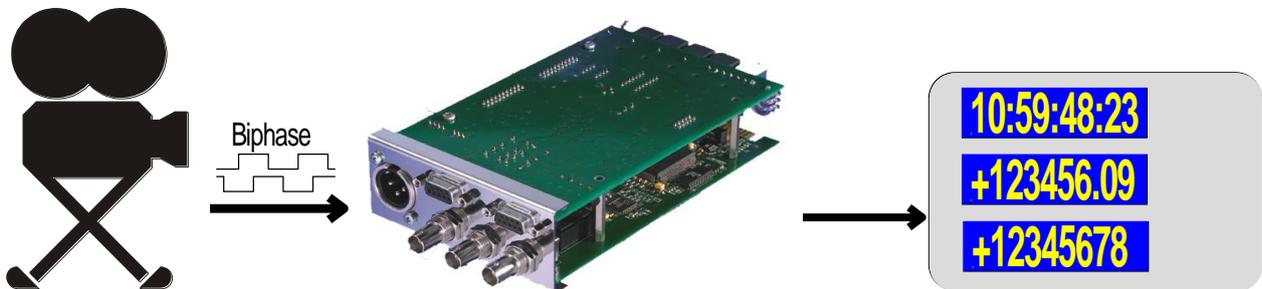




RUB AT-P
RUB XT-P

Biphase to Time Code Converter

Film Frames Counter
Film Footage Counter
Film Frames to Time Converter



Option "P"
Version: 2.2
December 3, 2020





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A1 Revision History

No.	Date	Subject
0.n		Preliminary documents, changes without notice.
1.0	March 01, 2007	First released document.
1.1	January 02, 2008	- Revised. - Chapter "Two Projectors Connected via a Switching Box" added.
1.2	May 05, 2011	Adapted to XT modules.
2.0	November 06, 2012	Phase shift of LTC with respect to biphase.
2.1	September 30, 2019	Changed address of Plura Europe GmbH.
2.2	December 3, 2020	Re-formatted in new design.

A2 Copyright

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For further information please contact your local dealer or:

Plura Europe GmbH
 Binger Weg 12
 D- 55437 Ockenheim
 Phone: +49 6725 918 006-70
 Fax: +49 6725 918 006-77
 E-Mail: info@plurainc.com
 Internet: <http://www.plurainc.com>

A3 General Remarks

This manual is a supplement to the "Functional Description & Specifications" of the appropriate module (AT or DT or HT or XT).

It describes a special function of the module realized by an optional firmware.

A module with this special option may have not all the functions as there are in a standard module.



1 Functional Description

1.1 Overview

The "Option P" for a RUBIDIUM Time Code Module (AT, DT, HT or XT) has been developed for "film and time code" applications.

This special RUBIDIUM Module accepts biphase signals at its GPI inputs. These pulses will be converted to a time (HH:MM:SS:FF), to a film frame counter and to a footage counter. These data can be output in a time code format and can visibly be displayed on a video window. Choose the Rubidium module according to the video system:

RUB AT: CVBS analogue video 525/60 (NTSC) or 625/50 (PAL).

RUB DT: Digital video channel (SD).

RUB HT: HD or SD digital video channel.

RUB XT: 3G or HD or SD digital video channel.

The special RUBIDIUM module transfers the data in a time code format to further RUBIDIUM modules, so the time can visibly insert on different video channels. External time code reader units are able to decode and display the data.

These are the key features of the system:

- Biphase pulses with 1 to 255 pulses per frame.
- Film frame counter: ± 0 to $\pm 99\,999\,999$.
- Film frame rate selectable 10 to 100 frames per foot.
- Film footage counter: ± 0 to $\pm 999\,999.99$. A start value can be set.
- Biphase to time converter. A start value can be set.
- Start values can be programmed utilizing any of our configuration tools. The values can be set pressing a front button or using a GPI input (SET and RESET function).
- Time code frame rate selectable: 24/25/30/30drop.
- The module generates LTC and/or VITC (as well as D-VITC, ATC - depending on the type of the module). The time code generator can be genlocked to biphase, to video, to external LTC or to internal crystal.
- The time information of the time code can contain the film frame counter (biphase to time conversion) or a free-running counter.
- The binary groups (user bits) of the time code can contain the film frame counter, the film footage counter, the time converted from the biphase, or a fixed programmed value.
- The film frame counter, the film footage counter and the time converted from the biphase can visibly be inserted on a video monitor. The video windows can be positioned over the entire screen. Size, brightness, background mask, ... , can be adjusted.



1.2 Configuring the RUBIDIUM Module

Upon delivery the RUBIDIUM module has got a setup to a basic configuration. The following guide describes the most important setups and enables you to find the configuration for your special environment. This example shows screen shots of the PC program tabs configuring an AT module.

1. "Factory Settings": Start the configuration after a "Reset" of the module.
Activate the "Profile" page and select: Profile: **Factory Settings**
Click on the **OK** button.



2. Select **Functions**:
If the "Factory Settings" has been applied the following functions now are activated/deactivated:

Connection	Functions	Profile	System	Keys	Generate	Insert	Biphase
		Edit	Use				
	System	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				
	Keys	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				
	Read	<input type="checkbox"/>	<input checked="" type="checkbox"/>				
	LTC Read	<input type="checkbox"/>	<input type="checkbox"/>				
	VITC Read	<input type="checkbox"/>	<input type="checkbox"/>				
	Jam	<input type="checkbox"/>	<input type="checkbox"/>				
	Generate	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				
	LTC Generate	<input type="checkbox"/>	<input checked="" type="checkbox"/>				
	VITC Generate	<input type="checkbox"/>	<input type="checkbox"/>				
	Link	<input type="checkbox"/>	<input checked="" type="checkbox"/>				
	Video	<input type="checkbox"/>	<input checked="" type="checkbox"/>				
	Insert	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				
	Serial	<input type="checkbox"/>	<input type="checkbox"/>				

To enable further functions, click on the applicable **Edit** and/or **Use** check boxes.



3. Basic set-up of the time code generator:

The following adjustment will be important for a biphase to time conversion:

Frame Rate: Select the frame rate of the time code: *24/25/30df/30*. For a frame accurate biphase to time code conversion this frame rate has to correspond to the number of film frames per second. 30df corresponds to 29.97 Hz.

Sync: Select the genlock source:

Internal internal crystal

Video at VIDEO IN connected video signal

LTC Read at LTC_IN_A / LTC_IN_B connected LTC

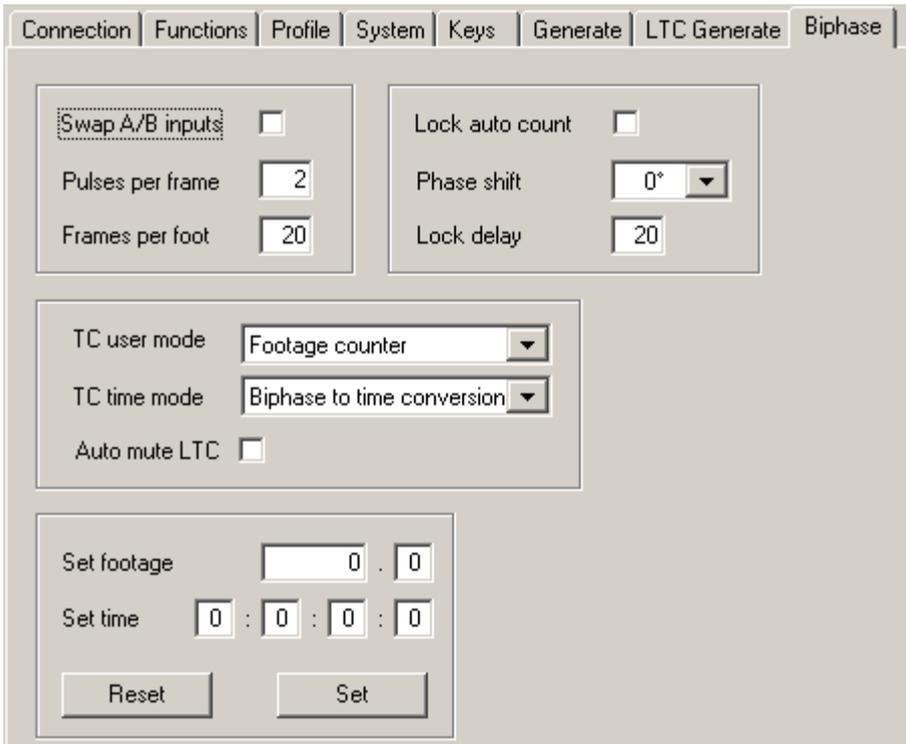
Biphase at GPI_1 / GPI_2 connected biphase signal

The screenshot shows the software interface for the Biphase to Time Code Converter. The interface has a tabbed menu at the top with the following tabs: Connection, Functions, Profile, System, Keys, Generate, LTC Generate, and Biphase. The 'Biphase' tab is currently selected. Below the tabs, there are several configuration options:

- Frame Rate:** A dropdown menu set to '25'.
- Sync:** A dropdown menu set to 'Biphase'.
- User Mode:** A dropdown menu set to 'Set User'.
- PAL 8:** A checkbox that is unchecked.
- Disable BGF:** A checkbox that is unchecked.
- Generator:** A section containing:
 - Time:** Four input fields showing '10', '0', '0', and '0', followed by a 'Set Time' button.
 - User:** An input field showing '00000000', followed by a 'Set User' button.
- Real-Time:** A section containing:
 - Time:** Three input fields showing '0', '0', and '0', followed by a 'Set Real-Time' button.
 - Date:** Input fields for 'D: 1', 'M: 1', and 'Y: 2004', followed by a 'Set Date' button.



4. **Biphase and film parameter:**



Swap A/B inputs: In case that all counters (time, footage counter, frame counter) are counting in the wrong direction, the input signals A and B ("R" and "S") probably have been reversed. Instead of changing the connection you can swap A with B ("R" with "S") activating this check box.

Pulses per Frame: Number of biphase pulses each film frame.
 Range: **1 – 255**.
 Example: Choice = "2" corresponds to a nominal frequency of 50 Hz/25 fps or 60 Hz/30 fps respectively.

Frames per Foot: Number of film frames per foot. Range: **10 – 100**. This enables to calculate the film length.

Lock auto count: As soon as the unit detects nominal biphase frequency (film frame = time code frame), a "Lock" state will be indicated. Having this check box activated the counting of time, footage, and frames will be done automatically during "Lock" state. This guaranties a "clean" time code output with a continuous ± 1 counting without drop-outs or jumps, even if the biphase input signal jitters.

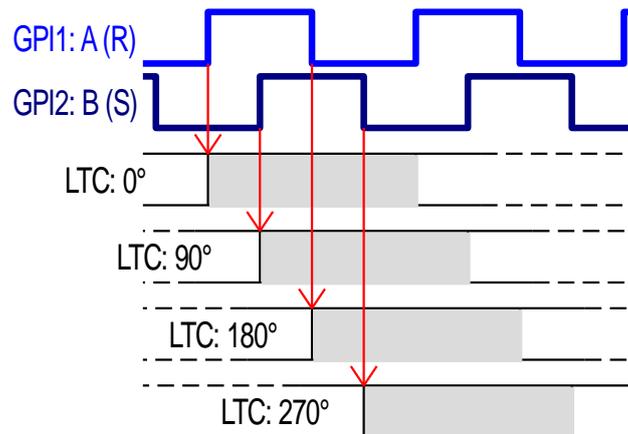
Lock Delay: Number of frames needed to enter the "Lock" state. Range: **10 – 100**.

For further details to these items please refer to chapter "Biphase to LTC Conversion for Synchronizing Purposes".

Phase shift: Select between: **0°, 90°, 180°, and 270°**.
 As default, the LTC frame is synchronized to the leading



edge of signal at GPI 1 (signal A or R); this corresponds to 0°. Any change to 90°, 180°, or 270° will shift the LTC frame as shown in the diagram:



This entry mainly is relevant where "Pulses per Frame = 1" has been selected.

TC user mode:	<p>Select the data content of the binary groups (user bits) of the time code from the drop-down list:</p> <p>No counter: Binary groups contain a fixed programmed value ('Set User', refer to the "Generate" function).</p> <p>Frame counter: Binary groups contain the 8-digits film frame counter (BCD), without sign.</p> <p>Footage counter: Binary groups contain the BCD 6-digits footage counter and 2-digits frame counter (film length), without sign.</p> <p>Biphase to time conversion: Binary groups contain the time converted from the biphase, in a HH:MM:SS:FF format.</p>
TC time mode:	<p>Select the data content of the time information of the time code from the drop-down list:</p> <p>Free running: Time generated independently from the biphase. A start value can be set ('Set Time', refer to the "Generate" function).</p> <p>Biphase to time conversion: The time information contains the time converted from the biphase, in a HH:MM:SS:FF format.</p>
Auto mute LTC:	<p>If this check box is activated the LTC output will be switched off if the biphase stops. Valid only if "TC time mode = Biphase to time conversion" has been selected.</p>

Utilizing the RUBIDIUM CONFIGURATION PC program, you enter a number pressing the **tabulator key** at the PC's keyboard afterwards.

Set footage: Start value for the footage counter.



	<p>Range: 0.0 – 999 999.99. Please stop the biphase before setting a start value. Click on the Set button to transfer the start value to the module.</p>
Set time:	<p>Start value for the time converted from the biphase. Please stop the biphase before setting a start value. Click on the Set button to transfer the start value to the module.</p>
Set:	<p>A click on this button transfers the current start values ('Set footage' and 'Set time') to the module. This resets the film frame counter to zero. This function is available for any of the module's function keys or for GPI_3 or GPI_4.</p>
Reset:	<p>A click on this button resets all counters in the module: film frame counter, footage counter and the time converted from the biphase. This function is available for any of the module's function keys or for GPI_3 or GPI_4.</p>



5. Adjust the video windows:

The video window can be adjusted according to your needs.

You may find the following windows suitable for your "film and time code" application. Please notice the 'Source' and 'Format' selection.

Displaying the time of the time code (the time converted from the biphase). For example, as "Window 1":

The screenshot shows the 'Biphase' tab of the software interface. The 'Window' dropdown is set to '1'. The 'Visible' checkbox is checked. Under 'Values', 'Pre Text' is empty, 'Source' is 'Generate', 'Format' is 'Time, HH:MM:SS.FF', 'Delimiter' is ': (Colon)', 'Identifier' is 'Off', and 'Post Text' is empty. Under 'Position', 'Horizontal' is 60 and 'Vertical' is 43. There are four directional arrow icons for window placement. Under 'Character', 'Font' is '5: 36'. Under 'Mask', 'Mode' is 'Solid'.

Displaying the footage counter. For example, as "Window 2":

The screenshot shows the 'Biphase' tab of the software interface. The 'Window' dropdown is set to '2'. The 'Visible' checkbox is checked. Under 'Values', 'Pre Text' is empty, 'Source' is 'Biphase Footage', 'Format' is 'Biphase Footage', 'Delimiter' is ': (Colon)', 'Identifier' is 'Off', and 'Post Text' is empty. Under 'Position', 'Horizontal' is 320 and 'Vertical' is 43. There are four directional arrow icons for window placement. Under 'Character', 'Font' is '5: 36'. Under 'Mask', 'Mode' is 'Solid'.

Displaying the film frame counter. For example, as "Window 3":

The screenshot shows the 'Biphase' tab of the software interface. The 'Window' dropdown is set to '3'. The 'Visible' checkbox is unchecked. Under 'Values', 'Pre Text' is empty, 'Source' is 'Biphase Counter', 'Format' is 'Biphase Counter', 'Delimiter' is ': (Colon)', 'Identifier' is 'Off', and 'Post Text' is empty. Under 'Position', 'Horizontal' is 320 and 'Vertical' is 73. There are four directional arrow icons for window placement. Under 'Character', 'Font' is '5: 36'. Under 'Mask', 'Mode' is 'Solid'.



6. **Keys, LEDs and GPI:**

The following functions for the keys are provided for a "film and time code" application:

Biphase Reset: Resets all counters in the module: film frame counter, footage counter and the time converted from the biphase.

Biphase Set: Transfers the current start values ('Set footage' and 'Set time') to the module. This resets the film frame counter to zero.

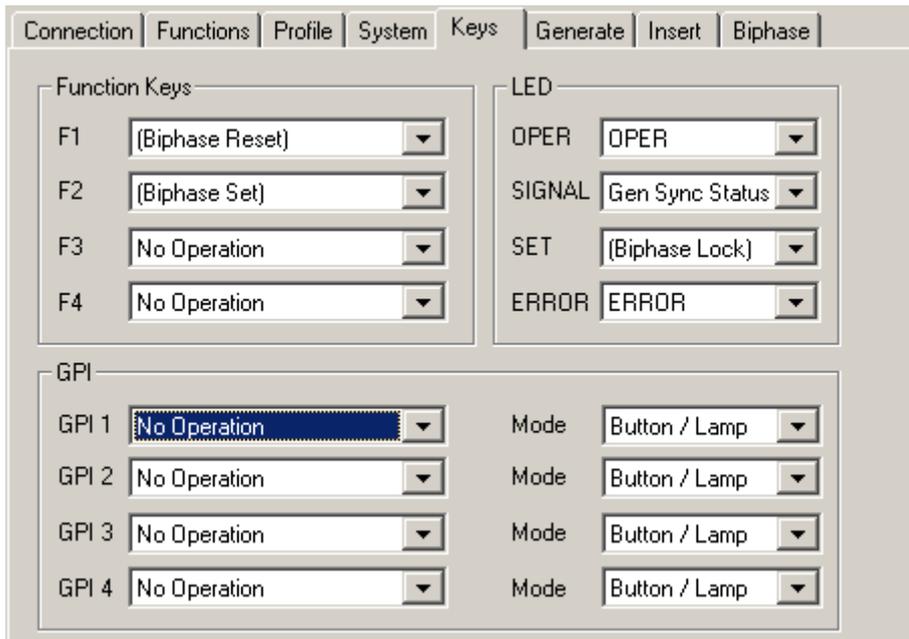
These functions are available for GPI_3 or GPI_4 as well. Select from the drop-down list.

The following functions for the LEDs are provided for a "film and time code" application:

Gen Sync Status Indicates the state of biphase synchronisation (if 'Sync = Biphase' has been selected, refer to the "Generate" function):
LED lights up = genlock.
LED flashes slowly = fine trim procedure.
LED flashes fast = synchronization is lost.

Biphase Lock LED lights up during the "Lock" state.

Biphase Signal LED lights up as long as any biphase signal is present.



1.3 Specification

The following technical data supplement or replace data presented in the manual "Functional Description & Specifications" of the appropriate module (AT, DT, HT or XT):

GPI:

GPI_1 ... GPI_4: Input specification	Input "Low":	-2.0 to +1.0 V
	Input "High":	+3.0 to +24.0 V
	Impedance:	4.7 kΩ
	Frequency:	0 – 1 MHz

Biphase Synchronisation:

Frequency range of the frame pulse signal (= biphase frequency / pulses pro frame) to obtain a phase lock of the time code.	Nominal time code frequency $\pm 1,5\%$
	at frame rate 24: 23,6 – 24,4 Hz
	at frame rate 25: 24,6 – 25,4 Hz
	at frame rate 30: 29,4 – 30,6 Hz



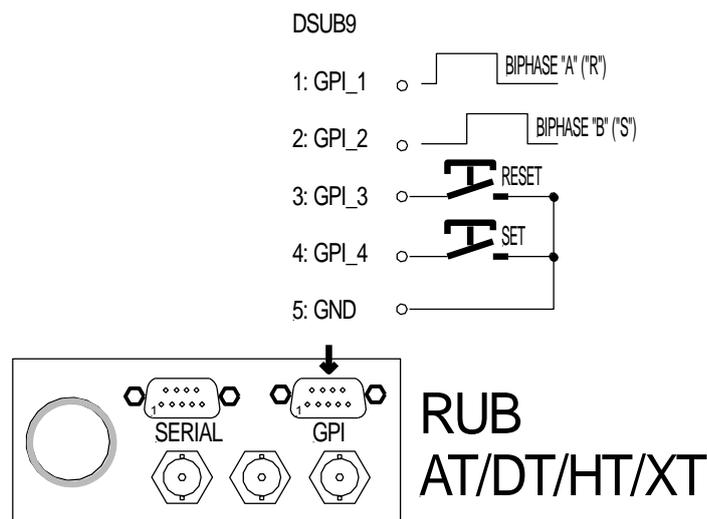
2 Connections

2.1 GPI: Input for Biphase and for Reset/Set Control

At the rear of the RUBIDIUM module you will find the 9-pins DSUB female GPI/LTC IN. Two inputs have been reserved for the biphase signals; two inputs may be used for external push buttons:

GPI_1	Biphase Signal A ("R")
GPI_2	Biphase Signal B ("S")
GPI_3	programmable, e.g. as RESET ('Biphase Reset' function)
GPI_4	programmable, e.g. as SET ('Biphase Set' function)

The switching characteristic for the RESET and SET inputs is equal to a push button, so a short impulse (short circuit to GND) will give a trigger.



3 Applications

In all applications it is necessary to correctly select the parameters:

Pulses per frame,

Frames per foot.

Further it is assumed that time code and film run 1:1, i.e. film frame frequency during PLAY corresponds to the time code frequency.

3.1 Biphase to LTC Conversion for Synchronizing Purposes

This application requires a "clean" LTC. The time code output - synchronized to the biphase - should be continuous without drop-outs or jumps.

With a stable biphase signal no problems are to expect. Please verify that the module accepts the biphase signal for synchronisation doing the following simple test:

Select the basic setup:

Sync = Biphase	refer to the "Generate" function,
TC time mode = Biphase to time conversion	refer to the "Biphase" function,
LED SIGNAL = Gen Sync Status	refer to the "Keys" function,
LED SET = Biphase LOCK	refer to the "Keys" function.

With biphase at nominal frequency the LEDs SIGNAL and SET must light up – after a run-up time of a few seconds. Once light up there should be no flashing in between!

If this test has been passed the biphase seems to have no disturbing jitter. In this case it is recommended to work with **Sync = Biphase**. The '**Lock auto count**' check box can be activated or deactivated.

If this test fails the biphase seems to have a disturbing jitter, no long-term synchronization can be achieved. In this case it is recommended to try out the following operating modes and to compare the results:

- Sync = Biphase** and **Lock auto count** activated.
- Sync = Biphase** and **Lock auto count** deactivated.
- Sync = Video** (if present) or **Sync = Internal**. **Lock auto count** activated.

The **Lock auto count** mode works as follows: as soon as the unit detects nominal biphase frequency (frequency of the film frames = frequency of the time code frames), the generator enters the "Lock" state – after a programmable delay (**Lock Delay**). Now the time code generator counts all the counters (time, footage counter, frame counter) independent. This guaranties a "clean" time code output, with a continuous +/- 1 counting without drop-outs or jumps. Small deviations from the nominal frequency of the biphase will not terminate the "Lock" state, but a stop or a fast forward or reverse frequency will do. Having the time code not phase-locked to the biphase and after a long period it is possible that a difference is built up between the count values and the real film frames. Returning to the normal mode ("Lock"



state off) all counters will get an update, if there has been any difference before now the count values will match with the real film frames.

Having **Lock auto count** activated the '**Lock Delay**' parameter has to be noticed. This value represents a time period (in units of time code frames) during which the system should reach a stable state (Stop → Play run-up time). A small value leads to entering the "Lock" state early. If the film transport runs not stable at that point and the module works in the 'Lock auto count' mode already there is a risk to immediately have all counters not in coincidence with the real film frames.

Selecting 'Lock delay' to 100 (= maximum value), the delay time equals for example to four seconds (frame rate = 25). Only in case that the genlock source is the biphase signal (**Sync = Biphase**) the "Lock" state will additionally be delayed until the phase locked has been achieved. The 'Lock delay' parameter delays the termination of the "Lock" state as well.



3.2 Time, Footage Counter and Frame Counter in a Time Code Format

In an application where external time code readers (time code displays) are used to visualise the counters (time converted from the biphase, footage counter, frame counter), it is recommended to deactivate the **Lock auto count** mode. The module can output LTC and video time code formats – dependent on the type of module.

The data content of the time information of the time code can be the time converted from the biphase pulses (film duration):

TC time mode = Biphase to time conversion (refer to the "Biphase" function).

The data content of the binary groups (user bits) of the time code can be the time converted from the biphase pulses (film duration):

TC user mode = Biphase to time conversion,

or the footage counter (film length):

TC user mode = Footage counter,

or the film frame counter:

TC user mode = Frame counter.

3.3 Time, Footage Counter and Frame Counter Visibly Inserted on a Video Monitor

The film frame counter, the film footage counter and the time converted from the biphase can visibly be inserted on a video monitor. Utilize the "Insert" function of one of the configuration tools to adjust as follows:

	Source	Format	Representation
Time converted from the biphase	Generate	Time, HH:MM:SS:FF	Example: 15:56:59:13
Footage counter	Biphase Footage	Biphase Footage	6-digits footage and 2-digits frames, with sign: +123456.12
Film frame counter	Biphase Counter	Biphase Counter	8-digits with sign: +12345678



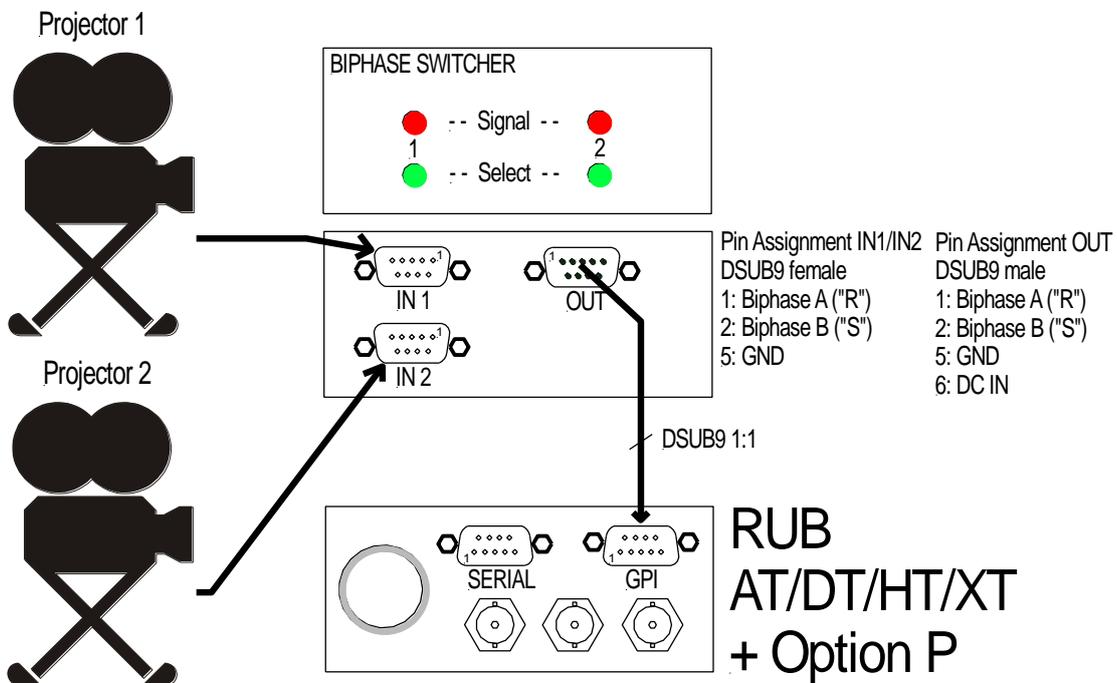
3.4 Two Projectors Connected via a Switching Box

The "Plura BIPHASE SWITCHER" box enables to connect two biphase sources (film projectors). The box automatically detects the source and feeds these signals to the RUBIDIUM module, which still counts the pulses from one projector only. During switching one count pulse will be lost, so a "Reset" should be done if a switching has been occurred.

The connected RUBIDIUM module supplies this box with power. There is a latching relay in the box which remains in its last position during power-off, so immediately after power-on the signals will be passed same way as before.

The green LEDs "Select" indicate whether the signals at IN1 or at IN2 will be passed to the OUT connector. Only one green LED lights up.

The red LEDs "Signal" indicate that pulses are present and passed to the OUT connector. One or none of these red LEDs will light up.



Specifications:

Operating voltage	12 - 30 VDC
Power consumption	Max. 0.5 W
Weight	≈ 440 g
Dimensions	103 (B) x 42 (H) x 172 (T) mm; 4.06 (B) x 1.65 (H) x 6.77 (T) inch
Material of housing	Aluminium





Contact Us



Corporate Offices:
Plura Broadcast, Inc.
Ph: +1-602-944-1044
Sales@plurainc.com



Plura Europe GmbH
Ph: +49-6725-918006-70
Sales@plurainc.com

GERMANY



Plura MEA
Ph: +971-50-715-9625
Sales@plurainc.com



Plura Asia
Ph: +82-10-6688-8826
Sales@plurainc.com

S. KOREA

