in chapters '*Video Monitoring*' and '*VITC Monitoring*'.

System Error Check the '*System Error*' checkbox

Active, as long as the 'overall errors' counter has a count value > 0.

The error indication cannot be disabled, so this trap will be sent in case of any error, i.e. video/VITC errors, errors with respect to the real-time reference, and errors with respect to the self-test.

System Failure Check the '*System Failure*' checkbox

Active, as long as the 'overall failures' counter has a count value > 0.

Apart from the 'current sequence' error, all other individual errors can raise this alarm provided this error has been enabled to indicate a failure (checkbox '**disable**' not checked). Depending on this configuration, video/VITC errors, errors with respect to the real-time reference, and errors with respect to the self-test, can activate this trap.

2.7.4 Entries in the Log File of an Ethernet Module

The use of the log file requires the installation of an Ethernet module (**RUB IE** or **RUB PM**).

As it is shown in the tables of chapters:

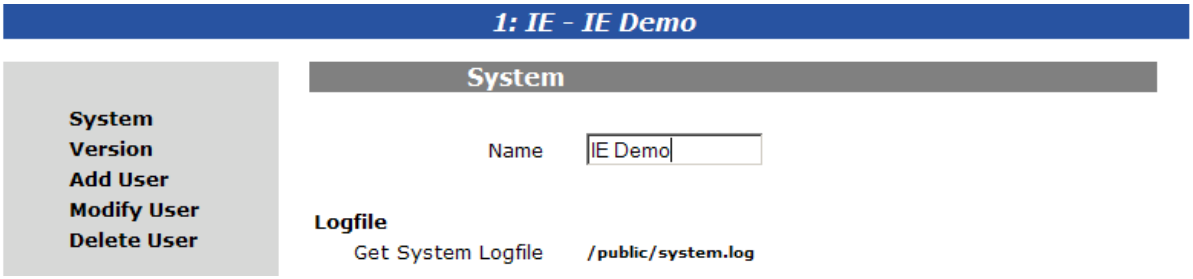
- *'Video Monitoring' – 'Consequences of Errors'*,
- *'VITC Monitoring' – 'Consequences of VITC Errors'*,
- *'Real-Time Reference Monitoring' – 'Consequences of Real-Time Reference Errors'*,
- *'Self-Test'*,

every error can produce an entry in the log file if the corresponding '**disable**' checkbox has not been checked.

Additional entries can be produced triggered by the following events:

- VITC 'current sequence' error,
- manual or automatic changeover,
- error reset – pressing key FAIL (or any key assigned with the 'Reset All' function) or clicking the 'Error Reset' button at the **Switcher** page of any configuration tool.

Open the log file clicking on **/public/system.log** at the **System** page of an Ethernet module.



Example: (SB 2:1) identifies the module which sent this entry:
SB module located at frame address **2** at slot **1**.

[29/Apr/2013 11:15:40] (SB 2:1) Event: VITC A1 signal loss
[29/Apr/2013 11:15:40] (SB 2:1) Event: System automatic changeover
[29/Apr/2013 11:15:40] (SB 2:1) Event: Video A1 signal loss
[29/Apr/2013 11:15:45] (SB 2:1) Event: System manual changeover
[29/Apr/2013 11:15:49] (SB 2:1) Event: VITC B1 current sequence error
[29/Apr/2013 11:16:46] (SB 2:1) Event: System error reset

The Ethernet module adds a time stamp (time & date) = time of its internal clock when it receives the entry.

If **SB** receives real-time reference signals and no other module of the system sends the *'Reference'* telegram, this telegram should be sent from **SB** module (see chapter *'"Link": Communication between Modules'*). This telegram sets and synchronizes the internal clock of the Ethernet module. The time stamps of each entry now correspond to the UTC time & date of the event.

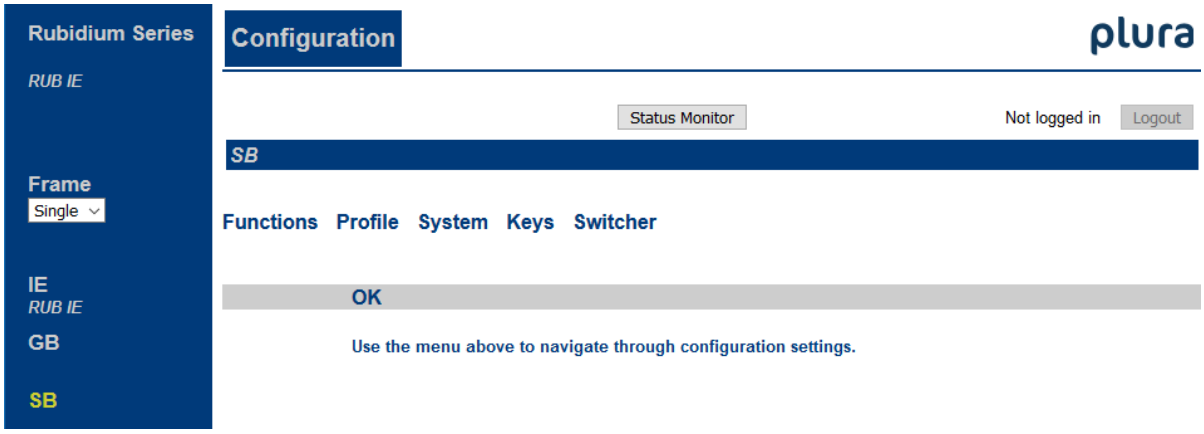
3 Status Monitor

3.1 Status Monitor by the Ethernet Module

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

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

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



- Click on **SB** on the left.
- Click on the button **Status Monitor** to open the **SB** status monitor.

Requirements:

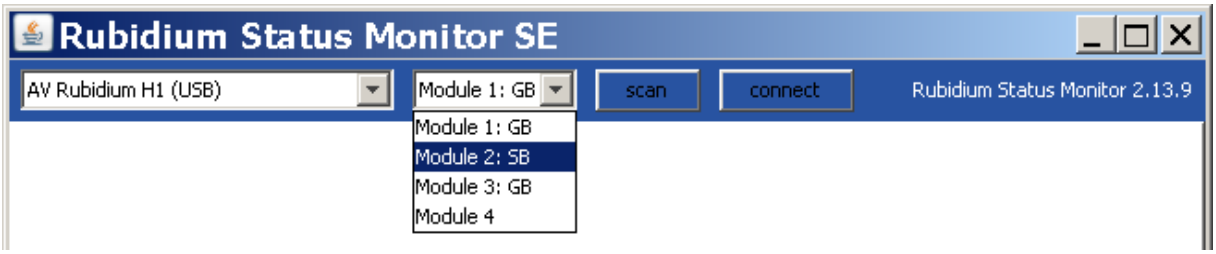
- Please have Java Runtime Environment 1.6.0 or higher installed (for example download at www.java.com).
- Java should be installed as a browser plug-in (a Windows installation will do this automatically if you download Java from the source mentioned above).
- The Status Monitor works with all operating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

3.2 Status Monitor by a PC Program

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

https://www.plurainc.com.

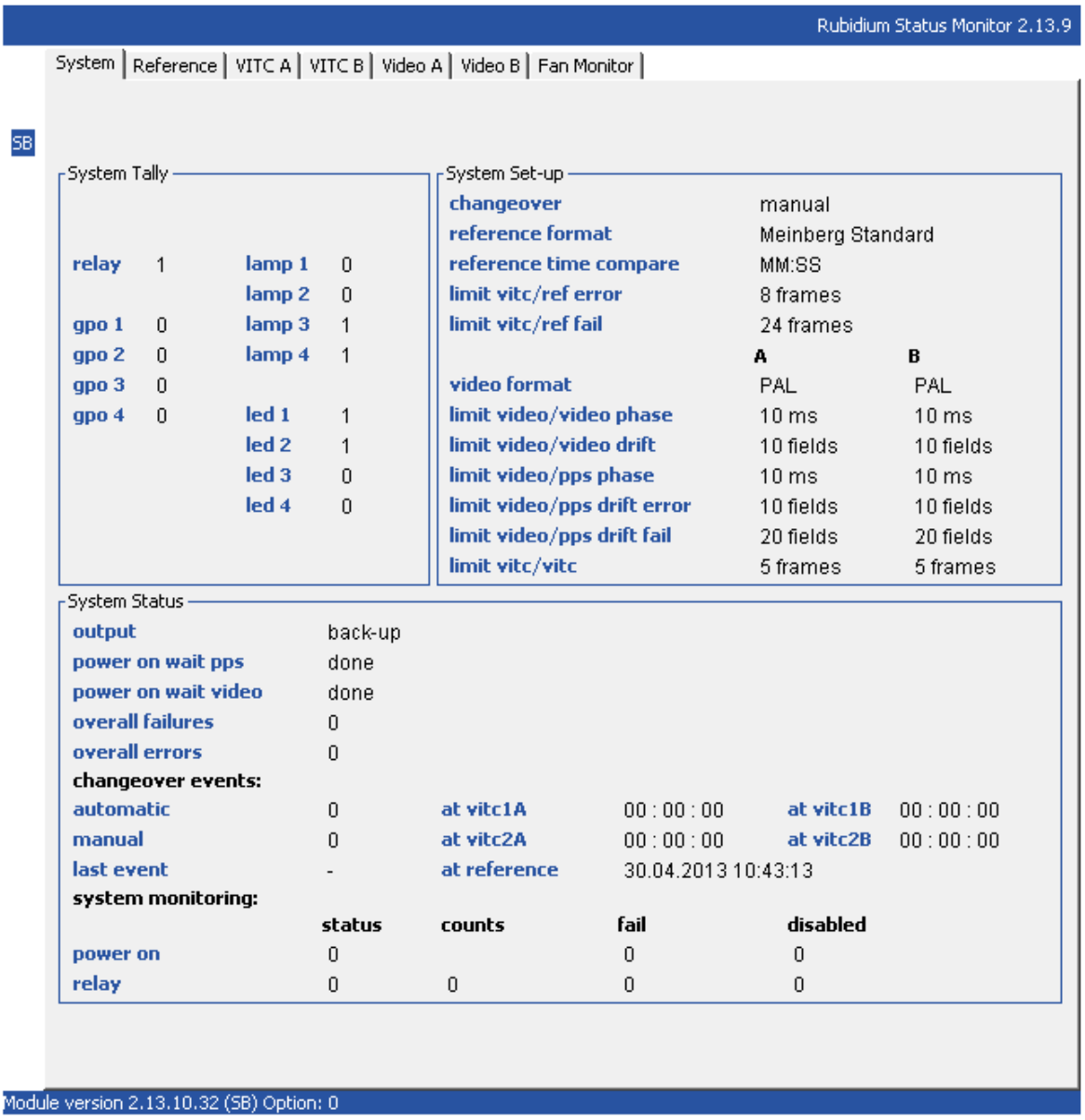
Execute this program, select the COM port or USB connection and press the **scan** button to get a list of the modules plugged to this housing. Select the module and press the **connect** button.



Requirements:

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

3.3 Status 'System'



The **System** page of the status monitor gives a feedback on all relevant operational parameters and on the general operating mode.

System Set-up

Reflects the set-up as selected by a configuration tool. Please refer to chapter '*"Switcher": Set-Up of General Parameters*' for a detailed description.

System Tally

Reflects the state of the latching relays, the GPOs, the lamps and the LEDs. The GPOs, lamps and LEDs have programmable functions. For service purpose, 'System Tally' reflects the state of the default function, independent of what has been really assigned to.

relay	Sense of the latching relay: 0 = primary (*IN 1*), 1 = back-up (*N 2*).
GPOs:	0 = output/function inactive, 1 = output/function active.
gpo 1	'Signal 1 Failure': Any major error at *IN 1* (A or B) detected.
gpo 2	'Signal 2 Failure': Any major error at *IN 2* (A or B) detected.
gpo 3	'Signal 1 Warning': Any minor error at *IN 1* (A or B) detected.
gpo 4	'Signal 2 Warning': Any minor error at *IN 2* (A or B) detected.
Lamps:	Lamps of the keys. 0 = off/function inactive, 1 = on/function active.
lamp 1	'Fail': = 1 if any failure has happened ('overall failures' > 0).
lamp 2	'Primary': = 1 if output is switched to *IN 1* (relays in primary position).
lamp 3	'Signal 1 present': = 1 if a video signal at *IN 1* (A or B) is present.
lamp 4	'Signal 2 present': = 1 if a video signal at *IN 2* (A or B) is present.
LEDs:	0 = off/function inactive, 1 = on/function active.
led 1	'Operation': = 1 during normal operating.
led 2	'Switcher signal': = 1 if any pair of VITC signals is present: at *IN 1 A* + *IN 2 A* or at *IN 1 B* + *IN 2 B*.
led 3	'Switcher set': = 1 if real-time reference signals (PPS IN + RXD IN) are present.
led 4	'Switcher error': = 1 as long as 'overall errors' counter > 0.

System Status

output	*VIDEO OUT* is currently switched to the primary or the back-up source.
power on wait pps	Regarding error analyses and measurements of video/pps phase and drift, VITC/ref difference, and 10 MHz drift, a delay of 30 minutes is provided to give the real-time reference a warm-up phase. '**wait**' will be indicated during this phase; '**done**' will be indicated afterwards.
power on wait video	Regarding error analyses and measurements of video/video phase and drift, a delay of 4.5 minutes is provided. '**wait**' will be indicated during this phase; '**done**' will be indicated afterwards.
overall failures	Current value of the 'overall failures' counter.
overall errors	Current value of the 'overall errors' counter.

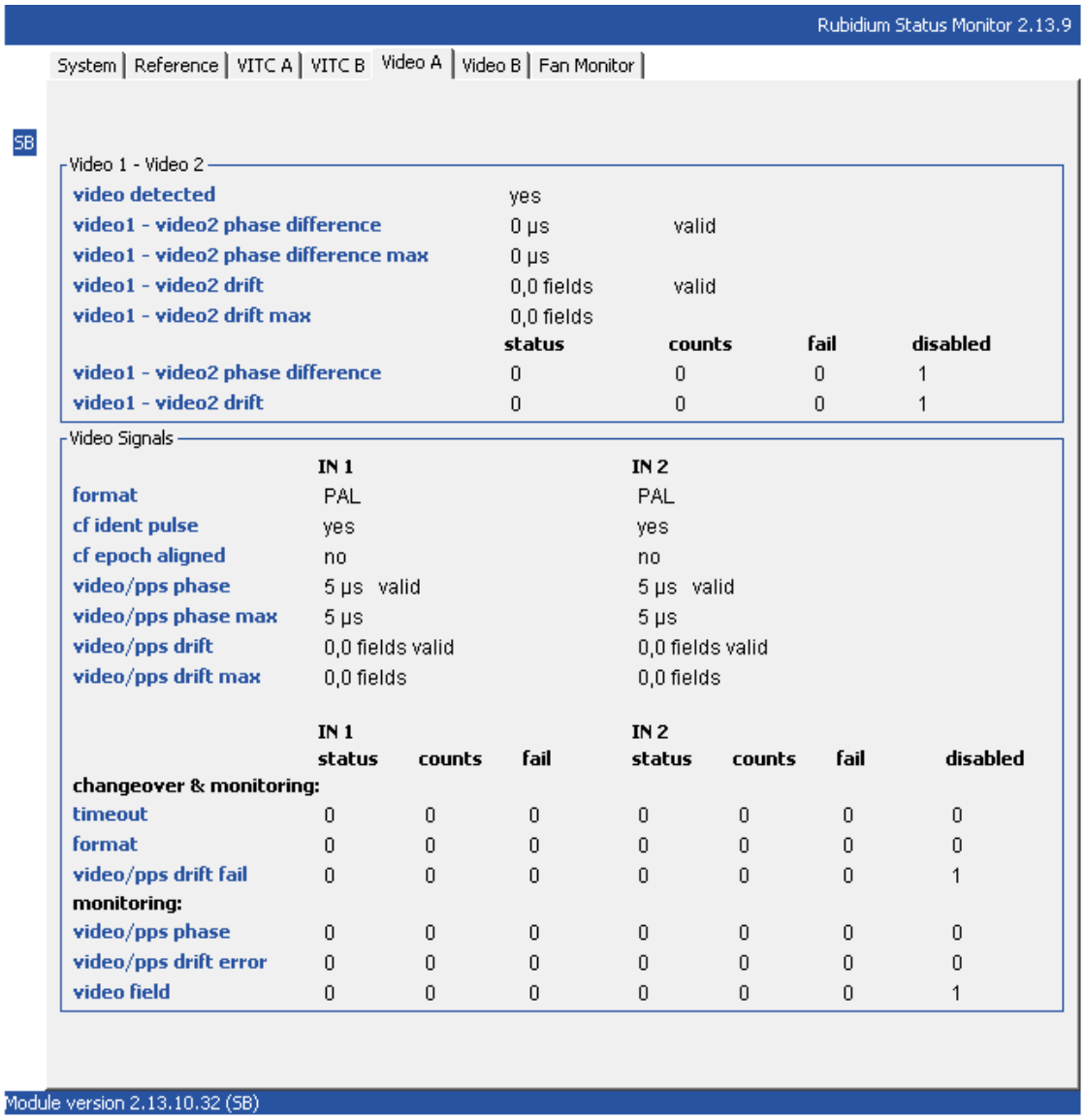
changeover events:

automatic	Number of automatic changeover events.
manual	Number of manual changeover events.
last event	Kind of last event: '**automatic**', '**manual**', '**-**' (= no changeover since power has turned on, or since last error reset).
at vitc1A/vitc2A/vitc1B/vitc2B	Time of VITC at last changeover event.
at reference	Time & date of real-time reference (UTC) at last changeover event, or at last error reset, or at first receipt of real-time.

system monitoring (individual system errors):

power on	Check after power has turned on: invalid set-up parameters found and/or latching relay error found. There is no individual counter for this error.
relay	During normal operating mode, the latching relays are checked that the actual position is equal to the intended position. Errors will be indicated here.

3.4 Status ‘Video A’ and ‘Video B’



The **Video A** page of the status monitor shows measurements and errors regarding signals *VIDEO IN 1 A* and *VIDEO IN 2 A*.

The **Video B** page of the status monitor shows measurements and errors regarding signals *VIDEO IN 1 B* and *VIDEO IN 2 B*.

Video 1 – Video 2: Monitoring signal pairs (IN1A – IN2A and IN1B – IN2B).

video detected *'yes'*, if at least one signal of a pair has been detected.

video1 – video2 phase difference Phase difference between both video signals. *'valid'* will be indicated if video signals of identical format are connected and the warm-up phase of 4.5 minutes has passed.

video1 – video2 phase difference max Maximum value of phase difference measured since power has turned on, or since last error reset.

video1 – video2 drift Drift of the video signals against each other, i.e. the variation of phase difference in time. This is measured in 1/10 *fields* for interlaced formats, and in 1/10 *frames* for progressive formats. *'valid'* will be indicated if the phase difference is valid and the drift measurement has not stopped.

video1 – video2 drift max Maximum value of drift measured since power has turned on, or since last error reset, or since last re-start of the drift measurement.

Errors:

video1 – video2 phase difference	This error will be indicated if the phase difference equals or exceeds limit video/video phase three consecutive measurements.
video1 – video2 drift	This error will be indicated if the drift equals or exceeds limit video/video drift three consecutive measurements.

Video Signals: Measurements and error detections on each video signal.

format Video format, recognized automatically.

cf ident pulse *'yes'* = a white pulse identifying the colour sequence is present.

cf epoch aligned *'yes'* = the white pulse is aligned according to the epoch method.

video/pps phase Phase difference between video and the PPS. *'valid'* will be indicated if all signals are present and valid, and the warm-up phase of 30 minutes has passed, and a valid measurement could be made.

video/pps phase max Maximum value of phase difference measured since power has turned on, or since last error reset.

video/pps drift Drift of the video signal against the PPS, i.e. the variation of phase difference in time. This is measured in 1/10 *fields* for interlaced formats, and in 1/10 *frames* for progressive formats. *'valid'* will be indicated if the phase difference is valid and the drift measurement has not stopped.

video/pps drift max Maximum value of drift measured since power has turned on, or since last error reset, or since last re-start of the drift measurement.

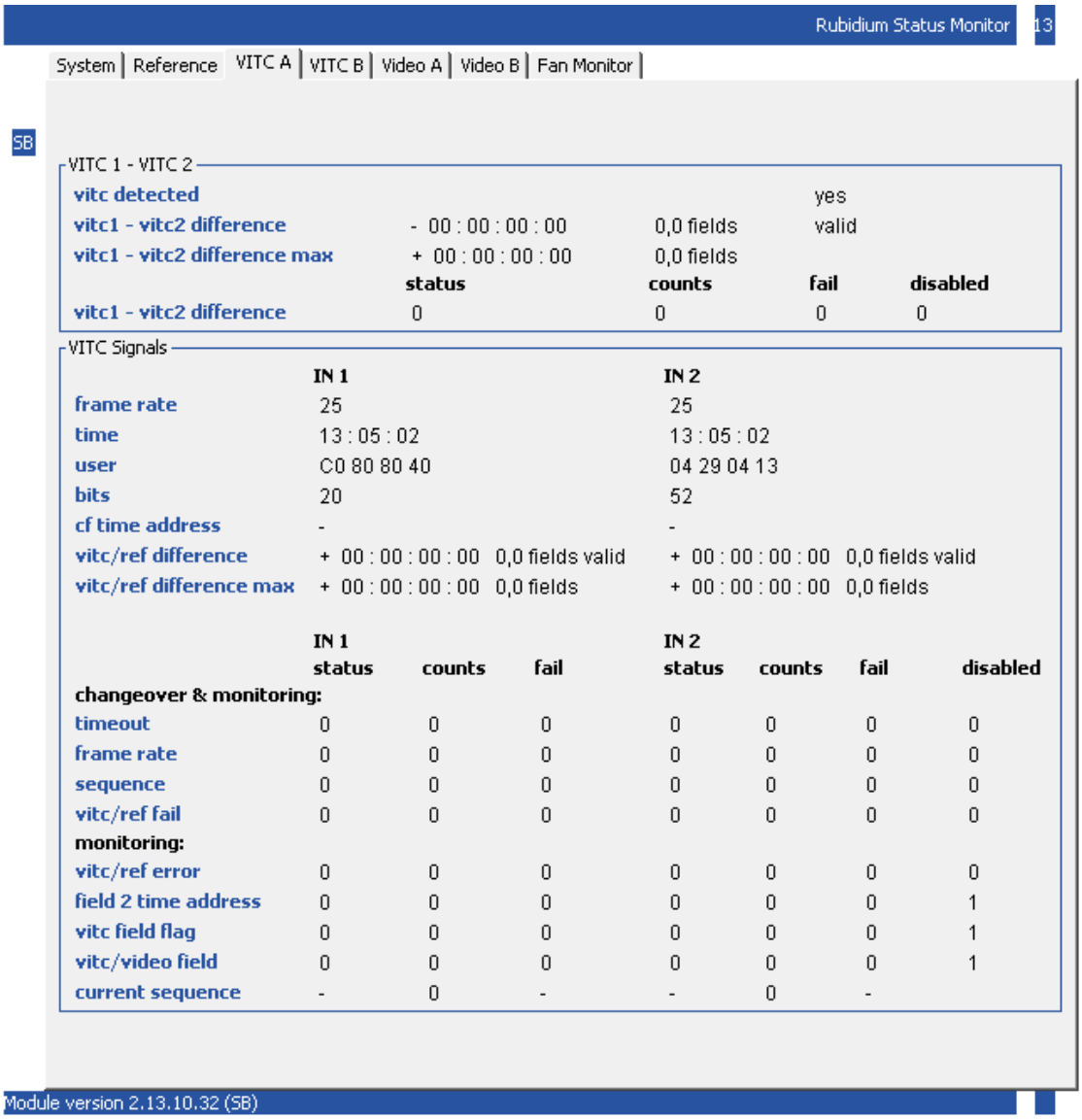
changeover & monitoring (major errors which can force a changeover):

timeout	Signal loss: no video signal has been detected since 140 ms.
format	Video format unknown or does not correspond to the format selected at set-up.
video/pps drift fail	Drift ≥ limit video/pps drift fail.

monitoring (minor errors which cannot force a changeover)

video/pps phase	Phase difference between video and the PPS equals or exceeds limit video/pps phase three consecutive measurements.
video/pps drift error	Drift ≥ limit video/pps drift error.
video field	The internal sync separation detects a field pulse error.

3.5 Status ‘VITC A’ and ‘VITC B’



The **VITC A** page of the status monitor shows measurements and errors regarding VITC signals at *VIDEO IN 1 A* and *VIDEO IN 2 A*.

The **VITC B** page of the status monitor shows measurements and errors regarding VITC signals at *VIDEO IN 1 B* and *VIDEO IN 2 B*.

VITC 1 – VITC 2: Comparing VITC of signal pairs (IN1A – IN2A and IN1B – IN2B).

vitc detected	'yes', if at least one VITC signal of a pair has been detected.
vitc1 – vitc2 difference	Time difference (HH:MM:SS:FF and 1/10 fields). A "+" sign means: VITC IN1 time is equal or ahead of VITC IN2 time. *'valid'* will be indicated if both video channels have VITC and the video signals have identical format.
vitc1 – vitc2 difference max	Maximum value of time difference measured since power has turned on, or since last error reset.

Errors:

vitc1 – vitc2 difference	The time difference equals or exceeds limit vitc/vitc three consecutive measurements.

VITC Signals: Measurements and error detections on each VITC signal.

frame rate	Frame rate which corresponds to the picture rate of the automatic detected video format.
time	Time address of the VITC word.
user	User data (binary groups) of the VITC word.
bits	Six flag bits of the VITC word, combined to one BCD number.
cf time address	If a valid white pulse identifying the colour sequence of the video has been detected (cf ident pulse = yes), and if the colour frame bit of the VITC word is set, the time address should bear a predictable relationship with the colour sequence. *'ok'* indicates that this check has passed.
vitc/ref diference	Time difference (HH:MM:SS:FF and 1/10 fields). A "+" sign means: VITC time is equal or ahead of real-time reference. *'valid'* will be indicated if valid signals of a real-time reference as well as valid VITC words have been detected.
vitc/ref difference max	Maximum value of time difference measured since power has turned on, or since last error reset.

changeover & monitoring (major errors which can force a changeover):

timeout	Signal loss: no VITC signal has been detected since 140 ms.
frame rate	Wrong frame rate: the sequence of the VITC time addresses does not correspond to the frame rate of the video.
sequence	Multiple breaks: the VITC reader detects multiple breaks or time discontinuities over a longer time interval.
vitc/ref fail	Time difference ≥ limit vitc/ref fail.

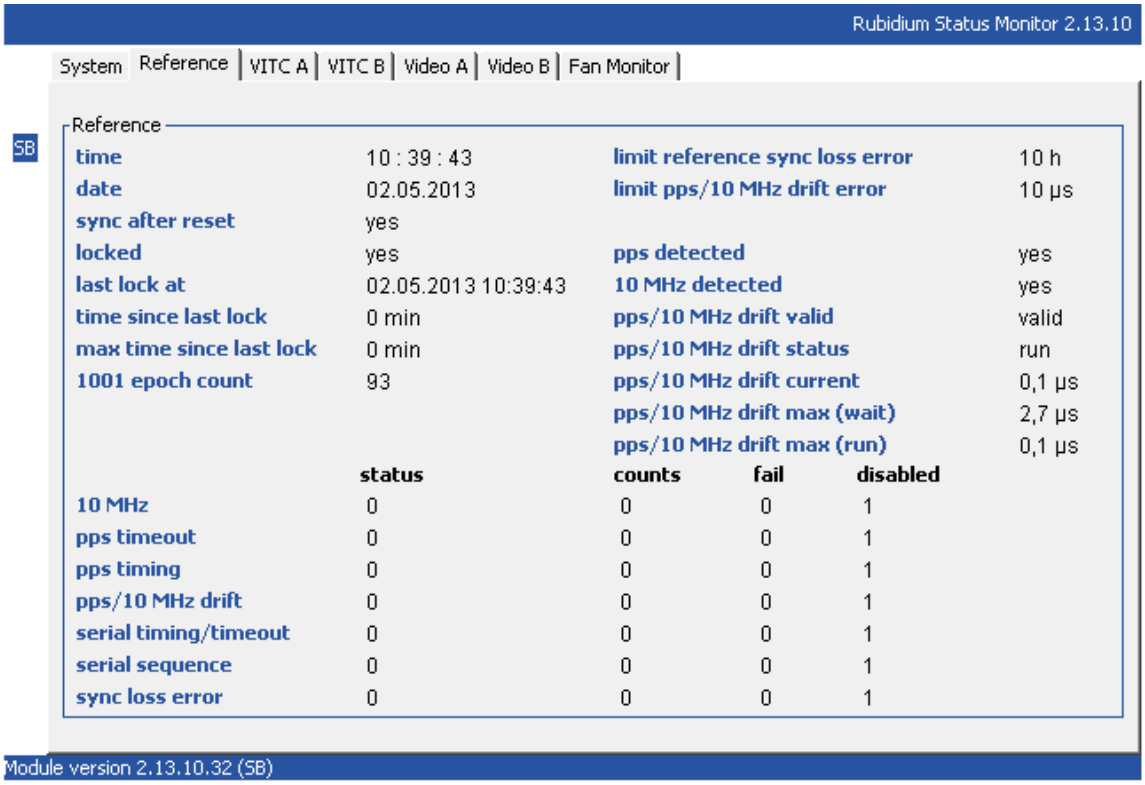
monitoring (minor errors which cannot force a changeover)

vitc/ref error	Time difference ≥ limit vitc/ref error.
field 2 time address	VITC time address at 2nd field not equal to time address at 1st field.
vitc field flag	Error detected on VITC field mark flag.
vitc/video field	The odd/even field derived from the internal sync pulse separation circuit does not match with the VITC field mark flag.
current sequence	A time discontinuity has been detected while checking the VITC time information.

3.6 Status of the Real-Time Reference

SB monitors the pulse-per-second input signal (PPS), the serial data string with time & date and status information (RXD), and the correct timing of both signals with respect to a definite correspondence of the serial data to the PPS signal.

If a 10 MHz signal is connected, **SB** monitors signal loss and the drift compared to PPS.



Reference:

time	Current time, received via serial data string.
date	Current date, received via serial data string.
sync after reset	Status, received via serial data string. Indicates that the reference source could have been synchronized at least once after turning the power on.
locked	Status, received via serial data string. Indicates that the reference source currently is synchronized: 'locked = yes' or 'locked = no'.
last lock at	Time & date of the moment when at last 'locked = yes' has been received. This moment corresponds to current time & date if 'locked = yes' is indicated now.
time since last lock	Length of time (minutes) since status indicates 'locked = no'.
max time since last lock	Maximum value of 'time since last lock'.
1001 epoch count	The phase difference as well as the colour sequence of '1.001' video

formats will be measured in a 1,001 seconds interval (please refer to chapter '*The Epoch Method*'). If the serial data string includes the amount of leap seconds, this counter will count upwards. Next measurement will take place when this counter reaches 1000 and then resets to zero.

limit reference sync loss error — Display of the limiting value regarding loss of synchronization. This limit can be set in the range of 1 – 100 hours

limit pps/10 MHz drift error — Display of the limiting value regarding drift between PPS and 10 MHz. This limit can be set in the range of 1 – 256 µs.

pps detected — '*yes*', if once a valid PPS signal has been detected.

10 MHz detected — '*yes*', if once a valid 10 MHz signal has been detected.

pps/10 MHz drift valid — '*valid*' will be indicated if the drift measurement currently is active. '*invalid*' will be indicated if either PPS or 10 MHz is lost, or if the measurement yields incorrect data.

pps/10 MHz drift status — Phase of drift measurement: '**wait**' = period of 30 minutes after power has turned on, afterwards the '**run**' phase starts.

pps/10 MHz drift current — Current value of drift. Maximum value = 6,553.4 µs.

pps/10 MHz drift max (wait) — Maximum value measured during the '**wait**' phase. No limiting value will be considered during this phase.

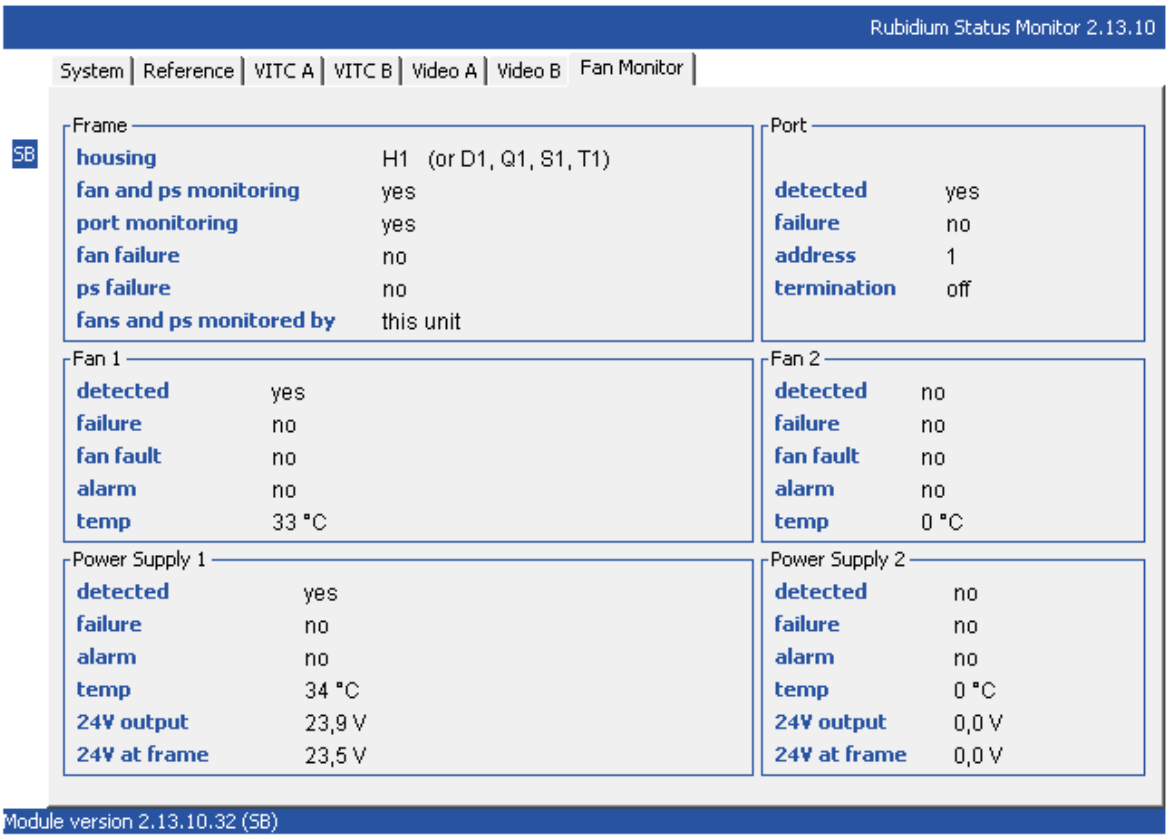
pps/10 MHz drift max (run) — Maximum value measured during the '**run**' phase. This phase takes limit pps/10 MHz drift error into account. This limiting value can be set in the range of 1 – 256 µs.

Individual errors:

Error	**Description**
10 MHz	Signal loss at the 10 MHz input.
pps timeout	Signal loss at the PPS IN input: no valid PPS detected since 1.6 s.
pps timing	PPS signal disturbance: the interval between two consecutive PPS signals does not correspond to one second.
pps/10 MHz drift	Drift between PPS and 10 MHz ≥ limit pps/10 MHz drift error.
serial timing/timeout	Serial data string at RXD IN either is lost or is not synchronized with the PPS signal.
serial sequence	A time discontinuity has been detected while checking the time & date information of the serial data string. This leads to an error even at a valid time discontinuity in case of a leap second or a DST switching if a local time zone has been selected as reference.
sync loss error	Real-time reference no longer synchronized: time since last lock ≥ limit reference sync loss error.

3.7 Status of Fan and Power Supplies

SB – as all configurable RUBIDIUM modules – is able to monitor the fan and power supplies which are plugged to the same housing as **SB**.



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

4 The Rubidium Configuration Tools

4.1 The Rubidium Configuration PC Program

Please refer to the

"Installation & Systems Manual RUBIDIUM SERIES"

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

4.2 The Rubidium Series HTTP Server

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

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

- Click on "Configuration" at the RUBIDIUM homepage to open the **Configuration** page.
- Click on the blue **SB** button to establish a communication to this module. It opens a page with a list of all the links which correspond to all the available functions.

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

Button **Save To Module**:

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

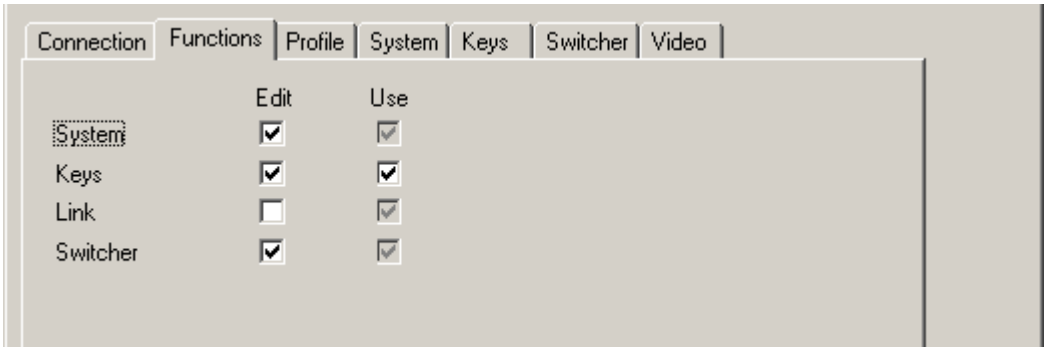
Button **Reload From Module**:

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

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

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

List of tabs/functions:

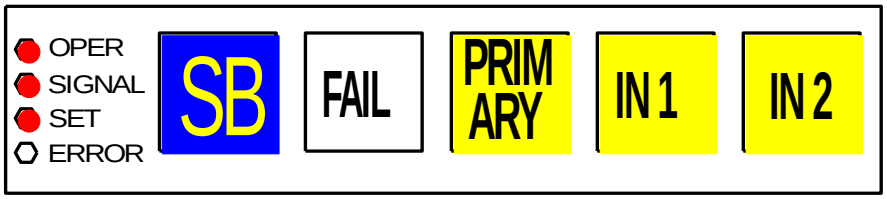
Profile	Store and Load Configurations on the Module (*)
System	Identification, Reset, SNMP, Fan Control
Keys	Keys and Lamps, LEDs and GPOs
Switcher	Set-Up of General Parameters
Video	Set-Up of Video and VITC Monitoring
Link	Communication between Modules

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

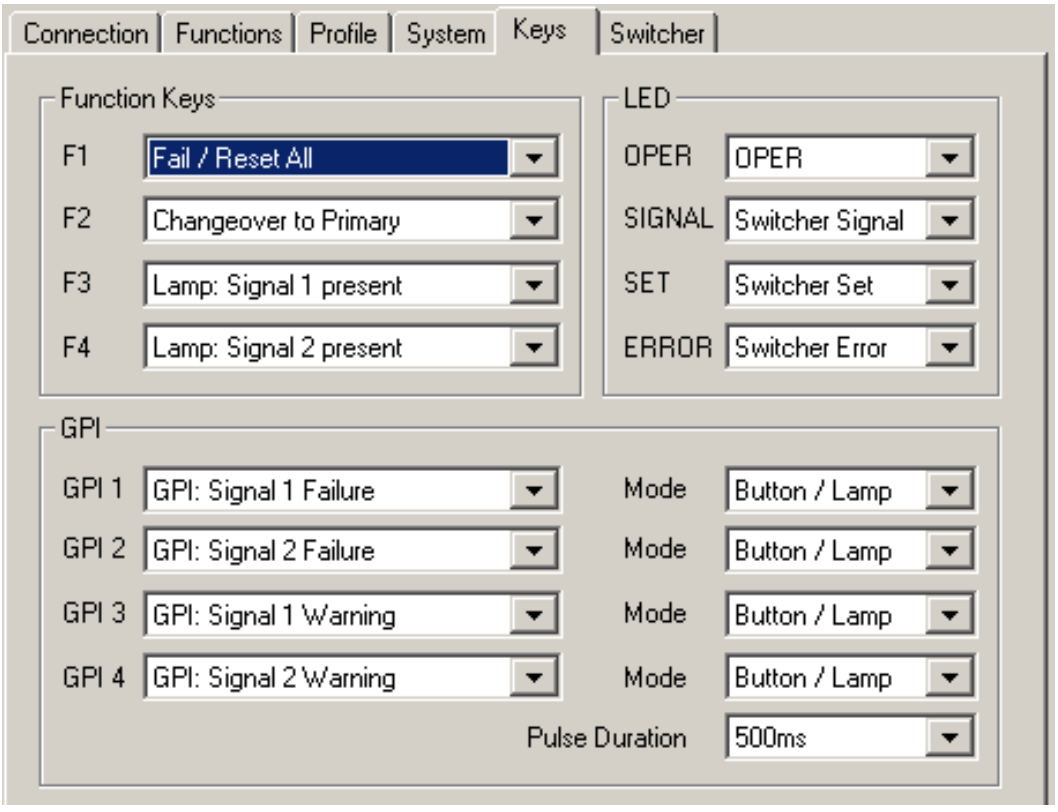
4.4 “Keys“: Keys and Lamps, LEDs and GPOs

The module has four GPOs (General Purpose Output), the RUB1 module 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):



The following functions for the **keys** are provided for this module:

Function	Description	Recommended Key
Clear	Resets all error counters.	F1: FAIL
Reset All	Resets all error counters and status.	F1: FAIL
Changeover to Primary	Manual changeover to *VIDEO IN 1* ('primary' source): Automatic mode: Changeover occurs only if the signals at *VIDEO IN 1* have no or fewer failures than the signals at *VIDEO IN 2*. Manual mode: Changeover occurs regardless of any errors or failures.	F2: PRIMARY
Changeover Toggle	Manual changeover: Automatic mode: Changeover occurs only if the input to which switching shall occur has no or fewer failures than the current switched input. Manual mode: Changeover occurs regardless of any errors or failures.	F2: PRIMARY

The following functions for the **lamps** are provided for this module:

Function	Description	Recommended Lamp
Fail	Lights up, as long as the 'overall failures' counter has a count value > 0.	F1: FAIL
Switcher on Primary Changeover Toggle Changeover to Primary	Lights up, if *VIDEO IN 1* ('primary' source) is switched to output.	F2: PRIMARY
Signal 1 present	Lights up, if a video signal at *IN 1* (A or B) is present. Flashes to indicate an imminent timeout.	F3: IN 1
Signal 2 present	Lights up, if a video signal at *IN 2* (A or B) is present. Flashes to indicate an imminent timeout.	F4: IN 2

The following functions for the **LEDs** are provided for this module:

Function	Description	Recommended LED
OPER	Lights up, if the module is operating.	OPER
Switcher Signal	Lights up, if any pair of VITC signals is present: at *IN 1 A* + *IN 2 A* or at *IN 1 B* + *IN 2 B*.	SIGNAL
Switcher Set	Lights up, if real-time reference signals (PPS IN + RXD IN) are present and valid.	SET
Switcher Error	Lights up, as long as the 'overall errors' counter has a count value > 0.	ERROR

The following functions for the **GPOs** are provided for this module:

Function	**Description**	**Recommended GPO**
Signal 1 Failure	Indicates a failure at *VIDEO IN 1*: any major video or VITC error.	GPO_1
Signal 2 Failure	Indicates a failure at *VIDEO IN 2*: any major video or VITC error.	GPO_2
Signal 1 Warning	Indicates an error at *VIDEO IN 1*: any minor video or VITC error.	GPO_3
Signal 2 Warning	Indicates an error at *VIDEO IN 2*: any minor video or VITC error.	GPO_4
System Error	Indicates, that the 'overall errors' counter has a count value > 0.	
System Failure	Indicates, that the 'overall failures' counter has a count value > 0.	
Switcher on Primary	Indicates, that the primary source (*VIDEO IN 1*) is switched to the output *VIDEO OUT*.	
Signal 1 present	Indicates, that a video signal at *IN 1* (A or B) is present.	
Signal 2 present	Indicates, that a video signal at *IN 2* (A or B) is present.	

Additionally, the output characteristic is selectable:

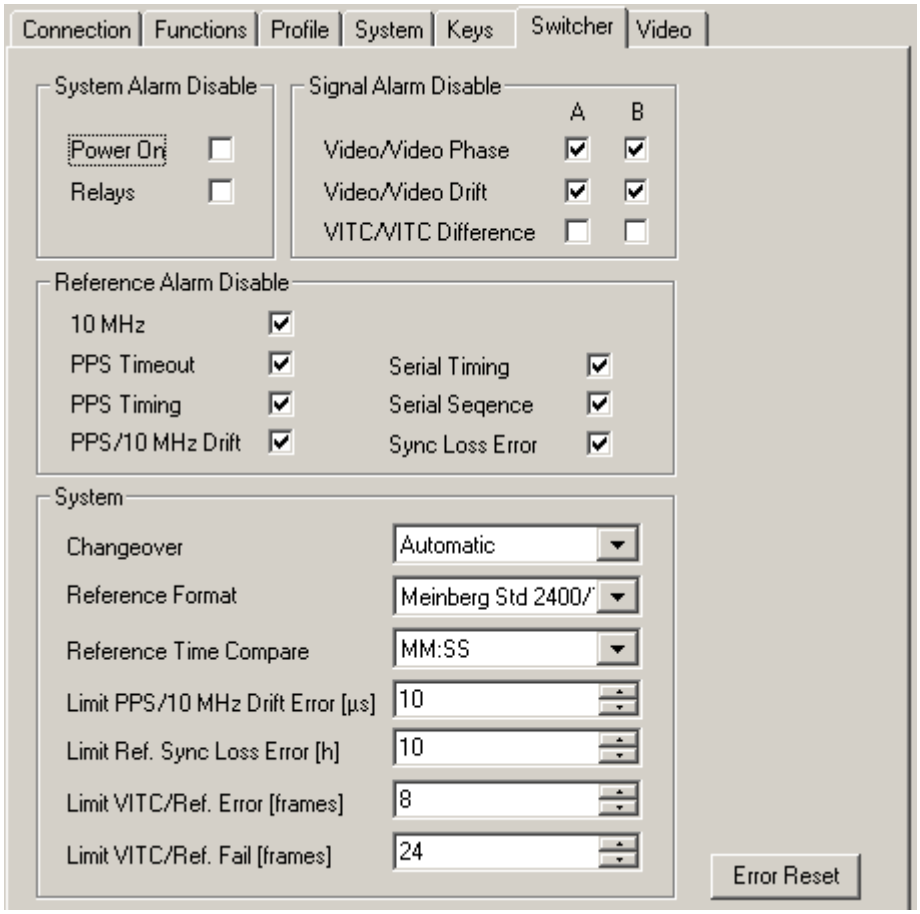
Dropdown list at **Mode**	Description
Button/Lamp	Statically, active "Low" [recommended]
Inv. Button/Lamp	Statically, active "High"
Switch/On Pulse	Pulse, active "Low"; pulse width selectable from 100 ms to 2 s. Pulse will be generated at event entry.
Inv. Switch/Off Pulse	Pulse, active "High"; pulse width selectable from 100 ms to 2 s. Pulse will be generated at the end of the event.

Pulse Duration The pulse width is selectable as 100 ms, 200 ms, 500 ms, 1 s, 2 s. This selection refers to all GPO outputs set to a pulse mode.

4.5 “Switcher“: Set-Up of General Parameters

These set-ups are provided for the monitoring and changeover characteristics.

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



System Alarm Disable

SB monitors some system characteristics. For a detailed description of each item please refer to chapter ‘*Self-Test*’.

The failure indication of each individual error can be disabled by checking the ‘*disable*’ checkbox. If disabled, no failure alarm will be given in case of an error.

Signal Alarm Disable

Signals at input **A** (IN1 A, IN2 A) are checked and compared with each other, same way signals at input **B** (IN1 B, IN2 B): video phase, video drift, and VIC time difference.

The failure indication of an error at a signal pair can be disabled by checking the ‘*disable*’ checkbox. If disabled, no failure alarm will be given in case of an error.

Reference Alarm Disable

SB monitors the signals of a real-time reference: PPS (= pulse per second), RXD (= serial data string), 10 MHz. For a detailed description of each item please refer to chapter ‘*Real-Time Reference Monitoring*’.

The failure indication of each individual error can be disabled by checking the “disable” checkbox. If disabled, no failure alarm will be given in case of an error.

System
Select the operating mode and some parameters (default values in **bold** characters):

Item	Selection	Description
Changeover	**Automatic** Manual	Automatic or manual changeover operating mode. → Chapter "Video/VITC Changeover".
Reference Format	**Meinberg Std ...** NMEA $GPRMC... Meinberg Uni ... Wharton Status ...	**SB** expects a PPS and a serial data string from a real-time reference. The format and protocol of the serial data string should be selected in accordance with the connected device: *"Meinberg Std 2400/7e2 + PPS"* [GPS 10 MHz, GLS 10 MHz] *"NMEA $GPRMC 4800/8n1 + PPS"* [GPS35, GPS16, GPS17] If *"Meinberg Std 2400/7e2 + PPS"* has been selected, **SB** automatically accepts the *"Meinberg GPS"* protocol as well. → Chapter *'Real-Time Reference Monitoring'*.
Reference Time Compare	HH:MM:SS **MM:SS** M:SS SS	**SB** compares the VITC time with the real-time reference. If the time zone of the VITC time is different from the time zone of the real-time reference, hours or even minutes should not be considered. Please select according to your application. → Chapter *'VITC Monitoring'* → *'Measurements and Error Detections on each VITC Signal'*.
Limit PPS/10 MHz Drift Error [µs]	1 – 256 (**10**) Allowed range: 1 – 256 µs	**SB** monitors the drift between 10 MHz and PPS. If the drift equals or exceeds this limit, error 'pps/10 MHz drift' will be indicated. → Chapter *'Real-Time Reference Monitoring'* → *'Measurements and Error Detections'*.
Limit Ref. Sync Loss Error [h]	1 – 100 (**10**) Allowed range: 1 – 100 hours	The RXD serial data string contains time, date and status information. The status tells about a 'lock' or 'unlock' of the source. **SB** calculates and monitors the duration of an 'unlock' state. If the elapsed time equals or exceeds this limit, a 'sync loss error' error will be indicated. → Chapter *'Real-Time Reference Monitoring'* → *'Measurements and Error Detections'*.
Limit VITC/-Ref. Error Limit VITC/-Ref. Fail [frames]	1 – 9 (**8**) 10 – 59 (**24**)	**SB** monitors the time difference of VITC compared to the real-time reference. A 'vitc/ref error' minor error will be indicated if the time difference equals or exceeds *'Limit VITC/Ref. Error'*. A 'vitc/ref fail' major error will be indicated if the time difference equals or exceeds *'Limit VITC/Ref. Fail'*. → Chapter *'VITC Monitoring'* → *'Measurements and Error Detections on each VITC Signal'*.

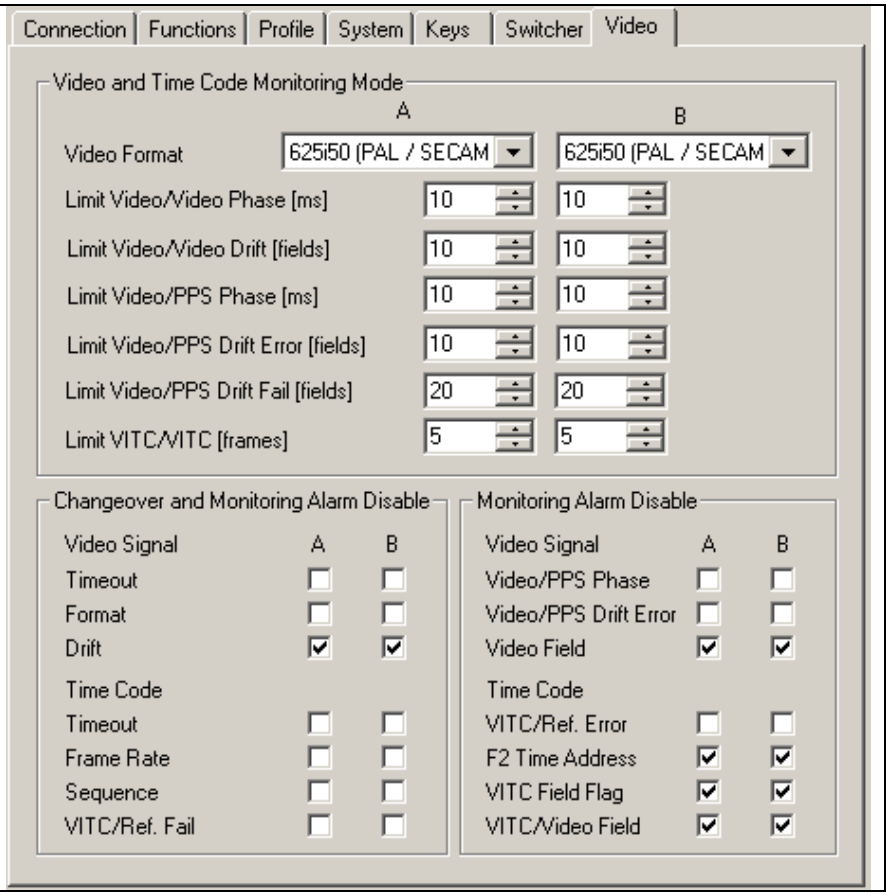
Error Reset
Click this button to reset all error counters and status of the module – identical to pressing the FAIL key programmed with the *'Reset All'* function.

4.6 “Video“: Set-Up of Video and VITC Monitoring

This function offers to set up the video and VITC monitoring and changeover characteristic.

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

Set-up can be done independent for input **A** (IN 1 A and IN 2 A) and for Input **B** (IN 1 B and IN 2 B).



Video Format All valid formats are shown at chapter *‘Specifications’*. In addition, **SB** detects the format of each video signal automatically. If the detected video format is unknown or does not correspond to the format selected at this set-up, a major error ‘format’ will be indicated.

Changeover and Monitoring Alarm Disable and *Monitoring Alarm Disable*

Any individual error at a video or VITC signal can raise an alarm if the corresponding ‘**disable**’ checkbox has not been checked.

Please notice the detailed description of errors at chapters:

Video signal errors: chapter *‘Video Monitoring’* → *‘Measurements and Error Detections on each Video Signal’*.

VITC time code error: chapter *‘VITC Monitoring’* → *‘Measurements and Error Detections on each VITC Signal’*.

Changeover and Monitoring Alarm Disable: ‘Major’ errors which can force a changeover.

Monitoring Alarm Disable: ‘Minor’ errors which cannot force a changeover.

Selecting the limiting values:

Item	Selection	Description
Limit Video/Video Phase [ms]	1 – 20 (**10**)	Phase difference between two video signals: A 'video1 – video2 phase difference' error will be indicated if the phase difference equals or exceeds this limit. → Chapter *'Video Monitoring'* → *'Measurements and Error Detections Comparing Signals IN1 with IN2'*.
Limit Video/Video Drift [fields]	1 – 20 (**10**)	Drift between two video signals: This entry refers to *'fields'* for interlaced formats and to *'frames'* for progressive formats. A 'video1 – video2 drift' error will be indicated if the drift equals or exceeds this limit. → Chapter *'Video Monitoring'* → *'Measurements and Error Detections Comparing Signals IN1 with IN2'*.
Limit Video/PPS Phase [ms]	1 – 20 (**10**)	Phase difference between a video signal and PPS: A 'video/pps phase' error will be indicated if the phase difference equals or exceeds this limit. → Chapter *'Video Monitoring'* → *'Measurements and Error Detections on each Video Signal'*.
Limit Video/PPS Drift Error Limit Video/PPS Drift Fail [fields]	1 – 20 (**10**) 11 – 99 (**20**)	Drift between a video signal and PPS: This entry refers to *'fields'* for interlaced formats and to *'frames'* for progressive formats. A 'video/pps drift error' minor error will be indicated if the drift equals or exceeds 'Limit Video/PPS Drift Error'. A 'video/pps drift fail' major error will be indicated if the drift equals or exceeds 'Limit Video/PPS Drift Fail'. → Chapter *'Video Monitoring'* → *'Measurements and Error Detections on each Video Signal'*.
Limit VITC/VITC [frames]	1 – 15 (**5**)	Time difference between two VITC signals: A 'vitc1 - vitc2 difference' error will be indicated if the phase difference equals or exceeds this limit. → Chapter *'VITC Monitoring'* → *'Measurements and Error Detections Comparing VITC IN1 with IN2'*.

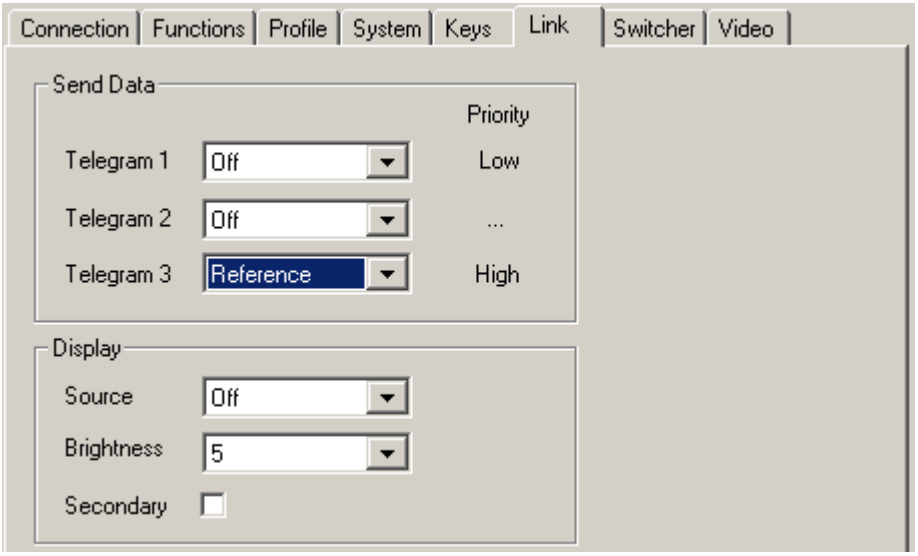
4.7 “Link”: Communication between Modules

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

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

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

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



Send Data

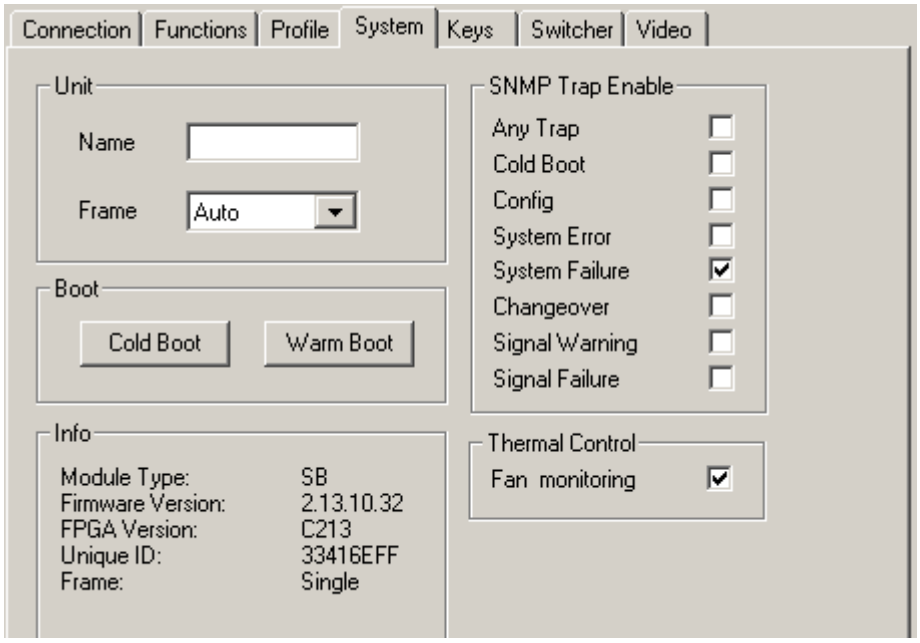
Three channels (**Telegram 1 - 3**) have been provided to transmit data. For each channel a function can be selected from the drop-down list:	
Off	This channel will not be used to transmit data, data can be received.
Reference	This channel transfers time and date (UTC) of the external reference once per second, as long as there are valid signals (PPS IN, RXD IN) at REF IN connector.

Display

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

4.8 “System“: Identification, Reset, SNMP, Fan Control

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



Unit

Name:	The connected module can get a name. You may enter, change, or verify this name at this window.
Frame:	Modules in a network can be uniquely identified by a frame number and the module’s position within the frame. In a single frame system, you may select “Single” or “Auto” at this set-up. If a system is built-up of more than one frame, each frame has to receive a unique address (adjusted at the fan module). If you select “Auto”, the module will request this frame number automatically and will show it on the info box. Likewise, it is possible to select a frame number manually.

Boot

Cold Boot:	Do a cold boot of the module.
Warm Boot:	Do a warm boot of the module.

Info

Displays module’s status information.

SNMP Trap Enable

Activate the “Any Trap” check box to enable the SNMP functionality in general. If not checked, this module will not send any SNMP traps.
The individual traps can be enabled/disabled by a click on the corresponding check box.
Please notice the chapter *‘Alarms by SNMP Traps’* as well.

Thermal Control

At least one module of each frame should have the fan monitoring activated. This enables the power supply monitoring – for power supplies within this frame - as well.

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